Final

Remedial Design Work Plan Addendum, Quanta Resources Corporation Superfund Site, Operable Unit 1, Edgewater, NJ

Prepared for

Honeywell International Inc.

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Abbreviations and Acronyms

AHA	activity hazard analysis
bgs	below ground surface
BOD	basis of design
CD	consent decree
cm/s	centimeter per second
EPA	U.S. Environmental Protection Agency
FS	feasibility study
FSAR	field sampling and analysis report
ft	foot, feet
GRO	gasoline range organics
HCAA	high-concentration arsenic area
ISCF	in situ chemical fixation
ISS	in situ solidification/stabilization
NAPL	non–aqueous phase liquid
NJDEP	New Jersey Department of Environmental Quality
NZ	NAPL zone
OSHA	Occupational Safety and Health Administration
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PDI	predesign investigation
PDWP	predesign investigation work plan
psi	pounds per square inch
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
RDWP	remedial design work plan
RI	remedial investigation
ROD	Record of Decision
UCS	unconfined compressive strength
UFP	Uniform Federal Policy
yd^3	cubic yard

SECTION 1

Introduction

This Remedial Design Work Plan (RDWP) Addendum is prepared in conformance with Section VII(A) of Appendix B of the Remedial Design/Remedial Action Consent Decree (CD) for Civil Action Number 2:12-CV-7091-SRC-CLW. The CD between Honeywell and U.S. Environmental Protection Agency (EPA) was lodged on November 27, 2012, and became effective on March 11, 2013. It provides the framework for implementation of remedial design activities for the upland portion (Operable Unit 1, or OU1) of the Quanta Resources Corporation Superfund Site (Site). The Site is adjacent to the Hudson River, in Bergen County, in northeastern New Jersey. Surface water and sediment in the Hudson River are considered OU2 and are being investigated as part of an ongoing remedial investigation/feasibility study (RI/FS) that is separate from this response action.

To support remedial design at OU1, a Predesign Investigation Work Plan (PDWP) (CH2M HILL, 2012) was prepared and submitted to EPA on May 23, 2012, detailing field investigations to support the preliminary planning and design of the remedy specified in the OU1 Record of Decision (ROD) (EPA, 2011) On September 12, 2012 an addendum to the PDWP was provided to EPA detailing additional work which was subsequently approved by EPA on September 21, 2012. EPA approved the PDWP on August 22, 2012. The PDWP contents were incorporated into the draft RDWP for OU1, submitted to EPA on January 11, 2013. Comments were received from EPA on May 17, 2013, and a final RDWP was submitted on June 17, 2013.

This RDWP Addendum presents the plans for proposed additional predesign data collection activities, particularly the field demonstration of in situ solidification/stabilization (ISS) in non–aqueous phase liquid (NAPL) zones and arsenic areas and the field demonstration of in situ chemical fixation (ISCF) in the High Concentration Arsenic Area (HCAA). This RDWP Addendum also includes the additional task of removing a drum encountered during the implementation of the pre-design investigation test pitting as described in Section 4.4.4 of the Field Sampling Analysis Report (FSAR) (CH2M HILL, 2013).

An overview of the remedial design process is shown in Figure 1. Following EPA approval of the RDWP Addendum, mobilization for the field demonstrations will begin. Following evaluation of the data associated with all field activities and testing, a basis of design (BOD) document will be prepared and submitted. The BOD will include treatment area performance objectives, design criteria, preliminary design drawings, and performance specifications for all components of the OU1 remedy.

A discussion of the site, source areas, remedial action objectives, design approach, remedial design management, and project schedule are provided in the draft final RDWP, submitted to EPA on June 17, 2013.

SECTION 2

ISS Field Demonstration

The remedial design component of the OU1 remedy that involves the ISS of NZ-1, NZ-2, NZ-5, a portion of NZ-3, and seven arsenic areas outside the HCAA (Figure 2) consists of two main elements: reagent selection and reagent delivery. The work performed during the predesign investigation (PDI) focused on reagent selection. Representative samples of site media were collected as described within Section 2 of the FSAR, and subjected to bench-scale treatability testing to identify a range of reagent and reagent dosages that will meet ROD objectives:

- Permeability of less than 1×10^{-6} cm/s;
- An unconfined compressive strength (UCS) of at least 40 psi; and
- 90 percent or greater reduction in leachability for the majority of the site constituents.

As discussed within Section 3 and 4 of the FSAR, data collected as part of the PDI has allowed for the identification of a reagent mix and dosages capable of meeting the performance objectives identified in the ROD. The bench-scale treatability testing performed by WRS Compass and Envirocon evaluated multiple reagent mixtures and the final verification mix designs are anticipated to be used during the field demonstrations. The mix design selected by WRS Compass for final verification testing via Method 1315 consisted of 2 percent portland cement and 6 percent ground granular blast furnace slag mixed with 8 percent water. The final mix designs developed by Envirocon included either 2 percent portland cement and 8 percent slag or 3 percent portland cement and 12 percent slag. Variations in the dosage will be further evaluated in the field demonstration. The purpose of this RDWP addendum is to further refine the understanding of reagent delivery by conducting an ISS field demonstration test that would meet following objectives:

1. Demonstrate consistency with the treatability test results and ability to achieve project performance goals in the field with two mechanical mixing devices: auger mixing and bucket mixing
2. Evaluate the efficacy of the quality assurance/quality control (QA/QC) approach to reliably and consistently show conformance with the project performance goals and monitor construction parameters
3. Evaluate debris management in the field; develop a process for debris handling and removal, including determination of clean and dirty debris, and develop a process for evaluating the effect of incorporating the debris in the final mixed area
4. Assess potential exposure risk through real-time monitoring and analytical sampling methods:
   - Establish baseline air quality conditions at the property boundaries prior to the start of intrusive work and monitor ambient air quality during the implementation of the field demonstration test
   - Demonstrate that concentrations of contaminants of concern at the property boundaries are below the risk-based screening levels for residential populations
   - Demonstrate that concentrations of contaminants of concern within the exclusion zone are below worker health and safety action levels
5. Demonstrate the efficacy of odor and dust control mitigation methods
6. Evaluate scale-up of construction parameters including, but not limited to, the following:
   - Production rates
   - Equipment selection
   - Work sequencing

7. Estimate amount of swell/expansion from each mixing method, evaluate subcontractor's onsite management of material, and develop an understanding of the "workability" of the swell material as a function of cure time.
8. Determine if additional parameters, beyond depth, should be considered in selection of the mixing method for areas in the full-scale implementation
9. Evaluate approach for pile removal and management

2.1 ISS Remedial Design Data Needs

Table 1 provides the remedial design objective component and a brief overview of the scope proposed as part of this work plan to address each data need.

TABLE 1
ISS Remedial Design Objectives and Proposed Scope
Quanta Resources Corporation Superfund Site

Objective Description	Overview of Proposed Scope
1. Demonstrate consistency with the treatability test results and ability to achieve project performance goals in the field with two mechanical mixing devices: auger mixing and bucket mixing	Collect samples of treated soil at discrete depths within treated areas for conformance testing for UCS, permeability, and leachability reduction.
2. Evaluate the efficacy of the QA/QC approach to reliably and consistently show conformance with the project performance goals and monitor construction parameters	Utilize field tests and short-term laboratory tests to determine ranges of short-term test results correlating with laboratory conformance testing results meeting performance criteria.
3. Evaluate debris management in the field; develop a process for debris handling and removal, including determination of clean and dirty debris, and develop a process for evaluating the effect of incorporating the debris in the final mixed area	Characteristics of debris encountered (quantity, size, thickness, type, etc.) will be documented. Debris removed will be sized and visually categorized. Incorporation of the sized debris will be field tested and documented.
4. Assess potential exposure risk through real-time monitoring and analytical sampling methods	Establish baseline air quality conditions at the property and monitor ambient air quality at the property boundaries and within the exclusion zone.
5. Demonstrate the efficacy of odor and dust control mitigation methods	Implement odor and dust control measures, and implement mitigation if air quality monitoring indicates that specified levels are exceeded.
6. Evaluate scale up of construction parameters	Monitor and document construction parameters during implementation including production rates, equipment selection and/or modification, and sequencing of work.
7. Estimate amount of swell/expansion from each mixing method and evaluate subcontractor's onsite management of material and develop an understanding of the "workability" of the swell material as a function of cure time.	Containment berms will be constructed around the treatment areas to manage and estimate the amount of swell generated during mixing.
8. Determine if additional parameters, beyond depth, should be considered in selection of the mixing method for areas in the full-scale implementation	Performance sampling, including consistency and conformance tests, will be conducted and evaluated to support development of full-scale construction quality control.
9. Evaluate approach for pile removal and management	Test two proposed methods for pile management, pile cutting (treatment areas less than 15 ft bgs) and pile extraction (treatment areas greater than 15 ft bgs).

2.2 ISS Field Demonstration Activities

The purpose of this work is to in situ solidify four field demonstration test areas, approximately 20-foot-by-20-foot, to treatment depths identified in Figure 3. These four treatment areas have been selected to correspond with locations where bench-scale treatability test samples were collected and baseline analytical testing was performed. Two areas, approximately 222 cubic yards (yd^3) each, will be completed with bucket-mixing techniques and two areas, one of approximately 325 yd^3 and the other of approximately 370 yd^3, will be completed with auger-mixing techniques. The total treatment volume is approximately 1,140 yd^3. An additional area with a total treatment volume of 1,320 yd^3 will be solidified with bucket-mixing techniques to allow construction of a utility corridor to support the demolition of the 115 River Road building. This additional area associated with the proposed utility corridor is shown in Figure 4. The property owners are not ready for the mobilization associated with the utility corridor and this portion of the work has been delayed.

The field demonstration test consists of the following main activities:

- Mobilization and site preparation
- Debris removal and management, including piles
- ISS of approximately 1,140 yd^3 of soil using bucket and auger mixing techniques
- ISS of approximately 1,320 yd^3 of soil along a proposed utility corridor crossing NZ-1, using bucket mixing techniques (delayed)
- QA/QC monitoring and sampling
- Waste management and equipment decontamination
- Air monitoring and dust and odor control
- Drum removal
- Site restoration and survey

2.2.1 Mobilization and Site Preparation

The selected subcontractors will mobilize equipment, materials, supplies, and personnel to the site following submittal of required plans and submittals. The following additional tasks will be performed as part of the site mobilization:

- Set up the slurry batch plant
- Demarcate the five treatment areas
- Establish the perimeter air monitoring stations
- Establish temporary facilities and utilities to support site activities
- Construct a decontamination pad
- Establish staging areas and construction exclusion work zones
- Mark out boundaries of the treatment areas based on coordinates provided by CH2M HILL
- Provide temporary spill containment controls
- Establish overall site stormwater and erosion control
- Establish stockpile areas for debris sizing and staging
- Install privacy screen to existing chain link fence

Anticipated contractor heavy equipment mobilized to the site includes:

- Crawler-mounted lift crane (Manitowoc 4000 or equivalent)
- Diesel Hain Model 450 drill platform

- Hollow stem Kelly bar with a king swivel
- 10-foot-diameter auger/mixing tool
- Caterpillar Model 349 CL (or equivalent)
- Batch plant (batch tank, transfer tank, two silos, a centrifugal pump, and a positive displacement pump)
- Air monitoring, dust, and odor control equipment (e.g., temporary backfill covers, water sprays, and foam)

Site preparation activities will include clearing, grubbing, and chipping of brush and trees within the treatment areas. Surface asphalt present within the treatment areas will be removed and stockpiled. Site security will be provided by the existing chain-link fence and gate.

The field demonstration areas located on the Quanta property have been cleared for subsurface utilities by a private utility locator, to the extent feasible, during the PDI work. Prior to intrusive work, the area will be inspected for evidence of utilities (uniform sand, caution tape, etc.). The utilities around the field demonstration area associated with the utility corridor have not been cleared. The NJ One-Call number and a third-party utility locate will be used to identify utilities within the work area.

2.2.2 In Situ Solidification/Stabilization

The in situ solidification will be applied over up to five separate areas, listed in Table 2 and shown in Figures 3 and 4. A total of approximately 2,460 yd^3 is estimated for in situ treatment based on the following treatment depths for each area.

TABLE 2
ISS Field Demonstration Areas
Quanta Resources Corporation Superfund Site

ISS Location	Area Depth (Feet)	Mix Volume (yd^3)	Mixing Type
A-02	22	325	Auger
AN-02	15	222	Bucket
N-01	25	370	Auger
N-04	15	222	Bucket
Utility corridor	10	1,320	Bucket

After the treatment area has been cleared of debris and obstructions as described in Section 2.2.3, containment berms will be created and the reagents will be introduced into each field demonstration area as a wet slurry. With the removal of surface debris, there will be a depression that will aid in the management of swell treated material. Additional near-surface soils may be removed or clean backfill imported to create berms, if necessary, to accommodate the swell of treated material.

The subcontractor will set up a slurry batch plant that will consist of the necessary tanks and mixers, reagent storage silos, pumps, and meters to deliver a uniform slurry to each treatment area. The pozzalonic reagents will be delivered in dry bulk and conveyed into storage silos or tankers adjacent to the slurry batch plant. Dust generation during the handling of the reagent will be controlled through the use of air filters on the silo, and monitoring/controlling pressure of pneumatic delivery to the silo. The dry reagent will be metered into the slurry batch plant to document the proper mass of reagent is added to each batch of slurry prepared. Water will be obtained from a nearby water source and pumped or piped directly to the slurry batch plant. A grout pump with variable speed motor will be used to convey the slurry to the treatment areas through a discharge pipe and applied to the work area with the quantity metered to document the

required amount of reagent is added to each treatment area. The slurry batch plant is operated by integral diesel engine and power supply or generators.

For the auger-mixing technique, the ISS will be performed using a crane-mounted drill rig equipped with an 8- to 10-ft-diameter auger. The auger drill will be placed on mats to provide stability, maintain vertically plumb mixing, and minimize contamination of the drill rig tracks. The location of the columns will be predetermined and the center point of each column located with a 10 to 20 percent overlap with adjacent columns to provide complete mixing of the treatment area.

The auger is mounted to a Kelly bar (drill stem) which is marked with graduations to indicate the distance from the cutting point of the auger to the bar. The mixing depth is then calculated based on the pre-existing surface elevation and the depth on the Kelly bar. As the cutting point of auger is advanced, slurry is injected into the treatment area and thoroughly mixed. The proposed QA/QC monitoring and sampling is described in Section 2.2.4.

For the bucket-mixing technique, the ISS will be performed using an excavator equipped with GPS guidance for both vertical and horizontal control during mixing. Slurry is pumped to the treatment area through a pipe mounted on the excavator and the excavator bucket is used to blend the reagent slurry with the soils.

2.2.3 Debris Removal and Pile Management

In preparation for ISS, subsurface debris must be removed to clear obstructions that would impede the thorough mixing of the treatment areas. Based on the historic operations and finding during the test pitting investigation, it is anticipated that debris encountered may consist of concrete building and tank foundations, timber piles, buried drums, and brick footings. Pile tops will be exposed during the removal of the surface debris. To the extent practicable, gross removal of soils and coal tar that may remain on the debris will be performed over the treatment area.

Debris removed from the treatment areas will be segregated into two categories based on qualitative methods. The material will be placed in the designated staging area depending upon the following characteristics:

- Category 1—material that has *no* visible contamination, staining, or odors
- Category 2—material that has visible contamination, staining, or odors

The removed debris/obstructions will be sized and stockpiled in the appropriate staging area. The Category 2 material, and as much as possible of the Category 1 material, will be re-incorporated into the treatment area. Excess material will be managed as described in Section 2.2.5. Material to be incorporated in the auger mixed area will be sized to a maximum of 1 foot by 1 foot and material to be incorporated in the bucket-mixed areas or sent offsite for disposal will be sized to a maximum of 2 feet by 2 feet. In the event buried drums are found, the procedures in Section 2.3 will be followed.

Piles located within the treatment areas will require removal to allow for complete mixing of the treatment areas. Due to the use of two mixing techniques during the field demonstration test, two different methods for pile removal will be tested.

- Bucket-mixed areas: Piles will be exposed as needed to allow the pile to be cut with a trackhoe and sheer attachment, or similar, at the treatment depth.
- Auger-mixed areas: Piles tops will be exposed and the excavation filled with grout. As the pile is extracted with static force, possibly using dynamic assistance, grout will be added to the excavation to maintain a constant hydraulic pressure that provides the force necessary to fill the void created by the pile. If grout is not lost to the void space as the pile is extracted, the treatment depth will be extended to the depth of the void as determined by the length of the removed pile.

2.2.4 QA/QC Monitoring and Sampling

QA/QC monitoring and sampling will be performed during the field demonstration test and includes baseline testing, reagent and equipment monitoring, and collection of performance samples. Sample collection and analysis will be conducted in accordance with the updated UFP-QAPP included as Appendix A of this report.

2.2.4.1 Baseline Sampling

The four treatment areas have been selected to correspond with locations where baseline analytical testing and bench-scale treatability test samples were performed; however, additional baseline sampling will occur to accommodate for site variability. Additionally, baseline testing will be performed in the treatment area associated with the utility corridor. Sample locations and analytical methods are specified in Appendix B.

2.2.4.2 Reagent and Equipment Monitoring

The ISS contractor will verify that delivered reagent meets specifications by tracking delivery/feed rates of reagent mix, slurry characteristics (water ratio, density), and mixing parameters including but not limited to penetration depth, mixing speed, mixing time, production rate, precise location of treatment area, auger strokes, and rotation speed.

2.2.4.3 Performance Sampling

Bulk samples of freshly mixed material will be collected from each treatment area and subjected to the performance testing, including both consistency and conformance testing as summarized below. Sample locations, depth intervals, frequencies, and sample methods are specified in Appendix B. The subcontractor will collect sufficient volume to perform the required analysis. Samples will be collected using a sampling tool capable of providing discrete sample at specified depth intervals.

Consistency Testing. Consistency testing will be required to monitor for variability in the mixed material, to demonstrate material properties are consistent with results from bench-scale treatability testing, and to demonstrate construction quality control. These results will also be used for establishing parameters for full-scale implementation that correlate with conformance testing samples that meet project performance goals. The following analyses will be performed:

- Pocket penetrometer testing performed on 1-, 3-, 5-, and 7-day cured samples
- Slump test on freshly treated material
- Moisture content and wet density
- Alkalinity and pH
- UCS: reported on 7- and 14-day cured samples

Conformance Testing. Conformance testing will be required to demonstrate consistency with the project performance goals. The following analyses will be performed:

- UCS: reported on 28-day cured samples
- Permeability: reported on 28-day cured sample
- Leachability: Premethod 1315 and/or ANS 16.1 (GRO; arsenic; benzene, toluene, ethylbenzene, and total xylenes [BTEX compounds]; and polycyclic aromatic hydrocarbons) reported on 28-day cured sample

Aliquots of the bulk samples will be subjected to laboratory testing to demonstrate conformance with UCS, permeability, and leachability reduction performance objectives. Leachability will be evaluated by comparing baseline data to Premethod 1315 and/or ANS 16.1 data from each of the field demonstration locations. Analyses to be performed are specified in Appendix B.

2.2.5 Waste Management and Equipment Decontamination

Waste will be characterized and managed as described in the Waste Management Plan (Appendix C). Excess debris will be transported and disposed of offsite. Groundwater or stormwater encountered in the test areas can be used in the makeup of the reagent slurry or managed by pumping from an active test area into

a previously treated test area within the Site. Groundwater will not be allowed to overflow test areas. If groundwater volumes exceed the capacity of the excavated areas it will be pumped into an onsite frac tank for characterization and disposal as described in the Waste Management Plan.

A portable steam cleaner will be available for decontamination of excavation equipment. An equipment decontamination area will be constructed, and all waste from the decontamination area will be containerized and managed following completion of site activities.

2.2.6 Air Monitoring, Dust and Odor Control

The field demonstration activities have the potential to generate odors, dust, and emissions. The subcontractors will be prepared to implement the necessary controls based on the results of the air monitoring. Real-time perimeter air monitoring will be conducted by the Emilcott (Morristown, NJ) Greenlight Environmental Monitoring System as detailed in Appendix D. Emission, odor, and dust control will be conducted as necessary based on both perimeter and/or personnel air monitoring data.

Dust control methods will include the use of water sprays over areas were particulates are likely generated including high traffic areas, debris sizing, etc. There should be minimal dust generated during the slurry preparation due to the use of pneumatic delivery of the bulk reagents and filters in the storage silos.

The subcontractor may use a number of controls to mitigate odor and emission during the field demonstration test activities. Control methods may include, but are not limited to, placement of temporary backfill covers, water sprays, and foam. Additional contingency measures (e.g., shroud and vapor management system) will be available if necessary for the auger-mixed areas. At the end of each work day, all exposed excavated soil piles will be covered and secured.

2.2.7 Site Restoration and Survey

The surface of the treated soils will be graded to match the existing surrounding grade. The final graded treatment area will be covered with a minimum of 6 inches of clean imported backfill. The area will be seeded and mulched/hay to minimize erosion. A final survey of the treatment areas will be conducted using a New Jersey–certified surveyor.

2.3 Drum Removal

During the PDI activities, a drum with fluids was encountered in the location of TP-07 (Figure 3. Notification was made to the New Jersey Department of Environmental Quality (NJDEP) Bureau of Emergency Response (release notification number 130112122242). Subsequently, the test pit was backfilled to cover the drum and minimize any adverse health and safety impacts to the field crew while an appropriate removal approach was determined.

The drum will be removed during activities preparing the site for the ISS field demonstration. The area where the drum was encountered will be excavated to expose the drum. Surface soils (approximately 3 feet) will be removed and segregated from the remaining soils to be excavated to expose the drum. Excavated soils will be stored onsite in accordance with the Waste Management Plan (Appendix C). The drum shall be removed with staff wearing Level B personal protective equipment as per the Health and Safety Plan and immediately placed into overpacking material. The overpack will be capable of containing all liquids (i.e., watertight). A sample will be collected from the drum for offsite analyses to facilitate waste profiling per the Waste Management Plan. The overpack drum will be properly stored onsite awaiting results for offsite disposal. In the event that additional drums are encountered, the above procedures will be followed for each drum.

Once excavation is complete, the excavations will be backfilled with the stockpiled soil and surface soil used as cover. If additional material is needed, the subcontractor will provide clean fill that meets the definition provided in N.J.A.C. 7:26E-1.8. (“Clean fill” means material to be used in a remedial action that meets all soil

remediation standards, site-specific alternative standards, or site-specific interim standards, does not contain extraneous debris or solid waste, and does not contain free liquids. This also includes any material that meets all criteria or action levels for contaminants without standards, available on NJDEP's Web site at www.nj.gov/dep/srp. This material can be soil or not.)

2.4 Permitting

In preparation for performance of the ISS field demonstration, a pre-application meeting request was submitted to NJDEP with a permit-readiness checklist and a Substantive Requirements Compliance Document. The Substantive Requirements Compliance Document includes the following components:

- Project description (including site description and history)
- Project components overview (describing the proposed field demonstration)
- Compliance statement (summarizing applicable regulations, with the intent that regulations will be reviewed during the development of permit equivalent applications to verify substantive compliance, and consulted for compliance during field demonstration)
- Regulations, guidelines, and policies (summarizing additional regulations associated with field demonstration)

Following the pre-application meeting and prior to mobilization for the field demonstration, permit equivalence submittals will be prepared and provided to NJDEP and EPA. A copy of the pre-application meeting request, permit readiness checklist, and Substantive Requirements Compliance Document are attached to this RDWP Addendum as Appendix E.

2.5 Health and Safety

All field demonstration activities will be conducted in accordance with the current site Health, Safety, and Environment Plan, dated June 2013 and included herein as Appendix F.

The subcontractor's onsite employees will be required to have successfully completed the Occupational Safety and Health Administration's (OSHA) 40-hour hazardous waste operations and emergency response (HAZWOPER) training in accordance with 29 Code of Federal Regulations 1910.120 and to have maintained compliance with the 8-hour annual refresher requirement. Onsite workers will present documentation of the OSHA 40-hour, current OSHA 8-hour annual, and equipment operator (as applicable) training prior to beginning onsite work. Activity hazard analyses (AHAs) will be prepared for each task to identify the work sequence, hazards posed, and control measures required to perform the activity according to accepted industry safe work practices and regulatory requirements. The AHAs will include, at a minimum, the following:

- A step-by-step breakdown of the activities being conducted
- The potential physical, chemical, and biological hazards associated with each task
- The measures that will be implemented to eliminate or mitigate the potential hazards
- The equipment required to safely perform the work
- Waste disposal methods

The subcontractor personnel will participate in mandatory daily safety briefings at the start of work each day, conduct inspections per regulatory requirements and/or the health and safety plan, and provide a competent supervisory person onsite at all times during operations, which require supervision according to the OSHA regulations.

2.6 Data Evaluation

The purpose of the field demonstration for ISS is to evaluate field conditions and potential challenges unique to the site prior to mobilization for the full-scale implementation. The data collected will allow modifications to field procedures as necessary to provide for an efficient and safe full-scale implementation. Site-specific details associated with the unique challenges to implementation at the site will be included in the remedial design and remedial action work plan on the basis of observations made during the field demonstration. The data from the treatability test and the field demonstration will be used to determine the relationship among UCS, permeability, and leachability as well as to identify what analytical and/or physical tests will be required during full-scale implementation and the frequency of testing needed to ensure that the remedial design is effective. Analytical results, field observations, and conclusions will be presented in the BOD document.

SECTION 3

ISCF Field Demonstration for HCAA

ISCF—in situ application of chemical reagents for the purpose of stabilizing (i.e., fixating and immobilizing, thereby reducing contaminant solubility from the soil matrix to the groundwater, or leaching) arsenic in soil at concentrations greater than 1,000 mg/kg through adsorption and precipitation in the aquifer—has been chosen as the selected remedy for the HCAA. As described in the RDWP, the remedial design for the HCAA consists of two main components: (1) reagent selection and dose design and (2) reagent delivery. During the PDI, batch-scale treatability testing was performed on representative soil samples, as described in Section 3 of the FSAR, to determine the reagents and dosages for ISCF. Ferrous sulfate heptahydrate ($FeSO_4$ $7H_2O$) followed by a pH buffer of magnesium hydroxide ($Mg[OH]_2$) has been identified as an effective reagent mix and further refinement on dosage and solution is currently being evaluated. The sequenced application of multiple reagents is an innovative method that is based on proven technologies, but additional refinement of the approach is required prior to field-scale testing. The final stages of treatability testing are currently underway and are focused on optimizing the field-scale reagent design. Specifically, additional laboratory work is being conducted as part of the Phase IV bench-scale treatability testing to determine the optimal reagent delivery approach and to refine the understanding of the reagent dosages, mixing, and volumes required for field-scale application.

Phase IV of the treatability testing is being designed and includes column tests and sequential extractions to demonstrate the stability and long-term leaching reductions of the ISCF treatment. Field conditions (e.g., groundwater flow rate(s), reagent injection pressures, and flow rates) will be simulated during the column testing to evaluate the reductions in leaching that result from treatment of the pore space associated with the soil column. Although treatability testing to date has shown significant reductions in leachability (i.e., greater than 90 percent), additional testing will include nondestructive methods and techniques for evaluating arsenic leaching in the untreated and treated columns using EPA Method 1314. In accordance with the PDWP, in vitro bioaccessibility testing will be performed during Phase IV on both treated and untreated (controls) samples to evaluate the toxicity of the arsenic.

3.1 ISCF Field Study and Field Demonstration

ISCF field demonstration activities will be implemented in a phased approach, with subsequent phases conducted based on results and findings of prior phases. Following the evaluation of the column testing results, a one well field study followed by a larger-scale field demonstration will be completed as discussed below.

The proposed phased approach will allow for the optimization of the injection well design, chemical staging and handling, and delivery of reagents to the subsurface and will accommodate the changes needed to properly evaluate performance relative to the field demonstration objectives. Once the Phase IV testing is completed, a brief letter report discussing the column testing results and the proposed one-well field study approach will be prepared and provided for the EPA's review and approval. The goal for the one-well test is to further refine the understanding of the subsurface conditions, reagent delivery, and mixing of reagents in the subsurface, and it will provide a further basis for the subsequent full-scale ISCF field demonstration.

Upon completion of the one-well field study, a separate RDWP Addendum will be prepared for the full-scale ISCF field demonstration based on the results observed. This RDWP Addendum is anticipated to provide details for the next phases of the field demonstration for the HCAA which will include vertical reagent delivery and subsequently a horizontal reagent delivery testing. Vertical delivery testing will include the application of the reagents in a small controlled environment within the HCAA at multiple newly installed vertical injection wells. The test plot will be based on the one-well test results and the additional information provided during the column testing.

For full-scale implementation of the remedy, reagent delivery may require the use of horizontal injection wells due to the active businesses, roadways, and surface constraints on the City Place property. Horizontal delivery testing will be performed following the completion and evaluation of the horizontal testing and will include installation of horizontal injection wells for delivery of the reagents to the subsurface. Additional details of the vertical and horizontal injection field demonstration will be provided in a separate addendum to the RDWP.

3.2 Updated Schedule and Path Forward

Due to status of the Phase IV column testing and the need to perform the one well injection test in the field prior to initiating the full-scale ISCF field demonstration a delay in the original schedule provided with the RDWP is anticipated. It is anticipated that a letter report detailing the results of the final phase of the bench-scale treatability testing as well as a proposed approach for the one-well test will be provided 4 to 6 weeks following the initiation of the Phase IV column testing, which is anticipated to begin the week of August 5, 2013. Once the one well test is complete, an updated RDWP Addendum will be provided with an updated schedule for the ISCF portion of the remedial design. At this time, the only delays to the overall project schedule are associated with the column testing and ISCF field demonstration. The submission of the Basis of Design Report and full-scale implementation remain consistent with the schedule provided in the RDWP (CH2M HILL, 2013).

SECTION 4

References

CH2M HILL. 2012. *Predesign Investigation Work Plan, Quanta Resources Superfund Site, OU1*. August.

CH2M HILL. 2013. Draft Final *Remedial Design Work Plan*, *Quanta Resources Superfund Site, Operable Unit 1, Edgewater, New Jersey*

EPA (U.S. Environmental Protection Agency). 2011. *Record of Decision, Operable Unit 1, Quanta Resources OU1, Edgewater, New Jersey.* September.

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Figures

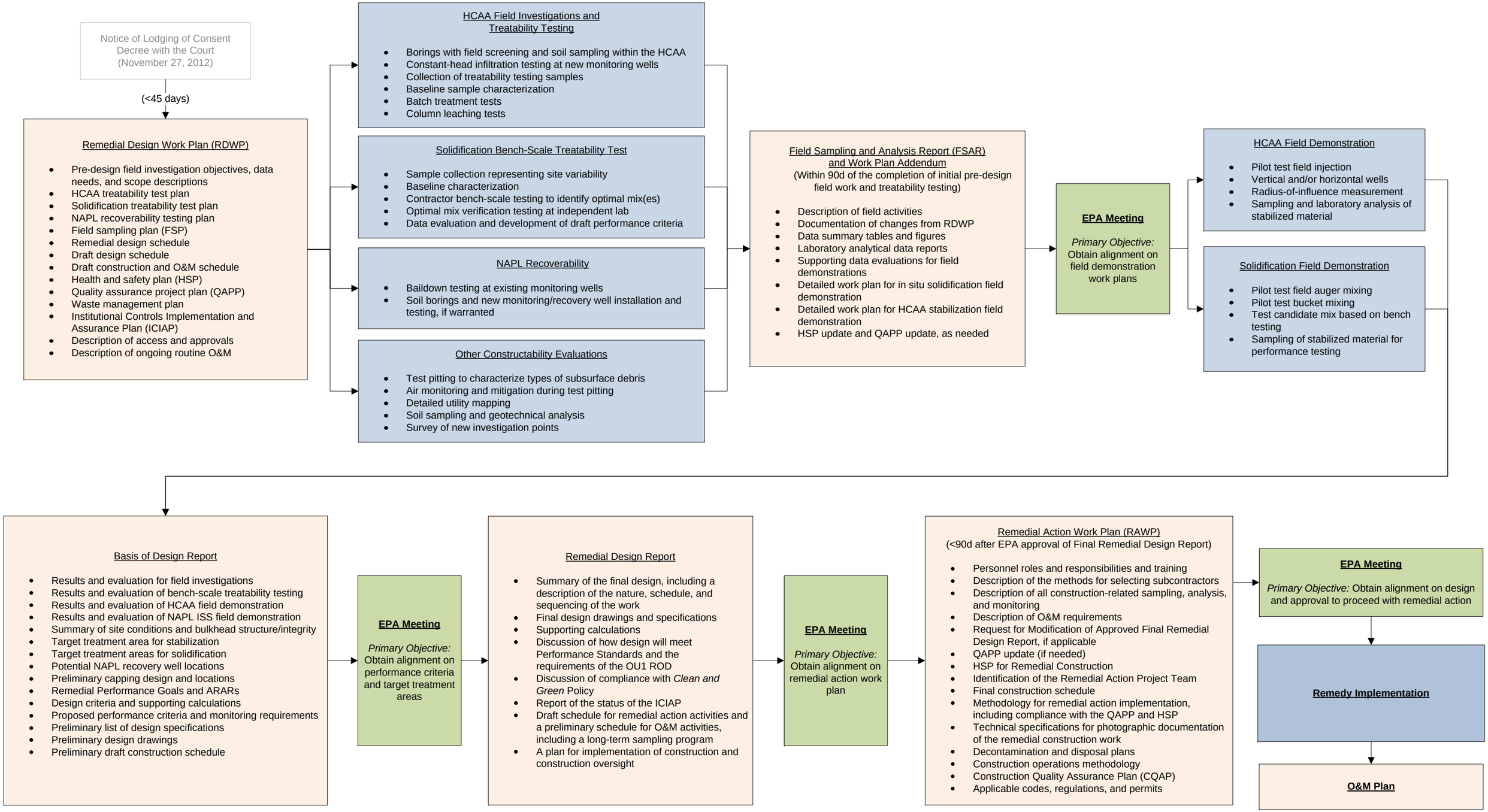
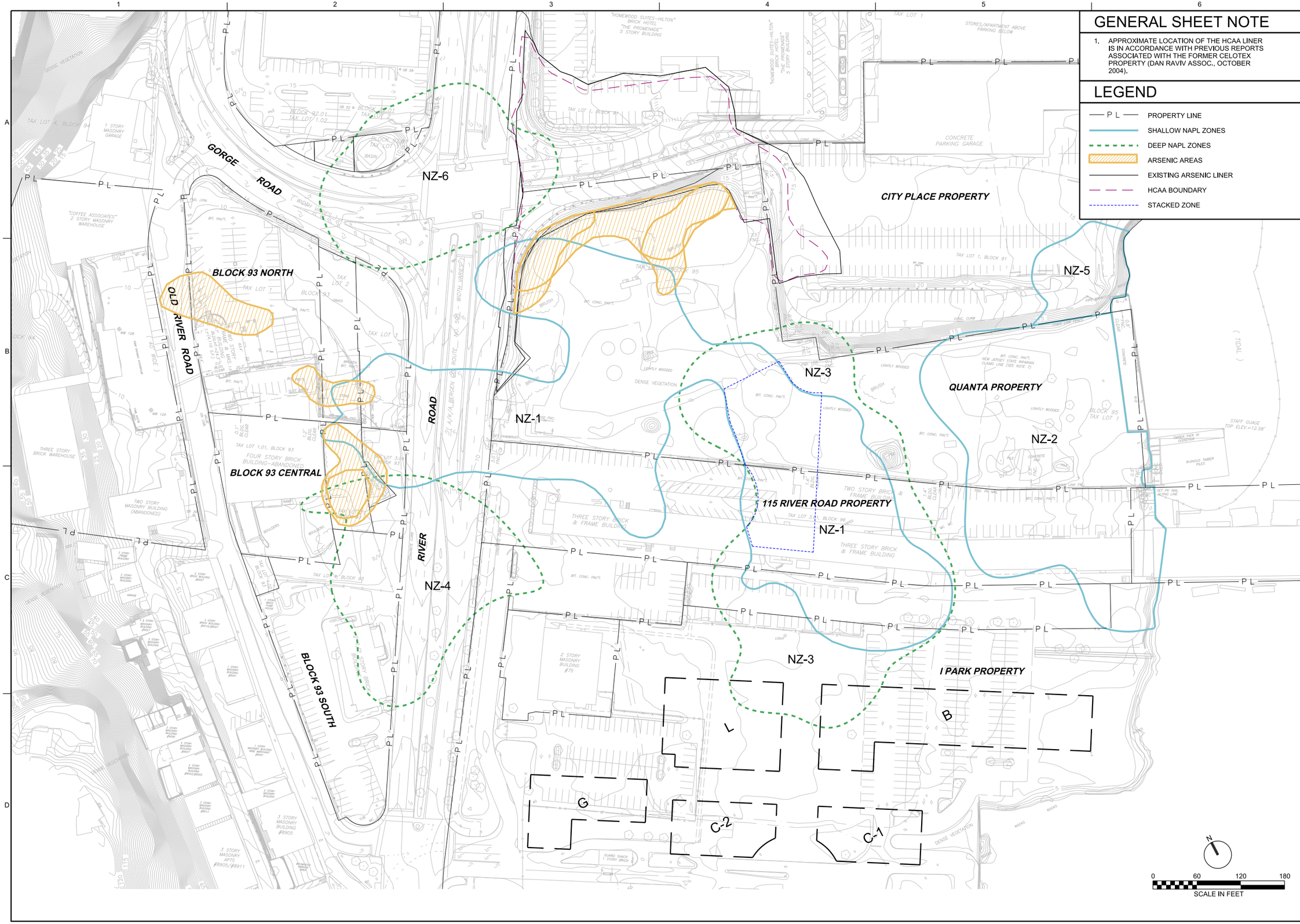


FIGURE 1
OU1 Remedial Design Process
Quanta Resources Corporation Superfund Site



GENERAL SHEET NOTE

1. APPROXIMATE LOCATION OF THE HCAA LINER IS IN ACCORDANCE WITH PREVIOUS REPORTS ASSOCIATED WITH THE FORMER CELOTEX PROPERTY (DAN RAVIV ASSOC., OCTOBER 2004).

LEGEND

- PROPERTY LINE
- SHALLOW NAPL ZONES
- DEEP NAPL ZONES
- ARSENIC AREAS
- EXISTING ARSENIC LINER
- HCAA BOUNDARY
- STACKED ZONE

NO.	DATE	REVISION	BY	APVD

DSGN KD BLOCK | DR PA KARABAN | CHK | APVD

HONEYWELL INTERNATIONAL INC.
QUANTA RESOURCES CORPORATION
SUPERFUND SITE
Edgewater, New Jersey

CH2MHILL®

FIGURE 2
OU1 BASE MAP

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	
PROJ	428872
DWG	FIGURE 2
SHEET	of

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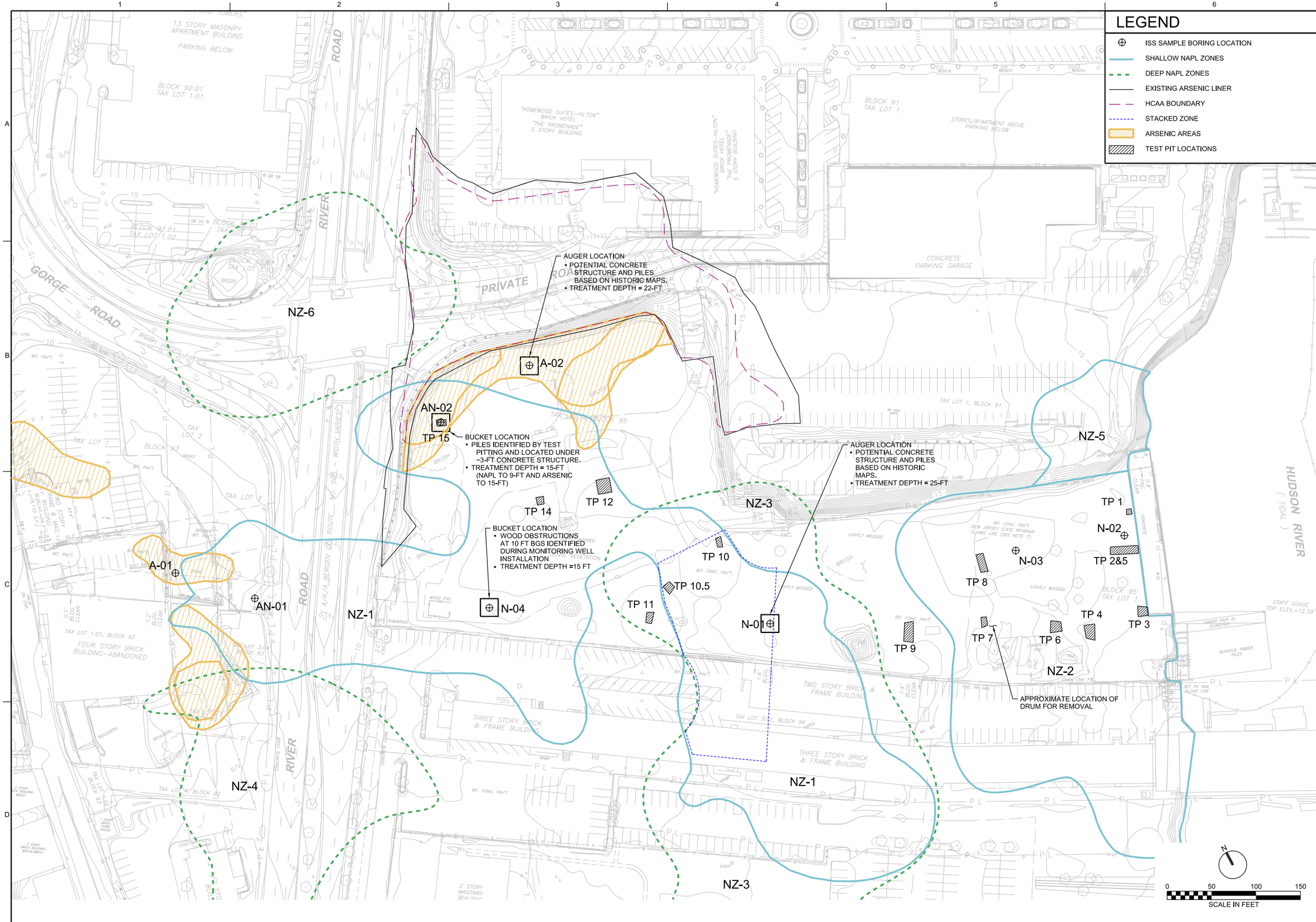

NO.	DATE	REVISION	BY	APVD

DSGN KD BLOCK | DR TB WEINSTEIN | CHK | APVD

HONEYWELL INTERNATIONAL INC.
QUANTA RESOURCES CORPORATION
SUPERFUND SITE
Edgewater, New Jersey

CH2MHILL®

FIGURE 3
DEMONSTRATION TEST LOCATION PLAN

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	
PROJ	428872
DWG	FIGURE 3
SHEET	of

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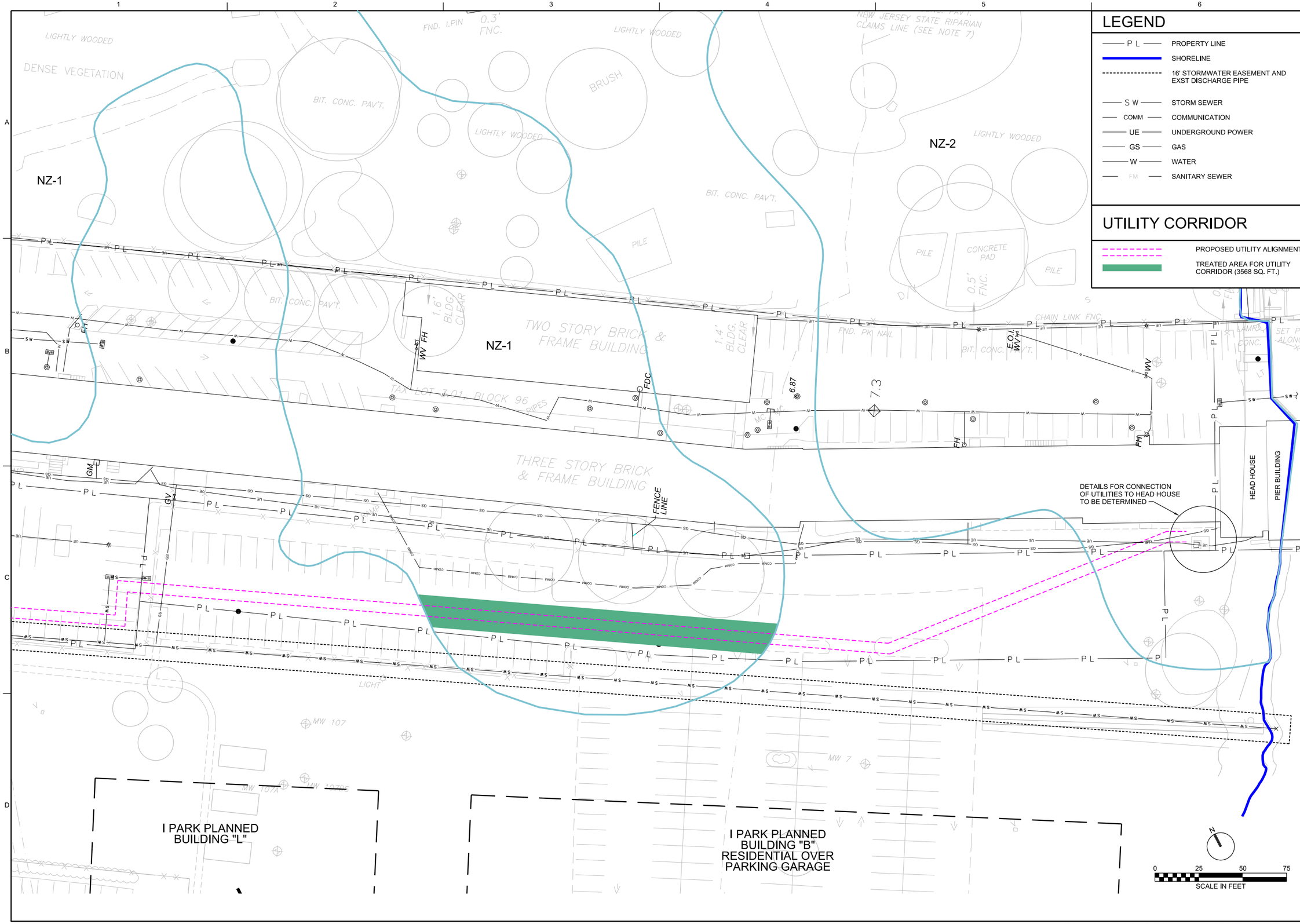

LEGEND

P L	PROPERTY LINE
	SHORELINE
	16' STORMWATER EASEMENT AND EXST DISCHARGE PIPE
S W	STORM SEWER
COMM	COMMUNICATION
UE	UNDERGROUND POWER
GS	GAS
W	WATER
FM	SANITARY SEWER

UTILITY CORRIDOR

	PROPOSED UTILITY ALIGNMENT
	TREATED AREA FOR UTILITY CORRIDOR (3568 SQ. FT.)

NO.	DATE	REVISION	BY	APVD

DSGN NK BETTS | DR PA KARABAN | CHK | APVD

HONEYWELL INTERNATIONAL INC.
QUANTA RESOURCES CORPORATION
SUPERFUND SITE
Edgewater, New Jersey

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FIGURE 4
POTENTIAL UTILITY CORRIDOR FOR PIER BUILDING

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	
PROJ	428872
DWG	FIGURE 4
SHEET	of

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Appendix A
UFP-QAPP for ISS Field Demonstration

Note: For Attachment 1 (SOPs), see Appendix A–specific CD accompanying the hard copy report.

Final

UFP-Quality Assurance Project Plan, ISS Field Demonstration, Quanta Resources Corporation Superfund Site, OU1, Edgewater, New Jersey

Prepared for

Honeywell International Inc.

November 2013

CH2MHILL®

Document Control Number: CH2M-Quanta-V2

Prepared using 2012 EPA guidance (http://www.epa.gov/fedfac/pdf/ufp_qapp_worksheets.pdf)

Contents

Acronyms and Abbreviations

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QAPP Worksheet #6: Communication Pathways

QAPP Worksheet #9: Project Planning Session Summary

QAPP Worksheet #10: Conceptual Site Model

QAPP Worksheet #11: Project/Data Quality Objectives

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QAPP Worksheet #23: Analytical SOPs

QAPP Worksheet #24: Analytical Instrument Calibration

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QAPP Worksheet #26 and #27: Sample Handling, Custody, and Disposal

QAPP Worksheet #28: Analytical Quality Control and Corrective Action

QAPP Worksheet #29: Project Documents and Records

QAPP Worksheets #31, #32, and #33: Assessments and Corrective Action

QAPP Worksheet #34: Data Verification and Validation Inputs

QAPP Worksheet #35: Data Verification Procedures

QAPP Worksheet #36: Data Validation Procedures

QAPP Worksheet #37: Data Usability Assessment

References

Attachment 1 – Standard Operating Procedures

Acronyms and Abbreviations

µg	microgram
%R	percent recovery
BTU	British thermal unit
CA	corrective action
CCAL	continuing calibration
CCV	continuing calibration verification
COC	chain-of-custody
DDT	dichlorodiphenyltrichloroethane
DNAPL	dense nonaqueous phase liquid
DQI	data quality indicator
DQO	data quality objective
EB	equipment blank
ECD	electron capture detector
EOX	extractable organic halides
FD	Field Duplicate
FOP	Field Operating Procedure
FSP	Field Sampling Plan
FTL	Field Team Leader
GWCS	Groundwater Collection System
HBB	hexabromobenzene
ICAL	initial calibration
ICV	initial calibration verification
kg	kilogram
L	liter
LCS	laboratory control sample
MB	method blank
MDL	method detection limit
mg	milligram
mL	milliliter
MS/MSD	matrix spike/matrix spike duplicate
N/A	not applicable
NAPL	nonaqueous phase liquid
O&M	operations and maintenance
OU	Operable Unit
oz.	ounce(s)
PAL	Project Action Limit
PBB	hexabromobiphenyl
PCB	polychlorinated biphenyl
PDWP	Pre-Design Work Plan
PM	Project Manager
ppm	parts per million
PQO	Project Quality Objectives
QA	quality assurance
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QC	quality control
QL	quantitation limit

QM	Quality Manager
RA	remedial action
RAC	Remedial Action Contract
RDWP	Remedial Design Work Plan
RL	reporting limit
RPD	relative percent difference
RT	retention time
RTL	Review Team Leader
SM	Site Manager
SME	Subject Matter Expert
SOP	Standard Operating Procedures
SSAP	Sediment Sampling and Analysis Plan
SVOA	semivolatile organic analysis
SVOC	semivolatile organic compound
TBD	to be determined
TCLP	toxicity characteristic leaching procedure
TOC	total organic carbon
USEPA	U.S. Environmental Protection Agency
VOA	volatile organic aromatic
VOC	volatile organic compound
WAM	Work Assignment Manager

QAPP Worksheets #1 and #2: Title and Approval Page

1. Project Identifying Information
   a. Site Name/Project Name: Quanta Resources Corporation Superfund Site, Operable Unit (OU) 1
   b. Site Location/Number: Edgewater, New Jersey
   c. Contract/Work Assignment Number: NJD000606442
2. Lead Organization
   a. Lead Organization Project Manager: Steve Zarlinski/CH2M HILL

      Signature: _____ Date: _____

   b. Lead Organization Quality Manager: Kyle Block/CH2M HILL

      Signature: _____ Date: _____

3. Federal Regulatory Agency: Richard Ho/USEPA Region 2 Remedial Project Officer

   Signature: _____ Date: _____

4. State Regulatory Agency: Erica Bergman/New Jersey DEP, Project Manager

   Signature: _____ Date: _____

5. Other Stakeholders (as needed):

   Steve Coladonato/Honeywell International Inc., Site Remediation Manager

   Signature: _____ Date: _____

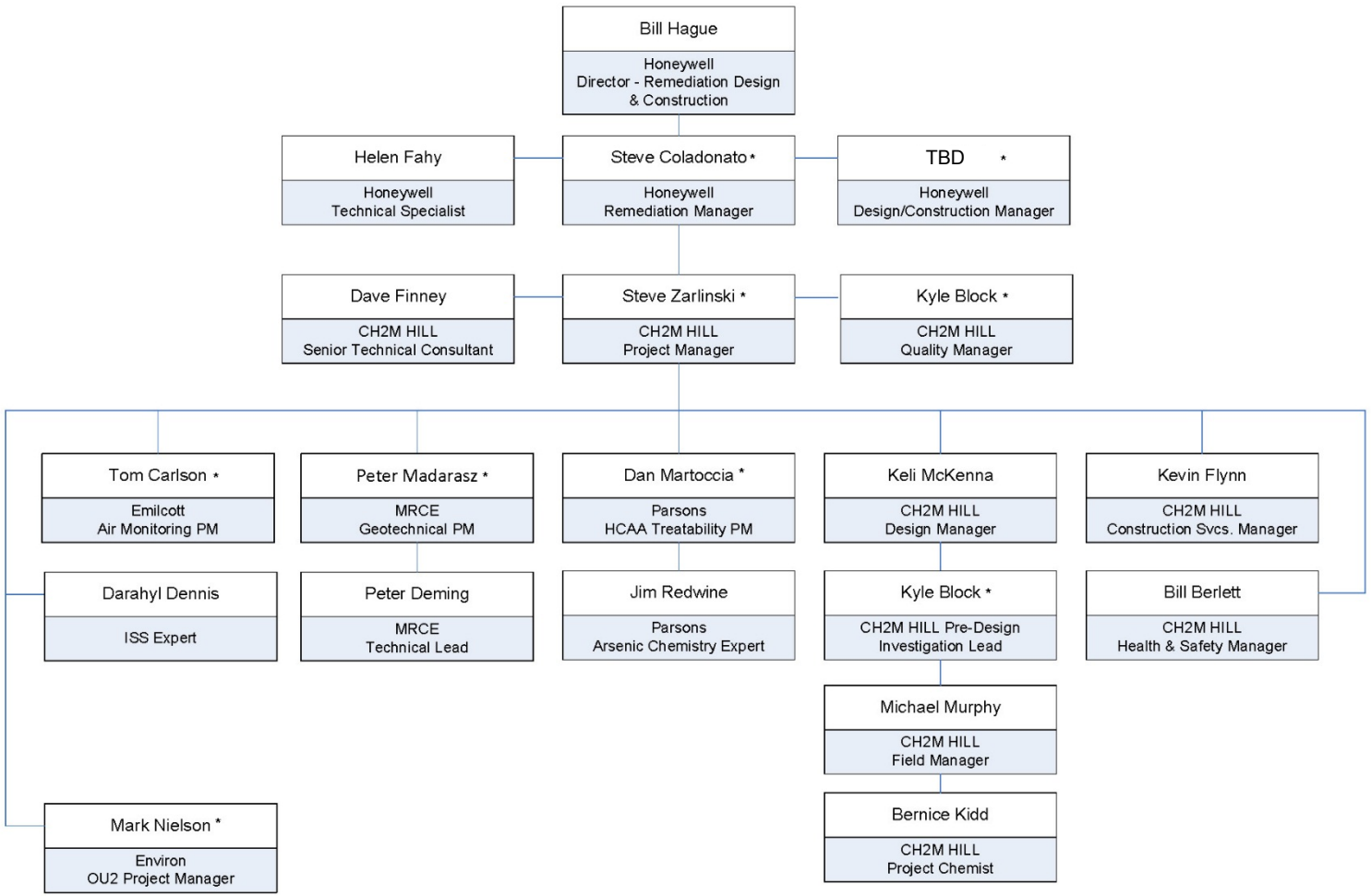
   Additional Personnel

   Signature: _____ Date: _____

6. List plans and reports from previous investigations relevant to this project

Title	Approval Date
QAPP (Revised), Operable Unit 1, Quanta Resources OU1	October 2005
QAPP (Revised), Operable Unit 1, Quanta Resources OU1	November 2006
QAPP (Revised), Operable Unit 1, Quanta Resources OU1	July 2008
QAPP (Revised), Operable Unit 1, Quanta Resources OU1	October 2011
Quality Assurance Project Plan, Quanta Resources Corporation Superfund Site, Operable Unit 1, Edgewater, New Jersey. August 2012.	August 2012

QAPP Worksheets #3 and #5: Project Organization and QAPP Distribution



* QAPP recipient.

FIGURE 8-1

Core Project Team Organization

Quanta Resources Corporation Superfund Site, OU1

CH2MHILL

QAPP Worksheets #4, #7, and #8: Personnel Qualifications and Sign-off Sheet

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date*
Organization: USEPA				
Richard Ho	Region 2 Remediation Project Manager			
Organization: NJDEP				
Erica Bergman	Remediation Project Manager			
Organization: Honeywell				
Steve Coladonato	Remediation Manager			
TBD	Design and Construction Manager			
Helen Fahy	Technical Specialist			
Organization: CH2M HILL				
Steve Zarlinski	CH2M HILL PM			
Kyle Block	Quality Manager			
Keli McKenna	Design Manager			
Michael Murphy	Field Manager			
Bill Berlett	Health and Safety Manager			
Berney Kidd	Project Chemist			
Organization: MRCE				
Peter Madarasz	MRCE PM			
Organization: Emilcott				
Tom Carlson	Emilcott PM			
Organization: Environ				
Mark Nielson	Environ PM			

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date*
Organization: Parsons				
Dan Martoccia	Parsons PM			

*Signatures indicate personnel have read and agree to implement this QAPP as written.

This project will require uniquely trained personnel to perform specialized field reconnaissance, sampling, onsite/offsite analysis, data review, and other project functions. All project personnel are qualified and experienced in the project tasks for which they are responsible. All field personnel will have received the required OSHA 40-hour HAZWOPER certification and the annual 8-hour refresher course, if applicable. Training records/certificates will maintained by the CH2M HILL.

In addition to the aforementioned roles, subcontractors will be utilized on this project to complete the required work. The subcontractors will include analytical laboratories and field services subcontractors. The below table provides a list of current subcontractors and their contact phone numbers. Should this list change, an updated list will be provided to the personnel listed in Section 2.3 of this QAPP.

Subcontractor	Role	Contact Name	Telephone Number
Envirocon	Potential subcontractor - field demonstration for stabilization/solidification	Brian Bell	(219) 548-0042
WRScompass	Potential subcontractor - field demonstration for stabilization/solidification	Kevin M. Corradino	(609) 371-7500
Applied Sciences Laboratory	Analytical Laboratory	Ashley Wille	(541) 768-3147
Accutest	Analytical Laboratory	Kristin Beebe	(732) 329-0200
ALS Environmental	Analytical Laboratory	Kate Aguilera	805-526-7161 x234

QAPP Worksheet #6: Communication Pathways

Communication pathways will follow the above organizational chart (Worksheet #3). The Honeywell RPM (Steve Coladonato) and the CH2M HILL PM (Stephen Zarlinski) will be the main contact for questions or concerns. Frequent and timely team communication is important and has a direct connection to the successful delivery of the remedial design. Individual tasks are listed in Worksheets #4, #7, and #8.

Communication Driver	Organization	Name	Contact Information
Regulatory Agency Interface	EPA Region 2	Richard Ho	212-637-4372, Ho.Richard@epamail.epa.gov
Regulatory Agency Interface	New Jersey Department of Environmental Protection	Erica Bergman	609-292-7406, Erica.Bergman@dep.state.nj.us
All project related tasks	Honeywell International Inc.	Steve Coladonato	302-791-6738, Steven.Coladonato@Honeywell.com
Construction Related Tasks	Honeywell	TBD	—
All project related tasks	CH2M HILL	Steve Zarlinski	810-360-2061, Steve.Zarlinski@ch2m.com
All project related tasks	CH2M HILL	Kyle Block	617-626-7013, Kyle.block@ch2m.com
Analytical Actions	CH2M HILL	Berney Kidd	530-229-3203, Bernice.Kidd@CH2M.com
Air Monitoring Concerns	Emilcott	Tom Carlson	973-538-1110, tcarlson@emilcott.com
Injection Tasks	Parsons	Dan Martoccia	732-537-3557, Daniel.Martoccia@parsons.com
Analytical Actions	Accutest	Kristin Beebe	732-329-0200, kristinb@accutest.com
Analytical Actions	Applied Sciences Laboratory	Ashley Wille	541-768-3147, awillie@ch2m.com
Analytical Actions	ALS Environmental	Kate Aguilera	805-526-7161, ext. 234, Kate.Aguilera@alsglobal.com

QAPP Worksheet #9: Project Planning Session Summary

Date of planning session: February 28, 2013

Location: Morristown, New Jersey

Purpose: 2013 Quanta Remedial Design Strategy Meeting

Participants:

Name	Organization	Title/Role	Phone/Email
Steve Coladonato	Honeywell	Remediation Manager	302-791-6738, Steven.Coladonato@Honeywell.com
Helen Fahy	Honeywell	Technical Specialist	973-455-2989 Helen.Fahy@Honeywell.com
TBD	Honeywell	Design/Construction Manager	—
Steve Zarlinski	CH2M HILL	Project Manager	810-360-2061, Steve.Zarlinski@ch2m.com
Dave Finney	CH2M HILL	Senior Technical Consultant	617-626-7024, david.finney@ch2m.com
Keli McKenna	CH2M HILL	Design Manager	414-272-1052 x40561, keli.mckenna@ch2m.com
Kyle Block	CH2M HILL	Quality Manager	617-626-7013, Kyle.block@ch2m.com
Peter Deming	MRCE	Technical Lead	917-339-9300, Pdeming@mrce.com
Dan Martoccia	Parsons	HCAA Treatability PM	732-537-3557, Daniel.Martoccia@parsons.com
Jim Redwine	Parsons	Arsenic Chemistry Expert	201-240-3464, James.Redwine@parsons.com
Mark Nielson	Environ	OU2 Project Manager	215-801-7955, mnielsen@environcorp.com
Darahyl Dennis	Independent Contractor	ISS Expert	770-252-6901, ndennis2@bellsouth.net

Strategy Session—Agenda

- Project Status
  - Recap Progress through Predesign Investigation scope
    - Geotechnical Evaluation
    - Test Pitting
  - HCAA Characterization and Treatability Testing
  - ISS Treatability Testing
  - NAPL Recovery
  - Air Monitoring Results
  - Review 2013 Milestones and Deliverables per Consent Decree
- Critical Strategic Issues Discussion
  - OU1/OU2 Schedule
  - Debris Management

- Remediation work sequence
- ISS Procurement
- Pilot Demonstration Planning

Action Summary	Notes/Decision
Develop options for pile removals during field demonstration and subsequently full scale implementation	—
Determine if a varied sequential application of Fe Sulfate would affect the UCS on treatability samples	—
Determine path forward for field decisions to be utilized for bucket vs. auger mixing	Utilize the field demonstration to evaluate results of both methods
Determine remedial goals for HCAA ISCF treatability testing	Understand the needs for leachability reduction and contaminant reduction. Understand means and methods for evaluating during field demonstration/full scale
Evaluate NAPL recovery schedule and prepare path forward based on results from Phase I of the PDI work. Review aggressive measures for implementation on NAPL recovery to try and exhaust what is recoverable in the short term	Include in white paper
Develop options for utility corridor to minimize areas required for ISS	Three options: - Directly south of 115 River Road - Southern end of Heagney property - Through iPark around all ISS areas
Understand implications of various remedy methods on 115 River Road	—
Develop plan for field demonstration locations to meet objectives	- Auger location - Bucket mixing location - South of 115 RR/utility corridor
Prepare field demonstration bid package	—
Develop specific objectives of field demonstration	Include implementation, debris removal, waste management, etc.
Develop an understanding on extending ISS south of 115 River Road during field demo to accommodate utility corridor	—

QAPP Worksheet #10: Conceptual Site Model

This QAPP addresses sampling and analysis associated with field demonstrations for in situ solidification and in situ chemical fixation, and waste characterization. Other field activities will be addressed under separated QAPPs submitted in conjunction with relevant work plans. The following subsections present the conceptual site model for OU1.

Site Description

The Site is located at the intersection of River Road and Gorge Road in Edgewater, New Jersey. A vacant lot referred to as the Quanta property, portions of River Road and Gorge Road, and properties and portions of properties surrounding the Quanta property comprise the upland portion of the Site, or OU1. The area of OU1 is approximately 24 acres. The Site is adjacent to the Hudson River. Figure 1 depicts the properties constituting OU1.

The Quanta property contains the following:

- Exposed former tank and building foundations
- Remnants of a former oil-water separator
- A wooden bulkhead along the shoreline
- Remains of wooden docks

The property is generally flat and at a lower elevation than River Road to the west and the City Place property to the north. The Quanta, 115 River Road, and i.Park properties are all at a similar elevation, one corresponding to the land surface during industrial use (prior to 1982). River Road and City Place are located at higher elevations due to more recent placement of fill material.

Site History

The brief site history below was provided within the Record of Decision (ROD).

The Quanta site is located at River Road and the intersection of Gorge Road, Edgewater, New Jersey. At the center of the site is a 5.5-acre vacant lot, referred to as the Quanta property, surrounded by a number of developed and undeveloped parcels, portions of which are also considered part of the site. Sections of River and Gorge Roads have been constructed on top of the site. The land portion of the site is approximately 24 acres. The site also includes an area of sediment contamination in the Hudson River. The extent of the Hudson River sediments affected by the site will be determined as part of an ongoing Operable Unit 2 (OU2) Remedial Investigation and Feasibility Study (RI/FS) that is separate from this response action.

The site is characterized by contamination from a variety of industries that operated there from at least the 1870s to 1981. These industries included coal tar processing, chemical manufacturing, and waste oil storage. The 5.5-acre Quanta property is a remnant of an industrial coal tar facility that once covered approximately 15 acres.

Geology

At the upland portion of the Site, the overburden stratigraphy listed below is generally observed (in order encountered from ground surface):

Stratigraphic Unit	Description
Fill material	Up to 35 feet of fill material consisting of a mixture of gravel, sand, and silt with brick, wood, concrete fragments, coal, cinders, and slag.
Peat/clayey peat	Up to 25 feet of organic peat or meadow mat with varying amounts of clay, fine sand, and silt. The peat/clayey peat deposits are discontinuous and have been observed primarily in borings completed near River Road, Block 93, and the former Lever Brothers property.
Soft organic silt	Up to 68 feet of soft gray-to-black organic silt containing wood, roots, and shell fragments. This unit is also included in the estuarine and salt marsh deposits. The soft organic silt is typically present only within 100 feet of the shoreline throughout the entire study area and represents former river sediments that were buried during shoreline filling. It pinches out to the west and against the bedrock high to the northwest on the former Celotex property. Moving east to west, the organic silts become the main layer within the Hudson River Basin, dipping downward extending to nearly the bedrock with a thin layer of till between the silts and bedrock.
Shallow native sand	Up to 21.5 feet of fine to medium/coarse sand with varying amounts of gravel and fines. In the central portions of the Quanta property and the northern portion of the former Lever Brothers property where the peat/clayey peat and soft organic silt are absent, the shallow native sand resides directly beneath the fill unit. South of the high bedrock elevations within the former Celotex property, native sands along the shoreline dip down, eventually pinching to an end along the shoreline of the Hudson River Basin and giving way to the soft organic silts.
Silty clay (confining unit)	Up to 35 feet of continuous silty clay with varying amounts of fine sand. The silty clay represents a lake-bottom unit that underlies the estuarine and salt marsh deposits. The silty clay serves as a confining unit and an aquitard between both the overlying native sand and fill units and the underlying deep sand deposits. It is found across most of the site with an undulating surface that dips eastward in close proximity to the existing shoreline and pinches out towards the north against a bedrock high at the former Celotex property. On the southern portion, the silty clay along the shoreline dips down in a manner similar to what is observed with the native sands, eventually pinching to an end along the shoreline of the Hudson River Basin and giving way to the soft organic silts.
Deep sand	Ranging up to approximately 32 feet of fine to coarse sand, sand with varying amounts of silt and clay, and silt and clay with varying amounts of sand. The deep sand represents a lacustrine fan unit that lies beneath the confining silty clay unit. Like the overlying silty clay confining unit, the deep sand dips eastward under the Hudson River and pinches out towards the north against the bedrock high present on the former Celotex property and to the west against the rising Palisades ridge. On the southern portion of the Site, the deep sands follow the bedrock surface and extend farther from the shoreline below the “estuarine and salt-marsh deposits” into the Hudson River Basin.
Till	Up to 12 feet of a very dense, low-permeability, reddish-brown to reddish-yellow silty sand and sand with gravel, cobbles, and boulders. Along the shoreline to the south of PZ-6D, and to a lesser extent to the north Moving from east to west into the Hudson River basin, the till deposits slope downward dramatically giving way to a thickening of the organic silt deposits.
Bedrock	The Stockton Formation composes the underlying bedrock formation at the site and is found at depths ranging from 8.5 feet (at the bedrock high in the south-central portion of the former Celotex property) to 86 feet below ground surface (bgs). Its appearance in core samples collected during the RI consisted of variably consolidated alternating sandstone and siltstone lenses with a variety of colors, including, red, white, pink, brown-gray, and brown-yellow. Towards the east and southeast bedrock dips dramatically forming the Hudson River channel.

Three distinct hydrostratigraphic units exist at the Site above the bedrock surface. The shallowest unit consists of an unconfined, surficial water-bearing zone extending from the water table—approximately 4 feet below ground

surface (bgs)—to approximately 15 to 20 feet bgs. This unit is underlain by a silty clay aquitard approximately 10 to 20 feet thick. Last, a confined water-bearing "deep sand" unit between 5 and 20 feet thick exists between the aquitard (confining unit) and the surface of the bedrock (Stockton Formation). The shallow saturated zone and deep sand units are not hydraulically connected.

Shallow groundwater flowing eastward toward the Hudson River is largely diverted to flow north and south once it reaches the shoreline, as a result of the presence of a wooden bulkhead. However, much of the groundwater above the clay confining unit flows beneath the bulkhead in the organic silt and shallow sand. Groundwater discharges to surface water through the river sediments in areas of upwelling north of and adjacent to the wooden bulkhead and to a lesser degree offshore south of the bulkhead.

Source Areas

Soil and groundwater at OU1 contain constituents from industries that operated on various portions of the Site from at least the 1870s to 1981, including coal tar processing, chemical manufacturing, and waste oil storage. A substantial amount of data and information was collected and assessed during the OU1 RI and various supplemental investigations and has achieved the objective of completing a comprehensive site characterization of the Site. The RI and various supplemental investigations included the following:

- Characterization of OU1 sources
- Determination of the nature and extent of contamination
- Evaluation of fate and transport of constituents of interest (COIs)
- Assessment of potential risks to human health and the environment

Soils at OU1 have been found to contain source material in the form of principal threat and low-level threat waste. Principal threat wastes are considered source materials, that is, materials that include or contain hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, or as a source for direct exposure. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur.

NAPL

The location, nature, and extent of the NAPL at OU1 have been comprehensively delineated through the RI process for the purposes of remedial design and implementation. NAPL is found throughout the Site and is made up of aromatic volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs). Most of the SVOCs are polycyclic aromatic hydrocarbons (PAHs). Coal tar materials found at the Site range from low-viscosity liquids to solid tar. NAPL at the Site is identified as either free-phase or residual NAPL. Free-phase NAPL is able to collect in monitoring wells, whereas residual NAPL is present in quantities insufficient to allow mobility. Most of the free-phase NAPL at the Site is denser than water and is present in six discrete areas (NAPL zones [NZs] 1 through 6), shown in Figure 1. These NZs were defined on the basis of one or more of following factors:

- Thickness of visually observed NAPL as well as TarGOST response indicating NAPL
- Lateral and vertical separation between areas where visual observations and TarGOST results indicated significant thicknesses of NAPL
- Observation of free-phase (i.e., mobile) NAPL in monitoring wells

All principal threat NAPL at the Site (i.e., the portion of the NAPL for which active remediation is required per the ROD) is present within the boundaries of these six zones (Figure 1). Exposure through direct contact, ingestion, or inhalation is plausible for NZ-1 and NZ-2, and the potential is likely that future use of the Site could result in exposure if appropriate remedial actions are not implemented. Direct exposure to NAPL in NZ-3, NZ-4, or NZ-6 is unlikely, even under a construction scenario, given their depth (generally deeper than 10 feet below ground surface). Without additional remedial effort, there is the potential for the migration of free-phase NAPL to

sediment and surface water in the Hudson River from NZ-2 and NZ-5. As indicated in the ROD, release of free-phase NAPL from NZ-1, NZ-3, NZ-4, and NZ-6 to sediments is not plausible.

Outside the defined NAPL zones and throughout the Site, NAPL is present as residual NAPL or thin, discontinuous pockets of free-phase NAPL that have not been found to be contiguous with the defined NAPL zones. These areas contain constituents exceeding soil remediation values but are not identified as source areas, and therefore they "can generally be managed in place with engineering controls (capping) and proper land-use restrictions." (ROD)

High-Concentration Arsenic Area

The HCAA lies beneath a cover and fill material, and a portion is located beneath an active access ramp to the City Place development. The extent of the HCAA is defined as soil concentrations of arsenic greater than 1,000 milligrams per kilogram (mg/kg). The 1,000 mg/kg boundary (i.e., the HCAA) as depicted was developed using historical data collected during the investigation, remediation, design, and development of the City Place property, and new data collected during the RI and supplemental investigations. The cover placed during construction of the City Place development extends beyond the delineated 1,000 mg/kg boundary along the edge of River Road on the Quanta property. The extent of the HCAA and the extent of the cover are depicted in Figure 1.

Arsenic Areas

Eight separate sources of soluble arsenic to groundwater and of other inorganic constituents in groundwater were identified as principal threat waste within the lateral extent of OU1 but outside the HCAA. Each arsenic area has elevated soil concentrations that have a potential direct-contact risk to human health defined as greater than 390 mg/kg for arsenic contamination in the shallow, unsaturated soils (approximately the first 4 feet of surface soil) and 1,000 mg/kg for deeper soils. The ROD refers to these areas as "shallow arsenic hotspots," although these areas may contain residual NAPL or overlap areas delineated as NAPL zones (Figure 1). One of these arsenic areas (referred to as AA-3), located on the i.Park property, was excavated in December 2010 by i.Park Edgewater, LLC, with oversight by CH2M HILL. The remaining seven arsenic source areas and the HCAA are depicted in Figure 1.

Site-wide Soil

Outside the areas defined as NAPL zones, residual NAPL, discontinuous pockets of free-phase NAPL, and site-related constituents are found in saturated and unsaturated soil. The primary site COCs driving the remediation are VOCs, SVOCs, and metals, particularly arsenic and lead. Remedial evaluations and design are being based on a subset of representative constituents:

- VOCs: benzene, ethylbenzene, toluene, and xylenes
- SVOCs: naphthalene and benzo(a)pyrene
- Arsenic
- Lead

Some of the remaining constituents detected less frequently above the soil remediation goals will be addressed in source areas through the remedial actions for the source areas. Outside the source areas, capping and institutional controls will meet the remedial action objectives for these other constituents by preventing direct contact.

Site-wide Groundwater

Similar Site-related constituents were detected in groundwater throughout the site. As noted in the ROD, "groundwater contamination above screening criteria, with similar constituents, has been identified from remedial investigations of all neighboring properties"; therefore, a complete delineation of the extent of groundwater impacts from the Site is not possible. EPA concluded that the factors listed below along with "the presence of off-site sources and regional characteristics…would undermine a successful restoration within OU1."

Type of Factor	Characteristics Limiting Groundwater Restoration Potential
Contaminant	Widespread presence of NAPL (primarily as DNAPL), and recalcitrant DNAPL-related constituents
	Long history of industrial use and associated releases at and outside of the site
	Volume and depth of contaminated media
	Presence of arsenic in soil and groundwater, and the collocation of arsenic and DNAPL
Hydrogeologic	Complex geology consisting of interbedded and undulating layers of sands, silts and clays with discontinuous peat deposits
	Heterogeneous soil conditions and the presence of low permeability materials such as silts and clays
Site setting	Highly urbanized environment with significant surficial and subsurface infrastructure

DNAPL, dense non-aqueous-phase liquid.

A waiver of groundwater Applicable or Relevant and Appropriate Requirements (ARARs) within the OU1 boundary was granted by EPA on the basis of technical impracticability from an engineering perspective, and Remedial Action Objectives (RAOs) were developed to prevent unacceptable exposure and limit offsite migration. The complete evaluation of groundwater restoration potential is documented in the technical impracticability evaluation (CH2M HILL, 2010).

Remedial Action Objectives

The ROD established RAOs for principal threat waste, soil, and groundwater. Remedial action objectives for principal threat wastes and other media at the Site are as follows:

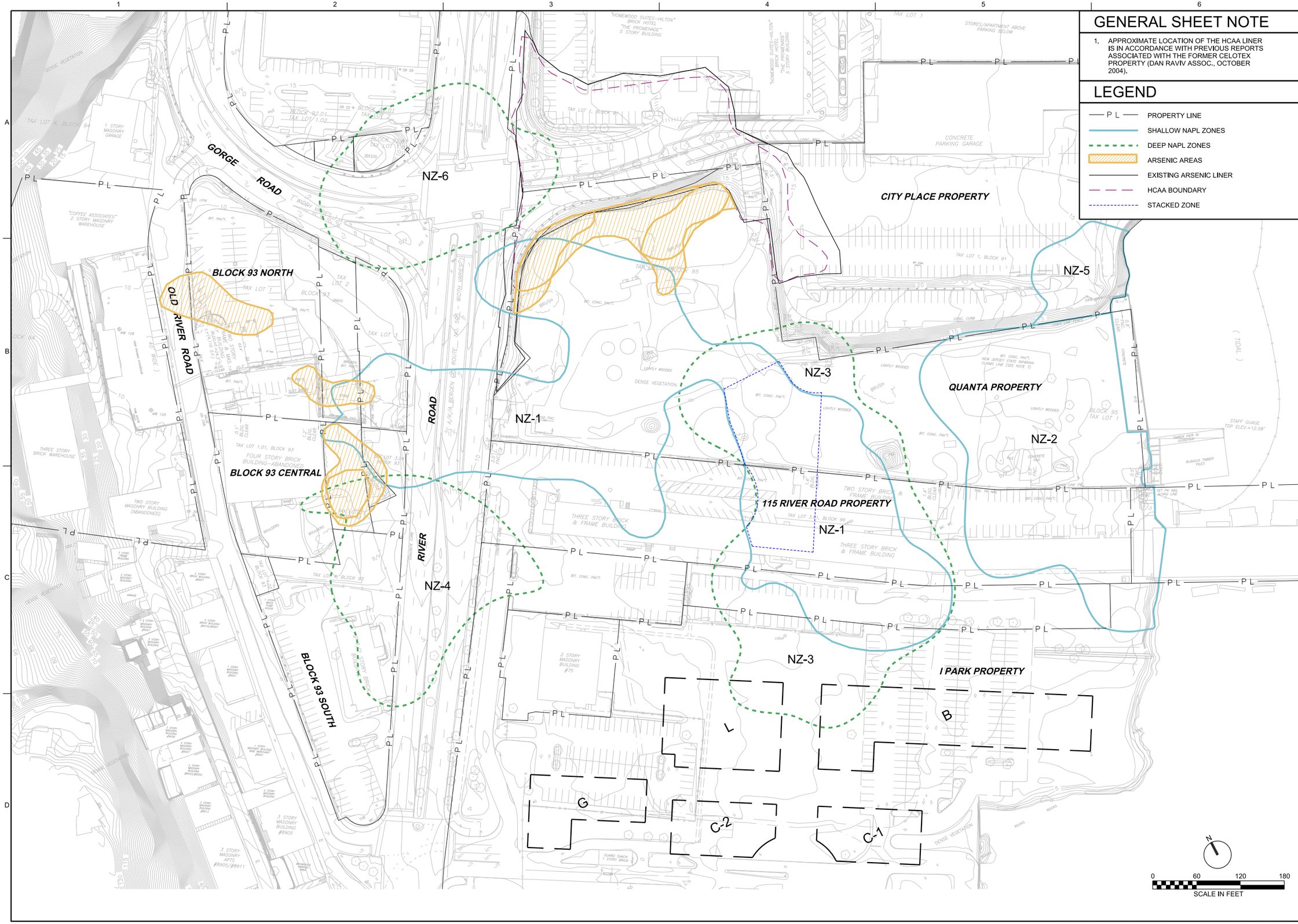
Material	Remedial Action Objectives
Principal threat waste	Remove, treat, or contain principal threat waste, to the extent practicable.
	Prevent exposure to NAPL and arsenic source material that poses an unacceptable human health risk.
	Prevent current or potential future migration of free-phase NAPL to the Hudson River or to areas that would result in direct contact exposure.
	Mitigate free-phase NAPL that poses a potential source of vapor intrusion and resulting inhalation exposure within existing or potential future structures.
	Mitigate NAPL and arsenic principal threats as sources of groundwater contamination, to the extent practicable.
Soil	Prevent or minimize potential human exposure through direct contact, ingestion, dust inhalation, or vapor intrusion that presents unacceptable risk from exposure to contaminated soil attributable to the site.
	Prevent or minimize potential erosional transport off site or to the Hudson River of contaminated soils at concentrations posing unacceptable risk.
Groundwater	Prevent or minimize potential exposure by contact, ingestion, or inhalation/vapor intrusion that presents unacceptable risk from exposure to contaminated groundwater attributable to the site.
	Prevent migration and preferential flow of site contaminants in groundwater to sediments and surface water of the Hudson River at levels posing an unacceptable risk to human health or ecological receptors.

GENERAL SHEET NOTE

1. APPROXIMATE LOCATION OF THE HCAA LINER IS IN ACCORDANCE WITH PREVIOUS REPORTS ASSOCIATED WITH THE FORMER CELOTEX PROPERTY (DAN RAVIV ASSOC., OCTOBER 2004).

LEGEND

- PROPERTY LINE
- SHALLOW NAPL ZONES
- DEEP NAPL ZONES
- ARSENIC AREAS
- EXISTING ARSENIC LINER
- HCAA BOUNDARY
- STACKED ZONE



NO.	DATE	REVISION	BY	APVD

DSGN KD BLOCK | DR PA KARABAN | CHK | APVD

HONEYWELL INTERNATIONAL INC.
QUANTA RESOURCES CORPORATION
SUPERFUND SITE
Edgewater, New Jersey

CH2MHILL®

FIGURE 1
OU1 BASE MAP

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	
PROJ	428872
DWG	FIGURE 1
SHEET	of

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Selected Remedial Action

The Selected Remedy described within the ROD involves the solidification/stabilization of NAPL and arsenic source areas, capping and institutional controls, coupled with the installation of a groundwater containment remedy, a subaqueous reactive barrier in the Hudson River to mitigate contaminated groundwater releases. The components of the Selected Remedy include:

- On-site solidification/stabilization of an estimated 150,000 cubic yards of contaminated soil containing arsenic and NAPL, primarily by in-situ solidification/stabilization (ISS).
- Remaining deep NAPL will be collected utilizing recovery wells or recovery trenches and NAPL collected and disposed of offsite.
- Installation of a vapor mitigation system and basement sealing at 115 River Road; construction of a temporary barrier wall at 115 River Road along the shoreline to isolate untreated free phase NAPL from the Hudson River and sediments.
- Capping of contaminated soils remaining on site at concentrations greater than the Remediation Goals for residential direct contact with a multilayer cap as approved by EPA.
- Installation of a subaqueous reactive barrier (SRB) in Hudson River sediments, coordinated with a future OU2 remedy.
- Operation and maintenance for the active components of the remedy, such as the Deep NAPL collection system and vapor intrusion systems, monitoring of the site over the long term to assure the protectiveness of the Remedy, and institutional controls; implementation of a long-term sampling and analysis program to monitor the contamination at the site in order to assess groundwater migration, and the effectiveness of the remedy over time.

QAPP Worksheet #11: Project/Data Quality Objectives

This QAPP addresses the field demonstration of in situ solidification/stabilization (ISS) in non–aqueous phase liquid (NAPL) zones and arsenic areas. This QAPP also covers air monitoring and waste characterization in support of the field demonstration.

ISS Field Demonstration

Data collected during the predesign investigation in 2012–2013 has allowed for the identification of a reagent mix and dosages capable of meeting the performance criteria identified in the ROD. The purpose of the field demonstration for ISS is to further refine the understanding of reagent delivery by completing the objectives and scope listed below.

Objective Description	Overview of Proposed Scope
1. Demonstrate consistency with the treatability test results and ability to achieve project performance goals in the field with two mechanical mixing devices: auger mixing and bucket mixing	Collect samples of treated soil at discrete depths within treated areas for compliance testing for UCS, permeability, and leachability reduction.
2. Evaluate the efficacy of the QA/QC approach to reliably and consistently show compliance with the project performance goals and monitor construction parameters	Utilize field tests and short-term laboratory tests to determine ranges of short-term test results correlating with laboratory compliance testing results meeting performance criteria.
3. Evaluate debris management in the field; develop a process for debris handling and removal, including determination of clean and dirty debris, and develop a process for evaluating the effect of incorporating the debris in the final mixed area	Characteristics of debris encountered (quantity, size, thickness, type, etc.) will be documented. Debris removed will be sized and visually categorized. Incorporation of the sized debris will be field tested and documented.
4. Assess potential exposure risk through real-time monitoring and analytical sampling methods	Establish baseline air quality conditions at the property and monitor ambient air quality at the property boundaries and within the exclusion zone.
5. Demonstrate the efficacy of odor and dust control mitigation methods	Implement odor and dust control measures, and implement mitigation if air quality monitoring indicates that specified levels are exceeded.
6. Evaluate scale up of construction parameters	Monitor and document construction parameters during implementation including production rates, equipment selection and/or modification, and sequencing of work.
7. Estimate amount of swell/expansion from each mixing method and evaluate subcontractor's onsite management of material	Containment berms will be constructed around the treatment areas to manage and estimate the amount of swell generated during mixing.
8. Determine if additional parameters, beyond depth, should be considered in selection of the mixing method for areas in the full-scale implementation	Performance sampling, including consistency and compliance tests, will be conducted and evaluated to support development of full-scale construction quality control.
9. Evaluate approach for pile removal and management	Test two proposed methods for pile management, pile cutting (treatment areas less than 15 ft bgs) and pile extraction (treatment areas greater than 15 ft bgs).

QA/QC monitoring and sampling will be performed during the field demonstration test and includes baseline testing, reagent and equipment monitoring, and collection of performance samples.

Air Monitoring

The purpose of the perimeter air monitoring program (PAMP) is to ensure that members of the general public, including any workforce located at the site but not involved with intrusive activities, are not exposed to hazardous levels of airborne contaminants due to fugitive emissions from the site remedial activities. Perimeter air monitoring is designed to accomplish the following objectives:

- Protect human health from exposure to unacceptable risk levels of contaminants in the soil to be remediated;
- Minimize risk of community exposure to contaminants resulting from remediation work performed at the site;
- Determine the need for, and evaluate the effectiveness of dust and vapor emission controls;
- Monitor and document ambient air quality at project perimeter locations during remediation activities to prevent elevated off-site exposures;
- Evaluate the monitoring data over the course of the project to continuously assess exposure risks at the project perimeter;
- Support real-time air monitoring data through the periodic collection of laboratory analytical samples.

Waste Characterization

Waste generated during the field demonstrations will be characterized and managed. It is anticipated that the following wastes could be generated during these activities:

- Cleared vegetation
- Buried unknown drums and containers with unknown content or contaminants (includes buried tanks, equipment, unknown devices or equipment
- Debris including construction and demolition debris such as wood, brick or concrete
- Contaminated debris (personal protective equipment [PPE], and disposable sampling equipment)
- Soils cuttings from the following activities:
  - Boring installation for soil sample collections
- Aqueous wastes, including
  - Potentially contaminated excavation water (surface or groundwater)
  - Decontamination water and container cleanout water
  - Purged groundwater
  - Unused reagents
  - Unknown liquids contained in buried containers
- Empty containers
- Residual hazardous and nonhazardous materials

QAPP Worksheet #12: Measurement Performance Criteria

As part of the remedial design, environmental samples will be collected on several matrices. Environmental samples will be required to meet selected performance criteria as indicated in the below tables. Measurement performance criteria are acceptance limits selected for project-specific sampling and analytical systems that will be used to judge whether project quality objectives are met. These measurement performance criteria should be satisfied in order to support defensible decisions and provide sufficient data for ultimately completing the implementation of the remedial action.

Data quality will be evaluated based on their precision, accuracy, representativeness, completeness, and comparability.

Precision

Precision is a measure of reproducibility of analytical results. It can be defined as the degree of mutual agreement among individual measurements obtained under similar conditions. Total precision is a function of the variability associated with both sampling and analysis. Precision will be evaluated as the relative percent difference (RPD) between field duplicate sample results and laboratory sample duplicates, or between the MS and MSD results. Field duplicates will compose 10 percent of the sampling effort. MS/MSD samples will be field designated at a 5 percent frequency.

Accuracy

Accuracy is the degree of agreement between a measured value and the “true” (or expected) value. It represents an estimate of total error from a single measurement, including either systematic error (bias) or random error that may reflect variability due to imprecision. Accuracy is evaluated in terms of percent recoveries determined from results of MS/MSD and laboratory control sample (LCS) analyses.

Representativeness

Representativeness is the degree to which sample data accurately reflect the characteristics of a population of samples. It is achieved through a well-designed sampling program and by using standardized sampling strategies and techniques, and analytical procedures. Factors that can affect representativeness include site homogeneity, sample homogeneity at a single point, and available information around which the sampling program is designed. Using multiple methods to measure an analyte can also result in nonrepresentativeness of sample data.

Completeness

Completeness is the amount of valid measurements compared to the total amount generated. It will be determined for each method, matrix, and analyte combination. The completeness goals of each project are optimized to meet the DQOs. The goals for this program are 95 percent.

Comparability

Comparability is the confidence with which one data set can be compared to another. It is achieved by maintaining standard techniques and procedures for collecting and analyzing samples, and reporting the analytical results in standard units. Results of performance evaluation samples and systems audits will provide additional information for assessing comparability of data among participating subcontractor laboratories.

Matrix: Water

Analytical group or method: Volatile organics, SW-846 8260B

Concentration level: Low

Data Quality Indicator (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Field Duplicates	≤30% RPD for analytes at least 5X reporting limit
Accuracy/Precision (laboratory)	Laboratory Control Sample and Laboratory Control Sample Duplicate	Criteria listed in Table 28-1
Sensitivity	Initial calibration and Form I for all environmental samples	Reporting limit 1 µg/L or better for chlorinated VOCs
Accuracy	Internal Standards	Criteria listed in Table 28-1
Accuracy/Precision	Matrix Spike and Matrix Spike Duplicate	Criteria listed in Table 28-1
Accuracy	Surrogate Compounds	Criteria listed in Table 28-1
Accuracy	Lab Method Blank, Field (rinsate) blank, trip blank	< RL

Matrix: Water

Analytical group or method: Semivolatile organics, SW-846 8270C

Concentration level: Low

Data Quality Indicator (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Field Duplicates	≤30% RPD for analytes at least 5X reporting limit
Accuracy/Precision (laboratory)	Laboratory Control Sample and Laboratory Control Sample Duplicate	Criteria listed in Table 28-2
Sensitivity	Initial calibration and Form I for all environmental samples	Reporting limit 10 µg/L or better for most SVOCs
Accuracy	Internal Standards	Criteria listed in Table 28-2
Accuracy/Precision	Matrix Spike and Matrix Spike Duplicate	Criteria listed in Table 28-2
Accuracy	Surrogate Compounds	Criteria listed in Table 28-2
Accuracy	Lab Method Blank, Field (rinsate) Blank	< RL

Matrix: Water

Analytical group or method: TPH—GRO/DRO, SW-846 8015B

Concentration level: Low

Data Quality Indicator (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Field Duplicates	≤30% RPD for analytes at least 5X reporting limit
Accuracy/Precision (laboratory)	Laboratory Control Sample and Laboratory Control Sample Duplicate	Criteria listed in Table 28-3
Sensitivity	Initial calibration and Form I for all environmental samples	See Table 15-2
Accuracy/Precision	Matrix Spike and Matrix Spike Duplicate	Criteria listed in Table 28-3
Accuracy	Surrogate Compounds	Criteria listed in Table 28-3
Accuracy	Lab Method Blank, Field (rinsate) blank, trip blank	< RL

Matrix: Water

Analytical group or method: RCRA metals, SW-846 6010C (7470A for mercury and IC-ICP-MS for arsenic speciation)

Concentration level: Low

Data Quality Indicator (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision (field)	Field Duplicates	≤ 30% RPD for analytes at least 5X reporting limit
Precision (laboratory)	Laboratory Control Sample Duplicate and Matrix Spike Duplicate	Criteria listed in Table 28-4
Precision	Serial Dilution	Criteria listed in Table 28-4
Sensitivity	Initial calibration and Form I for all environmental samples	Reporting limit to meet or exceed USEPA CRQLs for target metals *
Accuracy	Matrix Spike	Criteria listed in Table 28-4
Accuracy	Post Digestion Spike	Criteria listed in Table 28-4
Accuracy	Laboratory Control Sample	Criteria listed in Table 28-4
Accuracy	Preparation Blank	No analyte > CRQL
Precision	Interference Check Sample	< RL for RCRA metals

* See Table 15-2.

Matrix: Water

Analytical group or method: General chemistry, E415.1 TOC

Concentration level: Medium

Data Quality Indicator (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision (field)	Field Duplicates	≤ 30% RPD for analytes at least 5X reporting limit
Precision (laboratory)	LCS Duplicate, Matrix Spike Duplicate, or Laboratory Duplicate	Criteria listed in Table 28-5
Sensitivity	Initial calibration and Form I for all environmental samples	See Table 15-2
Accuracy	Matrix Spike	Criteria listed in Table 28-5
Accuracy	Laboratory Control Sample	Criteria listed in Table 28-5
Accuracy	Preparation Blank	No analyte > CRQL

Matrix: Soil

Analytical group or method: Volatile organics, SW-846 8260B

Concentration level: Low

Data Quality Indicator (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Field Duplicates	≤50% RPD for analytes at least 5X reporting limit
Accuracy/Precision (laboratory)	Laboratory Control Sample and Laboratory Control Sample Duplicate	Criteria listed in Table 28-1
Sensitivity	Initial calibration and Form I for all environmental samples	Reporting limit 5 µg/kg or better for chlorinated VOCs**
Accuracy	Internal Standards	Criteria listed in Table 28-1
Accuracy/Precision	Matrix Spike and Matrix Spike Duplicate	Criteria listed in Table 28-1
Accuracy	Surrogate Compounds	Criteria listed in Table 28-1
Accuracy	Lab Method Blank, Field (rinsate) Blank	< RL

** Actual RLs, adjusted for moisture content of sample and reported on a dry-weight basis, may be higher.

Matrix: Soil

Analytical group or method: Semivolatile organics, SW-846 8270C

Concentration level: Low

Data Quality Indicator (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Field Duplicates	≤50% RPD for analytes at least 5X reporting limit
Accuracy/Precision (laboratory)	Laboratory Control Sample and Laboratory Control Sample Duplicate	Criteria listed in Table 28-2
Sensitivity	Initial calibration and Form I for all environmental samples	Reporting limit 10 µg/kg or better for most SVOCs**
Accuracy	Internal Standards	Criteria listed in Table 28-2
Accuracy/Precision	Matrix Spike and Matrix Spike Duplicate	Criteria listed in Table 28-2
Accuracy	Surrogate Compounds	Criteria listed in Table 28-2
Accuracy	Lab Method Blank, Field (rinsate) Blank	< RL

** Actual RLs, adjusted for moisture content of sample and reported on a dry-weight basis, may be higher.

Matrix: Soil

Analytical group or method: TPH—GRO/DRO, SW-846 8015B

Concentration level: Low

Data Quality Indicator (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Field Duplicates	≤50% RPD for analytes at least 5X reporting limit
Accuracy/Precision (laboratory)	Laboratory Control Sample and Laboratory Control Sample Duplicate	Criteria listed in Table 28-3
Sensitivity	Initial calibration and Form I for all environmental samples	See Table 15-1
Accuracy/Precision	Matrix Spike and Matrix Spike Duplicate	Criteria listed in Table 28-3
Accuracy	Surrogate Compounds	Criteria listed in Table 28-3
Accuracy	Lab Method Blank, Field (rinsate) blank, trip blank	< RL

Matrix: Soil

Analytical group or method: RCRA metals, SW-846 6010C (7471A for Mercury)

Concentration level: Low

Data Quality Indicator (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision (field)	Field Duplicate	≤50% RPD for analytes at least 5X reporting limit
Precision (laboratory)	LCS Duplicate, Matrix Spike Duplicate	Criteria listed in Table 28-4
Precision	Serial Dilution	Criteria listed in Table 28-4
Sensitivity	Initial calibration and Form I for all environmental samples	Reporting limit to meet or exceed USEPA CRQLs for target metals*
Accuracy	Matrix Spike	Criteria listed in Table 28-4
Accuracy	Post Digestion Spike	Criteria listed in Table 28-4
Accuracy	Laboratory Control Sample	Criteria listed in Table 28-4
Accuracy	Preparation Blank	No analyte > CRQL
Precision	Interference Check Sample	< RL for RCRA metals

* See Table 15-1.
** Criterion not applicable when sample concentration is greater than 4 times the spike concentration.

Matrix: Soil

Analytical group or method: General chemistry, E365.3M – ortho-Phosphate, SM2320 B-11Mod - Alkalinity

Concentration level: Medium

Data Quality Indicator (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision (field)	Field Duplicate	≤50% RPD for analytes at least 5X reporting limit
Precision (laboratory)	LCS Duplicate, Matrix Spike Duplicate, or Laboratory Duplicate	Criteria listed in Table 28-5
Sensitivity	Initial calibration and Form I for all environmental samples	See Table 15-1
Accuracy	Matrix Spike	Criteria listed in Table 28-5
Accuracy	Laboratory Control Sample	Criteria listed in Table 28-5
Accuracy	Preparation Blank	no analyte > CRQL

Matrix: Air

Analytical group or method: Volatile organics, TO-15

Concentration level: Low

Data Quality Indicator (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Field Duplicates	≤50% RPD for analytes at least 5X reporting limit
Accuracy/Precision (laboratory)	Laboratory Control Sample and Laboratory Control Sample Duplicate	Criteria listed in Table 28-6
Sensitivity	Initial calibration and Form I for all environmental samples	See Worksheet #15-3
Accuracy	Internal Standards	Criteria listed in Table 28-6
Accuracy	Surrogate Compounds	Criteria listed in Table 28-6
Accuracy	Lab Method Blank	< RL

Matrix: Air

Analytical group or method: Semi-volatile organics, NIOSH Method 5515

Concentration level: Low

Data Quality Indicator (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Field Duplicates	≤50% RPD for analytes at least 5X reporting limit
Accuracy/Precision (laboratory)	Laboratory Control Sample and Laboratory Control Sample Duplicate	Criteria listed in Table 28-7
Sensitivity	Initial calibration and Form I for all environmental samples	See Worksheet #15-3
Accuracy	Internal Standards	Criteria listed in Table 28-7
Accuracy	Surrogate Compounds	Criteria listed in Table 28-7
Accuracy	Lab Method Blank	< RL

Matrix: Air

Analytical group or method: Metals, Modified NIOSH Method 7303

Concentration level: Low

Data Quality Indicator (DQI)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Field Duplicates	≤50% RPD for analytes at least 5X reporting limit
Accuracy/Precision (laboratory)	Laboratory Control Sample and Laboratory Control Sample Duplicate	Criteria listed in Table 28-8
Sensitivity	Initial calibration and Form I for all environmental samples	See Worksheet #15-3
Accuracy	Lab Method Blank	< RL

QAPP Worksheet #13: Secondary Data Criteria and Limitations

Secondary data refer to historical data previously collected for the sites. The source(s) of the data, date of collection, planned uses, and limitations of the secondary data for each site are summarized in the following table.

Data Type	Source	Data Uses Relative to Current Project	Factors Affecting the Reliability of Data and Limitations on Data Use
GW, SW, SS, SB, Sediment, NAPL	Various, historical	Historical data to be used as needed based on limitations	The data is treated as screening-level qualitative measurements since full analytical QC data was not received with the data nor was there conclusive indication that full review was conducted.
Soil, GW,	CH2M HILL, OU1 RI	To help identify potential source areas and to help plan sampling locations	No limitation
Soil, GW, SW, Air, NAPL	CH2M HILL, OU1 SI	To help identify potential source areas and to help plan sampling locations	No limitation
Sediment	CH2M HILL, OU2 sediment study	To help identify potential source areas and to help plan sampling locations	No limitation
Air	CH2M HILL, vapor intrusion events	To help identify potential source areas and to help plan sampling locations	No limitation
Soil, GW, SW, PW	CH2M HILL, 2008–2009 SRI	To help identify potential source areas and to help plan sampling locations	No limitation
Soil	CH2M HILL, 2008–2009 soil sampling	To help identify potential source areas and to help plan sampling locations	No limitation
Sediment	CH2M HILL, 2008 OU2 BERA	To help identify potential source areas and to help plan sampling locations	No limitation
Soil, NAPL	CH2M HILL, 2010 soil sampling	To help identify potential source areas and to help plan sampling locations	No limitation
Soil, NAPL	CH2M HILL, 2011 soil sampling	To help identify potential source areas and to help plan sampling locations	No limitation
GW, Soil, Air	CH2M HILL, 2012 PDI	To help identify potential source areas and to help plan sampling locations	No limitation

Notes:
BERA— baseline ecological risk assessments
GW - groundwater
PCB— polychlorinated biphenyls
PDI— Pre-Design Investigation
RI— Remediation Investigation
SI— Supplemental Investigation
SRI— Supplemental Remediation Investigation
SVOC—semi-volatile organic compounds
TPH—total petroleum hydrocarbons
VOC—volatile organic compounds

QAPP Worksheets #14 and #16: Project Tasks and Schedule

The work scope involves tasks summarized below. The ISS field demonstration test consists of the following main activities:

- Mobilization and site preparation
- Debris removal and management, including piles
- ISS of approximately 1,140 yd^3 of soil using bucket and auger mixing techniques
- ISS of approximately 1,320 yd^3 of soil along a proposed utility corridor crossing NZ-1, using bucket mixing techniques (tentative)
- Air monitoring
- QA/QC monitoring and sampling
- Waste management
- Site restoration and survey

Mobilization and Site Preparation

The selected subcontractors will mobilize equipment, materials, supplies, and personnel to the site following submittal of required plans and submittals. The following additional tasks will be performed as part of the site mobilization:

- Set up the slurry batch plant
- Demarcate the five treatment areas
- Establish the perimeter air monitoring stations
- Establish temporary facilities and utilities to support site activities
- Construct a decontamination pad
- Establish staging areas and construction exclusion work zones
- Mark out boundaries of the treatment areas based on coordinates provided by CH2M HILL
- Provide temporary spill containment controls
- Establish overall site stormwater and erosion control
- Establish stockpile areas for debris sizing and staging
- Install privacy screen to existing chain link fence

Site preparation activities will include clearing, grubbing, and chipping of brush and trees within the treatment areas. Surface asphalt present within the treatment areas will be removed and stockpiled. Site security will be provided by the existing chain-link fence and gate.

The field demonstration areas located on the Quanta property have been cleared for subsurface utilities by a private utility locator, to the extent feasible, during the PDI work. Prior to intrusive work, the area will be inspected for evidence of utilities (uniform sand, caution tape, etc.). The utilities around the field demonstration area associated with the utility corridor have not been cleared. The NJ One-Call number and a third-party utility locate will be used to identify utilities within the work area.

In Situ Solidification/Stabilization

The in situ solidification will be applied over up to five separate areas. A total of approximately 2,460 yd^3 is estimated for in situ treatment based on the following treatment depths for each area.

After the treatment area has been cleared of debris and obstructions, containment berms will be created and the reagents will be introduced into each field demonstration area as a wet slurry. With the removal of surface debris, there will be a depression that will aid in the management of swell treated material. Additional near-surface soils may be removed or clean backfill imported to create berms, if necessary, to accommodate the swell of treated material.

The subcontractor will set up a slurry batch plant that will consist of the necessary tanks and mixers, reagent storage silos, pumps, and meters to deliver a uniform slurry to each treatment area. The pozzalonic reagents will be delivered in dry bulk and conveyed into storage silos or tankers adjacent to the slurry batch plant. Dust generation during the handling of the reagent will be controlled through the use of air filters on the silo, and monitoring/controlling pressure of pneumatic delivery to the silo. The dry reagent will be metered into the slurry batch plant to document the proper mass of reagent is added to each batch of slurry prepared. Water will be obtained from a nearby water source and pumped or piped directly to the slurry batch plant. A grout pump with variable speed motor will be used to convey the slurry to the treatment areas through a discharge pipe and applied to the work area with the quantity metered to document the required amount of reagent is added to each treatment area. The slurry batch plant is operated by integral diesel engine and power supply or generators.

For the auger-mixing technique, the ISS will be performed using a crane-mounted drill rig equipped with an 8- to 10-ft-diameter auger. The auger drill will be placed on mats to provide stability, maintain vertically plumb mixing, and minimize contamination of the drill rig tracks. The location of the columns will be predetermined and the center point of each column located with a 10 to 20 percent overlap with adjacent columns to provide complete mixing of the treatment area.

The auger is mounted to a Kelly bar (drill stem) which is marked with graduation to indicate the distance from the cutting point of the auger to the bar. The mixing depth is then calculated based on the pre-existing surface elevation and the depth on the Kelly bar. As the cutting point of auger is advanced, slurry is injected into the treatment area and thoroughly mixed.

For the bucket-mixing technique, the ISS will be performed using an excavator equipped with GPS guidance for both vertical and horizontal control during mixing. Slurry is pumped to the treatment area through a pipe mounted on the excavator and the excavator bucket is used to blend the reagent slurry with the soils.

Debris Removal and Pile Management

In preparation for ISS, subsurface debris must be removed to clear obstructions that would impede the thorough mixing of the treatment areas. Based on the historic operations and finding of the test pitting investigation, it is anticipated that debris encountered may consist of concrete building and tank foundations, timber piles, and brick footings. Pile tops will be exposed during the removal of the surface debris. To the extent practicable, gross removal of soils and coal tar that may remain on the debris will be performed over the treatment area.

Debris removed from the treatment areas will be segregated into two categories based on qualitative methods. The material will be placed in the designated staging area depending upon the following characteristics:

- Category 1—material that has *no* visible contamination, staining, or odors
- Category 2—material that has visible contamination, staining, or odors

The removed debris/obstructions will be sized and stockpiled in the appropriate staging area. The Category 2 material, and as much as possible of the Category 1 material, will be re-incorporated into the treatment area. Material to be incorporated in the auger mixed area will be sized to a maximum of 1 foot by 1 foot and material to be incorporated in the bucket-mixed areas or sent offsite for disposal will be sized to a maximum of 2 feet by 2 feet.

Piles located within the treatment areas will require removal to allow for complete mixing of the treatment areas. Due to the use of two mixing techniques during the field demonstration test, two different methods for pile removal will be tested.

- Bucket-mixed areas: Piles will be exposed as needed to allow the pile to be cut with a trackhoe and sheer attachment, or similar, at the treatment depth.
- Auger-mixed areas: Piles tops will be exposed and the excavation filled with grout. As the pile is extracted with static force, possibly using dynamic assistance, grout will be added to the excavation to maintain a constant hydraulic pressure that provides the force necessary to fill the void created by the pile. If grout is not lost to the void space as the pile is extracted, the treatment depth will be extended to the depth of the void as determined by the length of the removed pile.

QA/QC Monitoring and Sampling

QA/QC monitoring and sampling will be performed during the field demonstration test and includes baseline testing, reagent and equipment monitoring, and collection of performance samples. Sample collection and analysis will be conducted in accordance with this updated UFP-QAPP and worksheet #17 and worksheet #18.

Waste Management and Equipment Decontamination

Waste will be characterized and managed as described in the Waste Management Plan (Appendix C of the RDWP Addendum). Excess debris will be transported and disposed of offsite. Groundwater or stormwater encountered in the test areas can be used in the makeup of the reagent slurry or managed by pumping from an active test area into a previously treated test area within the Site. Groundwater will not be allowed to overflow test areas. If groundwater volumes exceed the capacity of the excavated areas it will be pumped into an onsite frac tank for characterization and disposal as described in the Waste Management Plan.

A portable steam cleaner will be available for decontamination of excavation equipment. An equipment decontamination area will be constructed, and all waste from the decontamination area will be containerized and managed following completion of site activities.

Air Monitoring, Dust and Odor Control

The field demonstration activities have the potential to generate odors, dust, and emissions. The subcontractors will be prepared to implement the necessary controls based on the results of the air monitoring. Real-time perimeter air monitoring will be conducted by the Emilcott (Morristown, NJ) Greenlight Environmental Monitoring System as detailed in Appendix D of the RDWP Addendum. Emission, odor, and dust control will be conducted as necessary based on both perimeter and/or personnel air monitoring data.

Dust control methods will include the use of water sprays over areas were particulates are likely generated including high traffic areas, debris sizing, etc. There should be minimal dust generated during the slurry preparation due to the use of pneumatic delivery of the bulk reagents and filters in the storage silos.

The subcontractor may use a number of controls to mitigate odor and emission during the field demonstration test activities. Control methods may include, but are not limited to, placement of temporary backfill covers, water sprays, and foam. Additional contingency measures (e.g., shroud and vapor management system) will be available if necessary for the auger-mixed areas. At the end of each work day, all exposed excavated soil piles will be covered and secured.

Site Restoration and Survey

The surface of the treated soils will be graded to match the existing surrounding grade. The final graded treatment area will be covered with a minimum of 6 inches of clean imported backfill. The area will be seeded and mulched/hay to minimize erosion. A final survey of the treatment areas will be conducted using a New Jersey–certified surveyor.

Schedule

Activity	Responsible Party	Planned Start Date	Anticipated Duration	Deliverable
Mobilization	CH2M HILL and Subcontractors	TBD	5 days	Field Notes
Site Preparation	Site Civil Subcontractor	Following Mobilization	2 weeks	Field Notes
Debris removal and management	Site Civil Subcontractor			Field Notes
ISS Field Demonstration on Quanta site	ISS Subcontractor	Following Debris Removal	3 weeks	Field Notes
ISS Field Demonstration within Utility corridor (tentative)	ISS Subcontractor	Following ISS on Quanta site	3 weeks	Field Notes
Air monitoring	Emilcott	With Debris Removal	Throughout Invasive Field Activities	Project Completion Report and Air Analytical Data
QA/QC monitoring and sampling	CH2M HILL	With ISS Field Demonstration	Throughout ISS	Field Notes/Analytical Report
Waste management	CH2M HILL	Upon Waste Generation	Up to 2 months following Demobilization	Field Notes/Analytical Report
Offsite Analysis	Accutest/ASL	Following Sample Submission	45 days	Analytical Report
Site restoration and survey	CH2M HILL and Subcontractors	Following ISS	5 days	Survey Data
Demobilization	CH2M HILL and Subcontractors	Following Field Activities	5 days	N/A

QAPP Worksheet #15: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

The following tables contain the list of target compounds or contaminants of concern (COCs) that will be evaluated for this project. Due to the nature of the project, no project action limits (PAL) or project quantitation limits (PQL) have been specified or are required, with the exception of air monitoring.

Matrix: Soils

Analytical method: Total TAL Metals, Total VOCs, Total SVOCs, TPH, ortho-Phosphate, Alkalinity, Geotechnical

Concentration level (if applicable): Low

TABLE 15-1

Analyte	Project Action Limit (PAL)	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific Quantitation Limit[a] (µg/kg)	Laboratory-specific Detection Limit[b] (µg/kg)
Aluminum	NA	50000	50000	2144
Antimony	NA	2000	2000	212
Arsenic	NA	2000	2000	440
Barium	NA	20000	20000	27
Beryllium	NA	200	200	10
Cadmium	NA	500	500	71
Calcium	NA	500000	500000	4957
Chromium	NA	1000	1000	120
Cobalt	NA	5000	5000	80
Copper	NA	2500	2500	113
Iron	NA	50000	50000	2355
Lead	NA	2000	2000	365
Magnesium	NA	500000	500000	1352
Manganese	NA	1500	1500	39
Nickel	NA	4000	4000	146
Potassium	NA	1000000	1000000	3159

TABLE 15-1

Analyte	Project Action Limit (PAL)	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific Quantitation Limit[a] (µg/kg)	Laboratory-specific Detection Limit[b] (µg/kg)
Selenium	NA	2000	2000	435
Silver	NA	500	500	41
Sodium	NA	1000000	1000000	25110
Titanium	NA	1000	1000	894
Vanadium	NA	5000	5000	87
Zinc	NA	2000	2000	173
Mercury	NA	34	34	9.83
Acetone	NA	10	10	6.6
Benzene	NA	1	1	0.13
Bromochloromethane	NA	5	5	0.52
Bromodichloromethane	NA	5	5	0.22
Bromoform	NA	5	5	0.76
Bromomethane	NA	5	5	0.39
2-Butanone (MEK)	NA	10	10	4.3
Carbon disulfide	NA	5	5	0.2
Carbon tetrachloride	NA	5	5	0.35
Chlorobenzene	NA	5	5	0.32
Chloroethane	NA	5	5	0.41
Chloroform	NA	5	5	0.48
Chloromethane	NA	5	5	0.62
Cyclohexane	NA	5	5	0.38
1,2-Dibromo-3-chloropropane	NA	10	10	1.5
Dibromochloromethane	NA	5	5	0.17

TABLE 15-1

Analyte	Project Action Limit (PAL)	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific Quantitation Limit[a] (µg/kg)	Laboratory-specific Detection Limit[b] (µg/kg)
1,2-Dibromoethane	NA	1	1	0.24
1,2-Dichlorobenzene	NA	5	5	0.28
1,3-Dichlorobenzene	NA	5	5	0.19
1,4-Dichlorobenzene	NA	5	5	0.17
Dichlorodifluoromethane	NA	5	5	0.32
1,1-Dichloroethane	NA	5	5	0.22
1,2-Dichloroethane	NA	1	1	0.18
1,1-Dichloroethene	NA	5	5	0.61
cis-1,2-Dichloroethene	NA	5	5	0.32
trans-1,2-Dichloroethene	NA	5	5	0.42
1,2-Dichloropropane	NA	5	5	0.27
cis-1,3-Dichloropropene	NA	5	5	0.15
trans-1,3-Dichloropropene	NA	5	5	0.34
1,4-Dioxane	NA	130	130	58
Ethylbenzene	NA	1	1	0.15
Freon 113	NA	5	5	0.72
2-Hexanone	NA	5	5	2.5
Isopropylbenzene	NA	5	5	0.14
Methyl Acetate	NA	5	5	2.2
Methylcyclohexane	NA	5	5	0.25
Methyl Tert Butyl Ether	NA	1	1	0.18
4-Methyl-2-pentanone (MIBK)	NA	5	5	2.6
Methylene chloride	NA	5	5	0.23

TABLE 15-1

Analyte	Project Action Limit (PAL)	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific Quantitation Limit[a] (µg/kg)	Laboratory-specific Detection Limit[b] (µg/kg)
Styrene	NA	5	5	0.19
1,1,2,2-Tetrachloroethane	NA	5	5	0.18
Tetrachloroethene	NA	5	5	0.19
Toluene	NA	1	1	0.38
1,2,3-Trichlorobenzene	NA	5	5	0.44
1,2,4-Trichlorobenzene	NA	5	5	0.34
1,1,1-Trichloroethane	NA	5	5	0.24
1,1,2-Trichloroethane	NA	5	5	0.43
Trichloroethene	NA	5	5	0.25
Trichlorofluoromethane	NA	5	5	0.48
Vinyl chloride	NA	5	5	0.46
m,p-Xylene	NA	1	1	0.31
o-Xylene	NA	1	1	0.18
Xylene (total)	NA	1	1	0.18
2-Chlorophenol	NA	170	170	34
4-Chloro-3-methyl phenol	NA	170	170	33
2,4-Dichlorophenol	NA	170	170	54
2,4-Dimethylphenol	NA	170	170	56
2,4-Dinitrophenol	NA	670	670	41
4,6-Dinitro-o-cresol	NA	670	670	41
2-Methylphenol	NA	67	67	38
3&4-Methylphenol	NA	67	67	42
2-Nitrophenol	NA	170	170	35

TABLE 15-1

Analyte	Project Action Limit (PAL)	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific Quantitation Limit[a] (µg/kg)	Laboratory-specific Detection Limit[b] (µg/kg)
4-Nitrophenol	NA	330	330	56
Pentachlorophenol	NA	330	330	57
Phenol	NA	67	67	35
2,3,4,6-Tetrachlorophenol	NA	170	170	34
2,4,5-Trichlorophenol	NA	170	170	39
2,4,6-Trichlorophenol	NA	170	170	31
Acenaphthene	NA	33	33	9.7
Acenaphthylene	NA	33	33	11
Acetophenone	NA	170	170	5.9
Anthracene	NA	33	33	12
Atrazine	NA	170	170	6.6
Benzo(a)anthracene	NA	33	33	11
Benzo(a)pyrene	NA	33	33	10
Benzo(b)fluoranthene	NA	33	33	11
Benzo(g,h,i)perylene	NA	33	33	12
Benzo(k)fluoranthene	NA	33	33	13
4-Bromophenyl phenyl ether	NA	67	67	12
Butyl benzyl phthalate	NA	67	67	19
1,1’-Biphenyl	NA	67	67	3.9
Benzaldehyde	NA	170	170	7.7
2-Chloronaphthalene	NA	67	67	10
4-Chloroaniline	NA	170	170	11
Carbazole	NA	67	67	15

TABLE 15-1

Analyte	Project Action Limit (PAL)	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific Quantitation Limit[a] (µg/kg)	Laboratory-specific Detection Limit[b] (µg/kg)
Caprolactam	NA	67	67	10
Chrysene	NA	33	33	11
bis(2-Chloroethoxy)methane	NA	67	67	13
bis(2-Chloroethyl)ether	NA	67	67	10
bis(2-Chloroisopropyl)ether	NA	67	67	9.9
4-Chlorophenyl phenyl ether	NA	67	67	10
2,4-Dinitrotoluene	NA	67	67	15
2,6-Dinitrotoluene	NA	67	67	13
3,3’-Dichlorobenzidine	NA	170	170	8.5
Dibenzo(a,h)anthracene	NA	33	33	11
Dibenzofuran	NA	67	67	9.9
Di-n-butyl phthalate	NA	67	67	7.4
Di-n-octyl phthalate	NA	67	67	16
Diethyl phthalate	NA	67	67	11
Dimethyl phthalate	NA	67	67	12
bis(2-Ethylhexyl)phthalate	NA	67	67	29
Fluoranthene	NA	33	33	15
Fluorene	NA	33	33	11
Hexachlorobenzene	NA	67	67	11
Hexachlorobutadiene	NA	33	33	9.3
Hexachlorocyclopentadiene	NA	670	670	34
Hexachloroethane	NA	170	170	9.3
Indeno(1,2,3-cd)pyrene	NA	33	33	12

TABLE 15-1

Analyte	Project Action Limit (PAL)	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific Quantitation Limit[a] (µg/kg)	Laboratory-specific Detection Limit[b] (µg/kg)
Isophorone	NA	67	67	9
2-Methylnaphthalene	NA	67	67	19
2-Nitroaniline	NA	170	170	15
3-Nitroaniline	NA	170	170	13
4-Nitroaniline	NA	170	170	13
Naphthalene	NA	33	33	9.1
Nitrobenzene	NA	67	67	9.6
N-Nitroso-di-n-propylamine	NA	67	67	8.1
N-Nitrosodiphenylamine	NA	170	170	20
Phenanthrene	NA	33	33	15
Pyrene	NA	33	33	13
1,2,4,5-Tetrachlorobenzene	NA	170	170	10
TPH-DRO (C10-C28)	NA	6700	6700	210
TPH-GRO (C6-C10)	NA	10000	10000	1800
Alkalinity	NA	50000	50000	10000
Ortho-Phosphate	NA	1000	1000	100

[a] Quantitation limit equals the laboratory Reporting Limit
[b] Detection Limit equals the laboratory method detection limit

Matrix: Groundwater

Analytical method: Total TAL Metals, Dissolved TAL Metals, Arsenic Speciation, TOC, Total VOCs, Total SVOCs, and TPH

Concentration level (if applicable): Low

TABLE 15-2

Analyte	Project Action Limit (PAL)	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific Quantitation Limit[a] (µg/kg)	Laboratory-specific Detection Limit[b] (µg/kg)
Aluminum	NA	200	200	7.49
Antimony	NA	6	6	4.53
Arsenic	NA	8	8	2.68
Barium	NA	200	200	0.74
Beryllium	NA	1	1	0.13
Cadmium	NA	3	3	0.49
Calcium	NA	5000	5000	26.07
Chromium	NA	10	10	0.83
Cobalt	NA	50	50	0.75
Copper	NA	10	10	1.91
Iron	NA	100	100	59.88
Lead	NA	3	3	1.09
Magnesium	NA	5000	5000	17.32
Manganese	NA	15	15	0.45
Nickel	NA	10	10	1.72
Potassium	NA	10000	10000	26.65
Selenium	NA	10	10	4.06
Silver	NA	10	10	0.66
Sodium	NA	10000	10000	243
Titanium	NA	10	10	5.85

TABLE 15-2

Analyte	Project Action Limit (PAL)	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific Quantitation Limit[a] (µg/kg)	Laboratory-specific Detection Limit[b] (µg/kg)
Vanadium	NA	50	50	0.7
Zinc	NA	20	20	3.04
Mercury	NA	0.2	0.2	0.088
Acetone	NA	10	10	7.6
Benzene	NA	1	1	0.22
Bromochloromethane	NA	5	5	0.4
Bromodichloromethane	NA	1	1	0.23
Bromoform	NA	4	4	0.24
Bromomethane	NA	2	2	0.31
2-Butanone (MEK)	NA	10	10	2.9
Carbon disulfide	NA	2	2	0.18
Carbon tetrachloride	NA	1	1	0.19
Chlorobenzene	NA	1	1	0.22
Chloroethane	NA	1	1	0.37
Chloroform	NA	1	1	0.21
Chloromethane	NA	1	1	0.22
Cyclohexane	NA	5	5	0.29
1,2-Dibromo-3-chloropropane	NA	10	10	1.3
Dibromochloromethane	NA	1	1	0.2
1,2-Dibromoethane	NA	2	2	0.21
1,2-Dichlorobenzene	NA	1	1	0.18
1,3-Dichlorobenzene	NA	1	1	0.29
1,4-Dichlorobenzene	NA	1	1	0.26

TABLE 15-2

Analyte	Project Action Limit (PAL)	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific Quantitation Limit[a] (µg/kg)	Laboratory-specific Detection Limit[b] (µg/kg)
Dichlorodifluoromethane	NA	5	5	0.31
1,1-Dichloroethane	NA	1	1	0.19
1,2-Dichloroethane	NA	1	1	0.18
1,1-Dichloroethene	NA	1	1	0.28
cis-1,2-Dichloroethene	NA	1	1	0.22
trans-1,2-Dichloroethene	NA	1	1	0.31
1,2-Dichloropropane	NA	1	1	0.22
cis-1,3-Dichloropropene	NA	1	1	0.22
trans-1,3-Dichloropropene	NA	1	1	0.19
1,4-Dioxane	NA	130	130	72
Ethylbenzene	NA	1	1	0.21
Freon 113	NA	5	5	0.49
2-Hexanone	NA	5	5	3
Isopropylbenzene	NA	2	2	0.19
Methyl Acetate	NA	5	5	2.9
Methylcyclohexane	NA	5	5	0.18
Methyl Tert Butyl Ether	NA	1	1	0.18
4-Methyl-2-pentanone (MIBK)	NA	5	5	1.2
Methylene chloride	NA	2	2	0.2
Styrene	NA	5	5	0.23
1,1,2,2-Tetrachloroethane	NA	1	1	0.2
Tetrachloroethene	NA	1	1	0.32
Toluene	NA	1	1	0.15

TABLE 15-2

Analyte	Project Action Limit (PAL)	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific Quantitation Limit[a] (µg/kg)	Laboratory-specific Detection Limit[b] (µg/kg)
1,2,3-Trichlorobenzene	NA	5	5	0.69
1,2,4-Trichlorobenzene	NA	5	5	0.15
1,1,1-Trichloroethane	NA	1	1	0.24
1,1,2-Trichloroethane	NA	1	1	0.23
Trichloroethene	NA	1	1	0.21
Trichlorofluoromethane	NA	5	5	0.35
Vinyl chloride	NA	1	1	0.27
m,p-Xylene	NA	1	1	0.32
o-Xylene	NA	1	1	0.17
Xylene (total)	NA	1	1	0.17
2-Chlorophenol	NA	5	5	0.97
4-Chloro-3-methyl phenol	NA	5	5	1.8
2,4-Dichlorophenol	NA	5	5	1.2
2,4-Dimethylphenol	NA	5	5	1.5
2,4-Dinitrophenol	NA	20	20	17
4,6-Dinitro-o-cresol	NA	20	20	0.99
2-Methylphenol	NA	2	2	1
3&4-Methylphenol	NA	2	2	0.93
2-Nitrophenol	NA	5	5	1.5
4-Nitrophenol	NA	10	10	5.2
Pentachlorophenol	NA	10	10	1.4
Phenol	NA	2	2	1.3
2,3,4,6-Tetrachlorophenol	NA	5	5	0.94

TABLE 15-2

Analyte	Project Action Limit (PAL)	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific Quantitation Limit[a] (µg/kg)	Laboratory-specific Detection Limit[b] (µg/kg)
2,4,5-Trichlorophenol	NA	5	5	1.6
2,4,6-Trichlorophenol	NA	5	5	1.3
Acenaphthene	NA	1	1	0.26
Acenaphthylene	NA	1	1	0.23
Acetophenone	NA	2	2	0.29
Anthracene	NA	1	1	0.29
Atrazine	NA	5	5	0.49
Benzaldehyde	NA	5	5	3.3
Benzo(a)anthracene	NA	1	1	0.23
Benzo(a)pyrene	NA	1	1	0.23
Benzo(b)fluoranthene	NA	1	1	0.46
Benzo(g,h,i)perylene	NA	1	1	0.32
Benzo(k)fluoranthene	NA	1	1	0.51
4-Bromophenyl phenyl ether	NA	2	2	0.36
Butyl benzyl phthalate	NA	2	2	0.29
1,1’-Biphenyl	NA	1	1	0.3
2-Chloronaphthalene	NA	2	2	0.3
4-Chloroaniline	NA	5	5	0.53
Carbazole	NA	1	1	0.36
Caprolactam	NA	2	2	0.69
Chrysene	NA	1	1	0.29
bis(2-Chloroethoxy)methane	NA	2	2	0.31
bis(2-Chloroethyl)ether	NA	2	2	0.31

TABLE 15-2

Analyte	Project Action Limit (PAL)	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific Quantitation Limit[a] (µg/kg)	Laboratory-specific Detection Limit[b] (µg/kg)
bis(2-Chloroisopropyl)ether	NA	2	2	0.45
4-Chlorophenyl phenyl ether	NA	2	2	0.31
2,4-Dinitrotoluene	NA	2	2	0.43
2,6-Dinitrotoluene	NA	2	2	0.46
3,3'-Dichlorobenzidine	NA	5	5	0.36
Dibenzo(a,h)anthracene	NA	1	1	0.38
Dibenzofuran	NA	5	5	0.27
Di-n-butyl phthalate	NA	2	2	0.56
Di-n-octyl phthalate	NA	2	2	0.31
Diethyl phthalate	NA	2	2	0.33
Dimethyl phthalate	NA	2	2	0.28
bis(2-Ethylhexyl)phthalate	NA	2	2	0.59
Fluoranthene	NA	1	1	0.32
Fluorene	NA	1	1	0.28
Hexachlorobenzene	NA	1	1	0.34
Hexachlorobutadiene	NA	1	1	0.51
Hexachlorocyclopentadiene	NA	20	20	7.1
Hexachloroethane	NA	2	2	0.55
Indeno(1,2,3-cd)pyrene	NA	1	1	0.37
Isophorone	NA	2	2	0.27
2-Methylnaphthalene	NA	1	1	0.38
2-Nitroaniline	NA	5	5	1.1
3-Nitroaniline	NA	5	5	1.3

TABLE 15-2

Analyte	Project Action Limit (PAL)	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific Quantitation Limit[a] (µg/kg)	Laboratory-specific Detection Limit[b] (µg/kg)
4-Nitroaniline	NA	5	5	1.7
Naphthalene	NA	1	1	0.26
Nitrobenzene	NA	2	2	0.42
N-Nitroso-di-n-propylamine	NA	2	2	0.3
N-Nitrosodiphenylamine	NA	5	5	0.31
Phenanthrene	NA	1	1	0.29
Pyrene	NA	1	1	0.27
1,2,4,5-Tetrachlorobenzene	NA	2	2	0.31
TPH-DRO (C10-C28)	NA	100	100	3.5
TPH-GRO (C6-C10)	NA	200	200	16
Arsenic (III)	NA	—	—	0.008
Arsenic (V)	NA	—	—	0.008
Inorganic Arsenic	NA	—	—	0.008
Monomethylarsonic Acid (MMA) & Dimethylarsenic Acid (DMA) (organic arsenic species)	NA	—	—	0.010/0.018

[a] Quantitation limit equals the laboratory Reporting Limit
[b] Detection Limit equals the laboratory method detection limit

Matrix: Air

Analytical method: Various

Concentration level (if applicable): Low

TABLE 15-3

Target Parameter		Project Action Limit (PAL) (µg/m^3)	Project Quantitation Limit Goal (µg/m^3)	Laboratory-specific Quantitation Limita (µg/m^3)	Estimated Detection Limitb (µg/m^3)
Total Dust	Particulate	Not Applicable	10	TBD	10
Metals	Antimony	2.4	<PAL	TBD	0.035
	Arsenic	0.18	<PAL	TBD	0.035
	Lead	0.1	<PAL	TBD	0.035
	Vanadium	1.2	<PAL	TBD	0.035
SVOCs	Benz(a)anthracene	3.1	<PAL	TBD	0.3
	Benzo(a)pyrene	0.31	<PAL	TBD	0.3
	Benzo(b)fluoranthene	3.1	<PAL	TBD	0.3
	Benzo(k)fluoranthene	3.1	<PAL	TBD	0.3
	Chrysene	31	<PAL	TBD	0.3
	Dibenz(a,h)anthracene	0.31	<PAL	TBD	0.3
	Fluoranthene	0.31	<PAL	TBD	0.3
	Fluorene	0.31	<PAL	TBD	0.3
	Indeno(1,2,3-cd)pyrene	3.1	<PAL	TBD	0.3
	Naphthalene	36	<PAL	TBD	1
	Pyrene	0.31	<PAL	TBD	0.3
VOCs	Benzene	437	<PAL	TBD	1
	Ethylbenzene	1,360	<PAL	TBD	1
	Isopropylbenzene	1,100	<PAL	TBD	1
	n-Propylbenzene	12,200	<PAL	TBD	1

TABLE 15-3

Target Parameter	Project Action Limit (PAL) (µg/m³)	Project Quantitation Limit Goal (µg/m³)	Laboratory-specific Quantitation Limita (µg/m³)	Estimated Detection Limitb (µg/m³)
Toluene	60,800	<PAL	TBD	1
1,2,4-Trimethylbenzene	252	<PAL	TBD	3
1,3,5-Trimethylbenzene	122	<PAL	TBD	2
Xylenes, Total	4,870	<PAL	TBD	2

[a] Quantitation limit equals the laboratory Reporting Limit. Laboratory Quantitation Limits will be determined following selection of a laboratory.
[b] Detection Limit equals the laboratory method detection limit

For real-time air monitoring, analysis of the soil and sediment sampling data for the project site compared with chronic action levels (RSLs) for target parameter COCs (in table above) is limited by lead, and the threshold for TVOC concentration is limited by 1,3,5-trimethylbenzene. This analysis considered both maximum and mean concentration levels of the COCs measured in the soil with an immediate and total release of the COC from the airborne soil in determining the action levels. Based on this analysis, the following 15-minute Time-Weighted Average (TWA) Action Levels and Alarm Levels are recommended for the project during intrusive activities.

Condition	Particulate Concentration (PM-10)**	Volatile Concentration (TVOC)**
Action Level*	150 µg/m3	1.0 ppm
Operational action required, including possible work stoppage		
Alarm Level*	100 µg/m3	0.5 ppm
Notification and observation of site operations to be conducted		

* Based on 15-minute Time Weighted Average (TWA) for the value specified.
** Allowable concentration above background or upwind level for each parameter

QAPP Worksheet #17: Sampling Design and Rationale

Sampling design and rationale are described in the following subsections.

ISS Field Demonstration

Baseline Sampling

The four treatment areas have been selected to correspond with locations where baseline analytical testing and bench-scale treatability test samples were performed (Figure 2) however additional baseline sampling will occur to accommodate for site variability. Secondly, baseline testing will be performed in the treatment area associated with the utility corridor (Figure 3). Sample locations and methods are specified in Table 17-1.

TABLE 17-1
ISS Baseline Soil Sampling and Analysis
Quanta Resources Corporation Superfund Site

Location	Sample ID*	Soil									
		Total Arsenic (EPA 6010)	Select VOCs (EPA 8260)*	PAHs (EPA 8270)	TPH-GRO (EPA 8015)	Liquid-Solid Partitioning (EPA Method 1316)	SPLP (EPA 1312)**	Bulk Density and Moisture Content (ASTM D2216-80)	pH (EPA 9045)	Alkalinity	Particle Size Distribution (ASTM D-422-63)
Field Samples											
A-2	A-2-MMYY-rebase	X	X	X	X	X	X	X	X	X	X
AN-2	AN-2-MMYY-rebase	X	X	X	X	X	X	X	X	X	X
N-1	N-1-MMYY-rebase	X	X	X	X	X	X	X	X	X	X
N-4	N-4-1MMYY-rebase	X	X	X	X	X	X	X	X	X	X
Alternate Location—Utility Corridor	TBD	X	X	X	X	X	X	X	X	X	X

Notes:
*Select VOCs include benzene, ethylbenzene, toluene, and xylenes
**SPLP leachate will be analyzed for Total Arsenic, Select VOCs, PAHs, TPH-GRO.
X - Sample to be analyzed for the indicated parameter
TPH - total petroleum hydrocarbons
PAH - polycyclic aromatic hydrocarbon
VOC - volatile organic compound

Reagent and Equipment Monitoring

The ISS contractor will verify that delivered reagent meets specifications by tracking delivery/feed rates of reagent mix, slurry characteristics (water ratio, density), and mixing parameters including but not limited to penetration

depth, mixing speed, mixing time, production rate, precise location of treatment area, auger strokes, and rotation speed.

Performance Sampling

Bulk samples of freshly mixed material will be collected from each treatment area and subjected to the performance testing, including both consistency and compliance testing as summarized below. Sample locations and methods are specified in Table 17-2. The subcontractor will collect sufficient volume to perform the required analysis. Samples will be collected using a sampling tool capable of providing discrete samples at specified depth intervals.

Consistency Testing. Consistency testing will be required to monitor for variability in the mixed material, to demonstrate material properties are consistent with results from bench-scale treatability testing, and to demonstrate construction quality control. These results will also be used for establishing parameters for full-scale implementation that correlate with compliance testing samples that meet project performance goals. The following analyses will be performed:

- Pocket penetrometer testing performed on 1-, 3-, 5-, and 7-day cured samples
- Slump test on freshly treated material
- Moisture content and wet density
- Alkalinity and pH
- UCS: reported on 7-, and 14-day cured samples.

Conformance Testing. Testing will be required to demonstrate conformance with the project performance objectives. The following analyses will be performed:

- UCS: reported on 28-day cured samples
- Permeability: reported on 28-day cured sample
- Leachability: Method 1315 and/or ANSI 16.1 (GRO; arsenic; benzene, toluene, ethylbenzene, and total xylenes [BTEX compounds]; and polycyclic aromatic hydrocarbons) reported on 28-day cured sample

Aliquots of the bulk samples will be subjected to laboratory testing to demonstrate conformance with UCS, permeability, and leachability reduction performance objectives. Leachability will be evaluated by comparing baseline data to Premethod 1315 and/or ANSI 16.1 data from each of the field demonstration locations. Analyses to be performed are specified in Table 17-2.

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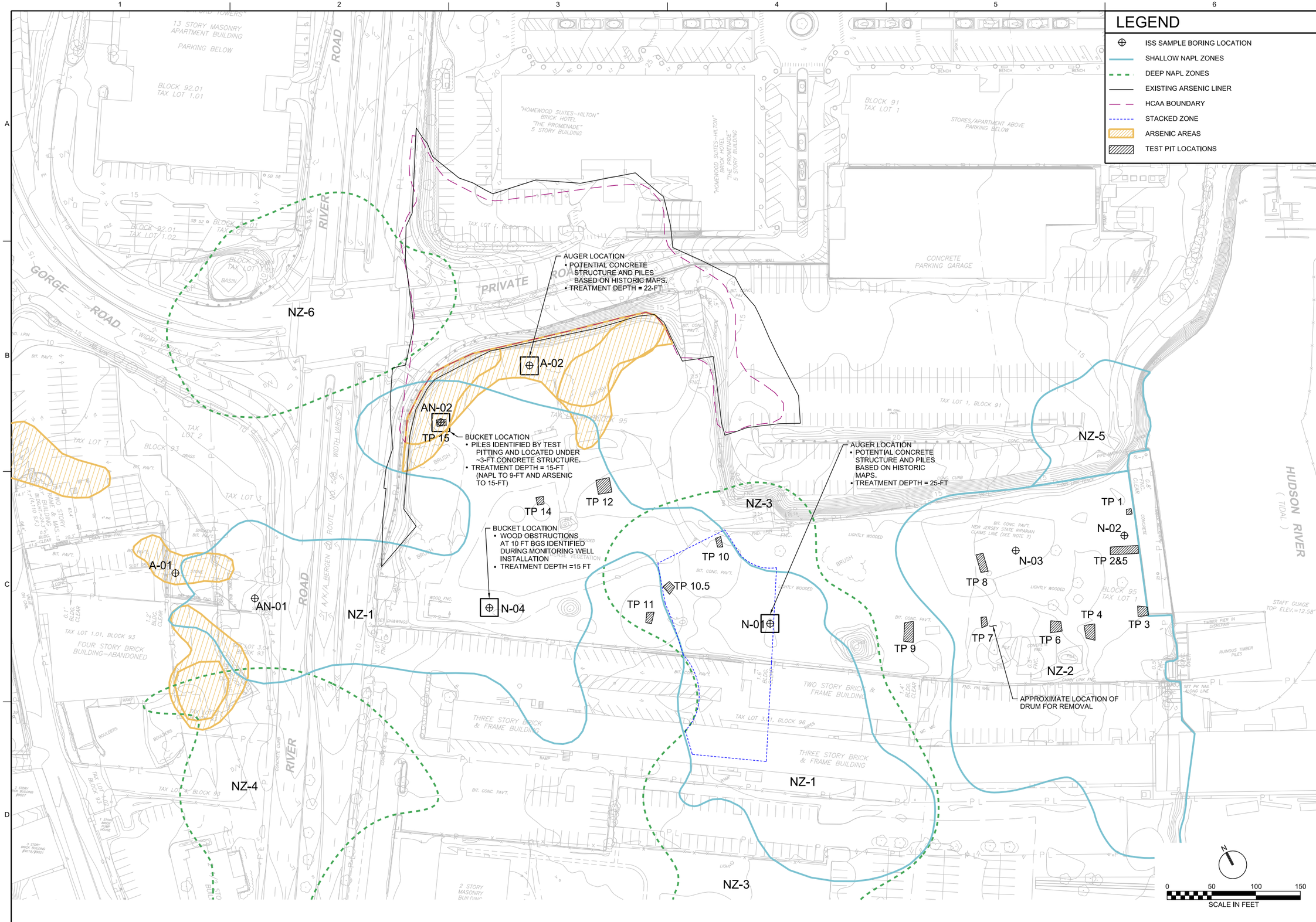

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QUANTA RESOURCES CORPORATION
SUPERFUND SITE
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FIGURE 2
DEMONSTRATION TEST LOCATION PLAN

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	
PROJ	428872
DWG	FIGURE 2
SHEET	of

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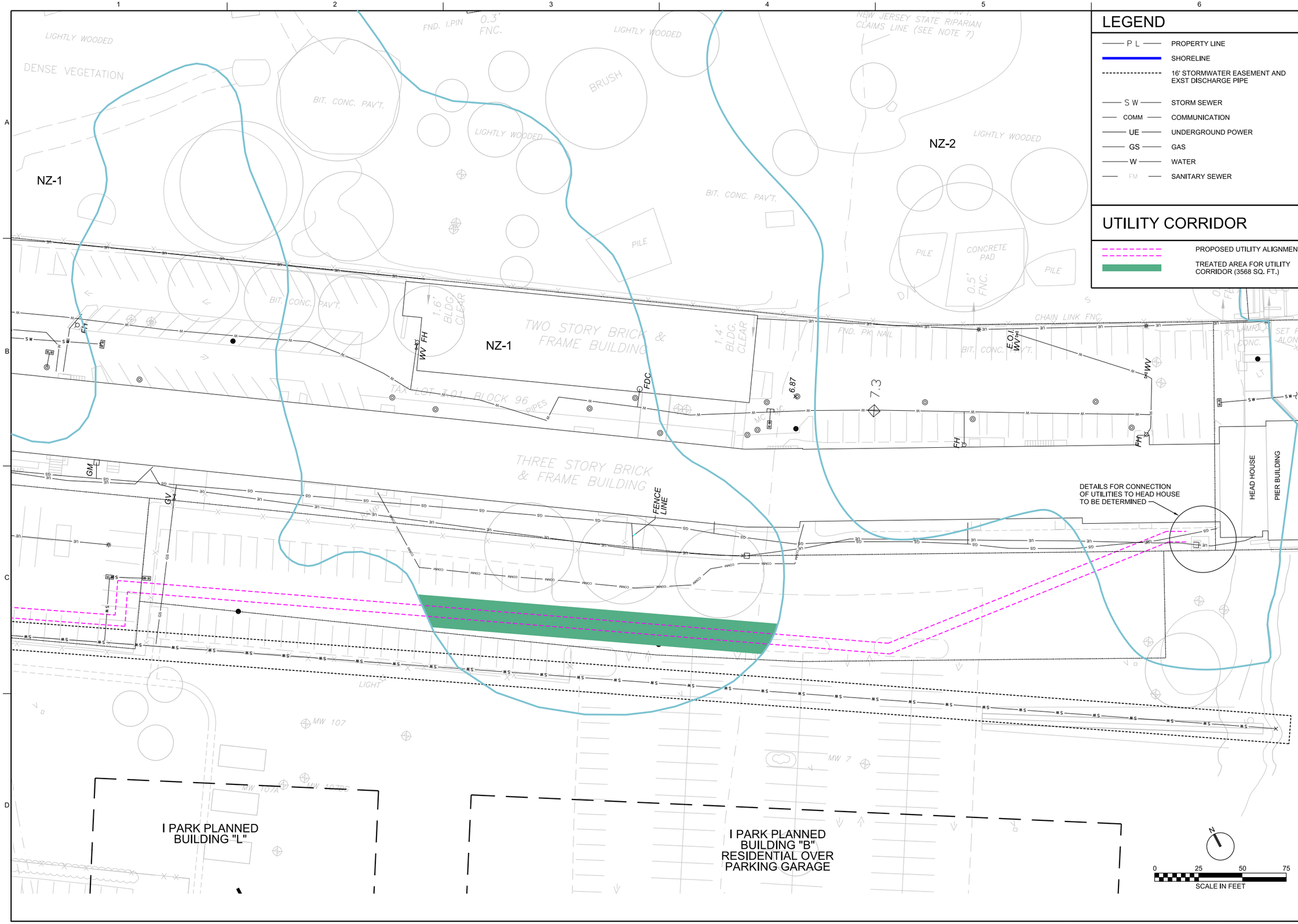

LEGEND

P L	PROPERTY LINE
	SHORELINE
	16' STORMWATER EASEMENT AND EXST DISCHARGE PIPE
S W	STORM SEWER
COMM	COMMUNICATION
UE	UNDERGROUND POWER
GS	GAS
W	WATER
FM	SANITARY SEWER

UTILITY CORRIDOR

	PROPOSED UTILITY ALIGNMENT
	TREATED AREA FOR UTILITY CORRIDOR (3568 SQ. FT.)

NO.	DATE	REVISION	BY	APVD

DSGN NK BETTS | DR PA KARABAN | CHK | APVD

HONEYWELL INTERNATIONAL INC.
QUANTA RESOURCES CORPORATION
SUPERFUND SITE
Edgewater, New Jersey

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FIGURE 3
POTENTIAL UTILITY CORRIDOR FOR PIER BUILDING

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	
PROJ	428872
DWG	FIGURE 3
SHEET	of

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TABLE 17-2

ISS Field Demonstration Soil Sampling and Analysis
Quanta Resources Corporation Superfund Site

			Consistency Testing										Conformance Testing					
															Method 1315 and/or ANSI 16.1 Leachate Analyses (28 day cured sample)**			
Location	**Sample ID***	**Target Sample Depth (ft bgs)**	**Pocket Penetrometer 1 day**	**Pocket Penetrometer 3 day**	**Pocket Penetrometer 5 day**	**Pocket Penetrometer 7 day**	**Slump Test**	**Moisture Content and Wet Density**	**Alkalinity and pH**	**UCS - 3 day**	**UCS - 7 day**	**UCS - 14 day**	**UCS by ASTM D2166 (28 day)**	**Permeability by ASTM D5084 Method A (28 day)**	**Dissolved Arsenic (EPA 6010)**	**Select VOCs (EPA 8260)***	**PAHs (EPA 8270C)**	**TPH-GRO (EPA 8015)**
Field Samples																		
A-2	A-2A-X	0-5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	A-2B-X	8.5-13.5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	A-2C-X	17-22	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
AN-2	AN-2A-X	0-5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	AN-2B-X	5-10	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	AN-2C-X	10-15	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
N-1	N-1A-X	0-5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	N-1B-X	10-15	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	N-1C-X	20-25	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
N-4	N-4A-X	0-5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	N-4B-X	5-10	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	N-4C-X	10-15	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Alternate Location - Utility Corridor	UC-A-X	0-5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	UC-B-X	5-10	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Notes:

The "X" listed in the Sample IDs will be replaced with an appropriate designation within the treatment area from which it is collected. Quantity of samples to be determined during implementation.
*Select VOCs include benzene, ethylbenzene, toluene, and xylenes

** Single sample from each location be tested for leaching

X - Sample to be analyzed for the indicated parameter

TPH - total petroleum hydrocarbons

PAH - polycyclic aromatic hydrocarbon

UCS - unconfined compressive strength

VOC - volatile organic compound

Air Monitoring

A minimum of eight (8) perimeter real-time air monitoring stations will be used for real-time monitoring during the remedial action. Four of the stations will be at fixed locations at or near the perimeter of the site. The remaining four stations will be deployed in the vicinity of the work zone each day during intrusive activities. It is possible that up to four additional mobile stations will be needed for a portion of the project if two work zones are active simultaneously. The actual monitoring station arrangement will be reviewed and agreed upon prior to the remediation activity and during the course of the project. The monitoring station locations each day will be recorded on a site map for reporting purposes

Each monitoring station will be configured with air intake ports at a height of four to six feet above grade surface to represent the breathing zone. The field stations will be housed in a weatherproof enclosure, either a rugged fiber case mounted on a tripod or a secure metal box on a semi-permanent structure. A full-service meteorological station will be located at the site during monitoring events. The location of this station will be determined based on site activities. One additional wind speed and direction detector will be located at a separate location on site, at one of the field stations.

Air Monitoring Sample Summary

Parameter	Intrusive Phase Samples (Weekly Samples*)
Total Dust	1 day per week/2 locations
Metals	1 day per week/2 locations
Volatile Organic Compounds and Naphthalene	1 day per week/2 locations
PAHs	1 day per week/2 locations

*Includes blanks

Waste Characterization

Separate waste characterization samples of solid waste (primarily soil) and liquid waste generated during field demonstration and drum removal activities will be collected and analyzed to support waste profiling. Analyses and sample bottle requirements are presented in Worksheet #18.

QAPP Worksheet #18: Sampling Locations and Methods

Sampling locations and methods are outlined in the following subsections with a full list shown within Table 18-3.

ISS Field Demonstration

QA/QC monitoring, including monitoring the reagent addition and equipment and collecting performance samples, will be performed throughout the field demonstration test. For each treatment area on the Quanta property (depicted on Figure 3 of the RDWP Addendum), bulk samples of freshly mixed material will be collected in each sample location at specified depth intervals:

- Top 5 feet of treatment area
- Middle 5 feet of treatment area
- Bottom 5 feet of treatment area

For the alternate treatment area (depicted on Figure 4 of the RDWP Addendum), bulk samples of freshly mixed material will be collected in each sample location at each of two specified depth intervals:

- Top 5 feet of treatment area
- Bottom 5 feet of treatment area

Samples will be collected at the following frequencies:

- Minimum of one location in each treatment area per day of production, regardless of size
- Minimum of four locations in each treatment area or a sample location every 100 yd^3 of treated material, whichever is greater
- Any time physical characteristics of the material appear to change significantly

The anticipated rate of production is that each treatment area will take approximately three days to complete therefore requiring approximately nine samples from the four locations in each treatment area as detailed in Table 18-3.

Air Monitoring

A complete real-time monitoring system of four fixed perimeter-monitoring stations will be placed for this phase of the project. In addition, four mobile monitoring stations will be provided for use near the work zone each day during intrusive activities. Up to four additional monitoring stations will be available in the event that two work zones are active at the same time. The final number and locations of the monitoring stations will be determined just prior to mobilization and during the course of the project. All eight stations (four fixed and four mobile) will consist of portable tripod-mounted units, thus providing flexibility in locating all the stations during the course of the project. Analytical sampling will be conducted 1 day per week at two locations for total dust, metals, VOCs and naphthalene, and PAHs as indicated in the air monitoring work plan (Appendix D of the RDWP Addendum). Based on the schedule, it is anticipated that up to 20 samples will be collected for analysis as detailed in Table 18-3.

The following are the key elements and characteristics of the real-time monitoring system to be utilized:

- A TSI DustTrak-II, model 8520, or equivalent will be used to measure particulate matter (PM-10) concentrations.
- A RAE systems model MiniRAE-3000, or equivalent photo-ionization detector (PID), will be used to measure TVOC concentrations.
- An automated weather station will be used to monitor wind direction, wind speed, ambient temperature, relative humidity and barometric pressure.
- Auxiliary wind speed and direction detectors will be placed around the site to further characterize airflow patterns and to aid in determining background levels and other potential offsite sources of emissions.

Waste Characterization

Soil/Solids Characterization

Actual amount of waste characterization samples to be collected is to be determined based on the amount of waste collected. Waste characterization samples will be collected to evaluate the disposal requirements for soil accumulated during the drilling and trenching activities. Samples will be collected from the 55-gallon drums or soil bins prior to disposal; one composite sample and one grab for VOCs will be collected per 10 drums and one composite sample per 500 tons will be collected from soil bins. It is anticipated that a total of 20 samples will be required as detailed in the below Table 18-3. Soil samples will be analyzed for the parameters listed in below. Waste characterization samples will be analyzed per the disposal facility requirements. Additional analyses, such as total petroleum hydrocarbons, may be necessary.

TABLE 18-1
Investigative-derived Waste (IDW) Soil Sample Bottle Requirements

Parameter	Analytical Method	Bottle Requirement	Preservative
Total VOCs	SW8260B	(3) 40-mL VOA vials	Ice
TCLP VOCs	SW1311/8260B	(1) 4-oz glass jar	Ice
Total SVOCs	SW8270C	(1) 8-oz glass jar	Ice
TCLP SVOCs	SW1311/8270D	(1) 8-oz glass jar	Ice
Total Pesticides	SW8081A	(1) 8-oz glass jar	Ice
TCLP Pesticides	SW1311/8081A	(1) 8-oz glass jar	Ice
TCLP Metals	SW1311/6010C	(1) 8-oz glass jar	Ice
PCBs	SW8082	(1) 8-oz glass jar	Ice
Ignitability	SW1010/1030	(1) 8-oz glass jar	None
Corrosivity	SW9040/9045	(1) 8-oz glass jar	None
Reactivity	SW846 Chapter 7	(1) 8-oz glass jar	None

The waste characterization sample will be obtained from the drums or bins as follows:

Procedure for Collecting Volatile Fractions

1. Using a hand auger or other device, retrieve a core from the drums or bins.
2. Remove the core from the auger or other device and using a disposable Terra Core sampler, place the sample into unpreserved PTFE-lined septum screw cap with magnetic stir bar volatile organic analysis (VOA) vials. The transfer operation should ideally be completed in 1 minute to minimize loss of volatile components.

Procedure for Collecting Nonvolatile Fractions

1. From five randomly selected sample locations, collect several spoonfuls of the soil into a stainless steel bowl.
2. Homogenize the five grab samples by the quartering techniques using the stainless steel spoon.
3. Fill the appropriate sample jars completely full with the homogenized sample.
4. Close the jar, label, and package the sample for shipment to the laboratory.

Liquids Characterization

Waste liquids generated as part of the decontamination and well-sampling activities include groundwater (purge water and development water), decontamination fluids, mud rotary drilling fluids, and NAPL. Waste liquids will be containerized in 55-gallon drums or portable tanks for offsite treatment or disposal. NAPL will be containerized only in 55-gallon drums. The following procedures will be used for liquids characterization.

Waste characterization samples will be collected to evaluate the handling and disposal requirements of accumulated decontamination water and well purge water. One composite sample (and one grab sample for VOC analysis) will be collected per 10 drums and one sample per portable tank per location and/or area. Water samples will be collected as follows and analyzed for the parameters listed in Table 2.

1. Using a bailer or dip jar, collect a water sample from its containment.
2. Fill the sample containers for VOC analysis first (grab sample). Fill the 40-milliliter (mL) vials so that there is no headspace in each vial.
3. Fill the sample containers for the remaining analyses.
4. Label and package the samples for shipment to the laboratory.

TABLE 18-2
IDW Sample Bottle Requirements

Parameter	Analytical Method	Bottle Requirement	Preservative
Volatile Organic Compounds	SW8260B	(3) 40-mL glass vials	HCl to pH < 2, Ice No bubbles/ headspace
SVOCs	SW8270C	(1) 1-L amber glass	HCl to pH < 2, Ice
Pesticides	SW8081A	(1) 1-L amber glass	Ice

Parameter	Analytical Method	Bottle Requirement	Preservative
Total Metals	SW6010C/7174A	(1) 500-mL HDPE	HNO3 to pH<2, Ice
PCBs	SW8082	(1) 1-L amber glass	Ice
Ignitability	SW1010/1020	(1) 1-L amber glass	Ice
Corrosivity	SW9040/9045	(1) 1-L amber glass	Ice
Reactivity	SW846 Chapter 7	(1) 1-L amber glass	Ice

HCl = hydrochloric acid
L = liter
mL = milliliter

Sample Table

TABLE 18-3
Sample Count for the Field Demonstration

Sample ID	Matrix	Depth (ft bgs)	Type	Analyte/Analytical Group	Sampling SOP	Comments
A-2-MMYY-rebase	Soil	5 to 16	Baseline	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2-MMYY-rebase	Soil	0 to 8	Baseline	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1-MMYY-rebase	Soil	3 to 10; 15 to 22	Baseline	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4-1MMYY-rebase	Soil	5 to 12	Baseline	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
UC-A-X	Soil	0 to 5	Baseline	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
UC-B-X	Soil	0 to 5	Baseline	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002

TABLE 18-3
Sample Count for the Field Demonstration

Sample ID	Matrix	Depth (ft bgs)	Type	Analyte/Analytical Group	Sampling SOP	Comments
A-2A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2B-X-MMDDYY	Soil	8.5-13.5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2B-X-MMDDYY	Soil	8.5-13.5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2B-X-MMDDYY	Soil	8.5-13.5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2B-X-MMDDYY	Soil	8.5-13.5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2B-X-MMDDYY	Soil	8.5-13.5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2B-X-MMDDYY	Soil	8.5-13.5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2B-X-MMDDYY	Soil	8.5-13.5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2B-X-MMDDYY	Soil	8.5-13.5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2C-X-MMDDYY	Soil	17-22	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2C-X-MMDDYY	Soil	17-22	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2C-X-MMDDYY	Soil	17-22	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2C-X-MMDDYY	Soil	17-22	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2C-X-MMDDYY	Soil	17-22	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2C-X-MMDDYY	Soil	17-22	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2C-X-MMDDYY	Soil	17-22	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
A-2C-X-MMDDYY	Soil	17-22	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002

TABLE 18-3
Sample Count for the Field Demonstration

Sample ID	Matrix	Depth (ft bgs)	Type	Analyte/Analytical Group	Sampling SOP	Comments
AN-2A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2B-X-MMDDYY	Soil	5-10	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2B-X-MMDDYY	Soil	5-10	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2B-X-MMDDYY	Soil	5-10	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2B-X-MMDDYY	Soil	5-10	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2B-X-MMDDYY	Soil	5-10	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2B-X-MMDDYY	Soil	5-10	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2B-X-MMDDYY	Soil	5-10	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2B-X-MMDDYY	Soil	5-10	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2C-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2C-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2C-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2C-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2C-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002

TABLE 18-3
Sample Count for the Field Demonstration

Sample ID	Matrix	Depth (ft bgs)	Type	Analyte/Analytical Group	Sampling SOP	Comments
AN-2C-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2C-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2C-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
AN-2C-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1B-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1B-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1B-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1B-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1B-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1B-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1B-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1B-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1B-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002

TABLE 18-3
Sample Count for the Field Demonstration

Sample ID	Matrix	Depth (ft bgs)	Type	Analyte/Analytical Group	Sampling SOP	Comments
N-1C-X-MMDDYY	Soil	20-25	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1C-X-MMDDYY	Soil	20-25	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1C-X-MMDDYY	Soil	20-25	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1C-X-MMDDYY	Soil	20-25	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1C-X-MMDDYY	Soil	20-25	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1C-X-MMDDYY	Soil	20-25	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1C-X-MMDDYY	Soil	20-25	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1C-X-MMDDYY	Soil	20-25	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-1C-X-MMDDYY	Soil	20-25	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4A-X-MMDDYY	Soil	0-5	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4B-X-MMDDYY	Soil	5-10	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4B-X-MMDDYY	Soil	5-10	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4B-X-MMDDYY	Soil	5-10	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4B-X-MMDDYY	Soil	5-10	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002

TABLE 18-3
Sample Count for the Field Demonstration

Sample ID	Matrix	Depth (ft bgs)	Type	Analyte/Analytical Group	Sampling SOP	Comments
N-4B-X-MMDDYY	Soil	5-10	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4B-X-MMDDYY	Soil	5-10	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4B-X-MMDDYY	Soil	5-10	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4B-X-MMDDYY	Soil	5-10	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4B-X-MMDDYY	Soil	5-10	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4C-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4C-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4C-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4C-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4C-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4C-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4C-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
N-4C-X-MMDDYY	Soil	10-15	Confirmation Sampling	per Worksheet #17	SOP #001 and #004	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002

TABLE 18-3
Sample Count for the Field Demonstration

Sample ID	Matrix	Depth (ft bgs)	Type	Analyte/Analytical Group	Sampling SOP	Comments
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002

TABLE 18-3
Sample Count for the Field Demonstration

Sample ID	Matrix	Depth (ft bgs)	Type	Analyte/Analytical Group	Sampling SOP	Comments
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
EB-MMDDYY	Water	NA	Equipment Blank	per Worksheet #17	per Worksheet#20	Decon sampling equipment per SOP #002
FD-01-MMDDYY	Air	NA	Air Monitoring	per Worksheet #17	SOP #003	NA
FD-01-D-MMDDYY	Air	NA	Air Monitoring/Duplicate	per Worksheet #17	SOP #003	NA
FD-01-MMDDYY	Air	NA	Air Monitoring	per Worksheet #17	SOP #003	NA
FD-01-MMDDYY	Air	NA	Air Monitoring	per Worksheet #17	SOP #003	NA
FD-02-MMDDYY	Air	NA	Air Monitoring	per Worksheet #17	SOP #003	NA
FD-02-MMDDYY	Air	NA	Air Monitoring	per Worksheet #17	SOP #003	NA
FD-02-MMDDYY	Air	NA	Air Monitoring	per Worksheet #17	SOP #003	NA
FD-03-MMDDYY	Air	NA	Air Monitoring	per Worksheet #17	SOP #003	NA
FD-03-MMDDYY	Air	NA	Air Monitoring	per Worksheet #17	SOP #003	NA
FD-03-MMDDYY	Air	NA	Air Monitoring	per Worksheet #17	SOP #003	NA
FD-04-MMDDYY	Air	NA	Air Monitoring	per Worksheet #17	SOP #003	NA
FD-04-MMDDYY	Air	NA	Air Monitoring	per Worksheet #17	SOP #003	NA
FD-04-MMDDYY	Air	NA	Air Monitoring	per Worksheet #17	SOP #003	NA
MD-01-MMDDYY	Air	NA	Air Monitoring	per Worksheet #17	SOP #003	NA
MD-01-MMDDYY	Air	NA	Air Monitoring	per Worksheet #17	SOP #003	NA
MD-02-MMDDYY	Air	NA	Air Monitoring	per Worksheet #17	SOP #003	NA
MD-02-MMDDYY	Air	NA	Air Monitoring	per Worksheet #17	SOP #003	NA
MD-03-D-MMDDYY	Air	NA	Air Monitoring/Duplicate	per Worksheet #17	SOP #003	NA
MD-03-MMDDYY	Air	NA	Air Monitoring	per Worksheet #17	SOP #003	NA
MD-03-MMDDYY	Air	NA	Air Monitoring	per Worksheet #17	SOP #003	NA

TABLE 18-3
Sample Count for the Field Demonstration

Sample ID	Matrix	Depth (ft bgs)	Type	Analyte/Analytical Group	Sampling SOP	Comments
MD-04-MMDDYY	Air	NA	Air Monitoring	per Worksheet #17	SOP #003	NA
MD-04-MMDDYY	Air	NA	Air Monitoring	per Worksheet #17	SOP #003	NA
WC-AQ-1-MMDDYY	Liquid	N/A	Waste Characterization	per Table 18-2	per Worksheet #18	N/A
WC-AQ-2-MMDDYY	Liquid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A
WC-AQ-3-MMDDYY	Liquid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A
WC-AQ-4-MMDDYY	Liquid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A
WC-AQ-5-MMDDYY	Liquid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A
WC-SO-1-MMDDYY	Solid	N/A	Waste Characterization	per Table 18-1	per Worksheet #18	N/A
WC-SO-2-MMDDYY	Solid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A
WC-SO-3-MMDDYY	Solid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A
WC-SO-4-MMDDYY	Solid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A
WC-SO-5-MMDDYY	Solid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A
WC-SO-6-MMDDYY	Solid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A
WC-SO-7-MMDDYY	Solid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A
WC-SO-8-MMDDYY	Solid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A
WC-SO-9-MMDDYY	Solid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A
WC-SO-10-MMDDYY	Solid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A
WC-SO-11-MMDDYY	Solid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A
WC-SO-12-MMDDYY	Solid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A
WC-SO-13-MMDDYY	Solid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A
WC-SO-14-MMDDYY	Solid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A
WC-SO-15-MMDDYY	Solid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A

TABLE 18-3
Sample Count for the Field Demonstration

Sample ID	Matrix	Depth (ft bgs)	Type	Analyte/Analytical Group	Sampling SOP	Comments
WC-SO-16-MMDDYY	Solid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A
WC-SO-17-MMDDYY	Solid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A
WC-SO-18-MMDDYY	Solid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A
WC-SO-19-MMDDYY	Solid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A
WC-SO-20-MMDDYY	Solid	N/A	Waste Characterization	per Table 18	per Worksheet #18	N/A

The "X" listed in the Sample IDs will be replaced with an appropriate designation within the treatment area from which it is collected. Actual quantity of samples may drastically change based on field implementation.
Actual amount of QC samples (Equipment Blank, Duplicates, and MS/MSD) will be based on total amount of samples collected in accordance with Worksheet #20

QAPP Worksheets #19 and #30: Sample Containers, Preservation, and Hold Times

The sampling objectives for analysis by an offsite laboratory are described below. The project specific target analytes and required methods are defined in the below table along with the appropriate bottleware to be used for each analysis.

Laboratory (name, sample receipt address, POC, e-mail, and phone numbers): Accutest Laboratories New Jersey, Inc., 2235 US Highway 130, Dayton, NJ 08810, POC: Kristin Beebe, 732-329-0200, Kristinb@accutest.com

List any required accreditations/certifications: Laboratory has current NELAC and/or New Jersey certification.

Back-up Laboratory: None

Sample delivery method: Courier pickup

Analytical Group	Matrix	Method/SOP	Containers (Number, Size, and Type per Sample)	Preservation Requirements	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround (not including validation)
VOCs	Soil	SW-846 5035/8260B	One 8 oz glass jar, Teflon-lined cap, zero headspace or 3 EnCore Samplers	4°C	N/A	14 days	21-day
TCLP VOCs	Soil	SW-846 1311/5030B /8260B	One 8 oz glass jar, Teflon-lined cap, zero headspace or 3 EnCore Samplers	4°C	14 days	7 days	21-day
SPLP VOCs	Soil	SW-846 1312/5030B /8260B	One 8 oz glass jar, Teflon-lined cap, zero headspace or 3 EnCore Samplers	4°C	14 days	7 days	21-day
SVOCs	Soil	SW-846 3550B/8270C	One 8 oz glass jar, Teflon-lined cap	4°C	14 days	40 days	21-day
TCLP SVOC	Soil	SW-846 1311/5030B/8270C	One 8 oz glass jar, Teflon-lined cap	4°C	14 days leach/7 days extraction	40 days	21-day
SPLP SVOC	Soil	SW-846 1312/5030B/8270C	One 8 oz glass jar, Teflon-lined cap	4°C	14 days leach/7 days extraction	40 days	21-day
TPH—GRO	Soil	SW-846 5035/8015B	One 8 oz glass jar, Teflon-lined cap, zero headspace or 3 EnCore Samplers	4°C	N/A	14 days	21-day
TPH—DRO	Soil	SW-846 3550B/8015B	One 8 oz glass jar, Teflon-lined cap	4°C	14 days	40 days	21-day
Metals	Soil	SW 846 6010C/7471A	One 8 oz glass jar, Teflon-lined cap	4°C	N/A	180 days (28 days for mercury)	21-day

Analytical Group	Matrix	Method/SOP	Containers (Number, Size, and Type per Sample)	Preservation Requirements	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround (not including validation)
TCLP Metals	Soil	SW 846 1311/6010B/7471A	One 8 oz glass jar, Teflon-lined cap	4°C	180 days (28 days for mercury)	180 days (28 days for mercury)	21-day
SPLP Metals	Soil	SW 846 1312/6010B/7471A	One 8 oz glass jar, Teflon-lined cap	4°C	180 days (28 days for mercury)	180 days (28 days for mercury)	21-day
Arsenic sequential extraction	Soil	Sequential Extraction	4-oz Poly Jar/ Intact Core is preferred	4°C	N/A	7 days	21-day
ortho-Phosphate	Soil	E365.3M	One 8 oz glass jar, Teflon-lined cap	4°C	N/A	48 hours	21-day
Alkalinity	Soil	SM2320 B-11Mod	4-oz glass	4°C	N/A	14 days	21-day
Geotechnical	Soil	D2166 (Unconfined Compressive Strength); Pocket Penetrometry (per instrument manual); D5084A (Hydraulic conductivity permeability)	1 Shelby tube	None	N/A	N/A	21-day
VOCs	Liquid	SW-846 5030B/8260B	Three 40 mL glass vial	HCl, pH<2, 4°C		14 days	21-day
SVOCs	Liquid	SW-846 3550B/8270C	1-L amber glass	4°C	7 days	40 days	21-day
TPH—GRO	Liquid	SW-846 5030B/8015B	Three 40 mL glass vial	HCl, pH<2, 4°C		14 days	21-day
TPH—DRO	Liquid	SW-846 3550B/8015B	1-L amber glass	4°C	7 days	40 days	21-day
Metals	Liquid	SW 846 6010B/7471A	500 ml Polyethylene	HNO_3, pH<2, 4°C		180 days (28 days for mercury)	21-day
TOC	Liquid	E415.1	250 ml Polyethylene	H_2SO_4 or HCl, pH<2, Cool 4°C	N/A	28 days	21-day

Analytical Group	Matrix	Method/SOP	Containers (Number, Size, and Type per Sample)	Preservation Requirements	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround (not including validation)
Arsenic Speciation As(III) & As(V)	Liquid	IC-ICP-MS	125-mL HDPE	EDTA, Cool 4°C, keep dark	N/A	14 days	21-day

Laboratory (name, sample receipt address, POC, e-mail, and phone numbers): Applied Sciences Laboratory, 2300 NW Walnut Boulevard · Corvallis, Oregon 97330, POC: Ashley Willie, 541-768-3147, Ashley.Wille@ch2m.com

List any required accreditations/certifications: Laboratory has current NELAC and/or New Jersey certification.

Back-up Laboratory: None

Sample delivery method: Fed Ex

Analytical Group	Matrix	Method/SOP	Containers (Number, Size, and Type per Sample)	Preservation Requirements	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround (not including validation)
Leaching	Soil	EPA 1313	1-gal container	4°C	Varies—should be consistent with the aqueous sample holding times of the definitive method performed after the leaching procedure.		30-day
Leaching	Soil	EPA Pre-Method 1314	1-gal container	4°C	Varies—should be consistent with the aqueous sample holding times of the definitive method performed after the leaching procedure.		90-day
Leaching	Soil	EPA Pre-Method 1315	Solidified Column	4°C	Varies—should be consistent with the aqueous sample holding times of the definitive method performed after the leaching procedure.		90-day
Leaching	Soil	EPA Pre-Method 1316	1-gal container	4°C	Varies – should be consistent with the aqueous sample holding times of the definitive method performed after the leaching procedure.		90-day

Laboratory (name, sample receipt address, POC, e-mail, and phone numbers): ALS Environmental, 2655 Park Center Drive, Ste. A, Simi Valley, California 93065, POC: Kate Aguilera, 805-526-7161 x234, Kate.Aguilera@alsglobal.com

List any required accreditations/certifications: Laboratory has current NELAC and/or New Jersey certification.

Back-up Laboratory: None

Sample delivery method: Fed Ex

Analytical Group	Matrix	Method/SOP	Containers (Number, Size, and Type per Sample)	Preservation Requirements	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround (not including validation)
VOCs	Air	TO-15	6-L Summa Canister	None	N/A	30 days	21-day
SVOCs	Air	NIOSH Method 5515	TBD	TBD	TBD	TBD	TBD
Metals	Air	Modified NIOSH Method 7303	TBD	TBD	TBD	TBD	TBD
Dust	Air	Modified NIOSH Method 0500	TBD	TBD	TBD	TBD	TBD

TBD – Requirements to be determined following selection of laboratory.

QAPP Worksheet #20: Field QC Summary

Quality control samples will be collected to monitor accuracy, precision, and the presence of field contamination for analytical methods to be performed in the offsite laboratory. The frequency of collection of the quality control samples is outlined below.

Matrix	Analytical Group	Analysis	Field Samples	Field Duplicates	Matrix Spikes	Matrix Spike Duplicates	Field Blanks	Equipment Blanks	Trip Blanks	Total No. of Samples Analyzed
Soil	Baseline Treatability Samples	As per Worksheet #17	6	0	0	0	0	0	0	6
Soil	Confirmation Sampling	As per Worksheet #17	109	NA	NA	NA	0	30	0	139
Liquid	Waste Characterization	As per Worksheet #18	5	NA	NA	NA	NA	NA	5	5
Soil	Waste Characterization	As per Worksheet #18	20	NA	NA	NA	NA	NA	TBD	20
Air	Perimeter Air Monitoring	VOCs, TO-15	20	2	NA	NA	NA	NA	NA	22

Actual sample counts are based on anticipated schedule, field conditions, and waste produced. The above sample counts are estimations and final samples collected will be provided within the Basis of Design.

- **Trip Blanks** - A trip blank will be prepared before the laboratory sends the sample containers. The trip blank will consist of a 40-ml volatile organic analytic vial containing distilled, deionized water, which accompanies the other aqueous and methanol-preserved soil sample bottles into the field and back to the laboratory. A trip blank will be included with each shipment of water samples for TCL volatiles analysis. The trip blank will be analyzed for TCL volatile organic compounds to detect any contamination from sampling and transport, and internal laboratory procedures.
- **Equipment Blanks** - Equipment blanks will be taken at a frequency of one per decontamination event, maximum of one per day sampling equipment type, minimum of one per week. An equipment blank is used to assess the effectiveness of the decontamination procedures for sampling equipment. It is a sample of deionized, distilled water provided by the laboratory, which has passed through a decontaminated bailer or other sampling apparatus. It is usually collected as a last step in the decontamination procedure, before taking an aqueous sample. The equipment blank may be analyzed for all of the parameters of interest. An equipment blank is not needed if clean disposable sampling equipment is utilized.

- **Field Blank**—A field blank will be taken at a frequency of one for each batch of source water used during the event. 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.
- **Duplicates** will consist of:
  - Field Duplicate—to assess the representativeness of the sampling methods, field duplicates will be collected at a minimum frequency of one per 10 environmental samples per matrix however due to the specialized leaching methods for 1315 and 1316, duplicates will not be collected as part of the Baseline and Confirmation Sampling
  - Matrix Spike/Matrix Spike Duplicate—MS/MSD samples (MS/MSD for organics; MS and laboratory duplicate for inorganics) will be taken at a frequency of one pair per 20 field samples. These samples are used to assess the effect of the sample matrix on the recovery of target compounds or target analytes. however due to the specialized leaching methods for 1315 and 1316, MS/MSD samples will not be collected as part of the Baseline and Confirmation Sampling

QAPP Worksheet #21: Field SOPs

SOP#	Title, Revision, Date, and URL (if Available)	Originating Organization	SOP Option or Equipment Type (if SOP Provides Different Options)	Modified for Project? Y/N	Comments
001	In Situ Solidification/Stabilization Wet Sample Collection, 9/19/2013	CH2M HILL	For ISS sampling	Y	
002	Equipment Decontamination, 7/16/2012	CH2M HILL	Applies to all non-disposable equipment used for sampling	N	
003	Indoor, Outdoor, and Crawl Space Air Sampling for VOCs Using Canisters, 6/14/2012	CH2M HILL	Not Applicable	N	
004	Drilling and Soil Sampling, 7/16/2012	CH2M HILL	Not Applicable	N	

QAPP Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection

Field Equipment	Activity	SOP Reference	Title or Position of Responsible Person	Frequency	Acceptance Criteria	Corrective Action
TSI DustTrak-II, model 8520, or equivalent	Per Manual	Per Manual	Field Team Lead and/or Air Monitoring Technician	Per Manual	Per Manual	Per Manual
PID	Per Manual	Per Manual	Field Team Lead and/or Air Monitoring Technician	Per Manual	Per Manual	Per Manual
pH Monitor	Per Manual	Per Manual	Field Team Lead	Per Manual	Per Manual	Per Manual
YSI 600	Per Manual	Per Manual	Field Team Lead	Per Manual	Per Manual	Per Manual

QAPP Worksheet #23: Analytical SOPs

Laboratory must have current NELAC and/or New Jersey certification.

SOP#	Title, Revision Date, and/or Number[1]	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
EOP5035	Collection/Preparation of Solids for VO Analysis: 5035	Definitive	SW-846 5035: Closed Loop Purge and Trap and Extraction for Volatile Organics in Soil and Waste Samples	TerraCore™ Samplers	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No
EOP5030	Purge-and-Trap Extraction of Aqueous Samples	Definitive	SW-846 5030B: Purge and Trap for Aqueous Samples	Ol Model 4680 Autosampler	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No
EMS8260B	Volatile Organics by SW8260B	Definitive	SW-846 8260B: Volatile Organic Compounds by Gas Chromatography/Mass Spectroscopy	HP 5890/5973 HP 6890/5973 Agilent 6890/5973	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No
EOP002	Pre of Base Neutral/Acid Extractables in Solids	Definitive	SW-846 3550B: Ultrasonic Extraction	Teknar Sonicator Hot water bath	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No
EOP001	Prep of Base Neutral/Acid Extractables: Water Matrices	Definitive	SW-846 3510C: Separatory Funnel Liquid-Liquid Extraction	Separatory Funnels Zymark Turbovap	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No
EMS8270	Semi-Volatile Organics by SW8270	Definitive	SW-846 8270C: Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry	HP 5890/5972 HP 6890/5973 Agilent 6890/5975	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No
EGC8081	Pesticides Analysis by SW8081	Definitive	SW-846 8081A: Organochlorine Pesticides by Gas Chromatography	HP 5890, 6890 Dual ECD	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No
EGC8082	PCB Analysis by SW8082	Definitive	SW-846 8082: Polychlorinated Biphenyls (PCBs) by Gas Chromatography	HP 5890, 6890 Dual ECD	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No
EMP073	Soil Digestion for ICP Analysis	Definitive	SW-846 3050: Acid Digestion of Sediments, Sludges, and Soils	Environmental Express 36 position Hot Block	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No

SOP#	Title, Revision Date, and/or Number[1]	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
EMP070	Non-Potable Waters Digestion for ICP/Flame Analysis	Definitive	SW-846 3010A: Acid Digestion of Aqueous Samples & Extracts for Total Metals by FLAA or ICP Spectroscopy	Environmental Express 36 position Hot Block	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No
EMA207	Metals: ICP Emission Spec. SW846 6010B	Definitive	SW-846 6010B: Inductively Coupled Plasma-Atomic Emission Spectrometry	TJA Environ Trace 61E	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No
EMA055	Mercury Analysis In Aqueous Samples	Definitive	SW-846 7470A: Mercury in Liquid Waste (Manual Cold-Vapor Technique)	Leeman PS20011 Leeman Hydra AA	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No
EMA072	Mercury Analysis In Solid Samples: SW7471A	Definitive	SW-846 7471A: Mercury in Solid or Semi-Solid Waste (Manual Cold-Vapor Technique)	Leeman PS20011 Leeman Hydra AA	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No
EGCTPHS	Diesel Range Organics by SW8015	Definitive	SW-846 8015M: Total Petroleum Hydrocarbons—Diesel Range Organics	HP 6890 PID/FID	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No
EGN142	TCLP—Volatiles Extraction	Definitive	SW-846 1311: Toxicity Characteristic Leaching Procedure	Rotary Agitator Millipore Filtration Apparatus Extraction Vessels	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No
EGN141	TCLP—Semi-volatiles/Metals Extraction	Definitive	SW-846 1311: Toxicity Characteristic Leaching Procedure	Rotary Agitator Millipore ZHE	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No
EGC8151	Herbicides by SW842-8151	Definitive	SW-846 8151A: Chlorinated Herbicides by Gas Chromatography Using Methylation or Pentafluorobenzyl Derivitization	HP 5890, 6890 Dual ECD	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No
EGN137	Reactive Sulfide and Reactive Cyanide	Definitive	SW-846 Chapter 7 Section 7.3: Reactivity	Lachat Quikchem 8000	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No
EGN200	pH and Corrosivity for Soils/Solid Wastes SW846 9045	Definitive	SW-846 9040B: pH Electronic Measurement	Orion 250A pH meter	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No

SOP#	Title, Revision Date, and/or Number[1]	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
EGN238	pH and Corrosivity for Aqueous and Multiphasic Wastes	Definitive	SW-846 9045D: Soil and Waste pH	Orion 250A pH meter	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No
EGN140	Ignitability	Definitive	SW-846 1010A: Pensky-Martens Closed Cup Method for Determining Ignitability	Pensky Martens Flash Tester	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No
EGN037-09	Alkalinity in Soils SM2320B	Definitive	SM2320B Alkalinity in Soil	Orion 250A pH meter	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No
EGN310-03	Ortho-Phosphate EPA 365.3	Definitive	Ortho-Phosphate EPA 365.3	Lachat Quikchem 8000	Accutest Laboratories New Jersey, Inc., Dayton, NJ	No
EPA 1313	*Method 1313** "Liquid-Solid Partitioning as a Function of Extract pH for Constituents in Solid Materials using a Parallel Batch Extraction Procedure"	Screening	Leaching Environmental Assessment Framework (LEAF)		Applied Sciences Laboratory, Corvallis, OR	No
EPA 1314	Method 1314* "Liquid-Solid Partitioning as a Function of Liquid-Solid Ratio for Constituents in Solid Materials using an Up-flow Percolation Column Procedure"	Screening	Leaching Environmental Assessment Framework (LEAF)		Applied Sciences Laboratory, Corvallis, OR	No
EPA 1315	Method 1315* "Mass Transfer Rates of Constituents in Monolithic or Compacted Granular Materials using a Semi-dynamic Tank Leaching Procedure"	Screening	Leaching Environmental Assessment Framework (LEAF)		Applied Sciences Laboratory, Corvallis, OR	No
EPA 1316	Method 1316 "Liquid-Solid Partitioning as a Function of Liquid-Solid Ratio for Constituents in Solid Materials Using a Parallel Batch Extraction Procedure"	Screening	Leaching Environmental Assessment Framework (LEAF)		Applied Sciences Laboratory, Corvallis, OR	No

SOP#	Title, Revision Date, and/or Number[1]	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
VOA-TO15	Determination of Volatile Organic Compounds in Air Samples Collected in Specially Prepared Canisters and Gas Collection Bags by Gas Chromatography/Mass Spectrometry (GC/MS): EPA TO-15	Definitive	VOCs in Air	HP 5890/5972 HP 6890/5973 Agilent 6890/5973 Agilent 7890/5973	ALS Environmental, Simi Valley, CA	No
TBD	TBD	Definitive	SVOCs in Air	TBD	TBD	TBD
TBD	TBD	Definitive	Metals in Air	TBD	TBD	TBD
TBD	TBD	Definitive	Dust in Air	TBD	TBD	TBD

TBD – SOPs to be obtained following selection of laboratory.

QAPP Worksheet #24: Analytical Instrument Calibration

Identify all analytical instrumentation that requires calibration and provide the SOP reference number for each. In addition, document the frequency, acceptance criteria, and corrective action requirements on the worksheet.

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
HP 5890, 6890 Dual ECD	SW-846 8081A		As needed	≤ 20% RSD Correlation Coefficient R ≥ 0.995	Instrument maintenance, standard, inspection, recalibration	Laboratory Analyst	EGC 8081
HP 5890, 6890 Dual ECD	SW-846 8082		As needed	≤ 20% RSD Correlation Coefficient R ≥ 0.995	Instrument maintenance, standard, inspection, recalibration	Laboratory Analyst	EGC 8082
HP 5890, 6890 Dual ECD	SW-846 8151A		As needed	≤ 20% RSD Correlation Coefficient R ≥ 0.995	Instrument maintenance, standard, inspection, recalibration	Laboratory Analyst	ECG 8181
HP 5890/5970 HP 6890/5973 Agilent 6890/5975	SW-846 8260B		As needed	≤ 20% RSD Correlation Coefficient R ≥ 0.995	Instrument maintenance, standard, inspection, recalibration	Laboratory Analyst	EMS 8260B
HP 5890/5970 HP 6890/5973 Agilent 6890/5975	SW-846 8270C		As needed	≤ 20% RSD Correlation Coefficient R ≥ 0.995	Instrument maintenance, standard, inspection, recalibration	Laboratory Analyst	EMS 8270C
HP 6890 PID/FID	SW-846 8015M		As needed	≤ 20% RSD Correlation Coefficient R ≥ 0.995	Instrument maintenance, standard, inspection, recalibration	Laboratory Analyst	EGC TPHS
TJA Enviro Trace 61E	SW-846 6010B		As needed	≤ 20% RSD Correlation Coefficient R ≥ 0.995	Instrument maintenance, standard, inspection, recalibration	Laboratory Analyst	EMA 207
Leeman PS 20011 Leeman Hydra AA	SW-846 7470A/7471A		As needed	≤ 20% RSD Correlation Coefficient R ≥ 0.995	Instrument maintenance, standard, inspection, recalibration	Laboratory Analyst	EMA 055 EMA 072

Instrument	Calibration Procedure	Calibration Range	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Lachat Quickchem 8000	EPA 335.3		Daily	Correlation Coefficient R ≥ 0.995	Instrument maintenance, standard, inspection, recalibration	Laboratory Analyst	ENG 207

QAPP Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
HP 5890, 6890 Dual ECD	Replace septa, clean injection port, clip replace column	SW-846 8081A	Leak test, column and injection port inspection	Daily or as needed	Passing DDT and Endrin breakdown, passing CCV	Perform maintenance, check standards, recalibrate	Laboratory Analyst	EGC 8081
HP 5890, 6890 Dual ECD	Replace septa, clean injection port, clip replace column	SW-846 8082	Leak test, column and injection port inspection	Daily or as needed	Passing CCV	Perform maintenance, check standards, recalibrate	Laboratory Analyst	EGC 8082
HP 5890, 6890 Dual ECD	Replace septa, clean injection port, clip replace column	SW-846 8151A	Leak test, column and injection port inspection	Daily or as needed	Passing CCV	Perform maintenance, check standards, recalibrate	Laboratory Analyst	ECG 8181
HP 5890/5970 HP 6890/5973 Agilent 6890/5975	Replace septa, clean injection port, clip replace column	SW-846 8260B	Leak test, column and injection port inspection, source insulator integrity	Daily or as needed	Passing BFB and CCV, passing internal standards response	Perform maintenance, check standards, recalibrate	Laboratory Analyst	EMS 8260B
HP 5890/5970 HP 6890 5973 Agilent 6890/5975	Replace septa, clean injection port, clip replace column	SW-846 8270C	Leak test, column and injection port inspection, source insulator integrity	Daily or as needed	Passing DFTPP and CCV, passing internal standards response	Perform maintenance, check standards, recalibrate	Laboratory Analyst	EMS 8270C
HP 6890 PID/FID	Replace septa, clean injection port, clip replace column	SW-846 8015M	Leak test, column and injection port inspection	Daily or as needed	Passing CCV	Perform maintenance, check standards, recalibrate	Laboratory Analyst	EGC TPHS
TJA Enviro Trace 61E	Torch, nebulizer, spray chamber, autosampler, pump tubing maintenance	SW-846 6010B	Check connections, flush lines, clean nebulizer	Daily or as needed	Passing calibration	Perform maintenance, check standards, recalibrate	Laboratory Analyst	EMA 207
Leeman PS 20011 Leeman Hydra AA	Pump tubing, absorption cell and lens cleaning	SW-846 7470A/ 7471A	Check connections, flush sample lines	Daily or as needed	Passing calibration	Perform maintenance, check standards, recalibrate	Laboratory Analyst	EMA 055 EMA 072
Lachat Quickchem 8000	Pump, tubing, photocell maintenance	EPA 335.3	Clean or replace tubing, check connections	Daily or as needed	Passing calibration	Perform maintenance, check standards, recalibrate	Laboratory Analyst	ENG 207

QAPP Worksheet #26 and #27: Sample Handling, Custody, and Disposal

Sampling organization: Various

Laboratory: Accutest

Method of sample delivery (shipper/carrier): Federal Express—Priority Overnight

Number of days from reporting until sample disposal: Minimum 30 days after final report sent to the client

Activity	Organization and Title or Position of Person Responsible for the Activity	SOP Reference
Sample labeling	Field Team Lead, CH2M HILL	As Per FSP
Chain-of-custody form completion	Field Team Lead, CH2M HILL	As Per FSP
Packaging	Field Team Lead, CH2M HILL	As Per FSP
Shipping coordination	Field Team Lead, CH2M HILL	As Per FSP
Sample receipt, inspection, and log-in	Nick Popow, Supervisor, Receiving/Accutest	Accutest SOP# EPM004-04
Sample custody and storage	Dave Hukele, Sample Custodian/Accutest	Accutest SOP# ESM001-09
Sample disposal	Robert MacLean, Accutest	Accutest SOP# EHS004-04

Collecting data of known quality begins at the point of sample collection. Legally defensible data are generated by adhering to proven evidentiary procedures. These procedures are outlined in the following sections and must be followed to preserve and ensure the integrity of all samples from the time of collection through analysis. Sample custody records must be maintained both in the field and in the subcontractor laboratory. A sample is considered to be in someone's custody if it is either in his or her physical possession or view, locked up, or kept in a secured and restricted area. Until shipment, sample custody will be the responsibility of the sampling team leader.

Chain-of-custody records document sample collection and shipment to the laboratory. A chain-of-custody form will be completed for each sampling event. The original copy will be provided to the laboratory with the sample shipping cooler, and a copy will be retained in the field documentation files. The chain-of-custody form will identify the contents of each shipment and maintain the custodial integrity of the samples. All chain-of-custody forms will be signed and dated by the responsible sampling team personnel. The "relinquished by" box will be signed by the responsible sampling team personnel, and the date, time, and air bill number will be noted on the chain-of-custody form. The laboratory will return the executed copy of the chain-of-custody with the hardcopy report.

The shipping coolers containing the samples will be sealed with a custody seal any time the coolers are not in an individual's possession or view before shipping. All custody seals will be signed and dated by the responsible sampling team personnel.

At a minimum, the chain-of-custody form must contain:

- Site name.
- Project Manager, Project Chemist, and Data Manager names, telephone numbers, and fax numbers.
- Unique sample identification.
- Date and time of sample collection.
- Source of sample (including name, location, sample type, and matrix).
- Number of containers.
- Designation of MS/MSD.
- Preservative used.
- Analyses required.
- Name of sampler.
- Custody transfer signatures and dates and times of sample transfer from the field to transporters and to the laboratories.
- Bill of lading or transporter tracking number (if applicable).
- Turnaround time.
- Lab name, address, and contact information.
- Any special instructions.

Erroneous entries on chain-of-custody records will be corrected by drawing a line through the error and entering the corrected information. The person performing the correction will date and initial each change made on the chain-of-custody form.

Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal): A custodian at the laboratory will accept custody of the shipped samples, and check them for discrepancies, proper preservation, integrity, etc. If noted, issues will be forwarded to the laboratory project or laboratory manager for corrective action; Earth Tech will be notified and will be involved in decisions on corrective action. The sample custodian will relinquish custody to the appropriate department for analysis. A “Condition upon Receipt” or similar form will be completed by the laboratory and will be included in the analytical data package.

Disposal of the samples will occur only after analyses and QA/QC checks are completed, and 60 days after issuance of analytical report.

QAPP Worksheet #28: Analytical Quality Control and Corrective Action

Matrix: Aqueous/Soil/NAPL

Analytical group: Volatile Organic Compounds

Analytical method/SOP: SW 846 8260B

TABLE 28-1

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/Position of Person Responsible for Corrective Action	Project-Specific MPC[a]
Tuning (Mass calibration check)	At beginning of run and every 12 hours	Meet all BFB criteria	Check instrument, reanalyze, re-tune	Lab personnel	Meet all BFB criteria
Method Blank (Lab Reagent Blank)	Prior to each analytical run	< RL (except acetone and methylene chloride)	Identify source and correct prior to continuing analysis	Lab personnel	< RL
Trip Blank (aqueous only)	One per shipment including aqueous VOCs	< RL	Identify source and correct	Field and/or laboratory personnel	< RL
Initial Calibration	Prior to sample analysis	RSD ≤ 20% of average RRF; no more than 10% of analytes failure	Check instrument, recalibrate; qualify data	Lab personnel	RSD ≤ 20% of average RRF; no more than 10% of analytes failure
Continuing calibration check standard	Every 12 hours	RRF % D ≤ 30%; not more than 10% of analytes failure;	Recalibrate, qualify data	Lab personnel	RRF % D ≤ 30%; not more than 10% of analytes failure
MS/MSD	1 per ≤ 20 samples	Mean recovery average 70-130 %R	Assume matrix bias; qualify data; note in case narrative	Lab personnel	Recovery 70-130% (each analyte); RPD ≤ 20% (water) or ≤ 30% (soil)
LCS/LCSD	2 per batch of ≤ 20 samples	Average recovery 70 – 130% R; RPD ≤ 20%	Qualify data unless high recovery and/or not detected	Lab personnel	Average recovery 70 – 130% R; RPD ≤ 20% (water) or ≤ 30% (soil)
Surrogate Compounds	all samples, standards, and blanks	70– 130% R	Reinject; qualify data	Lab personnel	70– 130% R
Internal Standards	all samples, standards, and blanks	-30 to +40% from initial/continuing calibration (for superfund program)	Check instruments, reanalyze affected samples if possible. If reanalysis not possible qualify data (except nondetects with high IS recovery).	Lab personnel	-30 to +40% from initial/continuing calibration

[a] Recovery and precision limits and measurement performance criteria are generic.

Matrix: Aqueous/Soil/NAPL

Analytical group: Semivolatile Organic Compounds

Analytical method/SOP: SW 846 8270C

TABLE 28-2

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/Position of Person Responsible for Corrective Action	Project-Specific MPC[a]
Tuning (Mass calibration check)	At beginning of run and every 12 hours	Meet all DFTPP criteria	Check instrument, reanalyze, re-tune	Lab personnel	Meet all DFTPP criteria
Method Blank (Lab Reagent Blank)	Prior to each analytical run	< RL (except bis 2-ethylhexyl phthalate)	Identify source and correct prior to continuing analysis	Lab personnel	< RL
Initial Calibration	Prior to sample analysis	RSD ≤ 20% of average RRF; no more than 10% of analytes failure	Check instrument, recalibrate; qualify data	Lab personnel	RSD ≤ 20% of average RRF; no more than 10% of analytes failure
Continuing calibration check standard	Every 12 hours	RRF % D ≤ 30%; not more than 10% of analytes failure;	Recalibrate, qualify data	Lab personnel	RRF % D ≤ 30%; not more than 10% of analytes failure
MS/MSD	1 per ≤ 20 samples	70-130 %R	Assume matrix bias; qualify data; note in case narrative	Lab personnel	Recovery 70-130% (each analyte); RPD ≤ 20% (water) or ≤ 30% (soil)
LCS/LCSD	2 per batch of ≤ 20 samples	70 – 130% R; RPD ≤ 20%	Qualify data unless high recovery and/or not detected	Lab personnel	70 – 130% R; RPD ≤ 20% (water) or ≤ 30% (soil)
Surrogate Compounds	all samples, standards, and blanks	70–130% R	Reinject; qualify data	Lab personnel	70–130% R
Internal Standards	all samples, standards, and blanks	-30 to +40% from initial/continuing calibration (for superfund program)	Check instruments, reanalyze affected samples if possible. If reanalysis not possible qualify data (except nondetects with high IS recovery).	Lab personnel	-30 to +40% from initial/continuing calibration

[a] Recovery and precision limits and measurement performance criteria are generic.

Matrix: Aqueous/Soil/NAPL

Analytical group: TPH—DRO/GRO

Analytical method/SOP: SW8015

TABLE 28-3

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/Position of Person Responsible for Corrective Action	Project-Specific MPC[a]
Method Blank (Lab Reagent Blank)	Prior to each analytical run	< RL	Identify source and correct prior to continuing analysis	Lab personnel	< RL
Initial Calibration	Prior to sample analysis	RSD ≤ 20% of average RRF	Check instrument, recalibrate; qualify data	Lab personnel	RSD ≤ 20% of average RRF
Continuing calibration check standard	Every 12 hours	RRF % D ≤ 20%	Recalibrate, qualify data	Lab personnel	RRF % D ≤ 20%
MS/MSD	1 per ≤ 20 samples	70-130 %R	Assume matrix bias; qualify data; note in case narrative	Lab personnel	Recovery 70-130%; RPD ≤ 20% (water) or ≤ 30% (soil)
LCS/LCSD	2 per batch of ≤ 20 samples	70 – 130% R; RPD ≤ 20%	Qualify data unless high recovery and/or not detected	Lab personnel	70 – 130% R; RPD ≤ 20% (water) or ≤ 30% (soil)
Surrogate Compounds	all samples, standards, and blanks	70–130% R	Reinject; qualify data	Lab personnel	70–130% R

[a] Recovery and precision limits and measurement performance criteria are generic.

Matrix: Aqueous/Soil/NAPL

Analytical group: RCRA Metals

Analytical method/SOP: SW 846 6010C/7470A/7471A

TABLE 28-4

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/Position of Person Responsible for Corrective Action	Project-Specific MPC[a]
Method Blank	1 per < 20 samples	all constituents < RL	Investigate source of contamination	Laboratory personnel	All constituents < RL
Continuing Calibration Check Std (CCV)	1 per < 10 samples	80 – 120% R	Reanalyze; qualify data	Laboratory personnel	80 – 120% R
MS/MSD	1 per < 20 samples	80-120%R*	Qualify data	Laboratory personnel	80-120%R; RPD ≤ 20% (water) or ≤ 30% (soil)
Low Level Check Std	Beginning and end of each analytical run	± 30 % of true value	Check instrument; recalibrate	Laboratory personnel	± 30 % of true value
Initial Calibration Verification (ICV)	After each calibration; every 10 samples; end of each analytical run	90% - 110%	Check instrument; reanalyze	Laboratory personnel	90% - 110%
Initial Calibration Blank (ICB)	After ICV	< RL	Investigate source of contamination	Laboratory personnel	< RL
Continuing Calibration Blank (CCB)	After every CCV	< RL	Investigate source of contamination	Laboratory personnel	< RL
Serial Dilution	Matrix spike sample	RPD < 20%	Qualify data	Laboratory personnel	RPD < 10%
Post Digestion Spike	Matrix spike sample	85-115%R	Qualify data	Laboratory personnel	85-115%R
Interference Check Sample [ICP 6010]	beginning, and end of each analytical run	< RL for all RCRA metals	As per SOP	Laboratory personnel	< RL
Laboratory Control Sample (LCS)/LCSD	2 per extraction batch of ≤ 20 samples	Average recovery 80-120%; RPD < 20%	Qualify data	Laboratory personnel	80-120% R; RPD ≤ 20% (water) or ≤ 30% (soil)

[a] Recovery and precision limits and measurement performance criteria are generic.

Matrix: Aqueous/Soil/NAPL

Analytical group: General Chemistry

Analytical method/SOP: E415.1 TOC (water); E365.3M ortho-Phosphate (soil), SM2320 B-11Mod Alkalinity (soil)

TABLE 28-5

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/Position of Person Responsible for Corrective Action	Project-Specific MPC[a]
Method Blank	1 per < 20 samples	all constituents < RL	Investigate source of contamination	Laboratory personnel	all constituents < RL
Continuing Calibration Check Std (CCV)	1 per < 10 samples	80 – 120% R	Reanalyze; qualify data	Laboratory personnel	80 – 120% R
MS/MSD	1 per < 20 samples	80-120%R*	Qualify data	Laboratory personnel	80-120%R; RPD ≤ 20% (water) or ≤ 30% (soil)
Initial Calibration Verification (ICV)	After each calibration; every 10 samples; end of each analytical run	90% - 110%	Check instrument; reanalyze	Laboratory personnel	90% - 110%
Initial Calibration Blank (ICB)	After ICV	< RL	Investigate source of contamination	Laboratory personnel	< RL
Continuing Calibration Blank (CCB)	After every CCV	< RL	Investigate source of contamination	Laboratory personnel	< RL
Laboratory Control Sample (LCS)/LCSD	2 per extraction batch of ≤ 20 samples	Average recovery 80-120%; RPD < 20%	Qualify data	Laboratory personnel	80-120% R; RPD ≤ 20% (water) or ≤ 30% (soil)

[a] Recovery and precision limits and measurement performance criteria are generic.

Matrix: Air

Analytical group: Volatile organic compounds

Analytical method/SOP: TO-15

TABLE 28-6

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/Position of Person Responsible for Corrective Action	Project-Specific MPC[a]
Tuning (Mass calibration check)	At beginning of run and every 24 hours	Meet all DFTPP criteria	Check instrument, reanalyze, re-tune	Lab personnel	Meet all DFTPP criteria
Method Blank (Lab Reagent Blank)	Prior to each analytical run	< RL	Identify source and correct prior to continuing analysis	Lab personnel	< RL
Initial Calibration	Prior to sample analysis	RSD ≤ 30% of average RRF; no more than 10% of analytes failure	Check instrument, recalibrate; qualify data	Lab personnel	RSD ≤ 30% of average RRF; no more than 10% of analytes failure
Continuing calibration check standard	Every 12 hours	RRF % D ≤ 30%; not more than 10% of analytes failure;	Recalibrate, qualify data	Lab personnel	RRF % D ≤ 30%; not more than 10% of analytes failure
LCSLCSD	2 per batch of ≤ 20 samples	70 – 130% R; RPD ≤ 20%	Qualify data unless high recovery and/or not detected	Lab personnel	70 – 130% R; RPD ≤ 20%
Lab QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits [1]	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria[1]
Surrogate Compounds	all samples, standards, and blanks	70–130% R	Reinject; qualify data	Lab personnel	70–130% R
Internal Standards	all samples, standards, and blanks	-30 to +40% from initial/continuing calibration (for superfund program)	Check instruments, reanalyze affected samples if possible. If reanalysis not possible qualify data (except nondetects with high IS recovery).	Lab personnel	-30 to +40% from initial/continuing calibration

[a] Recovery and precision limits and measurement performance criteria are generic.

Matrix: Air

Analytical group: Semi-volatile organic compounds

Analytical method/SOP: NIOSH Method 5515

TABLE 28-7

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/Position of Person Responsible for Corrective Action	Project-Specific MPC[a]
Tuning (Mass calibration check)	At beginning of run and every 24 hours	Meet all DFTPP criteria	Check instrument, reanalyze, re-tune	Lab personnel	Meet all DFTPP criteria
Method Blank (Lab Reagent Blank)	Prior to each analytical run	< RL	Identify source and correct prior to continuing analysis	Lab personnel	< RL
Initial Calibration	Prior to sample analysis	RSD ≤ 30% of average RRF; no more than 10% of analytes failure	Check instrument, recalibrate; qualify data	Lab personnel	RSD ≤ 30% of average RRF; no more than 10% of analytes failure
Continuing calibration check standard	Every 12 hours	RRF % D ≤ 30%; not more than 10% of analytes failure;	Recalibrate, qualify data	Lab personnel	RRF % D ≤ 30%; not more than 10% of analytes failure
LCSLCSD	2 per batch of ≤ 20 samples	70 – 130% R; RPD ≤ 20%	Qualify data unless high recovery and/or not detected	Lab personnel	70 – 130% R; RPD ≤ 20%
Lab QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits [1]	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria[1]
Surrogate Compounds	all samples, standards, and blanks	70% - 130% R	Reinject; qualify data	Lab personnel	70% - 130% R
Internal Standards	all samples, standards, and blanks	-30 to +40% from initial/continuing calibration (for superfund program)	Check instruments, reanalyze affected samples if possible. If reanalysis not possible qualify data (except nondetects with high IS recovery).	Lab personnel	-30 to +40% from initial/continuing calibration

[a] Recovery and precision limits and measurement performance criteria are generic.

Matrix: Air

Analytical group: Metals

Analytical method/SOP: Modified NIOSH Method 7303

TABLE 28-8

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/Position of Person Responsible for Corrective Action	Project-Specific MPC[a]
Method Blank	1 per < 20 samples	all constituents < RL	Investigate source of contamination	Laboratory personnel	all constituents < RL
Continuing Calibration Check Std (CCV)	1 per < 10 samples	80 – 120% R	Reanalyze; qualify data	Laboratory personnel	80 – 120% R
Low Level Check Std	Beginning and end of each analytical run	± 30 % of true value	Check instrument; recalibrate	Laboratory personnel	± 30 % of true value
Initial Calibration Verification (ICV)	After each calibration; every 10 samples; end of each analytical run	90% - 110%	Check instrument; reanalyze	Laboratory personnel	90% - 110%
Initial Calibration Blank (ICB)	After ICV	< RL	Investigate source of contamination	Laboratory personnel	< RL
Continuing Calibration Blank (CCB)	After every CCV	< RL	Investigate source of contamination	Laboratory personnel	< RL
Interference Check Sample [ICP 6010]	beginning, and end of each analytical run	< RL for all RCRA metals	As per SOP	Laboratory personnel	< RL
Laboratory Control Sample (LCS)/LCSD	2 per extraction batch of ≤ 20 samples	Average recovery 80-120%; RPD < 20%	Qualify data	Laboratory personnel	80-120% R; RPD ≤ 20%

[a] Recovery and precision limits and measurement performance criteria are generic.

QAPP Worksheet #29: Project Documents and Records

The electronic data will be used to generate validation reports, modeling results, data summary tables, maps, and other figures. This program will follow CH2M HILL standard procedures for environmental data collection.

Data collected during the field demonstrations will be reduced, reviewed, and a report on the findings will be tabulated in a standard format. The criteria used to identify and quantify the analytes will be those specified in the analytical methods. Data deliverables will be reported as “CLP-like” Sample Delivery Groups (SDGs). In addition, the USEPA shall have access to the lab and site data upon request.

The completed copies of the chain-of-custody records (both external and internal) accompanying each sample from time of initial bottle preparation to completion of analysis shall be attached to the analytical reports.

The Data Package will consist of SDGs in “PDF” format. The laboratory will upload the EDD directly to the project LocusFocus EIM database. The laboratory will provide the data package deliverables 21 business days after sample receipt of a complete sample delivery group. The Project Chemist (PC) will check the package to ensure all deliverables have been provided. If problems are identified, the laboratory will be alerted, and corrective actions will be requested. The data will be used to generate summary tables.

The electronic deliverable formats will be submitted according to the Honeywell EDD requirements. All deliverables must also undergo a QC check by the laboratory before delivery. The original data, tabulations, and electronic media are stored in a secure and retrievable fashion.

The Project Manager or Data Manager will maintain close contact with the PC to ensure all non-conformance issues are acted upon prior to data manipulation and assessment routines.

Data will be archived in project files and on electronic archive tapes for the duration of the project, 5 years, or as specified in contractual agreements.

The data flow from the laboratory and field to the project staff and data users will be sufficiently documented to ensure that data are properly tracked and reviewed before use.

In addition to the data management procedures, the laboratory will ensure that electronic and hardcopy records sufficient to recreate each analytical event are maintained. The minimum records the laboratory will keep contain the following:

- Raw data, including instrument printouts, bench work sheets, and/or chromatograms with compound identification and quantitation reports.
- Laboratory-specific written SOPs for each analytical method and QA/QC function in place at the time of analysis of project samples.
- Record keeping requirements for non-analytical data are included in the PDWP.

The below table lists field files and assessment reports that will be kept on file. Additional records will be kept on an as needed basis.

Sample Collection Documents and Records	On-site Analysis Documents and Records	Off-site Analysis Documents and Records	Data Assessment Documents and Records	Other
• Site and field logbooks • COC forms • Request forms and associated correspondence	• Boring logs • PID readings • Water quality parameters	• Internal COC forms • Sample preparation log • Standard traceability logs • Instrument calibration data • Instrument analysis logs • QC summary checklist with all relevant information • Sample analysis data • Instrument/computer printouts • Definition of qualifiers • Final report	• Sample acceptance checklist • Corrective action reports	• Telephone/email logs • Corrective action documentation • Equipment maintenance logs • Procurement request forms

QAPP Worksheets #31, #32, and #33: Assessments and Corrective Action

Assessments

Assessment Type	Responsible Party and Organization	Number/Frequency	Estimated Dates	Assessment Deliverable	Deliverable Due Date
Health and Safety Audit	Bill Berlett, Health and Safety Manager, CH2M HILL	Minimum of 1 per year	TBD	Audit checklist	TBD
Laboratory Audit	Bernice Kidd, Project Chemist, CH2M HILL	As needed	N/A	Laboratory Audit Report	As needed

Assessment

Quality assurance audits may be performed by or under the direction of the project QM (Quality Manager). These audits will be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). The QM may plan, schedule, and approve system and performance audits based upon CH2M HILL SOP customized to the project requirements. At times, the QM may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits. However, these personnel will not have responsibility for the project work associated with the performance audit.

System Audits

System audits, performed by the QM or designated auditors, will encompass a qualitative evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory quality control procedures and associated documentation may be system audited. These audits may be performed once during the performance of the project. However, if conditions adverse to quality are detected or if the Project Manager requests, additional audits may occur.

Performance Audits

The laboratory will be required to conduct an analysis of Performance Evaluation (PE) samples or provide proof that Performance Evaluation samples submitted by USEPA or a state agency have been analyzed within the past twelve (12) months.

Formal Audits

Formal audits refer to any system or performance audit that is documented and implemented by the QM. These audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that quality assurance requirements have been developed, documented, and instituted in accordance with contractual and project criteria. Formal audits may be performed on project and subcontractor work at various locations.

Auditors who have performed the site audit after gathering and evaluating all data will write audit reports. Items, activities, and documents determined by lead auditors to be in noncompliance shall be identified at exit interviews conducted with the involved management. Noncompliance's will be logged and

documented through audit findings, which are attached to and are a part of the integral audit report. These audit-finding forms are directed to management to satisfactorily resolve the noncompliance in a specified and timely manner.
The Project Manager has overall responsibility to ensure that all corrective actions necessary to resolve audit findings are acted upon promptly and satisfactorily. Audit reports must be submitted to the Project Manager within fifteen days of completion of the audit. Serious deficiencies will be reported to the Project Manager within 24 hours. All audit checklists; audit reports, audit findings, and acceptable resolutions are approved by the QM prior to issue. Verification of acceptable resolutions may be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the QM will close out the audit report and findings.

Assessment Response and Corrective Action

Assessment Type	Responsibility for Responding to Assessment Findings	Assessment Response Documentation	Timeframe for Response	Responsibility for Implementing Corrective Action	Responsible for Monitoring Corrective Action Implementation
Health and Safety Audit	Steve Zarlinski, PM CH2M HILL	Letter and any verification documentation	24 hours after notification	Field Team Leader, CH2M HILL	Bill Berlett, Health and Safety Manager CH2M HILL

Corrective Action

The following procedures have been established to ensure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected. Corrective action forms are included in the PDWP.

Procedure Description

When a significant condition adverse to quality is noted at site, laboratory, or subcontractor location, the cause of the condition will be determined and corrective action will be taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the QM, Project Manager, Field Team Leader and involved subcontractor management, at a minimum. Implementation of corrective action is verified by documented follow-up action.

All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality. Corrective actions will be initiated as follows:

- When predetermined acceptance standards are not attained;
- When procedure or data compiled are determined to be deficient;
- When equipment or instrumentation is found to be faulty;
- When samples and analytical test results are not clearly traceable;
- When quality assurance requirements have been violated;
- When designated approvals have been circumvented;
- As a result of system and performance audits;
- As a result of a management assessment;

- As a result of laboratory/field comparison studies; and
- As required by USEPA and USEPA SW-846 Methods.

Project management and staff, such as field investigation teams, remedial response planning personnel, and laboratory groups, monitor on-going work performance in the normal course of daily responsibilities. Work may be audited at the CH2M HILL office, sites, laboratories, or subcontractor locations. Activities or documents ascertained to be noncompliant with quality assurance requirements will be documented. Corrective actions will be mandated through audit finding sheets attached to the audit report. Audit findings are logged, maintained, and controlled by the Task Manager.

Personnel assigned to quality assurance functions will have the responsibility to issue and control Corrective Action Request (CAR) forms (See PDWP). The CAR identifies the out-of-compliance condition, reference document(s), and recommended corrective action(s) to be administered. The CAR is issued to the personnel responsible for the affected item or activity. A copy is also submitted to the Project Manager. The individual to whom the CAR is addressed returns the requested response promptly to the QA personnel, affixing his/her signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The QA personnel maintain the log for status of CARs, confirms the adequacy of the intended corrective action, and verifies its implementation. CARs will be retained in the project file for the records.

Any project personnel may identify noncompliance issues; however, the designated QA personnel are responsible for documenting, numbering, logging, and verifying the close out action. The Project Manager will be responsible for ensuring that all recommended corrective actions are implemented, documented, and approved.

Reports to Management

CH2M HILL management personnel receive QA reports appropriate to their level of responsibility. The PM receives copies of all QA documentation. QC documentation is retained within the department that generated the product or service except where this documentation is a deliverable for a specific contract. QC documentation is also submitted to the QM for review and approval. Previous sections detailed the QA activities and the reports that they generate. A final audit report for each project may also be prepared. The reports may include:

- periodic assessment of measurement data accuracy, precision, and completeness;
- results of performance audits and/or system audits;
- significant QA problems and recommended solutions for future projects; and
- status of solutions to any problems previously identified.

Additionally, any incidents requiring corrective action will be fully documented.

QAPP Worksheet #34: Data Verification and Validation Inputs

Verification Input	Description	Internal/External	Responsible for Verification (Name, Organization)
Field Notes	Field notes will be reviewed internally and placed in the site file. A copy of the field notes will be attached to the final report.	Internal	FTL, CH2M HILL
COC and shipping forms	COC and shipping forms will be reviewed internally upon completion and verified against the packed coolers they represent. The shippers' signature on the COC should be initialed by the reviewer, a copy of the COC retained in the site file, and the original and remaining copies taped inside the cooler for shipment.	Internal	FTL, CH2M HILL
Audit Report	Upon report completion, a copy of all audit reports will be placed in the site file. If CAs are required, a copy of the documented CA taken will be attached to the appropriate audit report in the site file. At the beginning of each week and at the completion of the site work, site file audit reports will be reviewed internally to ensure that all appropriate CAs have been taken and that CA reports are attached. If CAs have not been taken, the Site Manager will be notified to ensure no action is taken.	Internal	Steve Zarlinski, PM, CH2M HILL
Laboratory Data	All laboratory data packages will be verified externally by the laboratory performing the work for completeness and technical accuracy prior to submittal.	External	Accutest (Kristin Beebe) ASL (Ashley Willie) ALS Environmental (Kate Aguillera)

QAPP Worksheet #35: Data Verification Procedures

Step IIa/IIb	Validation Input	Description	Person(s) Responsible for Validation
IIa	Field SOPs	Verify that the sampling SOPs were followed	Mike Murphy, FTL, CH2M HILL
IIa	Analytical SOPs	Verify that the analytical SOPs were followed	Laboratory QA Officer/TBD Berney Kidd/CH2M HILL
IIa	Method QC Results	Verify that the required QC samples were run and met required limits	Laboratory QA Officer/TBD Berney Kidd/CH2M HILL
IIa/IIb	Data Validation	Validate 100 percent of the data to confirm quality	Berney Kidd/CH2M HILL
IIa/IIb	Data Usability Evaluation	Evaluate data based on precision, accuracy, representativeness, comparability and completeness for project objectives	Berney Kidd/CH2M HILL
IIb	Onsite Screening (such as PID readings)	Verify that the field data meets Work Plan requirements for completeness and accuracy based on field calibration records	Mike Murphy, FTL, CH2M HILL
IIb	Field Documentation	Verify accuarcy and completenss of field notes	Mike Murphy, FTL, CH2M HILL
IIb	Field QC Sample Results	Verify that the required field QC samples were run and met required limits	Laboratory QA Officer/TBD Berney Kidd/CH2M HILL

QAPP Worksheet #36: Data Validation Procedures

TABLE 36-1
Data Validation Procedures

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (Title and Organizational Affiliation)
IIa/IIb	Soil	All methods	Low	Defined below	Berney Kidd/CH2M HILL Peeyush Gupta/HTS
IIa/IIb	Groundwater	All methods	Low	Defined below	Berney Kidd/CH2M HILL Peeyush Gupta/HTS
IIa/IIb	Air	VOCs	Low	Defined below	Berney Kidd/CH2M HILL Peeyush Gupta/HTS

Personnel involved in data validation will be independent of any data generation effort. The Project Chemist will be responsible for overseeing data validation. Data validation will be carried out when the data packages are received from the laboratory. It will be performed on an analytical batch basis using the summary results of calibration and laboratory quality control, as well as those of the associated field samples. Data packages will be reviewed for all constituents of concern. Raw data will be reviewed for approximately 10 percent of the data packages or as deemed necessary by the Project Chemist. Validation will be performed using the following procedures and those referenced for Level 3 or 4 as appropriate:

- A review of the data set narrative to identify any issues that the lab reported in the data deliverable
- A check of sample integrity (sample collection, preservation, and holding times)
- An evaluation of basic QC measurements used to assess the accuracy, precision, and representativeness of data, including QC blanks, LCSs, MS/MSDs, surrogate recovery when applicable, and field or laboratory duplicate results
- A review of sample results, target compound lists, and detection limits to verify that project analytical requirements are met
- Initiation of corrective actions, as necessary, based on the data review findings
- Qualification of the data using appropriate qualifier flags, as necessary, to reflect data usability limitations

Level 3 validation procedures will also include reviewing the evaluation of calibration and quality control summary results against the project requirements and other method-specific QC requirements.

Data validation will be patterned after EPA guidelines for organic and inorganic data review, substituting the calibration and quality control requirements specified in this QAPP for those specified in the guidelines. The flagging criteria in Tables 36-2 and 36-3 will be used. The qualifier flags are defined in Table 36-4.

Qualifier flags, if required, will be applied to the electronic sample results. If multiple flags are required for a result, the most severe flag will be applied to the electronic result. The hierarchy of flags from the most severe to the least severe will be as follows: R, UJ, U, and J.

Any significant data quality problems will be brought to the attention of the Project Chemist.

TABLE 36-2
Flagging Conventions for Organic Methods
Quanta, Quality Assurance Project Plan

Quality Control Check	Evaluation	Flag	Samples Affected
Holding Time	Holding time exceed for extraction or analysis by less than a factor of two	J positive results UJ non-detects	affected samples
	Holding time exceed for extraction or analysis by a factor of two	J positive results R non-detects	affected samples
Temperature	temperature exceedance >6°C if received within 24 hr	UJ non-detects	
	temperature exceedance >6C if received > 24 hr	UJ non-detects, J positive results	
Sample Preservation (volatiles)	Sample preservation requirements not met and analyzed out of holding time if preservation not performed in the field, but performed in the laboratory upon receipt, no flagging is required	J positive results R non-detects	affected samples
Sample Integrity (volatiles)	Professional Judgment on sample condition Example: Bubbles in VOA vial used for analysis	J positive results/professional judgment R non-detects/professional judgment	affected samples
GC/MS Instrument Performance Check	Mass assignment in error and laboratory cannot reprocess data	R all results	all samples in batch
	Ion abundance criteria not met	R all results if critical ions involved, use judgment otherwise	all samples in batch
Initial Calibration GC/MS Methods	RRF <0.050 (0.010 poor performers)	J positive results R non-detects	analyte in associated samples
	%RSD > 20% (30% poor performers) and no and no calibration curve used or linear calibration curve used and R <0.990	J positive results UJ non-detects	analyte in associated samples
	%RSD > 90%	J positive results R non-detects	analyte in associated samples
Initial Calibration GC Methods; see Note 1	%RSD >20% and no calibration curve used or linear calibration curve used and R <0.990	J positive results UJ non-detects	analyte in associated samples

TABLE 36-2
Flagging Conventions for Organic Methods
Quanta, Quality Assurance Project Plan

Quality Control Check	Evaluation	Flag	Samples Affected
Continuing Calibration Verification GC/MS Methods (ICV and CCV)	RRF <0.050 (0.010 poor performers)	J positive results R non-detects	analyte in associated samples
	% difference or % drift > >30% with high recovery	J positive results	analyte in associated samples
	% difference or % drift >30% with low recovery	J positive results UJ non-detects	analyte in associated samples
Continuing Calibration Verification GC Methods (ICV and CCV)	**% difference or % drift >20% with high recovery**	J positive results	analyte in associated samples
	% difference or % drift >20% with low recovery	J positive results UJ non-detects	analyte in associated samples
Laboratory Control Sample (LCS)	%R >UCL	J positive results	analyte in associated samples
	%R <LCL but ≥10%	J positive results UJ non-detects	analyte in associated samples
	%R <LCL but ≤10%	J positive results R non-detects	analyte in associated samples
Method Blank (MB) <RL	Convert blank to soil units if necessary, multiply highest blank value by 5 (by 10 for common lab contaminants, acetone, methylene chloride, MIBK, cyclohexane, phthalates)	U positive results <5 x highest blank concentration (<10 x for common contaminants)	all associated samples in batch
Equipment Blank (FB) <RL	Convert blank to soil units if necessary, multiply highest blank value by 5 (by 10 for common lab contaminants, acetone, methylene chloride, MIBK, cyclohexane, phthalates)	U positive results <5 x highest blank concentration (<10 x for common contaminants)	all associated samples in batch
Trip Blank (TB) <RL	Convert blank to soil units if necessary, multiply highest blank value by 5 (by 10 for common lab contaminants, acetone, methylene chloride, MIBK, cyclohexane, phthalates)	U positive results <5 x highest blank concentration (<10 x for common contaminants)	all associated samples in batch
Matrix Spike/Matrix Spike Dup (MS/MSD)	%R >UCL	J positive results	parent sample

TABLE 36-2
Flagging Conventions for Organic Methods
Quanta, Quality Assurance Project Plan

Quality Control Check	Evaluation	Flag	Samples Affected
does not apply if sample result is greater than four times the spike value	%R <LCL but >10%	J positive results UJ non-detects	parent sample
	%R <LCL but <10%	J positive results R non-detects	parent sample
	RPD >UCL	J positive results	parent sample
Surrogates - SW8260	%R >UCL	J positive results	parent sample
	%R <LCL but >10%	J positive results UJ non-detects	parent sample
	%R <LCL but <10%	J positive results R non-detects	parent sample
Surrogates - SW8270.	2 or more surrogates with %R >UCL	J positive results	parent sample
	2 or more surrogates with %R <LCL but >10%	J positive results UJ non-detects	parent sample
	2 or more surrogates with %R <LCL but <10%	J positive results R non-detects	parent sample
Surrogates - GC Methods	%R >UCL	J positive results	parent sample
	%R <LCL but >10%	J positive results UJ non-detects	parent sample
	%R <LCL but <10%	J positive results R non-detects	parent sample
Internal Standards -30% to +40% recovery	Area > UCL	J positive results	associated analytes in sample
	Area < LCL	J positive results UJ non-detects	associated analytes in sample

TABLE 36-2
Flagging Conventions for Organic Methods
Quanta, Quality Assurance Project Plan

Quality Control Check	Evaluation	Flag	Samples Affected
	Area < 25%	J positive results R non-detects	associated analytes in sample
Laboratory Duplicates ± 25% precision	Both sample results >5 times RL and RPD>UCL	J positive results	laboratory duplicate pair
	One or both samples <5 times RL and a difference between results of ± 2 times RL	J positive results UJ non detects	laboratory duplicate pair
Field Duplicates ± 50% precision for soil ± 30% precision for aqueous	Both sample results >5 times RL and RPD>UCL	J positive results	field duplicate pair
	One or both samples <5 times RL and a difference between results of ± 2 times RL for water and ± 3.5 times RL for soil	J positive results UJ non-detects	field duplicate pair
Confirmation ± 40% precision	RPD >40%	J positive results	affected analytes
	if lab reports higher of two results and coelution is suspected, reviewer can replace higher result with lower		
	Confirmation analysis not performed	J positive results	affected analytes

Initial calibration should be based on average response factors or a linear regression equation. Laboratories will need Project Chemist approval to use a nonlinear calibration curve.

TABLE 36-3
Flagging Conventions for Inorganic Methods
Quanta, Quality Assurance Project Plan

Quality Control Check	Evaluation	Flag	Samples Affected
Holding Time cool to 4°C (except metals) metals hold 180 days mercury hold 28 days	**Holding time exceed for digestion or analysis**	J positive results	affected samples
	Temperature exceedance >6°C if received within 24 hr)	UJ non-detects	
	Temperature exceedance >6°C if received >24 hr)		
	Holding time exceed for digestion or analysis by a factor of two	J positive results for all analytes	affected samples
		R non-detects for all analytes	
Sample preservation Follow guidelines in QAPP or follow USEPA	Sample preservation requirements not met	J positive results for all analytes	affected samples
	if preservation not performed in the field, but performed in the laboratory upon receipt, no flagging is required	R non-detects for all analytes	
Initial Calibration	Correlation coefficient ≤0.995	J positive results UJ non-detects	analyte in associated samples
Initial Calibration Verification (ICV) 90-110% accuracy	%R >UCL	J+ positive results	analyte in associated samples
	%R <LCL	J- positive results UJ non-detects	analyte in associated samples
Continuing Calibration Verification (CCV) 80-120% accuracy	%R >UCL	J+ positive results	analyte in associated samples
	%R <LCL	J- positive results UJ non-detects	analyte in associated samples
Interference Check Sample metals only 80-120% accuracy	If Interference present and %R >UCL	J+ positive results	analyte in associated samples
	If interference is present and %R <LCL	J- positive results UJ non-detects	analyte in associated samples

TABLE 36-3
Flagging Conventions for Inorganic Methods
Quanta, Quality Assurance Project Plan

Quality Control Check	Evaluation	Flag	Samples Affected
Laboratory Control Sample (LCS) 80-120% accuracy	%R >UCL	J+ positive results	analyte in associated samples
	%R <LCL but ≥30%	J- positive results UJ non-detects	analyte in associated samples
	%R <LCL but ≤30%	J- positive results R non-detects	analyte in associated samples
Calibration Blank (ICB or CCB) <RL	Convert blank to soil units if necessary, multiply highest blank value by 5	U positive results < 5 x highest blank concentration	all associated samples in batch
	If negative blank and absolute value is greater than the MDL and negative value is >25% of sample Result	J- positive results UJ non-detects	analyte in associated samples
Method Blank (MB or PB if prep blank) <RL	Convert blank to soil units if necessary, multiply highest blank value by 5	U positive results < 5 x highest blank concentration	all associated samples in batch
	If negative blank and absolute value is greater than the MDL and negative value is >25% of sample Result	J- positive results UJ non-detects	analyte in associated samples
Equipment Blank (FB) <RL	Professional Judgment on application Convert blank to soil units if necessary, multiply highest blank value by 5	U positive results < 5 x highest blank concentration	all associated samples in batch
Matrix Spike/Matrix Spike Dup (MS/MSD) does not apply if sample result is greater than four times the spike value 80-120% accuracy ± 20% (water) 30% (soil) precision	%R >UCL	J+ positive results	parent sample
	%R <LCL but ≥30%	J- positive results UJ non-detects	parent sample
	%R <LCL but ≤30%	J- positive results R non-detects	parent sample
	RPD >UCL	J positive results	parent sample
Dilution Test metals only ± 10% precision	If concentration is >50 times the MDL and % difference is >UCL	J positive results	all samples from same site as parent sample

TABLE 36-3
Flagging Conventions for Inorganic Methods
Quanta, Quality Assurance Project Plan

Quality Control Check	Evaluation	Flag	Samples Affected
Post-Digestion Spike metals only perform if dilution test fails 85-115% accuracy	%R >UCL	J+ positive results	all samples in digestion batch
	%R <LCL but ≥30%	J- positive results UJ non-detects	all samples in digestion batch
	%R <LCL but ≤30%	J- positive results R non-detects	all samples in digestion batch
Method of Standard Additions metals only perform if post-digestion spike fails	R <0.995	J positive results	analyte in sample
Laboratory Duplicates ± 25% precision	Both sample results >5 times RL and RPD>UCL	J positive results	laboratory duplicate pair
	One or both samples <5 times RL and a difference between results of ± 2 times RL	J positive results UJ non-detects	laboratory duplicate pair
Field Duplicates ± 50% precision for solids ± 30% precision for aqueous	Both sample results >5 times RL and RPD>UCL	J positive results	field duplicate pair
	One or both samples <5 times RL and a difference between results of ± 2 times RL for water and ± 3.5 times RL for soil	J positive results UJ non-detects	field duplicate pair

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TABLE 36-4
Qualifier Flag Definitions
Quanta, Quality Assurance Project Plan

Flag	Definition
J	The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
R	The data are unusable. The sample results are rejected due to serious deficiencies in meeting Quality Control (QC) criteria. The analyte may or may not be present in the sample.
U	This analyte was analyzed for but not detected at the specified detection limit.
UJ	The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.
NJ	The analysis indicates the presence of an analyte that has been “tentatively identified” and the associated numerical value represents its approximate concentration.

QAPP Worksheet #37: Data Usability Assessment

The data usability assessment is an evaluation based on the results of data verification and validation in the context of the overall project decisions or objectives. The assessment determines whether the project execution and resulting data meet the project DQOs. Both the sampling and analytical activities must be considered, with the ultimate goal of assessing whether the final, qualified results support the decisions to be made with the data.

All the results will be assembled and statistically reported for an overall Data Quality Evaluation (DQE), which will be provided as an appendix to the Remedial Design Report. The assessment report will identify precision and accuracy exceedances with respect to the laboratory performance for each batch of samples, as well as comparability of field and lab duplicates. Discussion will cover precision, accuracy, representativeness, comparability, and completeness as detailed in Worksheet #12 and detailed below.

Precision

Laboratory precision is measured by the variability associated with duplicate (two) or replicate (more than two) analyses. One type of sample that can be used to assess laboratory precision is the LCS. Multiple LCS analyses over the duration of the project can be used to evaluate the overall laboratory precision for the project. In this case, the comparison is not between a sample and a duplicate sample analyzed in the same batch, but between LCSs analyzed in multiple batches.

Total precision is the measurement of the variability associated with the entire sampling and analytical process. It is determined by analysis of duplicate field samples and measures variability introduced by both the laboratory and field operations. Field duplicate samples and MSD samples shall be analyzed to assess field and laboratory precision. For duplicate sample results, the precision is evaluated using the relative percent difference (RPD). For replicate results, the precision is measured using the relative standard deviation (RSD). The formula for the calculation of RPD and PRD are provided below.

If calculated from duplicate measurements:

$$RPD = \frac{(C_1 - C_2)\ x\ 100\%}{(C_1 + C_2)/2} \qquad (1)$$

Where:

RPD = relative percent difference

C_1= larger of the two observed values

C_2 = smaller of the two observed values

If calculated from three or more replicates, use RSD rather than RPD:

$$RSD = (s/\overline{y})\ x\ 100\% \quad (2)$$

Where:

RSD = relative standard deviation

s = standard deviation

$\bar{y}$ = mean of replicate analyses

Standard deviation, s, is defined as follows:

$$S = \sqrt{\sum_{i=1}^{n} \frac{(yi - \bar{y})^2}{n-1}} \qquad (3)$$

Where:

S = standard deviation

yi = measured value of the ith replicate

$\bar{y}$ = mean of replicate analyses

n = number of replicates

Accuracy

Accuracy reflects the total error associated with a measurement. A measurement is considered accurate when the reported value agrees with the true value or known concentration of the spike or standard within acceptable limits. Analytical accuracy is measured by comparing the percent recovery of analytes spiked into an LCS to a control limit. For many methods of organic compound analysis, surrogate compound recoveries are also used to assess accuracy and method performance for each sample analyzed.

Both accuracy and precision are calculated for each analytical batch, and the associated sample results are interpreted by considering these specific measurements. The formula for calculation of accuracy is included in below as percent recovery (%R) from pure and sample matrices.

For measurements where matrix spikes are used:

$$\%R = 100\%\ x \left[\frac{S - U}{C_{sa}} \right] \qquad (4)$$

Where:

%R = percent recovery

S = measured concentration in spiked aliquot

U = measured concentration in unspiked aliquot

Csa = actual concentration of spike added

For situations where a standard reference material (SRM) is used instead of or in addition to matrix spikes:

$$\%R = 100\% \; x \left[\frac{C_m}{C_{sm}} \right] \quad (5)$$

Where:

%R = percent recovery

Cm = measured concentration of SRM

Csm = actual concentration of SRM

Representativeness

Representativeness is a qualitative term that refers to the degree in which data accurately and precisely depicts the characteristics of a population, whether referring to the distribution of contaminant within a sample, a sample within a matrix, or the distribution of a contaminant at a site. Representativeness is determined by appropriate program design, with consideration of elements such as proper well locations, drilling and installation procedures, operations process locations, and sampling locations. Objectives for representativeness are defined for each sampling and analysis task and are a function of the investigative objectives. Assessment of representativeness shall be achieved through use of the standard field, sampling, and analytical procedures.

Comparability

Comparability is a qualitative indicator of the confidence with which one data set can be compared to another data set. The objective for this QA/QC program is to produce data with the greatest possible degree of comparability. The number of matrices that are sampled and the range of field conditions encountered are considered in determining comparability. Comparability is achieved by using standard methods for sampling and analysis, reporting data in standard units, normalizing results to standard conditions, and using standard and comprehensive reporting formats. Complete field documentation using standardized data collection forms shall support the assessment of comparability. Historic comparability shall be achieved through consistent use of methods and documentation procedures throughout the project. Assessment of comparability is primarily subjective and results should be interpreted by experienced environmental professionals with a clear knowledge of the DQOs and project decisions.

Completeness

Completeness is a measure of the amount of valid data obtained compared with the amount that was expected to be obtained under correct, normal conditions. It is calculated for the aggregation of data for each analyte measured for any particular sampling event or other defined set of samples (for example, by site) as set out in the DQOs. Valid data are data which are usable in the context of the project goals. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not qualified with an R-flag after a

usability assessment has been performed. Completeness should not be determined only on the basis of laboratory data qualifiers. The goal for completeness is 95 percent.

Defined as follows for all measurements:

$$\%C = 100\%\ x\left[\frac{V}{T}\right] \qquad (6)$$

Where:

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

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Appendix B
RDWP Field Sampling Plan Addendum

Appendix B
RDWP Field Sampling Plan Addendum

Appendix B

Field Sampling Plan Addendum, Operable Unit 1, Quanta Resources Corporation Superfund Site, Edgewater, NJ

Prepared for

Honeywell International Inc.

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B-1 Example Sampling Tool for Auger Mixed ISS Areas

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Acronyms and Abbreviations

EPA	U.S. Environmental Protection Agency
FS	feasibility study
FSP	field sampling plan
HCAA	high-concentration arsenic area
ISS	in situ solidification/stabilization
L	liter
NZ	NAPL (non–aqueous phase liquid) zone
OU1	Operable Unit 1
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
RDWP	remedial design work plan
RI	remedial investigation
SAP	sampling and analysis plan
PAHs	polycyclic aromatic hydrocarbons
VOC	volatile organic compounds

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SECTION 1

Introduction

This Field Sampling Plan (FSP) Addendum details additional sampling and data-gathering methods and procedures for activities to be performed as part of the in situ solidification/stabilization (ISS) Field Demonstration for the Quanta Resources Corporation Superfund Site, Operable Unit 1 (OU1) (the site). This FSP Addendum provides the specific field-sampling locations and frequencies, equipment and procedures, and sample handling and analysis for tasks supporting the Field Demonstration. The scope description for the Field Demonstration is provided in the Remedial Design Work Plan (RDWP) Addendum to which this FSP is an appendix.

Except as otherwise noted herein, the work described will be conducted in accordance with the applicable methods and procedures outlined in the original OU1 RI/FS FSP (Parsons, 2005a, 2005b) and relevant addendums, and the Field Sampling Plan for Predesign Investigation (CH2M HILL, 2012). This FSP should be used in conjunction with the Quality Assurance Project Plan (QAPP), Appendix A of the RDWP Addendum, to guide all field and laboratory sampling and measurement conducted during implementation of the Field Demonstration. Together, this FSP and the QAPP compose the Sampling and Analysis Plan (SAP).

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SECTION 2

Sample Location and Frequency

Each of the tasks described in the RDWP Addendum and listed below, require sample collection or field analysis, as described in the following subsections.

2.1 In Situ Solidification/Stabilization

QA/QC monitoring, including monitoring the reagent addition and equipment and collecting performance samples, will be performed throughout the field demonstration test. To verify that the required amount of reagent is delivered to the treatment areas and thoroughly mixed, at a minimum, the following parameters will be tracked and documented:

- Delivery/feed rates of reagent mix
- Slurry characteristics (water ratio, density)
- Penetration depth
- Mixing time
- Production rate
- Mixing speed, auger strokes, rotation speed, precise auger location, overlap (for auger mixing)

For each treatment area on the Quanta property (depicted on Figure 3 of the RDWP Addendum), bulk samples of freshly mixed material will be collected in each sample location at specified depth intervals:

- Top 5 feet of treatment area
- Middle 5 feet of treatment area
- Bottom 5 feet of treatment area

For the alternate treatment area (depicted on Figure 4 of the RDWP Addendum), bulk samples of freshly mixed material will be collected in each sample location at each of two specified depth intervals:

- Top 5 feet of treatment area
- Bottom 5 feet of treatment area

Samples will be collected at the following frequencies:

- Minimum of one location in each treatment area per day of production, regardless of size
- Minimum of four locations in each treatment area or a sample location every 100 yd^3 of treated material, whichever is greater
- Any time physical characteristics of the material appear to change significantly

Bulk samples will be analyzed as indicated in Section 4.1.

2.2 Air Monitoring

A complete real-time monitoring system of four fixed perimeter-monitoring stations will be placed for this phase of the project. In addition, four mobile monitoring stations will be provided for use near the work zone each day during intrusive activities. Up to four additional monitoring stations will be available in the event that two work zones are active at the same time. The final number and locations of the monitoring stations will be determined just prior to mobilization and during the course of the project. All eight stations (four fixed and four mobile) will consist of portable tripod-mounted units, thus providing flexibility in locating all the stations during the course of the project.

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Analytical sampling will be conducted 1 day per week at two locations for total dust, metals, VOCs and naphthalene, and PAHs as indicated in the air monitoring work plan (Appendix D of the RDWP Addendum).

2.3 Survey

The lateral locations and pertinent elevation information for each treatment area will be surveyed relative to the established site datum by a Licensed New Jersey Surveyor. The purpose of the survey is to fix the lateral location and elevation of the areas relative to the New Jersey State Plane Coordinate System (NAD 1983) and the North American Vertical Datum (NAVD 1988), respectively.

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SECTION 3

Field Procedures

3.1 In Situ Solidification/Stabilization

3.1.1 Baseline Sampling

Baseline samples from the treatment area associated will be collected directly from the excavator bucket utilizing a decontaminated shovel and placed directly into the laboratory-provided sample container(s), as specified in SOP #004 (Attachment 1 of this FSP). All reusable sampling equipment (e.g., trowel, shovel) will be decontaminated using Alconox–water wash and a nitric acid rinse followed by a deionized water rinse and in accordance with SOP #002 (Attachment 1 of this FSP). Decontamination fluids will be contained within a 55-gallon drum in accordance with Section 3.3 of the original FSP (Parsons, 2005b). Equipment blanks will be collected in accordance with the updated QAPP (Appendix A of the RDWP Addendum).

3.1.2 Debris Management

In preparation for ISS, subsurface debris must be removed to clear obstructions that would impede the thorough mixing of the treatment areas. Debris removed from the treatment areas will be segregated into two categories based on qualitative methods. The material will be placed in the designated staging area depending upon the following characteristics:

- Category 1—material that has *no* visible contamination, staining, or odors
- Category 2—material that has visible contamination, staining, or odors

The removed debris/obstructions will be sized and stockpiled in the appropriate staging area. The Category 2 material, and as much as possible of the Category 1 material, will be re-incorporated into the treatment area. Excess material will be managed as described in the Waste Management Plan, Appendix C of the RDWP Addendum. Material to be incorporated in the auger mixed area will be sized to a maximum of 1 foot by 1 foot and material to be incorporated in the bucket-mixed areas or sent offsite for disposal will be sized to a maximum of 2-foot by 2-foot.

3.1.3 Water Management

Groundwater or stormwater in the test areas encountered can be used in the makeup of the reagent slurry or managed by pumping from an active test area into a previously treated test area. Groundwater will not be allowed to overflow test areas. If groundwater volumes exceed the capacity of the treatment areas, it will be pumped into an onsite frac tank. Water unable to be used in the mixing process that remains at the completion of the ISS will be sampled for waste characterization and disposed of offsite as indicated in Waste Management Plan, Appendix C of the RDWP Addendum.

3.1.4 Sampling of ISS Treated Material

The following procedures will be used to collect bulk samples of freshly mixed material for the analysis indicated in Section 4.1.

3.1.4.1 Bucket-Mixed Areas

Bulk soil samples from each targeted interval will be collected directly from the excavator bucket utilizing a decontaminated shovel and placed directly into the laboratory-provided sample container(s), as specified in SOP #004 (Attachment 2 of this FSP). All reusable sampling equipment (e.g., trowel, shovel) will be decontaminated using Alconox–water wash and a nitric acid rinse followed by a deionized water rinse and in accordance with SOP #002 (Attachment 2 of this FSP). Decontamination fluids will be contained within a 55-

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gallon drum in accordance with Section 3.3 of the original FSP (Parsons, 2005b). Equipment blanks will be collected in accordance with the updated QAPP (Appendix O of the FSAR).

3.1.4.2 Auger-Mixed Areas

Bulk soil samples from each targeted interval will be collected using a sampling tool designed to provide a sample at discrete intervals within the mix column. The sampling tool includes a hydraulically controlled sample bucket that can be opened and closed using an attached power pack. The sampling tool is attached to the excavator bucket (see Figure B-1), which is used to lower the sampling device (in the closed position) to the specified depth of the treatment column. Once at the specified depth, the device is opened, and the sampling tool is moved up and down a few inches using the excavator to facilitate material capture. The sampling tool is then closed, pulled to the surface, and kept in a vertical orientation. Treated material is retrieved from the sampling device using a shovel and will be placed directly into the laboratory-provided sample container(s), as specified in SOP #004 (Attachment 1of this FSP). All reusable sampling equipment (e.g., trowel, shovel) will be decontaminated using Alconox–water wash and a nitric acid rinse followed by a deionized water rinse and in accordance with SOP #002 (Attachment 1 of this FSP). Decontamination fluids will be contained within a 55-gallon drum in accordance with Section 3.3 of the original FSP (Parsons, 2005b). Equipment blanks will be collected in accordance with the QAPP (Appendix A of the RDWP Addendum).

3.1.5 Site Restoration

Treatment of the soils through ISS results in an expansion of the in situ soil volume. For treatment areas located on the Quanta property, the final surface of the treated soils will be graded to match existing grade. The final graded ISS treatment area will be covered with a minimum of 6 inches of clean imported backfill. A sample will be collected from the backfill source to confirm the material is clean. Clean fill to be delivered to the site shall meet the definition provided in N.J.A.C. 7:26E-1.8. “Clean fill” means material to be used in a remedial action that meets all soil remediation standards, site-specific alternative standards, or site-specific interim standards, does not contain extraneous debris or solid waste, and does not contain free liquids. This also includes any material that meets all criteria or action levels for contaminants without standards, available on the Department’s website at www.nj.gov/dep/srp.

For the treatment area associated with the utility corridor, the treated material above the existing grade will be excavated and the surface graded in preparation for asphalt replacement. The swell/expansion material excavated from the treatment area will be transported to the Quanta property and managed onsite in accordance with local, state, and federal regulation or stockpiled on the parking lot area northeast of the Quanta property out of the flood hazard area (NJAC 7:13) with the appropriate stormwater and erosion controls. If the parking lot in this area is no longer in use, the treatment area will be managed the same manner as the treatment areas on the Quanta property.

3.2 Air Monitoring

The real-time system will include environmental monitoring stations and other equipment, as indicated in the complete air monitoring plan attached to the RDWP Addendum as Appendix D:

- A TSI DustTrak-II, model 8520, or equivalent will be used to measure particulate matter (PM-10) concentrations.
- A RAE systems model MiniRAE-3000, or equivalent photo-ionization detector (PID), will be used to measure TVOC concentrations.
- An automated weather station will be used to monitor wind direction, wind speed, ambient temperature, relative humidity and barometric pressure.

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- Auxiliary wind speed and direction detectors will be placed around the site to further characterize airflow patterns and to aid in determining background levels and other potential offsite sources of emissions.

These measurement instruments will be part of an integrated air-monitoring system transmitting data from the field instruments to a central computer server via wireless telemetry. User applications and database will be hosted offsite. Each station will provide redundant data logging and real-time data integrated into a comprehensive monitoring system with multiple alarm levels and reporting capabilities.

The system will employ one full-service weather station, with additional wind speed and direction monitors at two other field locations. Wind speed and direction will provide real-time data on which stations are upwind and downwind due to changing wind direction and to assist in determining if particulates or VOCs are generated onsite or offsite. Meteorological monitoring will be conducted.

3.3 Equipment Calibration

Each device will be calibrated according to the manufacturer's operating manual and in accordance with the original FSP (Parsons, 2005b) and the current site-specific Health and Safety Plan (Appendix F of the RDWP Addendum).

3.4 Decontamination

An equipment decontamination area will be constructed for decontamination of equipment. All water used for decontamination will be controlled and containerized for characterization and disposal. Upon completion of site activities, the decontamination area will be deconstructed and waste from the decontamination area will be containerized. The waste be will be characterized in accordance with the Waste Management Plan (Appendix C of the RDWP Addendum).

All sampling devices coming in contact with soil will be decontaminated between each sampling location in accordance with the methods specified in SOP #004 (Attachment 1).

3.5 Waste Management

Investigation-derived waste, containerized water, and debris for offsite disposal will be managed in accordance with the updated Waste Management Plan (Appendix C of the RDWP Addendum).

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SECTION 4

Sample Handling and Analysis

Sample labeling, handling, packaging, and shipping will be performed in accordance with the procedures identified in Section 7 of the original FSP (Parsons, 2005b), unless otherwise specified below. Analyses will be performed in accordance with the methods specified in the updated QAPP, provided as Appendix O of the FSAR. All analytical testing, sample handling and quality assurance/quality control (QA/QC) will also be performed in accordance with the QAPP and samples will be submitted for offsite analysis under a chain-of-custody (Attachment 1). The laboratory methods that will be used for each of the soil samples are summarized in Table B-1, and for air samples in Appendix D of the RDWP Addendum.

A primary laboratory will be contracted to handle the bulk of analytical testing. Exceptions to this will include specialty analyses such as sequential extractions on stabilized/treated soils. All chemical analyses will be performed by a New Jersey–certified laboratory.

4.1 In Situ Solidification/Stabilization

Analytical testing to be performed in support of the field demonstration is listed in Table B-1 and described below.

4.1.1 Consistency Testing

Real-time or short-term testing will be required to monitor for variability in the mixed material, to demonstrate material properties are consistent with results from bench-scale treatability testing, and to demonstrate construction quality control. These results will also be used for establishing parameters for full-scale implementation that correlate with compliance testing samples that meet project performance goals. The following analyses will be performed:

- Pocket penetrometer testing performed on sample at 1, 3, 5, and 7 days
- Slump test on freshly treated material
- Moisture content and wet density
- Alkalinity and pH

Sufficient sample volume will be collected in accordance with the QAPP for the following analyses to be performed at an offsite analytical laboratory:

- UCS: ASTM D2166 reported on 7-, and 14-day cured samples.

4.1.2 Conformance Testing

Conformance testing will be required to demonstrate conformance with the project performance goals. Sufficient sample volume in accordance with the QAPP for the following analyses to be performed at an offsite analytical laboratory:

- UCS: ASTM D2166 reported on 28-day cured samples
- Permeability: ASTM D5084 Method A reported on 28-day cured sample
- Leachability: Premethod 1315 and/or ANSI 16.1 (GRO; BTEX; PAHs) reported on 28-day cured sample

4.2 Air Monitoring

Analytical sampling requirements including constituents for which monitoring will be conducted and action levels for real-time monitoring are detailed in Appendix D of the RDWP Addendum. Detection limits and other analysis requirements are included in the updated UFP-QAPP (Appendix A of the RDWP Addendum).

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SECTION 5

References

CH2M HILL. 2012. *Predesign Investigation Work Plan, Quanta Resources Corporation Superfund Site, Operable Unit 1, Edgewater, New Jersey.* August.

Parsons. 2005a. *Remedial Investigation/Feasibility Study Work Plan, Operable Unit 1, Quanta Resources OU1, Edgewater, New Jersey*. May.

Parsons. 2005b. *Field Sampling Plan, Operable Unit 1, Quanta Resources OU1, Edgewater, New Jersey*. May.

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Tables and Figure

TABLE B-1

ISS Field Demonstration Soil Sampling and Analysis

Quanta Resources Corporation Superfund Site

Location	Sample ID*	Target Sample Depth (ft bgs)	Consistency Testing									Conformance Testing					
			Pocket Penetrometer - 1 day	Pocket Penetrometer - 3 day	Pocket Penetrometer - 5 day	Pocket Penetrometer - 7 day	Slump Test	Moisture Content and Wet Density	Alkalinity and pH	UCS - 7 day	UCS - 14 day	UCS by ASTM D2166 (28 day)	Permeability by ASTM D5084 Method A (28 day)	Pre-Method 1315 Leachate Analyses (28 day cured sample), reported at 2-hr, 24-hr, and 48-hr			
														Dissolved Arsenic (EPA 6010)	Select VOCs (EPA 8260)*	PAHs (EPA 8270C)	TPH-GRO (EPA 8015)
Field Samples																	
A-2	A-2A-X	0-5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	A-2B-X	8.5-13.5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	A-2C-X	17-22	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
AN-2	AN-2A-X	0-5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	AN-2B-X	5-10	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	AN-2C-X	10-15	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
N-1	N-1A-X	0-5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	N-1B-X	10-15	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	N-1C-X	20-25	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
N-4	N-4A-X	0-5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	N-4B-X	5-10	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	N-4C-X	10-15	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Utility Corridor	UC-A-X	0-5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	UC-B-X	5-10	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Notes:

The "X" listed in the Sample IDs will be replaced with an appropriate designation within the treatment area from which it is collected. Quantity of samples to be determined during implementation in accordance with the Field Sampling Plan.

*Select VOCs include benzene, ethylbenzene, toluene, and xylenes

X - Sample to be analyzed for the indicated parameter

TPH - total petroleum hydrocarbons

PAH - polycyclic aromatic hydrocarbon

UCS - unconfined compressive strength

VOC - volatile organic compound

TABLE B-2

ISS Baseline Soil Sampling and Analysis

Quanta Resources Corporation Superfund Site

Location	Sample ID*	Soil									
		Total Arsenic (EPA 6010)	Select VOCs (EPA 8260)*	PAHs (EPA 8270)	TPH-GRO (EPA 8015)	Liquid-Solid Partitioning (EPA Method 1316)	SPLP (EPA 1312)**	Bulk Density and Moisture Content (ASTM D2216-80)	pH (EPA 9045)	Hydraulic conductivity/ permeability (ASTM D5084 Method A)	Particle Size Distribution (ASTM D-422-63)
Field Samples											
A-2	TBD	X	X	X	X	X	X	X	X	X	X
AN-2	TBD	X	X	X	X	X	X	X	X	X	X
N-1	TBD	X	X	X	X	X	X	X	X	X	X
N-4	TBD	X	X	X	X	X	X	X	X	X	X
Alternate Location - Utility Corridor	TBD	X	X	X	X	X	X	X	X	X	X

Notes:

*Select VOCs include benzene, ethylbenzene, toluene, and xylenes

**SPLP leachate will be analyzed for Total Arsenic, Select VOCs, PAHs, TPH-GRO.

X - Sample to be analyzed for the indicated parameter

TPH-GRO - total petroleum hydrocarbons, gasoline range

PAH - polycyclic aromatic hydrocarbon

VOC - volatile organic compound

FIGURE B-1
Example Sampling Tool for Auger Mixed ISS Areas
Quanta Resources Corporation Superfund Site, OU1

Note: Photographs courtesy of GeoCon.

CH2MHILL.

Attachment 1
Standard Operating Procedures

Equipment Decontamination
July 16, 2012
Erik Spande/CH2M HILL

APPROVED:

_____ Author	7/16/2012 Date
_____ Project Manager	7/16/2012 Date
_____ Quality Assurance Manager	7/16/2012 Date

Annual Review Summary

Annual Reviewer	Erik Spande			
Date of Review	6/7/2013			

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Attachments

Attachment 1 – Equipment List

A. Purpose and Applicability

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for equipment decontamination. The procedures outlined in this SOP are applicable the decontamination of heavy equipment, drilling equipment, well materials, and sampling equipment.

B. Summary of Method

Decontamination procedures were established in Section 3.2 of the Field Sampling Plan by Parsons (2005), and these instructions are summarized in this SOP.

C. Definitions

AHA Activity Hazard Analysis

FSP Field Sampling Plan

FTL Field Team Leader

HandS health and safety database

OSHA Occupational Safety and Health Administration

SSC Site Safety Coordinator

USEPA United States Environmental Protection Agency

D. Health and Safety

CH2M HILL staff will have current Occupational Safety and Health Administration (OSHA) and 8-hour OSHA refresher training, as applicable. Staff will review and sign the site health and safety plan (HASP), will review and sign the activity hazard analysis (AHA) for the task, and understand and use personal protective equipment as specified in the HASP.

E. Personnel Qualifications

This SOP is written for CH2M HILL staff. The field team leader (FTL) will be responsible for the execution of the Work Plan and Field Sampling Plan. The FTL will be identified by the Project Manager before the start of the task. The site safety coordinator (SSC) will have completed the CH2M HILL-required SSC training and will be responsible for the execution of the HASP. All CH2M HILL staff will have current OSHA and 8-hour OSHA refresher training, as applicable. The SSC will verify that all HASP-required training using the HandS database and any lapsed training is updated before the start of the task, and that copies of training for each staff member are onsite.

F. Equipment and Supplies

Attachment 1 contains equipment and supplies for decontamination activities.

G. Procedural Steps

Decontamination Pad for Drilling Equipment or Other Heavy Equipment

- The location of the decontamination pad will be determined in the field.

- The drilling or heavy equipment subcontractor will construct a decontamination pad of high-density polyethylene sheeting.
- The pad will be sloped such that water drains toward a sump, and the sides of the decontamination pad will be bermed to contain decontamination water.
- Water from the sump will be pumped to a 55-gallon drum.

Heavy Equipment Decontamination

- The subcontractor will use a high-pressure steam-cleaning unit for decontamination of drill rigs, augers, bits, rods, tools, split-spoon samplers, and tremie pipes before work and after the conclusion of each boring.
- Wire brushes will be used to remove dirt, grease, and oil as needed.
- Tools, drill rods, and augers will be placed on sawhorses or polyethylene plastic sheets following steam cleaning. Direct contact with the ground will be prevented.
- Well material such as well casings and screens will be decontaminated as heavy equipment unless they arrive at the site in factory-sealed plastic sleeves.

Sampling Equipment Decontamination

- Dedicated and disposable equipment will not need to be decontaminated. All sampling equipment that will be reused will be decontaminated using these procedures. Sampling equipment such as split spoons may be steam-cleaned (see Heavy Equipment Decontamination) or may be decontaminated by using the procedure noted below.
- Clean disposable equipment (groundwater sampling tubing, bladders for pumps, sampling spoons, etc.) should be used when necessary to minimize cross-contamination. Disposable equipment does not have to be decontaminated.
- Conduct sampling equipment decontamination at the decontamination pad. If the pad is not present, then sampling equipment decontamination will occur within buckets that are placed on plastic sheeting.
- Wash sampling equipment such as low-flow pumps, bowls, spoons, augers, Geoprobe rods, and Macrocore samplers with potable water and then phosphate-free detergent (such as Alconox).
- Equipment will undergo a acid rinse consisting of a 10 percent solution of reagent grade nitric acid and deionized water if sampling for metals.
- Rinse with potable water and then rinse with distilled water.
- Between rinses, place equipment on plastic sheeting or aluminum foil, as needed.
- Decontaminated equipment will be wrapped in aluminum foil for storage or transportation from the decontamination area to the sampling area. Decontaminated equipment will not be placed on the ground.

H. Data and Records Management

Record the time and procedures used for decontamination in the field book or field form. Field data will be finalized the day of collection. Hardcopy records will be scanned and copied to a project directory at least weekly. Electronic records will be backed up on a laptop or similar device daily, and will be copied to a project directory at least weekly.

I. Quality Assurance and Quality Control

Follow and document procedures noted above and in accordance with quality assurance/quality control (QA/QC) procedures specified in the QAPP, as previously amended (CH2M HILL, 2005, 2006, 2008), and in the current QAPP Addendum (CH2M HILL, 2012).

J. References

CH2M HILL. 2005. Quality Assurance Project Plan (Revised), Operable Unit 1, Quanta Resources OU1, Edgewater, New Jersey. October.

CH2M HILL. 2006. Quality Assurance Project Plan (Revised), Operable Unit 1, Quanta Resources OU1, Edgewater, New Jersey. November.

CH2M HILL. 2008. Quality Assurance Project Plan (Revised), Operable Unit 1, Quanta Resources OU1, Edgewater, New Jersey. November.

CH2M HILL. 2012a. Draft Predesign Investigation Work Plan, Quanta Resources Corporation Superfund Site, Operable Unit 1, Edgewater, New Jersey. May.

CH2M HILL. 2012b. Field Sampling Plan for Predesign Investigation, Operable Unit 1, Quanta Resources OU1, Edgewater, New Jersey. May.

Parsons. 2005. *Field Sampling Plan, Operable Unit 1, Quanta Resources OU1,* Edgewater, New Jersey. May.

K. Attachments/Checklists

1. Equipment Checklist

Attachment 1 – Equipment List

Heavy equipment and well material decontamination equipment will be supplied by the drilling subcontractor.

- Plastic-lined decontamination pad of high density polyethylene sheeting—sides of decon pad will be bermed
- Sump for decontamination pad
- High-pressure steam cleaning unit
- Sawhorses
- Polyethylene plastic sheets
- 55-gallon drums for decon water

Decontamination Equipment for Sampling Equipment and PPE

- Alconox® solution (or equivalent)
- Potable water
- Deionized water
- Diluted reagent grade acid (Nitric Acid)
- Spray bottles for alconox solution, diluted acid, potable water, and distilled water. Each type of spray bottle used for decontamination will be labeled.
- Brushes
- 5-gallon buckets with lids
- Four or more 5-gallon buckets for decontamination of pumps
- Aluminum foil
- Protective gloves (nitrile or latex, per HASP)

Drilling and Soil Sampling
July 16, 2012
Erik Spande/CH2M HILL

APPROVED:

Author	7/16/2012 Date
Project Manager	7/16/2012 Date
Quality Assurance Manager	7/16/2012 Date

Annual Review Summary

Annual Reviewer	Erik Spande			
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Attachments

Attachment 1 – Equipment List

A. Purpose and Applicability

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for soil borings and for soil sampling. The techniques used are discussed in the 2012 Field Sampling Plan (FSP), and additional detail is provided in the original RI/FS FSP (Parsons, 2005a, 2005b) and FSP addendum for the SRI (CH2M HILL, 2008b, Attachment C). All references in this document refer to the CH2M HILL FSP (CH2M HILL, 2012b) unless otherwise specified.

B. Summary of Method

Several drilling techniques and soil sampling techniques will be used. Rotosonic drilling will collect treatability samples and will be used for the installation of monitoring and recovery wells. Direct push drilling will be used for investigation borings within the high-concentration arsenic areas (HCAA) for the collection of soil samples and for collecting soil samples to support the non-aqueous phase liquid (NAPL) recovery evaluations. Mud rotary drilling will be used to collect geotechnical samples.

C. Definitions

AHA Activity Hazard Analysis

FSP Field Sampling Plan

FTL Field Team Leader

HandS health and safety database

HCAA high-concentration arsenic area

OSHA Occupational Safety and Health Administration

NAPL non-aqueous phase liquid

SSC Site Safety Coordinator

USEPA United States Environmental Protection Agency

D. Health and Safety

CH2M HILL staff will have current Occupational Safety and Health Administration (OSHA) and 8-hour OSHA refresher training, as applicable. Staff will review and sign the site health and safety plan (HASP), will review and sign the activity hazard analysis (AHA) for the task, and understand and use personal protective equipment as specified in the HASP.

E. Personnel Qualifications

This SOP is written for CH2M HILL staff. The Field Team Leader (FTL) will be responsible for the execution of the Work Plan and Field Sampling Plan. The FTL will be identified by the Project Manager before the start of the task. The site safety coordinator (SSC) will have completed the CH2M HILL-required SSC training, and will be responsible for the execution of the HASP. All CH2M Hill staff will have current OSHA and 8-hour OSHA refresher training, as applicable. The SSC will verify that all HASP-required training using the HANDS database and any lapsed training is updated before the start of the task, and that copies of training for each staff member are onsite.

F. Equipment and Supplies

Attachment 1 contains equipment and supplies for soil sampling and supporting drilling operations. Drilling rigs will be provided by subcontractors, and equipment and supplies directly related to drilling will not be discussed in this SOP.

G. Procedural Steps

The following section outlines soil collection and sampling techniques to be utilized during the predesign investigation.

Soil Collection Techniques

The following section outlines procedures for the collection of soil.

Soil Logging

The following procedures will be used when the FSP requires the classification of soil.

- Soil samples will be continuously logged for the project record according to the Unified Soil Classification System.
- Each boring will describe at a minimum (1) percent recovery, (2) soil type, (3) color, (4) moisture content, (5) texture, (6) grain size and shape, (7) consistency, and (8) visible evidence of impacts.
- Visual observations indicating potential soil impacts (including, but not limited to, NAPL, soft tar, hard tar, staining, sheens, fibrous paper, coal, slag, cinders, and reddish-purple discolorations) will be recorded on the soil boring log.
- Soil samples will be screened for ionizable compounds at 1-ft intervals with the headspace screening technique outlined Section 3.2 of the FSP (CH2M HILL, 2012).
- Soil samples collected within the HCAA will be photographed. Photographs will include a dry-erase board (or other marker board) marked with (at a minimum) sample ID and date and time of photograph. Photographs will also include a reference indicator such as a tape measure.
- Other observations (including soil descriptions) will be recorded in the log book.

Direct Push

All direct-push drilling will be performed in accordance with the procedures provided in Section 5.2 of the original RI/FS FSP (Parsons, 2005a, 2005b) and Section 6.1.2 and 6.2 of RI/FS Work Plan Addendum No. 1 (CH2M HILL, 2006b), unless noted below.

- Borings will be advanced utilizing a 2-inch-diameter, 4-ft-long macrocore sampler with a basket trap and a clean, disposable, acetate or stainless steel liner (provided by the drilling subcontractor).
- If recovery within the macrocore liner is less than 100 percent, equal compression across the length of the 4-ft sampler will be assumed for the purpose of assigning depths to soil descriptions, screening results, and samples collected for laboratory analysis.
- Soil samples will be screened for ionizable compounds using a photoionization detector (PID) and the headspace screening technique (Section 3.3.1 of the FSP addendum), and for total arsenic concentration using a handheld XRF unit (Section 3.3.2 of the FSP addendum). In addition, soil samples within the HCAA will also be tested at the same interval in the field for pH using the procedures outlined in Section 3.3.3 of the FSP addendum.

- Following the completion of each direct-push boring, the hole will be backfilled with bentonite or cement/bentonite grout in accordance with the procedures in Section 5.7 of the original FSP (Parsons, 2005b). In paved areas, the last 4 inches of each boring will be topped with asphalt cold-patch.
- Any drill cuttings and used acetate liners will be disposed of in accordance with the Waste Management Plan (Appendix D of the PDWP).

Rotosonic

The following procedures will be used for completing rotosonic soil borings at the site:

- Treatability testing sample collection borings will be completed by continuously advancing a stainless steel rotosonic sample core barrel (minimum of 3 inches in diameter) and subsequent override casing (minimum of 6 inches in diameter) with a basket trap. At each location, continuous soil samples will be retrieved at a maximum of 5-ft intervals using the core barrel. Depending on the thickness of the target interval, recovery across that interval, and the volume required to satisfy the treatability sample volume requirements, between one and three cores (collocated) will be advanced at each location to collect soils from the targeted interval (see Table A-1 in the FSP addendum).
- If recovery within the core barrel is less than 100 percent, equal compression across the length of the 5-ft sampler will be assumed for the purpose of assigning depths to soil descriptions, screening results, and sample collection. If the recovery is less than 50 percent across an interval targeted for treatability sample collection, then that interval will be sampled again to achieve improved recovery.
- Treatability soil sample collection and homogenization will be performed using the procedures outlined in Section 3.4.2 and Section 3.4.3 of the FSP addendum.
- Following the completion of each rotosonic boring, the borehole will be backfilled with a cement/bentonite grout in accordance with Section 5.7 of the original FSP (Parsons, 2005b). In paved areas, the last 4 inches of each borehole will be topped with asphalt cold-patch supplied by the drilling subcontractor.
- Any drill cuttings will be disposed of in accordance with the Waste Management Plan (Appendix D of the PDWP).

Mud Rotary

All mud rotary drilling will be performed in general accordance with the procedures outlined in ASTM Standard D 5783-95 for Direct Rotary Drilling with Water-Based Drilling Fluids.

- Split spoon soil samples will be taken in accordance with ASTM D1586-08a, “Standard Test Method for Standard Penetration Test (SPT) and Split Barrel Sampling of Soils,” for sampling of noncompressible deposits (sands and gravels).
- Undisturbed samples will be taken in accordance with ASTM D1587-08, “Standard Practice for Thin Walled Tube Sampling of Soils for Geotechnical Purposes,” for samples of the compressible deposits (peat, organic silty clay, and silty clay strata).
- Log soil as noted above. Based on description, select dry and undisturbed soil samples will be sealed and decontaminated for transport to the laboratory for testing.
- All soil cuttings and drilling fluids will be contained, tested, and disposed of in accordance with the methods specified in Section 3.2 of the original FSP (Parsons, 2005b).
- All down-hole equipment will be decontaminated between each boring in accordance with the methods specified in SOP 2.0, *Equipment Decontamination*, and Section 3.2 of the original FSP (Parsons, 2005b).
- Following the completion of each mud rotary boring, the borehole will be tremie grouted with a cement/bentonite grout in accordance with Section 5.7 of the original FSP (Parsons, 2005b).

- In paved areas, the top 4 inches of each borehole will be topped with cold-patch asphalt. In the two locations on the existing wharf, the deck will be patched with a fish plate and concrete.

Excavation

The following procedures will be used when completing excavation-related soil sampling activities at the site:

- Decontaminate the excavator in accordance with the methods specified in SOP 2.0, *Equipment Decontamination* as required.
- Site representatives will review the health and safety plan to identify safe procedures when conducting activities around excavations and large excavation equipment.
- Record all activities, soil characteristics, and other observations in the field. The site representative will log the appearance of the excavated soil as noted above.
- Obtain soil samples using the procedures specified under *Soil Sampling Techniques,* below.
- At termination of excavation-related sampling, direct the excavator operator to return the material to the appropriate location.

Soil Sampling Techniques

The following section outlines procedures for sampling soil both utilizing field techniques and collection for offsite analysis.

PID Headspace Screening

Screening for the presence of ionizable compounds in soil will be performed using a PID equipped with a 10.2-electronvolt (eV) bulb using the steps outlined below. Each device will be calibrated according to the manufacturer's operating manual and the current Health and Safety Plan and measurement will be made using the following equipment and procedures:

- Calibrate the PID to isobutylene standard using a response factor of 1 at the beginning and middle of each day (approximately every 4 hours), and then check the PID at the completion of day. All calibration and checks will be recorded in the project field log book.
- Half fill either a glass jar or a plastic whirl pack bag or Ziploc-type baggie with the soil to be tested.
  - When using glass jars:
    1. Use jars with a total capacity of 8 oz. or 16 oz. (preferably 16 oz.).
    2. Seal each jar with one or two sheets of aluminum foil with the screw cap applied to secure the aluminum foil in place.
  - When using whirl pack bags or Ziploc-type baggies:
    1. Half fill bags from the sampler or the excavation.
    2. Whirl and tie or zip to close.
- Vigorously shake the sample jars or bags for at least 30 seconds once or twice in a 10- to 15-minute period to allow for headspace development.
- If ambient temperatures are below 32 degrees Fahrenheit (0 degrees Celsius), ensure headspace development takes place within a heated vehicle or building.
- Quickly insert the PID sampling probe through the aluminum foil. If whirl packs are used, quickly insert the probe into the headspace of the bag by puncturing it. If plastic bags are used, unzip the corner of the bag

approximately 1–2 inches and insert the probe or insert the probe through the plastic. Record the maximum meter response (should be within the first 2–5 seconds) in the field log book or soil boring/test pit log.

- Document in the field log book any weather conditions (rain or high humidity) that can affect the performance of the PID. Any erratic responses may be discounted as a result of high organic vapor concentrations or conditions of elevated headspace moisture.

DPT Soil Sample Collection

As required in the FSP addendum, XRF (in accordance with SOP 1.0) and pH screening (in accordance with SOP 3.0) for each sample will be collected as outlined below:

- Soils will be composited from across the targeted 1-ft intervals within the macrocore acetate liner using a disposable stainless steel Scoopula.
- Soils will be transferred into a clean plastic mixing bowl and homogenized thoroughly using the Scoopula.
- The necessary aliquot of soil will be transferred from the mixing bowl to the laboratory-supplied container, placed on ice, and shipped to the laboratory for analysis as described in Section 4 of this FSP Addendum.

HCAA Treatability Sample Collection

Intervals of collected rotosonic soil cores identified in the field to represent the targeted soil type will be documented prior to homogenization. If required, corresponding intervals from multiple collocated cores will be combined in order to obtain the sample volumes for each target interval that are required for treatability testing. Samples representing similar intervals (based on observed soil conditions, and arsenic and pH field screening results) will be composited into four to eight individual samples of 5 gallons by volume each. In addition to treatability samples, separate soil samples for grain-size and chemical analysis will be taken from beneath the HCAA liner during advancement of treatability sampling cores.

Samples from rotosonic borings advanced within the HCAA liner area for analytical testing will be collected using the following procedures:

- At each interval, up to 1 gallon of soil will be collected from across the targeted strata.
- Samples will be collected from the rotosonic cores using clean sampling utensils and placed in a double-bagged, labeled ,1-gallon Ziploc-type bag.
- Samples for grain-size analysis will be placed in a cooler and sent to the laboratory for the analysis of coarse and fine grained particle distribution using ASTM D-422-63.

Treatability samples collected from the HCAA liner area for treatability testing will be homogenized using the following procedures:

- Samples from each targeted interval will be placed in a clean, unused, 55-gallon drum for homogenization using a clean stainless steel shovel. Soils from the corresponding intervals in co-located borings that may be required to achieve the necessary sample volume will be placed in the same drum prior to mixing/homogenization.
- Soils for each interval will be mixed thoroughly within the drum until the soil appears to be homogenized and a uniform color and consistency is observed. Homogenization will occur by utilizing the shovel to dig and turn over the soil within the drum.
- An aliquot of the homogenized soil from the target interval will then be placed into a clean stainless steel mixing bowl using a stainless-steel shovel and then transferred using a clean disposable stainless steel Scoopula into laboratory-supplied sample containers for baseline characterization as described in Section 4.

- Following homogenization and baseline soil sample collection, samples of soils will be taken from the mixing bowl and screened for arsenic concentrations using the XRF (as described in SOP 1.0 and Section 3.2.2 of the FSP addendum) and for pH (as described in SOP 3.0 and Section 3.2.3 of the FSP addendum).
- The remaining soil within the 55-gallon drum will then be placed into 5-gallon buckets. Each 5-gallon bucket will be shipped to the treatability testing contractor in a specialized box designed for hazardous materials shipping (UN-4G480 box).
- Once homogenization and sampling is complete, the drum can be used to contain drill cuttings from remaining borings.
- All reusable sampling equipment (for example, trowel and shovel) will be decontaminated in accordance with SOP 2.0, *Equipment Decontamination*, and Section 3.2 of the original FSP (Parsons, 2005b). Decontamination fluids will be contained within a 55-gallon drum in accordance with Section 3.3 of the original FSP (Parsons, 2005b). Equipment blanks will be collected in accordance with the QAPP.

Solidification Treatability Testing Sample Collection

Intervals of collected rotosonic soil cores identified in the field to represent the targeted soil type will be documented prior to homogenization. If required, corresponding intervals from multiple collocated cores will be combined in order to obtain the sample volumes for each target interval that are required for treatability testing.

Treatability samples collected from across the site using rotosonic drilling techniques will be collected and homogenized using the following procedures:

- Samples from each targeted interval will be placed in a clean, unused, 55-gallon drum for homogenization using a clean stainless steel shovel. Soils from the corresponding intervals in collocated borings that may be required to achieve the necessary sample volume will be placed in the same drum prior to mixing/ homogenization.
- Soils for each interval will be mixed thoroughly within the drum until the soil appears to be homogenized and a uniform color and consistency is observed. Homogenization will occur by utilizing the shovel to dig and turn over the soil within the drum.
- An aliquot of the homogenized soil from the target interval will then be placed into a clean stainless steel mixing bowl using a stainless-steel shovel and then transferred using a clean disposable stainless steel Scoopula into laboratory-supplied sample containers for baseline characterization as described in Section 4.
- Following homogenization and baseline soil sample collection, samples of soils from areas of known arsenic impacts (that is, adjacent to the HCAA liner) will also be taken from the mixing bowl and screened for arsenic concentrations using the XRF (as described in SOP 1.0 and Section 3.2.2 of the FSP addendum) and pH (as described in SOP 3.0 and Section 3.2.3 of the FSP addendum).
- The remaining soil within the 55-gallon drum will then be placed into as many as three 5-gallon buckets (one for each anticipated treatability contractor). Each 5-gallon bucket will be shipped to the contractor in a specialized box designed for hazardous materials shipping (UN-4G480 box) unless baseline sampling results indicate that nonhazardous shipping is appropriate.
- Once homogenization and sampling is complete, the drum can be used to contain drill cuttings from remaining borings.
- All reusable sampling equipment (for example, trowel and shovel) will be in accordance with SOP 2.0, *Equipment Decontamination* and Section 3.2 of the original FSP (Parsons, 2005b). Decontamination fluids will be contained within a 55-gallon drum in accordance with Section 3.3 of the original FSP (Parsons, 2005b). Equipment blanks will be collected in accordance with the QAPP.

In-Situ Stabilization Excavation Sampling

Bulk soil samples will be taken during in-situ stabilization for consistency and compliance testing. These soil samples will be collected directly from the excavator bucket utilizing a decontaminated stainless steel shovel or large stainless steel spoon.

In-situ stabilization soil samples will be collected using the following procedures:

- Representative soil will be taken from the excavator bucket with a decontaminated stainless steel shovel or stainless steel spoon and will be placed in the stainless steel bowl.
- Soils for VOC analysis will not be homogenized. The sampler will identify and use laboratory-supplied equipment and containers to collect a representative soil sample.
- The remaining soil will be homogenized by mixing the soil using a decontaminated stainless steel spoon until a uniform color and consistency is observed.
- All remaining soil analytes will be sampled from the homogenized soil. An aliquot of the homogenized soil will then be placed into laboratory-supplied sample containers using decontaminated stainless steel spoons or spatulas.
- All reusable sampling equipment (for example, trowel and shovel) will be decontaminated in accordance with SOP 2.0, *Equipment Decontamination* and Section 3.2 of the original FSP (Parsons, 2005b). Decontamination fluids will be contained within a 55-gallon drum in accordance with Section 3.3 of the original FSP (Parsons, 2005b). Equipment blanks will be collected in accordance with the QAPP.

Test Pit Treatability Sample Collection

Should it be determined that it is more effective to collect treatability testing samples during the test pitting activities at select locations, soil samples will be collected directly from the excavator bucket utilizing a decontaminated shovel and placed directly into a sample container.

Treatability samples collected utilizing an excavator will be will be collected and homogenized using the following procedures:

- Samples from each targeted interval will be placed a clean, unused, 55-gallon drum for homogenization using a clean stainless steel shovel and taken directly from the excavator bucket. Soils from the corresponding intervals in collocated borings that may be required to achieve the necessary sample volume will be placed in the same drum prior to mixing/homogenization.
- Soils for each interval will be mixed thoroughly within the drum until the soil appears to be homogenized and a uniform color and consistency is observed. Homogenization will occur by utilizing the shovel to dig and turn over the soil within the drum.
- An aliquot of the homogenized soil from the target interval will then be placed into a clean stainless steel mixing bowl using a stainless-steel shovel or trowel and then transferred using a clean disposable stainless steel Scoopula into laboratory-supplied sample containers for baseline characterization as described in Section 4 of the FSP.
- Following homogenization and baseline soil sample collection samples of soils from areas of known arsenic impacts (that is, adjacent to the HCAA liner) will also be taken from the mixing bowl and screened for arsenic concentrations using the XRF (as described in SOP 1.0 and Section 3.2.2 of the FSP addendum) and for pH (as described in SOP 3.0 and Section 3.2.3 of the FSP addendum).
- The remaining soil within the 55-gallon drum will then be placed into as many as three 5-gallon buckets (one for each anticipated treatability contractor). Each 5-gallon bucket will be shipped to the contractor in a

specialized box designed for hazardous materials shipping (UN-4G480 box) unless baseline sampling results indicate that nonhazardous shipping is appropriate.

- Once homogenization and sampling is complete, the drum can be used to contain drill cuttings from remaining borings.
- All reusable sampling equipment (for example, trowel and shovel) will be decontaminated in accordance with SOP 2.0, *Equipment Decontamination* and Section 3.2 of the original FSP (Parsons, 2005b). Decontamination fluids will be contained within a 55-gallon drum in accordance with Section 3.3 of the original FSP (Parsons, 2005b). Equipment blanks will be collected in accordance with the QAPP.

NAPL Sampling

During borings advanced as part of the NAPL recovery pilot test, for each boring where NAPL impacts are observed, a separate, adjacent borehole will be installed. Undisturbed soil core samples for petrochemical analyses will be collected from the 5-ft intervals identified as those most highly impacted using stainless steel liners (supplied by the drilling subcontractor). Samples will be analyzed as specified in Section 4 of the FSP addendum and collected and shipped in accordance with the following procedures.

Sample collection will occur utilizing the following technique:

- Soil core samples should be collected in a stainless steel rather than the typical plastic liners used for direct-push sampling. The plastic liners tend to get brittle and crack when frozen.
- The metal liners consist of 6-inch segments that are held in place by a plastic coating, which allows for easy cutting of the core between segments; however, they can become brittle during shipping and freezing. Upon collection, the entire length of the soil cores samples will be wiped clean on the outside and spiral-wrapped in duct tape before freezing (see below). Note on the core which one end of the segmented stainless steel liners has a short segment (approximately 3 inches); this end of the liner is intended to be oriented downward and allow for placement of the cutting shoe.
- Note: If plastic liners must be used, it is essential that the entire length of the soil cores samples be wiped clean on the outside and spiral-wrapped in duct tape before freezing. The duct tape will hold the core segments together as the plastic liners crack during freezing.
- Upon collection, a hacksaw (or similar) will be used to cut the cores down to 6-inch lengths (if utilizing the steel liners) or short enough if utilizing plastic liners in order to ship within a cooler. The drilling subcontractor will cut the cores.
- Note that a high degree of sample recovery is important for obtaining intact, undisturbed soil samples and for proper interpretation of the sample depth. Greater than 75 percent recovery is the target for representative samples. If less than 75 percent recovery is obtained, it is recommended that additional sample attempts be conducted.

Once the sample has been properly collected as per above and strengthened utilizing duct tape, each sample will need to be frozen in order to preserve the soil cores. In freezing the samples, use the following procedures:

- Cut core to the length required to fit in the cooler as per above and wipe cores clean with a paper towel. Any void space within the cores will be filled with plastic wrap, and end caps (supplied by the drilling subcontractor) will be placed on the cores. It will be important to label each core with orientation (top and bottom) depths at each end, and borehole I.D. Label directly on the outside of the core and on the end caps in case one of the markings wears off.
- Add dry ice in the bottom of the cooler, between core layers, and on top. Use 50 to 75 pounds of dry ice per cooler. Note that there are special shipping requirements for containers with dry ice. Contact the project's Environmental Coordinator for details.

- Place cores in the cooler with foam cushioning material between cores. Do not add more than three layers of core to each cooler.
- There should be no other samples placed within the coolers that have core samples in them.

H. Data and Records Management

Soil logging observations and data will be recorded on a field form or the field book. Additional information such as field photographs and instrument calibration will be documented on a field form, boring log, or field book. Field data will be finalized the day of collection. Hardcopy records will be scanned and copied to a project directory at least weekly. Electronic records will be backed up on a laptop or similar device daily, and will be copied to a project directory at least weekly.

Chain-of-custody (COC) forms will be completed and accompany soil samples to the specified laboratory.

I. Quality Assurance and Quality Control

Follow and document procedures noted above and in accordance with quality assurance/quality control (QA/QC) procedures specified in the QAPP, as previously amended (CH2M HILL, 2005, 2006, 2008), and in the current QAPP Addendum (CH2M HILL, 2012a).

J. References

ASTM Standard D 5783-95. Direct Rotary Drilling with Water-Based Drilling Fluids

ASTM D1586-08a. Standard Test Method for Standard Penetration Test (SPT) and Split Barrel Sampling of Soils

ASTM D1587-08. Standard Practice for Thin Walled Tube Sampling of Soils for Geotechnical Purposes

ASTM D-422-63. Standard Test Method for Particle-Size Analysis of Soils

CH2M HILL. 2005. Quality Assurance Project Plan (Revised), Operable Unit 1, Quanta Resources OU1, Edgewater, New Jersey. October.

CH2M HILL. 2006. Quality Assurance Project Plan (Revised), Operable Unit 1, Quanta Resources OU1, Edgewater, New Jersey. November.

CH2M HILL. 2008. Quality Assurance Project Plan (Revised), Operable Unit 1, Quanta Resources OU1, Edgewater, New Jersey. November.

CH2M HILL. 2008b. Final Remedial Investigation/Feasibility Study Work Plan Addendum No. 4 for a Supplemental Remedial Investigation. July.

CH2M HILL. 2012a. Draft Predesign Investigation Work Plan, Quanta Resources Corporation Superfund Site, Operable Unit 1, Edgewater, New Jersey. May.

CH2M HILL. 2012b. Field Sampling Plan for Predesign Investigation, Operable Unit 1, Quanta Resources OU1, Edgewater, New Jersey. May.

Parsons. 2005a. Remedial Investigation/Feasibility Study Work Plan, Operable Unit 1, Quanta Resources OU1, Edgewater, New Jersey. May.

Parsons. 2005b. Field Sampling Plan, Operable Unit 1, Quanta Resources OU1, Edgewater, New Jersey. May.

K. Attachments/Checklists

1. Equipment List

Attachment 1 – Equipment List

- Tape measure
- Chain-of-custody forms
- Shipping labels and forms
- Ice
- Bubble wrap and packing material
- Dry ice
- Lab bottles and coolers
- Field sample forms
- Field book
- Indelible ink pens and sharpies
- Stainless steel spoons, butter knives, and spatulas
- Stainless steel bowls
- 55-gallon drum
- Stainless steel shovel
- Disposable stainless steel Scoopula
- USCS soil classification summary sheets
- Phosphate-free detergent (such as Alconox) and spray bottles, buckets, brushes, and plastic sheeting required for decontamination
- Camera for digital photographs
- White board with dry-erase markers
- Stakes for identifying sample locations
- Survey flagging
- Scissors and project-appropriate cutting devices
- Duct tape
- Paper towels
- Plastic wrap
- Re-sealable plastic bags
- 16 oz jars or equivalent for head space
- Aluminum foil
- Air monitoring equipment (per HASP and FSP) with calibration regulators and calibration gas
- PPE per the HASP and FSP
- 5-gallon buckets with lids

- Specialized box designed for hazardous materials shipping (UN-4G480 box)

Attachment 2
Chain of Custody Form

CHAIN OF CUSTODY (SOIL)

LABORATORY NAME
Address

Honeywell **Chain Of Custody / Analysis Request**

AESI Ref: 38544.52162
COC # : 30916_07212005
Lab Use Only
Lab Proj #
Lab ID LL

Privileged & Confidential

Site Name: Quanta Resources Corporation Superfund Site
Location of Site: Edgewater, New Jersey

EDD To:

Client Contact: (name, co., address)

Sampler: Austin Hareclerode/CH2M HILL
P O #

Analysis Turnaround Time: 10
Standard - Y
Rush Charges Authorized for -
2 weeks -
1 week -
Next Day -

Hardcopy Report To:

Invoice To:

PAGE of
Job No.

What is in the Text File? Mouse over here.

Written and maintained by AESI (Ver 3_7) 02-01-05
renesurgi@aol.com

Sample Identification: Location ID	Start Depth (ft)	End Depth (ft)	Field Sample ID	Sample Date	Sample Time	Sample Type	Sample Matrix	Sample Purpose	# of Cont.	Grab/Composite	Field Filtered Sample ?	Atterberg Limits ASTM D4318	Grain Size ASTM D422	Ammonia EPA 305.2	VOCs SW-846 8260B	SVOCs SW-846 8270C	PCBs SW-846 8082	Pesticides, Organochlorine SW-846 8081A	Total Chromium SW-846 6010B	Hexavalent Chromium SW-846 3060A/7196A	Arsenic sW-846 6010B	Lead SW-846 6010B	TAL Metals SW-846 6010B/7471A		Lab Sample Numbers
											Preservative	8	8	8	8	8	8	8	8	8	8	8	8		
											Units														
1																									
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									

RUN MS/MSD on SB-01A-003

Relinquished by	Company CH2M HILL		Received by	Company		Condition		Custody Seals Intact
	Date/Time			Date/Time		Cooler Temp.		
Relinquished by	Company CH2M HILL		Received by	Company		Condition		Custody Seals Intact
	Date/Time			Date/Time		Cooler Temp.		

Preservatives: 0 = None; [1 = HCL]; [2 = HNO3]; [3 = H2SO4]; [4 = NaOH]; [5 = $Na_2S_2O_3$]; [6 = MeOH]; [7 = NaHSO4]; 8 = Other (specify): Additional Preservative for all samples: #8 (Ice)

CHAIN OF CUSTODY (GROUNDWATER)

LABORATORY NAME
Address

Honeywell **Chain Of Custody / Analysis Request**

AESI Ref: 38544.52162
COC # : 30916_07212005
Lab Use Only
Lab Proj #
Lab ID LL

Privileged & Confidential
EDD To:

Site Name: Quanta Resources Corporation Superfund Site
Location of Site: Edgewater, New Jersey

Client Contact: (name, co., address)

Sampler:
P O #
Analysis Turnaround Time: 10
Standard - Y
Rush Charges Authorized for -
2 weeks -
1 week -
Next Day -

Hardcopy Report To:
Invoice To:

PAGE of
Job No.

What is in the Text File? Mouse over here.

Written and maintained by AESI (Ver 3_7) 02-01-05
renesurgi@aol.com

Sample Identification				Sample Date	Sample Time	Sample Type	Sample Matrix	Sample Purpose	# of Cont.	Grab/Composite	Field Filtered Sample ?	Ammonia EPA 305.2	VOCs SW-846 8260B	SVOCs SW-846 8270C	PCBs SW-846 8082	Pesticides, Organochlorine SW-846 8081A	Total Chromium SW-846 6010B	Hexavalent Chromium SW-846 7196A	Arsenic SW-846 6010B	Lead SW-846 6010B	TAL Metals SW-846 6010B/7471A				Lab Sample Numbers
											Preservative	3	1	1	1	5	2	8	2	2	2				
	Location ID	Start Depth (ft)	End Depth (ft)	Field Sample ID							Units														
1																									
2																									
3																									
4																									
5																									
6																									

Run MS/MSD on MW-101DS

Relinquished by	Company CH2M HILL		Received by	Company		Condition		Custody Seals Intact	
	Date/Time			Date/Time		Cooler Temp.			
Relinquished by	Company CH2M HILL		Received by	Company		Condition		Custody Seals Intact	
	Date/Time			Date/Time		Cooler Temp.			

Preservatives: 0 = None; [1 = HCL]; [2 = HNO3]; [3 = H2SO4]; [4 = NaOH]; [5 = $Na_2S_2O_3$]; [6 = MeOH]; [7 = NaHSO4]; 8 = Other (specify): Additional Preservative for all samples: #8 (Ice)

Appendix C
Waste Management Plan

Waste Management Plan

This Waste Management Plan (WMP) describes requirements and procedures that will be implemented for those wastes generated during the predesign investigation, field demonstration, and remediation activities at the Quanta Resources Corporation Superfund Site, Operable Unit 1 (OU1). The general procedures for waste management include generation, containment, characterization, profiling, transport, and disposal. The scope of work for this project includes:

- Clearing and grubbing
- Debris removal (concrete, wood, brick, cinders, slag, piles, and PVC)
- Installing soil borings for collection of treatability samples, geotechnical, and NAPL recovery characterization soil samples
- Infiltration testing
- Installation of recovery wells
- Nonaqueous phase liquid (NAPL) recovery testing
- Purging and sampling of existing groundwater monitoring wells
- Excavation of test pits to collect treatability samples and management of dewatering water
- In situ solidification and stabilization

Constituents of Concern

Constituents of concern (COCs) associated with the site include volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs) (predominantly polynuclear aromatic hydrocarbons [PAHs]), and metals (principally arsenic, chromium, and lead). COCs identified less frequently include chlorinated VOCs, pesticides, and polychlorinated biphenyls (PCBs). COCs associated with the groundwater include VOCs, SVOCs, arsenic, chromium, and lead.

The predominate Resource Conservation and Recovery Act (RCRA) hazardous waste codes associated with past waste generated at the site were D008, characteristic hazardous waste for lead and D018, characteristic hazardous waste for benzene. As discussed in the Feasibility Study (CH2M HILL, 2007), all waste generated during this scope of work will be characterized in accordance with federal and state regulations.

Waste Streams

It is anticipated that the following wastes will be generated during these activities:

- Cleared vegetation
- Buried unknown drums and containers with unknown content or contaminants (includes buried tanks, equipment, unknown devices or equipment
- Debris including construction and demolition debris such as wood, brick or concrete
- Contaminated debris (personal protective equipment [PPE], and disposable sampling equipment)
- Soils cuttings from the following activities:
  - Boring installation for geotechnical, treatability, and NAPL recovery characterization soil sample collections
  - Well installation
  - Trenching activities to collect treatability samples
- NAPL
- Aqueous wastes, including

  - Potentially contaminated excavation water (surface or groundwater)
  - Mud rotary drilling fluids
  - Monitoring well development water
  - Decontamination water and container cleanout water
  - Purged groundwater
  - Unused reagents
  - Unknown liquids contained in buried containers
- Empty containers
- Residual hazardous and nonhazardous materials (iron sulfate and magnesium hydroxide)

Treatability Study Samples

A major component of predesign activities for in situ stabilization and solidification of soil is collection and testing of treatability study samples. Samples of soil and non-aqueous-phase liquid (NAPL) will be collected and containerized for shipping to laboratories to perform treatability testing. This section has been provided to document exemptions under RCRA for treatability samples and the requirements associated with this exemption.

Treatability samples are exempt from certain RCRA requirements under 40 CFR 261.4(e) when the samples are collected and prepared for transport, when the samples are accumulated and stored by the generator prior to transport, and while the samples are transported to the testing facility.

In support of the treatability study the following approximate quantities will be collected:

- 45 gallons of NAPL- and arsenic-impacted soil
- 15 gallons of arsenic-impacted river sediments
- 90 gallons of NAPL-impacted soil
- 30 gallons arsenic-impacted soil

After the collection of the treatability study samples, they will be shipped to subcontractors for treatment and analysis. Requirements for the RCRA exemption for treatability study samples are as follows:

- The generator or sample collector uses (in “treatability studies”) no more than 10,000 kilograms (kg) of media contaminated with non-acute hazardous waste
- The mass of each sample shipment does not exceed 10,000 kg
- The sample must be packaged so that it will not leak, spill, or vaporize from its packaging during shipment
- The transportation of each sample shipment complies with U.S. Department of Transportation (DOT), U.S. Postal Service (USPS), or any other applicable shipping requirements for hazardous materials, including manifesting, truck placarding, etc.
- The samples must be shipped to a laboratory exempt under 40 CFR 261.4(f) (Samples undergoing treatability studies at laboratories and testing facilities) or that has an EPA RCRA permit

The samples must have the following information documented on the shipping papers (often on a hazardous waste manifest):

- The name, mailing address, and telephone number of the originator of the sample
- The name, address, and telephone number of the facility that will perform the treatability study
- The quantity of the sample
- The date of shipment
- A description of the sample, including its EPA hazardous waste number

Recordkeeping requirements are discussed in Section D.12.

If additional time is needed or additional sample quantity is needed, Honeywell will need to request authorization from NJDEP, as required by 40 CFR 261.4(e) (referenced at NJAC 7:26G-5.1). The laboratories performing the

treatability studies need to meet the requirements of 40 CFR 261.4(f), which includes agency notification, reporting, records retention, and final disposition of samples.

High Concentration Arsenic Area (HCAA) Infiltration Testing and Treatability Study Samples

During the infiltration testing and stabilization treatability testing of soils under the HCAA cap, soil cuttings and decontamination water will be generated. Soil cuttings and decontamination water will be containerized in drums, portable tanks, or roll-off containers as appropriate. Treatability study samples fall under the exemptions listed above.

In Situ Solidification/Stabilization

In situ solidification/stabilization (ISS) works through large augers or bucket mixing, which inject/mix a combination of slag/cement into or through the ground. To provide information on both techniques during the field demonstrations, two locations will be completed augured, and two locations will be mixed with a bucket. Onsite mixing stations will be used to mix and inject the slag/cement. Information obtained during the field demonstration will be used to design the final full scale design.

Prior to ISS activities, debris that will cause on obstruction to the mixing will be removed. These materials will be managed onsite or, if determined to be incompatible with remedial methods, will be analyzed to determine proper disposal and transported offsite for disposal in accordance with the Resource Conservation and Recovery Act (RCRA) and New Jersey requirements.

In accordance with the Area of Contamination Policy (described under Aqueous Waste section), groundwater encountered during mixing will be managed by using the groundwater as the water in the ISS mix or by pumping from an active treatment area into another active treatment area within the area of contamination. Groundwater will not be allowed to overflow treatment areas. If groundwater volumes exceed the capacity of the treatment areas and is not used within the mixing process, it will be containerize and managed as aqueous waste in accordance with Resource Conservation and Recovery Act (RCRA) and New Jersey requirements.

HCAA Stabilization

The field demonstration within the HCAA uses stabilization of contaminants (specifically, arsenic) techniques. Implementation will include installation of vertical injection wells and subsequent installation of horizontal injection wells (to be determined based on the results from the vertical injection well). ISCF will include application of ferrous sulfate followed by magnesium hydroxide injected into the ground via these vertical and horizontal injection wells. Information obtained during the field demonstration will be used to design the remedy.

Waste produced during the HCAA field demonstration will include soil cuttings from well installations, miscellaneous debris; purge water from well development and subsequent sampling, excess reagent and buffer, and potentially excess groundwater during extraction. It is anticipated that all groundwater extracted during the injection testing will be used in the makeup of the reagent slurry. Waste generated during the HCAA field demonstration will be containerized and disposed of offsite as aqueous waste in accordance with Resource Conservation and Recovery Act (RCRA) and New Jersey requirements.

NAPL

Free phase NAPL is known to exist on site. Past waste characterization sampling of recovered NAPL indicates this waste stream exhibits the hazardous characteristic for benzene (D018). NAPL will be managed onsite or, if determined to be incompatible with remedial methods, will be analyzed to determine proper disposal and transported offsite for disposal in accordance with the Resource Conservation and Recovery Act (RCRA) and New Jersey requirements.

PPE, Disposable Sampling Equipment, and Cleared Vegetation

PPE and disposable sampling equipment will be containerized for offsite disposal. Cleared vegetation will remain onsite until the remedial action is performed.

Debris

Construction debris (concrete, wood, etc.) removed during predesign investigation will be containerized for disposal. Debris removed to clear obstructions prior to the field demonstration test will be sized and reincorporated into the treatment areas, to the extent feasible. Debris not reincorporated into the treatment areas will be containerized, characterized, and disposed of offsite.

Mud Rotary Drilling Fluids

During mud rotary drilling, fluids are used in order to keep the borehole open and are pumped back to the surface. These drilling fluids and spoils will be contained within the casing and a mud tub during drilling activities. The casing will have a water tight fitting to contain the drilling fluids. At the boring locations located along the shoreline, a casing will be advanced to approximately 20-feet below grade and come approximately 8 feet above grade to the wharf in order to main subsurface integrity. Upon completion of each borehole, the spoils and fluids will be transferred into drums or portable tanks as appropriate. Drilling fluids will be characterized for off-site disposal at an appropriate receiving facility.

Aqueous Wastes

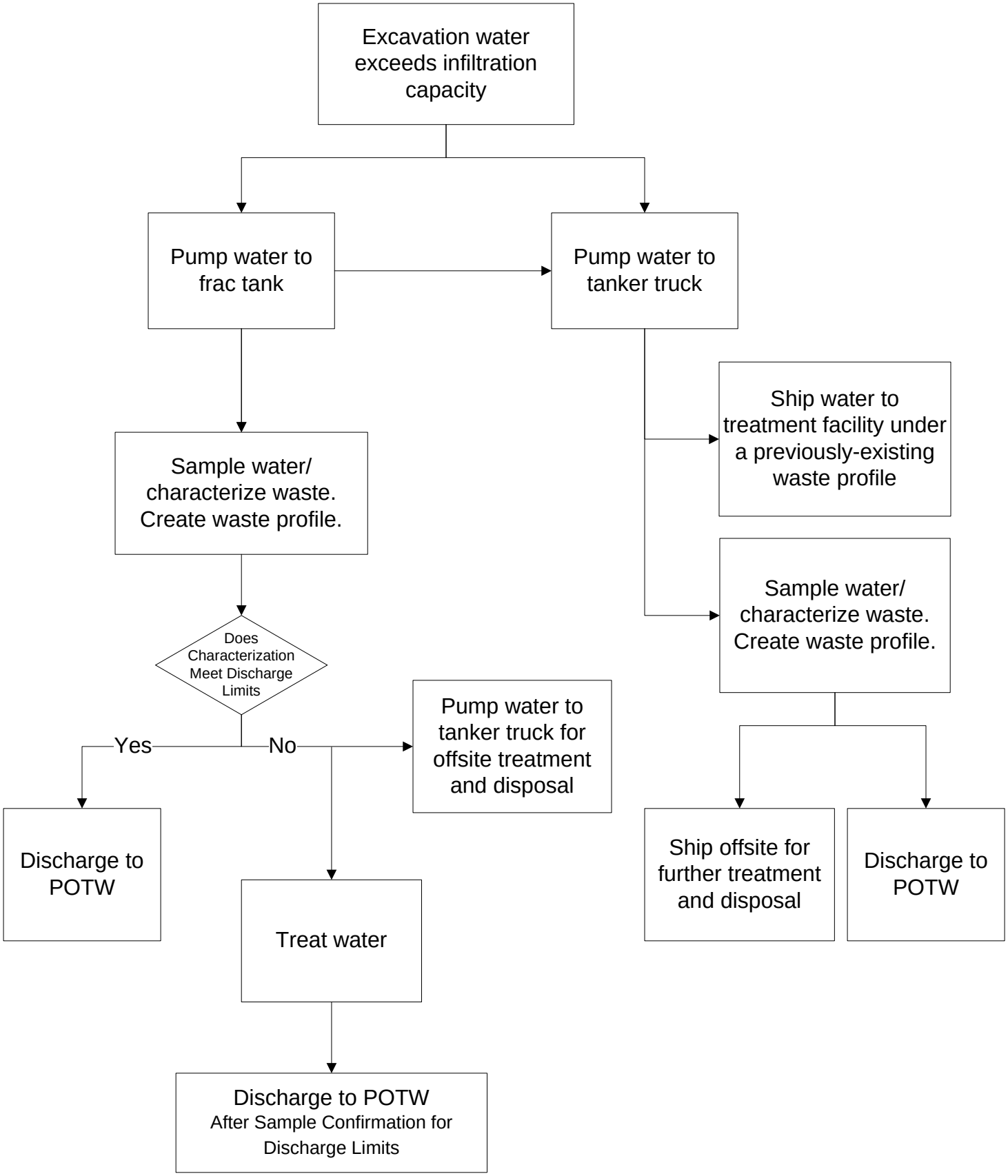
Activities onsite may encounter the groundwater table at the site. When appropriate, groundwater encountered during will be managed in accordance with the EPA Area of Contamination (AOC) policy. An AOC is delineated by the areal extent or boundary of contiguous contamination. The contamination must be touching but may contain varying types and concentrations of hazardous substances. In general, a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) AOC is the same as a single RCRA land-based unit (55 FR 8760; March 8, 1990). Wastes or contaminated media can be moved, consolidated, or treated in situ within an AOC without being generated or triggering land disposal restrictions (LDRs), RCRA minimum technology requirements (MTRs), or other RCRA hazardous waste requirements as long as the waste is not managed in containers, tanks, or other non-land-based units. When wastes or contaminated media are removed from the AOC, they are generated. Note that EPA has also stated that waste consolidated from different units or AOCs at a CERCLA facility is subject to any applicable RCRA requirements regardless of the volume of the waste or the purpose of the consolidation (55 FR 8760).

In accordance with the AOC policy, groundwater encountered during field activities will be managed by pumping from an active test pit or treatment area into a previous test pit or treatment area within the AOC. Groundwater will not be allowed to overflow the test pit or treatment areas. If groundwater volumes exceed the capacity of the test pit or treatment areas, it will be managed in accordance with the Water Management Decision Flowchart (Figure 1). A representative sample will be collected as described below to characterize water prior to treatment, discharge, or disposal.

Purge, development, and decontamination water will be containerized and transported for offsite disposal in accordance with RCRA and New Jersey requirements

Buried Drums and Containers

During debris removal or treatment activities conducted as part of the field demonstration or remedial action there is the potential to encounter buried drums and containers. Upon initial discovery of unknown buried containers or contaminated debris, the safety of the situation will be assessed and the field personnel will react accordingly. The unknown debris or container will be recovered and geographic positioning system (GPS) coordinates will be collected to allow for future location. Field personnel, with appropriate training will perform the necessary field screening and sample collection of unknown drums or containers, and contents. Unknown materials will be placed into the appropriate compatible overpack container pending waste characterization. All unknown wastes will be transported offsite for disposal in accordance with RCRA and New Jersey requirements.



Notes
POTW: Publically Owned Treatment Works

Prior to any discharge to the POTW, the necessary permits will need to be obtained.

Dependent on final volume, offsite treatment may be a better option rather than POTW

Figure 1
Water Management Decision Flowchart
Quanta Resources Corporation Superfund Site

Residual Nonhazardous and Hazardous Materials

CH2M HILL and Subcontractors as much as possible will bring onto the site only the amount of hazardous and nonhazardous materials (chemicals) needed to perform work, however there is the potential to generate excess residual materials at the completion of work. Residual materials will be managed in accordance with safety data sheets (SDSs) that will be maintained on site. Residual materials will be managed, transported, and reused or disposed of in accordance with Department of Transportation (DOT), RCRA, and New Jersey requirements.

Empty Containers

Empty containers may be generated following activities such as injection of chemicals or materials for chemical stabilization, unused empty drums, or used empty drums. According to 40 CFR 261.7(b)(1), a container or inner liner removed from a container that held a non-acute hazardous waste is empty if

1. All wastes have been removed that can be removed using 'commonly employed practices' from that type of container AND
2. No more than 2.5 centimeters (1 inch) of residue remains on the bottom of the container or liner OR
3. No more than 3 percent by weight of the total capacity of the container remains if the container is less than or equal to 110 gallons* in size OR
4. No more than 0.3 percent by weight of the total capacity of the container remains if the container is greater than 110 gallons* in size

Commonly employed practices include pouring, pumping and aspirating and must be appropriate for the specific type of container you are emptying. For example, if the act of pouring from an upside-down 55-gallon drum removes more hazardous waste than only hand pumping it, then the drum should be inverted and drained.

When emptied, containers will be managed

- By reclaiming the containers scrap value onsite;
- By sending the container to a person who reclaims the container's scrap value;
- By reconditioning or remanufacturing the container onsite; or
- By shipping the container to a person who reconditions or remanufactures the container.

Containers that formerly held nonhazardous materials or waste shall be emptied to the extent possible and can then be repurposed/recycled. Containers that are not repurposed will be recycled or disposed as nonhazardous waste.

Waste Characterization

Waste classification determinations will be made using process knowledge and laboratory analysis. The regulations set forth in 40 CFR 239 through 282 are known as RCRA or the Solid Waste Disposal Act. These regulations set forth requirements for determining whether a waste is considered a RCRA or federal hazardous waste based on the process generating the waste (listed waste) or determined by testing (characteristic waste). Environmental media that is not considered listed hazardous waste will be analyzed using the Toxicity Characteristic Leaching Procedure (TCLP). RCRA further defines federal waste management requirements, including storage, labeling, transport, and disposal.

Listed hazardous wastes as defined by RCRA regulation are not known to have been released at the site, as indicated in the Feasibility Study. As a result, excavated soils, debris and water would not be required to be managed as listed hazardous wastes (CH2M HILL, 2010). If excavated and removed from the area of contamination (i.e., the soil is "generated"), the soil may be a characteristic hazardous waste if it exhibits one of the four characteristics defined in 40 CFR Part 261 Subpart C: ignitability, corrosivity, reactivity, or toxicity.

Potentially hazardous wastes will be segregated from nonhazardous wastes onsite. Additionally, incompatible wastes (e.g., flammable and corrosive wastes) will be segregated. Wastes of the same matrix, compatible contamination, similar contaminant concentrations, and source may be aggregated to facilitate accumulation and disposal. Wastes with different expected contaminants or contaminant concentrations will not be mixed, as doing so could cause additional wastes to be disposed of as hazardous waste.

Uncontaminated waste such as general trash will be characterized using process knowledge and generally will be classified as municipal solid waste.

Waste Characterization Sampling

Separate waste characterization samples of solid waste (primarily soil) and liquid waste generated during drilling or trenching activities will be collected and analyzed in accordance with the sample collection procedures provide below. A Level 2 data package will be required for the waste characterization and incidental waste stream samples. All analytical data will be submitted by both hard copy and electronic files. Laboratory results will undergo a Level 2 data validation, as specified in the Quality Assurance Project Plan (QAPP) (CH2M HILL, 2005, 2006, 2008, 2012).

Soil/Solids Characterization

Waste characterization samples will be collected to evaluate the disposal requirements for soil accumulated during the drilling and trenching activities. Samples will be collected from the 55-gallon drums or soil bins prior to disposal; one composite sample and one grab for VOCs will be collected per 10 drums and one composite sample per 500 tons will be collected from soil bins. Soil samples will be analyzed for the parameters listed in Table 1. Waste characterization samples will be analyzed per the disposal facility requirements. Additional analyses, such as total petroleum hydrocarbons, may be necessary.

TABLE 1
Investigative-derived Waste (IDW) Soil Sample Bottle Requirements

Parameter	Analytical Method	Bottle Requirement	Preservative
Total VOCs	SW8260B	(3) 40-mL VOA vials	Ice
TCLP VOCs	SW1311/8260B	(1) 4-oz glass jar	Ice
Total SVOCs	SW8270D	(1) 8-oz glass jar	Ice
TCLP SVOCs	SW1311/8270D	(1) 8-oz glass jar	Ice
Total Pesticides	SW8081A	(1) 8-oz glass jar	Ice
TCLP Pesticides	SW1311/8081A	(1) 8-oz glass jar	Ice
TCLP Metals	SW1311/6010C	(1) 8-oz glass jar	Ice
PCBs	SW8082	(1) 8-oz glass jar	Ice
Ignitability	SW1010/1030	(1) 8-oz glass jar	None
Corrosivity	SW9040/9045	(1) 8-oz glass jar	None
Reactivity	SW846 Chapter 7	(1) 8-oz glass jar	None

The waste characterization sample will be obtained from the drums or bins as follows:

Procedure for Collecting Volatile Fractions

1. Using a hand auger or other device, retrieve a core from the drums or bins.
2. Remove the core from the auger or other device and using a disposable Terra Core sampler, place the sample into unpreserved PTFE-lined septum screw cap with magnetic stir bar volatile organic analysis (VOA) vials. The transfer operation should ideally be completed in 1 minute to minimize loss of volatile components.

Procedure for Collecting Nonvolatile Fractions

1. From five randomly selected sample locations, collect several spoonfuls of the soil into a stainless steel bowl.

2. Homogenize the five grab samples by the quartering techniques using the stainless steel spoon.
3. Fill the appropriate sample jars completely full with the homogenized sample.
4. Close the jar, label, and package the sample for shipment to the laboratory.

Liquids Characterization

Waste liquids generated as part of the decontamination and well-sampling activities include groundwater (purge water and development water), decontamination fluids, mud rotary drilling fluids, and NAPL. Waste liquids will be containerized in 55-gallon drums or portable tanks for offsite treatment or disposal. NAPL will be containerized only in 55-gallon drums. The following procedures will be used for liquids characterization.

Waste characterization samples will be collected to evaluate the handling and disposal requirements of accumulated decontamination water and well purge water. One composite sample (and one grab sample for VOC analysis) will be collected per 10 drums and one sample per portable tank per location and/or area. Water samples will be collected as follows and analyzed for the parameters listed in Table 2.

1. Using a bailer or dip jar, collect a water sample from its containment.
2. Fill the sample containers for VOC analysis first (grab sample). Fill the 40-milliliter (mL) vials so that there is no headspace in each vial.
3. Fill the sample containers for the remaining analyses.
4. Label and package the samples for shipment to the laboratory.

TABLE 2
IDW Sample Bottle Requirements

Parameter	Analytical Method	Bottle Requirement	Preservative
Volatile Organic Compounds	SW8260B	(3) 40-mL glass vials	HCl to pH < 2, Ice No bubbles/ headspace
SVOCs	SW8270D	(1) 1-L amber glass	HCl to pH < 2, Ice
Pesticides	SW8081A	(1) 1-L amber glass	Ice
Total Metals	SW6010C/7174A	(1) 500-mL HDPE	HNO3 to pH<2, Ice
PCBs	SW8082	(1) 1-L amber glass	Ice
Ignitability	SW1010/1020	(1) 1-L amber glass	Ice
Corrosivity	SW9040/9045	(1) 1-L amber glass	Ice
Reactivity	SW846 Chapter 7	(1) 1-L amber glass	Ice

HCl = hydrochloric acid
L = liter
mL = milliliter

Waste Profiling

Treatment, storage, and disposal facilities (TSDFs) require approval of a waste load prior to shipment. Hazardous waste profiles should be completed and provided—along with the waste assessment sheet, any laboratory reports associated with the waste stream, and any necessary LDR notification forms—to Honeywell or its designated representative for review and approval prior to sending this documentation to the TSDF for acceptance. *Do not* rely on the TSDF to fill out the profiles; the profiles *must* be reviewed by a knowledgeable person, since Honeywell, as the generator, is responsible for proper waste characterization.

Waste characterization information will be documented in a waste profile form provided by the offsite disposal facility as part of the waste acceptance process. An approved copy of the waste profile will be received prior to offsite transportation of the material. The Honeywell representative will provide the generator signature for waste profiles.

The profile typically requires the following information, which includes, but is not limited to, the following:

- Generator information, including name, address, contact, and phone number

- Site name, including street/mailing address
- Process generating waste (for example, soil removal and well installation)
- Source of contamination
- Historical use for the area
- Waste composition (for example, 95 percent soil, 5 percent debris)
- Physical state of waste (for example, solid or liquid)
- Applicable hazardous waste codes

A designated facility-approved copy of the waste profile will be received prior to scheduling offsite transportation of the waste.

Waste Containerization and Accumulation Areas

40 CFR 234.34 specifies requirements for accumulation and storage of hazardous waste. These include an accumulation period of no greater than 90 days prior to offsite shipment, proper labeling of containers, and weekly accumulation area inspections. Although hazardous waste requirements do not pertain to nonhazardous waste, handling, storage, and disposal should follow best management practices to comply with the DOT labeling and transport requirements and best management practices.

Wastes generated during the course of the project may be accumulated in roll-off boxes, drums, or portable tanks temporarily staged at an area or areas approved by Honeywell or its designated representative. The volume and type of waste will be evaluated by field staff to determine the appropriate container for each waste stream. Good housekeeping practices will be maintained at all waste accumulation areas. All drums, portable tanks, and roll-off boxes will be inspected upon delivery to the site for signs of disrepair and any residual contents. If containers are in disrepair or contain waste, they will be immediately rejected, and a record of the rejection will be prepared and maintained with the project files.

Waste containers will be accumulated in an area designated by Honeywell. Waste accumulation areas will be inspected at least weekly for malfunctions, deterioration, discharges, and leaks that could result in a release. Inspections for hazardous waste containers will be conducted weekly for signs of leaks, corrosion, or general deterioration. All inspections will be documented and any deficiencies corrected.

Drums/Small Containers

The following guidelines relate to drums and small containers:

- Containers will be compatible with the waste to be placed into them.
- Adequate aisle space (e.g., 30 inches) will be provided for containers such as 55-gallon drums to allow the unobstructed movement of personnel and equipment. A row of drums should be no more than two drums wide to allow inspection of each drum and its label.
- Each drum will be provided with its own label, and labels will be visible. All old labels will be removed.
- Drums will remain closed except when removing or adding waste to the drum. “Closed” means lids are on and bolts are tightened down.
- Drums will be disposed of with the contents or at the end of the project as appropriate.
- Drums will be routinely inspected and removed from service if found to be deteriorated.
- Drums will be placed in secondary containment and may not be located near a stormwater inlet or conveyance.

Portable Tanks

The following guidelines relate to portable tanks that may be used to store liquid waste onsite:

- Each portable tank will be provided with its own label, which will be placed in a visible location. Multiple labels may be utilized for full visibility. All old labels will be removed.
- For hazardous wastes, only nonstationary (i.e., portable) tanks such as cargo tanks or wheeled tanks will be used.

- Tanks will remain closed except when waste is being removed or added to the tank.
- Portable tanks will be provided with secondary containment.
- Portable tanks may not be located near a stormwater inlet or conveyance.

Roll-Off Boxes

The following guidelines relate to roll-off boxes that may be used onsite for the temporary storage of waste before its transport for offsite disposal:

- Roll-off boxes for contaminated waste will be provided with covers, bows, and disposable liners. Liners will be disposed of as waste.
- When waste is not being added or removed, covers will be properly secured.
- Old labels will be removed, and each roll-off box will be provided with its own label, which will be placed in an easily visible location. Multiple labels may be utilized for full visibility. Roll-off containers will be inspected by the transporter after the liner is removed and decontaminated in the event there is evidence of liner failure.
- Free liquids, other than an incidental amount of liquid, may not be added to waste in a roll-off box.
- Saturated soils will be placed in a roll-off box provided with sealable containment or a container otherwise designed for free liquids (e.g., dewatering box, sludge box, or vacuum box).
- Roll-off containers will be filled until half full or otherwise monitored to ensure that they will meet DOT weight restrictions.
- Roll-off boxes will not be located near a stormwater inlet or conveyance.

Waste Storage Time Limit

Any hazardous wastes that are generated will be removed from the site *within 90 days* from date of generation. Other nonhazardous wastes will be removed from the site as soon as possible. The date of generation (or accumulation start date) is the day that a waste is *first* placed in a container (drum, roll-off box, or portable tank).

Labels

Waste containers will be labeled. Labels will always include the type of waste, location from which the waste was generated, and accumulation start date. Drums, containers, roll-off boxes, and portable tanks used to accumulate waste will include one of the following labels (The type of label will be determined by Honeywell's designated representative):

- "Analysis Pending" or "Waste Material": This is a temporary label used until analytical results are received and reviewed, and the waste characterized as hazardous or nonhazardous. Once the waste is characterized, this label will be replaced with one of the following labels. Include the accumulation start date on this label. If there is any possibility that the waste may be hazardous waste, the container will also be labeled with a hazardous waste label pending the results of analyses.
- "Hazardous Waste": Preprinted or handwritten labels with the following information:
  - Accumulation start date
  - Generator name, address and phone number
  - EPA identification (ID) number
  - RCRA waste code(s)
  - Proper DOT shipping name

  Prior to transport, the manifest number must be added (for containers with a capacity less than 110 gallons).

  Where applicable, labels showing the major hazards (e.g., flammable, oxidizer, carcinogen) also will be included on the container prior to shipment.

- "Nonhazardous Waste": Preprinted or handwritten labels with the following information:
  - Generator name, address and phone number
  - Waste-specific information (e.g., contaminated soil)

  Where applicable, labels showing the major hazards (e.g., flammable, oxidizer, carcinogen) also will be included on the container prior to shipment.

Inspections

Waste accumulation and equipment storage areas will be inspected *at least weekly* for malfunctions, deterioration, discharges, and leaks that could result in a release of contaminants.

- Containers, tanks, drums, and roll-off containers will be inspected for leaks, signs of corrosion, or signs of general deterioration.
- Secondary containment will be inspected for berm failure and/or tears or holes in the liner.
- All areas will be inspected to ensure that good housekeeping practices are maintained.

All inspections will be documented in writing. Any deficiencies observed or noted during inspection will be corrected immediately, and corrective measures will be documented. Appropriate measures may include transfer of waste from a leaking container to a new container or replacement of liner or cover. Copies of inspection reports and corrective measures will be maintained onsite and available for review.

Security and Emergency Response

Site access in all working areas will be limited to authorized personnel during work activities. A daily log of all personnel onsite will be kept in the field book.

Before work is started, the work area will be demarcated with approved barricades and marked with "Do Not Enter/Authorized Personnel Only" signage to protect the equipment, allow site control for a safe working environment, and prevent unauthorized entry into the work area.

Waste accumulation areas (temporary waste staging at the work area[s]) will contain signage and emergency response equipment, and spill equipment appropriate to the wastes' hazards. Signage will include the emergency response contact information and phone number(s). The Health and Safety Plan identifies the project emergency response procedures and equipment, including emergency response contacts and phone numbers.

In addition to the Health and Safety Plan procedures, hazardous waste accumulation areas will be provided with (1) fire extinguishers if wastes known or suspected to be flammable or ignitable are present, (2) decontamination equipment, and (3) radio equipment available to all staff working in accumulation areas. Spill control equipment (e.g., sorbent pads) will be available in the waste accumulation areas and where liquids are transferred from one vessel to another.

Transportation

Honeywell may ship waste from the site to an offsite facility only if it verifies, prior to any shipment, that the offsite facility has been approved by EPA under the offsite rule for use by CERCLA sites (40 CFR 300.440). Honeywell will contact the appropriate EPA Regional office for the facility to obtain this determination (http://www.epa.gov/osw/hazard/wastetypes/wasteid/offsite/). Honeywell may ship waste material from the site to an out-of-state waste management facility only if, prior to any shipment; it provides written notice to the appropriate state environmental official in the receiving facility's state and to the EPA Project Coordinator. This notice requirement shall not apply to any offsite shipments when the total quantity of all such shipments will not exceed 10 cubic yards. The written notice will include the following information, if available: (1) the name and location of the receiving facility; (2) the type and quantity of waste material to be shipped; (3) the schedule for the shipment; and (4) the method of transportation. Honeywell also will notify the state environmental official referenced above and the EPA Project Coordinator of any major changes in the shipment plan, such as a decision

to ship the waste material to a different out-of-state facility. Honeywell will provide the written notice after the award of the contract for Remedial Action construction and before the waste material is shipped.

Proper Shipping Name

Material that meets the definition of one of the nine DOT hazard classes (e.g., explosive, flammable, poison, combustible) is regulated under DOT rules for the transportation of hazardous material. Each shipment of a suspected hazardous material will be properly classified using the hazardous materials table in 49 CFR 172.101 and associated regulations. All determinations will be made by personnel trained in accordance with 49 CFR 172 Subpart H.

Available data indicate that treatability study samples may be DOT hazardous materials even if they are not hazardous wastes. Tables D-3 and D-4 summarize available information on potential exceedances of Reportable Quantities (RQs) in the samples that could cause the samples to be shipped as DOT hazardous materials, even if they do not fail a hazardous waste characteristic (e.g., TCLP for benzene).

Transporter Requirements

Each waste transportation vehicle will be inspected upon arrival at and before leaving the site. Honeywell or its designated representative, as appropriate, will verify that the driver has the appropriate driver's license with the appropriate endorsements for the class of vehicle and type of material being transported before hazardous waste is loaded onto the vehicle.

The quantities of waste leaving the site will be recorded on a waste-tracking log. The transporter will be responsible for ensuring that loaded trucks comply with applicable weight limits. Only carriers licensed for commercial transportation will transport wastes. Hazardous materials and hazardous waste carriers must also be licensed and permitted for hazardous materials. The carrier must be permitted to carry hazardous materials and hazardous waste in New Jersey and all states on routes in between. All permits must be present in the transport vehicle. The carrier will have a current and compliant hazardous materials transportation plan.

The transporter will be briefed on the following practices to observe when hauling and transporting wastes offsite:

- Minimize impact to general public traffic
- Verify all loads are adequately covered
- Secure the load from movement
- Verify that seals on truck transporting liquids are in good condition
- Do not combine waste from different areas of the site without prior approval and authorization from the Honeywell or their designated representative
- Always use the safest, most direct route to the disposal or recycling facility
- Report any transportation incident or accident while transporting wastes to the designated site coordinator
- Provide operable working equipment in good condition. Inspect vehicles prior to arrival at the site
- Perform proper check-in and abide by all site requirements while driving onsite and transporting waste offsite

TABLE 3
Subsurface Soil, 0–10 Feet Below Ground Surface

Constituent	Maximum Concentration (mg/kg)	Concentration (kg const/kg soil)	Sample Volume (Gallons)	Sample Quantity (lbs)	Quantity in Total Sample (lbs of Constituent per lbs of Soil)	RQ (lbs)
Antimony	205	0.000205	45	661.76	0.14	5,000
Arsenic	35,100	0.0351	45	661.76	23.23	1
Benzo(a)pyrene	0.29	0.00000029	45	661.76	0.00	1
Naphthalene	10,000	0.01	45	661.76	6.62	100
2-methylnaphthalene	2,500	0.0025	45	661.76	1.65	NA

Notes:
1. NA = no RQ promulgated.
2. Highlighted cell exceeds RQ.
3. The RQ for arsenic is limited to pieces of the metal having a diameter smaller than 100 micrometers (0.004 inches). No information on particle size is available.
4. Note that this constituent list is based on COC data in Table 4 of the Record of Decision for OU1 (Sept. 2011). Additional constituents (e.g., benzene) may also cause the samples to be DOT hazardous materials. These additional constituents should be evaluated prior to offsite shipment to determine the proper DOT shipping name.

TABLE 4
Shallow Soil, 0–2 Feet Below Ground Surface

Constituent	Maximum Concentration (mg/kg)	Concentration (kg const/kg soil)	Sample Volume (gallons)	Sample Quantity (lbs)	Quantity in Total Sample (lbs of Constituent per lbs of soil)	RQ (lbs)
Antimony	174	0.000174	45	661.76	0.12	5,000
Arsenic	3,900	0.0039	45	661.76	2.58	1
Copper	6,170	0.00617	45	661.76	4.08	5,000
Thallium	8.2	0.0000082	45	661.76	0.01	100
Vanadium	82	0.000082	45	661.76	0.05	1,000
Mercury	30	0.00003	45	661.76	0.02	1
Aroclor-1242	3.2	0.0000032	45	661.76	0.00	1
Aroclor-1260	1.6	0.0000016	45	661.76	0.00	1
benzo(a)anthracene	990	0.00099	45	661.76	0.66	10
benzo(a)pyrene	941	0.000941	45	661.76	0.62	1
benzo(b)fluoranthene	1,100	0.0011	45	661.76	0.73	1
benzo(k)fluoranthene	632	0.000632	45	661.76	0.42	5,000
dibenzo(a,h)anthracene	220	0.00022	45	661.76	0.15	1
indo(1,2,3-c,d) pyrene	540	0.00054	45	661.76	0.36	100
naphthalene	6,200	0.0062	45	661.76	4.10	100
xylene total	270	0.00027	45	661.76	0.18	100
2-methylnaphthalene	764	0.000764	45	661.76	0.51	NA

Notes:
1. NA = no RQ promulgated.
2. Highlighted cell exceeds RQ.
3. The RQ for arsenic is limited to pieces of the metal having a diameter smaller than 100 micrometers (0.004 inches). No information on particle size is available
4. Note that this constituent list is based on COC data in Table 4 of the Record of Decision for OU1 (Sept. 2011). Additional constituents (e.g., benzene) may also cause the samples to be DOT hazardous materials. These additional constituents should be evaluated prior to offsite shipment to determine the proper DOT shipping name.

Spill Reporting

In the event of a spill or release of waste, the carrier must immediately notify 24-hour Emergency Contact noted on the shipping papers. The Emergency Contact shall then notify the following individuals:

- Richard Ho/EPA
- Erica Bergman/New Jersey Department of Environmental Protection (NJDEP)

The following information about the spill will be reported and recorded:

- Type of material (e.g., soil, sludge, or water) and contaminant(s)
- Location
- Estimated volume
- Media affected (e.g., spilled on a concrete pad or soil)
- Time of spill release
- Final disposition of spilled material
- Injuries
- Property damage
- Roadway closures or blockages

The carrier will also report any spill or release of hazardous waste, as required by 49 CFR 171.15.

Spill Response

The carrier is responsible for the cleanup of any spill or release of waste (including soil or water) that occurs during transportation and will take such action as may be required or approved by federal, state, or local officials. Under no circumstances will the carrier attempt to clean up hazardous materials or waste without proper training or equipment. When appropriate, the spilled material will be returned to the original waste container. In any case, the spilled material will be properly contained and disposed of in accordance with applicable local, state, and federal regulations.

Waste Manifests

Before waste is disposed of offsite, manifests, LDRs, and other documentation will be provided and reviewed by the Honeywell or their designated representative. At a minimum, the manifest form will include the following information:

- Generator information, including name, address, contact, phone number, and USEPA ID number
- Transporter information, including name, address, contact, phone number, and USEPA ID number
- Designated facility information, including name, address, phone number, and USEPA ID number
- Site name, including street and mailing address
- DOT proper shipping name (e.g., Hazardous Waste Solid, n.o.s., 9, UN 3077, PG III [D008])
- Type and number of containers
- Quantity of waste (volumetric estimate)
- Waste codes (RCRA and California)
- Task order or job number
- Profile number
- Twenty-four-hour emergency phone number

The generator or its designated representative as well as the transporter must sign the manifest before the load of waste leaves the site. If waste is hazardous or contains regulated PCBs, an LDR and/or PCB certification will be required along with the manifest. All portions of the manifest, including transporter names and EPA facility ID numbers, will be properly filled out prior to the manifest being signed. No manifests will be “presigned.”

In accordance with 40 CFR 264.71, the disposal facility is required to return a signed copy of the manifest to the generator within 30 days of receipt and the generator is required to maintain a copy of the manifest for 3 years.

Only personnel qualified and trained as manifest preparers may certify a radioactive, NRC exempt, or mixed waste shipment for transportation.

Employee Training

Field staff that will manage hazardous waste will meet the training requirements of 40 CFR 262.34(a)(4) and 265.16 and NJDEP regulation 7.26G through the following:

- OSHA 1910.120 HAZWOPER training
- Dangerous goods shipping
- On-the-job training, which includes:
  - Site-specific Health and Safety Plan review (requires each site worker and guests to review and sign the plan)
  - Activity hazard analysis and daily “tailgate” meetings
  - Project-specific work plan review (e.g., this Waste Management Plan)

Recordkeeping

RCRA requires that certain hazardous waste documents be retained for at least 5 years (40 CFR 262.23(a) and 40 CFR 262.11). The following records and documents will be maintained by CH2M HILL and provided to Honeywell as the generator of the waste:

- Waste-tracking log
- Training records
- Inspection records
- Waste profiles and associated laboratory analyses
- Waste manifests

Treatability testing records must be kept for 3 years as required by 40 CFR 261.4(e). The following records and documents will be maintained by CH2M HILL and provided to Honeywell as the generator of the waste:

- Copies of shipping documents
- A copy of the contract with the facility conducting the treatability study
- Documentation showing:
  - The amount of waste shipped under the treatability study exemption
  - The name, address, and EPA identification number of the laboratory or testing facility that received the waste
  - The date the shipment was made
  - Whether or not unused samples and residues were returned to the generator

The documentation must be submitted to NJDEP with the hazardous waste biennial report for the site.

Appendix D
Air Monitoring Work Plan

EMILCOTT
environmental, health & safety experts

PERIMETER AIR MONITORING PLAN

Quanta Resources Corporation Superfund Site

Edgewater, New Jersey

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1.0 Introduction

This Perimeter Air Monitoring Plan (PAMP) will be implemented in support of the soil and groundwater remediation initiatives at the Operable Unit 1 (OU1) of the Quanta Resources Corporation Superfund Site, located in Edgewater, New Jersey. This PAMP is specifically dedicated and limited to the upcoming demonstration phase of the project, in which two approaches to in situ remediation will be evaluated.

The OU1 project site occupies approximately 24 acres, located within a mixed residential, commercial, and industrial area and in close proximity to both river traffic which includes ferries, barges and cruise ships and road traffic. It is specifically located at the intersection of River Road and Gorge Road in Edgewater, New Jersey. A vacant lot referred to as the Quanta property, portions of River Road and Gorge Road, and properties and portions of properties surrounding the Quanta property compose entirety of the OU1 project site. The Site is adjacent to the Hudson River, although sediment within the river affected by the OU1 site is considered as a separate area of concern (designated as OU2). Figure 1 depicts the boundary of the Quanta property.

The OU1 site has a history of industrial use extending back more than one-hundred years. These activities included coal tar processing, chemical manufacturing, and waste oil storage. Consequently, the soil and groundwater contain a variety of constituents of concern as defined in the site specific Health Hazard Risk Assessment (HHRA), including arsenic, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, dibenz[a,h]anthracene, and naphthalene. This PAMP was developed to supplement the existing health and safety plan with specific actions to monitor and reduce or abate fugitive emissions during soil intrusive activities at the site. Specifically, this document outlines the air quality monitoring procedures to be followed to protect the surrounding community (i.e., potential offsite receptors) from airborne contaminant releases that may be present as a direct result of the remedial activities.

2.0 Objectives of Perimeter Monitoring

The purpose of the perimeter air monitoring program (PAMP) is to ensure that members of the general public, including any workforce located at the site but not involved with intrusive activities, are not exposed to hazardous levels of airborne contaminants due to fugitive emissions from the site remedial activities. Perimeter air monitoring is designed to accomplish the following objectives:

- Protect human health from exposure to unacceptable risk levels of contaminants in the soil to be remediated;
- Minimize risk of community exposure to contaminants resulting from remediation work performed at the site;
- Determine the need for, and evaluate the effectiveness of dust and vapor emission controls;
- Monitor and document ambient air quality at project perimeter locations during remediation activities to prevent elevated off-site exposures;
- Evaluate the monitoring data over the course of the project to continuously assess exposure risks at the project perimeter;
- Support real-time air monitoring data through the periodic collection of laboratory analytical samples.

Air monitoring data will be placed on the website www.quantaremediation.com.

2.1 Project Approach to Perimeter Monitoring

This PAMP is being established to provide a mechanism by which the public is protected from emissions of particulates and vapors resulting from remediation activities. The PAMP sets forth guidelines and requirements for the monitoring of air quality at the perimeter of the project site. Perimeter air monitoring will be performed during periods of any intrusive activities associated with the RDWP Addendum to ensure that the remedial activities do not adversely affect off-site air quality.

The selection of measurement parameters for inclusion in the PAMP was based on the findings of the site specific HHRA and available soil analyses. Real-time monitoring will be supplemented with integrated analytical samples at locations at the perimeter of the site. Contaminants of interest are described in detail in Section 3. Position of sample stations is described in Section 4. The perimeter monitoring program will entail two overall efforts:

- Real-time monitoring of the concentrations of particulates and of total volatile organic compounds (TVOC) at several monitoring stations during soil-intrusive work shifts. Real-time monitoring will also include measurement of meteorological parameters.

- Laboratory analytical samples for the COCs, taken periodically over the course of the project.

3.0 Target Parameters and Action Levels

3.1 Target Parameters for Analytical Air Monitoring

Target parameter selection was based on the soil sampling analytical data along with the results of the HHRA that indicate that the key contaminants of concern for monitoring include volatiles, semi-volatiles, and metals. The following specific chemicals were identified in soil investigation data and defined as risk drivers in the HHRA.

Antimony	Carbazole	Indeno[1,2,3-cd]pyrene	Thallium
Arsenic	Chrysene	Isopropylbenzene	Toluene
Benz[a]anthracene	Copper	Lead	1,2,4-Trimethylbenzene
Benzene	Dibenz[a,h]anthracene	2-Methylnaphthalene	1,3,5-Trimethylbenzene
Benzo[a]pyrene	Ethylbenzene	Naphthalene	Vanadium
Benzo[b]fluoranthene	Fluoranthene	n-Propylbenzene	Total Xylenes
Benzo[k]fluoranthene	Fluorene	Pyrene	Zinc

These chemicals identified in the soil samples were evaluated for applicable risk-based screening levels (RSL) for residential populations for the duration of the planned project using the EPA Risk Based Screening Levels: "Regional Screening Levels for Chemical Contaminants at Superfund Sites"[1]. The site specific exposure basis for used for calculating the chemical specific RSL was a 3-month project duration with 72 days of intrusive work (6 days per week) with work shifts of 10 hours per day. Where EPA RSLs were not established or not applicable to the site activities, New Jersey Department of Environmental Protection, Reference Concentrations for Inhalation (RCL)[2] were applied for this analysis.

Compounds with both RSL values and established analytical methods were included as target parameters for the integrated analytical air monitoring strategy. These target parameters along with site specific RSLs are presented in Table 3.1.

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[1] EPA Risk Based Screening Levels: "Regional Screening Levels for Chemical Contaminants at Superfund Sites", Calculator for Site-specific Risk-Based Screening Levels for Ambient Air, http://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search

[2] Based on guidance from the NJDEP for projects with durations of less than one year, acute exposure, or reference concentration (RfCs) for short-term inhalation exposures, criteria apply. NJ DEP Short-Term Inhalation reference concentration for lead is listed. Since no short-term RfC is available from NJDEP for chromium VI particulate the longer-term exposure criteria, Reference Concentrations for Inhalation, is identified. Reference Concentrations for Short-Term Inhalation Exposure, August 2011 http://www.state.nj.us/dep/aqpp/downloads/risk/Acute2011.pdf. Reference Concentrations for Inhalation, August 2011 http://www.nj.gov/dep/aqpp/downloads/risk/RfCs2011.pdf.

Table 3.1
Target Parameters: Analytical Air Monitoring

Target Parameter		Site Specific RSL ($\mu g/m^3$)
Total Dust	Particulate	Not applicable
Metals	Antimony	2.4
	Arsenic	0.18
	Lead (NJ DEP RCL)	0.1
	Vanadium	1.2
SVOCs	Benz[a]anthracene	3.1
	Benzo[a]pyrene	0.31
	Benzo[b]fluoranthene	3.1
	Benzo[k]fluoranthene	3.1
	Chrysene	31
	Dibenz[a,h]anthracene	0.31
	Fluoranthene	0.31
	Fluorene	0.31
	Indeno[1,2,3-cd]pyrene	3.1
	Naphthalene	36
	Pyrene	0.31
VOCs	Benzene	437
	Ethylbenzene	1,360
	Isopropylbenzene	1,100
	n-Propylbenzene	12,200
	Toluene	60,800
	1,2,4-Trimethylbenzene	252
	1,3,5-Trimethylbenzene	122
	Xylenes, Total	4,870

3.2 Target Parameters for Real-Time Air Monitoring

Target parameters for real-time air monitoring measurements focus on particulate concentration in air and total volatile organic carbon. Constituents of concern will be associated with either particulate (PM_{10}) or volatile organic compounds (VOC) to allow for the use of real-time monitoring during future remediation efforts.

3.3 Action Levels for Real-Time Air Monitoring

Analysis of the soil and groundwater sampling analytical data for the project site compared with chronic action levels (RSLs) for target parameter COCs (Table 3.1) indicates that the action threshold for total particulates (measured as PM-10) is limited by lead, and the threshold for TVOC concentration is limited by 1,3,5-trimethylbenzene. This analysis considered both maximum and mean concentration levels of the COCs measured in the soil with an immediate and total release of the COC from the airborne soil in determining the action levels. A summary of the calculations are presented in Appendix A.

Based on this analysis, the following 15-minute Time-Weighted Average (TWA) Action Levels and Alarm Levels above background are recommended for the project during intrusive activities. Specific operational and response procedures utilizing these levels are detailed in the following section.

Table 3.2
Real-Time Air Monitoring – Action Levels

Condition	Particulate Concentration (PM-10) **	Volatile Concentration (TVOC) **
Action Level * Operational action*** required, including possible work stoppage.	150 µg/m^3 plus background	1.0 ppm plus background
Alarm Level * Notification and observation of site operations to be conducted and possible operational action***.	100 µg/m^3 plus background	0.5 ppm plus background

* Based on 15-minute Time Weighted Average (TWA) for the value specified.
** Allowable concentration above background or upwind level for each parameter.
*** Operational actions may include dust control, vapor suppression, change in work procedures and practices, or work stoppage.

Dust control methods will include the use of water sprays over areas were particulates are likely generated including high traffic areas, debris sizing, etc. There should be minimal dust generated during the slurry preparation due to the use of pneumatic delivers of the bulk reagents and filters in the storage silos. The subcontractor may use a number of controls to mitigate odor and emission during the field demonstration test activities. Control methods may include, but are not limited to, placement of temporary backfill covers, water sprays, and foam. Additional contingency measures (e.g. shroud and vapor management system) will be available if necessary for the auger-mixed areas. At the end of each work day, all exposed excavated soil piles will be covered with polyethylene sheeting and secured.

3.4 Responses to Action Level Exceedances

Visible Dust

- Any observation of visible dust leaving the site from contaminated portions of the site should be evaluated in the same manner as the downwind work zone instrument readings. Visible dust is an early warning of a problem, such as inadequate dust control or an excessive rate of disturbance. Visible dust generated at the immediate work area which settles out of the air within close proximity to the work area should not be treated in the same manner as visible dust leaving the site.

Locations Immediately Downwind of Work Zones

- Since the work station monitors primary function is to provide early warning of adverse conditions, before they can affect the perimeter. Any potentially adverse change in emission conditions must be investigated and/or evaluated.
- Any increase in particulate and/or VOC concentrations due to remedial activities is to be investigated and/or evaluated.
- Proactive steps must be taken to ensure an alarm condition caused by remedial action does not occur at the perimeter.

Site Perimeter Actions

1. For an initial alarm condition at the perimeter (period of exceedance not to be greater than 15 minutes), the cause of the alarm must be investigated.
2. If conditions cause the alarm at the perimeter to persist into the next 15-minute period, and are the result of emissions-generating remediation activity, vapor and dust control corrective actions must be implemented. These would include the application of water and/or foam, as well as the reduction in the rate of vapor- and/or particulate-generating activities.
3. If the alarm condition at the perimeter still persists into the following 15-minute period, is attributable to the same cause, and is due to emissions- generating remedial activity, all activity with the potential to generate vapors or particulates must cease.
4. If the alarm condition at the downwind perimeter station occurs and receptors could be potentially impacted, either the maximization of vapor and dust controls or the cessation of work must be initiated immediately. If the use of controls is the selected option and levels are not acceptable within 15 minutes, all work must cease.
5. Following a shutdown, if upon re-start the action levels are again exceeded as in Steps 1, 2, and 3 above, and operations are again precluded, the use of an enclosure should be considered where feasible. Similarly, if work cessation occurs as in Step 4 above, an enclosure should be considered.

Exceedances Caused by Conditions Not Related to Remedial Activities

- It is expected that short-term exceedences caused by activities not directly resulting from the remedial activity may occasionally occur. When these exceedences occur and can be documented as not being related, the project manager or designee should reset the monitoring station, record the reason for the exceedance and proceed with site activities. Appropriate action should be taken to eliminate the cause of the short-term exceedance when possible (i.e., having an idling vehicle moved away from the vicinity of the monitoring station). In the event the exceedance is caused by equipment malfunction, the equipment must be immediately re-set, repaired, or replaced as appropriate. If the exceedence is caused from off-site sources, EPA and NJDEP must be notified. The action level exceedance and an explanation of any action taken must be recorded in the final report.

4.0 Instrumentation and Methods

The following monitoring and sampling instruments will be utilized by the Air Monitoring Technician (AMT) to implement the PAMP. Specific operational procedures and sampling schedules are presented in Section 5.

4.1 Real-Time Monitoring Equipment:

The following are the key elements and characteristics of the real-time monitoring system to be utilized:

- A TSI DustTrak-II, model 8520, or equivalent will be used to measure particulate matter (PM-10) concentrations.
- A RAE systems model MiniRAE-3000, or equivalent photo-ionization detector (PID), will be used to measure TVOC concentrations.
- An automated weather station will be used to monitor wind direction, wind speed, ambient temperature, relative humidity and barometric pressure.
- Auxiliary wind speed and direction detectors will be placed around the site to further characterize airflow patterns and to aid in determining background levels and other potential offsite sources of emissions.
- These measurement instruments will be part of an integrated air-monitoring system transmitting data from the field instruments to a central computer server via wireless telemetry. The server will maintain the central database and will provide end-user applications needed by the PAMT, including: presentation of live and historic data, notification of alarms, and generation of reports. These applications will be made available to the PAMT and other project personnel via a secure internet interface, and can be accessed via web-enabled devices such as PCs, laptops, tablets and smart-phones. The system will also present real-time information about its own performance and status, eliminating the need for the PAMT to traverse the jobsite to verify normal operation of the measurement instruments.

Air monitoring data will be placed on the website www.quantaremediation.com.

4.2 Laboratory Analytical Sampling Methods and Equipment:

The specific analytical methods to be utilized for the various contaminants of interest are listed in Table 4.1. Method selection was based on achieving a minimum detection limit to permit measurement at or below the parameter specific RSL.

Table 4.1 Analytical Methods and Detection Limits

Parameter/Category	Method	Sampling and Analysis Approach	Detection Limit[3]
Total Dust *Particulates Not Otherwise Regulated*	Modified NIOSH Method 0500	Ambient air is drawn through a PVC filter; Gravimetric analysis.	10 µg/m^3
Metals	Modified NIOSH Method 7303	Ambient air is drawn through mixed cellulose ester or PVC filter; Analysis by ICP-MS.	Varies based on metal – MDL will be less than RSL
Volatile Organic Compounds and Naphthalene	EPA TO-15	Air collected in specially prepared canisters. Analysis by GC-MS- Scan	Varies based VOC – MDL will be less than RSL
Polycyclic Aromatic Hydrocarbons (PAHs)	NIOSH Method 5515	Ambient air is drawn through a PTFE filter and XAD tube	Varies based on PAH – MDL will be less than RSL

[3] Estimated minimum detection limits are listed in Appendix A

5.0 Operational Monitoring Program

This section describes the various project tasks and operational procedures to be performed to implement the provisions of this PAMP.

5.1 Location of Monitoring Stations

A minimum of eleven (11) perimeter real-time air monitoring stations will be used for real-time monitoring during the remedial action. Six of the stations will be at fixed locations at or near the perimeter of the site, as shown in Fig. 1. The remaining five stations will be deployed in the vicinity of the work zone each day during intrusive activities and set up at cardinal directions to accommodate all wind directions with some adjustment to cover sensitive receptors, including outside the fence line. It is possible that up to four additional mobile stations will be needed for a portion of the project if two work zones are active simultaneously. The actual monitoring station arrangement will be reviewed and agreed upon with the onsite Field Manager and confirmed with the Quality Manager. Mobile stations will be configured based on field operations, wind direction, and sensitive receptors. The monitoring station locations each day will be recorded on a site map for reporting purposes. The field operations, wind direction, and location of sensitive receptors will also be documented to support the daily station locations.

Each monitoring station will be configured with air intake ports at a height of four to six feet above grade surface to represent the breathing zone. The field stations will be housed in a weatherproof enclosure, either a rugged fiber case mounted on a tripod or a secure metal box on a semi-permanent structure. A full-service meteorological station will be located at the site during monitoring events. The location of this station will be determined based on site activities. One additional wind speed and direction detector will be located at a separate location on site, at one of the field stations.

5.2 Monitoring During Intrusive Project Activities

A comprehensive program of real-time monitoring and analytical sampling will be conducted during the project intrusive activities.

5.2.1 Real-Time

PM-10 and TVOC concentrations and meteorological parameters will be measured at the perimeter by the fixed air monitoring equipment for a 24 hour period. These measurements will be transmitted continuously in real-time to the central database of the air monitoring system. The system will also correlate wind-speed and direction to the environmental measurements in real-time, so that the PAMT will be aware of airflow patterns across the site when responding to alarms or other incidents of interest.

The full complement of eleven (11) field stations will be utilized, six positioned at their respective perimeter locations, the other five, with one downwind of the activities placed outside the fence and four near the work zone. As stated above, additional stations may be added to the system if and when multiple work zones are active at the same time. Prior to the intrusive activities beginning, all devices will be checked and verified that they are in working order. The mobile stations will be deployed each morning approximately one-half hour prior to the start of the remediation work-shift. The mobile stations will then operate continuously until after the completion of the shift while the fixed-devices operate 24-hours per day.

The AMT will have a dedicated set of hand-held measurement instruments (PID and dust monitor) to assist, as needed, in investigating possible emission sources.

5.2.2 Analytical

A program of analytical sampling will be conducted as part of operational monitoring to supplement the real-time air monitoring. Adjustments to the number sampling events, sampling locations, number of samples analyzed and schedule may be made during the course of the project, based on real-time data, weather conditions and wind direction, site activities, odors, and other environmental factors.

The schedule for field sampling is presented in Table 5.1.

5.2.3 Meteorological

The real-time monitoring and analytical sampling efforts will be supplemented by real-time measurement of meteorological parameters. One full-service weather station and an additional wind speed and direction detector will be utilized, each located on one of the real-time monitoring stations. The full-service station will measure ambient temperature, barometric pressure, relative humidity, and wind speed and direction. The use of two separate stations measuring wind speed and direction will provide real-time data to map prevailing wind flows across the site.

5.5 Contingency for Equipment Malfunction

The AMT will have available an extra set of real-time monitoring equipment as a backup. Should an instrument fail, the AMT may adjust the established air monitoring configuration, using only seven stations, until the system can be restored to the full complement. The implementation of the modified configuration will be recorded on the site map, and the reasons for the equipment outage will be noted in the AMT's site log. Due to the proximity of the storage warehouse, it is not anticipated that an outage of field instruments would occur longer than 4-hours.

Table 5.1 Analytical Sampling Methods and Schedule

Parameter	Method	Sampling Schedule
		Intrusive activities (a)(b)
Total Dust	Modified NIOSH Method 0500[4]	1 day per week / 2 locations
Metals	Modified NIOSH Method 7303[4]	1 day per week / 2 locations
Volatile Organic Compounds and Naphthalene	EPA TO-15	1 day per week / 2 locations
Polycyclic Aromatic Hydrocarbons (PAHs)	NIOSH Method 5515	1 day per week / 2 locations

(a) Sampling locations will be collocated with the real-time monitoring stations equipped with wind speed and direction indicators.
(b) Frequency of sampling may be decrease or increase over the course of the project based on sampling results and changing site conditions.

[4] NIOSH Method 7303 is modified with the analyses of the metals of interest using inductively coupled plasma mass spectrometry (IC ICP-MS) to reduce the minimum detection limits.

6.0 Quality Assurance

6.1 Operation and Calibration of Equipment

All instruments will be calibrated in accordance with the manufacturer's specifications. Instrument calibration shall be documented on calibration sheets. All particulate monitors will be calibrated before and after each shift. Calibration checks may be used during the day to confirm instrument accuracy.

All instruments will be operated in accordance with the manufacturer's specifications. The AMT will maintain manufacturer's literature, including an operations manual, for each piece of monitoring equipment on site.

6.2 Laboratory Quality Control

Laboratory QA/QC will be in accordance with the method requirements. Sample collection, holding times, calibration procedures and handling times will be in accordance with the appropriate United States Environmental Protection Agency (USEPA), Occupational Safety and Health Administration (OSHA), and/or National Institute of Occupational Safety and Health (NIOSH) air sampling methods. The data will include QA/QC elements specified by the appropriate analytical method. The data will be used to confirm the accuracy and precision of the real-time screening data and to show compliance with perimeter action thresholds and health-based air criteria for the contaminants of concern.

6.3 Documentation

Each real-time monitoring station will be inspected by the AMT at the beginning and end of each work shift, and when and if the integrated air monitoring system reports any problems with (or lack of data transmission from) the field stations. All alarms and subsequent emission source evaluations and corrective measures will be documented. In addition to the above, the AMT will maintain a daily air monitoring log that will include a general description of the site activities, a detailed description of site activities during an alarm condition, and potential sources of emissions causing such alarms. The environmental and meteorological data will be downloaded from the base-station computer by the AMT at the end of each work shift. The laboratory reports for analytical samples will be maintained on site by Site Project Manager. Following completion of the Air Monitoring, a final perimeter air monitoring report will be prepared and provided to the Site Project Manager. This report will document the monitoring and sampling activities, action levels and their basis, exceedances and alarms with appropriate explanations including supporting wind roses, results, and field and laboratory QA/QC procedures that were implemented during the air monitoring for the site.

Figure 1. Locations of Environmental Monitoring Stations

Locations of the six (6) fixed stations are shown. Five additional stations will be located near the work zone during intrusive shift activity.

Appendix A. Estimated Analytical Detection Limits

Target Parameters: Analytical Air Monitoring

Target Parameter		Site Specific RSL (µg/m^3)	Estimated Minimum Limit of Detection (µg/m^3)
Total Dust	Particulate	Not applicable	10
Metals	Antimony	2.4	0.035
	Arsenic	0.18	0.035
	Lead (NJ DEP RCL)	0.1	0.035
	Vanadium	1.2	0.035
SVOCs	Benz[a]anthracene	3.1	0.3
	Benzo[a]pyrene	0.31	0.3
	Benzo[b]fluoranthene	3.1	0.3
	Benzo[k]fluoranthene	3.1	0.3
	Chrysene	31	0.3
	Dibenz[a,h]anthracene	0.31	0.3
	Fluoranthene	0.31	0.3
	Fluorene	0.31	0.3
	Indeno[1,2,3-cd]pyrene	3.1	0.3
	Naphthalene	36	1
	Pyrene	0.31	0.3
VOCs	Benzene	437	1
	Ethylbenzene	1,360	1
	Isopropylbenzene	1,100	1
	n-Propylbenzene	12,200	1
	Toluene	60,800	1
	1,2,4-Trimethylbenzene	252	3
	1,3,5-Trimethylbenzene	122	2
	Xylenes, Total	4,870	2

Table A.1. Volatile Organic Compounds (VOC): TVOC Action Levels

At the VOC Action Level of 1 ppm, all contaminants have calculated concentrations at or below their respective chronic action levels.

Parameter	Molec. Wt.	Measured Concentration in Soil (a)		Action Levels: Resident - Full Project Occupancy (b,c)		Calculated TVOC to reach individual AL (d)
		mg/kg	Normalized % of TVOC	µg/m^3	ppb	ppm
Benzene	78	92.6	6%	437	137	2
Ethylbenzene	106	174	11%	1,360	314	3
Isopropylbenzene	120.2	30.3	2%	1,100	224	11
n-Propylbenzene	120.2	10.7	0.7%	12	2	0
Toluene	92	186	12%	60,800	16,158	132
1,2,4-Trimethylbenzene	120.2	157	10%	852	191	2
1,3,5-Trimethylbenzene	120.2	61.5	4%	122	25	1
Xylenes, Total	106	348	23%	4,870	1,123	5
Other, non-COC PID Sensitive Soil Contaminants for TVOC		*460*	*30%*			

Notes:

(a) The greatest concentration of VOCs detected are shown, based on historical site investigation findings. TVOC normalized based on total VOC measured in soil that will respond to a photoionization detection, not only those identified as COCs.

(b) EPA Risk Based Screening Levels: "Regional Screening Levels for Chemical Contaminants at Superfund Sites", Calculator for Site-specific Worker Risk-Based Screening Levels for Ambient Air
http://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search

(c) Exposure Basis for this project: 3 month duration or 72 active work days (6 days/week) 10 hours/day.

(d) Normalized percentage concentrations are used to calculate the TVOC concentration needed to reach the individual action levels of the VOC components. These calculations demonstrate that the project's selected action level is applicable.

COC TVOC Action Level (ppm) = (RfC*AT)/(ET*ED*EPC*CF)
Where:
RfC = Short Exposure Duration Reference Concentration (COC) in air (ppm)
ED = Exposure Duration (days)
ET = Exposure Time (hours)
EPC = Exposure Point Concentration (95% Upper Confidence Limit of the Arithmetic Mean or 95%UCL) of COC in TVOC (ppm)
AT = Averaging Time (days)
CF = Conversion factor of kg to mg (10^6)

Table A.2. Semivolatiles and Metals : PM-10 Action Levels

At the PM-10 Action Level of 150 µg/m3, all parameters have calculated concentrations at or below their respective chronic action levels.

Parameter	Measured Concentration in Soil (a)		Chronic Action Levels: Site-specific 10-hr work shift (b,c)	Calculated PM-10 to reach individual Action Level (d,e)
	mg/kg	µg/µg	µg/m^3	µg/m^3
Antimony	229	2.29E-04	2.7	11,790
Arsenic, Inorganic	473	4.73E-04	0.202	427
Lead	639	6.39E-04	0.10	156
Vanadium	116	1.16E-04	0.14	1,207
Benz[a]anthracene	3,700	3.70E-03	3.43	927
Benzo[a]pyrene	117	1.17E-04	0.343	2,932
Benzo[b]fluoranthene	4,100	4.10E-03	3.43	837
Benzo[k]fluoranthene	2,000	2.00E-03	3.43	1,715
Chrysene	4,200	4.20E-03	34.3	8,167
Dibenz[a,h]anthracene	510	5.10E-04	0.314	616
Fluoranthene	346	3.46E-04	0.343	991
Fluorene	133	1.33E-04	0.343	2,579
Indeno[1,2,3-cd]pyrene	1,700	1.70E-03	3.43	2,018
Naphthalene	10,200	1.02E-02	40.4	3,961
Pyrene	282	2.82E-04	0.343	1,216

Notes:

(a) Per the historical investigation findings, the greatest concentration of parameters detected are shown, with the exception of aresenic, chromium, benzo[a]pyrene, fluoranthene, fluorene, pyrene, for which the numercal mean of sampling results was utilized.

(b) EPA Risk Based Screening Levels: "Regional Screening Levels for Chemical Contaminants at Superfund Sites", Calculator for Site-specific Worker Risk-Based Screening Levels for Ambient Air
http://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search

(c) Exposure Basis for this project: 90 days, 5 days/week, 10 hours/day.

(d) Ratio of individual action level to soil concentration is used to calculate the PM-10 concentration needed to reach the individual action levels of the parameters. These calculations demonstrate that the project's selected action level is applicable.

(e) Since no EPA reference is provided for Lead, the NJDEP Chronic action level is used.
Reference Concentrations for Short-Term Inhalation Exposure, August 2011,
http://www.state.nj.us/dep/aqpp/downloads/risk/Acute2011.pdf

COC Dust Action Level (mg/m^3) = (RfC*AT)/(ET*ED*EPC*CF)

Where:

RfC = Short Exposure Duration Reference Concentration (COC) in air (mg/m^3)
ED = Exposure Duration (days)
ET = Exposure Time (hours)
EPC = Exposure Point Concentration (95% Upper Confidence Limit of the Arithmetic Mean or 95%UCL) of COC in dust (mg/kg)
AT = Averaging Time (days)
CF = Conversion factor of kg to mg (10^6)

Appendix E
NJDEP Permitting Package

CH2M HILL
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July 16, 2013

Megan Brunatti
Office of Permit Coordination and Environmental Review
NJDEP
401 East State St.
Mail code: 401-07J
P.O. Box 420
Trenton, NJ 08625

Subject: Quanta Property Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Field Demonstration, Pre-application Meeting Request

Dear Megan Brunatti,

CH2M HILL, on behalf of Honeywell International Inc. (Honeywell), has prepared this letter to request a pre-application meeting with the New Jersey Department of Environmental Protection (NJDEP), Division of Land Use Regulation. The pre-application meeting is associated with upcoming remedial activities planned to occur in late summer 2013 at the Quanta Resources Corporation Superfund Site at 163 River Road in Edgewater, New Jersey. Activities to be discussed at this meeting include a small-scale field demonstration of in situ solidification/stabilization (ISS) of soil to test methods for implementing the site-wide remedy.

In support of this pre-application review and meeting, the following documents are provided for review:

- Project Description and Compliance Statement
- NJDEP Permit Readiness Checklist
- Figure 1 – Operable Unit 1 and Quanta Resources Corporation Site Boundary (United States Geological Survey Quad map).
- Figure 2 – Property Location Map with Aerial Photograph
- Figure 3 – Site Plan and Environmental Features
- Figure 4 – Federal Emergency Management Act (FEMA) Flood Map

The field demonstration is tentatively scheduled to commence in September 2013, with permit equivalence submittals planned to be submitted in July 2013. As a result, we would appreciate the opportunity to meet with you as soon as possible.

Five copies of the above listed documents will be provided via mail. Additional copies can be provided upon request.

Please feel free to contact me at 267.250.7387 or Steve Coladonato, Honeywell Remediation Manager, at 302.791.6738 if you have any questions or comments regarding this request.

Sincerely,

CH2M HILL

Stephen J. Zarlinski
Project Manager

c: Richard Ho (USEPA)
Erica Bergman (NJDEP)
Steve Coladonato (Honeywell)

SECTION 1

Project Description

Introduction

To outline applicable state regulations and permit equivalent requirements for upcoming field demonstration activities at the Quanta Resources Corporation Superfund Site (Site), Operable Unit 1 (OU1), CH2M HILL has prepared this Substantive Requirements Compliance Document on behalf of Honeywell International Inc. (Honeywell). The field demonstration, scheduled for summer/fall 2013, will be conducted at OU1 for purposes of designing the selected remedy.

This Site, located in the Borough of Edgewater, New Jersey, was included in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priorities List (NPL) on September 9, 2002, and assigned Site Number NJD000606442. It is being remediated under an Administrative Settlement Agreement and Administrative Order on Consent (AOC) (CERCLA Docket Number [No.] 12-CV-07091-SRC-CLW) effective March 11, 2013 between the U.S. Environmental Protection Agency (USEPA) and Honeywell.

This document includes the following sections:

- Project Description (including site description and history)
- Project Components Overview (describing the proposed field demonstration)
- Compliance Statement (summarizing potentially applicable regulations, with the intent that regulations will be reviewed during the development of permit equivalent applications that might be needed to verify substantive compliance, and consulted for compliance during field demonstration)
- Regulations, Guidelines, and Policies (summarizing additional regulations associated with field demonstration activities)

On January 11, 2001, USEPA proposed inclusion of the Site on the NPL, and on September 9, 2002, USEPA placed the Site on the NPL. The Remedial Investigation/Feasibility Study (RI/FS) for the selected remedy for OU1 has been performed under an AOC, which USEPA signed in 2003. Applicable Relevant and Appropriate Requirements (ARARs) associated with the selected remedy were provided as Table 12 of the Record of Decision (ROD), which was finalized in September 2011.

Site Description

The Site is located at the intersection of River Road and Gorge Road in Edgewater, New Jersey. A vacant lot referred to as the Quanta property, portions of River Road and Gorge Road, and properties and portions of properties surrounding the Quanta property compose the upland portion of the Site, or OU1. The area of OU1 is approximately 24 acres. The Site is adjacent to the Hudson River, and sediment within the river affected by the site is considered OU2 and is being investigated and addressed separately, pursuant to a USEPA AOC. The presence of constituents associated with former Site operations has been observed in parts of the following areas, which, together, make up OU1 (Figure 1):

- Block 91, Lot 1 (referred to as the former Celotex property)
- Block 92.01, Lots 1.01, 1.03, and 2
- Block 93, Lots 1, 1.01, 2.01, 2.02, 3, 3.03, 3.04, and 4
- Block 94, Lot 1
- Block 95, Lot 1 (referred to as the Quanta property)
- Block 96, Lots 3.01, 3.02, and 3.03
- Block 99, Lots 1 and 1.12 (referred to as the former Lever Brothers property)
- River and Gorge Roads

Prior to development, this area was marshland in the floodplain of the Hudson River. During industrial development of the area, the marshland was reclaimed through the installation of a wooden bulkhead and placement of 10 or more feet of non-native fill material. The non-native fill overlying the native soils is present throughout the Site and surrounding properties, and consists of a mixture of gravel, sand, and silt with cinder/slag material, brick, wood, and concrete fragments. In some areas at the Quanta property, large concrete structures that formerly served as footers for aboveground storage tanks (ASTs) remain visible at grade.

The Site is relatively flat and at a lower elevation than the surrounding properties and River Road, resulting in standing water over a portion of the property year-round. A concrete embankment exists along the western and northwestern property boundaries of the Quanta property at the boundary with River Road and the former Celotex property (Figure 2). A 12-foot-high rock slope exists along the northeastern boundary of the Quanta and Celotex properties.

The 115 River Road and the former Lever Brothers properties are at a similar elevation to the Quanta lot. The 115 River Road property is entirely covered with asphalt, buildings, or similar capping material, and the former Lever Brothers property is fenced. With the exception of a few small sections of Block 93 Central and North, the remainder of the area included in the field demonstration is developed or covered with fill material or asphalt.

Site History

From approximately 1878 to 1971, a large portion of the Site was used to process coal tar and produce paving and roofing materials, first by Barrett Manufacturing Company and later by Allied Chemical Corporation. Sanborn fire insurance maps from 1900 to 1944 identify the property as the "Barrett Company's Shadyside Plant, Manufacturers of Tar Products." Allied Chemical Corporation's Asphalt Division took over operations of the coal tar distillation plant in the early 1930s. The coal tar processing plant operated until 1974, when the former Barrett property was sold to James Frola (now deceased) and Albert Von Dohln. From 1974 through 1980, the property was operated by numerous entities involved in the oil recycling business, many of which were owned or controlled by Russell Mahler. In 1977, the former Barrett property was leased to E.R.P. Corporation for the storage and recycling of oil. The lease was assigned to Edgewater Terminals, Inc., and then transferred to Quanta Resources Corporation in July 1980. The property contained 61 ASTs, at least 10 underground storage tanks (USTs), septic tanks, and underground piping. The total storage capacity of the tanks was over 9 million gallons.

The New Jersey Department of Environmental Protection (NJDEP) closed the facility in 1981 after discovering polychlorinated biphenyls (PCBs) in some of the oil stored at the facility. On October 6, 1981, Quanta Resources Corporation filed for bankruptcy. Following operational shutdown, NJDEP requested that USEPA address Site contamination pursuant to CERCLA. Since then, multiple non-time-critical removal actions have occurred at the Site. The Final ROD for OU1 was issued in September 2011.

The predominant Site contaminants, coal tar constituents and arsenic, are commonly found in urban settings. These constituents have also been identified as primary Site contaminants in Site investigations performed on nearby properties (e.g., for example, Celotex and Lever Brothers).

The primary objective of field work planned in 2013 is to conduct a field demonstration to evaluate implementation of identified reagents and dosages for solidification and stabilization capable of meeting the performance criteria identified in the ROD. The ROD specifies that most of the non-aqueous phase liquid (NAPL) and arsenic areas identified as source areas will be solidified/stabilized in situ, including NZ-1, NZ-2, NZ-5, a portion of NZ-3, the High-concentration Arsenic Area (HCAA), and seven arsenic areas outside the HCAA. Of these, the HCAA will be stabilized, and the remaining areas will be solidified. The field demonstration will involve the following activities:

- Site preparation
- In situ solidification/stabilization (ISS) demonstration
- In situ chemical fixation (ISCF) within the HCAA
- Site restoration

The likely facilities needed to support the field demonstration are shown in Figure 3 and described in the following subsections. Refinements to these components may occur prior to the start of testing at the request of the subcontractor.

Project Components Detail

Site Preparation

Site preparation activities will include clearing and grubbing of brush and trees within the treatment areas. Staging and chemical storage areas, temporary facilities, and base of operations will be established. Overall Site stormwater and erosion controls will be established, and stockpile areas for debris sizing and staging will be designated. A utility locate will be performed if conditions require any of the field demonstration locations to be moved from the five planned locations (previously cleared for utilities during the Preliminary Design Investigation [PDI]). Signage, barricades, and caution tape will be used to designate and control access to the work zones.

Field Demonstration Scope of Work

The field demonstration will consist of two main components to meet the required performance criteria established in the ROD, as follows:

1. Solidification of NAPL, comingled NAPL/arsenic, and arsenic areas outside the HCAA using a cement/slag mixture
2. Chemical stabilization of arsenic impacts within the HCAA using a ferrous sulfate reagent and magnesium hydroxide buffer

Solidification

The ISS field demonstration is proposed for five separate areas. Four of the areas will encompass approximately 20 feet by 20 feet and have been targeted to evaluate the remedy on a variety of subsurface conditions (that is, contaminant concentrations, soil types, and depth). A total volume of approximately 1,140 cubic yards (yd^3) is estimated for ISS treatment based on Table 1. An additional area with a total treatment volume of approximately 1,320 yd^3 will be included during the field demonstration to accommodate Site changes. This additional area is located south of the 115 River Road building (Figure 3).

TABLE 1
In Situ Solidification/Stabilization Treatment Summary

ISS Location	Area Depth (Feet)	Mix Volume (yd^3)	Mixing Type
A-02	22	325	Auger
AN-02	15	222	Bucket
N-01	25	370	Auger
N-04	15	222	Bucket
Utility Corridor (Alternate)	10	1,320	Bucket

ISS works through large augers or bucket mixing, which inject/mix a combination of slag/cement into or through the ground. To provide information on both techniques during the field demonstrations, two locations will be augured, and two locations will be mixed with a bucket. Onsite mixing stations will be used to mix and inject the slag/cement.

Prior to ISS activities, surficial (approximately 0 to 5 feet below ground surface [bgs]) debris will be managed and removed. These materials will be managed onsite or, if determined to be incompatible with remedial methods, will be analyzed to determine proper disposal and transported offsite for disposal in accordance with the Resource Conservation and Recovery Act (RCRA) and New Jersey requirements.

In accordance with the Area of Contamination Policy (see Section 3), groundwater encountered during mixing will be managed by using the groundwater as the water in the ISS mix or by pumping from an active field

demonstration area into another field demonstration area within the area of contamination. Groundwater will not be allowed to overflow field demonstration areas. If groundwater volumes exceed the capacity of the treatment areas, it will be managed in accordance with the ROD, and RCRA and New Jersey requirements.

Stabilization

The field demonstration within the HCAA uses stabilization of contaminants (specifically, arsenic) techniques. Implementation will include installation of vertical injection wells and subsequent installation of horizontal injection wells (to be determined based on the results from the vertical injection well). ISCF will include application of ferrous sulfate followed by magnesium hydroxide injected into the ground via these vertical and horizontal injection wells. Waste produced during the HCAA field demonstration will include soil cuttings from well installations, miscellaneous debris from well installations, purge water from monitoring well development and subsequent sampling, excess reagent and buffer, and potentially excess groundwater during extraction. It is anticipated that all groundwater extracted during the injection testing will be used in the makeup of the reagent slurry. Waste generated during the HCAA field demonstration will be containerized and disposed of offsite in accordance with RCRA and New Jersey requirements.

Site Restoration

Site restoration activities will be conducted following the completion of the field demonstration. Restoration activities will comprise various decommissioning activities, including removing debris or trash, applying erosion control measures, grading of surface soil to match existing grade, installing temporary fencing, and decommissioning all temporary facilities and equipment. Waste generated during the field demonstration will be tested and disposed of offsite in accordance with regulatory requirements. Because additional remedial actions are intended following the field demonstration, the ISS areas will be graded to match existing grade when the field demonstration is completed.

Schedule

The following list provides an overview of the construction schedule. The schedule may be refined following selection of the remediation contractor. Changes may be associated with changing Site conditions encountered during the field demonstration, sequencing efficiencies, or engineering refinements, but will not change performance requirements.

- July 2013—Finalize Design
- July/August 2013—Field Demonstration Contractor Procurement
- August/September 2013—Site Mobilization and Set Up
- September/October 2013—Field Demonstration
- October/November 2013—Offsite Waste Disposal
- October/November 2013—Site Restoration/Demobilization

SECTION 2

Compliance Statement

This compliance statement is voluntarily provided to aid in NJDEP's review of the proposed field demonstration and its compliance with substantive requirements of federal and state regulations, guidelines, and policies.

New Jersey Department of Environmental Protection Waterfront Development Act Compliance

Based on input received from NJDEP, Site Remediation Program, and EPA on July 9, 2013, a Waterfront Development Permit Equivalency application will not be required for the field demonstration phase of remediation activities on OU1 due to the CERCLA status of the activities, the limited nature of disturbance, and the location of the majority of the demonstration activities outside of the regulated waterfront. Instead, this compliance statement is being submitted to the NJDEP Division of Land Use Regulation (DLUR), as a demonstration of compliance with the Coastal Program Permit Rules (NJAC 7:7) and Coastal Zone Management (CZM) Rules (NJAC 7:7E) for ISS. All work will be performed above the mean high-water line. The CZM Rules (NJAC 7:7E) applicable to the field demonstration are identified in the following subsections. The applicable portion of the CZM Rules and how the project will comply with these requirements is described in the following subsections.

Subchapter 3, Special Areas

The following NJAC Special Areas are not applicable to the field demonstration because no work will be performed within the water, the Site is not located within the specific area, or the feature does not exist on the Site:

- 7:7E-3.2 Shellfish habitat
- 7:7E-3.3 Surf clam areas
- 7:7E-3.4 Prime fishing areas
- 7:7E-3.5 Finfish migratory pathways
- 7:7E-3.6 Submerged vegetation habitat
- 7:7E-3.7 Navigation channels
- 7:7E-3.8 Canals
- 7:7E-3.9 Inlets
- 7:7E-3.10 Marina moorings
- 7:7E-3.11 Ports
- 7:7E-3.12 Submerged infrastructure routes
- 7:7E-3.13 Shipwreck and artificial reef habitats
- 7:7E-3.14 Wet borrow pits
- 7:7E-3.15 Intertidal and subtidal shallows
- 7:7E-3.16 Dunes
- 7:7E-3.17 Overwash areas
- 7:7E-3.18 Coastal high hazard areas
- 7:7E-3.19 Erosion hazard areas
- 7:7E-3.20 Barrier island corridor
- 7:7E-3.21 Bay islands
- 7:7E-3.22 Beaches
- 7:7E-3.24 Existing lagoon edges
- 7:7E-3.31 Coastal bluffs
- 7:7E-3.33 Farmland conservation areas
- 7:7E-3.34 Steep slopes
- 7:7E-3.35 Dry borrow pits

- 7:7E-3.37 Specimen trees
- 7:7E-3.42 Excluded federal lands
- 7:7E-3.43 Special urban areas
- 7:7E-3.44 Pinelands National Reserve and Pinelands Protection Area
- 7:7E-3.45 Hackensack Meadowlands District
- 7:7E-3.46 Wild and scenic river corridors
- 7:7E-3.49 Atlantic City

The following Special Areas potentially apply to the field demonstration activities.

7:7E-3.23 Filled Water's Edge

The Site contains areas defined as filled water's edge. Site development is not planned as part of the field demonstration. Therefore, the project complies with NJAC 7:7E 3.23.

7:7E-3.25 Flood Hazard Areas

The Flood Hazard Area extends across the entire project site, which is classified as an A2E flood zone according to the Federal Emergency Management Association (FEMA) (Figure 4). Although the project is within the Flood Hazard Area, no impact on the flood hazard area is anticipated during the field demonstration. The proposed project does not include permanent structures that may obstruct tidal and stormwater flows, has minimal effect on the impervious area, and does not preclude future water-dependent uses. Therefore, the field demonstration will comply with this requirement.

7:7E-3.26 Riparian Zones.

The Hudson River is a regulated Category 1 water area according to the Flood Hazard Area Control Act rules (N.J.A.C. 7:13-2.2). The New Jersey Flood Hazard Area Control Rules, NJAC 7:13-4.1(a)4, state that a riparian zone exists along every regulated water body. The riparian zone for Category 1 waters extends 300 feet landward from the centerline of the water body. Activities associated with the field demonstration are outside of the riparian zone.

OU1 is currently disturbed and contains sparse vegetation as a result of historical placement of fill. Soil erosion and sediment control measures will be implemented to protect the surrounding riparian zone beyond the work area. The project, therefore, will be in compliance with this requirement.

7:7E-3.27 Wetlands and 7:7E-3.28 Wetlands Buffers

Wetlands are defined as areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation. A wetland buffer or transition area may be required depending on the functional value of the wetland.

Although a review of the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory, Wetlands Mapper (http://107.20.228.18/Wetlands/WetlandsMapper.html), indicates the land area that constitutes OU1 does not contain wetlands and much of the Site consists of non-native fill, hydric soils were identified in one location and *Phragmites* vegetation in another location. As a result, a field reconnaissance/survey was conducted on June 24, 2013 to determine if wetlands, water bodies, or transition areas were within the "work zones" identified on Figure 3.

During the survey, a CH2M HILL biologist observed that the Site is able to support wetland vegetation adapted to low quality conditions. It appears that the dense fill material, compacted by years of heavy equipment usage, retains surface water runoff from surrounding developed land on higher ground. In conjunction with the accumulation of sediments on top of the fill, wetland vegetation has become established. The situation is similar to one where silt accumulates in a concrete lined drainage channel and is able to support cattails. Based on the disturbed nature of the site, soil borings, the presence of dense fill material, and field investigations, it was determined that the features on the Quanta site do not meet all three parameters of a wetland (hydrology, vegetation, soils).

7:7E-3.36 Historic and Archaeological Resources

A Stage IA Literature Search and Sensitivity Analysis (also known as a Stage IA Cultural Resources Survey) of OU1 was conducted in accordance with the January 2007 Work Plan (approved by USEPA on February 26, 2007). The following paragraphs describing the conclusions of the survey duplicate the material presented in the Stage IA Cultural Resources Survey Report submitted to USEPA on May 30, 2007:

> *No properties currently listed on the State or National Registers of Historic Places are present within [the Quanta property] or the greater Project Area [i.e., OU1] where remediation activities are proposed. A single property previously determined to be eligible for the National Register—the Spencer Kellogg and Sons, Inc. Pier and Transit Shed—is located within the Project Area, on the southern edge of [the Quanta property]. The Spencer Kellogg and Sons, Inc. pier and transit shed were determined eligible under criteria A and C in 1984. In the intervening 23 years, the pier and transit shed were razed and rebuilt as a two-story parking garage. The resource now lacks integrity and thus, in the opinion of JMA, is no longer considered an eligible property. South of [the Quanta property] the Spencer Kellogg and Sons, Inc. production and pressing plant was determined to be ineligible for the NRHP in 1984. The files of the New Jersey HPO and the NJSM were reviewed and no previously recorded archeological sites are known to exist in or near the Project Area.*
>
> *The proposed remediation activities confined within the site will not adversely affect any significant archeological or historical resources. However, similar remediation, if carried out on Block 93, may affect potentially significant historic architectural resources.*

Based on the findings of the Stage IA Cultural Resources Survey and the location of the field demonstration, the activities will comply with the historic and archeological resources requirements.

7:7E-3.38 Endangered or Threatened Wildlife or Plant Species Habitat

The occurrence of threatened and endangered species within a 1 mile radius of OU1 was evaluated by contacting the USFWS (January 26, 2006), National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (January 26, 2006), and the NJDEP Natural Heritage Program (February 7, 2006). Information was requested for both terrestrial and aquatic species, although the Screening-level Ecological Risk Assessment (ERA) (November 2007) addressed only terrestrial receptors.

Information provided by the USFWS indicated that no federally listed or proposed endangered or threatened flora or fauna were known to occur within a 1-mile radius of the Site. The New Jersey Natural Heritage Database and the Landscape Project did not indicate the occurrence of any rare wildlife or plant species or ecological communities within a 1-mile radius of OU1. A follow-up information request will be made to the USFWS to verify the previous results that no threatened or endangered species or any rare wildlife or plant species or ecological communities exist.

As a result, the field demonstration will comply with this requirement.

7:7E-3.40 Public Open Space

Public open space constitutes land areas owned or maintained by state, federal, county, and municipal agencies or private groups (such as conservation organizations and homeowners associations); and used for or dedicated to conservation of natural resources, public recreation, visual or physical public access, or wildlife protection or management. The Site is privately owned and is a CERCLA NPL site. During remedial actions, public access will be restricted. As a result, the field demonstration will comply with this requirement.

7:7E-3.41 Special Hazard Areas

Special hazard areas include areas with a known actual or potential hazard to public health, safety, and welfare, or to public or private property, such as where hazardous substances, as defined by New Jersey Statutes Annotated (NJSA) 58:10-23.11b-k, are used or disposed of, including adjacent areas and areas of hazardous material contamination. Typically, approvals from NJDEP's Division of Solid and Hazardous Waste are obtained before

beginning hazardous substance investigations or cleanup activities at contaminated sites. The Quanta Resources Site is a CERCLA NPL site; therefore, is known to contain potentially hazardous materials.

The purpose of this project is to perform a field demonstration of the proposed remedial option that will ultimately lead to remediation of the hazardous materials contained within the Site. Investigations have been conducted to indicate contamination levels and to provide data for designing the remedial option. Based on engineering evaluation and review, the recommended remedial actions include ISS of contaminant principal source areas.

Hazardous material (including hazardous waste) handling will be conducted following appropriate best management practices (BMPs) to reduce health and safety hazards to the extent practical for compliance with this requirement.

7:7E-3.47 Geodetic Control Reference Marks

According to the U.S. Geologic Survey (USGS) 1995 7.5 minute Central Park NY-NJ quadrangle there are no survey markers located at the Site. Therefore, the project would have no effect on geodetic control reference marks and would be in compliance with this requirement.

7:7E-3.48 Hudson River Waterfront Area

The project is within the Hudson River Waterfront Area; however, development is not part of the field demonstration. Over the longer term, remediation activities will enhance the waterfront. Therefore, the field demonstration is in compliance with this requirement.

Future development performed by others, which may occur after completion of this project, will require compliance with Hudson River Waterfront Area development and with all other applicable CZM rules, with particular attention given to the following:

- NJAC 7:7E- 3.40 Public open space
- NJAC 7:7E-3.41 Special hazards areas
- NJAC 7:7E- 3.43 Special urban areas
- NJAC 7:7E-3.50 Lands and waters subject to public trust rights
- NJAC 7:7E-7.14 High-rise structures
- NJAC 7:7E-8.11 Public trust rights
- NJAC 7:7E-8.12 Scenic resources and design
- NJAC 7:7E-8.4 Water quality

7:7E-3.50 Lands and Waters Subject to Public Trust Rights

Lands and waters subject to public trust rights are tidal waterways and their shores, including both lands now or formerly below the mean high-water (MHW) line, and shores above the MHW line. The waterfront portion of OU1 is within a currently or formally flowed area shown in NJDEP Tidelands maps 714-2184, with grants previously issued and shown on Figure 3. Based on the Tidelands map, the field demonstration areas are outside of the Tidelands, with the exception of a small area of the ISS utility corridor. This Tidelands area is identified as being granted to the New York Transit Co. Prior to initiation of field demonstration activities, the Tidelands Bureau will be contacted to confirm whether additional action is needed.

7:7E-4.1 General Water Areas

General Water Areas, as defined by NJAC 7:7E-4.1, are all water areas that are located below either the spring high-water line or the normal water level of non-tidal water subject to this subchapter and to Special Area rules. The Hudson River is a General Water Area, as defined in NJAC 7:7E 4.1(b)5 as a “large river.” No dredging or filling will occur in the waterway; therefore, the field demonstration complies with this requirement .

Subchapter 5, Requirements for Impervious Cover and Vegetative Cover for General Land Areas and Certain Special

This subchapter of the Coastal Zone Management Act sets requirements for impervious cover and vegetative cover on sites in the upland waterfront development area, as defined in NJAC 7:7E 5.1, and the applicable cover limits and vegetative cover percentages as determined under NJAC 7:7E 5A, based on the Site's growth rating, development potential, and environmental sensitivity. The regulation also allows for an increase of impervious cover limits for contaminated sites in order to properly remediate the contaminated portion of the site.

The approximate area estimated to be rendered impervious during the field demonstration is 0.1 acre. Because a limited area will be impacted, the field demonstration will comply with this requirement.

Subchapter 6, General Location Rules

7:7E-6.2 Basic Location Rule

The field demonstration is in an area that is environmentally degraded due to a variety of environmental impacts and a history of industrial land use. OU1 is not considered an exceptional wildlife habitat. The remedial area is a CERCLA NPL Site, which is a known contaminated site. This field demonstration and related remediation project will improve the environment, and public health and safety related to the Site because Site contaminants will be solidified/stabilized in accordance with ROD requirements, with a net goal of reducing impacts to human health and the environment. Therefore, the field demonstration complies with this rule.

7:7E-6.3 Secondary Impacts

Secondary impacts are the effects of additional development likely to be constructed as a result of a particular proposal. Secondary impacts can also include traffic increases, increased recreational demand, and any other offsite impacts generated by onsite activities that affect the Site and surrounding region. The field demonstration will occur over a short duration, be performed onsite with the exception of offsite transport of waste, and no permanent development is planned. Therefore, this project complies with this rule.

Subchapter 8, Resource Rules

7:7E-8.4 Water Quality

The Hudson River is categorized as an FW2-NT/SE2 water body. The designated uses of FW2 water bodies according to NJAC 7:9B-1.12 are:

1. *Primary contact recreation;*
2. *Industrial and agricultural water supply;*
3. *Public potable water supply after conventional filtration treatment (a series of processes including filtration, flocculation, coagulation, and sedimentation, resulting in substantial particulate removal but no consistent removal of chemical constituents) and disinfection; and*
4. *Any other reasonable uses.*

The designated uses of SE2 water bodies according to NJAC 7:9B-1.12 are:

1. *Maintenance, migration and propagation of the natural and established biota;*
2. *Migration of diadromous fish;*
3. *Maintenance of wildlife;*
4. *Secondary contact recreation; and*
5. *Any other reasonable uses.*

The field demonstration is in compliance with this rule because no work will be performed within the water body. The overall remediation project is designed to improve long-term water quality in the area.

7:7E-8.10 Air Quality

Impacts due to generation of dust, attributable to ISS-related activities, during the field demonstration are anticipated. Continuous air monitoring will be performed during the field demonstration to (1) demonstrate that concentrations of contaminants of concern (COCs) at the property boundaries are less than the risk-based

screening levels for residential populations, (2) demonstrate that concentrations of COCs within the exclusion zone are less than worker health and safety action levels, and (3) demonstrate the efficacy of odor and dust control mitigation methods. The field demonstration will be in compliance with this rule.

7:7E-8.11 Public Trust Rights

Public trust rights to tidal waterways and their shores established by the Public Trust Doctrine include public access, which is the ability of the public to pass physically and visually to, from, and along lands and waters subject to public trust rights, as defined by NJAC 7:7E-3.50, as well as to use these lands and waters for recreational activities. Public trust rights also include the right to perpendicular and linear access. Public access ways and public access areas provide a means for the public to pass along and use lands and waters subject to public trust rights. Because this is a CERCLA action, and for the safety of the general public, public access to the field demonstration areas will not be provided during the ISS. At the conclusion of the field demonstration, existing access will be restored, consistent with this requirement.

7:7E-8.14 Traffic

Field demonstration activities will be performed within the OU1 Site boundary and, specifically, within the Quanta Resources property boundary. Transport routes for vehicle traffic will be established prior to the start of work. The subcontractor will establish a traffic control plan for any work in locations where public traffic may be encountered, including the use of barricades and spotters. Work performed in public traffic areas will be conducted in accordance with the substantive requirements of the Borough of Edgewater, New Jersey, Ordinance No. 1109-97 (Chapter 236, Article II, of the 1975 Code).

No permanent impacts to the current traffic patterns on local roads and highways are anticipated, so the project will comply with this requirement.

7:7E-8.22 Solid and Hazardous Waste

The project will conform with all applicable state and federal regulations, standards, and guidelines for the handling and disposal of solid and hazardous wastes, including the Solid Waste Management Act, NJSA 13:1E-1 et seq.; the Solid Waste Management rules, NJAC 7:26; and the Hazardous Waste rules, NJAC 7:26G. The purpose of the project is to test methods for solidification/stabilization of contaminants within specific areas of OU1. Contaminated soil, debris, or groundwater that cannot be stabilized/solidified in accordance with the goals established in the ROD are considered solid waste. Possible waste streams that may be generated during the field demonstration include contaminated soil and groundwater, NAPL, and contaminated debris. Waste characterization samples will be collected and analyzed to classify waste prior to offsite transport for disposal.

Therefore, this project complies with this requirement.

SECTION 3

Regulations, Guidelines, and Policies

The following regulations, guidelines, and policies will be applied to activities performed during the field study.

Area of Contamination Policy

When appropriate, soil and groundwater will be managed in accordance with the USEPA Area of Contamination policy. An area of contamination is delineated by the areal extent or boundary of contiguous contamination. The contamination must be touching, but may continue to varying types and concentrations of hazardous substances. In general, a CERCLA area of contamination is the same as a single RCRA land-based unit (55 Federal Register [FR] 8760; March 8, 1990). Wastes or contaminated media can be moved, consolidated, or treated in situ within an area of contamination without being generated or triggering land disposal restrictions (LDRs), RCRA minimum technology requirements (MTRs), or other RCRA hazardous waste requirements as long as the waste is not managed in containers, tanks, or other non-land-based units. When wastes or contaminated media are removed from the area of contamination, they are considered generated. Note that USEPA has also stated that waste consolidated from different units or areas of contamination at a CERCLA facility is subject to any applicable RCRA requirements, regardless of the volume of the waste or the purpose of the consolidation (55 FR 8760).

Soil and groundwater may be managed within the AOC during the field demonstration.

Underground Injection Control

The primary goal of the field demonstration is to evaluate the effectiveness of injecting solidifying/stabilizing chemicals into the ground to meet cleanup goals established in the ROD. Regulations included as ARARs for the Site, which are associated with underground injection, include:

- 40 Code of Federal Regulations (CFR) 144 – Federal Underground Injection Control (UIC) regulations
- NJAC 7:14A – New Jersey UIC regulations
- NJAC 7:26e –New Jersey Technical Requirements
- NJAC 7:14A – 8.5 (b)(11) allows for performing injections into Class V wells by permit-by-rule for underground injection wells used during remediation of a contaminated site where the person conducting the remediation meets the conditions set forth at NJAC 7:14A 7.5(b)

NJAC 7:14A 7.5(b) states that any person responsible for the discharges to groundwater listed in (b)3i through the following clause vii is deemed to have a permit-by-rule if the discharge occurs when:

1. *A contaminated site, as defined in NJAC 7:26E-1.8, is being remediated pursuant to the rules at NJAC 7:14B implementing the Underground Storage of Hazardous Substances Act (NJSA 13:1K-6 et seq.), these the requirements of the Spill Compensation and Control Act (NJSA 58:10-23.11), or the Administrative Requirements for the Remediation of Contaminated Sites rules at NJAC 7:26C; and*
2. *The person is in receipt of written approval of the discharge from the Department.*
3. *The following ground water discharges are authorized by permit-by-rule under this subsection:*
    i. *Discharges to ground water, not to exceed 180 calendar days, from pilot treatment plants to obtain engineering design data;*
    ii. *Discharges to ground water related to biotreatability studies where the discharge will not exceed 180 calendar days;*
    iii. *Discharges to ground water, not to exceed 30 calendar days, from wells to test aquifers for the purpose of obtaining engineering and hydrogeologic design data;*

iv. Discharges to ground water not to exceed 180 calendar days, from any other facility or equipment associated with engineering studies, remedial action selection, or design studies and associated monitoring;

v. Discharges to ground water to remediate contamination from discharges of heating oil as defined at NJAC 7:14A-1.2, at a residential building of four units or less;

vi. Discharges to ground water, not to exceed 180 calendar days, related to dewatering at a contaminated site or regulated underground storage tank facility; and

vii. Discharges to ground water, including those listed in (b)3i through vi above, that occur during the course of a site remediation when the person responsible for conducting the remediation submits a proposal in accordance with the Technical Requirements for Site Remediation, NJAC 7:26E, including the requirements of NJAC 7:26E-7.2.

The field demonstration meets the requirements of Item i to perform the underground injections under a permit-by-rule. A work plan will be provided to NJDEP for review and approval prior to mobilization. Written approval of the work plan from NJDEP will indicate authorization to perform underground injections in accordance with the permit-by-rule requirements.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA, 1918, 16 United States Code [USC] 703-711, and subsequent amendments) established a federal prohibition to:

> *…pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention for the protection of migratory birds or any part, nest, or egg of any such bird. (16 USC 703)*

Activities that might cause harm to migratory birds (as detailed) are prohibited by federal law. There is no general 'taking' provision, whereby one could apply for a permit that would allow loss of some individual birds, so MBTA compliance requires avoidance of harmful impacts to protected birds. The MBTA is administered by the USFWS.

Prior to any field work commencing, a Site walk will be performed to evaluate if any migratory birds are present at the Site and whether avoidance actions will be needed.

Chemical Storage (Tier 2)

New Jersey employers who are engaged in certain types of business activities specified by the New Jersey Worker and Community Right to Know Act (CRTK) and regulations are required to submit a survey to NJDEP for each of their facility locations. These employers are identified by the North American Industry Classification System (NAICS) codes assigned to them by the New Jersey Department of Labor and Workforce Development (DLWD). New Jersey businesses whose NAICS codes do not appear in the list of covered codes may still be required to complete the survey under federal law, specifically Section 312 of the Emergency Planning and Community Right to Know Act (EPCRA). If the facility owner/operator is required to maintain Material Safety Data Sheets (MSDSs) for hazardous substances in accordance with the Occupational Safety and Health Administration's (OSHA's) Hazard Communication Standard, and quantities of these substances at the facility were at or greater than 10,000 pounds at any one time during the reporting year, the facility must complete the survey for these substances, unless federal exemptions apply. Also under EPCRA, any substance listed on the Extremely Hazardous Substance (EHS) list with an asterisk (denoting it as an EHS) must be reported in the survey if present at or greater than 500 pounds or the designated Threshold Planning Quantity (TPQ). The completion of the CRTK survey replaces the federal forms (Tier I or II) required by Section 312 of EPCRA.

Stormwater Management and Erosion Controls

Field demonstration activities are estimated to disturb less than 0.1 acres. Therefore, a stormwater management plan is not required. Stormwater will be managed locally using erosion control measures. Measures may include, but are not limited to, use of hay bales or silt fences around the perimeter of the field demonstration areas, placement of equipment on existing paved areas, covering field demonstration areas during storm events, and regular inspection of erosion control measures.

Waste Management

It is anticipated that the following wastes will be generated during the field demonstration, which will require onsite management or offsite disposal:

- Cleared vegetation
- Debris (for example, buried wood and concrete)
- Contaminated debris (personal protective equipment [PPE], and disposable sampling equipment)
- Soils cuttings from well installation
- NAPL
- Potentially contaminated surface and groundwater, including:
  - Monitoring well development water
  - Decontamination water
  - Purged groundwater

Some of the waste generated during the field demonstration will be transported offsite for treatment or disposal. A waste management plan will be prepared for the field demonstration, documenting procedures for compliance with applicable portions of RCRA, 40 CFR, Parts 239 through 282, and NJAC 7:26G-1 et seq.

Comprehensive Environmental Response, Compensation, and Liability Act Offsite Rule

Waste from the Site may only be shipped to an offsite facility if the offsite facility has been approved by USEPA under the offsite rule for use by CERCLA sites (40 CFR 300.440). Prior to offsite waste transport, USEPA will be contacted to verify the facility is approved for receipt of waste from CERCLA sites.

NJDEP Permit Readiness Checklist

Updated 2/27/13

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

OFFICE OF PERMIT COORDINATION AND ENVIRONMENTAL REVIEW

PERMIT READINESS CHECKLIST

FOR PCER OFFICE USE ONLY

DATE RECEIVED _____ PRC ID NUMBER _____

Completion of this form will assist the Department in determining what permits might be needed to authorize a project and to insure that all appropriate programs attend a pre-application meeting. Please fill out the below form as completely as possible, noting any areas you are not sure of and including any information about the project and the site that might help the Department determine the permitting needs of the project.[1]

1. Please complete the following questions if applicable and return to the Department with a 1 to 2 page narrative description of project, its function, and its benefits.

[1] Please be advised that this form is not a permit application. To receive authorization, approval, or a permit to conduct regulated activities, a formal application must be filed and a formal permit or authorization issued by the appropriate Bureau within the Department prior to the conduct of regulated activity. This form is used solely for the Department's preliminary review and discussion of this project to determine what permits or authorizations may be needed to conduct the proposed activity. Any guidance offered to the applicant during this process is not binding on the Department or the applicant and a final response can only be rendered through the actual issuance of permits, approvals, or authorizations.

A. GENERAL INFORMATION

1. Name of Proposed Project Quanta Resources Corporation

2. Consultant/Contact Information (if any) Stephen Zarlinski/CH2M HILL
   7927 Nemco Way, Suite 120
   Brighton, MI 48116
   810-360-2061

3. Name/Address of Prospective Applicant Steven Coladonato
   Address/tel./fax 6100 Philadelphia Pike, Claymont, DE 19703/302-791-6738
   Company Name Honeywell International
   Address/tel./fax _____

4. Does the project have any existing NJDEP ID#s assigned Superfund Identification #: NJD000606442

i.e., Case number, Program Interest (PI)#, Program ID#?

B. PROPOSED PROJECT LOCATION

Street Address/munic. Quanta Resources Corporation/163 River Road, Edgewater, NJ
County Bergen Zip Code 07020
Block No. 91 and 95 Lot No. 1 and 1
X Coordinate in State Plane (project centroid) 633248.75
Y Coordinate in State Plane (project centroid) 718741.42

C. PROPOSED ACTIVITY DESCRIPTION AND SCHEDULE

1. Project Type: New Construction _____ Brownfield Redevelop. _____Alternative Energy_____ Other (Please describe) Site Remediation

    a) Estimated Schedule: Date permits needed or desired by, beginning construction date; construction completion, and operation of facility date: August 15, 2013; September 15, 2013; and January 30, 2014. (ISS test, no long-term operation.)

    b) Funding Source: Is any Federal Funding being used for this project? No

    State Funding over 1 million dollars? No

    Is funding secured at this time? _____ Is funding conditional? _____
    If so, on what?_____

    c) Is the project contingent on receiving the identified funding?

    If yes, explain

    d) What DEP permits do you think you need for this project? (The Department will confirm this through the PRC process).

    1. Coastal General Permit Equivalency (NJAC 7:7-7.15)/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) field demonstration
    2. Flood hazard applicability
    3. Possibly Transition Area Waiver or Freshwater Wetland General Permit (FWGP) 4 Hazard Site Investigation/Cleanup Permit Equivalency
    4. Authorization under permit by rule for underground injection control

2. For additional guidance on Department permits, please refer to the Permit Identification Form (PIF) which will be forwarded upon request. The PIF does not need to be filled out or submitted to the Department.

    a) Which Department(s), Bureau(s), and staff have you contacted regarding your proposed project? NJDEP – Bureau of Case Management

    b) Are there any Department permits that will need to be modified as a result of this project. Please explain and identify the project reviewer of the permit to be modified. No

    c) Please identify any pre-permit actions or modifications you have applied for or obtained from the Department or other state agencies for this project:

        1) Water Quality Management Plan consistency _____
        2) Highlands Consistency _____
        3) Wetland Delineation (LOI) _____
        4) Tidelands Conveyance _____
        5) Flood Hazard Jurisdiction or determinations _____
        6) Water Allocation _____
        7) Site Remediation RAW, Remedial Action Permit – Soil and or Groundwater, NJPDES Discharge to Ground Water, NJPDES Discharge to Surface Water, No Further Action Response Action Outcome _____

8) Landfill Disruption Approval _____

9) Landfill Closure Plan _____

10) Other _____

3. Please submit this Permit Readiness Checklist form, completed to the extent possible, electronically to Ruth.Foster@dep.state.nj.us and one (1) copy via mail[2] with the following items if available:

   a) The completed Permit Readiness Checklist;

   b) A description of the proposed project; See Project Description and Compliance Statement.

   c) Any overarching regulatory or policy call(s) or guidance that the Department must make or make known prior to the receipt of the application to determine the project's feasibility, regulatory, or review process. Written approval to perform Injection of stabilization materials under permit by Rule N.J.A.C. 7:14B. Discharges to groundwater not to exceed 180 calendar days, from any other facility or equipment associated with engineering studies, remedial action selection, or design studies and associated monitoring.

   d) USGS map(s) with the site of the proposed project site boundaries clearly delineated (including the title of the USGS quadrangle sheet from which it was taken) See attached Figure 1.

   e) Aerial photos/GIS information regarding the site; See attached Figure 2.

   f) A site map including any known environmental features (wetlands, streams, buffers, etc[3]); See attached Figure 3.

   g) Site plans to the extent available; See attached Figure 3.

   h) Street map indicating the location of the proposed project; See attached Figure 2.

   i) Any other information that you think may be helpful to the Department in reviewing this project. See Project Description and Compliance Statement.

   j) List of any local or regional governments or entities, their historical involvement in this project or site, identification of conflicts with DEP rules; with contact names and information whose attendance/input would be helpful in facilitating this project, ie Soil Conservation Districts, health departments, local zoning officials, etc. None.

D. The following are questions by Program to guide the Department in its determination of what permits may be needed to authorize this project. If the questions do not apply to the proposed project please indicate N/A. Please include any other information you think may be helpful for the Department to determine which permits are needed.

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[2] Submit to: New Jersey Department of Environmental Protection
Office of Permit Coordination and Environmental Review
P.O. Box 423, Trenton, New Jersey 08625-0423
Street Location: 401 East State Street, 7th Floor East Wing
Telephone Number:(609) 292-3600
Fax Number: (609) 777-1330

[3] NJGIS information

WATER AND WASTE WATER INFORMATION

DEP Safe Drinking Water Program (609) 292-5550 Not applicable (N/A); there will be no construction of infrastructure as part of this scope of work.

http://www.nj.gov/dep/watersupply/

Is the project located within an existing water purveyor service area? If yes, which one? _____

http://www.nj.gov/dep/gis/stateshp.html#WATPUR

Does the purveyor have adequate firm capacity and allocation to support project demand?

Do water pipes currently extend to the project location? _____

If not, is it located within a franchise area? _____

Does the project have an approved Safe Drinking Water main extension permit? _____

DEP Water Allocation Program (609) 292-2957 N/A; there will be no construction of infrastructure as part of this scope of work.

http://www.nj.gov/dep/watersupply

Is the project seeking a new ground water allocation or modification? If yes, does the project have all necessary well location and safe drinking water permits? No

Is the project located within an area of critical water supply concern? _____

Will this project have the capability to divert more than 100,000 gallons per day from a single source or a combination of surface or groundwater sources? _____

Will this project draw more than 100,000 gallons per day of ground or surface water for construction or operation?_____

WATER POLLUTION MANAGEMENT ELEMENT

DIVISION OF WATER QUALITY

Non-Point Pollution Control (609) 292-0407

http://www.nj.gov/dep/dwq/bnpc_home.htm

The **Bureau of Non-Point Pollution Control** (BNPC) is responsible for protecting and preserving the state's groundwater resources through the issuance of NJPDES Discharge to Groundwater Permits and is responsible for permitting industrial facilities and municipalities under NJPDES for discharges of stormwater to waters of the State.

Groundwater Section (609) 292-0407

This Program does not issue NJPDES-DGW permits for remediation operations.

The following definitions should be used to assist in identifying discharge activities:

Subsurface disposal system is any contrivance that introduces wastewater directly to the subsurface environment, such as, but not limited to: septic systems, recharge beds, trench systems, seepage pits, and dry wells.

Injection/recharge wells are constructed such that they are deeper than they are wide, receive effluent via gravity flow or pumping, and include dry wells and seepage pits.

Overland flow is the introduction of wastewater to the ground surface, over which the wastewater travels and eventually percolates or evaporates.

Industrial wastewater is any wastewater or discharge which is not sanitary or domestic in nature, including non-contact or contact cooling water, process wastewater, discharges from floor drains, air conditioner condensate, etc.

1. Will the project/facility have a sanitary wastewater design flow which discharges to groundwater in excess of 2,000 gallons per day? No
2. Will the project/facility generate a discharge to groundwater of industrial wastewater in any quantity? No
3. Will the project/facility involve the discharge to groundwater by any of the following activities or structures, or include as part of the design any of these activities or structures? No

Please indicate which:

Upland CDF (Dredge Spoils) Spray Irrigation _____

Overland Flow Subsurface Disposal System (UIC) _____

Landfill Infiltration/Percolation Lagoon _____

Surface Impoundment _____

Please specify the source of wastewater for every structure identified above (e.g., sanitary wastewater to a subsurface disposal system or non-contact cooling water to a dry well): _____

Please specify lining materials for each lined structure identified as being used by the proposed project and give its permeability in cm/sec (e.g., 8-inch thick concrete lined evaporation pond at 10-7 cm/sec):

_____

Does your project/facility include an individual subsurface sewage disposal system design for a facility with a design flow less than 2,000 gallons per day which does not strictly conform to the State's standards? No

Does your project involve 50 or more realty improvements? No

Stormwater Program (609) 633-7021

http://www.njstormwater.org/

http://www.state.nj.us/dep/dwq/ispp_home.html

Will your site activity disturb more than one acre? No

Will any industrial activity be conducted at the site where material is exposed to the rain or other elements? Yes, remediation activities. Soil will be augured, mixed, and treated onsite. Debris (concrete, piles, etc) will be temporarily stockpiled onsite. Erosion and sediment control measures will be placed at the site at necessary locations prior to the start of work. These measures will be inspected and maintained for the duration of the project. Following completion of work, the surface will be graded consistent with the surrounding topography.

Does your facility have an existing NJPDES permit for discharge of stormwater to surface groundwater? No

Is your facility assigned one of the following Standard Industrial Classification (SIC) Codes? NAICS Code 562190

(To determine your SIC Code see the box "Industry Code" on your New Jersey Department of Labor Quarterly Contribution Report.

DEP Pretreatment and Residuals program (609) 633-3823

Will the project involve the discharge of industrial/commercial wastewater to a publicly owned treatment works (POTW)? No

If yes, name of POTW: N/A

Volume of wastewater (gpd): N/A

Will/does this project involve the generation, processing, storage, transfer and/or distribution of industrial or domestic residuals (including sewage sludge, potable water treatment residuals and food processing by-products) generated as a result of wastewater treatment. If so, please explain. No

Surface Water Permitting (609) 292-4860

http://www.nj.gov/dep/dwq/swp.htm

Will this wastewater facility discharge to Surface Water? N/A Yes/No

If yes, state the name of the proposed receiving stream _____

Describe the proposed discharge of wastewater to Surface Water _____

If no, how is the wastewater proposed to be discharged (e.g., to be conveyed to another STP, Publicly Owned Treatment Works, etc. _____

MUNICIPAL FINANCE AND CONSTRUCTION ELEMENT

Treatment Works Approvals (609) 984-4429

Will this project include the construction, expansion or upgrade of a domestic or industrial wastewater treatment facility or an off-site subsurface disposal system that generates more then 2,000 gallons per day? No If yes, explain _____

Will the project result in a construction design of more than 8,000 gallons of water discharge per day? No

LAND USE MANAGEMENT

DEP Water Quality Management Planning Program (609) 984-6888

http://www.nj.gov/dep/wqmp/

Sewer Service N/A; there will be no construction of infrastructure as part of this scope of work.

Is the project in an approved sewer service area for the type of waste water service needed? _____

If yes, what is the name of the sewer service area? _____

Has this project received endorsement from the appropriate sewer authority with adequate conveyance and capacity? _____

Do waste water pipes currently extend to the project location? _____

Is the project consistent with and in an area covered by an up to date Wastewater Management Plan? _____

Will an amendment to the existing WQMP be required to accommodate this project? _____

If tying into an offsite treatment plant, is the capacity and conveyance system currently available? _____

What is the volume of wastewater that will be generated by the project? _____

DEP Land Use Regulation (609) 777-0454

http://www.nj.gov/dep/landuse

Does the project involve ~~development~~ (construction) at or near, or impacts to the following; describe the type and extent of development in regards to location and impacts to regulated features:

Water courses (streams) Yes; see Project Description and Compliance Statement

State Open Waters? Yes; see Project Description and Compliance Statement

Freshwater Wetlands and/or freshwater wetland transition areas? Yes; see Project Description and Compliance Statement

Flood Hazard areas and/or riparian buffers Yes; see Project Description and Compliance Statement

Waterfront development areas Yes; see Project Description and Compliance Statement

Tidally Flowed Areas Yes

Please contact the Bureau of Tidelands at http://www.nj.gov/dep/landuse/tideland.html

The CAFRA Planning Area? http://www.nj.gov/dep/gis/cafralayers.htm#cpa

No

DEP NATURAL AND HISTORIC RESOURCES

Green Acres Program (609) 984-0631

http://www.nj.gov/dep/greenacres

Does the project require a diversion of State property or parkland, lease of same, lifting of a Green Acres of Land Use deed restriction, or work within an existing easement? No Will any activity occur on State owned lands? No If so please describe. _____

Does the project require a diversion of property funded with federal Land and Water Conservation Funding? No. If so, please describe _____.

Does the project include activities that are under the jurisdiction of the Watershed Property Review Board? If so, please describe. No Has the Watershed Property Review Board made a jurisdictional determination? No

Division of Parks and Forestry: State Park Service (609) 292-2772

Is the temporary use of State lands administered by the New Jersey State Park Service required for pre-construction, construction and/or post construction activities? No If so, please describe.

Division of Parks and Forestry: State Forestry Services (609) 292-2530

http://www.nj.gov/dep/parksandforests/forest

Forest clearing activities/No Net Loss Reforestation Act

Will construction of the project result in the clearing of ½ acres or more of forested lands owned or maintained by a State entity**?** No

If so, how many acres? _____

Division of Parks and Forestry: Office of Natural Lands Management (609) 984-1339

http://www.nj.gov/dep/parksandforests/natural/index.html

Is the project within a State designated natural area as classified in the Natural Areas System Rules at N.J.A.C. 7:5A? No

If so, please describe. _____

State Historic Preservation Office – SHPO (609) 292-0061

http://www.state.nj.us/dep/hpo/3preserve/clg_links.htm

Is the site a Historic Site or district on or eligible for the State or National registry? Yes

Will there be impacts to buildings over 50 years old? No

Are there known or mapped archeological resources on the site? Yes

See Project Description and Compliance Statement.

Dam Safety Program (609) 984-0859

http://www.nj.gov/dep/damsafety

Will the project involve construction, repair, or removal of a dam? No

If so, please describe _____

Fish and Wildlife (609) 292-2965

http://www.nj.gov/dep/fgw

Will there be any shut off or drawdown of a pond or a stream? No

Threatened and Endangered Species Program

Are there records of any Threatened and Endangered species, plant, or animal in this project area? No

Will the proposed development affect any areas identified as habitat for Threatened or Endangered Species? No

SITE REMEDIATION PROGRAM (609) 292-1250

http://www.nj.gov/dep/srp/

Office of Brownfield Reuse (609) 292-1251

Is the project located on or adjacent to a known or suspected contaminated site? Yes

http://www.nj.gov/dep/srp/kcsm

Is the project within a designated Brownfield Development Area? No

Has a No Further Action, Response Action Outcome, or Remedial Action Permit been issued for the entire project area? A CERCLA Site Record of Decision (ROD) was issued in 2011. The site is being remediated under an Administrative Settlement Agreement and Order on Consent (CERCLA Docket No. 12-CV-07091-SRC-CLW) effective March 11, 2013 between the U.S. Environmental Protection Agency (USEPA) and Honeywell International (Honeywell).

If not, what is the current status of remediation activities? Please include remedial phase, media affected and contaminant(s) of concern. Proposed work is a field demonstration for a proposed remedy in accordance with the ROD.

Name of current SRP Case Manager or Licensed Site Remediation Professional and Preferred Identification (PI) Number Erica Bergman

Is the applicant a responsible party for contamination at the property? Yes

Is the project located on a landfill that will be redeveloped for human occupancy? No If yes, is there an approved Landfill Closure Plan? _____

Dredging and Sediment Technology (609) 292-1250

Does the project involve dredging or disposing of dredge materials? No

CLIMATE AND ENVIRONMENTAL MANAGEMENT

http://www.nj.gov/dep/sage/cliamte-energy.html

AIR QUALITY PERMITTING PROGRAM

http://www.nj.gov/dep/aqpp

Will activity at the site release substances into the air? Yes – vehicle, generator, drill rig, and excavator emissions and particulates (see Attachment A, Scope of Work and Compliance Statement). Air monitoring at the perimeter and personnel monitoring will be performed.

Does the project require Air Preconstruction permits per N.J.A.C. 7.27-8.2©1? No

Will your project require Air Operating permits (N.J.A.C. 7:27--22.1)? No

Will the project result in a significant increase in emissions of any air contaminant for which the area is nonattainment with the national ambient air quality standards (all of NJ for VOC and NOx; 13 counties for fine particulates), thereby triggering the Emission Offset Rule at NJAC7:27-18? No

Will the project emit group 1 or 2 TXS toxic substances listed in NJAC 7:27-17? No

Will the project emit hazardous air pollutants above reporting thresholds in NJAC7:27 8, Appendix 1? No

Will the project result in stationary diesel engines (such as generators or pumps) or mobile diesel engines (such as bulldozers and forklifts) operating on the site? If so, which? Yes, vehicle, generator, drill rig, and excavator emissions and particulates. See Attachment A, Project Description and Compliance Statement.

SOLID AND HAZARDOUS WASTE MANAGEMENT PROGRAM (609) 633-1418

Does the project receive, utilize, or transport solid or hazardous wastes? Yes; transport solid and hazardous waste offsite.

Will the project involve the disposing of hazardous Substances per 40 CFR part 261 and NJAC 7:26? Yes, possible wastes include soil cuttings and groundwater from well installation and soil mixing activities.

Will the project include operation of a solid waste facility according to N.J.A.C. 7:26-1-et seq.? No

If the project is a solid waste facility or recycling center, is the project included in the appropriate county Solid Waste Management Plan? _____ Explain _____

RADIATION PROTECTION AND RELEASE PREVENTION (609) 984-5636

www.state.nj.us./dep/rpp

Will the operation receive, store or dispose of radioactive materials? No

Will the operation employ any type of x-ray equipment? No

DISCHARGE PREVENTION PROGRAM (DPCC) (609) 633-0610

www.nj.gov/dep/rpp

Is this a facility as defined in N.J.A.C. 7:1E in which more than 20,000 gallons of Hazardous substances other then petroleum or greater than 200,000 gallons of petroleum are stored? No

TOXIC CATASTROPHE PREVENTION ACT (TCPA) (609) 633-0610

www.nj.gov/dep/rpp

Is this a facility that handles or stores greater than a threshold amount of extraordinarily hazardous substances as defined in N.J.A.C. 7:31? No

SUSTAINABILITY AND GREEN ENERGY (SAGE)

http://www.nj.gov/dep/sage

GREEN DESIGN (609) 777-4211 N/A; there will be no infrastructure construction.

Have you incorporated green design features into this project? Examples of green design features may include: renewable energy, water conservation and use of low impact design for stormwater.

Yes_____ No_____

Will this project be certified by any of the following green building rating systems?

New Jersey Green Building Manual? _____

http://greenmanual.rutgers.edu/

US Green Building Council's LEED (Leadership in Energy and Environmental Design)? _____

http://www.usgbc.org/

ASHRAE Standard 189.1? _____

http://www.ashare.org/publications/page/927

National Green Building Standard ICC 700-2008? _____

http://www.nahbgreen.org

USEPA's ENERGY STAR? _____

http://www.energystar.gov/index.cfm?c=business.bus_index

INNOVATIVE TECHNOLOGY (609) 292-0125

Is an environmental and energy innovative technology included in this project? □Y X N

Is this technology used for manufacturing alternative fuels? □ Y □ N

If yes, what is the non-fossil feedstock(s) used for manufacturing the fuels?
__ Biomass __ Municipal Solid Waste __ Other Non-Fossil Feedstocks

What will be the primary use of the manufactured alternative fuels?
__ CHP System __ Micro Turbine __ Fuel Cells

For other innovative technology type, what is the proposed application?

__ Energy __ Site Remediation __ Drinking Water __ Wastewater

For other innovative energy systems, what is the source of energy?

__ Solar __ Wind __ Tidal/Wave __ Hydroelectric __ Geothermal

Is there independent third-party performance data for the technology? □ Y □ N

Has the technology been verified by an independent third-party entity? □ Y □ N

Is this technology in use at any other location at this time? □ Y □ N

If yes, please provide location _____

DEP COMPLIANCE AND ENFORCEMENT

Does the applicant have outstanding DEP enforcement violations, and if so, what is the status? No

If yes, please identify the case, case manager, program, and phone number. _____

Does the proposed project facilitate compliance where there is a current violation or ACO? _____

COMMUNITY ENGAGEMENT (609)292-2908

The Department is committed to the principles of meaningful and early community engagement in the project's approval process. The Department has representatives available who could discuss community engagement issues with you and we encourage this communication to take place at the earliest possible time.

On July 21, 2010, USEPA released to the public for comment the Proposed Plan and supporting documentation for this action, the final remedy for upland portions of the site referred to as Operable Unit 1 (OU1)**.** USEPA made these documents available to the public in the administrative record repositories maintained at the USEPA Region 2 office (located at 290 Broadway, New York, New York), and at the Edgewater Free Public Library (49 Hudson Avenue, Edgewater, New Jersey). A smaller group of documents was made available online (http://www.epa.gov/region02/superfund/npl/quanta/). USEPA published a notice of availability for these documents in *The Record*, and opened a public comment period from July 21 to August 19, 2010.

On August 3, 2010**,** USEPA held a public meeting at the Edgewater American Legion Hall on River Road in Edgewater, New Jersey to inform local officials and interested citizens about the Superfund process, review the planned remedial activities at the site, and respond to questions from area residents and other attendees. On August 4, 2010, less formal public availability sessions were also held at the American Legion Hall. A second public meeting was held on September 13, 2010. USEPA posted the entire project

details for public review and comment, and provided a press release on August 24, 2010. There was a 7-day public review period.

(a) What community groups and stakeholders have you identified that may be interested in or impacted by this project?

(b) How have you or will you engage community and stakeholders in this project? Please supply individuals or stakeholder groups contacted or who have been identified for community engagement.

(c) What are the potential impacts of this project on the community?

(d) How do you intend to mitigate these potential impacts?

(e) What are the community concerns or potential concerns about this project?

(f) How do you intend to address these concerns?

(g) As part of this project, do you plan to perform any environmental improvements in this community? If yes, describe.

Please provide the Department with an additional 1 to 2 page narrative description of the project, focusing on its function and its local/regional environmental, social, and economic benefits and impacts. Also, what sensitive receptors are present and how might they be affected by this project?

GENERAL

Is the project subject to:

Highlands Regional Master Plan – Planning or Preservation Area? No

http://www.state.nj.us/dep/gis/stateshp.html#HIGHLANDS

Pinelands Comprehensive Management Plan? No

http://www.state.nj.us/pinelands/cmp/

D&R Canal Commission Standards No

http://www.dandrcanal.com/drcc/maps.html

Delaware River Basin Commission

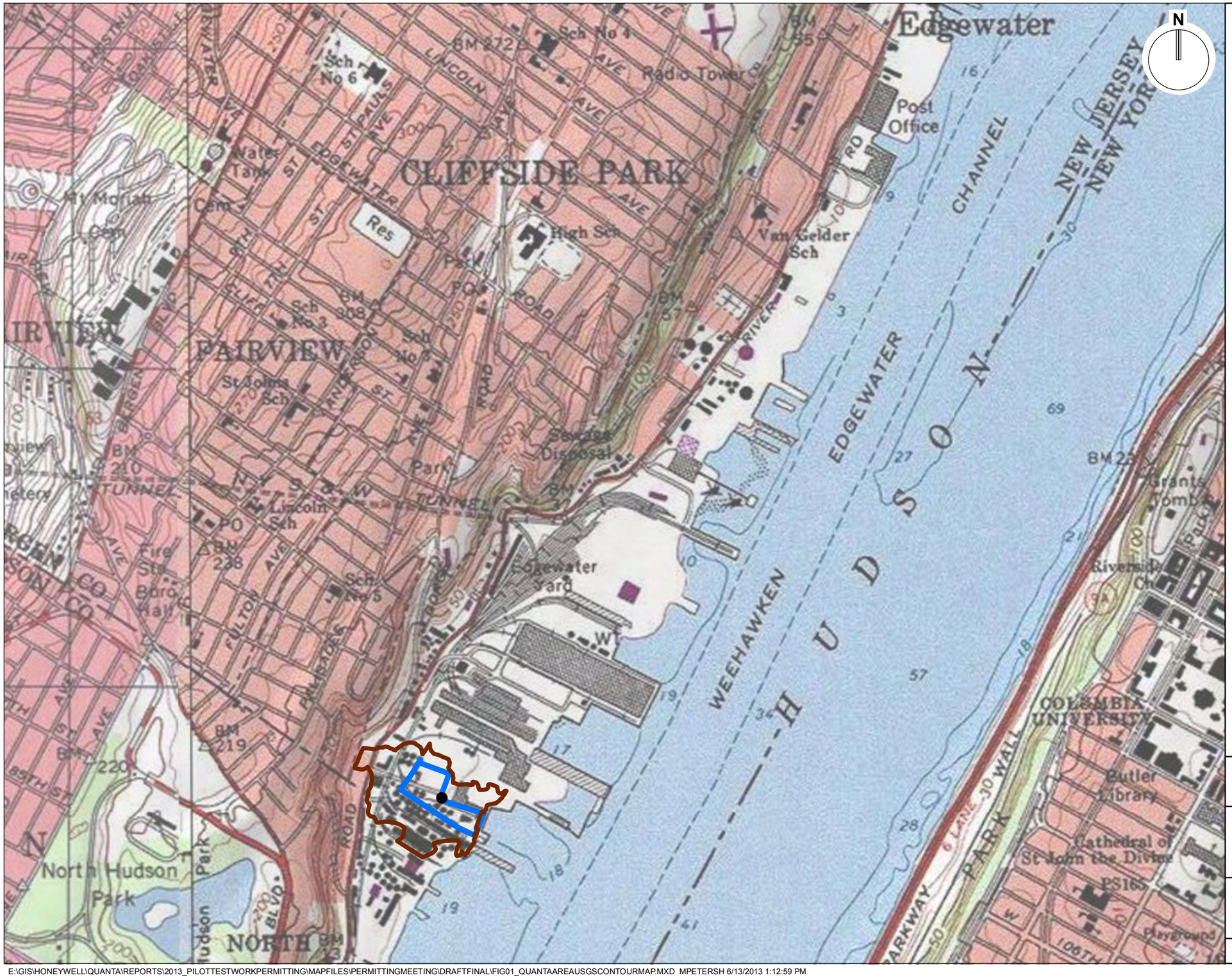
(609) 883-9500

http://www.state.nj.us/drbc

US Army Corp of Engineers review? Possibly

Will the project affect any land or water controlled by a Water Supply Authority or water purveyor in New Jersey? If so, please identify and explain. No

Figures



LEGEND

- Quanta Resources Corporation Center Point
- Approximate Boundary of Operable Unit 1
- Quanta Resources Corporation Site Boundary

Note:

Map Source:
Central Park, New York – New Jersey United States Geological Survey 7.5 Minute Quadrangle Topography and photogrammetric methods from aerial photographs taken in 1954 and planetable surveys in 1956. Field checked in 1966. Revised in 1979 from aerial photographs taken in 1977.

0 500 1000 ft.

CH2MHILL

OPERABLE UNIT 1 AND QUANTA RESOURCES CORPORATION SITE BOUNDARY

Quanta Resources Corporation Superfund Site Operable Unit 1 Edgewater, New Jersey

FIGURE 1

E:\GIS\HONEYWELL\QUANTA\REPORTS\2013_PILOTTESTWORKPERMITTING\MAPFILES\PERMITTINGMEETING\DRAFTFINAL\FIG01_QUANTAAREAUSGSCONTOURMAP.MXD MPETERSH 6/13/2013 1:12:59 PM

LEGEND

- Approximate Boundary of Operable Unit 1 (OU1)
- Properties within Operable Unit 1 (OU1)
- Quanta Resources Corporation Property Boundary

Note:
Aerial Source: http://goto.arcgisonline.com/maps/World_Imagery. This aerial comprises high-resolution imagery from the USDA, NAIP, and enhanced versions of USGS DOQQ imagery.

0 70 140 ft.

CH2MHILL

PROPERTY LOCATION MAP WITH AERIAL PHOTOGRAPH

Quanta Resources Corporation Superfund Site Operable Unit 1 Edgewater, New Jersey

FIGURE 2

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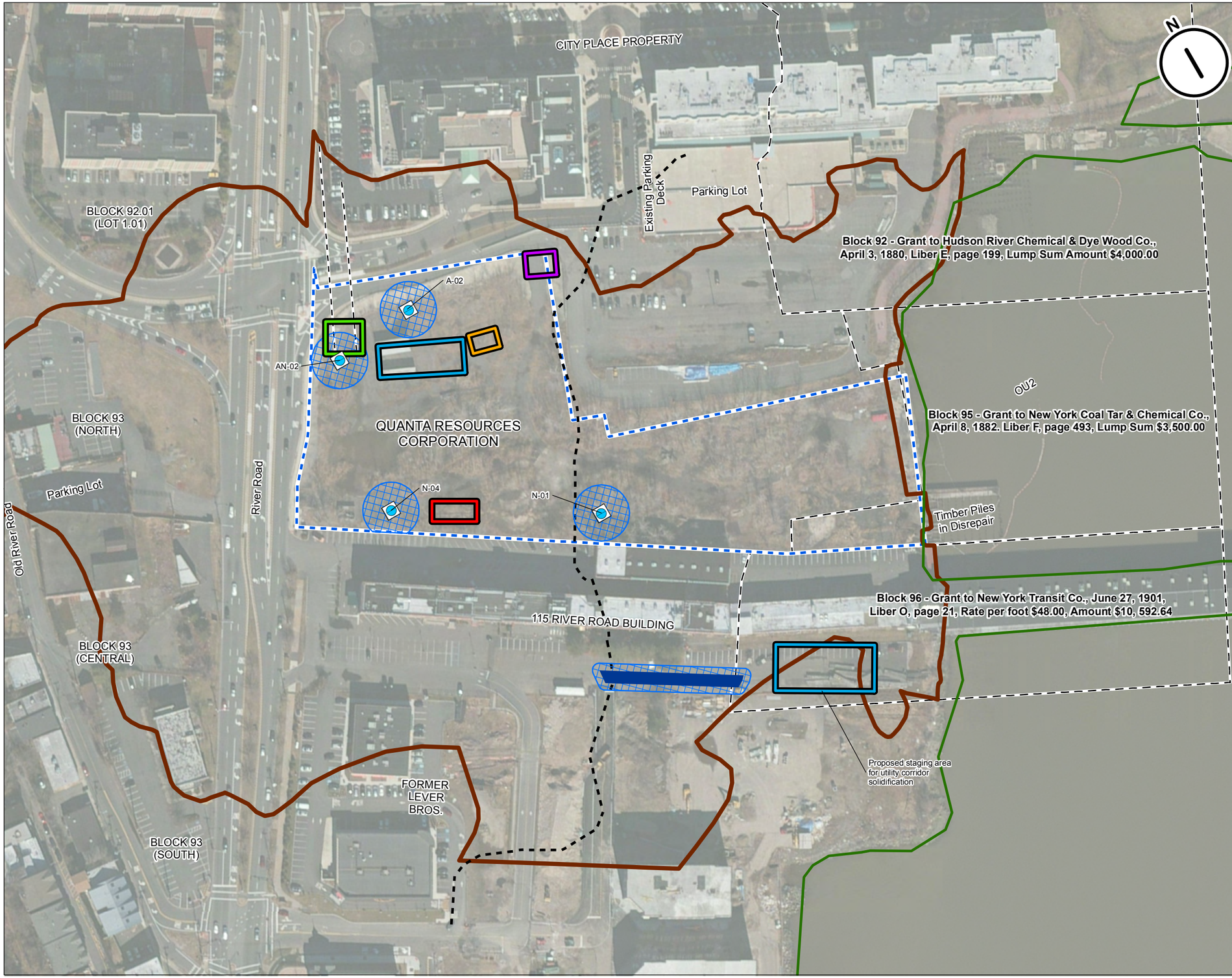


LEGEND

- Proposed Field Demonstration Solidification Test Areas
- Proposed Location for Field Demonstration of Installation of Horizontal Injection Wells
- Proposed Parking Area
- Proposed Area for Field Demonstration of in-situ stabilization using vertical injection wells
- Proposed Staging Area (trailers, equipment, mixing area)
- Proposed Waste Accumulation Area
- Proposed Utility Corridor Solidification Field Demonstration Area
- Approximate area of impact (i.e., work zone) around test areas
- Approximate Boundary of Operable Unit 1
- Quanta Resources Corporation Property Boundary
- Approximate boundary of Tideland Lease and/or Riparian Grant
- Proposed area of injection stabilization using horizontal wells
- Upper Wetland Limit
- 500' Landward Offset

Notes:

1. **Notes:**
   Aerial Source: http://goto.arcgisonline.com/maps/World_Imagery. This aerial comprises high-resolution imagery from the USDA, NAIP, and enhanced versions of USGS DOQQ imagery.
2. Claimed property boundaries were extracted from the Bureau of Tidelands Management Map showing Conveyances on Hudson River, North Bergen township - Hudson County; Edgewater Borough - Bergen County. Received from the State of New Jersey Department of Environmental Protection (NJDEP).

0 70 140 ft.

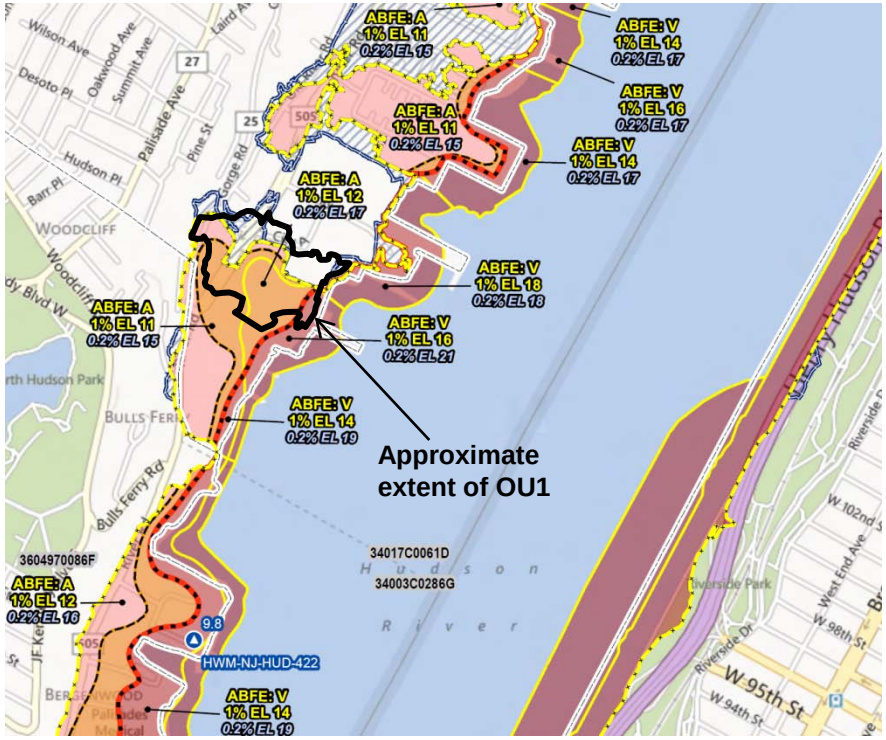
CH2MHILL

SITE PLAN AND ENVIRONMENTAL FEATURES

Quanta Resources Corporation Superfund Site Operable Unit 1 Edgewater, New Jersey

FIGURE 3

E:\GIS\HONEYWELL\QUANTA\REPORTS\2013_PILOTTESTWORKPERMITTING\MAPFILES\DEVELOPMENTAL_MXDS\FIG03_SITEPLANANDENVIRONMENTALFEATURES.MXD MPETERSH 7/2/2013 9:01:44 AM



LEGEND

Flood Advisory Related Data

- Advisory Base Flood Elevation Zone (ABFE)[2]
- 1% EL — 1% Advisory Base Flood Elevation, feet[1,2]
- 0.2% EL — 0.2% Advisory Base Flood Elevation, feet[1,3]
- Advisory Flood Hazard Zone V
- Area of Moderate Wave Action[4]
- Advisory Flood Hazard Zone A
- Advisory Limit of the 1% Annual Chance Flood Hazard Area[2]
- Advisory Limit of the 0.2% Annual Chance Flood Hazard Area[3]
- Advisory Shaded Zone X
- ID — Effective FIRM Panel Boundary

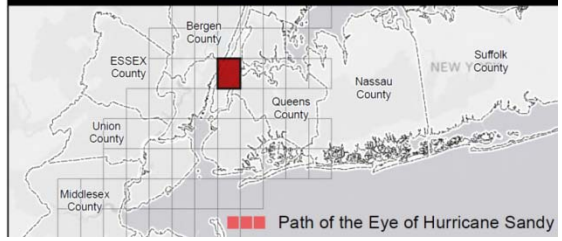
Hurricane Sandy Related Data

- Provisional Hurricane Sandy Surge Elevation[1,6]

Geographic Boundaries

- CBRA[5]
- County

OVERVIEW MAP



USAGE

The elevations shown on this map are considered best available data until issuance of updated Flood Insurance Rate Maps.

OBSERVED SANDY SURGE ELEVATIONS[1,6]

Approximately 9-10 ft on this Panel

0 1,000 2,000 3,000 4,000

Feet

NOTES

[1] Measured in feet relative to the North American Vertical Datum of 1988 (NAVD88).
To convert from NAVD88 to the National Geodetic Vertical Datum of 1929, add the following county-wide value(s): Bergen (1.0 ft), and City of New York (1.1 ft)

[2] Each whole-foot 1% annual chance Advisory Base Flood Elevation shown applies to all properties located in the mapped zone, with zone boundaries outlined in yellow.

[3] Each whole-foot 0.2% annual chance Advisory Base Flood Elevation shown applies to all properties located in the mapped zone, with zone boundaries outlined in yellow.

[4] Depicts the extent of the "Coastal A Zone" or area of moderate wave action where wave heights are between 1.5 and 3 feet. The FEMA Coastal Construction Manual, American Society of Civil Engineers, and the 2012 International Residential Building Code recommend Zone VE construction practices in this area.

[5] Depicts the approximate extent of the Coastal Barrier Resources System (CBRS). Most new Federal expenditures and financial assistance (including flood insurance) are prohibited within the CBRS, with some exceptions. For the best available CBRS boundary data, visit: http://www.fws.gov/cbra/Maps/Mapper.html

Data Sources:

[6] Sandy Surge Elevations: U.S. Geological Survey Rapid Deployment Gauges and High Water Marks (Provisional data retrieved on 11/27/2012). Current data can be found at: http://water.usgs.gov/floods/events/2012/sandy/; Base Map: Bing Maps Road; Stillwater Elevations: Preliminary Coastal FEMA Flood Insurance Study Update for New York City and New Jersey, 2012; Storm Track: NOAA National Weather Service

MAPS FOR ADVISORY PURPOSES ONLY - NOT FOR INSURANCE RATING PURPOSES

For insurance rating purposes refer to the effective Flood Insurance Rate Map (FIRM), available from your local floodplain administrator or the FEMA Map Service Center (http://msc.fema.gov)

Reference: Federal Emergency Management Agency (FEMA). Advisory Base Flood Elevation Map. New York-Queens-Hudson-Bergen Counties-New Jersey and New York. Map ID: Central Park SW. February 22, 2013

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FEMA FLOOD PLAIN MAP

Quanta Resources Corp. Superfund Site Operable Unit 1

July 11, 2013

FIGURE 4

Appendix F
Health and Safety Plan

Health and Safety Plan

Quanta Resources Corporation Superfund Site - Operable Unit 1

2013 Work Activities

Edgewater, New Jersey

Prepared for

Honeywell International Inc.

May 2013

Prepared by

CH2MHILL

HEALTH AND SAFETY PLAN
Quanta Resources Corporation Superfund Site
Operable Unit 1
163 River Road (and adjacent properties)
Edgewater, New Jersey

		PHONE
Project Number: 414598/428872		
Project Manager (PM): Steve Zarlinski/DET		810-360-2061 Cell: 267-250-7387
Safety Coordinators (SC):	Jennifer Simms/PHL	215-640-9071 x49071
	Austin Harclerode/NJO	973-316-3518
	Mike Murphy/NJO	973-316-3526
	Leslie Baechler/PHL	215-640-9003

Honeywell H&S Program Manager (HSPM): Bill Berlett 312-873-9784
Cell: (847) 770-0209

Project H&S Manager (HSM): Bill Berlett .....See above

Preparation Date: May 29, 2013

Expiration Date: May 31, 2014

APPROVALS

Project Manager:

May 29, 2013
(DATE)

Safety Coordinator

(DATE)

Honeywell Program or Project Health and Safety Manager:

May 29, 2013
CIH/CSP (DATE)

This Health and Safety Plan is valid only for this specific project as described in Section 1.0. It is not to be used for other projects or subsequent phases of this project without the written approval of the Honeywell Program Health and Safety Manager. **A copy of this plan is to be maintained at the site at all times.**

Change Management Form

Honeywell Project HSE Change Management Form

*This evaluation form should be reviewed on a **continuous** basis by the PM and/or SC to determine if the current site health and safety plan adequately addresses ongoing project work, and should be completed whenever new tasks are contemplated or changed conditions are encountered.*

Project Task:	OU1 Pre-Design and O&M work activities		
Project Number:	414598/428872	Project Manager:	Steve Zarlinski/DET
Name:	Quanta – Edgewater, NJ	Safety Coordinators:	Jennifer Simms/Mike Murphy/Austin Harclerode/Leslie Baechler

	Evaluation Checklist	Yes	No
1.	Have the CH2MHILL staff listed in the original HSP/FSI changed?		
2.	Has a new subcontractor been added to the project?		
3.	Is any chemical or product to be used that is not listed in Attachment 7 of the plan?		
4.	Have additional tasks been added to the project, which were not originally addressed in the plan?		
5.	Have new contaminants or higher than anticipated levels of original contaminants been encountered?		
6.	Have other safety, equipment, activity or environmental hazards been encountered that are not addressed in the plan?		

If the answer is "YES" to Question 3, an HSP/FSI revision is NOT needed. Please take the following actions:

- Add the chemical to Attachment 7; and,
- Ensure employees handling the chemical are trained.

If the answer is "YES" to Questions 1, 2 or 4-6, an HSP/FSI revision MAY BE NEEDED. Please contact Bill Berlett (773-458-2810) directly.

Emergency Contacts

24-hour CH2M HILL Serious Incident Hotline – (720) 286-4911

CH2M HILL Occupational Health Nurse – 1-866-893-2514

Medical Emergency – 911 **Fire/Spill Emergency -- 911** **Security & Police – 911** Local Facility Emergency Response Number: TBD by SC	**CH2M HILL Medical Consultant** WorkCare Dr. Peter Greaney M.D. 300 S. Harbor Blvd, Suite 600 Anaheim , CA 92805 800-455-6155 714-978-7488
Client Contact Name: Steve Coladonato Company: Honeywell Remediation Manager Phone: 302-791-6738 Cell: 973-216-2438 Name: Helen Fahy Company: Honeywell Remediation Manager Phone: 973-455-2989 Cell: 814-571-4912 Name: Sam Visnic Company: Honeywell Design and Construction Manager Phone: 973-455-5908 Cell: 908-872-1296	**Site Contact** Name: Insert Name Company: Title: Phone:
Honeywell Health, Safety & Environment Program Manager (HSPM) Name: Bill Berlett/CHI Phone: 773-458-2810 Cell: 847-770-0209	**Environmental Compliance Coordinator (ECC)** Name: Meg Morrison/DEN Phone: 850-261-4296
Project Health & Safety Manager (HSM) Name: Bill Berlett Phone: See above:	**Regional Human Resources Department (Workers' Compensation Contact)** Name: Cindy Bauder/WDC Phone: 703/471-6405 ext.
Project Manager (PM) Name: Steve Zarlinski/DET Phone:810-360-2061 Cell: 267-250-7387 **Assistant Project Manager (APM)** Name: Kyle Block Phone: 617-626-7013 Cell: 610-389-0899	**Safety Coordinator (SC)** Name: Austin Harclerode/NJO Phone: 973-316-3518 Name: Jennifer Simms/PHL Phone: 215-640-9071 x49071 Name: Mike Murphy/NJO Phone: 973-316-3536 Cell Phone:551-486-3621 Name: Leslie Baechler/PHL Phone: (215) 640-9003 Cell: (484) 844-4289
Federal Express Dangerous Goods Shipping Phone: 800/238-5355 **CH2M HILL Emergency Number for Shipping Dangerous Goods** Phone: 800/255-3924	**Worker's Compensation:** Contact Regional HR dept. to have form completed or contact Albert Jerman after hours: 303-741-5927 **Automobile Accidents:** Auto Claim Reporting-Teleplus Claim Reporting 800-753- Rental: Linda Anderson/DEN 720-286-2401 CH2M HILL owned vehicle: Zurich Insurance Co. 800-987-3373
Facility Alarms: N/A	**Evacuation Assembly Area(s):** TBD by SC
Facility/Site Evacuation Route(s): TBD by SC	

Hospital Name/Address:

Palisades General Hospital
7600 River Road
North Bergen, New Jersey

Directions to Hospital

1. Leave site through the north gate and make a right onto driveway into south parking lot of the Promenade/City Place Shopping Area.
2. Make first left to go into covered parking area.
3. Make almost immediate left to go up the ramp towards the Hilton Homewood Suites Hotel main entrance.
4. Make left (almost directly across from the main entrance to the Hilton Homewood Suites Hotel) to go out to the City Place Driveway towards River Road (Gorge Road Extension).
5. Get in the left hand lane at the traffic light at the intersection of River Road and the City Place Driveway/Gorge Road.
6. Make a left onto River Road to drive south.
7. Continue on River Road following signs for the Palisades Medical Center.
8. The Emergency Room entrance is a left hand turn off of River Road.

LEGEND

- Existing Arsenic Liner
- HCAA Boundary
- OU1 Boundary
- Area of Deep NAPL Zone Stabilization in Proposed Plan
- Approximate area of tar "boils" (Not necessarily present throughout depicted area)
- Principal Threat Arsenic Area
- Principal Threat NAPL Zone
- Low Level Threat NAPL Zone

0 75 150 ft.

CH2MHILL

OU1 SOURCE MATERIALS

Quanta Resources Corporation Superfund Site Operable Unit 1 Edgewater, New Jersey

July 19, 2012 | **FIGURE 1**

E:\GIS\HONEYWELL\QUANTA\REPORTS\2012_EPAWORKPLAN\FIGURES\LT_REQUESTS_2012\1-3_QUANTAOU1_SOURCEAREAS_AERIAL.MXD MPETERSH 7/19/2012 12:06:55 PM

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2 Job Hazard Analysis
3 Daily Tailgate Safety Briefing Form
4 Pre-Task Safety Plan
5 Project Activity Self-Assessment Checklists
6 Safe Work Observation Form
7 Project-Specific Chemical Product Hazard Communication Form
8 Applicable Material Safety Data Sheets
9 Chemical-Specific Training Form
10 Biological Hazard Information
11 Drug Testing Hospital Kit Notice
12 Incident Report Form, Root Cause Investigation, and Honeywell Incident Reporting Information
13 Working Alone Documents
14 Vehicle Accident Guidelines and Stop Work Order

Acronyms and Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
APR	air-purifying respirator
cm	centimeter
CNS	central nervous system
COPC	chemical of potential concern
CPR	cardiopulmonary resuscitation
Cr	chromium
dBA	decibel (A-weighted scale)
DEET	N,N-diethyl-meta-toluamide
DOT	Department of Transportation
ECC	Environmental Compliance Coordinator
GFCI	ground fault circuit interrupter
Hazwoper	Hazardous waste operations and emergency response
Honeywell	Honeywell International Inc.
HCAA	High Concentration Arsenic Area
HR	heart rate
HSE	health, safety, and environment
HSM	Health and Safety Manager
HSPM	Health and Safety Program Manager
IDLH	immediately dangerous to life and health
IRF	incident report form
JHA	job hazard analysis
LID	Legal and Insurance Department
MSDS	material safety data sheet
NIOSH	National Institute for Occupational Safety and Health
NSC	National Safety Council

OSHA	Occupational Safety and Health Administration
PAH	poly-aromatic hydrocarbon
PAPR	powered air-purifying respirator
PCB	poly-chlorinated biphenyl
PCE	tetrachlorethene
PEL	permissible exposure limit
PFD	personal flotation device
PIP	photoionization potential
PM	Project Manager
PPE	personal protective equipment
ppm	parts per million
PTSP	pre-task safety plan
RES	Remediation and Environmental Services
RQ	reportable quantity
SC	Safety Coordinator
SCBA	self-contained breathing apparatus
SOP	standard of practice
SPCC	spill prevention, control, and countermeasures
SSR	Subcontractor Safety Representative
TCE	Trichloroethane
TLV	threshold limit value
TSDF	treatment, storage, and disposal facility

1.0 Introduction

CH2MHILL

HSSE Target Zero World-Class Performance

Health, Safety, Security, and Environment Policy

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

- We require all management and supervisory personnel to provide the leadership and resources to inspire and empower our employees to take responsibility for their actions and for the actions of their fellow employees to create a safe, healthy, secure, and environmentally-responsible workplace.
- We provide value to clients by tailoring HSSE processes to customer needs and requiring all CH2M HILL employees and subcontractors to deliver projects with agility, personal service, and responsiveness and in compliance with HSSE requirements and company standards to achieve health, safety, security, and pollution prevention excellence. Our performance will aspire to influence others and continually redefine world-class HSSE excellence.
- We systematically evaluate our design engineering and physical work environment to verify safe and secure work conditions and practices are established, consistently followed, and timely corrected.
- We continually assess and improve our HSSE program to achieve and maintain world-class performance by setting and reviewing objectives and targets, reporting performance metrics, and routinely reviewing our progress.
- We care about the safety and security of every CH2M HILL employee and expect all employees to embrace our culture, share our core value for the protection of people and the environment, understand their obligations, actively participate, take responsibility, and "walk the talk" on and off the job.

The undersigned pledge our leadership, commitment, and accountability for making this policy a reality at CH2M HILL.

Dated the 1st day of October 2009.

Lee A. McIntire
Chief Executive Officer

Garry Higdem
President, Energy Division

Jacqueline Rast
President, Major Programs Group

Robert C. Allen
Chief Human Resources Officer

Mark Lasswell
President, Transportation Business Group

Catherine Santee
Chief Financial Officer

Bob Card
President, Facilities & Infrastructure Division

Margaret McLean
Chief Legal Officer

Thomas G. Searle
President, International Division

Bill Dehn
Senior Vice President, Special Projects

Michael E. McKelvy
President, Government, Environment, and Nuclear Division

Nancy R. Tuor
Vice-Chair, International

Keith Christopher
Senior Vice President, Health, Safety, Security, and Environment

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

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

The Project has established eleven specific goals and objectives:

- Create an injury-free environment;
- Have zero injuries or incidents;
- Provide management leadership for HSE by communicating performance expectations, reviewing and tracking performance, and leading by example;
- Ensure effective implementation of the HSP through education, delegation, and team work;
- Ensure 100 percent participation in HSE compliance;
- Continuously improve our safety performance;
- Maintain free and open lines of communication;
- Make a personal commitment to safety as a value;
- Focus safety improvements on high-risk groups;
- Continue strong employee involvement initiatives; and
- Achieve health and safety excellence.

1.2 About This Document

This Health, Safety and Environment (HSE) Plan will be kept on the site during all field activities conducted under the Honeywell International Inc. (Honeywell) program. The plan will be amended or revised as project activities or conditions change or when supplemental information becomes available. The plan adopts, by reference, the Standards of Practice (SOPs) in the CH2M HILL *Health, Safety, and Environmental Protection (HSE) Program Manual*. In addition, this plan adopts procedures in the project Work Plan and incorporates applicable elements of Honeywell's HSE requirements. The Safety Coordinator (SC) is to be familiar with the SOPs contained in the HSE Program Manual and the contents of this plan. The project Health and Safety Manager (HSM) must review and approve any changes to this plan.

CH2M HILL personnel and subcontractors must sign the CH2M HILL Employee Sign-Off Form included in Attachment 1 after reading/reviewing this HSE Plan.

1.3 Site Background

The Site is located at the intersection of River Road and Gorge Road in Edgewater, New Jersey. A vacant lot referred to as the Quanta property, portions of River Road and Gorge Road, and properties and portions of properties surrounding the Quanta property comprise the upland portion of the Site, or OU1. The area of OU1 is approximately 24 acres. The Site is located adjacent to the Hudson River, and sediment within the river affected by the site is considered OU2. OU2 is the subject of an ongoing RI/FS separate from the response action for OU1. The Site Map depicts the properties comprising OU1.

The Quanta site was formerly occupied by Barrett Manufacturing (a predecessor to Allied Chemical) beginning the late 1800s. Barrett used the site for coal tar processing. After the sale of the site in 1971, it was leased by E.R.P. Corporation who recycled and stored oil. Quanta Resources Corporation took over the site in 1980. At that time the site contained 61 aboveground storage tanks with a capacity of 9 million gallons along with at least 10 underground storage tanks and underground pipes. The site has been unoccupied since 1981 when the New Jersey Department of Environmental Protection ceased Quanta's operations after it was discovered that polychlorinated biphenyls were present in some of the oil stored onsite at concentrations as high as 260 parts per million.

The Quanta property contains exposed former tank and building foundations, the remnants of a former oil-water separator, a wooden bulkhead along the shoreline, and the remains of wooden docks. The property is generally flat and at a lower elevation than River Road and the City Place property to the north. The Quanta, 115 River Road, and i.Park properties are all at a similar elevation corresponding to the land surface during industrial use (prior to 1982). River Road and City Place are located at higher elevations due to more recent placement of fill material.

Three distinct hydrostratigraphic units exist at the site above the bedrock surface. The shallowest unit consists of an unconfined, surficial water-bearing zone extending from the water table—approximately 4 feet below ground surface (bgs)—to approximately 15 to 20 feet bgs. This unit is underlain by a silty clay aquitard approximately 10 to 20 feet thick. Last, a confined water-bearing "deep sand" unit exists between the aquitard (confining unit) and the bedrock surface. The shallow saturated zone and deep sand units are not hydraulically connected. The direction of the two water bearing zones (shallow unconfined and deep confined) groundwater flow is generally to the east and south in the direction of the Hudson River, with an area of radial flow within the shallow unconfined zone on the Quanta property.

A substantial amount of data and information was collected and assessed during the OU1 RI and SRI and has achieved the objective of completing a comprehensive site characterization of the site which included the following:

- Characterization of OU1 sources
- Determination of the nature and extent of contamination
- Evaluation of fate and transport of constituents of interest (COIs)
- Assessment of potential risks to human health and the environment

Soils at OU1 have been found to contain NAPL and arsenic constituting principal threats, as well as other soil and groundwater containing constituents attributable to the site. The location, nature, and extent of the NAPL at OU1 have been comprehensively delineated through the RI process for the purposes of remedial design. NAPL is found throughout the site, and is made up of aromatic volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs). Most of the SVOCs are polycyclic aromatic hydrocarbons (PAHs). Coal tar materials found at the site range from low viscosity liquids to solid tar. NAPL at the site is identified as either free-phase or residual NAPL. Free-phase NAPL is able to collect in monitoring wells, whereas residual NAPL has insufficient mass to allow mobility. Most of the free phase NAPL at the site is denser than water and is present in six discrete areas [NAPL Zones (NZ) 1 through 6]. Outside the defined NAPL zones, NAPL is present throughout the site as residual NAPL or thin, discontinuous pockets of free-phase NAPL that have not been found to be contiguous with the defined NAPL zones.

Eight separate sources of soluble arsenic to groundwater and of other inorganic constituents in groundwater were identified within the lateral extent of OU1: a High Concentration Arsenic Area (HCAA) and seven other smaller arsenic areas. The HCAA lies beneath an impermeable liner and fill material, and a portion is located beneath an active access ramp to the City Place development. The extent of the HCAA is defined as soil concentrations of arsenic greater than 1000 mg/kg. Each arsenic area including the HCAA has elevated soil concentrations that have a potential direct-contact risk to human health: 390 milligrams per kilogram (mg/kg) for arsenic contamination in the shallow, unsaturated soils (approximately the first four feet of surface soil) and 1,000 mg/kg for deeper soils and the HCAA. Outside the areas defined as NAPL zones, residual NAPL, discontinuous pockets of free-phase NAPL, and site-related constituents are found in saturated and unsaturated soil. Primary constituents of concern (COCs) include VOCs, SVOCs, and metals, with other constituents detected less frequently above the preliminary remediation goals (PRGs). Similar Site-related constituents were detected in groundwater throughout the site.

In September 2011, the EPA issued a ROD detailing the selected remedy which "involves the solidification/stabilization of NAPL and arsenic source areas, capping and institutional controls, coupled with the installation of a groundwater containment remedy, a subaqueous reactive barrier in the Hudson River to mitigate contaminated groundwater releases." The ROD indicates that the following OU1 source areas will be subject to remedial actions:

- Shallow free-phase NAPL
  - All of NZ-1, including areas beneath River Road and beneath the buildings at 115 River Road
  - All of NZ-2 and NZ-5
  - Portions of NZ-3 adjacent to or separated by no more than 5 feet from NZ-1 or NZ-2 and NZ-5
- Deep free-phase NAPL
  - Recoverable NAPL within NZ-3 not targeted for in situ solidification/stabilization
  - Recoverable NAPL within NZ-4
- Arsenic hotspots
  - All of the HCAA
  - Other shallow arsenic hotspots

1.4 Description of Tasks

Refer to project documents (e.g., the OU1 Pre-Design Work Plan, OU1 Remedial Design Work Plan and any addendums, TAR scopes of work, etc.) for detailed task information. A task hazard analysis has been performed for each task and is included below while project-specific hazard controls are provided in the next section. Tasks other than those listed below require an approved amendment or revision to this plan before tasks begin. Refer to Hazwoper Compliance Plan Section of this HSE Plan for procedures related to "clean" tasks that do not involve hazardous waste operations and emergency response (Hazwoper).

1.4.1 Hazwoper-Regulated Tasks

The following tasks are regulated under by OSHA's Hazwoper's standard, 29 CFR 1910.120:

- Site clearing
- Utility surveying
- Drilling investigations;
- Monitoring well installations;
- Injection well installations;
- Monitoring well abandonment;
- Soil/groundwater sampling;
- Infiltration testing;
- Land Surveying;
- Test pitting or excavations;
- Indoor/outdoor air sampling within and around office buildings adjacent/near the Quanta site;
- NAPL measurement and/or removal;
- Pore water sampling;
- Piezometer installation and sampling
- Operations and Maintenance of boom materials
- Site visits requiring entrance into exclusion or contamination reduction zones
- In Situ Solidification – four, 20-feet by 20-feet areas on site – pilot test for NAPL site contamination using auger and bucket mixing methods
- In Situ Chemical Injection in the High Concentration Arsenic Area (HCAA) – pilot test using ferrous sulfate and magnesium hydroxide solution mixture injecting into a set number of injection wells TBD

1.4.2 Non-Hazwoper-Regulated Tasks

Under specific circumstances, the training and medical monitoring requirements of federal or state Hazwoper regulations are not applicable. It must be demonstrated that the tasks can be performed without the possibility of exposure in order to use non-Hazwoper-trained personnel. The following task is considered non-hazardous.

Site visits – must not enter exclusion or contamination reduction zones

1.4.3 Environmental-Regulated Tasks and Conditions

Project tasks and site conditions that can impact the environment and are otherwise subject to environmental regulation are included in Section 1.3. These items are also known as the environmental aspects of the project (activities that can interact with the environment). Environmental impacts relating to each task or condition are also presented in Section 1.3, which is used to evaluate the project's significant impacts and control measures specified in Hazard Controls and Safe Work Practices section of this HSE Plan.

All personnel shall: (1) implement control measures described in Hazard Control Section; (2) obtain appropriate environmental training (e.g., Waste Management or Dangerous Goods Shipping) and (3) seek assistance from the regional/program Environmental Compliance Coordinator (ECC) for all environmental questions or issues.

1.4.4 Honeywell Permit Required Tasks

The following tasks require a Honeywell permit:

Not applicable for this site.

1.5 Task Hazard Analysis

Table 1-1 presents the hazard analysis for work to be conducted under this HSE Plan.

1.6 Environmental Impacts

Table 1-2 summarizes the potential environmental impacts of the work to be conducted under this HSE Plan.

Tasks	Aerial Lifts	Back Injury (Bending/Lifting)	Biological Hazards	Buried Utilities	Cold Stress	Chemical Exposure	Electrical	Elevated Work Areas/Falls	Entanglement	Excavations	Fires	Flying Debris/Objects	Gas Cylinders	Hand and Power Tools	Heat Stress	Heavy Equipment Exposure	Ionizing Radiation	Lockout-Tagout	Noise	Radio-Frequency Radiation	Respiratory Protection	Slips, Trips and Falls	Stairways and Ladders	Suspended Loads	Traffic Exposure	Vehicle Backing Exposure	Working Above or Near Water
Test pitting/ excavation		X	X	X	X	X				X	X	X		X	X	X			X		X	X				X	X
Drilling, Geoprobe, well installation & abandonment, injection well installation		X	X	X	X	X			X		X	X		X	X	X			X		X	X			X	X	
Subsurface/surface soil sampling		X	X		X	X						X		X	X						X	X			X	X	X
Groundwater monitoring, NAPL measurement or removal, aquifer testing		X	X		X	X	X					X		X	X				X			X			X	X	
Surface water and sediment sampling from the shore		X	X		X	X						X		X	X				X			X	X				X
Hand auguring		X	X	X	X	X								X	X				X		X	X					
Non-intrusive utility surveying or land surveying		X	X		X	X								X	X				X			X			X	X	X
IDW drum sampling and disposal		X	X		X	X								X	X				X			X				X	
Observation of loading material for offsite disposal			X		X	X					X	X			X	X			X			X				X	
Indoor/outdoor air sampling – office buildings		X	X		X		X							X	X				X			X	X		X	X	
Pore Water Sampling		X	X	X	X	X						X		X	X							X					X
O&M of Boom Materials		X	X		X	X			X			X		X	X							X					X
Site Visits			X		X						X			X	X							X	X		X	X	
In Situ Solidification		X	X	X		X			X		X	X	X	X	X	X			X		X	X		X	X	X	
In Situ Chemical Injection (HCAA)		X	X	X		X			X		X	X	X	X	X	X			X		X	X		X	X	X	

TABLE 1-2
Environmental Impacts Table

Tasks/Conditions	Impacts						
	Air Pollution	**Land Pollution**	**Land Disposal**	**Noise Pollution**	**Water Pollution**	**Resource Depletion**	**Human Hazard**
Chemical/Petroleum Storage or Transport	X	X			X		X
Coastal and Wetland Resources Disturbed		X			X	X	
Excavate, Clearing or Grading	X			X	X		X
Waste (Haz/Non-Haz) Mgmt, Transport and Disposal	X	X	X		X		X
Water (Waste or Storm) Stored or Discharged		X	X		X		X

2.0 Hazard Controls and Safe Work Practices

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. These practices and controls are to be implemented by the party in control of either the site or the particular hazard. CH2M HILL employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M HILL employees and subcontractors who do not understand any of these provisions should contact the SC for clarification. In addition to the hazard controls specified in this section, the following are required for Honeywell projects.

2.1 Administrative Controls

2.1.1 HSE Plans

CH2M HILL requires HSE plans for all field projects and subcontractors are required to submit detailed Job Hazard Analysis for their activities. The HSE plan provides a risk analysis of each task and identifies the potential hazards and control measures (including personal protective equipment (PPE) and air monitoring requirements) for each task.

2.1.2 Job Hazard Analysis

A job hazard analysis (JHA) is required by CH2M HILL for all tasks unless the HSM specifically determines it is unnecessary. The JHA provides a step-by-step analysis of the activity being performed and identifies the equipment and control measures necessary to conduct the work safely. Each JHA must be reviewed by the work team immediately prior to conducting the work. The JHA can be a source of information for the daily safety meeting. Project-specific JHAs are provided in Attachment 2.

2.1.3 Safety Meetings

CH2M HILL requires that the safety coordinator conduct daily safety meetings to discuss with the field team the task to be performed that day and the potential hazards and mitigation measure. The safety meeting can be used to review the JHA with the team. A Daily Tailgate Safety Briefing Form is included in Attachment 3.

A Pre-Task Safety Plan (PTSP) must be developed each day prior to performing specific work tasks. Each member of the team performing the task must be included in the planning so all are aware of the task hazards and controls. A copy of a PTSP is included in Attachment 4.

2.1.4 Self-Assessments

Project Activity Self-assessment Checklists are contained in Attachment 5. These checklists provide a method of verifying compliance with established safe work practices, regulations, and industry standards pertaining to hazardous activities. The checklists can be used by any

CH2M HILL employee who may be exposed to a hazardous activity or by the SC when providing oversight of a subcontractor performing a hazardous activity. Self-assessments shall be completed prior to subjecting CH2M HILL staff to hazardous operations for any reason.

Self-assessment checklists should be completed initially, then once per week while activity (excavation, drilling, etc.) is being conducted.

If hazardous conditions exist or are apparent during the self-assessment, immediately notify the employees in the area and do not continue work in that area until the conditions are safe. If an imminent danger situation (immediately life threatening or would cause serious injury) exists, immediately stop work, warn all personnel in danger and notify the appropriate safety representative and the CH2M HILL SC. Non-compliance issues identified during the self-assessment shall be immediately rectified. If corrective action assistance is required, the HSM should be contacted for guidance.

Any site-specific requirements outlined in this HSE Plan that are more stringent than those contained in the self-assessment checklists are to take precedence. The self–assessment checklists are based upon minimum regulatory compliance and some site-specific requirements may be more stringent. The self-assessment checklists, including documented corrective actions, shall be made part of the permanent project records and maintained by the SC.

2.1.5 Site Compliance/Audits

In order to ensure compliance with requirements contained in the Honeywell Remediation and Environmental Services (RES) Health and Safety Manual, Specification 01620, and with this HSE Plan, audits will be conducted by a HSE professional as follows: Based on the work schedule for 2013, up to two field audits will be conducted during 2013 OU1 work activities. Additional site audits may be scheduled based on actual site conditions and/or additional project site activity.

2.1.6 Safe Behavior Observations/Interventions

Safe Behavior Observations (SBOs) shall be conducted by SC or designee for specific work tasks or operations comparing the actual work process against established safe work procedures identified in the project-specific HSP and JHAs. SBOs are a tool to be used by site workers to provide positive reinforcement for work practices performed correctly, while also identifying and eliminating deviations from safe work procedures that could result in a loss. The SC or designee shall perform at least three SBOs per week, or one per day up to three, for tasks/operations addressed in the project-specific HSP or AHA. The SC or designee shall complete the SBO form in Attachment 5 for the task/operation being observed and submit completed SBOs to the following email addresses:
ES Commercial Sector projects: CH2M HILL ES COM Safe Behavior Observation
Honeywell HS Program Manager: mailto:wberlett@ch2m.com

2.2 Project-Specific Hazards and Controls

The following sections describe potential hazards and control measures that may be encountered during site activities

2.2.1 Respiratory Protection

For intrusive activities conducted in the high arsenic areas or when respirator upgrade has been triggered based on real time air monitoring respiratory protection will be required. See Section 4 and 5 for additional details. Requirements for respiratory protection include:

- Respirator users must have completed appropriate respirator training within the past 12 months. Level C training is required for air-purifying respirators (APR) use and Level B training is required for supplied-air respirators (SAR) and self-contained breathing apparatus (SCBA) use. Specific training is required for the use of powered air-purifying respirators (PAPR).
- Respirator users must complete the respirator medical monitoring protocol and been approved for the specific type of respirator to be used.
- Tight-fitting facepiece respirator (negative or positive pressure) users must have passed an appropriate fit test within past 12 months.
- Respirator use shall be limited to those activities identified in this plan. If site conditions change, the HSM shall be notified to amend the respiratory protection requirements.
- Tight-fitting facepiece respirator users shall be clean-shaven and shall perform a user seal check before each use.
- Canisters/cartridges shall be replaced according to the change-out schedule specified in this plan. Respirator users shall notify the SC of any detection of vapor or gas breakthrough. The SC shall report any breakthrough events to the HSM.
- Respirators in regular use shall be inspected before each use and during cleaning
- Respirators in regular use shall be cleaned and disinfected as often as necessary to ensure they are maintained in a clean and sanitary condition.
- Respirators shall be properly stored to protect against contamination and deformation.
- Field repair of respirators shall be limited to routine maintenance. Defective respirators shall be removed from service.
- When breathing air is supplied by cylinder or compressor, the SC shall verify the air meets Grade D air specifications.
- The SC shall complete the H&S Self-Assessment Checklist – Respiratory Protection included in Attachment 5 of this plan to verify compliance with CH2M HILL's respiratory protection program.

Refer to CH2M HILL HSE SOP-121, Respiratory Protection, for additional information.

2.2.2 Arsenic

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

Arsenic is considered a "Confirmed Human Carcinogen." CH2M HILL is required to control employee exposure to arsenic when exposures are at or above 5.0 micrograms per

cubic meter (μg/m^3), or if there is the possibility of skin or eye irritation from arsenic. The elements of the CH2M HILL arsenic program include the following:

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

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

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

2.2.3 Benzene

(Reference CH2M HILL SOP HSE-503, *Benzene*)

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

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

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

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

2.2.4 Cadmium

(Reference CH2M HILL SOP HSE-504, *Cadmium*)

Cadmium is considered a "Suspected Human Carcinogen." CH2M HILL is required to control employee workplace exposure to cadmium when personal exposure is at or above 2.5 micrograms per cubic meter ($\mu g/m^3$) by implementing a program that meets the requirements of the OSHA Cadmium standard, 29 *Code of Federal Regulations* (CFR) 1926.1127. The elements of the CH2M HILL cadmium program include the following:

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

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

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

2.2.5 Lead

(Reference CH2M HILL SOP HSE-508, *Lead*)

CH2M HILL is required to control employee exposure to lead when exposures are at or above 30 $\mu g/m^3$ by implementing a program that meets the requirements of the OSHA Lead standard, 29 CFR 1910.1025 and 29 CFR 1926.62. The elements of the CH2M HILL lead program include the following:

- Exposure monitoring;

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

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

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

2.2.6 Drilling

Control measures to be followed during drilling activities include:

- Only authorized personnel are permitted to operate drill rigs.
- Stay clear of areas surrounding drill rigs during every startup.
- Stay clear of the rotating augers and other rotating components of drill rigs.
- Stay as clear as possible of all hoisting operations. Loads shall not be hoisted overhead of personnel.
- Do not wear loose-fitting clothing or other items such as rings or watches that could get caught in moving parts. Long hair should be restrained.
- If equipment becomes electrically energized, personnel shall be instructed not to touch any part of the equipment or attempt to touch any person who may be in contact with the electrical current. The utility company or appropriate party shall be contacted to have line de-energized prior to approaching the equipment.
- Smoking around drilling operations is prohibited.

Refer to CH2M HILL HSE SOP-204, Drilling, for additional information.

2.2.7 Excavation and Test Pitting Activities

(Reference CH2M HILL SOP HSE-307, *Excavation and Trenching Safety*)

The requirements in this section shall be followed whenever excavation is being performed. Refer to the Earthmoving Equipment section and SOP for additional requirements applicable to operating/oversight of earthmoving equipment. Below are the hazard

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

- If the project site is suspected of munitions or explosives of concern (MEC) contamination, requirements of the *Explosives Usage and Munitions Response (MR)* SOP HSE-610 shall be followed. MECs include unexploded ordnance (UXO), discarded military munitions, materials that present a potential explosive hazard, chemical warfare materials, munitions constituents, and contaminated soil or groundwater. "Down-hole" avoidance support may be required to prevent accidental contact with UXO. Safety requirements will be based on the risk assessment identified within the MR (safety) ORE (Opportunity Risk Evaluation).
- Do not enter the excavations unless completely necessary, and only after the excavation competent person has completed their daily inspection and has authorized entry. An inspection shall be conducted by the competent person prior to the start of work, as needed throughout the shift, after every rainstorm, and after any hazard increasing occurrence. Documentation of the inspection must be maintained onsite at all times.
- Follow all excavation entry requirements established by the excavation competent person and any excavation permit being used.
- Sloping, benching, shoring, shielding, or other protective systems are required to protect personnel from cave-ins except when the excavation is made entirely in stable rock or is less than 5 feet deep (1.5 meters) and there is no indication of possible cave-in, as determined by the excavation competent person. Protective systems for excavations deeper than 20 feet (6.1 meters) must be designed or approved by a registered professional engineer.
- Trenches greater than 4 feet (1.2 meters) deep shall be provided with a ladder, stairway, or ramp positioned so that the maximum lateral travel distance is no more than 25 feet (7.6 meters).
- The atmosphere of excavations greater than 4 feet (1.2 meters) deep shall be tested prior to entry when a hazardous atmosphere exists or could reasonably be expected to exist, such as excavating landfills, hazardous waste dumps; or areas containing sewer or gas utility systems, petroleum distillates, or areas where hazardous substances are stored nearby.
- Spoil piles, material, and equipment must be kept at least 2 feet (61 centimeters) from the edge of the excavation, or a retaining device must be used to prevent the material from falling into the excavation.
- Excavations shall not be entered when:
  - Protective systems are damaged or unstable;
  - Objects or structures above the work location may become unstable and fall into the excavation;
  - The potential for a hazardous atmosphere exists, unless the air has been tested and found to be at safe levels; or
  - Accumulated water exists in the excavation, unless precautions have been taken to prevent excavation cave-in.

- The excavation self-assessment checklist shall be used to evaluate excavations prior to entry.

2.2.8 Earthmoving Equipment

(Reference CH2M HILL, SOP HSE-306, *Earthmoving Equipment*)

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

- CH2M HILL authorizes only those employees qualified by training or previous experience to operate material handling equipment.
- CH2M HILL employees must be evaluated prior to operating earthmoving equipment by a CH2M HILL earthmoving equipment operator evaluation designated person. This evaluation will be documented according to SOP HSE-306, Earthmoving Equipment.
- Equipment must be checked at the beginning of each shift to ensure the equipment is in safe operating condition and free of apparent damage. The check should include: service brakes, parking brakes, emergency brakes, tires, horn, back-up alarm, steering mechanism, coupling devices, seat belts and operating controls. All defects shall be corrected before the equipment is placed in service. Documentation of this inspection must be maintained onsite at all times (use the Earthmoving Equipment Inspection form if operated by CH2M HILL).
- Equipment must be on a stable foundation such as solid ground or cribbing; outriggers are to be fully extended.
- Equipment must not be used to lift personnel; loads must not be lifted over the heads of personnel.
- Equipment, or parts thereof, which are suspended must be substantially blocked or cribbed to prevent shifting before personnel are permitted to work under or between them. All controls shall be in a neutral position, with the motors stopped and brakes set.
- Equipment which is operating in reverse must have a reverse signal alarm distinguishable from the surrounding noise or a signal person when the operators view is obstructed.
- When equipment is used near energized powerlines, the closest part of the equipment must be at least 10 feet (3 meters) from the powerlines less than 50 kilovolts (kV). Provide an additional 4 feet (1.2 meters) for every 10 kV over 50 kV. A person must be designated to observe clearances and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means. All overhead powerlines must be considered to be an energized until the electrical utility authorities indicate that it is not an energized line and it has been visibly grounded.
- Underground utility lines must be located before excavation begins; refer to the Utilities (underground) section.
- Operators loading and unloading from vehicles are responsible for seeing that vehicle drivers are in the vehicle cab or in a safe area.

- The parking brake shall be set whenever equipment is parked; wheels must be chocked when parked on inclines.
- When not in operation, the blade or bucket must be blocked or grounded; the master clutch must be disengaged when the operator leaves the cab. When equipment is unattended, power must be shut off, brakes set, blades or buckets landed and shift lever in neutral.

2.2.9 Utilities (underground)

Do not begin subsurface construction activities (e.g., trenching, excavation, drilling, etc.) until a check for underground utilities and similar obstructions has been conducted. The use of as-built drawings and utility company searches must be supplemented with a geophysical or other survey by a qualified, independent survey contractor to identify additional and undiscovered buried utilities.

Examples of the type of geophysical technologies include:

- **Ground Penetrating Radar (GPR),** which can detect pipes, including gas pipes, tanks, conduits, cables etc, both metallic and non-metallic at depths up to 30 feet depending on equipment. Sensitivity for both minimum object size and maximum depth detectable depends on equipment selected, soil conditions, etc.
- **Radio Frequency (RF),** involves inducing an RF signal in the pipe or cable and using a receiver to trace it. Some electric and telephone lines emit RF naturally and can be detected without an induced signal. This method requires knowing where the conductive utility can be accessed to induce RF field if necessary.
- **Dual RF**, a modified version of RF detection using multiple frequencies to enhance sensitivity but with similar limitations to RF
- **Ferromagnetic Detectors**, are metal detectors that will detect ferrous and non-ferrous utilities. Sensitivity is limited, e.g. a 100 mm iron disk to a depth of about one meter or a 25 mm steel paper clip to a depth of about 20 cm.
- **Electronic markers,** are emerging technologies that impart a unique electronic signature to materials such as polyethylene pipe to facilitate location and tracing after installation. Promising for future installations but not of help for most existing utilities already in place.

Procedure

The following procedures shall be used to identify and mark underground utilities during subsurface construction activities on the project:

- The survey contractor shall determine the most appropriate geophysical technique or combinations of techniques to identify the buried utilities on the project, based on the survey contractor's experience and expertise, types of utilities anticipated to be present and specific site conditions.

- The survey contractor shall employ the same geophysical techniques used on the project to identify the buried utilities, to survey the proposed path of subsurface construction work to confirm no buried utilities are present.
- Identify customer specific permit and/or procedural requirements for excavation and drilling activities. For military installations contact the Base Civil Engineer and obtain the appropriate form to begin the clearance process.
- Contact utility companies or the state/regional utility protection service at least two (2) working days prior to excavation activities to advise of the proposed work, and ask them to establish the location of the utility underground installations prior to the start of actual excavation.
- Schedule the independent survey.
- Obtain utility clearances for subsurface work on both public and private property.
- Clearances are to be in writing, signed by the party conducting the clearance.
- Underground utility locations must be physically verified by hand digging using wood or fiberglass-handled tools when any adjacent subsurface construction activity (e.g. mechanical drilling, excavating) work is expected to come within 5 feet of the marked underground system. If subsurface construction activity is within 5 feet and parallel to a marked existing utility, the utility location must be exposed and verified by hand digging every 100 feet.
- Protect and preserve the markings of approximate locations of facilities until the markings are no longer required for safe and proper excavations. If the markings of utility locations are destroyed or removed before excavation commences or is completed, the Project Manager must notify the utility company or utility protection service to inform them that the markings have been destroyed.
- Conduct a site briefing for employees regarding the hazards associated with working near the utilities and the means by which the operation will maintain a safe working environment. Detail the method used to isolate the utility and the hazards presented by breaching the isolation.
- Monitor for signs of utilities during advancement of intrusive work (e.g., sudden change in advancement of auger or split spoon during drilling or change in color, texture or density during excavation that could indicate the ground has been previously disturbed).

2.2.10 Utilities (overhead)

Proximity to Power Lines

No work is to be conducted within 50 feet (15.2 meters) of overhead power lines without first contacting the utility company to determine the voltage of the system. No aspect of any piece of equipment is to be operated within 50 feet (15.2 meters) of overhead power lines without first making this determination.

Operations adjacent to overhead power lines are PROHIBITED unless one of the following conditions is satisfied:

- Power has been shut off, positive means (such as lockout) have been taken to prevent the lines from being energized, lines have been tested to confirm the outage, and the utility company has provided a signed certification of the outage.
- The minimum clearance from energized overhead lines is as shown in the table below, or the equipment will be repositioned and blocked to ensure that no part, including cables, can come within the minimum clearances shown in the table.

MINIMUM DISTANCES FROM POWERLINES

Powerlines Nominal System Kv	Minimum Required Distance, Feet (Meters)
0-50	10 (3.0)
50-200	15 (4.6)
201-350	20 (6.1)
351-500	25 (7.6)
501-750	35 (10.7)
751-1000	45 (13.7)
Over 1000	Established by utility owner/operator or by a professional engineer in electrical power transmission/distribution

(These distances have been determined to eliminate the potential for arcing based on the line voltage.)

- The power line(s) has been isolated through the use of insulating blankets which have been properly placed by the utility. If insulating blankets are used, the utility will determine the minimum safe operating distance; get this determination in writing with the utility representative's signature.
- All inquiries regarding electric utilities must be made in writing and a written confirmation of the outage/isolation must be received by the PM prior to the start of work.

2.2.11 Hand and Power Tools

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

Below are the hazard controls and safe work practices to follow when personnel or subcontractors are using hand and power tools. Ensure the requirements in the referenced SOP are followed:

- Tools shall be inspected prior to use and damaged tools will be tagged and removed from service;
- Hand tools will be used for their intended use and operated in accordance with manufacturer's instructions and design limitations;
- Maintain all hand and power tools in a safe condition;
- Use PPE (such as gloves, safety glasses, earplugs, and face shields) when exposed to a hazard from a tool;
- Do not carry or lower a power tool by its cord or hose;

- Portable power tools will be plugged into GFCI protected outlets;
- Portable power tools will be Underwriters Laboratories (UL) listed and have a three-wire grounded plug or be double insulated;
- Disconnect tools from energy sources when they are not in use, before servicing and cleaning them, and when changing accessories (such as blades, bits, and cutters);
- Safety guards on tools must remain installed while the tool is in use and must be promptly replaced after repair or maintenance has been performed;
- Store tools properly in a place where they will not be damaged or come in contact with hazardous materials;
- If a cordless tool is connected to its recharge unit, both pieces of equipment must conform strictly with electrical standards and manufacturer's specifications;
- Tools used in an explosive environment must be rated for work in that environment (that is, intrinsically safe, spark-proof, etc.); and
- Working with manual and pistol-grip hand tools may involve highly repetitive movement, extended elevation, constrained postures, and/or awkward positioning of body members (for example, hand, wrist, arm, shoulder, neck, etc.). Consider alternative tool designs, improved posture, the selection of appropriate materials, changing work organization, and sequencing to prevent muscular, skeletal, repetitive motion, and cumulative trauma stressors.

Machine Guarding

- Ensure that all machine guards are in place to prevent contact with drive lines, belts, chains, pinch points or any other sources of mechanical injury.
- Unplugging jammed equipment will only be performed when equipment has been shut down, all sources of energy have been isolated and equipment has been locked/tagged and tested.
- Maintenance and repair of equipment that results in the removal of guards or would otherwise put anyone at risk requires lockout of that equipment prior to work.

2.2.12 Work Above or Near Water

The following precautions should be taken when working on or above water:

- Safe means of boarding or leaving the boat or platform must be provided to prevent slipping and falling.
- All persons participating in boating operations will be directed by the SSC.
- All personnel shall wear a Personal Flotation Device (PFD) at all times while on the water.
- The boating team will include at least one person qualified in First Aid.
- Team Leader has final authority on operations with regards to weather and water conditions

- All operations involving boating will be directed by qualified and experienced boater.
- A Safe Boating Checklist will be completed at the frequency specified in Section 2 of this plan (and will be included in Attachment 5).
- Boat/barge must be equipped with adequate railing.
- Boat/barge must be operated according to U.S. Coast Guard regulations (speed, lightning, right-of-way, etc.).
- Staff should be instructed on safe use and operation of boat prior to use.
- Work requiring the use of a boat will not take place at night or during inclement weather.
- Shut off engine before refueling.
- Do not smoke while refueling.
- Fall protection should be provided to prevent personnel from falling into water. Where fall protection systems are not provided and the danger of drowning exists, U.S. Coast Guard-approved PFDs, or life jacket, shall be worn.
- Inspect PFDs prior to use. Do not use defective PFDs.
- A life-saving skiff must be provided for emergency rescue.
- A minimum of one ring buoy with 90 feet of 3/8-inch solid-braid polypropylene (or equal) rope must be provided for emergency rescue.
- Use sampling and other equipment according to the manufacturers' instructions.

Refer to CH2M HILL HSE SOP-404, In-water, Wetland and Coastal Work, for additional information.

2.2.13 Groundwater or NAPL Sampling/Water Level Measurements/NAPL Measurements

- Wear the appropriate PPE when sampling, including safety glasses, nitrile gloves, and steel toe boots (refer to Section 4).
- Monitor headspace of wells prior to sampling to minimize any vapor inhalation (refer to Section 5 on air monitoring).
- Use caution when opening well lids. Wells may contain poisonous spiders and hornet or wasp nests.
- Use the appropriate lifting procedures (see CH2M HILL SOP HSE-112) when unloading equipment and sampling at each well.
- Avoid sharp edges on well casings.
- If dermal contact with the groundwater or acid used in sample preservation, wash exposed skin thoroughly with soap and water.

- Avoid eating and drinking on site and during sampling.
- Use ear plugs during sampling if sampling involves a generator.
- Containerize all purge water and transport to the appropriate storage area.

2.2.14 Drum and Portable Tank Handling

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

- Ensure that personnel are trained in proper lifting and moving techniques to prevent back injuries;
- Ensure drum or tank bungs and lids are secured and are labeled prior to moving;
- Ensure that drums and tanks remain covered except when removing or adding material or waste. Covers and/or lids will be properly secured at the end of each workday;
- Provide equipment to keep the operator removed from the drums to lessen the likelihood of injury. Such equipment might include: a drum grappler attached to a hydraulic excavator; a small front-end loader, which can be either loaded manually or equipped with a bucket sling; a rough terrain forklift; Roller conveyor equipped with solid rollers; drum carts designed specifically for drum handling;
- Make sure the vehicle selected has sufficient rated load capacity to handle the anticipated loads, and make sure the vehicle can operate smoothly on the available road surface;
- Ensure there are appropriately designed Plexiglas cab shields on loaders, backhoes, etc., when handling drums containing potentially explosive materials;
- Equipment cabs should be supplied with fire extinguishers, and should be air-conditioned to increase operator efficiency;
- Supply operators with appropriate respiratory protective equipment when needed;
- Ensure that drums are secure and are not in the operator's view of the roadway;
- Prior to handling, all personnel should be warned about hazards of handling;
- Before moving anything, determine the most appropriate sequence in which the various drums, portable tanks, and other containers should be moved (e.g. small containers may have to be removed first to permit heavy equipment to enter and move the drums;
- Overpack drums and an adequate volume of absorbent should be kept near areas where minor spills may occur;
- Use containers or overpacks that are compatible with the waste or materials;
- Drums containing liquids or hazardous waste will be provided with secondary containment and may not be located near a storm water inlet or conveyance;
- Allow enough aisle space between drum pallets and between drums and other equipment that the drums can be easily accessed (at least 2 to 3 feet) by fire control equipment and similar equipment.; and

- Make sure that a spill kit is available in drum or tank storage areas (or where liquids are transferred from one vessel to another).

2.2.15 Drum Sampling Safety

Personnel are permitted to handle and/or sample drums containing certain types of waste (drilling waste, investigation-derived waste, waste from known sources) only. Handling or sampling drums with unknown contents requires a plan revision or amendment approved by the RHSM. The following control measures will be taken when sampling drums:

- Minimize transportation of drums;
- Sample only labeled drums or drums from a known waste stream;
- Do not sample bulging or swollen drums. Contact the RHSM;
- If drums contain, or potentially contain, flammable materials, use non-sparking tools to open;
- Use the proper tools to open and seal drums;
- Reseal bung holes or plugs whenever possible;
- Avoid mixing incompatible drum contents;
- Sample drums without leaning over the drum opening;
- Transfer/sample the content of drums using a method that minimizes contact with material;
- Use the PPE and perform air monitoring as specified in the PPE and Site Monitoring sections of this HSP;
- Take precautions to prevent contaminated media from contacting the floor or ground, such as having plastic under the sampling area, having a spill kit accessible during sampling activities; and
- If transferring/sampling drums containing flammable or combustible liquids, drums and liquid transfer equipment should be grounded and bonded to reduce the potential of a static discharge.

2.2.16 Working Alone

(Reference CH2M HILL Core Standard, Working Alone)

- Personnel can only be tasked to work alone by their Project Manager who has assessed potential hazards and appropriate control measures, with assistance from the Responsible Health and Safety Manager (RHSM).
- "Lone workers" with an automated person down system or an accountability system are permitted, depending on the hazards present. "Working Alone Determination Flowchart" guidance on the protocol in included in Attachment 13.

Accountability Systems

- The Lone Worker Call-In Contact Form found in Attachment 13 must be completed.

- The employee shall at all times be equipped with a working voice communication device such as a cellular phone or two-way radio to check-in to their project contact (s) at pre-determined times.

  Call in contact name: TO BE DETERMINED BY SC IF WORK ALONE IS REQUIRED
  Phone numbers (office and cell):

- Check-in or contact times must be based on the risk associated with the task, or the timeframe expected to complete the task, but at a minimum of at least two times during an 8 hour work shift.
- Work tasks will cease if communication is lost during work day. Work may resume when communication is re-established.

2.2.17 Exposure to Public Vehicular Traffic

The following precautions must be taken when working around traffic, and in or near an area where traffic controls have been established by a contractor.

- Exercise caution when exiting traveled way or parking along street – avoid sudden stops, use flashers, etc.
- Park in a manner that will allow for safe exit from vehicle, and where practicable, park vehicle so that it can serve as a barrier.
- All staff working adjacent to traveled way or within work area must wear reflective/high-visibility safety vests.
- Eye protection should be worn to protect from flying debris.
- Remain aware of factors that influence traffic related hazards and required controls – sun glare, rain, wind, flash flooding, limited sight-distance, hills, curves, guardrails, width of shoulder (i.e., breakdown lane), etc.
- Always remain aware of an escape route -- behind an established barrier, parked vehicle, guardrail, etc.
- Always pay attention to moving traffic – never assume drivers are looking out for you
- Work as far from traveled way as possible to avoid creating confusion for drivers.
- When workers must face away from traffic, a “buddy system” should be used, where one worker is looking towards traffic.
- When working on highway projects, obtain a copy of the contractor’s traffic control plan.
- Work area should be protected by a physical barrier – such as a K-rail or Jersey barrier.
- Review traffic control devices to ensure that they are adequate to protect your work area. Traffic control devices should: 1) convey a clear meaning, 2) command respect of road users, and 3) give adequate time for proper traffic response. The adequacy of these

devices are dependent on limited sight distance, proximity to ramps or intersections, restrictive width, duration of job, and traffic volume, speed, and proximity.

- Either a barrier or shadow vehicle should be positioned a considerable distance ahead of the work area. The vehicle should be equipped with a flashing arrow sign and truck-mounted crash cushion. All vehicles within 40 feet of traffic should have an orange flashing hazard light atop the vehicle.
- Except on highways, flaggers should be used when 1) two-way traffic is reduced to using one common lane, 2) driver visibility is impaired or limited, 3) project vehicles enter or exit traffic in an unexpected manner, or 4) the use of a flagger enhances established traffic warning systems.
- Lookouts should be used when physical barriers are not available or practical. The lookout continually watches approaching traffic for signs of erratic driver behavior and warns workers. Vehicles should be parked at least 40 feet away from the work zone and traffic. Minimize the amount of time that you will have your back to oncoming traffic.

Refer to CH2M HILL HSE SOP-216, Traffic Control, for additional information.

2.2.18 Chainsaws

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

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

Equipment

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

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

PPE Requirements

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

- Safety glasses with side shields and face shield to prevent injury from wood chips, sawdust, or other flying objects;

- Hard hat with properly fitted suspension to prevent head injury from falling debris;
- Steel-toed safety shoes or boots to prevent foot injury from falling objects and accidental contact with the moving chain;
- Hearing protection to prevent permanent damage to hearing. Ear muffs or plugs will have a decibel noise reduction rating (NRR) assigned to them. The higher the rating, the greater the protection offered;
- Non-leather, fabric work gloves to prevent hand injury from abrasions, splinters and cuts;
- Clothing that is well-fitted and free of loose edges that could become entangled in the saw; and
- Protective chaps or leggings that cover the area from the groin to about 2 inches (5.08 cm) above the ankles should be used. These chaps are made from synthetic fabrics that are designed to prevent the running saw chain from coming in contact with your legs.

Safe Operation

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

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

- Work slowly; don't rush; and
- A fire extinguisher shall be present at all times when operating the chainsaw in forest or brushy areas.

Refueling the Engine

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

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

2.2.19 Chemical Injections

The pilot testing program objectives for this project will be facilitated via the subsurface injection of ferrous sulfate and magnesium hydroxide (FS/MH) solution in the HCAA via 6 vertical and 4 horizontal injection wells using pumps and piping. Where these chemical injection remediation technologies are engaged within the site target areas, the procedures and handling practices identified below must be implemented. Chemical/compound – specific hazards and controls associated with the FS/MH solution injection are discussed after these general bullets.

Pre-Injection

1. Review the Material Safety Data Sheets (MSDSs) for the materials which are expected to be utilized in the chemical injection processes for this contract task order and:
   - Document training in accordance with the Hazard Communication section of this plan.
   - Ensure that appropriate spill response materials are present (e.g., absorbent media for oil, neutralizing agents for potassium permanganate, secondary containment for larger chemical tanks).
2. Evaluate potential for "daylighting"of chemical injection in the work area:
   - Evaluation should identify known or potential pathways such as existing monitoring wells screened at the same depth interval as the planned injection, wells that were not properly abandoned, and utility corridors.
   - Identify potential surface release areas such as nearby sensitive areas (e.g., wetlands) storm drains, ditches, or streams, and ensure that mitigation measures are in place (e.g., temporarily blocking storm sewer drains).

  - Contact the project Environmental Manager for assistance in identifying release scenarios and mitigation measures.

Injection Operations

- Operate and maintain pressure vessels, pumps and hosing in accordance with the manufacturer's recommendations.
- Do not exceed the rated pressure of the vessels and associated piping or hoses of the system.
- The system must be provided with a pressure relief valve/controller that safely reduces the system pressure to within the system rated pressure.
- The pressure relief valve must be rated at no more than 110% the rated pressure of the system and must be tested at regular intervals.
- Each vessel must be equipped with a functioning pressure gauge to monitor pressure.
- For PPE and air monitoring requirements, refer to the PPE section and Site Monitoring section of this plan. PPE shall be used to minimize potential exposure to identified site contaminants of concern and injection solutions during site injection operations. In addition, good personal hygiene practices and procedures must be practiced.
- Use face shields in combination with safety glasses or goggles when the potential for exposure to chemical splashes may exist.
- If repairs to injection delivery system components are necessary after the subsurface injection operations have been initiated, the injection lines must be relieved of pressure and drained before conducting repair work. See also the Lockout/Tagout section of this HSP.
- If using drums, they shall be moved using a drum "dolly" or other appropriate material handling equipment where the weight of the drum can be properly managed and secured during the movement.
- Empty containers may require special preparation/rinsing prior to disposal. Verify requirements with the project Environmental Manager.
- Only qualified personnel, by prior training or experience, may operate the injection system delivery components/array(s).
- Appropriate spill response materials for all chemicals must be present at the job site. Only qualified (by training and previous experience) who have proper PPE and equipment available shall provide spill response operations.
- Station a portable eye wash in the immediate work area where chemical injections are occurring, along with wash facilities for hygienic practices and PPE decontamination.
- If PPE becomes saturated and may potentially impact work clothing, dermal surfaces, or mucous membranes, change PPE immediately.
- Verify the competency and integrity of the chemical injection hoses/piping and connection points

- Confirm hose/piping rated for the designated psi of the pilot test.
- Verify the any cam-lock fitting on the injection hose/piping, well head, or direct push technology (DPT) rods are structurally sound and free of defects. Where hoses are used, ensure fittings have been secured to the hose surface via mechanical banding equipment to prevent whipping.
- When injecting under pressure, stand at a sufficient distance (i.e. ~ 20 feet) from the injection well head/point. Keep unessential project personnel away from the injection system, array, and well head(s) during injection operations.
- Remove/stow all unnecessary equipment and material in the area.
- The injection system/array must be monitored/attended at all times during the injection process and when not in use, components must be properly secured, de-energized, or stowed. If the system will operate without an attendant, plans for operating unattended must be in place an approved by the PM an HSM/EM.
- All pressured lines and fittings should be 'tethered' or otherwise secured to minimize whipping or 'launching' of lines in the event of an equipment failure. Any "quick connect" type fittings (compressed air or fluid) should be secured with appropriate pins, clips to prevent accidental disengagement of the fitting during operation.
- Inspect all equipment, hoses, pressure lines, and fittings daily and prior to pressurizing.

Chemical Storage

- Some injection chemicals, such as strong oxidizers, may have stringent storage requirements per local or National Fire Codes. Verify that appropriate storage provisions are in place prior to starting work.
- NOTE: Counties and cities may have requirements specific to storing these chemicals. Also, storage and use of certain chemicals such as potassium permanganate and hydrogen peroxide may be subject to the new Chemical Facility Anti-Terrorism Standards of the Department of Homeland Security – the applicability depends on the chemical, quantity/concentration, and type of facility. Please contact the project Environmental Manager to determine whether chemicals are subject to these standards.

2.2.20 Noise

(Reference CH2M HILL SOP HSE-108, *Hearing Conservation*)

CH2M HILL is required to control employee exposure to occupational noise levels of 85 decibels, A-weighted, (dBA) and above by implementing a hearing conservation program that meets the requirements of the OSHA Occupational Noise Exposure standard, 29 CFR 1910.95. A noise assessment may be conducted by the RHSM or designee based on potential to emit noise above 85 dBA and also considering the frequency and duration of the task.

- Areas or equipment emitting noise at or above 90dBA shall be evaluated to determine feasible engineering controls. When engineering controls are not feasible, administrative controls can be developed and appropriate hearing protection will be provided.

- Areas or equipment emitting noise levels at or above 85 dBA, hearing protection must be worn.
- Employees exposed to 85 dBA or a noise dose of 50% must participate in the Hearing Conservation program including initial and annual (as required) audiograms.
- The RHSM will evaluate appropriate controls measures and work practices for employees who have experienced a standard threshold shift (STS) in their hearing.
- Employees who are exposed at or above the action level of 85 dBA are required to complete the online Noise Training Module located on CH2M HILL's virtual office.
- Hearing protection will be maintained in a clean and reliable condition, inspected prior to use and after any occurrence to identify any deterioration or damage, and damaged or deteriorated hearing protection repaired or discarded.
- In work areas where actual or potential high noise levels are present at any time, hearing protection must be worn by employees working or walking through the area.
- Areas where tasks requiring hearing protection are taking place may become hearing protection required areas as long as that specific task is taking place.
- High noise areas requiring hearing protection should be posted or employees must be informed of the requirements in an equivalent manner and a copy of the OSHA standard 29 CFR 1910.95 shall be posted in the workplace.
- Previous surveys indicate that heavy equipment such as drilling or excavation equipment may produce continuous and impact noise at or above the action level of 85 decibels (dBA). All CH2M HILL personnel within 25 feet of operating equipment, or near an operation that creates noise levels high enough to impair conversation, shall wear hearing protective devices (either muffs or plugs). Personnel will wash their hands with soap and water prior to inserting ear plugs to avoid initiating ear infections.

2.3 General Hazards and Controls

2.3.1 General Practices and Housekeeping

General "good housekeeping" practices include:

- Site work should be performed during daylight hours whenever possible. Work conducted during hours of darkness require enough illumination intensity to read a newspaper without difficulty.
- Good housekeeping must be maintained at all times in all project work areas.
- Common paths of travel should be established and kept free from the accumulation of materials.
- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions.

- Provide slip-resistant surfaces, ropes, and/or other devices to be used.
- Specific areas should be designated for the proper storage of materials.
- Tools, equipment, materials, and supplies shall be stored in an orderly manner.
- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area.
- Containers should be provided for collecting trash and other debris and shall be removed at regular intervals.
- All spills shall be quickly cleaned up. Oil and grease shall be cleaned from walking and working surfaces.

Refer to CH2M HILL HSE SOP-209, General Practices, for additional information.

2.3.2 Hazard Communication

The SC is to perform the following:

- Complete an inventory of chemicals brought to the site by CH2M HILL using Attachment 7.
- Confirm that an inventory of chemicals brought on site by CH2M HILL subcontractors is available.
- Request or confirm locations of Material Safety Data Sheets (MSDSs) from the client, contractors, and subcontractors for chemicals to which CH2M HILL employees potentially are exposed.
- Copies of all applicable MSDSs will be placed in Attachment 8.
- Before or as the chemicals arrive on site, obtain an MSDS for each hazardous chemical.
- Label chemical containers with the identity of the chemical and with hazard warnings, and store properly.
- Give employees required chemical-specific hazard communication training using Attachment 9.
- Store all materials properly, giving consideration to compatibility, quantity limits, secondary containment, fire prevention, and environmental conditions.

Refer to CH2M HILL HSE SOP-107, Hazard Communication, for additional information.

2.3.3 Shipping and Transportation of Chemical Products

Chemicals brought to the site might be defined as hazardous materials by the U.S. Department of Transportation (DOT). All staff who ship the materials or transport them by road must receive CH2M HILL training in shipping dangerous goods. All hazardous materials that are shipped (e.g., via Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. Contact the HSM or the Equipment Coordinator for additional information.

Refer to CH2M HILL's Procedures for Shipping and Transporting Dangerous Goods for additional information.

2.3.4 Knife Use

Knives (fixed/utility) shall not be used. If it is demonstrated that a knife is the right tool for the job, this plan will be amended and the activity that knife use will be used for shall be reviewed.

Responsibilities	• Supervisors with assistance from the FTL/SC are responsible for funding and ensuring the correct tool is being used, employees wear the proper PPE when using knives, and they have reviewed this policy. • Employees are responsible for having and utilizing the proper PPE while performing an activity requiring the use of a knife. Employees are also responsible for understanding the proper use of a knife.
Glove Requirements	• In general, Kevlar cut resistant gloves are to be worn when using a knife in an occupational setting. • Other types of gloves may be required and will be identified within the AHA / written procedure. Example - Leather gloves may be worn when using the acetate sleeve cutter.

Training (Ref. VO for additional hand safety topics)

All employees that will use a knife must be trained in the proper use.

- When using a knife always cut away from yourself.
- Many tasks using a utility knife require a knife edge but not a sharp point. For these tasks you can add protection against puncture wounds by using a rounded-tip blade.
- If you use a folding knife, it must be a locking blade type.
- Never use a knife that will fold under pressure.
- If you use a fixed blade knife, make sure there is a handle guard to keep your hand from slipping forward. Also, make sure the handle is dry and non- greasy/slippery to assure a better grip.
- When cutting, make the force of the cut carry the blade away from any part of your body. If you have a peculiar situation where this is not possible, protect yourself with a leather apron, or other material placed between you and the blade. Consider putting the material to be cut in a vise, or other holding device.
- If you carry a fixed blade knife, use a sheath or holder.
- Store utility knives safely, retract the blade or sheath an open blade before storing. Never, leave a knife with the blade exposed on the floor, on a pallet, on a work surface, or in a drawer or cabinet.
- Keep your knife sharp. A dull blade requires you to use more force to cut, and consequently increases the risk of slip or mistake.
- Knives used on the job, but not carried with you , must be properly stored when not in use
- Never use a defective knife.
- Utility knife blades are brittle and can snap easily. Don't bend them or apply side loads to them by using them to open cans or pry loose objects. Use the knife only to cut. It was not designed to work as a prybar, screw driver, hole punch, and other assorted things that make it seem so easy.

Examples of preferred tools and Kevlar cut resistant gloves:

A safety spring provides for automatic blade "shoot-back" into the handle when contact w/cutting surface is lost

Stay focused on the cutting job. It only takes a second of inattention with a sharp blade to produce a serious cut. Letting the mind wander or talking with others while using a knife greatly increases the risk of an accident and injury. If you are interrupted while working with a knife, stop cutting, retract the blade, and place the knife down on a secure surface before dealing with the interruption. You should never continue cutting while distracted!

As always, utilize the hierarchy of controls and first attempt to engineer out the hazard and frequently ask ourselves do we have the right tool for the job.

2.3.5 Lifting

Proper lifting techniques must be used when lifting any object:

- Plan storage and staging to minimize lifting or carrying distances.
- Split heavy loads into smaller loads.
- Use mechanical lifting aids whenever possible.
- Have someone assist with the lift -- especially for heavy or awkward loads.
- Make sure the path of travel is clear prior to the lift.

Refer to CH2M HILL HSE SOP-112, Lifting, for additional information.

2.3.6 Fire Prevention

Fire prevention measures include the following:

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

- The area in front of extinguishers must be kept clear.
- Post "Exit" signs over exiting doors, and post "Fire Extinguisher" signs over extinguisher locations.
- Combustible materials stored outside should be at least 10 feet from any building.
- Solvent waste and oily rags must be kept in a fire resistant, covered container until removed from the site.
- Flammable/combustible liquids must be kept in approved containers, and must be stored in an approved storage cabinet.

Refer to CH2M HILL HSE SOP-208, Fire Prevention, for additional information.

2.3.7 Electrical

Electrical safety measures include:

- Only qualified personnel are permitted to work on unprotected energized electrical systems.
- Only authorized personnel are permitted to enter high-voltage areas.
- Do not tamper with electrical wiring and equipment unless qualified to do so. All electrical wiring and equipment must be considered energized until lockout/tagout procedures are implemented.
- Inspect electrical equipment, power tools, and extension cords for damage prior to use. Do not use defective electrical equipment, remove from service.
- All temporary wiring, including extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed.
- Extension cords must be:
  - equipped with third-wire grounding.
  - covered, elevated, or protected from damage when passing through work areas.
  - protected from pinching if routed through doorways.
  - not fastened with staples, hung from nails, or suspended with wire.
- Electrical power tools and equipment must be effectively grounded or double-insulated UL approved.
- Operate and maintain electric power tools and equipment according to manufacturers' instructions.
- Maintain safe clearance distances between overhead power lines and any electrical conducting material unless the power lines have been de-energized and grounded, or where insulating barriers have been installed to prevent physical contact. Maintain at least 10 feet from overhead power lines for voltages of 50 kV or less, and 10 feet plus ½ inch for every 1 kV over 50 kV.

- Temporary lights shall not be suspended by their electric cord unless designed for suspension. Lights shall be protected from accidental contact or breakage.
- Protect all electrical equipment, tools, switches, and outlets from environmental elements.

Refer to CH2M HILL HSE SOP-206, Electrical, for additional information.

2.3.8 Stairways and Ladders

Safety guidelines pertaining to stairways and ladders include the following:

- Stairway or ladder is generally required when a break in elevation of 19 inches or greater exists.
- Personnel should avoid using both hands to carry objects while on stairways; if unavoidable, use extra precautions.
- Personnel must not use pan and skeleton metal stairs until permanent or temporary treads and landings are provided the full width and depth of each step and landing.
- Ladders must be inspected by a competent person for visible defects prior to each day's use. Defective ladders must be tagged and removed from service.
- Ladders must be used only for the purpose for which they were designed and shall not be loaded beyond their rated capacity.
- Only one person at a time shall climb on or work from an individual ladder.
- User must face the ladder when climbing; keep belt buckle between side rails
- Ladders shall not be moved, shifted, or extended while in use.
- User must use both hands to climb; use rope to raise and lower equipment and materials
- Straight and extension ladders must be tied off to prevent displacement
- Ladders that may be displaced by work activities or traffic must be secured or barricaded
- Portable ladders must extend at least 3 feet above landing surface
- Straight and extension ladders must be positioned at such an angle that the ladder base to the wall is one-fourth of the working length of the ladder
- Stepladders are to be used in the fully opened and locked position
- Users are not to stand on the top two steps of a stepladder; nor are users to sit on top or straddle a stepladder
- Fixed ladders $\geq$ 24 feet in height must be provided with fall protection devices.
- Fall protection should be considered when working from extension, straight, or fixed ladders greater than six feet from lower levels and both hands are needed to perform the work, or when reaching or working outside of the plane of ladder side rails.

Refer to CH2M HILL HSE SOP-214, Stairways and Ladders, for additional information.

2.3.9 Heat Stress

Heat-related illnesses are caused by more than just temperature and humidity factors.

Physical fitness influences a person's ability to perform work under heat loads. At a given level of work, the more fit a person is, the less the physiological strain, the lower the heart rate, the lower the body temperature (indicates less retrained body heat—a rise in internal temperature precipitates heat injury), and the more efficient the sweating mechanism.

Acclimatization is a gradual physiological adaptation that improves an individual's ability to tolerate heat stress. Acclimatization requires physical activity under heat-stress conditions similar to those anticipated for the work. With a recent history of heat-stress exposures of at least two continuous hours per day for 5 of the last 7 days to 10 of the last 14 days, a worker can be considered acclimatized. Its loss begins when the activity under those heat-stress conditions is discontinued, and a noticeable loss occurs after 4 days and may be completely lost in three to four weeks. Because acclimatization is to the level of the heat-stress exposure, a person will not be fully acclimatized to a sudden higher level; such as during a heat wave.

Dehydration reduces body water volume. This reduces the body's sweating capacity and directly affects its ability to dissipate excess heat.

The ability of a body to dissipate heat depends on the ratio of its surface area to its mass (surface area/weight). **Heat dissipation** is a function of surface area, while heat production depends on body mass. Therefore, overweight individuals (those with a low ratio) are more susceptible to heat-related illnesses because they produce more heat per unit of surface area than if they were thinner. Monitor these persons carefully if heat stress is likely.

When wearing **impermeable clothing**, the weight of an individual is not as important in determining the ability to dissipate excess heat because the primary heat dissipation mechanism, evaporation of sweat, is ineffective.

Precautions

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50°Fahrenheit (10 degrees Celsius [C]) to 60°Fahrenheit (F) (15.6 degrees C) should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons (7.5 liters) per day. Remind employees to drink water throughout their work shift.
- Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate to site work conditions by slowly increasing workloads; for example, do not begin site work with extremely demanding activities. Closely monitor employees during their first 14 days of work in the field.

- Supervisors and SCs must continually observe employees throughout the work shift for signs and symptoms of heat stress or illness. Employees must monitor themselves for heat stress as well as observe their co-workers.
- Effective communication must be maintained with employees throughout the work shift either by voice, observation, or electronic device.
- Use cooling devices, such as cooling vests, to aid natural body ventilation. These devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Avoid direct sun whenever possible, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brim hat or an umbrella when working under direct sun for extended periods.
- Provide adequate shade to protect personnel against radiant heat (sun, flames, hot metal).
- Use portable fans for convection cooling or in extreme heat conditions, an air-conditioned rest area when needed.
- In hot weather, rotate shifts of workers.
- Maintain good hygiene standards by frequent changes of clothing and showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should consult medical personnel.
- Brief employees initially before the project work begins and routinely as part of the daily safety briefing, on the signs and symptoms, of heat-relatedness illnesses, precautions to measures and emergency procedures to follow as described in this plan.
- Observe one another for signs of heat stress. PREVENTION and communication is key.

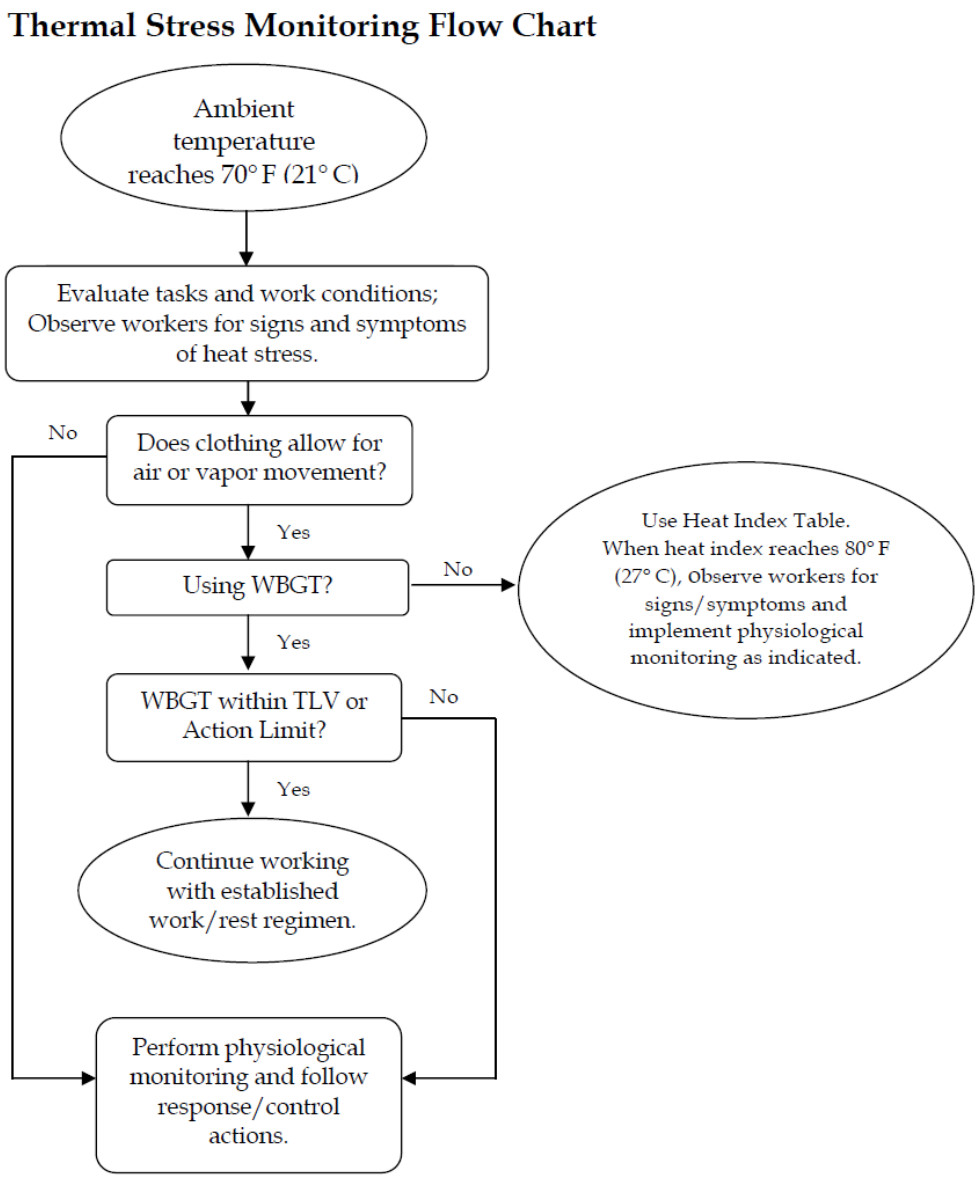
Symptoms and treatment of heat stress are summarized in Table 2-1.

TABLE 2-1
Symptoms and Treatment of Heat Stress

Type of Heat Stress	Signs and Symptoms	Treatment
Heat Syncope	Sluggishness or fainting while standing erect or immobile in heat.	Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.
Heat Rash	Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure.	Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.
Heat Cramps	Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours.	Remove to cooler area. Rest lying down. Increase fluid intake.
Heat Exhaustion	Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or	Remove to cooler area. Rest lying down, with head in low position.

	flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low	Administer fluids by mouth. Seek medical attention.
Heat Stroke	Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature.	Cool rapidly by soaking in cool–but not cold–water. Call ambulance, and get medical attention immediately!

Thermal Stress Monitoring



Thermal Stress Monitoring – Permeable or Impermeable Clothing

When **permeable work clothes** are worn (street clothes or clothing ensembles over street clothes), regularly observe workers for signs and symptoms of heat stress and implement

physiological monitoring as indicated below. This should start when the heat index reaches 80° F (27° C) [see Heat Index Table below], or sooner if workers exhibit symptoms of heat stress indicated in the table above. These heat index values were devised for shady, light wind conditions; exposure to full sunshine can increase the values by up to 15°F (8°C). Also, strong winds, particularly with very hot, dry air, can be extremely hazardous.

When wearing **impermeable clothing** (e.g., clothing doesn't allow for air or water vapor movement such as Tyvek), physiological monitoring as described below shall be conducted when the ambient temperature reaches 70° F (21° C) or sooner when climatic conditions may present greater risk of heat stress combined with wearing unique variations of impermeable clothing, or workers exhibit symptoms of heat stress

Heat Index

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	126	130					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Streuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

Heat Index	Possible Heat Disorders	Minimum Frequency of Physiological Monitoring
80°F - 90°F (27°C - 32°C)	Fatigue possible with prolonged exposure and/or physical activity	Conduct initial monitoring as baseline and observe workers for signs of heat stress and implement physiological monitoring if warranted.
90°F - 105°F (32°C - 41°C)	Sunstroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity	Conduct initial monitoring as baseline, then at least every hour, or sooner, if signs of heat stress are observed.
105°F - 130°F (41°C - 54°C)	Sunstroke, heat cramps, or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity.	Conduct initial monitoring as baseline, then every 30 minutes or sooner if signs of heat stress are observed.
130°F or Higher (54°C or Higher)	Heat/Sunstroke highly likely with continued exposure.	Conduct initial monitoring as baseline, then every 15 minutes or sooner if signs of heat stress are observed.
Source: National Weather Service		

Physiological Monitoring and Associated Actions

For employees wearing permeable clothing, follow the minimum frequency of physiological monitoring listed in the Heat Index Table.

For employees wearing impermeable clothing, physiological monitoring should begin initially at a 15 minute interval, then if the employee's heart rate or body temperature is within acceptable limits, conduct the subsequent physiological monitoring at 30 minutes, and follow the established regimen protocol below.

The following physiological monitoring protocol below, using either radial pulse or aural temperature, will occur when the heat index is 80 degrees F or greater (or when personnel exhibit signs of heat stress), the following will be performed:

- The sustained heart rate during the work cycle should remain below 180 beats per minute (bpm) minus the individual's age (e.g. 180 – 35 year old person = 145 bpm). The sustained heart rate can be estimated by measuring the heart rate at the radial pulse for 30 seconds as quickly as possible prior to starting the rest period.
- The heart rate after one minute rest period should not exceed 120 beats per minute (bpm).
- If the heart rate is higher than 120 bpm after the FIRST minute into the rest period, the next work period should be shortened by 33 percent, while the length of the rest period stays the same.
- If the pulse rate still exceeds 120 bpm at the beginning of the next rest period, the following work cycle should be further shortened by 33 percent.

- Continue this procedure until the rate is maintained below 120 bpm after the FIRST minute into the rest period.

Alternately, the body temperature can be measured, either oral or aural (ear), before the workers have something to drink.

- If the oral or aural temperature exceeds 99.6° F (37.6 ° F) at the beginning of the rest period, the following work cycle should be shortened by 33 percent.
- Continue this procedure until the oral or aural (ear) temperature is maintained below 99.6 ° F (37.6° C). While an accurate indication of heat stress, oral temperature is difficult to measure in the field, however, a digital aural (aural) thermometer is easy to obtain and inexpensive to purchase.

Procedures for when Heat Illness Symptoms are Experienced

- **Always** contact the RHSM when any heat illness related symptom is experienced so that controls can be evaluated and modified, if needed.
- In the case of cramps, reduce activity, increase fluid intake, move to shade until recovered.
- In the case of all other heat-related symptoms (fainting, heat rash, heat exhaustion), and if the worker is a CH2M HILL worker, contact the occupational physician at 1-866-893-2514 and immediate supervisor.
- In the case of heat stroke symptoms, call 911, have a designee give location and directions to ambulance service if needed, follow precautions under the emergency medical treatment of this HSP.
- Follow the Incident Notification, Reporting, and Investigation section of this HSP.

2.3.10 Cold Stress

General

Low ambient temperatures increase the heat lost from the body to the environment by radiation and convection. In cases where the worker is standing on frozen ground, the heat loss is also due to conduction.

Wet skin and clothing, whether because of water or perspiration, may conduct heat away from the body through evaporative heat loss and conduction. Thus, the body cools suddenly when chemical protective clothing is removed if the clothing underneath is perspiration soaked.

Movement of air across the skin reduces the insulating layer of still air just at the skin's surface. Reducing this insulating layer of air increases heat loss by convection.

Non-insulating materials in contact or near-contact with the skin, such as boots constructed with a metal toe or shank, conduct heat rapidly away from the body.

Certain common drugs, such as alcohol, caffeine, or nicotine, may exacerbate the effects of cold, especially on the extremities. These chemicals reduce the blood flow to peripheral parts of the body, which are already high-risk areas because of their large surface area to volume ratios. These substances may also aggravate an already hypothermic condition.

Precautions

- Be aware of the symptoms of cold-related disorders, and wear proper, layered clothing for the anticipated fieldwork. Appropriate rain gear is a must in wet weather.
- Consider monitoring the work conditions and adjusting the work schedule using guidelines developed by the U.S. Army (wind-chill index) and the National Safety Council (NSC).
- Wind-Chill Index (below) is used to estimate the combined effect of wind and low air temperatures on exposed skin. The wind-chill index does not take into account the body part that is exposed, the level of activity, or the amount or type of clothing worn. For those reasons, it should only be used as a guideline to warn workers when they are in a situation that can cause cold-related illnesses.
- Persons who experience initial signs of immersion foot, frostbite, and/or hypothermia should report it immediately to their supervisor/PM to avoid progression of cold-related illness.
- Observe one another for initial signs of cold-related disorders.
- Obtain and review weather forecast – be aware of predicted weather systems along with sudden drops in temperature, increase in winds, and precipitation.

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

Symptoms and treatment of cold stress are summarized in Table 2-2.

TABLE 2-2
Symptoms and Treatment of Cold Stress

Type of Cold Stress	Signs and Symptoms	Treatment
Immersion (Trench) Foot	Feet discolored and painful; infection and swelling present.	Seek medical treatment immediately.
Frostbite	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Remove victim to a warm place. Re-warm area quickly in warm–but **not** hot–water. Have victim drink warm fluids, but **not** coffee or alcohol. Do not break blisters. Elevate the injured area, and get medical attention.
Hypothermia	Shivering, apathy, sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow respiration.	Remove victim to a warm place. Have victim drink warm fluids, but not coffee or alcohol. Get medical attention.

Refer to CH2M HILL HSE SOP-211, Heat and Cold Stress, for additional information.

2.3.11 Compressed Gas Cylinders

Safety measures pertaining to handling compressed gas cylinders include:

- Valve caps must be in place when cylinders are transported, moved, or stored.
- Cylinder valves must be closed when cylinders are not being used and when cylinders are being moved.
- Cylinders must be secured in an upright position at all times.
- Cylinders must be shielded from welding and cutting operations and positioned to avoid being struck or knocked over; contacting electrical circuits; or exposed to extreme heat sources.
- Cylinders must be secured on a cradle, basket, or pallet when hoisted; they may not be hoisted by choker slings.

2.3.12 Procedures for Locating Buried Utilities

Local Utility Mark-Out Service:

Name: New Jersey One Call System
Phone: 800-272-1000

During indoor air quality sampling tasks, a utility mark out shall be performed prior to core-drilling through any structure's floor.

Procedures for locating buried utilities include:

- Contact your local utility location service.
- Where available, obtain utility diagrams for the facility.
- Review locations of sanitary and storm sewers, electrical conduits, water supply lines, natural gas lines, and fuel tanks and lines.
- Review proposed locations of intrusive work with facility personnel knowledgeable of locations of utilities. Check locations against information from utility mark-out service.
- Where necessary (e.g., uncertainty about utility locations), excavation or drilling of the upper depth interval should be performed manually.
- Monitor for signs of utilities during advancement of intrusive work (e.g., sudden change n advancement of auger or split spoon).
- When the client or other onsite party is responsible for determining the presence and locations of buried utilities, the SSC should confirm that arrangement.

2.3.13 Confined Space Entry

No confined space entry will be permitted. Confined space entry requires additional health and safety procedures, training, and a permit. If conditions change such that confined-space entry is necessary, contact the HSM to develop the required entry permit.

When planned activities will not include confined-space entry, permit-required confined spaces accessible to CH2M HILL personnel are to be identified before the task begins. The SSC is to confirm that permit spaces are properly posted or that employees are informed of their locations and hazards.

Refer to CH2M HILL SOP HS-203, Confined Space Entry, for additional information.

2.3.14 Driving in Areas with Tall Grass/Brush

Driving in areas with tall grass/brush can present a potential fire hazard if the grass/brush gets caught under and/or remains in contact with the vehicle exhaust system. Employees should exercise the following precautions:

- When stopping vehicle, ensure it is in an area where grass is not tall.
- Do not leave vehicle idling once stopped.
- When possible, try to drive through areas where grass is not tall or grass has been beaten down.
- Ensure that a fire extinguisher is available for each vehicle.
- Keep fire extinguisher readily available in passenger area of vehicle while driving.
- Keep fire extinguisher outside of vehicle upon stopping.
- Address fire hazards and controls in daily safety briefings as appropriate.

2.3.15 Inclement Weather

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

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

- Know where to go and how long it will take to get there. If possible, take refuge in a large building or vehicle. Do not go into a shed in an open area.
- The inclination to see trees as enormous umbrellas is the most frequent and most deadly mistake. Do not go under a large tree that is standing alone. Likewise, avoid poles, antennae and towers.
- If the area is wide open, go to a valley or ravine, but be aware of flash flooding.
- If you are caught in a level open area during an electrical storm and you feel your hair stand on end, drop to your knees, bend forward and put your hands on your knees or crouch. The idea is to make yourself less vulnerable by being as low to the ground as possible and taking up as little ground space as possible. Lying down is dangerous, since the wet earth can conduct electricity. Do not touch the ground with your hands.
- Do not use telephones during electrical storms, except in the case of emergency

Remember that lightning may strike several miles from the parent cloud, so work should be stopped/restarted accordingly. The lightning safety recommendation is 30-30: Seek refuge when thunder sounds within 30 seconds after a lightning flash; and do not resume activity until 30 minutes after the last thunder clap.

High winds can cause unsafe conditions, and activities should be halted until wind dies down. High winds can also knock over trees, so walking through forested areas during high-wind situations should be avoided. If winds increase, seek shelter or evacuate the area. Proper body protection should be worn in case the winds hit suddenly, because body temperature can decrease rapidly.

2.4 Biological Hazards and Controls

2.4.1 Snakes

Each year, about 9,000 people are bitten by poisonous snakes in the U.S. Only about 15-25% actually receive venom, and U.S. deaths from snakebites only total about 12-15 people annually. In 2002, there were only 9 snakebite deaths in the US. Most snakebite deaths occur in small, young children whose lack of body mass and immune system development

make them more susceptible to snake venom. However, a far larger number of people suffer medical complications ranging from mild to serious problems from improper treatment than the number who die. Therefore, knowing what to do to avoid snakebites, and how to properly treat them if they occur, is critical to preventing permanent injury or death.

Snakes typically are found in underbrush and tall grassy areas. If you encounter a snake, stay calm and look around; there may be other snakes. Turn around and walk away on the same path you used to approach the area. If a person is bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Seek medical attention immediately. **DO NOT** apply ice, cut the wound, or apply a tourniquet. Try to identify the type of snake: note color, size, patterns, and markings.

Table 2-3 summarizes the measures to be taken (and NOT to be taken) in the event of a snakebite.

TABLE 2-3
Snakebite Response Measures

Things to Do	Things NOT to Do
• Move victim, and everybody else, away from snakes. • Identify the snake - kill it ONLY if necessary. • Lie the victim down with the bite area at or just slightly below the heart level. • Calm the victim by explaining the facts about snakebites. • Immobilize the bite area with a splint and sling, if possible. • Remove constricting jewelry or clothing unless the victim resists. • Get professional medical help as quickly as possible.	• Do not cut and suck the wound, either manually or orally. • Do not apply a tight, narrow band tourniquet - these cause amputations! • Do not apply ice or heat packs, and do not use a stun gun on the bite area. • Do not give the victim any food or drink, and this applies especially to alcohol! • Do not allow the victim to become alarmed, excited or agitated, as this will only increase blood flow and the chances of getting poison to the heart. • Do not allow victim to exercise vigorously, including running. • If you must kill the snake, then do NOT touch its head for at least one hour. If you must kill a snake for identification purposes, then completely remove its head and bury it. Snake heads have been documented as capable of biting and injecting poison an hour or more after decapitation. • Do not waste valuable time on unimportant acts like trying to find a snake to identify or kill it. Hemotoxic poison will start to enter the blood stream within 30 minutes, and neurotoxic poison works even faster.

Following the above protocols (Table 2-3) will greatly reduce the chances of serious complications from snakebites. Bear in mind that few people die from poisonous snakebites

and the vast majority of snakebite victims are not even venomized. Snakes generally reserve their venom for prey they intend to eat. Snakebites are more a nuisance than a serious medical problem in most cases.

2.4.2 Poison Ivy and Poison Sumac

Poison ivy, poison oak, and poison sumac typically are found in brush or wooded areas. They are more commonly found in moist areas or along the edges of wooded areas. Become familiar with the identity of these plants. Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and water immediately. If the reaction is severe or worsens, seek medical attention. Additional information and photographs of each are provided in Attachment 10.

2.4.3 Ticks

Ticks typically are in wooded areas, bushes, tall grass, and brush. Ticks are black, black and red, or brown and can be up to one-quarter inch in size. Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into boots; spray **only outside** of clothing with permethrin or permanone and spray skin with only DEET; and check yourself frequently for ticks.

If bitten by a tick, grasp it at the point of attachment and carefully remove it. After removing the tick, wash your hands and disinfect and press the bite areas. Save the removed tick. Report the bite to human resources. Symptoms of tick-borne diseases include chills, fever, headache, fatigue, stiff neck, and bone pain. Other symptoms include:

- Lyme Disease - A rash might appear that looks like a bullseye with a small welt in the center.
- Rocky Mountain Spotted Fever – A rash of red spots may appear under the skin 3-10 days after the tick bite.

If any of these symptoms appear, seek medical attention.

2.4.4 Bees and Other Stinging Insects

Bee and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform the SSC and/or buddy. If a stinger is present, remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; seek medical attention if a reaction develops.

2.4.5 Bloodborne Pathogens

Exposure to bloodborne pathogens may occur when rendering first aid or cardiopulmonary resuscitation (CPR), or when coming into contact with landfill waste or waste streams containing potentially infectious material. Hepatitis B vaccination must be offered before the person participates in a task where exposure is a possibility.

Refer to CH2M HILL HSE SOP-202, Bloodborne Pathogens, for additional information regarding exposure controls and PPE.

2.4.6 Mosquito Bites

Due to the recent detection of the West Nile Virus in the Southeastern United States it is recommended that preventative measures be taken to reduce the probability of being bitten by mosquitoes whenever possible. Mosquitoes are believed to be the primary source for exposure to the West Nile Virus as well as several other types of encephalitis. The following guidelines should be followed to reduce the risk of these concerns for working in areas where mosquitoes are prevalent.

- Stay indoors at dawn, dusk, and in the early evening.
- Wear long-sleeved shirts and long pants whenever you are outdoors.
- Spray clothing with repellents containing permethrin or DEET since mosquitoes may bite through thin clothing.
- Apply insect repellent sparingly to exposed skin. An effective repellent will contain 35% DEET (N,N-diethyl-meta-toluamide). DEET in high concentrations (greater than 35%) provides no additional protection.
- Repellents may irritate the eyes and mouth, so avoid applying repellent to the hands.
- Whenever you use an insecticide or insect repellent, be sure to read and follow the manufacturer's DIRECTIONS FOR USE, as printed on the product.

Note: Vitamin B and "ultrasonic" devices are NOT effective in preventing mosquito bites.

Symptoms of Exposure to the West Nile Virus

The West Nile Virus incubation period is from 3-15 days. Most infections are mild, and symptoms include fever, headache, and body aches, occasionally with skin rash and swollen lymph glands. More severe infection may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and, rarely, death.

If you have any questions or to report any suspicious symptoms, contact the project HSM.

2.4.7 Spiders

Black Widow

Description

The female black widow spider is almost twice the size of its male counterpart. Although both are considered venomous, only the female spider is able to bite and envenomate humans. During the summer months, the female black widow spider is the most venomous. The spider undergoes multiple moltings throughout the year and often changes color. The female is most often shiny black in color and has a rounded abdomen with a red distinctive hourglass on its ventral surface. Occasionally, two red spots may be seen instead of the hourglass configuration.

Symptoms

When bitten by a black widow spider, the symptoms usually begin with a pinprick sensation, followed by the appearance of mild swelling and redness around the bite wound. It is not unusual for the patient to be unaware of the bite until a local reaction has occurred. Close evaluation of the site may reveal two fang marks. The first hour after the bite, pain often increases around the area of the bite and spreads to the entire body. Upper extremity bites usually lead to spasm of the upper trunk muscles; bites of the lower extremity often lead to abdominal spasms.

Other common symptoms include an abnormal sensation in the extremities (i.e., prickling or burning), deep tendon reflexes, headache, anxiety, nausea, vomiting, tremor, restlessness, and seizures may also be seen. Symptoms usually resolve within 24-48 hours

General treatment includes local wound care, a tetanus shot, and pain medication if needed. Airway, breathing, and circulation should be monitored closely.

Prevention

Wear gloves, heavy garments that are fully buttoned, and protective footwear when working in areas where spiders commonly inhabit (i.e., dark and protected spaces such as wells, rock and wood piles, pipes, gloves, boots, etc.)

Brown Recluse

Description

The brown recluse spider is approximately 1 centimeters (cm) in body length, with a leg span of up to 2.5 cm. The color of these spiders is usually tan to brown.

Symptoms

Envenomation is initially painless for most victims. Within the first few hours, pain and redness occur at the site of the bite. The bite mark may resemble a bullseye and is most often 1-5 cm in diameter. Over the next few days, the bite area will ulcerate and spread in diameter and into the fatty tissue below. In one week after the bite a large area of skin and tissue can be involved. Surgical intervention is usually required to remove the bite area.

Systemic reactions, while uncommon, can occur in some individuals. These symptoms usually occur within 2 days of the bite and can include fever, chills, rash, nausea, vomiting, and possible renal failure.

General treatment includes local wound care, tetanus inoculation, immobilization, elevation, observation, and surgical removal of the wound.

Prevention

Wear gloves, heavy garments that are fully buttoned, and protective footwear when working in areas where spiders commonly inhabit (i.e., dark and protected spaces such as wells, rock and wood piles, pipes, gloves, boots, etc.)

Additional information regarding spiders can be found in Attachment 10.

2.5 Chemicals of Potential Concern

Table 2-4 summarizes information pertaining to chemicals of potential concern (COPCs) at the project site.

Contaminant	Location and Maximum[a] Concentration (ppm)	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
1,1 Dichloroethene	GW: 5.1 ug/l	200 ppm	1,000 ppm	Irritation to eyes; CNS depression	10.0
2,4 Dimethylphenol	GW: 969 mg/l	NE			
Arsenic	GW:1,590 mg/l SB:39,500 kg/kg	0.01 mg/m^3	5 mg/m^3 Ca	Ulceration of nasal septum, respiratory irritation, dermatitis, gastrointestinal disturbances, peripheral neuropathy, hyperpigmentation	NA
Benzene	GW: 2690 mg/l SB: 327 mg/kg	0.5 ppm STEL 5 ppm	500 ppm Ca	Eye, nose, skin, and respiratory irritation; headache; nausea; dermatitis; fatigue; giddiness; staggered gait; bone marrow depression	9.24
Benzo(a)anthracene	GW: 6030 mg/l SB: 3700 mg/kg	0.2 mg/m^3	80 mg/m^3	Dust- confusion, nausea, eye irritant, headache, stomach pain	N/A
Benzo(a)pyrene	GW: 4030 mg/l SB: 3500 mg/kg	0.2 mg/m^3	80 mg/m^3	Dust- confusion, nausea, eye irritant, headache, stomach pain	N/A
Benzo(b)fluoranthene	GW: 4100 mg/l SB: 4100 mg/kg	0.2 mg/m^3	80 mg/m^3	Dust- confusion, nausea, eye irritant, headache, stomach pain	N/A
Benzo(k)fluoranthene	GW: 3500 mg/l SB: 2000 kg/mg	0.2 mg/m^3	80 mg/m^3	Dust- confusion, nausea, eye irritant, headache, stomach pain	N/A
Cadmium	GW: 16 mg/l	0.005 mg/m^3	9 mg/m^3 Ca	Pulmonary edema, coughing, chest tightness/pain, headache, chills, muscle aches, nausea, vomiting, diarrhea, difficulty breathing, loss of sense of smell, emphysema, mild anemia	NA
Chrysene	GW: 47 ug/l	0.2 mg/m^3	80 mg/m^3	Dust- confusion, nausea, eye irritant, headache, stomach pain	N/A
Chromium (as Cr(II) & Cr(III))	GW: 5.4 mg/l SB: 676 mg/kg	0.5 mg/m^3	25 mg/m^3	Irritated eyes, sensitization dermatitis, histologic fibrosis of lungs	NA
Dibenz(a,h)anthracene	GW:737 mg/l SB: 510 mg/kg	0.2 mg/m^3	80 Ca	Dermatitis and bronchitis	N/A
Ethylbenzene	GW: 2680 mg/l	100 ppm	800 ppm	Eye, skin, and mucous membrane irritation; headache; dermatitis; narcotic; coma	8.76
Indeno(1,2,3-cd)pyrene	GW: 1760 mg/l SB: 1700 mg/kg	0.2 mg/m^3	80 Ca	Dermatitis and bronchitis	N/A

Contaminant	Location and Maximum[a] Concentration (ppm)	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
Lead	GW: 31 ug/l SB: 38,800 mg/kg	0.05 mg/m^3	100 mg/m^3	Weakness lassitude, facial pallor, pal eye, weight loss, malnutrition, abdominal pain, constipation, anemia, gingival lead line, tremors, paralysis of wrist and ankles, encephalopathy, kidney disease, irritated eyes, hypertension	NA
Naphthalene	GW: 161,100 mg/l SB: 10,200 mg/kg	10 ppm	250 ppm	Eye irritation, headache, confusion, excitement, nausea, vomiting, abdominal pain, bladder irritation, profuse sweating, dermatitis, corneal damage, optical neuritis	8.12
PCBs	Aroclor 1242 SB: 1.8 mg/kg Aroclor 1254 SB: 46.4 mg/kg Aroclor 1260 SB: 16 mg/kg	0.5 mg/m^3	5 mg/m^3 Ca	Eye and skin irritation, acne-form dermatitis, liver damage, reproductive effects	UK
Phenol	GW: 3.1 mg/l	5 ppm	250 ppm	Corrosive to skin; eye irritant, muscleaches, dark urine	8.50
Styrene	GW: 1320 mg/l	20 ppm	700 ppm	Irritation to eyes & nose, dizziness, weakness	8.47
Tetrachloroethylene	GW: 7.5 ug/l	25 ppm	150 ppm	Irritation to eyes, nose, throat; flushed face/neck, dizziness	9.32
Toluene	GW:5920 mg/l SS: 310 mg/kg	50 ppm	500 ppm	Eye and nose irritation, fatigue, weakness, confusion, dizziness, headache, dilated pupils, excessive tearing, nervousness, muscle fatigue, dermatitis, liver and kidney damage	8.82
Trichloroethylene	GW: 380 ug/l	50 ppm	1,000 ppm	Vertigo, visual disturbances, headaches, drowsiness	9.45
Xylenes	GW: 9260 mg/l SB: 200 mg/kg	100 ppm	900 ppm	Irritated eyes, skin, nose, and throat; dizziness; excitement; drowsiness; incoherence; nausea; vomiting; abdominal pain; dermatitis	8.56

Contaminant	Location and Maximum[a] Concentration (ppm)	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)

Footnotes:

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

[b] OSHA PEL or ACGIH TLV lowest value listed.

[c] IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); ND = Not determined; CA = Potential occupational carcinogen.

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

Workers may also be exposed to chemicals used during sampling and remediation activities. MSDSs are required for all virgin (i.e., non-contaminant) chemicals brought to the site. These MSDSs are presented as Attachment 8.

A summary of the personal protective equipment required to minimize exposure to environmental contaminants and virgin chemicals is presented in Section 4.

2.6 Potential Routes of Exposure

Potential routes of exposure include the following:

- **Dermal:** Skin contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Personal Protective Equipment Section of this plan.
- **Inhalation:** Inhalation of vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in the PPE and Air Monitoring/Sampling Sections of this plan, respectively.
- **Ingestion:** Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).

3.0 Roles and Responsibilities

3.1 CH2M HILL Staff Responsibilities

3.1.1 Project Manager

The CH2M HILL project manager (PM) is responsible for providing adequate resources (budget and staff) for project-specific implementation of the HSE management process. The PM has overall management responsibility for the tasks listed below. The PM may delegate specific tasks to other staff, as described in sections that follow, but retains ultimate responsibility for completion of the following in accordance with this HSE Plan:

- Incorporate standard terms and conditions, and contract-specific HSE roles and responsibilities in the contract with the client.
- Budget for the appropriate level of HSE oversight during field activities. Contact the HSM for budget requirements and guidelines.
- Manage the site and interface with third parties in a manner consistent with our contract and subcontract agreements and the applicable standard of reasonable care.
- Ensure that the overall, project-specific HSE goals are fully and continuously implemented.
- Ensure that CH2M HILL's SC is completing all duties outlined in this HSE Plan.
- Promoting a safety culture with onsite CH2M HILL personnel and setting the example for safe behavior.

The PM has the following additional responsibilities when subcontractors are hired:

- Incorporate standard terms and conditions, and contract-specific HSE roles and responsibilities in subcontract agreements (including flow-down requirements to lower-tier subcontractors).
- Select safe and competent subcontractors by implementing the CH2M HILL Subcontractor Management Program. This program includes the review of subcontractor pre-qualification questionnaires, training and medical monitoring records, and site-specific safety procedures prior to the start of subcontractor's field operations.
- Ensure that acceptable certificates of insurance, including CH2M HILL as named additional insured, are secured as a condition of subcontract award.
- Maintain copies of subcontracts and subcontractor certificates of insurance, bond, contractor's license, training and medical monitoring records, and project-specific HSE procedures in the project file accessible to site personnel.
- Provide adequate oversight of subcontractor HSE practices per the HSE Plan.

3.1.2 Project Health and Safety Manager

The CH2M HILL Project Health and Safety manager (HSM) is responsible to:

- Support the SC's oversight of HSE practices and interfaces with onsite third parties per the HSE Plan.
- Conduct audits, as necessary, to assess site conditions and review HSE program implementation.
- Assist the PM with HSE budget guidelines.
- Assist with program implementation as needed.

The HSM has the following additional responsibilities when subcontractors are hired:

- Ensure that subcontractor pre-qualification questionnaires are reviewed and assist as applicable in the acceptance or rejection.
- Review and accept or reject subcontractor training records and site-specific safety procedures prior to start of subcontractor's field operations.
- Support the SC's oversight of subcontractor's (and lower-tier subcontractor's) HSE practices per the HSE Plan.

3.1.3 Safety Coordinator

The Safety Coordinator (SC) shall be onsite for the duration of onsite work and is responsible for verifying that the project is conducted in a safe manner including the following obligations:

- Verify that this HSE Plan is current and amended when project activities or conditions change.
- Verify that CH2M HILL site personnel and subcontractors read this HSE Plan and sign the CH2M HILL Employee Sign-Off Form included in Attachment 1.
- Verify compliance with the requirements of this HSE Plan, applicable contractor health and safety plan(s) and any federal, state, and local regulations.
- Review and understand contractual obligations regarding HSE roles and responsibilities.
- Manage the site and interfacing with third parties in a manner consistent with our contract/subcontract agreements and the applicable standard of reasonable care.
- Ensure that programs are effectively functioning to prevent and control hazards on the project.
- Verify that all CH2M HILL employees working in the field have the appropriate level of HSE training, medical surveillance, and drug and alcohol testing for their job duties including required specialty training (e.g., fall protection, confined space entry) identified in the Hazard Controls and Safe Work Practices Section of this HSE Plan.

- Conduct an HSE orientation for all CH2M HILL team members prior to entering the project work areas and deliver field HSE training as needed based on project-specific hazards and activities.
- Maintain active and visible involvement using open communication with employees regarding safety issues on the project.
- Verify that safety meetings are conducted and document in the project file as needed throughout the course of the project (e.g., as tasks or hazards change).
- Attend Contractor safety meetings and ask questions about access to work areas, safety hazards, precautions and other general safety issues.
- Post required information onsite. An Occupational Safety and Health Administration (OSHA) job-site poster is required at sites where project field offices, trailers, or equipment-storage boxes are established. Contact the HSM for posters.
- Maintain HSE records and documentation.
- Act as the project "Hazard Communication Coordinator" and perform the responsibilities outlined in the Hazard Communication section of this HSE Plan.
- Act as the project "Emergency Response Coordinator" and perform the responsibilities outlined in the Emergency Preparedness section of this HSE Plan.
- Verify that project HSE forms, permits and self-assessment checklists are being used as outlined in this plan.
- Ensure that the Drug Testing Hospital Kit is available onsite in the event of a serious injury involving hospital, ambulance, or paramedic care. The hospital kit must accompany the injured employee to the hospital so they will get drug tested. For additional information on the Drug Testing Hospital Kits, refer to Attachment 11.
- Verify appropriate PPE use, availability, and training.
- Inform the HSM of any project incident, ensure that an Incident Report Form (IRF) is completed and conduct incident investigations as outlined in the Incident Reporting and Investigation section of this HSE Plan.
- Facilitate OSHA or other government agency inspections including accompanying inspector and providing all necessary documentation and follow-up.
- Report all incidents to the HSM and/or the Honeywell HSPM immediately. Depending on the type and severity of incident, we may have to report it to Honeywell within hours of occurrence. The Honeywell HSPM will determine what needs to be reported, the timing of the reporting, and coordinate client notification so local and Corporate Honeywell personnel are appropriately notified.

The SC has the following additional responsibilities when subcontractors are hired:

- Verify that project files available to site personnel include copies of executed contracts and certificates of insurance; bond; contractors license; training, medical monitoring,

and drug and alcohol testing records; and project-specific HSE procedures prior to start of subcontractor's field operations.

- Verify that ongoing training, medical monitoring, and drug and alcohol testing requirements are being met (e.g., 8-hour refresher, random drug testing programs, etc).
- Perform oversight and/or assessments of subcontractor HSE practices per this HSE plan and verify that project activity self-assessment checklists have been completed (Attachment 5).

3.1.4 CH2M HILL Employees

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

- Perform work in a safe manner without injury, illness or property damage.
- Perform work in accordance with company policies, and report near misses, injuries, illnesses, and unsafe conditions.
- Report all incidents, include near misses, immediately to supervisor, and file proper forms with a human resources representative. Contact your HSE Manager and the Honeywell HSPM to ensure client reporting procedures are met. It is important to do incident notification immediately because, depending on the type of incident, we may be required to report to Honeywell within hours of the event.
- Report all hazardous conditions and/or hazardous activities immediately to a supervisor for corrective action.
- Intervene when an unsafe behavior and/or condition is observed.
- Complete an HSE orientation prior to being authorized to enter the project work areas.
- Inspect assigned PPE to ensure the absence of defects and proper function.

3.2 CH2M HILL Employee Medical Surveillance, Training, & Drug Testing

Employees assigned to this project will have the following minimum training.

- 40-hour hazardous waste operations training
- 3-day on-the-job experience
- 8-hour annual hazardous waste refresher training.

- Employees who are in an onsite supervisor role will complete 8 hours of hazardous waste supervisor training
- Safety Coordinators will complete CH2M Hill's SC-HW and/or SC-C courses
- Employees shipping samples/signing manifests will complete DOT Shipping Goods and Waste Management training modules
- Drug-Free Workplace training (when drug testing is required)
- Site-specific training/orientation

Employees designated as SC will have completed a 12-hour safety coordinator course. The safety coordinator training course meets the requirements of 29 CFR 1910.120 for on-site supervisor training. An SC must be present during all tasks performed in exclusion or decontamination zones.

The SC and additional designated employees, as necessary, will be certified in first aid and CPR by the American Red Cross, or equivalent. At least one first aid/CPR designated employee must be present during all tasks performed in exclusion or decontamination zones. Certain tasks (e.g., confined-space entry) and contaminants (e.g., lead) may require additional training. Additional training requirements are addressed in the specific hazard sections of this plan.

Employees who perform work activities in the decontamination or exclusion zone shall be enrolled in and have a current medical clearance as required by the medical surveillance program for hazardous waste workers.

Pregnant employees shall consult with the Corporate Consulting Physician prior to performing site activities and obtain a physician's statement of the employee's ability to perform hazardous activities before being assigned fieldwork.

Drug testing is required for CH2M HILL employees who engage in certain activities at Honeywell sites (e.g., activities involving operating-supervising heavy equipment or drill rigs). Employees who conduct fieldwork may be required to pass an initial 5-panel drug screen and an alcohol screen two weeks prior to starting field activities. These staff will also be required to enroll in a random testing program for the duration of their work on Honeywell, and will be subject to post-incident and "for cause" testing. **Contact the HSM to determine if drug testing is required**. If site conditions change and/or additional tasks are added, contact the HSM to determine drug and alcohol testing requirements.

Based on specific work activities/tasks, subcontractor personnel may be required to be drug and alcohol screened prior to conducting their field activities**. Contact the Health and Safety Program Manager (HSPM) for details and to determine if subcontractor personnel require drug testing.**

Refer to CH2M HILL HSE SOP-113, Medical Surveillance, SOP-110, Training, and SOP-105, Drug-Free Workplace, for additional information.

3.3 CH2M HILL Subcontractors

The table(s) below list the name of each subcontractor, the subcontractor safety representative, and a description of the subcontracted activities to be performed at the site.

The Safety Coordinator will update this list as applicable.

Subcontractor	SGS Drilling
Subcontractor Safety Rep	Art Becker
Subcontractor Onsite Tasks	Drilling

Subcontractor	Hager-Richter Geoscience, Inc
Subcontractor Safety Rep	Dorothy Richter
Subcontractor Onsite Tasks	Geophysical Surveyor
Subcontractor	Boart Longyear
Subcontractor Safety Rep	Michael Ravella
Subcontractor Onsite Tasks	Drilling
Subcontractor	EQ
Subcontractor Safety Rep	Roger Avallone
Subcontractor Onsite Tasks	Hudson River boom operations and maintenance and IDW and site waste disposal

SC to complete in field if additional subcontractors are conducting field activities

Subcontractor	TBD –
Subcontractor Safety Rep	TBD
Subcontractor Onsite Tasks	TBD

The subcontractors listed above are covered by this HSE Plan and must be provided a copy of this document. However, this plan does not address hazards associated with the tasks and equipment for which the subcontractors have been engaged (e.g., drilling, excavation work, electrical). Subcontractors are responsible for the health and safety procedures specific to their work, and are required to submit these procedures to CH2M HILL for review before the start of field work. Subcontractors must comply with all established health and safety plan(s) for this project. The CH2M HILL SC should verify that subcontractor employee training, medical clearance, and fit test records are current and must monitor and enforce compliance with the established HSE Plan(s). CH2M HILL's oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

CH2M HILL team members should endeavor to observe subcontractors' safety performance. This endeavor should be reasonable, and include observation of hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M HILL is not responsible for exhaustive observation for hazards and unsafe practices. The SC is responsible for confirming subcontractor performance against both the subcontractor's task specific safety procedures and applicable self-assessment checklists, as provided in Attachment 5.

HSE related communications with CH2M HILL subcontractors should be conducted as follows:

- Brief subcontractors on the provisions of this plan, and require them to sign the CH2M HILL HSE Plan Employee Sign-Off Form, included in Attachment 1.
- Request subcontractor(s) to brief project team on the hazards and precautions related to their work.
- When non-compliant or unsafe conditions or practices are observed, notify the subcontractor safety representative and require corrective action—the subcontractor is responsible for determining and implementing necessary controls and corrective actions.
- When repeat non-compliant or unsafe conditions are observed, notify the subcontractor safety representative and stop affected work until adequate corrective measures are implemented.
- When an apparent imminent danger exists, immediately remove all affected personnel, notify subcontractor safety representative, stop affected work until adequate corrective measures are implemented, and notify the Project Manager, HSM, and SC as appropriate.
- Document all verbal HSE related communications in project field logbook, daily reports, or other records.

Subcontractors are responsible to:

- Comply with all local, state, and federal HSE standards; and project/owner HSE requirements.
- Provide a qualified subcontractor safety representative (SSR) to oversee the subcontractor activities and conduct safety inspections for their work.
- Conduct site-specific orientations for all subcontractor employees.
- Actively participate in the project HSE program and attend all required safety meetings.
- Meet training, medical monitoring, and drug and alcohol testing requirements for their staff.
- Intervene when they observe unsafe behaviors and/or conditions.
- Maintain equipment and supplies necessary to complete activities in a safe manner.
- Notify the CH2M HILL SC of any injury or incident, including near-misses, immediately and submit reports to CH2M HILL within 24 hours. Additionally, all incidents must be reported to the HSM and Honeywell HSPM immediately so we can meet Honeywell's incident reporting requirements.

Refer to CH2M HILL HSE SOP-215, Contracts, Subcontracts, and HSE Management Practices, for additional information.

3.4 Third Parties

The table(s) below list the name of each third party, the third party safety representative, and a description of the third party activities being performed at the site which have the potential to impact CH2M HILL's activities. The Safety Coordinator will add or remove tables below, as necessary.

Third Party	Mueser Rutledge Consulting Engineers
Third Party Safety Rep	TBD
Third Party Onsite Tasks	Test pit observation, sonic echo, geotechnical sampling

Third Party	Parsons
Third Party Safety Rep	TBD
Third Party Onsite Tasks	HCAA treatability testing sample collection observation

This HSE Plan does not cover parties who do not have a contractual relationship with CH2M HILL. CH2M HILL is not responsible for the health and safety or means and methods of a third party's work, and we must never assume such responsibility through our actions (e.g., advising on HSE issues). In addition to this plan, CH2M HILL staff should

review third parties' safety plans so that we remain aware of appropriate precautions that apply to us. Except in unusual situations when conducted by the HSM, CH2M HILL must never comment on or approve a third party's safety procedures. Self-assessment checklists, provided in Attachment 5, are to be used by the SC to review the third party's performance ONLY as it pertains to evaluating CH2M HILL employee and subcontractor exposure and safety.

HSE related communications with third parties should be conducted as follows:

- Request the third party to brief CH2M HILL employees and subcontractors on the precautions related to the contractor's work.
- When an apparent third party's non-compliant or unsafe condition or practice poses a risk to CH2M HILL employees or subcontractors:
  - Notify the third party's safety representative
  - Request that the third party determine and implement corrective actions
  - If needed, stop affected CH2M HILL work until the third party corrects the condition or practice. Notify the client, Project Manager, and HSM as appropriate.
- If apparent third party's non-compliant or unsafe conditions or practices are observed, inform the third party's safety representative. CH2M HILL's obligation is limited strictly to informing the third party of the observation – the third party is solely responsible for determining and implementing necessary controls and corrective actions.
- If an apparent imminent danger is observed, immediately warn the third party's employee(s) in danger and notify the third party's safety representative. CH2M HILL's obligation is limited strictly to immediately warning the affected individual(s) and informing the third party of our observation – the third party is solely responsible for determining and implementing necessary controls and corrective actions.
- Document all verbal HSE related communications in project field logbook, daily reports, or other records.

Refer to CH2M HILL HSE SOP-215, Contracts, Subcontracts, and HSE Management Practices, for additional information.

4.0 Personal Protective Equipment

The PPE hazard assessment performed by the HSM requires the following PPE for use during site activities. The PPE required by the table will be evaluated periodically by the SC to ensure the adequacy based on air monitoring results or changes to expected site conditions. The SC shall coordinate all changes with the HSM.

4.1 PPE Specifications

PPE requirements for the project are summarized in Table 4-1.

Task	Level	Body	Head	Respirator [b]
General site entry Surveying (field and topographical) Air quality sample collection	D	Work clothes; steel-toe, leather work boots; work gloves. Inner/outer nitrile gloves as necessary	Hardhat [c] Safety glasses Ear protection [d]	None required
Drilling Monitoring/Piezometer well installation/abandonment Soil sampling Drum sampling Hammer drilling during air quality sampling Pore Water Sampling O&M of boom materials	Modified D	**Coveralls**: Work clothes, Polycoated Tyvek® suit (depending on potential for splash and air monitoring data) **Boots**: Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers **Gloves**: work gloves, or Inner surgical-style nitrile & outer chemical-resistant nitrile gloves during sample collection. Personal Floatation Devices must be worn when working on a boat without adequate guarding or working in the water	Hardhat [c] Safety glasses Splash shield [c] Ear protection [d]	None required
Groundwater sampling Free product sampling Infiltration tests In Situ Solidification In Situ Chemical Injection	Modified D	**Coveralls**: Polycoated Tyvek® suit (depending on potential for splash) **Boots**: Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers **Gloves**: Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Splash shield [c] Safety glasses Ear protection [d]	None required

Task	Level	Body	Head	Respirator [b]
Drilling/Excavation in high arsenic areas[f] All tasks requiring upgrade	C	**Coveralls**: Polycoated Tyvek® **Boots**: Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers **Gloves**: Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Splash shield [c] Ear protection [d] Spectacle inserts	APR, full face, MSA Ultratwin or equivalent; with GME P100/organic vapor combination cartridges or equivalent[e].
Not authorized	B	**Not Authorized**		

[a] Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.
[b] No facial hair that would interfere with respirator fit is permitted.
[c] Hardhat and splash-shield areas are to be determined by the SC.
[d] Ear protection should be worn when conversations cannot be held at distances of 3 feet or less without shouting.
[e] Cartridge change-out schedule will be established by the HSM and at a minimum shall be at least every 8 hours (or one work day), except if relative humidity is > 85%, or if organic vapor measurements are > midpoint of Level C range (refer to Section 5)--then at least every 4 hours. If encountered conditions are different than those anticipated in this HSE Plan, contact the HSM.
[f] High arsenic areas are located within the OU1 work area where arsenic levels are above 1,000 ppm – see Site Map for specific high arsenic areas.

4.2 Reasons for Changing Level of Protection

Reasons for upgrading or downgrading the level of PPE are provided below.

4.2.1 Upgrade

Potential reasons for upgrading PPE level are listed below. ***Note: Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the HSM, and an SC qualified at that level is present.***

- Request from individual performing tasks.
- Change in work tasks that will increase contact or potential contact with hazardous materials.
- Occurrence or likely occurrence of gas or vapor emission.
- Known or suspected presence of dermal hazards.
- Instrument action levels (Section 5) exceeded.

4.2.2 Downgrade

Potential reasons for downgrading PPE level are listed below.

- New information indicating that situation is less hazardous than originally thought.
- Change in site conditions that decreases the hazard.
- Change in work task that will reduce contact with hazardous materials.

5.0 Air Monitoring/Sampling

Air monitoring and sampling must be performed to verify that our employees are not be exposed to harmful levels of airborne contaminants and that airborne contaminants are not migrating into public areas. Refer to CH2M HILL SOP HSE-207, *Exposure Assessment for Airborne Chemical Hazards*, for additional information

5.1 Air Monitoring Specifications

Air monitoring specifications are summarized in Table 5-1.

Instrument	Tasks	Action Levels[a]		Frequency [b]	Calibration
Photoionization Detector: MultiRAE with 10.6eV lamp or equivalent	Drilling and well installation Soil excavation Soil sampling Groundwater sampling Free product sampling Infiltration tests Drum sampling Air quality sample collection Pore Water Sampling Excavation In Situ Solidification In Situ Chemical Injection	0 - 5 ppm >5 - 25 ppm >25 ppm	Level D Level C Stop work; re-evaluate	Initially and periodically during task Initiate benzene and vinyl chloride sampling if PID >1	Daily
Combustible Gas Indicator: MSA model 260 or 261 or equivalent	Excavation/Test Pitting Confined space entry	0-10% : 10-25% LEL: >25% LEL:	No explosion hazard Potential explosion hazard Explosion hazard; evacuate or vent	Continuous during advancement of boring	Daily
Oxygen Meter: MSA model 260 or 261 or equivalent	Confined space entry	>25%[c] O_2: 20.9%[c] O_2: <19.5%[c] O_2:	Explosion hazard; evacuate or vent Normal O_2 O_2 deficient; vent or use SCBA	Continuous during advancement of boring	Daily
Dust Visual Assessment	Drilling, excavation/test pitting and well installation or other intrusive activity Soil sampling	Dust levels controlled Use of dust suppression methods Dust levels can not be controlled	Level D Stop work; re-evaluate	Continuous	N/A

Instrument	Tasks	Action Levels[a]		Frequency [b]	Calibration
Dust Monitor: MIE DataRAM 4000, or equivalent	Drilling, excavation/test pitting, well installation, and soil sampling in high arsenic areas	<0.1 mg/m^3 0.1 - 1 mg/m^3 >1 mg/m^3	Level D [c] Level D + increase engineering controls to reduce dust levels Level C	Initially and periodically during tasks	Zero Daily
Colorimetric Tube: Drager or equivalent benzene specific 0.5/c (0.5 to 10 ppm range) with pre-tube, or equivalent	All tasks if PID reading is >1 ppm	<0.5 ppm 0.5-1 ppm >1 ppm	Level D Level C Level B	Initially and periodically when PID reading is >1 ppm	N/A
Colorimetric Tube: Drager or equivalent vinyl chloride specific 0.5/c (0.5 to 10 ppm range or equivalent	All tasks if PID reading is >1 ppm	<0.5 – 1 ppm >1 ppm	Level D Level B, Not authorized contact HSM for further action	Initially and periodically when PID reading is >1 ppm	N/A
Noise-Level Monitor [d]: Auditory	Drilling, excavation, Portable hammer-drilling	Conversations can be held at distances of 3 feet without shouting → Conversations cannot be held at a distances of 3 feet without shouting →	No action required Hearing protection required	Continuous	N/A

[a] Action levels apply to sustained breathing-zone measurements above background.
[b] The exact frequency of monitoring depends on field conditions and is to be determined by the SSC; generally, every 5 to 15 minutes if acceptable; more frequently may be appropriate. Monitoring results should be recorded. Documentation should include instrument and calibration information, time, measurement results, personnel monitored, and place/location where measurement is taken (e.g., "Breathing Zone/MW-3", "at surface/SB-2", etc.).
[c] If the measured percent of O_2 is less than 10, an accurate LEL reading will not be obtained. Percent LEL and percent O_2 action levels apply only to ambient working atmospheres, and not to confined-space entry. More-stringent percent LEL and O_2 action levels are required for confined-space entry (refer to Section 2).
[d] Noise monitoring and audiometric testing also required.

5.2 Calibration

Instruments will be function tested in accordance with the respective manufacturer's instructions for proper instrument use and maintenance. The instrument vendor or the CH2M HILL warehouse staff will ensure equipment has been calibrated in accordance with manufacturer's specifications.

All direct reading instruments will be function tested daily by the SC using span gas, prior to performing work activities and after the completion of the daily activities.

5.3 Air Sampling

Sampling, in addition to real-time monitoring, may be required by other OSHA regulations where there may be exposure to certain contaminants. Air sampling typically is required when site contaminants include lead, cadmium, arsenic, asbestos, beryllium, hexavalent chromium, benzene, methylene chloride, vinyl chloride and certain volatile organic compounds. Air sampling methods will be National Institute for Occupational Safety and Health (NIOSH) or OSHA-certified and samples analyzed by a laboratory that is accredited by the American Industrial Hygiene Association (AIHA) for the compound specific method.

The HSM will develop and specify a sampling approach that includes the number and frequency of sampling events. This approach will be included in this section. The HSM shall interpret all air sampling results and modify the requirements of this HSE Plan, based on the interpretation. Written notification of air sampling results will be provided to the CH2M HILL site employees and maintained in their HSE records.

6.0 Decontamination

(Reference CH2M HILL SOP HSE-218, *Hazardous Waste Operations*)

Decontamination areas will be established for work in potentially contaminated areas to prevent the spread of contamination. Decontamination areas should be located upwind of the exclusion zone where possible and should consider any adjacent or nearby projects and personnel. The SC must establish and monitor the decontamination procedures and their effectiveness. Decontamination procedures found to be ineffective will be modified by the SC. The SC must ensure that procedures are established for disposing of materials generated on the site.

No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The SC should establish areas for eating, drinking, and smoking.

6.1 Contamination Prevention

Preventing or avoiding contamination of personnel, tools, and equipment will be considered in planning work activities at all field locations. Good contamination prevention and avoidance practices will assist in preventing worker exposure and result in a more efficient decontamination process. Procedures for contamination prevention and avoidance include the following:

- Do not walk through areas of obvious or known contamination;
- Do not directly handle or touch contaminated materials;
- Make sure there are no cuts or tears in PPE;
- Fasten all closures in suits and cover them with duct tape, if appropriate;
- Take particular care to protect any skin injuries;
- Stay upwind of airborne contamination, where possible;
- Do not eat or drink in contaminated work areas;
- Do not carry food, beverages, tobacco, or flame-producing equipment into contaminated work areas;
- Minimize the number of personnel and amount of equipment in contaminated areas to that necessary for accomplishing the work;
- Choose tools and equipment with nonporous exterior surfaces that can be easily cleaned and decontaminated;
- Cover monitoring and sampling equipment with clear plastic, leaving openings for the sampling ports, as necessary; and
- Minimize the amount of tools and equipment necessary in contaminated areas.

6.2 Personnel and Equipment Decontamination

Personnel exiting an EZ must ensure that they are not spreading potential contamination into clean areas or increasing their potential for ingesting or inhaling potential contaminants. Personal decontamination may range from removing outer gloves as exiting the EZ, to proceeding through an outer layer doffing station including a boot and glove wash and rinse, washing equipment, etc. Equipment that has come into contact with contaminated media must also be cleaned/decontaminated when it is brought out of the EZ.

6.3 Decontamination During Medical Emergencies

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

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

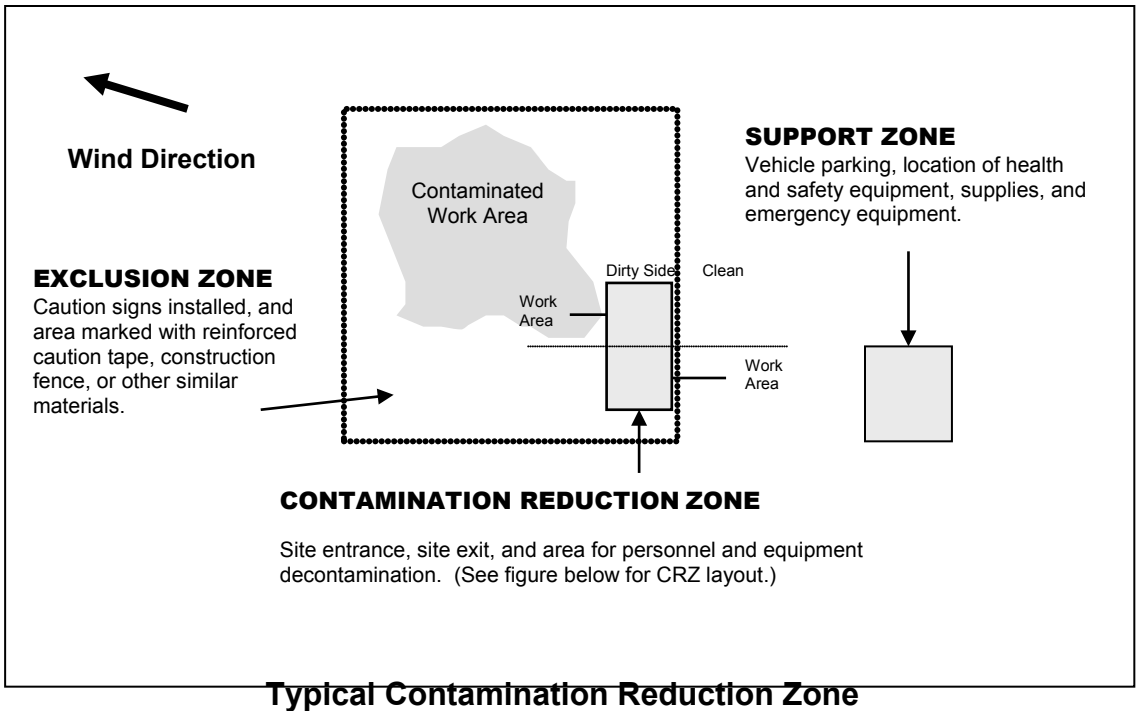
6.4 Waste Collection and Disposal

All contaminated material generated through the personnel and equipment decontamination processes (e.g., contaminated disposable items, gross debris, liquids, sludges) will be properly containerized and labeled, stored at a secure location, and disposed in accordance with the Waste Management Plan attached to the Pre-Design Investigation Work Plan or Remedial Design Work Plan, as appropriate.

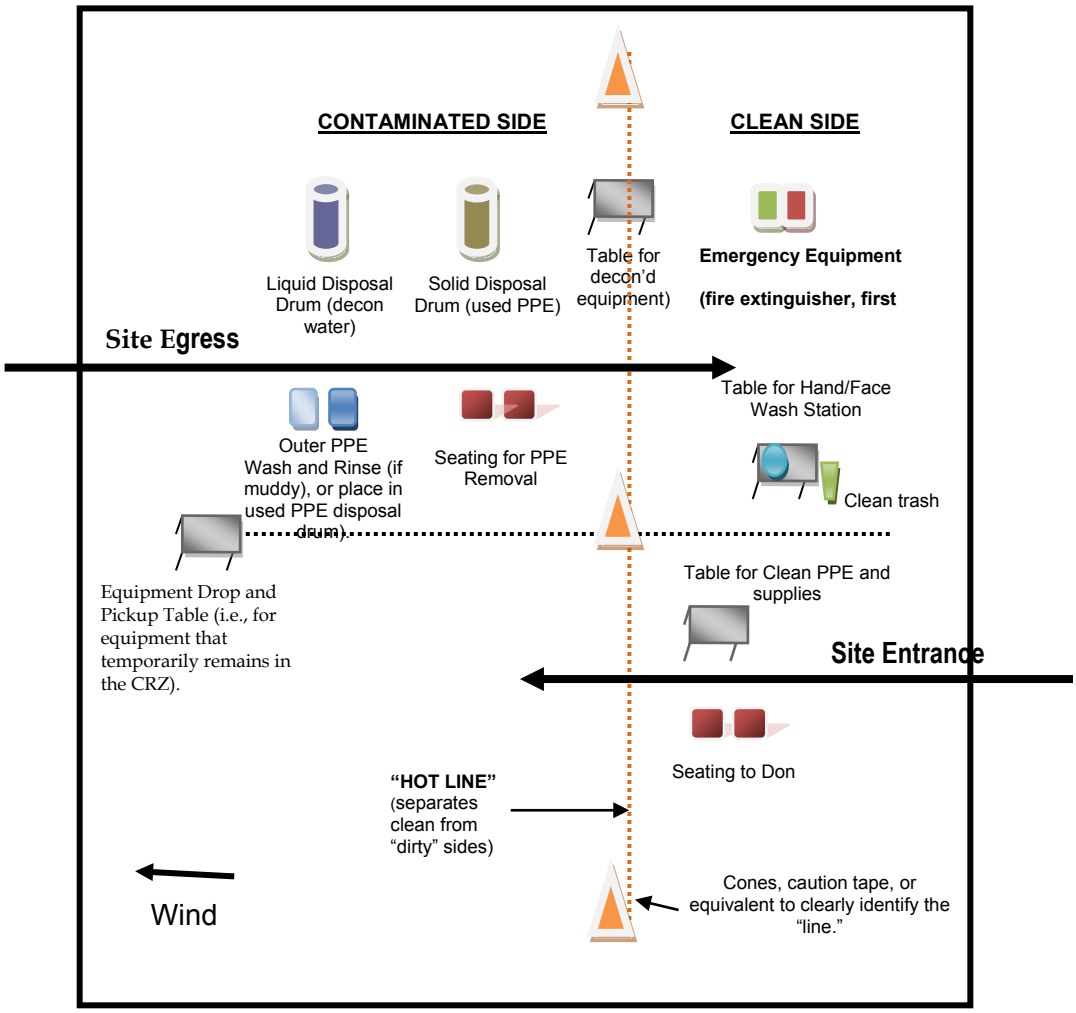
6.5 Diagram of Personnel-Decontamination Line

The following figure illustrates a conceptual establishment of work zones, including the decontamination line. Work zones are to be modified by the SC to accommodate task-specific requirements.

Work Area - Set up appropriately based on wind direction



Typical Contamination Reduction Zone



7.0 Spill Containment and Notification

This section describes spill containment and notification requirements.

7.1 SPCC Regulated Facility

If the client facility is subject to a Spill Prevention, Control and Countermeasures (SPCC) Plan, a copy must be obtained and all spill prevention and response must conform to client SPCC requirements. If the client does not have an SPCC Plan and the project requires storage of more than 1,320 gallons of petroleum in 55-gallon containers or greater, a project-specific SPCC plan will be prepared.

7.2 Non-SPCC Regulated Facility

Projects not subject to SPCC requirements shall comply with this section. All onsite personnel shall be trained to follow the procedures described in this section.

7.2.1 Equipment

Field staff should obtain client approval for use of client-owned spill containment equipment. If client equipment is not available, the minimum spill equipment that shall be made available in the project's support zone is described in Table 7-1. Additional contaminant-specific spill response information may be included in the chemical MSDS.

Ensure appropriate level of spill containment materials are on site adjacent to chemical storage area during in situ chemical injection and in situ solidification work activities. Refer to the specific MSDS for the materials being used to ensure appropriate materials are on hand and at the site for immediate use if necessary.

TABLE 7-1
Minimum Spill Kit Equipment List

Spill Kit Contents
• Absorbent material (kitty litter or vermiculite)
• Neutralizers (for chemical spills)
• Sodium Carbonate (acid spills)
• Citric Acid (base spills)
• Absorbent socks and pads
• Safety Goggles
• Protective Gloves
• Tyvek Suit
• Waste Containers and Labels

7.2.2 Emergency Spill Event

The release of an unknown hazardous material is considered an emergency spill event. Implement the following procedures during an emergency spill event:

1. Evacuate the area and go upwind
2. Warn others and direct them upwind
3. Immediately contact the onsite Safety Coordinator who will contact the HSM for direction

7.2.3 Non-Emergency Spill Event

A non-emergency spill event includes incidental releases that do not pose a significant safety or health hazard where chemical hazards are known and CH2M HILL personnel can safely implement the following procedures as a first responder:

1. Stop the source of the spill
2. Contain the spill material. If there is a chance the spill will reach nearby drains or waterways, block them off to keep the spill away
3. Contact the onsite Safety Coordinator

7.2.4 Cleanup

Clean up the spilled material wearing the proper PPE identified in the HSE Plan equipment table if the spilled material is less than 5 gallons and hazards are known. Spills larger than 5 gallons must be cleaned up by a qualified subcontractor since CH2M HILL personnel are not trained to implement OSHA spill response requirements. Dispose of spill debris according to the Waste Management Plan or as directed by the ECC.

7.2.5 Notification and Reporting

All spills are considered an "incident" and shall be reported internally according to procedures in HSE SOP-111, Incident Reporting and Investigation. Since many spills may require agency reporting within 24 hours, it is very important that internal notification occur immediately. The following summarizes required actions:

1. ***Immediately*** notify the onsite Safety Coordinator
2. SC notifies the HSM
3. HSM notifies the PM, who notifies the client
4. HSM notifies the Legal Department of a serious incident
5. HSM, ECC, and client shall determine if the incident is reportable to an agency

8.0 Site-Control Plan

8.1 Site-Control Procedures

(Reference CH2M HILL SOP HSE-218, *Hazardous Waste Operations)*

Site control is established to prevent the spread of contamination throughout the site and to ensure that only authorized individuals are permitted into potentially hazardous areas.

The SC will implement site control procedures including the following bulleted items.

- Establish support, contamination reduction, and exclusion zones. Delineate with flags or cones as appropriate. Support zone should be upwind of the site. Use access control at entry and exit from each work zone.
- Establish onsite communication consisting of the following:
  - Line-of-sight and hand signals;
  - Air horn; and
  - Two-way radio or cellular telephone if available.
- Establish offsite communication.
- Establish and maintain the "buddy system."

8.2 Remediation Work Area Zones

(Reference CH2M HILL SOP HSE-218 Hazardous Waste Operations)

A three-zone approach will be used to control areas where site contaminants exist. Access will be allowed only after verification of appropriate training and medical qualification. The three-zone approach shall include an EZ, Contamination Reduction Zone (CRZ) and a Support Zone (SZ). The three-zone approach is not required for construction work performed outside contaminated areas where control of site contamination is not a concern.

Specific work control zones shall be established as necessary during task planning. Site work zones should be modified in the field as necessary, based on such factors as equipment used, air monitoring results, environmental conditions, or alteration of work plans. The following guidelines shall be used for establishing and revising these preliminary zone designations.

8.2.1 Support Zone

The SZ is an uncontaminated area (trailers, offices, field vehicles, etc.) that will serve as the field support area for most operations. The SZ provides field team communications and staging for emergency response. Appropriate sanitary facilities and safety and emergency response equipment will be located in this zone. Potentially contaminated personnel/materials are not allowed in this zone. The only exception will be appropriately

packaged and decontaminated materials, or personnel with medical emergencies that cannot be decontaminated.

8.2.2 Contamination Reduction Zone

The CRZ is established between the EZ and the SZ, upwind of the contaminated area where possible. The CRZ provides an area for decontamination of personnel, portable handheld equipment and tools, and heavy equipment. In addition, the CRZ serves as access for heavy equipment and emergency support services.

8.2.3 Exclusion Zone

The EZ is where activities take place that may involve exposure to site contaminants and/or hazardous materials or conditions. This zone shall be demarcated to prevent unauthorized entry. More than one EZ may be established if there are different levels of protection to be employed or different hazards that exist in the same work area. The EZ shall be large enough to allow adequate space for the activity to be completed, including field personnel and equipment, as well as necessary emergency equipment.

The EZ shall be demarcated with some form of physical barrier or signage. The physical barrier or signage shall be placed so that they are visible to personnel approaching or working in the area. Barriers and boundary markers shall be removed when no longer needed.

8.2.4 Other Controlled Areas

Other work areas may need to be controlled due to the presence of an uncontrolled hazard, to warn workers of requirements, or to prevent unauthorized entry. Examples include general construction work areas, open excavations, high noise areas, vehicle access areas, and similar activities or limited access locations. These areas shall be clearly demarcated with physical barriers (fencing, cones, reinforced caution tape or rope) as necessary and posted with appropriate signage.

9.0 Hazwoper Compliance Plan

Certain parts of the site work are covered by state or federal Hazwoper standards and therefore require training and medical monitoring. Anticipated Hazwoper tasks (Section 1.3.1) might occur consecutively or concurrently with respect to non-Hazwoper tasks. This section outlines procedures to be followed when approved activities specified in Section 1.3.2 do not require 24- or 40-hour training. Non-Hazwoper-trained personnel also must be trained in accordance with all other state and federal OSHA requirements.

- In many cases, air sampling, in addition to real-time monitoring, must confirm that there is no exposure to gases or vapors before non-Hazwoper-trained personnel are allowed on the site, or while non-Hazwoper-trained staff are working in proximity to Hazwoper activities. Other data (e.g., soil) also must document that there is no potential for exposure. The HSM must approve the interpretation of these data. Refer to subsections 2.5 and 5.3 for contaminant data and air sampling requirements, respectively.
- When non-Hazwoper-trained personnel are at risk of exposure, the SC must post the exclusion zone and inform non-Hazwoper-trained personnel of the:
  - Nature of the existing contamination and its locations
  - Limitations of their access
  - Emergency action plan for the site
- Periodic air monitoring with direct-reading instruments conducted during regulated tasks also should be used to ensure that non-Hazwoper-trained personnel (e.g., in an adjacent area) are not exposed to airborne contaminants.
- When exposure is possible, non-Hazwoper-trained personnel must be removed from the site until it can be demonstrated that there is no longer a potential for exposure to health and safety hazards.
- Procedures for remediation treatment system start-ups are as follows: Once a treatment system begins to pump and treat contaminated media, the site is, for the purposes of applying the Hazwoper standard, considered a treatment, storage, and disposal facility (TSDF). Therefore, once the system begins operation, only Hazwoper-trained personnel (minimum of 24 hour of training) will be permitted to enter the site. All non-Hazwoper-trained personnel must not enter the TSDF area of the site.

Refer to CH2M HILL HSE SOP-220, Site-Specific Written Safety Plans, for additional information.

10.0 Incident Reporting and Investigation

This section describes the notification and investigation requirements pertaining to a site incident. Refer to CH2M HILL HSE SOP-111, Incident Reporting and Investigation, for additional information.

10.1 Definitions

10.1.1 Incident

An incident is an undesired event that results or could have resulted in an injury, illness, damage to assets or environment harm. The following events shall be considered incidents:

- Injury or illness to a CH2M HILL employee or CH2M HILL subcontractor employee
- Injury or illness to a third party that was caused by a CH2M HILL activity
- Hazardous substance exposure
- Damage to property or equipment
- Motor vehicle accident
- Fire or explosion
- Spill or release
- Environmental issue permit violation
- A "near-miss"

10.1.2 Near-Miss

A near-miss occurs when an intervening factor prevented an injury, damage to property, or environmental harm from occurring. Examples of near-miss situations include: a hard hat or other PPE prevented an injury; secondary containment or emergency shutoff prevented a spill; or an alert co-worker prevented an accident.

10.1.3 Serious Incidents

The HSM and Legal and Insurance Department (LID) shall determine if an event should be considered as a serious incident after reviewing the initial incident facts. The general criteria for serious incidents include:

- Intervention by external emergency response organizations
- Hospitalization
- Spills and releases of hazardous substances exceeding the reportable quantity (RQ)
- Potential violations of law or regulation
- Estimated property damage in excess of $10,000

10.2 Incident Notification and Communication

All CH2M HILL and subcontractors' employees shall immediately report any incident in which they are involved to their direct supervisor, and the supervisor shall inform the

CH2M HILL SC. The SC shall then contact the PM, HSM, and the Honeywell HSPM immediately. Immediate reporting is critical because there are certain types of incidents that must be reported to Honeywell within hours of occurrence. The Honeywell HSPM will help the team determine what needs to be reported to Honeywell, how quickly it needs to be reported to Honeywell, and who at Honeywell (local, corporate, etc) needs to be notified.

Incident communications regarding serious incidents (regardless of the party involved) shall be considered sensitive in nature and must be controlled in a confidential manner. Internal communications regarding a serious incident may be conducted with affected project, regional, and Business Group staff but must be kept to a minimum. Communication should be oral whenever possible. If e-mail communications are necessary they shall be sent as confidential emails following the procedure provided in section 6.2.2 of CH2M HILL HSE SOP-111, Incident Reporting and Investigation. A LID representative shall direct all internal and external communications, including internal incident reporting, agency reporting, client notification, and incident investigations.

10.3 Incident Reporting

Injury Reporting

- If a CH2M HILL employee is injured immediately notify their group leader.
- Call the CH2M HILL Occupational Health Nurse

1-866-893-2514

- In case of emergency call 911.

Incident Notification and Reporting

- Upon any other project incident (fire, spill, , near miss, death, etc.), immediately notify the PM and HSM. Call emergency beeper number if HSM is unavailable.
- Notify and submit reports to client as required in contract.
- Serious Incidents must be reported in accordance with CH2M HILL Standard of Practice, *Serious Incident Reporting Process,* immediately. Serious incidents are those that involve any of the following:
  - Work related death, or life threatening injury or illness of a CH2M HILL employee, subcontractor, or member of the public
  - Kidnap/missing person
  - Acts or threats of terrorism
  - Event that involves a fire, explosion, or property damage that requires a site evacuation or is estimated to result in greater than $ 500,000 in damage.

Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to site workers, neighboring facilities, the community or the environment

The PM or the HSPM will be responsible to ensure that the incident is entered into Honeywell's event tracking system and an IRF is completed within 24 hours of any incident. The HSPM can assist with complying with entering information into Honeywell's event tracking system. CH2M HILL's requirements can be met by entering an electronic IRF directly into the IRF database. The electronic IRF is found on the CH2M HILL HSE web page under Tools and Forms>Electronic Tools and Forms. If unable to submit an IRF electronically, the SC shall complete the hardcopy IRF provided in Attachment 12 and fax

the IRF to the human resources representative (for CH2M HILL employee injuries), the PM, or the HSM (for all other incidents) for database entry. A copy of the hard-copy form should also be sent to the Honeywell HSPM. **An IRF for a serious incident shall not be initiated until directed by a representative of the LID.**

When additional or updated information becomes available that was not included in the original IRF the PM shall forward such information to the human resources representative (for CH2M HILL employee injuries) or the HSM (for all other incidents) so that the IRF may be updated. Updates to IRF reports should also be sent to the Honeywell HSPM.

CH2M HILL staff shall comply with all applicable statutory incident reporting requirements such as those required by Federal agencies (EPA, OSHA, etc) and local authorities (police).

10.4 Incident Investigation

Incident investigations are to be initiated and completed as soon as possible, but no later than 72 hours after the incident has occurred. The level and type of investigation will be determined by Honeywell and/or the Honeywell HSPM. **All serious incidents shall be investigated as directed by a representative of the LID.** The HSM/ECC may conduct the investigation directly or may delegate this function to the SC or other party, depending on the extent of the incident and staff availability.

The Incident Investigation Guideline provided in Attachment 12 shall be followed when documenting an investigation. Typically, minor incident investigations will be completed by the HSM/ECC by including the investigation facts in the IRF. The HSM/ECC may require completion of a separate investigation report or the Root Cause Analysis Form for more extensive investigations. The HSM/ECC shall ensure that the PM and SC are made aware of investigation findings and all corrective actions, and shall verify that corrective actions are implemented to prevent further incidents.

10.5 Corrective Actions

All corrective actions recommended from the incident investigation report shall be taken to prevent recurrence of the incident. The PM or SC should hold a review meeting to discuss the incident and the corrective actions. The responsible supervisors shall be assigned to carry out the corrective actions and shall inform the SC upon successful implementation of all corrective actions.

10.6 Injury Management/Return-to-Work

(Reference CH2M HILL, SOP HSSE-124, Injury Management/Return-to-Work)

10.6.1 Background

The Injury Management Program has been established to provide orderly, effective and timely medical treatment and return-to-work transition for an employee who sustains a work-related injury or illness. It also provides guidance and assistance with obtaining

appropriate treatment to aid recovery, keep supervisors informed of employee status, and to quickly report and investigate work-related injury/illnesses to prevent recurrence.

To implement the Injury Management/Return-to-Work Program successfully, supervisors and/or SC should:

- Ensure employees are informed of the Injury Management/Return-to-Work Program;
- Become familiar with the Notification Process (detailed below); and
- Post the Injury Management/Return-to-Work Notification Poster.

10.6.2 The Injury Management/Return-to-Work Notification Process:

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

Honeywell Program
Incident Reporting Flow Diagram

Direct Reporting Responsibility → | Informational Reporting ⇢

Incident:
- Injury or illness
- Hazardous substance exposure
- Damage to property
- Fire or explosion
- Spill, release, potential violation, or permit exceedance
- A "near-miss"

If incident is an **injury** to US or Puerto Rico based CH2M HILL personnel contact the Occupational Health Nurse at 866/893-2514. Outside the US, the supervisor must notify the HR

The Ops Leader is responsible for completing the Incident Report Form (IRF) in **HITS** when there is an injury to a CH2M HILL employee. The PM, CM or SC is responsible for completing the IRF for all other incidents. ***The IRF/HITS must be completed within 24 hours of the incident and does not replace the required immediate PM and RHSM notifications.***

Incident
Ensure that Emergency Responders have been notified as necessary

Employee or Subcontractor
Provide immediate notification.

Supervisor – Construction Manager - Safety Coordinator
Provide immediate notification by phone and email to PM and RHSM. In addition, for spills, NOVs, and permit issues you may also call the EM.

CRISIS MANAGER:
If the incident meets the "**Serious Incident**" criteria, contact the Crisis Manager
(720.286.4911)

Third Party – Incidents outside of our contractual obligations do not need to be communicated, unless they are serious and/or may affect CH2M HILL. The RHSM will determine the level of communication necessary for third party incidents.

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

Responsible HSM (RHSM)
Immediately notify the Client Program HSE Manager, immediately notify the Responsible Environmental Manager (EM) for spills, NOVs, and permit issues, and direct the incident investigation.

Program HSE Manager
Notify Sector HSM, and coordinate communication and incident investigations.

Immediate notification to the Sector HSM is not required for some minor incidents. Follow the program protocol.

Project Manager
1) Provide notification to the Program Project Delivery (PD) or Operations (Ops) Manager or designee.
2) Provide notification to the Honeywell Remediation Manager Notification based on program criteria; work with Program HSM Immediate notification to the PD/Ops Manager is not required for some minor incidents. Follow the program protocol.

Program PD/Ops Manager
Notify Program Manager OR Sector Director, provide guidance and follow the incident through to resolution.

Program Manager
Notify Sector Director; provide decision-making assistance or direction for incident resolution.

Keep unnecessary communication of serious incidents to a minimum.

Sector HSE Manager
Coordinate communication, direct significant incident investigations, notify Sector EM for spills, NOVs, & permit issues.

HSSE Director
Provide decision-making assistance or direction for incident resolution.

Sector Director
Provide decision-making assistance or direction for incident resolution.

ES US Operations Director/ Executive Leadership Team
Provide decision-making assistance, direction for incident resolution, and make higher level notifications as necessary

Post-emergency incident communications regarding serious incidents at a CH2M HILL office or project (regardless of the party involved) shall be considered sensitive in nature and must be controlled in a confidential manner.

11.0 Emergency Response Plan

(Reference CH2M HILL SOP HSE-106, *Emergency Planning*)

11.1 Pre-Emergency Planning

The Emergency Response Coordinator (ERC), typically the SC or designee, performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with CH2M HILL onsite parties, the facility, and local emergency-service providers as appropriate. Pre-Emergency Planning activities performed by the ERC include:

- Review the facility emergency and contingency plans where applicable;
- Determine what onsite communication equipment is available (two-way radio, air horn);
- Determine what offsite communication equipment is needed (nearest telephone, cell phone);
- Confirm and post the "Emergency Contacts" page and route to the hospital located in this section in project trailer(s) and keep a copy in field vehicles along with evacuation routes and assembly areas. Communicate the information to onsite personnel and keep it updated;
- Field Trailers: Post "Exit" signs above exit doors, and post "Fire Extinguisher" signs above locations of extinguishers. Keep areas near exits and extinguishers clear;
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures;
- Where appropriate and acceptable to the client, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies;
- Inventory and check site emergency equipment, supplies, and potable water;
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases;
- Rehearse the emergency response plan before site activities begin. This may include a "tabletop" exercise or an actual drill depending on the nature and complexity of the project. Drills should take place periodically but no less than once a year;
- Brief new workers on the emergency response plan; and
- The ERC will evaluate emergency response actions and initiate appropriate follow-up actions.

11.2 Emergency Equipment and Supplies

The ERC shall ensure the following emergency equipment is on the site. Verify and update the locations of this equipment as needed. The equipment will be inspected in accordance with manufacturer's recommendations. The inspection shall be documented in a field logbook or similar means to be kept in the project files.

Emergency Equipment and Supplies	Location
Minimum of 20 # (or two 10#) class A,B,C fire extinguisher – additional fire extinguishers as warranted	
First aid kit	
Eye wash	
Emergency shower – as needed	
Potable water	
Bloodborne-pathogen kit	
Additional equipment (specify):	

11.3 Incident Response

In fires, explosions, or chemical releases, actions to be taken include the following:

- Notify appropriate response personnel;
- Shut down CH2M HILL operations and evacuate the immediate work area;
- Account for personnel at the designated assembly area(s);
- Assess the need for site evacuation, and evacuate the site as warranted;
- Implement HSE-111, Incident Notification, Reporting and Investigation; and
- Notify and submit reports to clients as required in contract.

Small fires or spills posing minimal safety or health hazards may be controlled with onsite spill kits or fire extinguishers without evacuating the site. When in doubt evacuate. Follow the incident reporting procedures in the "Incident Notification, Reporting, and Investigation" section of this HSP.

11.4 Emergency Medical Treatment

Emergency medical treatment is needed when there is a life-threatening injury (such as severe bleeding, loss of consciousness, breathing or heart has stopped). When in doubt if an injury is life-threatening or not, treat it as needing emergency medical treatment.

- Notify 911 or other appropriate emergency response authorities as listed in the "Emergency Contacts" page located in this section.
- The ERC will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.

- Prevent further injury, perform decontamination (if applicable) where feasible; lifesaving and first aid or medical treatment takes priority.
- Initiate first aid and CPR where feasible.
- Notify supervisor and if the injured person is a CH2M HILL employee, the supervisor will call the occupational nurse at 1-866-893-2514 and make other notifications as required by HSE SOP-111, *Incident Notification, Reporting and Investigation*.
- Make certain that the injured person is accompanied to the emergency room.
- Follow the Serious Incident Reporting process in HSE SOP-111, Incident Notification, Reporting and Investigation, and complete incident report using the HITS system on the VO or if not feasible, use the hard copy forms provided as an attachment to this HSP.
- Notify and submit reports to client as required in contract.

11.5 Evacuation

- Evacuation routes, assembly areas, and severe weather shelters (and alternative routes and assembly areas) are to be specified on the site map.
- Evacuation route(s) and assembly area(s) will be designated by the ERC or designee before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The ERC and a "buddy" will remain on the site after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.
- The ERC will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).
- The ERC will follow the incident reporting procedures in the "Incident Notification, Reporting and Investigation" section of this HSP.

11.6 Evacuation Signals

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

11.7 Inclement Weather

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

increase in wind. If stormy weather ensues, field personnel should discontinue work and seek shelter until the storm has passed.

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

- Know where to go and how long it will take to get there. If possible, take refuge in a large building or vehicle. Do not go into a shed in an open area;
- The inclination to see trees as enormous umbrellas is the most frequent and most deadly mistake. Do not go under a large tree that is standing alone. Likewise, avoid poles, antennae, and towers;
- If the area is wide open, go to a valley or ravine, but be aware of flash flooding;
- If you are caught in a level open area during an electrical storm and you feel your hair stand on end, drop to your knees, bend forward and put your hands on your knees or crouch. The idea is to make yourself less vulnerable by being as low to the ground as possible and taking up as little ground space as possible. Lying down is dangerous, since the wet earth can conduct electricity. Do not touch the ground with your hands; and
- Do not use telephones during electrical storms, except in the case of emergency.

Remember that lightning may strike several miles from the parent cloud, so work should be stopped and restarted accordingly. The lightning safety recommendation is 30-30: Seek refuge when thunder sounds within 30 seconds after a lightning flash; and do not resume activity until 30 minutes after the last thunder clap.

High winds can cause unsafe conditions, and activities should be halted until wind dies down. High winds can also knock over trees, so walking through forested areas during high-wind situations should be avoided. If winds increase, seek shelter or evacuate the area. Proper body protection should be worn in case the winds hit suddenly, because body temperature can decrease rapidly.

12.0 Records and Reports

An organized project filing system is essential for good documentation and recordkeeping. There are many benefits to an organized filing system:

- Other CH2M HILL employees can easily and quickly find documents;
- Records are readily available for review;
- Records may be needed during OSHA investigations, audits, or other legal matters;
- Records may be needed on short notice in case of an accident, illness or other emergency; and
- Systematic recordkeeping aids in overall project organization.

The project filing system shall be established at the beginning of the project and maintained throughout all phases of construction and archived in accordance with CH2M HILL's Records Retention Policy. The information contained in the filing system shall be updated regularly and/or as specified in this document. The PM and SC are responsible for collecting documentation, including subcontractor documentation, and maintaining a complete and organized filing system.

Below are examples of records that must be maintained as the project progresses:

- Exposure records includes air monitoring data (including calibration records), MSDSs, exposure modeling results;
- Physical hazard exposure records include noise, ionizing radiation, non-ionizing radiation, vibration, and lasers exposure assessments and measurements;
- Respiratory fit test records;
- Training records;
- Incident reports, investigations and associated back-up information such as agency notifications, calculations, and corrective actions taken;
- Federal or state agency inspection records;
- Other Records:
  - Ergonomic evaluations;
  - HSE audits and assessments;
  - Project-specific HSE plans;
  - Confined space entry permits;
  - Equipment inspections;
  - Equipment maintenance;
  - Emergency equipment inspection records;
  - SBOs;

  - Self-assessment checklists
- The RHSM shall coordinate with the PM or designee to ensure that final project-specific HSE records described in this section, including negative exposure determinations, are maintained with the project files in accordance with the CH2M HILL records retention schedule, or forwarded to the Medical Surveillance Program Administrator, as appropriate. Records retention requirements are detailed in the Recordkeeping and Access to Records SOP, HSE-119.

Attachment 1
Employee Signoff Form

CH2MHILL

EMPLOYEE SIGNOFF FORM

Health, Safety and Environment Plan

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

Project Name: Quanta Resources – OU1 Work Activities, Edgewater, New Jersey **Project Number:** Various

EMPLOYEE NAME (Please print)	EMPLOYEE SIGNATURE	COMPANY	DATE

Attachment 2
Job Hazard Analysis

JOB TASK: EXCAVATION IN HIGH CONCENTRATION ARSENIC AREA	**DATE:** 11-11
DESCRIPTION OF WORK: EXCAVATING SOIL DOWN TO APPROXIMATELY 10 FEET BGS. COLLECT SOIL FROM EXCAVATOR BUCKET INTO 5-GALLON BUCKETS.	**PROJECT:** QUANTA RESOURCES – EDGEWATER, NEW JERSEY
	SITE SUPERVISOR:
	SITE SAFETY COORDINATOR: JENNIFER SIMMS OR AUSTIN HARCLERODE
	DATE REVIEWED: 11-11

TASK BREAKDOWN	IDENTIFY & ANALYZE THE HAZARD	IDENTIFY HAZARD CONTROL
Excavation		▪
	Heavy Equipment Operations	▪ Only qualified operators shall operate equipment ▪ Daily, or before first operation of the day the equipment shall be inspected for proper operation. ▪ Seat belts, hardhats and safety glasses shall be worn while equipment is being operated. ▪ No passengers will be carried except in an approved safety platform. ▪ Loads will not be suspended or travel over personnel ▪ A spotter shall be used if operators view is obstructed. ▪ Prior to excavation, all underground utilities shall be located. ▪ Ensure minimum clearance of 10′ is maintained from all overhead utilities. ▪ Operator shall be aware of all equipment and worker(s) near his/her operating area. ▪ Operator shall ensure load is properly distributed. ▪ Operator shall not exceed safe operating conditions.

Activity Hazard Analysis

TASK BREAKDOWN	IDENTIFY & ANALYZE THE HAZARD	IDENTIFY HAZARD CONTROL
Excavation (continued)	Heavy Equipment Operations (continued)	▪ Operator shall not exceed safe operating conditions. ▪ Operator shall not operate equipment other than in accordance with the manufacturers operating manual. ▪ Equipment shall not be positioned closer than 2 feet from edge of trench/excavation.
	Struck-by	▪ Barriers, cones, or caution tape shall be used to clearly define excavation-operating area. ▪ All unauthorized personnel shall stay outside of the equipment operating areas. ▪ Only enter operating area after operator grants authorization and temporarily stops operations. ▪ Never walk between equipment and stationary object while equipment is in operation. ▪ Spotters shall wear highly reflective vests. ▪ All traffic shall remain clear of operating area. ▪ Be aware of all audible alarms, horns, backup alarms. Stop and verify where they are coming from.
	Poor visibility	▪ Work and operating area shall be properly illuminated. You must be able to read a newspaper without any difficulty. ▪ A spotter wearing a highly reflective vest shall be used whenever view is obstructed. ▪ Spotter and operator shall clearly understand standard hand signals. Work will be stopped if there is any question as to signals meaning.
	Noise	▪ If shouting is needed to hear a conversation 3-feet away, hearing protection shall be required. ▪ Use standard hand signals if voice communication is not possible.
	Sampling	▪ In addition to minimum PPE Latex gloves shall be worn ▪ Washing of skin that contacts suspected contaminated soil/water is required.

TASK BREAKDOWN	IDENTIFY & ANALYZE THE HAZARD	IDENTIFY HAZARD CONTROL
Excavation (continued)	Cave-in	▪ All excavations shall be inspected by a competent person throughout the workday and/or after rain or any other change in soil conditions. ▪ Setback of at least 2' from edge of excavation must be maintained. ▪ Sloping/shoring requirements must be followed. ▪ Entry into excavation is not permitted until inspected/authorized by a competent person. – **Entry Into Trench Prohibited Unless Authorized by the HSM** ▪ Trenches/excavations 5 feet and deeper shall be properly slopped, benched, shored or both before an employee can enter. ▪ Ladders or stepping shall be used as means of egress for excavations that are at least 4 feet in depth. ▪ Sidewalks, pavements, and related structures shall not be undermined unless a support system is provided to protect employees and the sidewalk, pavement, or related structure. ▪ Diversion ditches, dikes, or other means shall be used to prevent surface water from entering excavation. ▪ Employees shall not work in excavations in which there is accumulated water or in which water is accumulating unless the water hazard is controlled. ▪ Excavations shall be barricaded or adequate warning placed around pit/trench to warn of potential fall hazard. ▪ Air monitoring shall be performed where oxygen deficiency or gaseous conditions are known or suspected. The excavation shall be tested prior to the start of each shift or more often if directed, a log of all tests shall be maintained at the work site. ▪ If excavation of 4 feet in depth, sufficient stairs, ramps, or ladders shall be provided to require no more than 25 feet of lateral travel.

Equipment to be used	Inspection Requirements	Training Requirements
Concrete walk behind wet saw	DAILY OR PRIOR TO FIRST USE OF THE DAY	QUALIFIED OPERATOR
Track-hoe	DAILY OR PRIOR TO FIRST USE OF THE DAY	QUALIFIED OPERATOR
Air/soil sampling	CALIBRATED AWAY FROM SITE DAILY	QUALIFIED OPERATOR

PRINT **SIGNATURE**

Supervisor Name: _____ _____ **Date/Time:**_____

Safety Officer Name: _____ _____ **Date/Time:**_____

Employee Name(s): _____ _____ **Date/Time:**_____

_____ _____ **Date/Time:**_____

_____ _____ **Date/Time:**_____

_____ _____ **Date/Time:**_____

_____ _____ **Date/Time:**_____

_____ _____ **Date/Time:**_____

_____ _____ **Date/Time:**_____

_____ _____ **Date/Time:**_____

Activity:	**Date:**
	Project:
Description of the work:	**Site Supervisor:**
	Site Safety Officer:
	Review for latest use: **Before the job is performed.**

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	**Potential Health and Safety Hazards** (Analyze each principal step for potential hazards)	**Hazard Controls** (Develop specific controls for each potential hazard)

Equipment to be used (List equipment to be used in the work activity)	**Inspection Requirements** (List inspection requirements for the work activity)	**Training Requirements** (List training requirements including hazard communication)

	PRINT NAME	SIGNATURE	
Supervisor Name:	_____	_____	**Date/Time:**_____
Safety Officer Name:	_____	_____	**Date/Time:**_____
Employee Name(s):	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____

JOB/TASK NAME: Soil/groundwater/sediment sample collection and IDW Management	DATE: 11-11	NEW___ REVISED____	PAGE ____OF ____
ASSOCIATE(S)/JOB TITLE PERFORMING THE JOB/TASK:	SUPERVISOR(S):		ANALYSIS PERFORMED BY:
PROJECT NAME AND JOB/TASK LOCATION: Honeywell – Quanta –	DEPARTMENT(S):		REVIEWED BY:
PERSONAL PROTECTIVE EQUIPMENT:	SHIFT (if applicable):		APPROVED BY: Bill Berlett

JOB STEPS		POSSIBLE HAZARDS	PROCEDURE/ACTION TO CONTROL OR ELIMINATE
1.	**Mobilization and travel between wells**	**Vehicle Operation** 1) Opening/closing doors, windows and trunk 2) Loading objects 3) Driving 4) Parking 5) Distractions 6) Emergency preparedness	1) Keep fingers and hands free from pinch points 2) Use a golfer lift (raise one leg) while removing items from trunk. 3) Follow the Smith System's "5 keys of Safe Driving". a) Aim high in steering b) Get the Big picture c) Keep your eyes moving d) Leave yourself an out e) Make sure others see you 4) Park in a manner that will allow for safe exit from vehicle, and where practicable, park vehicle so that it can serve as a barrier 5) **Do not** do the following while driving: a) Talk on a mobile phone b) Eat or drink c) Take your eyes off of the road to adjust radio 6) Wear seat belt, maintain a first aid kit, and inform others of travel plans.
		Traffic 1) Struck by	1) The following precautions must be taken when working around traffic: a) Exercise caution when exiting traveled way or parking along street – avoid sudden stops, use flashers, etc. b) Park in a manner that will allow for safe exit from vehicle, and where practicable, park vehicle so that it can serve as a barrier. c) Wear reflective/high-visibility safety vests. d) Eye protection should be worn to protect from flying debris. e) Remain aware of factors that influence traffic related hazards and required controls – sun glare, rain, wind, flash flooding, limited sight-distance, hills, curves, guardrails, width of

			shoulder, etc. f) Always remain aware of an escape route -- behind an established barrier, parked vehicle, guardrail, etc. g) Always pay attention to moving traffic – never assume drivers are looking out for you
2.	**Sampling and IDW Management**	**Slip/ Trip/ Fall** 1) Walking 2) Sampling (cords and tubing from well wizards, air compressors-electrical hazards associated with pump operations)	1) Precautions to take while sampling monitoring wells: a) Maintain housekeeping (i.e. hoses, debris, standing water, etc.) i. Store sampling equipment out of the way when it is not in use ii. Be aware of placement of cords and hoses from compressors and other equipment iii. Clean up any spills before continuing work b) Use GFCIs, follow pump manufacturer's guidelines
		Chemical Exposure 1) Field instrument calibration chemicals, sample preservative chemicals, decontamination solutions, untreated groundwater, compressor gasoline and oil	1) Review the "Site Specific Health and Safety Plan". a) Contaminants of Concern Table b) Refer to Personal Protective Equipment Schedule c) Refer to air monitoring d) Personal hygiene i. No eating, drink or smoking. ii. Wash hands and face after performing task 2) To prevent exposure from chemicals: a) Review Material Safety Data Sheet (MSDS). b) Utilize Personal Protective Equipment identified in this Health and Safety Plan c) Label all bottles and containers d) Store chemicals in properly labeled containers
3.	**Material Handling and IDW Management**	**Lifting Objects (sample coolers, compressors)** 1) Back Strain 2) Crushed appendages, scrapes, abrasions and cuts	1) Utilize a material handling device to lift any object >25 pounds. For all other manual lifting, follow these recommendations: a) Stand with your feet at least shoulder distance apart. b) Position your feet to face the direction of travel. c) Slightly bend your knees. d) Start to squat, bending your hips and knees, not your waist. e) Keep load close to body and raise yourself using your leg and hip muscles.

			f) Tighten your stomach muscles as you lift. g) Avoid twisting movements. 2) Prevent crush hazards by: a) Not positioning fingers or toes under object b) Wearing steel toed or safety toed boots 3) Prevent abrasions, scrapes and cuts by: a) Being aware of sharp edges and other parts of stainless steel wells b) If sample containers break, clean up broken glass and dispose of in a puncture proof container. c) Decontamination procedures must also be followed if the broken container contained chemical preservative or untreated groundwater.

	PRINT NAME	SIGNATURE	
Supervisor Name:	_____	_____	**Date/Time:**_____
Safety Officer Name:	_____	_____	**Date/Time:**_____
Employee Name(s):	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____

Activity: Sediment/surface water/pore water sampling on/in tidal river bottom/channels at the Quanta Resources site in Edgewater, New Jersey.	**Date: 03/08** **Project: Quanta Resources**
Description of the work: sediment sampling on a boat using a hand core methods. Sediments will be visually inspected, recorded, photographed and sampled per SAP.	**Site Supervisor:** **Site Safety Officer:** **Review for latest use:** **Before the job is performed.**

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	**Potential Health and Safety Hazards** (Analyze each principal step for potential hazards)	**Hazard Controls** (Develop specific controls for each potential hazard)
Offshore activities using boat.	1. Personnel failing overboard.	1. Approved OSHA personal flotation devices will be worn by all onboard personnel when working outside the exclusion zone.
	2. Electrical or ignitable sources (fuel) creating the potential for fire.	2. Approved fire extinguishers will be onboard and readily accessible. Personnel will be trained in the proper use of said fire extinguishers.
	3. Severe weather encountered on Water Body.	3. Marine radio will monitor weather broadcasts. Crew will be equipped with cellular phones.
Sediment/Surface Water /Pore Water Sampling Activities	1. Boat tipping during sediment sampling.	1. Approved OSHA personal flotation devices will be worn by all onboard personnel when working outside the exclusion zone. During sampling the boat will be anchored and stabilized using oars or spud bars.
	2. Cable snapping	2. Crew and visitors should be cleared of area during any winching operation to retrieve sediment cores.

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	**Potential Health and Safety Hazards** (Analyze each principal step for potential hazards)	**Hazard Controls** (Develop specific controls for each potential hazard)
	3. Underground utilities; electrocution, explosion.	3. Contact proper authorities to perform utility clearance prior to arrival onsite.
	4. Sampling equipment or tools falling on or striking workers.	4. Hard hats and safety shoes or boots must be worn by all workers and visitors.
	5. Objects in eyes when hammering cores or during core retrieval.	5. Wear safety glasses.
	6. Slips, trips and falls.	6.a. Keep safety boots free of mud and grease. 6.b. Keep sharp objects off ground in work area. 6.c. Inspect work zones and remove trip hazards.
	7. Hand injuries.	7.a. Keep hands away from hoists, wire, and rope. 7.b. When opening sample casing joints, position hands so that fingers will not be injured should the casing slip. 7.c. Keep tools clean and dry.
	8. Exposure to potentially contaminated sediment.	8. Wearing proper PPE during any phase of work that requires contact with potentially contaminated sediment.

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	**Potential Health and Safety Hazards** (Analyze each principal step for potential hazards)	**Hazard Controls** (Develop specific controls for each potential hazard)
	9. Strain/Back Injuries during core recovery.	9.a. Two team members will be onboard boat to stabilize boat and to take turns pulling core onto boat. 9.b. Rope and hoists will be used in core recovery to minimize physical strain of core recovery. 9.c. Two-person sampling teams will rotate duties to minimize repetitive physical stress.

Equipment to be used (List equipment to be used in the work activity)	**Inspection Requirements** (List inspection requirements for the work activity)	**Training Requirements** (List training requirements including hazard communication)
Sediment sampling activities using boat in water body	Self-Assessment Checklist—Open Water Work	OSHA 40-hr Hazwopr, Able to swim, Review of HSE-404

	PRINT NAME	SIGNATURE	
Supervisor Name:	_____	_____	**Date/Time:**_____
Safety Officer Name:	_____	_____	**Date/Time:**_____
Employee Name(s):	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____

Attachment 3
Daily Tailgate Safety Briefing Form

CH2M HILL
Daily Tailgate Safety Briefing Form

Project Name: Quanta – OU1 Work Activities – Edgewater, NJ	Project Number: Various	
Date:	Start Time:	Completed Time:
Site Location:		
Type of Work (general):		

Safety Issues

Tasks (this shift):
PPE Requirements:
Chemical Hazards:
Air Monitoring Requirements:
Physical Hazards:
Control Measures:
Hazard Communication Overview (MSDSs):
Special Topics (i.e., incidents, near misses, etc.)

Daily Checklist

HSE Plan up to date and present onsite?	Yes	No
Air monitoring equipment present, working, and calibrated?	Yes	No
Personnel training current?	Yes	No
Hospital Route Map and Emergency Phone Numbers posted onsite?	Yes	No
PPE present and worn by personnel?	Yes	No
Comments:		

Attendees

Print Name	Sign Name
Meeting conducted by:	

Attachment 4
Pre-Task Safety Plan

CH2MHILL

Pre-Task Safety Plan (PTSP)

Project: _____ Location: _____Date:_____

Supervisor: _____ Job Activity:_____

_____

Task Personnel:

_____
_____
_____
_____

List Tasks:

_____
_____
_____
_____

Tools/Equipment Required for Tasks (ladders, scaffolds, fall protection, cranes/rigging, heavy equipment, power tools):

_____
_____
_____

Potential H&S Hazards, including chemical, physical, safety, biological and environmental (check all that apply):

__ Chemical burns/contact	__ Trench, excavations, cave-ins	__ Ergonomics
__ Pressurized lines/equipment	__ Overexertion	__ Chemical splash
__ Thermal burns	__ Pinch points	__ Poisonous plants/insects
__ Electrical	__ Cuts/abrasions	__ Eye hazards/flying projectile
__ Weather conditions	__ Spills	__ Inhalation hazard
__ Heights/fall > 6 feet	__ Overhead Electrical hazards	__ Heat/cold stress
__ Noise	__ Elevated loads	__ Water/drowning hazard
__ Explosion/fire	__ Slips, trip and falls	__ Heavy equipment
__ Radiation	__ Manual lifting	__ Aerial lifts/platforms
__ Confined space entry	__ Welding/cutting	__ Demolition

Other Potential Hazards (Describe):

_____
_____
_____
_____

CH2MHILL

Hazard Control Measures (Check All That Apply):			
PPE __ Thermal/lined __ Eye __ Dermal/hand __ Hearing __ Respiratory __ Reflective vests __ Flotation device	Protective Systems __ Sloping __ Shoring __ Trench box __ Barricades __ Competent person __ Locate buried utilities __ Daily inspections	Fire Protection __ Fire extinguishers __ Fire watch __ Non-spark tools __ Grounding/bonding __ Intrinsically safe equipment	Electrical __ Lockout/tagout __ Grounded __ Panels covered __ GFCI/extension cords __ Power tools/cord inspected
Fall Protection __ Harness/lanyards __ Adequate anchorage __ Guardrail system __ Covered opening __ Fixed barricades __ Warning system	Air Monitoring __ PID/FID __ Detector tubes __ Radiation __ Personnel sampling __ LEL/O2 __ Other	Proper Equipment __ Aerial lift/ladders/scaffolds __ Forklift/heavy equipment __ Backup alarms __ Hand/power tools __ Crane with current inspection __ Proper rigging __ Operator qualified	Welding & Cutting __ Cylinders secured/capped __ Cylinders separated/upright __ Flash-back arrestors __ No cylinders in CSE __ Flame retardant clothing __ Appropriate goggles
Confined Space Entry __ Isolation __ Air monitoring __ Trained personnel __ Permit completed __ Rescue	Medical/ER __ First-aid kit __ Eye wash __ FA-CPR trained personnel __ Route to hospital	Heat/Cold Stress __ Work/rest regime __ Rest area __ Liquids available __ Monitoring __ Training	Vehicle/Traffic __ Traffic control __ Barricades __ Flags __ Signs
Permits __ Hot work __ Confined space __ Lockout/tagout __ Excavation __ Demolition __ Energized work	Demolition __ Pre-demolition survey __ Structure condition __ Isolate area/utilities __ Competent person __ Hazmat present	Inspections: __ Ladders/aerial lifts __ Lanyards/harness __ Scaffolds __ Heavy equipment __ Cranes and rigging	Training: __ Hazwaste __ Construction __ Competent person __ Task-specific (THA) __ Hazcom
Field Notes:_____ _____ _____ _____ _____			

Name (Print): _____

Signature:_____ Date:_____

Attachment 5
Project Activity Self-Assessment Checklists

CH2MHILL

HS&E Self-Assessment Checklist – EXCAVATIONS

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: (1) CH2M HILL employees enter excavations (complete Sections 1 and 3), and/or (2) CH2M HILL oversight of an excavation subcontractor is required (complete entire checklist).

SC may consult with excavation subcontractors when completing this checklist, but shall not direct the means and methods of excavation operations nor direct the details of corrective actions. Excavation subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Conditions considered imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazardous area until corrected.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposures to excavation hazards
☐ Evaluate a CH2M HILL subcontractor's compliance with excavation HS&E requirements
Subcontractor Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the excavation subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HSE-32.

SECTION 1	Yes	No	N/A	N/O
EXCAVATION ENTRY REQUIREMENTS (4.1)				
1. Personnel have completed excavation safety training	☐	☐	☐	☐
2. Competent person has completed daily inspection and has authorized entry	☐	☐	☐	☐
3. Personnel are aware of entry requirements established by competent person	☐	☐	☐	☐
4. Protective systems are free from damage and in stable condition	☐	☐	☐	☐
5. Surface objects/structures secured from falling into excavation	☐	☐	☐	☐
6. Potential hazardous atmospheres have been tested and found to be at safe levels	☐	☐	☐	☐
7. Precautions have been taken to prevent cave-in from water accumulation in the excavation	☐	☐	☐	☐
8. Personnel wearing appropriate PPE, per HSP/FSI	☐	☐	☐	☐

SECTION 2	Yes	No	N/A	N/O
GENERAL (4.2.1)				
9. Daily safety briefing/meeting conducted with personnel	☐	☐	☐	☐
10. Excavation and protective systems adequately inspected by competent person	☐	☐	☐	☐
11. Defective protective systems or other unsafe conditions corrected before entry	☐	☐	☐	☐
12. Guardrails provided on walkways over excavation 6' (1.8m) or deeper	☐	☐	☐	☐
13. Barriers provided at excavations 6' or deeper when excavation not readily visible	☐	☐	☐	☐
14. Barriers or covers provided for wells, pits, shafts, or similar excavation 6' (1.8 m) or deeper	☐	☐	☐	☐
15. Earthmoving equipment operated safely (use earthmoving equipment checklist in HS-27)	☐	☐	☐	☐
PRIOR TO EXCAVATING (4.2.2)				
16. Dig permit obtained where required by client/facility	☐	☐	☐	☐
17. Location of underground utilities and installations identified	☐	☐	☐	☐
18. Excavation area evaluated for OE/UXO hazards	☐	☐	☐	☐
19. Soils characterized prior to excavation where contamination may be present	☐	☐	☐	☐
20. USDA (or local equivalent) soil permit obtained for soil transport, where required	☐	☐	☐	☐
21. Excavation area checked for wetlands, endangered species, cultural/historic resources	☐	☐	☐	☐
22. ACOE/CWA 404 (or local equivalent) permit obtained for wetlands, where required	☐	☐	☐	☐
23. Stockpile management plan prepared	☐	☐	☐	☐
24. Waste discharge/NPDES (or local equivalent) permit obtained for excavation dewatering	☐	☐	☐	☐
25. Stormwater pollution prevention or erosion & sediment control plan prepared, where required)	☐	☐	☐	☐
EXCAVATING ACTIVITIES (4.2.3)				
26. Rocks, trees, and other unstable surface objects removed or supported	☐	☐	☐	☐
27. Exposed underground utility lines supported	☐	☐	☐	☐
28. Undermined surface structures supported or determined to be in safe condition	☐	☐	☐	☐
29. Warning system used to remind equipment operators of excavation edge	☐	☐	☐	☐
30. Stockpile, excavation covers, liners, silt fences in place, where required	☐	☐	☐	☐
31. Fugitive dust suppressed	☐	☐	☐	☐
EXCAVATION ENTRY (4.2.4)				
32. Trenches > 4' (1.2 m) deep provided with safe means of egress within 25' (7.6 m)	☐	☐	☐	☐
33. Structure ramps designed and approved by competent person	☐	☐	☐	☐
34. Potential hazardous atmospheres tested prior to entry	☐	☐	☐	☐
35. Rescue equipment provided where potential for hazardous atmospheres exists	☐	☐	☐	☐
36. Ventilation used to control hazardous atmospheres and air tested frequently	☐	☐	☐	☐
37. Appropriate respiratory protection used when ventilation does not control hazards	☐	☐	☐	☐
38. Precautions taken to prevent cave-in from water accumulation in excavation	☐	☐	☐	☐
39. Precautions taken to prevent surface water from entering excavation	☐	☐	☐	☐
40. Protection provided from falling/rolling material from excavation face	☐	☐	☐	☐
41. Spoil piles, equipment, materials restrained or kept at least 2' (61 cm) from excavation edge	☐	☐	☐	☐
EXCAVATION PROTECTIVE SYSTEMS (4.2.5)				
42. Protective systems used for excavations 5' (1.5 m) or deeper, unless stable rock	☐	☐	☐	☐
43. Protective systems for excavation deeper than 20' (6.1 m) designed by registered PE	☐	☐	☐	☐
44. If soil unclassified, maximum allowable slope is 34 degrees	☐	☐	☐	☐
45. Protective systems free from damage	☐	☐	☐	☐
46. Protective system used according to manufacturer's recommendations and not subjected to loads exceeding design limits	☐	☐	☐	☐
47. Protective system components securely connected to prevent movement or failure	☐	☐	☐	☐
48. Cave-in protection provided while entering/exiting shielding systems	☐	☐	☐	☐
49. Personnel removed from shielding systems when installed, removed, or vertical movement	☐	☐	☐	☐

SECTION 2 (Continued)	Yes	No	N/A	N/O
PROTECTIVE SYSTEM REMOVAL AND BACKFILLING (4.2.6)				
50. Protective system removal starts and progresses from excavation bottom	☐	☐	☐	☐
51. Protective systems removed slowly and cautiously	☐	☐	☐	☐
52. Temporary structure supports used if failure of remaining components observed	☐	☐	☐	☐
53. Backfilling taking place immediately after protective system removal	☐	☐	☐	☐
54. Backfill certified clean when required by client or local regulation	☐	☐	☐	☐
EXCAVATING AT HAZARDOUS WASTE SITES (4.2.7)				
55. Waste disposed of according to HSP and RCRA regulations	☐	☐	☐	☐
56. Appropriate decontamination procedures being followed, per HSP	☐	☐	☐	☐
EXCAVATING AT POTENTIAL ORDNANCE EXPLOSIVES SITES (4.2.8)				
57. OE plan prepared and approved	☐	☐	☐	☐
58. OE/UXO avoidance provided, routes and boundaries cleared and marked	☐	☐	☐	☐
59. Personnel remain inside the marked boundary	☐	☐	☐	☐
60. Earthmoving equipment does not excavate closer than 1' (30.5 cm) to anomalies	☐	☐	☐	☐

SECTION 3

Complete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: _____ Project Manager: _____

CH2MHILL

H&S Self-Assessment Checklist – TRAFFIC CONTROL

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: 1) CH2M HILL employees are exposed to traffic hazards and/or 2) CH2M HILL provides oversight of subcontractor personnel who are exposed to traffic hazards.

SSC or DSC may consult with subcontractors when completing this checklist, but shall not direct the means and methods of traffic control operations nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies, and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Completed checklists shall be sent to the HS&E Staff for review.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposure to traffic hazards.
☐ Evaluate a CH2M HILL subcontractor's compliance with traffic control requirements.
Subcontractors Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HS-24.

SECTION 1

SAFE WORK PRACTICES (3.1)

		Yes	No	N/A	N/O
1.	Personnel working on/adjacent to active roadways or in control zones are wearing safety vests.	☐	☐	☐	☐
2.	Traffic control plan (TCP) is consistent with roadway, traffic, and working conditions.	☐	☐	☐	☐
3.	TCP has been approved by regulatory or contractual authority prior to work.	☐	☐	☐	☐
4.	TCP considers all factors that may influence traffic related hazards and controls.	☐	☐	☐	☐
5.	Work areas are protected by rigid barriers.	☐	☐	☐	☐
6.	Lookouts are used when applicable.	☐	☐	☐	☐
7.	Vehicles are parked 40 feet away from work zone or are equipped with hazard beacon/strobe.	☐	☐	☐	☐
8.	TMCC or TMA vehicle is used where appropriate.	☐	☐	☐	☐
9.	All CH2M HILL traffic control devices conform to MUTCD standards.	☐	☐	☐	☐
10.	Traffic control devices are inspected continuously.	☐	☐	☐	☐
11.	Flagging is only used when other means of traffic control are inadequate.	☐	☐	☐	☐
12.	Additional traffic control zone controls have been implemented.	☐	☐	☐	☐
13.	Cranes do not swing loads/booms over nor do workers enter/cross live roadways (as defined).	☐	☐	☐	☐

SECTION 2	Yes	No	N/A	N/O
GENERAL (3.2.1)				
14. Lane closings are performed when required by this SOP.	☐	☐	☐	☐
15. Traffic control configurations are based on an engineering study of the location.	☐	☐	☐	☐
16. If no study, traffic control is performed with approval of the authority having jurisdiction.	☐	☐	☐	☐
17. TCP has been prepared and understood by all responsible parties prior to work.	☐	☐	☐	☐
18. Special preparation/coordination with external parties has been conducted where applicable.	☐	☐	☐	☐
19. All contractor traffic control devices conform to MUTCD standards.	☐	☐	☐	☐
20. Traffic movement and flow are inhibited or disrupted as little as possible.	☐	☐	☐	☐
21. Supplemental equipment and activities do not interfere with traffic.	☐	☐	☐	☐
22. Drivers and pedestrians are considered when entering and traversing traffic control zone.	☐	☐	☐	☐
TRAFFIC CONTROL ZONES (3.2.2)				
23. Traffic control zones are divided into the necessary five areas.	☐	☐	☐	☐
24. Advances warning area is designed based on conditions of speed, roadways, and driver needs.	☐	☐	☐	☐
25. Advanced warning signage is spaced according to roadway type and conditions.	☐	☐	☐	☐
26. Transition areas are used to channelize traffic around the work area.	☐	☐	☐	☐
27. Buffer areas are used to provide a margin of safety for traffic and workers.	☐	☐	☐	☐
28. The buffer area is free of equipment, workers, materials, and worker vehicles.	☐	☐	☐	☐
29. The length of the buffer area is two times the posted speed limit in feet.	☐	☐	☐	☐
30. All work is contained in the work area and is closed to all traffic.	☐	☐	☐	☐
31. A termination area is used to provide traffic to return to normal lanes.	☐	☐	☐	☐
32. A downstream taper is installed in the termination area.	☐	☐	☐	☐
DEVICE INSTALLATION AND REMOVAL (3.2.3)				
33. All vehicles involved with device installation/removal have hazard beacons/strobes.	☐	☐	☐	☐
34. Devices are installed according to the order established by this SOP.	☐	☐	☐	☐
35. Devices are removed in the opposite order of installation.	☐	☐	☐	☐
36. Tapers are used to move traffic out of its normal path.	☐	☐	☐	☐
37. Tapers are created using channelizing devices.	☐	☐	☐	☐
38. The length of taper is determined by posted speed and width of lane to be closed (see formula).	☐	☐	☐	☐
39. Local police or highway patrol assist during taper installation and removal.	☐	☐	☐	☐
40. TMCC/ TMA vehicles are used to protect personnel during installation and removal of devices.	☐	☐	☐	☐
41. Cone trucks are equipped with platforms and railings.	☐	☐	☐	☐
42. Cones are the appropriate height for the specific roadway and are reflectorized.	☐	☐	☐	☐
43. Temporary sign supports are secured using sandbags to prevent movement.	☐	☐	☐	☐
44. Arrow panels are used on lane closures where required.	☐	☐	☐	☐
45. Concrete barriers are used where required.	☐	☐	☐	☐
46. Barrels, crash cushions, or energy absorbing terminals are used to protect traffic as required.	☐	☐	☐	☐
47. Changeable message signs (CMS) are used as required.	☐	☐	☐	☐
48. CMS are not used to replace required signage.	☐	☐	☐	☐
49. No more than two message panels are used in any message cycle on CMS.	☐	☐	☐	☐
FLAGGING (3.2.4)				
50. Flagging is used only when other traffic control methods are inadequate.	☐	☐	☐	☐
51. Only approved personnel with current certification are allowed to be used as flaggers.	☐	☐	☐	☐
52. Flaggers are located off the traveled portion of the roadway.	☐	☐	☐	☐
53. A communication system is established when more than one flagger is used.	☐	☐	☐	☐
54. Hand signaling by flaggers is by means of red flags, sign paddles, or red lights.	☐	☐	☐	☐
55. Flaggers are alert, positioned close enough to warn work crews, and easily identified from crew.	☐	☐	☐	☐
56. An escape plan is established by crew and flaggers prior to traffic control set up.	☐	☐	☐	☐
57. Signs indicating a flagger is present are used and removed as required.	☐	☐	☐	☐

SECTION 2	Yes	No	N/A	N/O
INSPECTION AND MAINTENANCE (3.2.5)				
58. Traffic control zones are monitored to determine their effectiveness under varying conditions.	☐	☐	☐	☐
59. Traffic control devices are inspected at the beginning and continuously during work shift.	☐	☐	☐	☐
60. Traffic control devices are restored to their proper position immediately and continuously.	☐	☐	☐	☐
61. Damaged, old, or ineffective devices are removed and replace immediately and continuously.	☐	☐	☐	☐
62. Devices using reflected light for illumination are cleaned and monitored continuously.	☐	☐	☐	☐

SECTION 3

Complete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: _____ Project Manager: _____

CH2MHILL

H&S Self-Assessment Checklist – HAND AND POWER TOOLS

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: 1) CH2M HILL employees are exposed to hand and power tool hazards and/or 2) CH2M HILL provides oversight of subcontractor personnel who are exposed to hand and power tool hazards.

SSC or DSC may consult with subcontractors when completing this checklist, but shall not direct the means and methods of hand and power tool use nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Completed checklists shall be sent to the HS&E Staff for review.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposure to hand and power tool hazards.
☐ Evaluate a CH2M HILL subcontractor's compliance with hand and power tool requirements.
Subcontractors Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HS-50.

SECTION 1

	Yes	No	N/A	N/O
SAFE WORK PRACTICES (3.1)				
1. All tools operated according to manufacturer's instructions and design limitations.	☐	☐	☐	☐
2. All hand and power tools maintained in a safe condition and inspected and tested before use.	☐	☐	☐	☐
3. Defective tools are tagged and removed from service until repaired.	☐	☐	☐	☐
4. PPE is selected and used according to tool-specific hazards anticipated.	☐	☐	☐	☐
5. Power tools are not carried or lowered by their cord or hose.	☐	☐	☐	☐
6. Tools are disconnected from energy sources when not in use, servicing, cleaning, etc.	☐	☐	☐	☐
7. Safety guards remain installed or are promptly replaced after repair.	☐	☐	☐	☐
8. Tools are stored properly.	☐	☐	☐	☐
9. Cordless tools and recharging units both conform to electrical standards and specifications.	☐	☐	☐	☐
10. Tools used in explosive environments are rated for such use.	☐	☐	☐	☐
11. Knife or blade hand tools are used with the proper precautions.	☐	☐	☐	☐
12. Consider controls to avoid muscular skeletal, repetitive motion, and cumulative trauma stressors.	☐	☐	☐	☐

CH2MHILL

H&S Self-Assessment Checklist – HAND AND POWER TOOLS

SECTION 2	Yes	No	N/A	N/O
GENERAL (3.2.1)				
13. PPE is selected and used according to tool-specific hazards anticipated.	☐	☐	☐	☐
14. Tools are tested daily to assure safety devices are operating properly.	☐	☐	☐	☐
15. Damaged tools are removed from service until repaired.	☐	☐	☐	☐
16. Power operated tools designed to accommodate guards have guards installed.	☐	☐	☐	☐
17. Rotating or moving parts on tools are properly guarded.	☐	☐	☐	☐
18. Machines designed for fixed locations are secured or anchored.	☐	☐	☐	☐
19. Floor and bench-mounted grinders are provided with properly positioned work rests.	☐	☐	☐	☐
20. Guards are provided at point of operation, nip points, rotating parts, etc.	☐	☐	☐	☐
21. Fluid used in hydraulic-powered tools is approved fire-resistant fluid.	☐	☐	☐	☐
ELECTRIC-POWERED TOOLS (3.2.2)				
22. Electric tools are approved double insulated or grounded and used according to SOP HS-23.	☐	☐	☐	☐
23. Electric cords are not used for hoisting or lowering tools.	☐	☐	☐	☐
24. Electric tools are used in damp/ wet locations are approved for such locations or GFCI installed.	☐	☐	☐	☐
25. Hand-held tools are equipped with appropriate on/off controls appropriate for the tool.	☐	☐	☐	☐
26. Portable, power-driven circular saws are equipped with proper guards.	☐	☐	☐	☐
ABRASIVE WHEEL TOOLS (3.2.3)				
27. All employees using abrasive wheel tools are wearing eye protection.	☐	☐	☐	☐
28. All grinding machines are supplied with sufficient power to maintain spindle speed.	☐	☐	☐	☐
29. Abrasive wheels are closely inspected and ring-tested before use.	☐	☐	☐	☐
30. Grinding wheels are properly installed.	☐	☐	☐	☐
31. Cup-type wheels for external grinding are protected by the proper guard or flanges.	☐	☐	☐	☐
32. Portable abrasive wheels used for internal grinding are protected by safety flanges.	☐	☐	☐	☐
33. Safety flanges are used only with wheels designed to fit the flanges.	☐	☐	☐	☐
34. Safety guards on abrasive wheel tools are mounted properly and of sufficient strength.	☐	☐	☐	☐
PNEUMATIC-POWERED TOOLS (3.2.4)				
35. Tools are secured to hoses or whip by positive means to prevent disconnection.	☐	☐	☐	☐
36. Safety clips or retainers are installed to prevent attachments being expelled.	☐	☐	☐	☐ 37.
Safety devices are installed on automatic fastener feed tools as required.	☐	☐	☐	☐
38. Compressed air is not used for cleaning unless reduced to < 30 psi, with PPE, and guarded.	☐	☐	☐	☐
39. Manufacturer's safe operating pressure for hoses, pipes, valves, etc. are not exceeded.	☐	☐	☐	☐
40. Hoses are not used for hoisting or lowering tools.	☐	☐	☐	☐
41. All hoses >1/2-inch diameter have safety device at source to reduce pressure upon hose failure.	☐	☐	☐	☐
42. Airless spray guns have required safety devices installed.	☐	☐	☐	☐
43. Blast cleaning nozzles are equipped with operating valves, which are held open manually.	☐	☐	☐	☐
44. Supports are provided for mounting nozzles when not in use.	☐	☐	☐	☐
45. Air receiver drains, handholes, and manholes are easily accessible.	☐	☐	☐	☐
46. Air receivers are equipped with drainpipes and valves for removal of accumulated oil and water.	☐	☐	☐	☐
47. Air receivers are completely drained at required intervals.	☐	☐	☐	☐
48. Air receivers are equipped with indicating pressure gauges.	☐	☐	☐	☐
49. Safety, indicating, and controlling devices are installed as required.	☐	☐	☐	☐
50. Safety valves are tested frequently and at regular intervals to assure good operating condition.	☐	☐	☐	☐

SECTION 2 (continued)

	Yes	No	N/A	N/O
LIQUID FUEL-POWERED TOOLS (3.2.5)				
51. Liquid fuel-powered tools are stopped when refueling, servicing, or maintaining.	☐	☐	☐	☐
52. Liquid fuels are stored, handled, and transported in accordance with SOP HS-21	☐	☐	☐	☐
53. Liquid fuel-powered tools are used in confined spaces in accordance with SOP HS-17.	☐	☐	☐	☐
54. Safe operating pressures of hoses, valves, pipes, filters, and other fittings are not exceeded.	☐	☐	☐	☐
POWDER-ACTUATED TOOLS (3.2.6)				
55. Only trained employee operates powder-actuated tools.	☐	☐	☐	☐
56. Powder-actuated tools are not loaded until just prior to intended firing time.	☐	☐	☐	☐
57. Tools are not pointed at any employee at any time.	☐	☐	☐	☐
58. Hands are kept clear of open barrel end.	☐	☐	☐	☐
59. Loaded tools are not left unattended.	☐	☐	☐	☐
60. Fasteners are not driven into very hard or brittle materials.	☐	☐	☐	☐
61. Fasteners are not driven into easily penetrated materials unless suitable backing is provided.	☐	☐	☐	☐
62. Fasteners are not driven into spalled areas.	☐	☐	☐	☐
63. Powder-actuated tools are not used in an explosive or flammable atmosphere.	☐	☐	☐	☐
64. All tools are used with correct shields, guards, or attachments recommended by manufacturer.	☐	☐	☐	☐
JACKING TOOLS (3.2.7)				
65. Rated capacities are legibly marked on jacks and not exceeded.	☐	☐	☐	☐
66. Jacks have a positive stop to prevent over-travel.	☐	☐	☐	☐
67. The base of jacks are blocked or cribbed to provide a firm foundation, when required.	☐	☐	☐	☐
68. Wood blocks are place between the cap and load to prevent slippage, when required.	☐	☐	☐	☐
69. After load is raised, it is cribbed, blocked, or otherwise secured immediately.	☐	☐	☐	☐
70. Antifreeze is used when hydraulic jacks are exposed to freezing temperatures.	☐	☐	☐	☐
71. All jacks are properly lubricated.	☐	☐	☐	☐
72. Jacks are inspected as required.	☐	☐	☐	☐
73. Repair or replacement parts are examined for possible defects.	☐	☐	☐	☐
74. Jacks not working properly are removed from service and repaired or replaced.	☐	☐	☐	☐
HAND TOOLS (3.2.8)				
75. Wrenches are not used when jaws are sprung to the point of slippage.	☐	☐	☐	☐
76. Impact tools are kept free of mushroomed heads.	☐	☐	☐	☐
77. Wooden handles of tools are kept free of splinters or cracks and are tightly fitted in tool.	☐	☐	☐	☐

SECTION 3

Complete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: _____ Project Manager: _____

CH2MHILL

HS&E Self-Assessment Checklist - DRILLING

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's written safety plan.

This checklist is to be used at locations where: 1) CH2M HILL employees are potentially exposed to drilling hazards, 2) CH2M HILL staff are providing support function related to drilling activities, and/or 3) CH2M HILL oversight of a drilling subcontractor is required.

Safety Coordinator may consult with drilling subcontractors when completing this checklist, but shall not direct the means and methods of drilling operations nor direct the details of corrective actions. Drilling subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately, or all exposed personnel shall be removed from the hazard until corrected.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposures to drilling hazards (complete Section 1).
☐ Evaluate CH2M HILL support functions related to drilling activities (complete Section 2)
☐ Evaluate a CH2M HILL subcontractor's compliance with drilling safety requirements (complete entire checklist).
Subcontractors Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the drilling subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in SOP HSE-35.

SECTION 1 - SAFE WORK PRACTICES (4.1)

	Yes	No	N/A	N/O
1. Personnel cleared during rig startup	☐	☐	☐	☐
2. Personnel clear of rotating parts	☐	☐	☐	☐
3. Personnel not positioned under hoisted loads	☐	☐	☐	☐
4. Loose clothing and jewelry removed	☐	☐	☐	☐
5. Smoking is prohibited around drilling operation	☐	☐	☐	☐
6. Personnel wearing appropriate personal protective equipment (PPE), per written plan	☐	☐	☐	☐
7. Personnel instructed not to approach equipment that has become electrically energized	☐	☐	☐	☐

SECTION 2 - SUPPORT FUNCTIONS (4.2)

FORMS/PERMITS (4.2.1)

8. Driller license/certification obtained	☐	☐	☐	☐
9. Well development/abandonment notifications and logs submitted and in project files	☐	☐	☐	☐
10. Water withdrawal permit obtained, where required	☐	☐	☐	☐
11. Dig permit obtained, where required	☐	☐	☐	☐

UTILITY LOCATING (4.2.2)

12. Location of underground utilities and structures identified	☐	☐	☐	☐

SECTION 2 (Continued)

	Yes	No	N/A	N/O
WASTE MANAGEMENT (4.2.3)				
13. Drill cuttings and purge water managed and disposed properly	☐	☐	☐	☐
DRILLING AT HAZARDOUS WASTE SITES (4.2.4)				
14. Waste disposed of according to project's written safety plan	☐	☐	☐	☐
15. Appropriate decontamination procedures being followed, per project's written safety plan	☐	☐	☐	☐
DRILLING AT ORDNANCE EXPLOSIVES (OE)/UNEXPLODED ORDNANCE (UXO) SITES (4.2.5)				
16. OE plan prepared and approved	☐	☐	☐	☐
17. OE/UXO avoidance provided, routes and boundaries cleared and marked	☐	☐	☐	☐
18. Initial pilot hole established by UXO technician with hand auger	☐	☐	☐	☐
19. Personnel remain inside cleared areas	☐	☐	☐	☐
SECTION 3 - DRILLING SAFETY REQUIREMENTS (4.3)				
GENERAL (4.3.1)				
20. Only authorized personnel operating drill rigs	☐	☐	☐	☐
21. Daily safety briefing/meeting conducted with crew	☐	☐	☐	☐
22. Daily inspection of drill rig and equipment conducted before use	☐	☐	☐	☐
DRILL RIG PLACEMENT (4.3.2)				
23. Location of underground utilities and structures identified	☐	☐	☐	☐
24. Safe clearance distance maintained from overhead power lines	☐	☐	☐	☐
25. Drilling pad established, when necessary	☐	☐	☐	☐
26. Drill rig leveled and stabilized	☐	☐	☐	☐
27. Additional precautions taken when drilling in confined areas	☐	☐	☐	☐
DRILL RIG TRAVEL (4.3.3)				
28. Rig shut down and mast lowered and secured prior to rig movement	☐	☐	☐	☐
29. Tools and equipment secured prior to rig movement	☐	☐	☐	☐
30. Only personnel seated in cab are riding on rig during movement	☐	☐	☐	☐
31. Safe clearance distance maintained while traveling under overhead power lines	☐	☐	☐	☐
32. Backup alarm or spotter used when backing rig	☐	☐	☐	☐
DRILL RIG OPERATION (4.3.4)				
33. Kill switch clearly identified and operational	☐	☐	☐	☐
34. All machine guards are in place	☐	☐	☐	☐
35. Rig ropes not wrapped around body parts	☐	☐	☐	☐
36. Pressurized lines and hoses secured from whipping hazards	☐	☐	☐	☐
37. Drill operation stopped during inclement weather	☐	☐	☐	☐
38. Air monitoring conducted per written safety plan for hazardous atmospheres	☐	☐	☐	☐
39. Rig placed in neutral when operator not at controls	☐	☐	☐	☐
DRILL RIG SITE CLOSURE (4.3.5)				
40. Ground openings/holes filled or barricaded	☐	☐	☐	☐
41. Equipment and tools properly stored	☐	☐	☐	☐
42. All vehicles locked and keys removed	☐	☐	☐	☐
DRILL RIG MAINTENANCE (4.3.6)				
28. Defective components repaired immediately	☐	☐	☐	☐
29. Lockout/tagout procedures used prior to maintenance	☐	☐	☐	☐
30. Cathead in clean, sound condition	☐	☐	☐	☐
31. Drill rig ropes in clean, sound condition	☐	☐	☐	☐
32. Fall protection used for fall exposures of 6 feet (U.S.) 1.5 meters (Australia) or greater	☐	☐	☐	☐
33. Rig in neutral and augers stopped rotating before cleaning	☐	☐	☐	☐
34. Good housekeeping maintained on and around rig	☐	☐	☐	☐

SECTION 4

Complete this section for all items checked “No” in previous sections. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: _________________________________ Project Manager: ___________________________________

CH2MHILL

H&S Self-Assessment Checklist—Open Water Work (Boats, Ships and Barges)

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: 1) CH2M HILL employees are exposed to open water hazards aboard a boat, ship or barge (complete Section 1 and 3) and/or 2) CH2M HILL provides oversight of subcontractor personnel who are exposed to open water hazards aboard a boat, ship or barge (complete entire checklist).

SSC or DSC may consult with subcontractors when completing this checklist, but shall not direct the means and methods of boat, ship or barge operations nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Completed checklists shall be sent to the HS&E Staff for review.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposure to open water hazards on boat, ship or barge
☐ Evaluate a CH2M HILL subcontractor's compliance with boat, ship or barge requirements
Subcontractors Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.

SECTION 1

	Yes	No	N/A	N/O
SAFE WORK PRACTICES				
1. Individuals working aboard ship can swim.	☐	☐	☐	☐
2. All ship-board personnel are wearing an OSHA-certified Personal Flotation Device	☐	☐	☐	☐
3. Individuals operating boats larger than state/federal minimum are certified operators	☐	☐	☐	☐
4. Ship is properly licensed for waterway site work	☐	☐	☐	☐
5. Competent person inspects ship's operational and navigational systems daily	☐	☐	☐	☐
6. Pre-Launch safety meetings conducted with all parties involved in ship operations	☐	☐	☐	☐
7. Adequate distance maintained between ship and overhead power lines, bridges, overpasses	☐	☐	☐	☐
8. Adequate distance maintained between ship other ships on waterways	☐	☐	☐	☐
9. Equipment is properly secured from shifting, sliding while aboard ship.	☐	☐	☐	☐
11. No unqualified personnel permitted near ship' rigging or spuds during operation	☐	☐	☐	☐
12. Manufacturers specifications and limitations for weight allowance and distribution on ship are followed at all times during operation	☐	☐	☐	☐
13. All ship-board personnel are wearing an OSHA-certified Personal Flotation Device	☐	☐	☐	☐
14. Weather conditions considered monitored continuously via maritime radio	☐	☐	☐	☐
15. Weather conditions are monitored by designated crew member	☐	☐	☐	☐
16. All rigging used as intended, inspected, stored, protected and supervised.	☐	☐	☐	☐
17. Rescue flotation devices are visibly marked and available, and in good working order	☐	☐	☐	☐
18. Ship is operated at speeds at appropriate for the waterway, or less than posted speeds	☐	☐	☐	☐

SECTION 2

	Yes	No	N/A	N/O
19. The competent person inspects all spuds, hoists, anchors, and rigging prior to use	☐	☐	☐	☐
20. Frequent and periodic inspections of the any necessary bilge pumps are recorded and available for review	☐	☐	☐	☐
21. All guards and safety devices are installed and equipment removed after maintenance	☐	☐	☐	☐
22. The ship's operator is aware of deck activities via direct view or two-way radio communications during drilling and/or sampling	☐	☐	☐	☐
23. The ships navigational system (such as GPS, Sonar or a combination thereof) can be used when vision is obstructed (such as in the early morning/evening, or due to fog or times of heavy precipitation)	☐	☐	☐	☐
24. Navigational maps are in use and available ship's operator	☐	☐	☐	☐
25. Navigational traverse routes best suited to the ship's capabilities are discussed prior to each daily launch	☐	☐	☐	☐
26. Seating or handholds are available for crew when ship is in transit	☐	☐	☐	☐
27. All work areas are kept clean of loose tools, cans, and waste	☐	☐	☐	☐
28. The ship has proper entrance and egress to shore for all crew and equipment.	☐	☐	☐	☐
29. Ship is equipped with a certified 5 ABC or higher fire extinguisher	☐	☐	☐	☐
30. Ship is equipped with rest areas for crew during events held during extreme heat or cold conditions or during periods of heavy precipitation	☐	☐	☐	☐
31. All decking has stable railings that meet OSHA standards	☐	☐	☐	☐
32. Any fuel aboard ship is kept away from engine as well as sampling equipment	☐	☐	☐	☐
33. A clearly marked exclusion zone is designated for drilling and sampling	☐	☐	☐	☐
ON BOARD DRILLING EQUIPMENT: POSITIONING				
33. Any drilling equipment operated near live power lines will maintain minimum distance from the lines	☐	☐	☐	☐
34. Adequate clearance must be maintained between a ship and obstructions both visible and submerged, including utility lines	☐	☐	☐	☐
35. Any drilling equipment aboard is level secured and blocked properly during both operation and transport to ensure no rapid load shifts.	☐	☐	☐	☐
36. Exhaust pipes are guarded from employee contact and vented away from exclusion zone	☐	☐	☐	☐

CH2MHILL

H&S Self-Assessment Checklist— Open Water Work (Boats and Barges)

SECTION 3

Complete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: _____ Project Manager: _____

HS&E Self-Assessment Checklist - EARTHMOVING EQUIPMENT

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: 1) CH2M HILL employees are potentially exposed to the hazards of earthmoving equipment operations, 2) CH2M HILL employees are operating earthmoving equipment, and/or 3) CH2M HILL provides oversight of a subcontractor operating earthmoving equipment.

The CH2M HILL Safety Coordinator may consult with subcontractors operating earthmoving equipment when completing this checklist, but shall not direct the means and methods of equipment operations nor direct the details of corrective actions. Earthmoving equipment subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposures to earthmoving equipment hazards (complete Section 1).
☐ Evaluate CH2M HILL employees operating earthmoving equipment (complete entire checklist).
☐ Evaluate CH2M HILL subcontractor's compliance with earthmoving equipment safety requirements (complete entire checklist). Subcontractors Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the earthmoving equipment subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HSE-27.

SAFE WORK PRACTICES (3.1) **SECTION 1**	**Yes**	**No**	**N/A**	**N/O**
1. Personnel maintaining safe distance from operating equipment	☐	☐	☐	☐
2. Positioning personnel in close proximity to operating equipment is avoided	☐	☐	☐	☐
3. Personnel wearing high-visibility and/or reflective vests when close to operating equipment	☐	☐	☐	☐
4. Personnel approach operating equipment safely	☐	☐	☐	☐
5. Personnel riding only in seats of equipment cab and using seat belts	☐	☐	☐	☐
6. Personnel not positioned under elevated portions of equipment	☐	☐	☐	☐
7. Personnel not positioned under hoisted loads	☐	☐	☐	☐
8. Personnel not hoisted by equipment	☐	☐	☐	☐
9. Personnel do not to approach equipment that has become electrically energized	☐	☐	☐	☐
10. Personnel wearing appropriate PPE, per HSP/FSI	☐	☐	☐	☐

EQUIPMENT SAFETY REQUIREMENTS PRIOR TO OPERATING EQUIPMENT (3.2.1)	SECTION 2	Yes	No	N/A	N/O
11. Only qualified and authorized personnel operating equipment		☐	☐	☐	☐
12. Daily safety briefing/meeting conducted with equipment operators		☐	☐	☐	☐
13. Daily inspection of equipment conducted and documented		☐	☐	☐	☐
14. Modifications and attachments used approved by equipment manufacturer		☐	☐	☐	☐
15. Backup alarm or spotter used when backing equipment		☐	☐	☐	☐
16. Operational horn provided on bi-directional equipment		☐	☐	☐	☐
17. Seat belts are provided and used		☐	☐	☐	☐
18. Rollover protective structures (ROPS) provided		☐	☐	☐	☐
19. Braking system capable of stopping full payload		☐	☐	☐	☐
20. Headlights and taillights operable when additional light required		☐	☐	☐	☐
21. Brake lights in operable condition		☐	☐	☐	☐
22. Cab glass provides no visible distortion to the operator		☐	☐	☐	☐
23. All machine guards are in place		☐	☐	☐	☐
24. Hauling equipment (dump trucks) provided with cab shield or canopy		☐	☐	☐	☐
25. Dump truck beds provided with positive means of support during maintenance or inspection		☐	☐	☐	☐
26. Dump truck operating levers provided with latch to prevent accidental dumping		☐	☐	☐	☐
27. Air monitoring conducted per HSP/FSI for hazardous atmospheres		☐	☐	☐	☐
EQUIPMENT PLACEMENT (3.2.2)					
28. Equipment position on firm/level surface, outriggers used		☐	☐	☐	☐
29. Location of underground utilities identified		☐	☐	☐	☐
30. Safe clearance distance maintained while working under overhead power lines		☐	☐	☐	☐
31. Safe distance is maintained while traveling under power lines		☐	☐	☐	☐
32. Warning system used to remind operator of excavation edge		☐	☐	☐	☐
33. Unattended equipment visibly marked at night		☐	☐	☐	☐
34. Tools lowered/parking brake set when not in use, wheels chocked when parked on incline		☐	☐	☐	☐
EQUIPMENT OPERATION (3.2.3)					
35. Equipment operated on safe roadways and grades		☐	☐	☐	☐
36. Equipment operated at safe speed		☐	☐	☐	☐
37. Operators maintain unobstructed view of travel path		☐	☐	☐	☐
38. Equipment not operated during inclement weather, lightning storms		☐	☐	☐	☐
39. Equipment started and moved safely		☐	☐	☐	☐
40. Operators keep body parts inside cab during operation		☐	☐	☐	☐
41. Vehicle occupants in safe position while loading/unloading		☐	☐	☐	☐
42. Signal person visible to operator when required		☐	☐	☐	☐
43. Equipment used for hoisting done according to equipment manufacturer specifications		☐	☐	☐	☐
44. Lifting and hauling capacities are not exceeded		☐	☐	☐	☐
EQUIPMENT MAINTENANCE (3.2.4)					
45. Defective components repaired immediately		☐	☐	☐	☐
46. Suspended equipment or attachments supported prior to work under or between		☐	☐	☐	☐
47. Lockout/tagout procedures used prior to maintenance		☐	☐	☐	☐
48. Tires on split rims removed using safety tire rack or cage		☐	☐	☐	☐
49. Good housekeeping maintained on and around equipment		☐	☐	☐	☐
EXCAVATING AT HAZARDOUS WASTE SITES (3.2.5)					
50. Waste disposed of according to HSP/FSI		☐	☐	☐	☐
51. Appropriate decontamination procedures being followed, per HSP/FSI		☐	☐	☐	☐

SECTION 3

Complete this section for all items checked “No” in Sections 1 or 2. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: _______________________________ Project Manager: _________________________________

CH2MHILL

HS&E Self-Assessment Checklist—Non-Hazardous Waste Management

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where:
1) CH2M HILL employees are exposed to non-hazardous waste hazards and/or
2) CH2M HILL provides oversight of subcontractor personnel who are engaged in non-hazardous waste operations.

SC-HW or SC-C may consult with subcontractors when completing this checklist, but shall not direct the means and methods of asbestos operations nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Completed checklists shall be sent to the HS&E Staff for review.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposure to non-hazardous waste
☐ Evaluate a CH2M HILL subcontractor's compliance with the non-hazardous waste management standards and its requirements
Subcontractors Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HS-81.

SECTION 1

	Yes	No	N/A	N/O
SOURCE REDUCTION AND RECYCLING (6.1 and 6.2)				
1. Products have been re-used to reduce waste quantity and toxicity	☐	☐	☐	☐
2. Material volumes have been reduced by using less packaging	☐	☐	☐	☐
3. Less toxic products have been used to reduce waste toxicity	☐	☐	☐	☐
4. Materials at CH2M HILL offices are recycled	☐	☐	☐	☐
5. Recyclables generated at project sites are recycled	☐	☐	☐	☐

SECTION 2	Yes	No	N/A	N/O
STORAGE (6.3)				
6. Local or state solid waste storage requirements have been identified	☐	☐	☐	☐
7. Local and state solid waste stockpile requirements have been identified	☐	☐	☐	☐
8. Solid waste containers meet DOT specifications	☐	☐	☐	☐
9. Non-hazardous waste label used for containers of non-hazardous waste	☐	☐	☐	☐
DISPOSAL (6.4)				
Construction and Demolition Debris (6.4.1)				
10. Construction debris is disposed of at a landfill permitted to take C&D debris	☐	☐	☐	☐
11. Clean C&D debris is reused	☐	☐	☐	☐
12. C&D debris considered for recycling	☐	☐	☐	☐
13. C&D debris containing hazardous substance is managed under HSE-79	☐	☐	☐	☐
Lead-Contaminated Waste (6.4.2)				
14. Lead-based paint debris managed under HSE-78 and HSE-79	☐	☐	☐	☐
Petroleum-Contaminated Soil (6.4.3)				
15. ECC consulted for treatment, disposal and recycling options for petroleum-contaminated soil	☐	☐	☐	☐
Well Water Onsite Treatment and Discharge (6.4.4.1)				
16. Non-hazardous well purge/development water treated in existing NPDES-permitted system	☐	☐	☐	☐
17. Non-hazardous water is discharged to sewer untreated with POTW approval	☐	☐	☐	☐
18. Non-hazardous waste is discharged to onsite wastewater pretreatment system	☐	☐	☐	☐
19. Treatment of hazardous wastewater meets requirements of RCRA wastewater treatment unit	☐	☐	☐	☐
Discharge at Offsite POTW/FOTW (6.4.4.2)				
20. Discharged water is classified using "client" knowledge and/or testing	☐	☐	☐	☐
21. The water is not ignitable, does not contain organics or have an oily sheen	☐	☐	☐	☐
22. Client provided written notice to POTW that water meets acceptance limits	☐	☐	☐	☐
23. POTW discharge approval received in writing	☐	☐	☐	☐
24. POTW EPA ID number obtained for hazardous wastewater	☐	☐	☐	☐
25. Hazardous waste manifest used for transport of hazardous waste to POTW	☐	☐	☐	☐
26. Waste meets pre-treatment requirements	☐	☐	☐	☐
Discharge to Injection Galleries/Injection Wells (6.4.4.3)				
27. Permit or approval obtained for discharge to injection gallery or well	☐	☐	☐	☐
28. Purge water originated from wells at the site (same aquifer with same chemical properties)	☐	☐	☐	☐
29. The purge water is non-hazardous or exempt from hazardous waste regulations	☐	☐	☐	☐
30. Injection gallery at site is operating under state permit or approval from EPA	☐	☐	☐	☐
Discharge to Ground Surface (6.4.4.4)				
31. Discharged water is classified using "Client" knowledge and/or testing	☐	☐	☐	☐
32. Purge water is not a RCRA or state hazardous waste	☐	☐	☐	☐
33. Written approval received from the client	☐	☐	☐	☐
34. State permit or approval received for discharge	☐	☐	☐	☐
35. Carbon filtration used prior to discharge to the ground surface	☐	☐	☐	☐

SECTION 3

Complete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: ________________________________ Project Manager: ____________________________

CH2MHILL

HS&E Self-Assessment Checklist - HAZARDOUS WASTE MANAGEMENT

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: 1) CH2M HILL employees are potentially exposed to hazards associated with waste management operations (complete Sections 1 and 3), and/or 2) CH2M HILL oversight of a hazardous waste management subcontractor is required (complete entire checklist).

SSEC/DSEC may consult with hazardous waste management subcontractors when completing this checklist, but shall not direct the means and methods of hazardous waste management operations nor direct the details of corrective actions. Waste management subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Completed checklists shall be sent to the Health and Safety Manager for review.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposure to hazardous waste.
☐ Evaluate a CH2M HILL subcontractor's compliance with the hazardous waste management requirements.
Subcontractors Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HS-80.

SECTION 1

	Yes	No	N/A	N/O
PERMITS AND NOTIFICATIONS (7.0)				
1. Client site has an EPA ID Number or RCRA permit.	☐	☐	☐	☐
2. CH2M activities comply with client's RCRA permit.	☐	☐	☐	☐
ACCUMULATION (8.0)				
3. LQG — accumulates hazardous waste for up to 90 days.	☐	☐	☐	☐
4. SQG — accumulates hazardous waste for up to 180 days.	☐	☐	☐	☐
5. CESQGs — no limit on accumulation unless it exceeds 1,000kg.	☐	☐	☐	☐
CONTAINERS (8.1)				
6. Hazardous wastes are packaged according to DOT requirements.	☐	☐	☐	☐
7. Container inspections are documented in writing using the Container Inspection Checklist.	☐	☐	☐	☐

SECTION 2	Yes	No	N/A	N/O
MARKING AND LABELING (8.2)				
Uncharacterized Waste (8.2.1)				
8. Containers of unknown wastes are marked with a description of the contents.	☐	☐	☐	☐
9. The accumulation start date is marked on the container.	☐	☐	☐	☐
10. Containers are marked with a unique identifier.	☐	☐	☐	☐
11. Non-classified label used for unclassified waste.	☐	☐	☐	☐
Non-Hazardous Waste (8.2.2)				
12. All containers must be marked an labeled, including non-regulated waste.	☐	☐	☐	☐
13. Non-Hazardous Waste label includes generator name, address, and description of waste.	☐	☐	☐	☐
Hazardous Waste (8.2.3)				
14. Hazardous waste identified with yellow Hazardous Waste label.	☐	☐	☐	☐
15. The accumulation start date marked and visible on the container.	☐	☐	☐	☐
16. Containers labeled according to DOT requirements.	☐	☐	☐	☐
Building/Storage Area Marking (8.2.4)				
17. Hazardous waste storage areas labeled.	☐	☐	☐	☐
ACCUMULATION AREAS (8.3)				
Satellite Accumulation Area (8.3.1)				
18. Up to 55 gal. of hazardous waste or 1 qt. of acutely haz. waste accumulated for unlimited time.	☐	☐	☐	☐
19. Accumulation area at or near the point of generation.	☐	☐	☐	☐
20. Area under control of waste generator.	☐	☐	☐	☐
90-Day Accumulation Area (8.3.2)				
21. Hazardous waste >55 gal. stored for 90 days in managed accumulation area.	☐	☐	☐	☐
22. Accumulation area is used only for storage of waste.	☐	☐	☐	☐
23. Container requirements have been followed.	☐	☐	☐	☐
24. Emergency spill response procedures posted and spill kit available.	☐	☐	☐	☐
25. Fire extinguisher, water supply, telephone, and alarm are located in accumulation area.	☐	☐	☐	☐
26. Emergency shower/eyewash station available, tested and functioning.	☐	☐	☐	☐
27. Accumulation area is locked when authorized personnel are not available.	☐	☐	☐	☐
28. Appropriate signs posted at the entrance.	☐	☐	☐	☐
29. Secondary containment provided for liquid hazardous waste.	☐	☐	☐	☐
30. Weekly inspections logged into book using Accumulation Area Inspection Log Sheet.	☐	☐	☐	☐
31. "NO SMOKING OR OPEN FLAME" signs posted.	☐	☐	☐	☐
32. Prior to closure all containers, liners, or containment devices removed or decontaminated.	☐	☐	☐	☐
CONTINGENCY PLAN AND EMERGENCY PROCEDURES (9.0)				
33. Contingency plans and emergency procedures have been incorporated in work plans.	☐	☐	☐	☐
TRAINING (10.0)				
34. Personnel handling hazardous waste have appropriate training.	☐	☐	☐	☐

SECTION 3	Yes	No	N/A	N/O
OFFSITE DISPOSAL (11.0)				
35. Disposal facilities identified using the procedures in HSE-79.	☐	☐	☐	☐
36. Disposal facilities evaluated under Waste Subcontractor Qualification Procedure in HSE-84.	☐	☐	☐	☐
37. Waste characterization, sampling, and analysis procedures in HSE-79 followed.	☐	☐	☐	☐
Evaluate Land Disposal Restrictions (11.3)				
Identification of Treatment Standards (11.3.1)				
38. Waste characterized and waste codes determined.	☐	☐	☐	☐
39. LDR exemptions identified.	☐	☐	☐	☐
40. Alternate treatment standards evaluated.	☐	☐	☐	☐
41. Waste determined to be wastewater or non-wastewater.	☐	☐	☐	☐
42. Treatment standards identified.	☐	☐	☐	☐
43. Universal Treatment Standards (UTS) identified.	☐	☐	☐	☐
Confirm Final Disposal Options (11.4)				
44. Disposal facilities waste profile forms have been completed.	☐	☐	☐	☐
45. Client signatures have been obtained on waste profile forms.	☐	☐	☐	☐
46. Signed waste profile forms and enclosures have been submitted to the disposal facility.	☐	☐	☐	☐
OFFSITE TRANSPORT (12.0)				
47. Transporter has documented H&S and monitoring program and written spill response plan.	☐	☐	☐	☐
48. Transporter is permitted in the state and has disposal facilities listed on their permit.	☐	☐	☐	☐
49. Transporter can service origin and destination state and disposal facility.	☐	☐	☐	☐
50. Transporter can meet proposed shipment schedule.	☐	☐	☐	☐
51. Disposal facility accepted waste and issued approval letter.	☐	☐	☐	☐
Manifesting (12.1)				
52. Manifest and LDR notification/certification form completed.	☐	☐	☐	☐
53. Manifest includes reference no., shipping name, hazard class, ID no., and packaging group.	☐	☐	☐	☐
54. DOT trained staff completed manifest.	☐	☐	☐	☐
55. Manifest is for the state where the waste will be disposed.	☐	☐	☐	☐
56. Pre-shipment manifest review completed.	☐	☐	☐	☐
57. Original signed manifest returned to client within 35 days of ship date.	☐	☐	☐	☐
58. Waste shipments tracked using Waste Tracking Form.	☐	☐	☐	☐
Waste Pickup (12.2)				
59. Signed shipping papers have been delivered to project site.	☐	☐	☐	☐
60. Individual assigned to supervise pickup and ensure transporter signs manifest.	☐	☐	☐	☐
61. Onsite representative must not sign any shipping documents unless authorized under contract.	☐	☐	☐	☐
RECORDKEEPING AND REPORTING (13.0)				
Copies of Waste Profiles (13.1)				
62. Two copies of completed, signed profile forms(s) and documentation for CH and client files.	☐	☐	☐	☐
Copies of Shipping Documents (13.2)				
63. Keep copy of all manifests in project file.	☐	☐	☐	☐
64. Manifest copies distributed to agencies, client and project file.	☐	☐	☐	☐
Recordkeeping (13.2.1)				
Copies of the following documents should be maintained by the client and CH2M HILL for at least 3 years from the date the hazardous waste was accepted by the initial transporter.				
65. Manifests signed by the disposal facility.	☐	☐	☐	☐
66. LDR notification and certification forms (must be retained for 5 years)	☐	☐	☐	☐
67. Biennial reports	☐	☐	☐	☐
68. Exception reports	☐	☐	☐	☐
69. Hazardous waste characterization information.	☐	☐	☐	☐

SECTION 3

Complete this section for all items checked “No” in Sections 1 or 2. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

CH2MHILL

HSE Self-Assessment Checklist—Benzene

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI. This checklist is to be used at locations where CH2M HILL employees are exposed to benzene, or are required to perform oversight of a subcontractor whose personnel are exposed to benzene.

CH2M HILL staff shall not direct the means and methods of subcontractor benzene activities nor direct the details of appropriate corrective actions. The subcontractor must determine how to correct deficiencies and CH2M HILL staff must carefully rely on their expertise. Conditions considered to be imminently dangerous (possibility of serious injury or death) must be corrected immediately or all exposed personnel must be removed from the hazard until corrected.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate CH2M HILL compliance with its Benzene program (SOP HSE-503)
☐ Evaluate a CH2M HILL subcontractor's compliance with its Benzene program

Subcontractors Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

SECTION 1

	Yes	No	N/A	N/O
PERSONNEL SAFE WORK PRACTICES (5.1) **COMPLIANCE PROGRAM (5.1.1)**				
1. A written compliance program is established for work above the PEL.	☐	☐	☐	☐
2. The compliance program includes a schedule for development and implementation of the engineering and work practice controls.	☐	☐	☐	☐
3. The compliance program is based on the most recent air monitoring results.	☐	☐	☐	☐
4. The compliance program is available to all affected employees.	☐	☐	☐	☐

SECTION 2	Yes	No	N/A	N/O
EMPLOYEE INFORMATION (5.1.2)				
5. CH2M HILL personnel have completed the Benzene Training Module	☐	☐	☐	☐
6. Training on the Fact Sheet, HSP/FSI and OSHA standard has been met.	☐	☐	☐	☐
7. The selection of the appropriate respirator is based on the airborne benzene concentration	☐	☐	☐	☐
8. Written or verbal notification to owners, contractors or other personnel working in the area of benzene work activities	☐	☐	☐	☐
9. Storage or shipping containers have been properly labeled	☐	☐	☐	☐
REGULATED AREAS (5.1.3)				
10. Areas that exceed the PELs (TWA or STEL) have been designated as regulated areas	☐	☐	☐	☐
11. Personnel meet medical and training requirements	☐	☐	☐	☐
12. Warning signs have been posted at all entrances to the regulated areas	☐	☐	☐	☐
EXPOSURE ASSESSMENTS (5.2)				
13. Initial air monitoring (TWA & STEL) conducted over full shift for each job classification.	☐	☐	☐	☐
14. Air sampling conducted at least yearly when exposure limit (EL) ≥ AL but < PEL	☐	☐	☐	☐
15. Air sampling of employees conducted every six months when EL ≥ PEL.	☐	☐	☐	☐
16. Additional air monitoring has been collected when there are any changes in operation	☐	☐	☐	☐
17. Employees have been informed of air monitoring results within 15 days after receipt of results.	☐	☐	☐	☐
18. Where PELs is exceeded, affected employees have been notified of results and control measures to be utilized to reduce exposure below the PEL.	☐	☐	☐	☐
19. Personal sampling conducted after spills, leaks, ruptures, etc.	☐	☐	☐	☐
CONTROL METHODS (5.3) **ENGINEERING AND WORK PRACTICE CONTROLS (5.3.1)**				
20. Engineering controls and work practices have been utilized to reduce exposures below the PEL.	☐	☐	☐	☐
21. When controls are unable to reduce exposures below the PEL, respiratory protection is utilized.	☐	☐	☐	☐
22. Regulated areas have been established where exposures exceed the PEL or STEL.	☐	☐	☐	☐
RESPIRATORY PROTECTION (5.3.2)				
22. Respirators are used in areas where EL ≥ PELs (TWA or STEL).	☐	☐	☐	☐
23. Respirator cartridges are replaced based on change-out schedule.	☐	☐	☐	☐
PERSONAL PROTECTIVE EQUIPMENT (5.3.3)				
24 PPE is supplied by the employer to the employees	☐	☐	☐	☐
25. PPE is selected to protect against eye and dermal contact.	☐	☐	☐	☐

<u>SECTION 3</u>

Complete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: ________________________________ Project Manager: ___________________________

CH2MHILL

HS&E Self-Assessment Checklist: PPERSONAL PROTECTIVE EQUIPMENT

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where CH2M HILL employees are required to wear PPE or are required to perform oversight of a subcontractor using PPE or both.

CH2M HILL staff shall not direct the means and methods of subcontractor use of PPE nor direct the details of corrective actions. The subcontractor must determine how to correct deficiencies and CH2M HILL staff must carefully rely on their expertise. Conditions considered to be imminently dangerous (possibility of serious injury or death) must be corrected immediately or all exposed personnel must be removed from the hazard until corrected.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____Title:_____ Date: _____

This specific checklist has been completed to (check only one of the boxes below):

☐ Evaluate CH2M HILL compliance with its PPE program (SOP HSE-117)
☐ Evaluate a CH2M HILL subcontractor's compliance with its PPE program
Subcontractor's Name: _____

Check the appropriate box, as follows:

- Check "Yes" if an assessment item is complete or correct.
- Check "No" if an item is incomplete or deficient. Section 2 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HSE-121.

SECTION 1	**Yes**	**No**	**N/A**	**N/O**
GENERAL				
1. Required PPE listed in HSP FSI or AHA.	☐	☐	☐	☐
2. PPE available for use by employees.	☐	☐	☐	☐
3. PPE cleaning supplies available for use.	☐	☐	☐	☐
4. PPE stored appropriately to prevent deformation or distortion.	☐	☐	☐	☐
5. PPE written certification has been completed.	☐	☐	☐	☐
EYEWEAR (Glasses/Goggles/Face Shields)				
6 Eyewear cleaning supplies available.	☐	☐	☐	☐
7 Safety glasses in good condition and lenses free of scratches.	☐	☐	☐	☐
8 Goggles adjustment strap not cracked or frayed, not deformed, or lenses not scratched.	☐	☐	☐	☐
9. Face shields in good condition, including adjustment band, and free of scratches or chips.	☐	☐	☐	☐

SECTION 1 (Continued)	Yes	No	N/A	N/O
HEAD PROTECTION				
10. Hard hat bill and suspension attached as allowed by manufacturer.	☐	☐	☐	☐
11. Shell is pliable, free of dents, cracks, nicks, or any damage due to impact.	☐	☐	☐	☐
12. Suspension maintained at 1.25 inches from inside of shell.	☐	☐	☐	☐
13. Suspension free of cuts or fraying, torn headband, adjustment strap workable.	☐	☐	☐	☐
14. Electrical hard hat matched to hazard classification.	☐	☐	☐	☐
15. Dated to determine whether within manufacturer's allowable 5-year use time period.	☐	☐	☐	☐
HAND PROTECTION				
16. Available in sizes matched to employee.	☐	☐	☐	☐
17. Gloves free of rips tears, abrasions, or holes.	☐	☐	☐	☐
18. Matched to manufacturer's specification for chemicals used onsite.	☐	☐	☐	☐
19. Electrical gloves matched to hazard and periodically inspected for insulating rating.	☐	☐	☐	☐
20. Maintained in a clean and sanitary condition, decontaminated or disposed properly.	☐	☐	☐	☐
BODY PROTECTION				
21. Available in sizes matched to employee.	☐	☐	☐	☐
22. Maintained in a clean and sanitary condition, decontaminated or disposed properly.	☐	☐	☐	☐
23. Vapor-tight fully encapsulated suits tested at required periodic intervals.	☐	☐	☐	☐
24. Flame-resistant clothing matched to electrical hazard and arc flash rating.	☐	☐	☐	☐
25 Welding gear matched to degree of hazard and free of cuts, tears or burn holes.	☐	☐	☐	☐
26 Flotation gear available for work near or on water and in good condition.	☐	☐	☐	☐
HOT AND COLD BODY PROTECTION				
27 Cooling gear available based on degree of heat stress hazard.	☐	☐	☐	☐
28 Cooling gear in operable, clean, and sanitary condition.	☐	☐	☐	☐
29 Cold-weather gear provided based on needs assessment.	☐	☐	☐	☐
30. Cold-weather gear available in sizes to match employees.	☐	☐	☐	☐
31 Cold-weather gear is in free of tears, rips, or holes and in maintained in a clean condition.	☐	☐	☐	☐
TRAINING				
32 Initial PPE training completed by employees.	☐	☐	☐	☐
33 Training conducted when new types or styles of PPE are issued.	☐	☐	☐	☐
34 PPE selection, use, and maintenance reviewed at daily safety briefings.	☐	☐	☐	☐

SECTION 2

Complete this section for all items checked “No” in Section 1. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned or Taken	Date Corrected

Auditor: ________________________________ Project Manager: ___________________________________

CH2MHILL

HSE Self-Assessment Checklist—Arsenic

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI. This checklist is to be used at locations where CH2M HILL employees are exposed to arsenic, or are required to perform oversight of a subcontractor whose personnel are exposed to arsenic.

CH2M HILL staff shall not direct the means and methods of subcontractor arsenic activities nor direct the details of appropriate corrective actions. The subcontractor must determine how to correct deficiencies and CH2M HILL staff must carefully rely on their expertise. Conditions considered to be imminently dangerous (possibility of serious injury or death) must be corrected immediately or all exposed personnel must be removed from the hazard until corrected.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate CH2M HILL compliance with its Arsenic program (SOP HSE-501)
☐ Evaluate a CH2M HILL subcontractor's compliance with its Arsenic program
Subcontractors Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

SECTION 1

	Yes	No	N/A	N/O
PERSONNEL SAFE WORK PRACTICES (5.1)				
COMPLIANCE PROGRAM (5.1.1)				
1. Where EL ≥ PEL, a written compliance program is implemented before commencing work	☐	☐	☐	☐
2. The compliance program is based on the most recent air monitoring/sampling results.	☐	☐	☐	☐
3. The compliance program is updated for new exposure monitoring data or every six months.	☐	☐	☐	☐
4. Written compliance program is available to all affected employees.	☐	☐	☐	☐
5. Waste generated must be determined if considered hazardous waste.	☐	☐	☐	☐
EMPLOYEE INFORMATION (5.1.2)				
6. Training on the Hazard Communication Standard has been met.	☐	☐	☐	☐
7. CH2M HILL personnel have completed the Arsenic Training Module.	☐	☐	☐	☐
8. Training on the Fact Sheet, HSP/FSI, and OSHA standard has been met.	☐	☐	☐	☐

HS&E Self-Assessment Checklist—Arsenic

	Yes	No	N/A	N/O
9. The selection of the appropriate respirator is based on the airborne arsenic concentration.	☐	☐	☐	☐
10. Personnel working near arsenic-contaminated soil or material shall use wet methods and work practices to control dust; wear disposable coveralls, and exercise personal hygiene practices.	☐	☐	☐	☐
11. Contact lenses are not to be worn when working with arsenic.	☐	☐	☐	☐
12. Written or verbal notification is given to owners, contractors, or other personnel working in the area of arsenic work activities.	☐	☐	☐	☐
13. Storage or shipping containers are properly labeled.	☐	☐	☐	☐
HOUSEKEEPING (5.1.3)				
14. All surfaces are free of accumulation of arsenic.	☐	☐	☐	☐
15. Cleaning methods minimize airborne arsenic activity.	☐	☐	☐	☐
16. Where vacuuming is used, vacuums are used and emptied to minimize airborne arsenic.	☐	☐	☐	☐
17. A written housekeeping and maintenance plan is in place and maintained.	☐	☐	☐	☐
18. Compressed air is not used to remove arsenic from surfaces.	☐	☐	☐	☐
REGULATED AREAS (5.1.4)				
19. Areas that exceed the PEL have been designated as regulated areas.	☐	☐	☐	☐
20. Personnel meet medical and training requirements.	☐	☐	☐	☐
21 No eating, drinking, and/or smoking is allowed in the regulated areas.	☐	☐	☐	☐
22 Warning signs have been posted at all entrances to the regulated areas.	☐	☐	☐	☐
23. Shower facilities are installed and used with cleaning agents and towels, where feasible.	☐	☐	☐	☐
24. Hand washing facilities are provided for use by employees before eating, drinking, smoking, etc.	☐	☐	☐	☐
25. Eating facilities free of arsenic are provided for employees working in regulated areas.	☐	☐	☐	☐
26. Change areas are provided where EL ≥ PEL or where employees are subject to eye/skin irritation	☐	☐	☐	☐
EXPOSURE ASSESSMENTS (5.2)				
27. Initial air monitoring is conducted over full shift for each job classification.	☐	☐	☐	☐
28. Air sampling is conducted every 6 months when exposure limit (EL) ≥ AL but < PEL.	☐	☐	☐	☐
29. Air sampling of employees is conducted quarterly when EL ≥ PEL.	☐	☐	☐	☐
30. Additional air monitoring has been collected when there are any changes in operation.	☐	☐	☐	☐
31. Employees have been informed of air monitoring results within 5 days after receipt of results.	☐	☐	☐	☐
32. Where PEL is exceeded, affected employees have been notified of results and control measures to be used to reduce exposure below the PEL.	☐	☐	☐	☐
CONTROL METHODS (5.3) - ENGINEERING AND WORK PRACTICE CONTROLS (5.3.1)				
33. Engineering controls and work practices have been used to reduce exposures below the PEL.	☐	☐	☐	☐
34. When controls are unable to reduce exposures below the PEL, respiratory protection is used.	☐	☐	☐	☐
35. Employees do not eat, drink, smoke, chew tobacco/gum, or apply cosmetics in regulated areas.	☐	☐	☐	☐
RESPIRATORY PROTECTION (5.3.2)				
36. Respirators are used in areas where EL ≥ PEL.	☐	☐	☐	☐
37. Respirator cartridges are replaced at the end of shift or service life indicator, where available.	☐	☐	☐	☐
38. PAPRs are provided to employees who request such a respirator.	☐	☐	☐	☐
PERSONAL PROTECTIVE EQUIPMENT (5.3.3)				
39. PPE is supplied at no cost to employees.	☐	☐	☐	☐
40. Employee exposed to arsenic tri-chloride wear impervious clothing.	☐	☐	☐	☐
41 Clean and dry protective clothing is provided weekly. Daily if EL ≥ 100 $\mu g/m^3$.	☐	☐	☐	☐
42. Protective clothing is repaired or replaced if found to be ineffective.	☐	☐	☐	☐
43. Contaminated protective clothing is removed from change areas at the end of the shift.	☐	☐	☐	☐
44. All clothing requiring laundering is packaged in sealed, labeled containers.	☐	☐	☐	☐
45. Personnel or vendors who launder contaminated clothing are formally informed of the hazards.	☐	☐	☐	☐
46. Employee are not allowed to leave workplace wearing clothing worn during work shift.	☐	☐	☐	☐

SECTION 3

Complete this section for all items checked "No" in Section 1. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: ________________________________ Project Manager: ____________________________

Attachment 6
Safe Work Observation Form

Safe Behavior Observation Form

☐Commercial Sector ☐ OMBG	☐Construction ☐Consulting ☐ OM&M

Project Number:	Client/Program: Honeywell	
Project Name:	Observer:	Date:
Position/Title of worker observed:	Background Information/ comments:	
Task/Observation Observed:		

- Identify and reinforce safe work practices/behaviors
- Identify and improve on at-risk practices/acts
- Identify and improve on practices, conditions, controls, and compliance that eliminate or reduce hazards
- Proactive PM support facilitates eliminating/reducing hazards (do you have what you need?)
- Positive, corrective, cooperative, collaborative feedback/recommendations

Actions & Behaviors	Safe	At-Risk	Observations/Comments
Current & accurate Pre-Task Planning/Briefing (Project safety plan, STAC, AHA, PTSP, tailgate briefing, etc., as needed)			**Positive Observations/Safe Work Practices:**
Properly trained/qualified/experienced			
Tools/equipment available and adequate			
Proper use of tools			**Questionable Activity/Unsafe Condition Observed:**
Barricades/work zone control			
Housekeeping			
Communication			
Work Approach/Habits			
Attitude			
Focus/attentiveness			**Observer's Corrective Actions/Comments:**
Pace			
Uncomfortable/unsafe position			
Inconvenient/unsafe location			
Position/Line of fire			
Apparel (hair, loose clothing, jewelry)			
Repetitive motion			**Observed Worker's Corrective Actions/Comments:**
Other…			

Please email completed SBOs for Honeywell program project sites to the following email addresses:
ES Commercial Sector projects: CH2M HILL ES COM Safe Behavior Observation
Honeywell HS Program Manager: mailto:wberlett@ch2m.com?subject=SBO

Attachment 7
Project-Specific Chemical Product Hazard Communication Form

CH2MHILL

Project-Specific Chemical Product Hazard Communication Form

This form must be completed prior to performing activities that expose personnel to hazardous chemicals products. Upon completion of this form, the SSC shall verify that training is provided on the hazards associated with these chemicals and the control measures to be used to prevent exposure to CH2M HILL and subcontractor personnel. Labeling and MSDS systems will also be explained. **The SC will modify (add-delete) this form as site conditions warrant.**

Project Name: Quanta Resources-OU1 Work Activities **Project Number:** Various

MSDSs will be maintained at the following location(s): TBD by SC

Hazardous Chemical Products Inventory

Chemical	Quantity	Location	MSDS Available	Container labels	
				Identity	Hazard
Methane	1 liter, compressed	Support Zone			
Isobutylene	1 liter, compressed	Support Zone			
Pentane	1 liter, compressed	Support Zone			
Hydrochloric acid	< 500 ml	Support Zone / sample bottles			
Nitric acid	< 500 ml	Support Zone / sample bottles			
Sulfuric Acid	< 500 ml	Support Zone / sample bottles			
Sodium hydroxide	< 500 ml	Support Zone / sample bottles			
Methanol	< 1 Gallon	Support/Decon Zones			
Hexane	< 1 Gallon	Support/Decon Zones			
pH buffers	< 500 ml	Support Zone			
MSA Sanitizer	< 1 liter	Support/Decon Zones			
Alconox/Liquinox	< 1liter	Support/Decon Zones			

Refer to SOP HS-05 *Hazard Communication* for more detailed information.

Attachment 8
Applicable Material Safety Data Sheets

ALCONOX

ALCONOX®

1. Product Identification

Synonyms: Proprietary blend of sodium linear alkylaryl sulfonate, alcohol sulfate, phosphates, and carbonates.
CAS No.: Not applicable.
Molecular Weight: Not applicable to mixtures.
Chemical Formula: Not applicable to mixtures.
Product Codes: A461

2. Composition/Information on Ingredients

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  Ingredient                                  CAS No         Percent
  Hazardous
  ----------------------------------------   ------------   ------------
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  Alconox®                                    N/A              90 - 100%
  Yes
  proprietary detergent mixture
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3. Hazards Identification

Emergency Overview

CAUTION! MAY BE HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 1 - Slight
Flammability Rating: 0 - None
Reactivity Rating: 1 - Slight
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES; LAB COAT
Storage Color Code: Orange (General Storage)

Potential Health Effects

Inhalation:
May cause irritation to the respiratory tract. Symptoms may include coughing and shortness of breath.
Ingestion:
May cause irritation to the gastrointestinal tract. Symptoms may include nausea, vomiting and diarrhea.
Skin Contact:
No adverse effects expected.
Eye Contact:
May cause irritation, redness and pain.
Chronic Exposure:
No information found.
Aggravation of Pre-existing Conditions:
No information found.

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4. First Aid Measures

Inhalation:
Remove to fresh air. Get medical attention for any breathing difficulty.
Ingestion:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention.
Skin Contact:
Wash exposed area with soap and water. Get medical advice if irritation develops.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

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5. Fire Fighting Measures

Fire:
Not expected to be a fire hazard.
Explosion:
No information found.
Fire Extinguishing Media:

Dry chemical, foam, water or carbon dioxide.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

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6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust. When mixed with water, material foams profusely. Small amounts of residue may be flushed to sewer with plenty of water.

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7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Moisture may cause material to cake. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

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8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
- OSHA Permissible Exposure Limit (PEL):
15 mg/m3 total dust, 5 mg/m3 respirable fraction for nuisance dusts.
- ACGIH Threshold Limit Value (TLV):
10 mg/m3 total dust containing no asbestos and < 1% crystalline silica for Particulates Not Otherwise Classified (PNOC).
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, a half-face dust/mist respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the

appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece dust/mist respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear protective gloves and clean body-covering clothing.

Eye Protection:

Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

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9. Physical and Chemical Properties

Appearance:

White powder interspersed with cream colored flakes.

Odor:

No information found.

Solubility:

Moderate (1-10%)

Specific Gravity:

No information found.

pH:

No information found.

% Volatiles by volume @ 21C (70F):

0

Boiling Point:

No information found.

Melting Point:

No information found.

Vapor Density (Air=1):

No information found.

Vapor Pressure (mm Hg):

No information found.

Evaporation Rate (BuAc=1):

No information found.

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10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

Carbon dioxide and carbon monoxide may form when heated to decomposition.

Hazardous Polymerization:

Will not occur.
Incompatibilities:
No information found.
Conditions to Avoid:
No information found.

11. Toxicological Information

No LD50/LC50 information found relating to normal routes of occupational exposure.

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  --------\Cancer Lists\-------------------------------------------------
----
                                          ---NTP Carcinogen---
  Ingredient                              Known    Anticipated    IARC
Category
  -------------------------------------   -----    -----------    ---------
----
  Alconox®                                 No          No            None
  proprietary detergent mixture
```

12. Ecological Information

Environmental Fate:
This product is biodegradable.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

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  --------\Chemical Inventory Status - Part 1\----------------------------
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  Ingredient                                          TSCA  EC   Japan
Australia
  ----------------------------------------------  ----  ---  -----  -----
----
  Alconox®                                          Yes  No    No       No
  proprietary detergent mixture

  --------\Chemical Inventory Status - Part 2\----------------------------
-----
                                                              --Canada--
  Ingredient                                          Korea  DSL   NDSL
Phil.
  ----------------------------------------------  -----  ---   ----  ----
-
  Alconox®                                           No    No    Yes    No
  proprietary detergent mixture

  --------\Federal, State & International Regulations - Part 1\-----------
-----
                                              -SARA 302-    ------SARA 313-
-----
  Ingredient                                  RQ    TPQ     List  Chemical
Catg.
  ----------------------------------------  ---   -----   ----  ---------
-----
  Alconox®                                    No    No      No         No
  proprietary detergent mixture

  --------\Federal, State & International Regulations - Part 2\-----------
-----
                                                            -RCRA-    -TSCA-
  Ingredient                                  CERCLA     261.33     8(d)
  ----------------------------------------  ------     ------    ------
  Alconox®                                    No         No         No
  proprietary detergent mixture


Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: Yes      Chronic: No   Fire: No  Pressure: No
Reactivity: No          (Pure / Solid)
```

16. Other Information

NFPA Ratings: Health: **0** Flammability: **0** Reactivity: **0**

Label Hazard Warning:

CAUTION! MAY BE HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT.

Label Precautions:

Avoid contact with eyes.
Keep container closed.
Use with adequate ventilation.
Avoid breathing dust.
Wash thoroughly after handling.

Label First Aid:

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of eye contact, immediately flush eyes with plenty of water for at least 15 minutes. In all cases, get medical attention.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 16.

Disclaimer:

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

NITRIC ACID

SPEX INDUSTRIES INC -- NITRIC ACID BLANK, PLBLK-HN03 -- 6850-00N020537

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MSDS Safety Information

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FSC: 6850
MSDS Date: 03/04/1988
MSDS Num: BLRMY
LIIN: 00N020537
Tech Review: 08/02/1995
Product ID: NITRIC ACID BLANK, PLBLK-HN03
Responsible Party
Cage: 07977
Name: SPEX INDUSTRIES INC
Address: 3880 PARK AVENUE
City: EDISON NJ 08820 US
Info Phone Number: 201-549-7144
Emergency Phone Number: 201-549-7144
Preparer's Name: LINDA OLCHVARY
Review Ind: N

==========

Contractor Summary

==========

Cage: 07977
Name: SPEX CERTIPREP INC
Address: 203 NORCROSS AVE
City: METUCHEN NJ 08840 US
Phone: 732-549-7144

==========

Ingredients

==========

Cas: 7697-37-2
RTECS #: QU5775000
Name: NITRIC ACID (SARA III)
% by Wt: 5
OSHA PEL: 2 PPM/4 STEL
ACGIH TLV: 2 PPM/4 STEL; 9192
EPA Rpt Qty: 1000 LBS
DOT Rpt Qty: 1000 LBS
Ozone Depleting Chemical: N

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Health Hazards Data

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LD50 LC50 Mixture: LC50:(INHALE/RAT) 224 PPM(NO2)/30M
Route Of Entry Inds - Inhalation: YES
Skin: YES
Ingestion: YES
Carcinogenicity Inds - NTP: NO
IARC: NO
OSHA: NO
Effects of Exposure: CONC NITRIC ACID MAY BE FATAL IF TOO MUCH IS INHALED/ABSORBED THRU SKIN.CONC NITRIC ACID VAP/MIST IS IRRITANT OF EYES, MUC MEMB & SKIN.IN CONT W/EYES, PRODUCES SEVERE BURNS WHICH MAY RESULT IN PERMANE NT DMG & VISUAL IMPAIRMENT.ON SKIN, LIQ/CONC VAP PRODUCES IMMED, SEVERE & PENETRATING BURNS; CONC (SEE EFTS OF OVEREXP)
Explanation Of Carcinogenicity: NOT RELEVANT
Signs And Symptions Of Overexposure: HLTH HAZ:SOLN CAUSES DEEP ULCERS & STAINS SKIN BRIGHT YELLOW/YELLOWISH BROWN COLOR.VAP & MIST MAY ERODE

EXPSD TEETH W/PRLNGD EXPOS.INGEST OF LIQ WILL CAUSE IMMED PAIN & BURNS OF MOUTH, ESOPHAGUS & GI TRACT.INHAL MAY BE FATAL CAUSING SPASM,INFLAM & EDEMA OF LARYNX & BRONCHI, CHEM PNEUM & PULM EDEMA. SYMP (SUPP DATA)
Medical Cond Aggravated By Exposure: NONE SPECIFIED BY MANUFACTURER.
First Aid: EYES: FLUSH WITH WATER FOR AT LEAST 15 MINUTES OCCASIONALLY LIFTING UPPER AND LOWER EYELIDS. SKIN: REMOVE CONTAMINATED CLOTHING, THEN FLUSH WITH WATER FOR AT LEAST 15 MINUTES. WASH CLOTHING THOROUGHLY BEFORE REUSE. INHAL: MOVE TO FRESH AIR. IF IRRITATION CONTINUES, CALL MD IMMEDIATELY. INGEST: CALL MD IMMEDIATELY (FP N).

Handling and Disposal

Spill Release Procedures: VENT AREA. DILUTE SPILL W/WATER & NEUT W/ SODA ASH, LIMESTONE, ETC. WIPE UP & PUT IN A SEALED CNTNR FOR PROPER DISP. WASH SPILL SITE OFF W/WATER AFTER MATL PICK UP IS COMPLETE. WEAR CHEM RESISTANT GLA SSES, GLOVES & CLTHG. WEAR NIOSH/MSHA APPRVD RESP.
Neutralizing Agent: SEE SPILL/RELEASE PROCEDURES.
Waste Disposal Methods: CONTACT LOCAL HAZARDOUS OR CHEMICAL WASTE DISPOSAL AGENCY FOR REGULATIONS. DISPOSAL MUST BE IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS (FP N).
Handling And Storage Precautions: CONCENTRATED NITRIC ACID WILL ATTACK SOME FORMS OF PLASTICS, RUBBER AND COATINGS. STORE AT ROOM TEMPERATURE. KEEP TIGHTLY SEALED WHEN NOT IN USE.
Other Precautions: HAVE IMMEDIATE AVAILABILITY OF AN EYE WASH IN CASE OF EMERGENCY. AVOID INHALATION, INGESTION AND CONTACT WITH EYES AND SKIN.

Fire and Explosion Hazard Information

Flash Point Text: NOT COMBUSTIBLE
Extinguishing Media: APPROPRIATE TO SURROUNDING FIRE CONDITIONS.
Fire Fighting Procedures: WEAR NIOSH/MSHA APPRVD SCBA & FULL PROT EQUIP (FP N). CONC HNO3 REACTS EXPLO W/COMBUST ORG/READILY OXIDIZABLE MATLS SUCH AS; ALCOHOL, WOOD, (SEE SUPP DATA)
Unusual Fire/Explosion Hazard: CONC HNO3 IS NOT COMBUST, BUT IS STRONG OXIDIZER & ITS HEAT OF RXN W/REDUCING AGENTS/COMBUST MAY CAUSE IGNIT. CAN REACT W/METALS TO RELEASE FLAM HYDROGEN GAS.

Control Measures

Respiratory Protection: NIOSH/MSHA APPROVED RESPIRATOR.
Ventilation: USE IN A CHEMICAL FUME HOOD.
Protective Gloves: CHEMICAL RESISTANT GLOVES.
Eye Protection: CHEM WORK GOGG/FULL LENGTH FACESHLD(FPN)
Other Protective Equipment: CHEMICAL RESISTANT CLOTHING. EYE WASH IN CASE OF EMERGENCY AND A LAB COAT. DELUGE SHOWER (FP N).
Work Hygienic Practices: WASH CAREFULLY AFTER USE.
Supplemental Safety and Health: FIRE FIGHT PROC:TURPENTINE/METAL POWDERS/ HYDROGEN SULFIDE/ETC. MATLS TO AVOID: ALCOHOL/WOOD/TURPENTINE, METAL POWDERS/HYDROGEN SULFIDE/ETC. CONT W/STRONG BASES WILL CAUSE VIOLENT SPLATTERING.EFTS OF OVEREXP:INCL BURNING SENSATION, COUGH, WHEEZING, LARYNGITIS, SHORTNESS OF BREATH, HDCH, NAUS & VOMIT.

Physical/Chemical Properties

HCC: C1
Spec Gravity: APPROXIMATELY 1
Solubility in Water: SOLUBLE

Appearance and Odor: TRANSPARENT WITH AN ACRID ODOR.
==========
Reactivity Data
==========
Stability Indicator: YES
Stability Condition To Avoid: ELEVATED TEMPERATURES MAY CAUSE CONTAINERS TO BURST AND LIBERATE TOXIC NOX.
Materials To Avoid: CONC HNO3 IS A POWERFUL OXIDIZING AGENT. IT REACTS EXPLO W/COMBUST ORG/READILY OXIDIZABLE MATLS SUCH AS; (SUPP DATA)
Hazardous Decomposition Products: WILL RELEASE TOXIC NITROGEN OXIDE FUMES AND VAPORS.
Hazardous Polymerization Indicator: NO
Conditions To Avoid Polymerization: NOT RELEVANT
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Toxicological Information
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Ecological Information
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MSDS Transport Information
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Regulatory Information
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Other Information
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Transportation Information
==========
Responsible Party Cage: 07977
Trans ID NO: 25204
Product ID: NITRIC ACID BLANK, PLBLK-HN03
MSDS Prepared Date: 03/04/1988
Review Date: 01/17/1992
Article W/O MSDS: N
Multiple KIT Number: 0
Unit Of Issue: NK
Container QTY: NK
==========
Detail DOT Information
==========
DOT PSN Code: KFD
DOT Proper Shipping Name: NITRIC ACID
DOT PSN Modifier: OTHER THAN RED FUMING, WITH NOT MORE THAN 70 PERCENT NITRIC ACID
Hazard Class: 8
UN ID Num: UN2031
DOT Packaging Group: II
Label: CORROSIVE
Special Provision: B2,B47,B53,T9,T27
Non Bulk Pack: 158
Bulk Pack: 242
Max Qty Pass: FORBIDDEN
Max Qty Cargo: 30 L
Vessel Stow Req: D

Water/Ship/Other Req: 44,66,89,90,110,111
==========
Detail IMO Information
==========
IMO PSN Code: KPF
IMO Proper Shipping Name: NITRIC ACID
IMO PSN Modifier: ,OTHER THAN RED FUMING,ALL CONCENTRATIONS
IMDG Page Number: 8195
UN Number: 2031
UN Hazard Class: 8
IMO Packaging Group: I/II
Subsidiary Risk Label: -
EMS Number: 8-03
MED First Aid Guide NUM: 610
==========
Detail IATA Information
==========
IATA PSN Code: RWI
IATA UN ID Num: 2031
IATA Proper Shipping Name: NITRIC ACID
IATA PSN Modifier: ,OTHER THAN RED FUMING, WITH 20% OR LESS NITRIC ACID
IATA UN Class: 8
IATA Label: CORROSIVE
UN Packing Group: II
Packing Note Passenger: 807
Max Quant Pass: 1L
Max Quant Cargo: 30L
Packaging Note Cargo: 813
==========
Detail AFI Information
==========
AFI PSN Code: RWI
AFI Symbols: T
AFI Proper Shipping Name: NITRIC ACID
AFI PSN Modifier: ,OTHER THAN RED FUMING, WITH LESS THAN 20% NITRIC ACID
AFI Hazard Class: 8
AFI UN ID NUM: UN2031
AFI Packing Group: II
AFI Label: CORROSIVE
Back Pack Reference: A12.11
==========
HAZCOM Label
==========
Product ID: NITRIC ACID BLANK, PLBLK-HN03
Cage: 07977
Company Name: SPEX CERTIPREP INC
Street: 203 NORCROSS AVE
City: METUCHEN NJ
Zipcode: 08840 US
Health Emergency Phone: 201-549-7144
Date Of Label Review: 10/18/1991
Label Date: 10/18/1991
Chronic Hazard IND: N
Eye Protection IND: YES
Skin Protection IND: YES
Signal Word: DANGER
Respiratory Protection IND: YES

Health Hazard: Moderate
Contact Hazard: Severe
Fire Hazard: None
Reactivity Hazard: None
Hazard And Precautions: ACUTE: CORROSIVE & FATAL IF TOO MUCH IS INHALED/ABSORBED THRU SKIN. CAUSES SEVERE EYE BURNS WHICH MAY RESULT IN PERMANENT DMG & VISUAL IMPAIRMENT. CAUSES SKIN BURNS, DEEP ULCERS & YELLOW/YELLOWISH BRO WN STAINS ON SKIN. SWALLOWING LIQ WILL CAUSE IMMEDIATE PAIN & BURNS OF MOUTH, ESOPHAGUS & GI TRACT. INHAL MAY BE FATAL CAUSING SPASM, INFLAM & EDEMA OF LARYNX & BRONCHI, CHEM PNEUMONIA & PULM EDEMA. A VOID INHAL, INGEST & EYE/SKIN CONTACT. CHRONIC EFTS: VAPOR & MIST MAY ERODE EXPOSED TEETH WITH PROLONGED EXPOSURE.

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METHANOL

MSDS Number: **M2015** * * * * * *Effective Date:* ***11/12/01*** * * * * * *Supercedes:* ***12/14/00***

METHYL ALCOHOL

1. Product Identification

Synonyms: Wood alcohol; methanol; carbinol
CAS No.: 67-56-1
Molecular Weight: 32.04
Chemical Formula: CH3OH
Product Codes:
J.T. Baker: 5217, 5370, 5794, 5807, 5811, 5842, 5869, 9049, 9063, 9065, 9066, 9067, 9069, 9070, 9071, 9073, 9075, 9076, 9077, 9091, 9093, 9096, 9097, 9098, 9263, 9822, 9893, V654
Mallinckrodt: 3004, 3006, 3016, 3017, 3018, 3024, 3041, 3701, 4295, 5160, 8814, H080, H488, H603, H985, V079, V571

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Methyl Alcohol	67-56-1	100%	Yes

3. Hazards Identification

Emergency Overview

POISON! DANGER! VAPOR HARMFUL. MAY BE FATAL OR CAUSE BLINDNESS IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. CANNOT BE MADE NONPOISONOUS. FLAMMABLE LIQUID AND VAPOR. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM AND LIVER.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)
Flammability Rating: 3 - Severe (Flammable)
Reactivity Rating: 1 - Slight
Contact Rating: 3 - Severe (Life)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:
A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Once absorbed into the body, it is very slowly eliminated. Symptoms of overexposure may include headache, drowsiness, nausea, vomiting, blurred vision, blindness, coma, and death. A person may get better but then worse again up to 30 hours later.
Ingestion:
Toxic. Symptoms parallel inhalation. Can intoxicate and cause blindness. Usual fatal dose: 100-125 milliliters.
Skin Contact:
Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure.
Eye Contact:
Irritant. Continued exposure may cause eye lesions.
Chronic Exposure:
Marked impairment of vision has been reported. Repeated or prolonged exposure may cause skin irritation.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired liver or kidney function may be more susceptible to the effects of the substance.

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4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes while removing

contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

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5. Fire Fighting Measures

Fire:

Flash point: 12C (54F) CC
Autoignition temperature: 464C (867F)
Flammable limits in air % by volume:
lel: 6.0; uel: 36
Flammable Liquid and Vapor!

Explosion:

Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Moderate explosion hazard and dangerous fire hazard when exposed to heat, sparks or flames. Sensitive to static discharge.

Fire Extinguishing Media:

Use alcohol foam, dry chemical or carbon dioxide. (Water may be ineffective.)

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Use water spray to blanket fire, cool fire exposed containers, and to flush non-ignited spills or vapors away from fire. Vapors can flow along surfaces to distant ignition source and flash back.

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6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand,

earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

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7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product. Do Not attempt to clean empty containers since residue is difficult to remove. Do not pressurize, cut, weld, braze, solder, drill, grind or expose such containers to heat, sparks, flame, static electricity or other sources of ignition: they may explode and cause injury or death.

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8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
For Methyl Alcohol:
- OSHA Permissible Exposure Limit (PEL):
200 ppm (TWA)
- ACGIH Threshold Limit Value (TLV):
200 ppm (TWA), 250 ppm (STEL) skin

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details. Use explosion-proof equipment.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134). This substance has poor warning properties.

Skin Protection:
Rubber or neoprene gloves and additional protection including impervious boots,

apron, or coveralls, as needed in areas of unusual exposure.
Eye Protection:
Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

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9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Characteristic odor.
Solubility:
Miscible in water.
Specific Gravity:
0.8
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
64.5C (147F)
Melting Point:
-98C (-144F)
Vapor Density (Air=1):
1.1
Vapor Pressure (mm Hg):
97 @ 20C (68F)
Evaporation Rate (BuAc=1):
5.9

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10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
May form carbon dioxide, carbon monoxide, and formaldehyde when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong oxidizing agents such as nitrates, perchlorates or sulfuric acid. Will attack some forms of plastics, rubber, and coatings. May react with metallic aluminum and generate hydrogen gas.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

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11. Toxicological Information

Methyl Alcohol (Methanol) Oral rat LD50: 5628 mg/kg; inhalation rat LC50: 64000 ppm/4H; skin rabbit LD50: 15800 mg/kg; Irritation data-standard Draize test: skin, rabbit: 20mg/24 hr. Moderate; eye, rabbit: 100 mg/24 hr. Moderate. Investigated as a mutagen, reproductive effector.

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  --------\Cancer Lists\-------------------------------------------------
----
                                          ---NTP Carcinogen---
  Ingredient                              Known    Anticipated    IARC
Category
  ------------------------------------   -----    -----------    ---------
----
  Methyl Alcohol (67-56-1)                 No          No            None
```

12. Ecological Information

Environmental Fate:
When released into the soil, this material is expected to readily biodegrade. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into the water, this material is expected to have a half-life between 1 and 10 days. When released into water, this material is expected to readily biodegrade. When released into the air, this material is expected to exist in the aerosol phase with a short half-life. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into air, this material is expected to have a half-life between 10 and 30 days. When released into the air, this material is expected to be readily removed from the atmosphere by wet deposition.
Environmental Toxicity:
This material is expected to be slightly toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: METHANOL
Hazard Class: 3
UN/NA: UN1230
Packing Group: II
Information reported for product/size: 350LB

International (Water, I.M.O.)

Proper Shipping Name: METHANOL
Hazard Class: 3, 6.1
UN/NA: UN1230
Packing Group: II
Information reported for product/size: 350LB

15. Regulatory Information

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--------\Chemical Inventory Status - Part 1\---------------------------------
Ingredient                                        TSCA  EC   Japan  Australia
----------------------------------------------  ----  ---  -----  ---------
Methyl Alcohol (67-56-1)                          Yes  Yes   Yes      Yes

--------\Chemical Inventory Status - Part 2\---------------------------------
                                                         --Canada--
Ingredient                                        Korea  DSL   NDSL  Phil.
----------------------------------------------  -----  ---   ----  -----
Methyl Alcohol (67-56-1)                          Yes   Yes   No     Yes

--------\Federal, State & International Regulations - Part 1\----------------
                                            -SARA 302-    ------SARA 313------
Ingredient                                  RQ    TPQ     List  Chemical Catg.
----------------------------------------  ---   -----   ----  --------------
Methyl Alcohol (67-56-1)                    No    No      Yes        No

--------\Federal, State & International Regulations - Part 2\----------------
                                                      -RCRA-    -TSCA-
Ingredient                                  CERCLA     261.33     8(d)
----------------------------------------  ------     ------    ------
Methyl Alcohol (67-56-1)                    5000       U154       No


Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: Yes      Chronic: Yes  Fire: Yes Pressure: No
Reactivity: No          (Pure / Liquid)
```

16. Other Information

NFPA Ratings: Health: **1** Flammability: **3** Reactivity: **0**
Label Hazard Warning:
POISON! DANGER! VAPOR HARMFUL. MAY BE FATAL OR CAUSE BLINDNESS IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. CANNOT BE MADE NONPOISONOUS. FLAMMABLE LIQUID AND VAPOR. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM AND LIVER.
Label Precautions:
Avoid breathing vapor.
Avoid contact with eyes, skin and clothing.
Wash thoroughly after handling.
Keep container closed.
Use only with adequate ventilation.
Keep away from heat, sparks and flame.
Label First Aid:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases get medical attention immediately.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 3, 8.
Disclaimer:
****
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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

ISOBUTYLENE

AIRGAS INC -- ISOBUTYLENE-C4H8

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MSDS Safety Information

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FSC: 6665
NIIN: 01-214-8247
MSDS Date: 01/16/1998
MSDS Num: CLCRL
Product ID: ISOBUTYLENE-C4H8
MFN: 01
Responsible Party
Cage: UO451
Name: AIRGAS INC
Address: 259 RADNOR-CHESTER RD SUITE 100
City: RADNOR PA 19087-5240
Info Phone Number: 1-610-687-5253
Emergency Phone Number: (800)424-9300
Resp. Party Other MSDS No.: DOCUMENT NUMBER: 1031
Chemtrec IND/Phone: (800)424-9300
Published: Y

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Preparer Co. when other than Responsible Party Co.

==========

Cage: 0KBF5
Name: CHEMICAL SAFETY ASSOCIATES INC
Address: 9163 CHESAPEAKE DR
City: SAN DIEGO CA 92123-1002

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Contractor Summary

==========

Cage: UO451
Name: AIRGAS INC
Address: 259 RADNOR-CHESTER RD SUITE 100
City: RADNOR PA 19087-5240
Phone: 1-610-687-5253
Cage: 7Z016
Name: KAMPI COMPONENTS CO., INC.
Address: 210 RT 13
Box: 721
City: BRISTOL PA 19007-3517
Phone: 215-736-2000
Contract Number: SP0440-00-M-JA63

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Item Description Information

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Item Manager: S9G
Item Name: CALIBRATION GAS CYL
Specification Number: NONE
Type/Grade/Class: NONE
Unit of Issue: EA
UI Container Qty: 1
Type of Container: CYLINDER

==========

Ingredients

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Cas: 115-11-7

RTECS #: UD0890000
Name: ISOBUTYLENE
> Wt: 90.

Name: MAXIMUM IMPURITIES
< Wt: 1.
==========
Health Hazards Data
==========
Route Of Entry Inds - Inhalation: YES
Carcinogenicity Inds - NTP: NO
IARC: NO
OSHA: NO
Effects of Exposure: ACUTE: THE MOST SIGNIFICANT HAZARD IS OXYGEN-DEFICIENT
ATOMSPHERES. AT HIGH CONCENTRATIONS UNCONSCIOUSNESS OR DEATH MAY OCCUR.
CONTACT WITH LIQUIDFIED GAS OR RAPIDLY EXPANDING GASES MAY CAUSE FROSTBIT E.
ISOBUTYLENE ALSO HAS SOME DEGREE OF ANESTHETIC ACTION AND CAN BE MILDLY
IRRITATING TO THE MUCOUS MEMBRANES. CHRONIC: NO KNOWN ADVERSE HEALTH EFFECTS
ASSOCIATED WITH CHRONIC EXPOSURE TO ISOBUTYLENE. TARGET ORGANS: RESPIRATORY
SYSTEM.
Explanation Of Carcinogenicity: ISOBUTYLENE IS NOT FOUND ON THE FOLLOWING
LISTS: FEDERAL OSHA Z LIST, NTP, IARC, CAL/OSHA, AND THEREFORE IS NEITHER
CONSIDERED TO BE NOR SUSPECTED TO BE A CANCER-CAUSING AGENT BY THESE
AGENCIES.
Signs And Symptions Of Overexposure: INHALATION: SYMPTOMS OF OXYGEN DEFICIENCY
INCLUDE RESPIRATORY DIFFICULTY, HEADACHES, RINGING IN EARS, DIZZINESS,
DROWSINESS, UNCONSCIOUSNESS, NAUSEA, VOMITING, AND DEPRESSION OF ALL THE
SENSES. UNDER SOME CIRCUSTANCES OF OVEREXPOSURE, DEATH MAY OCCUR.
First Aid: RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO
ISOBUTYLENE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. AT A MINIMUM,
SELF-CONTAINED BREATHING APPARATUS AND FIRE-RETARDANT PERSONAL PROTECTIVE
EQUIPMENT SHOULD BE WORN. FIRE PROTECTION MUST BE PROVIDED DURING RESCUE
SITUATIONS. REMOVE VICTIMS(S) TO FRESH AIR. TRAINED PERSONNEL SHOULD
ADMINISTER OXYGEN AND/OR CARDIO-PULMONARY RESUS CITATION, IF NECESSARY. IN
CASE OF FROSTBITE, PLACE FROSTBITEN PART IN WARM WATER. (CONTD. SEE OTHER
INFORMATION)
==========
Handling and Disposal
==========
Spill Release Procedures: UNCONTROLLED RELEASES SHOULD BE COVERED BY TRAINED
PERSONNEL USING PRE-PLANNED PROCEDURES. PROPER PROTECTIVE EQUIPMENT SHOULD BE
USED. ADEQUATE FIRE PROTECTION MUST BE PROVIDED. MINIMUM PERSONAL PROTE CTIVE
EQUIPMENT SHOULD BE LEVEL B: FIRE RETARDANT PROTECTIVE CLOTHING, GLOVES

RESISTANT TO TEARS AND SELF CONTAINED BREATHING APPARATUS. USE NON-SPARKING
TOOLS AND (CONTD. SEE "WASTE DISPOSAL))
Waste Disposal Methods: WASTE DISPOSAL MUST BE IN ACCORDANCE WITH APPROPRIATE
FEDERAL, STATE, AND LOCAL REGULTIONS. RETURN CYLINDERS WITH ANY RESIDUAL
PRODUCT TO AIRGAS INC. DO NOT DISPOSE OF LOCALLY. (CONTD. FROM "SPILL REL
EASE") EQUIPMENT. IF NOT ABLE TO STOP RELEASE, ALLOW GAS TO RELEASE IN PLACE
OR REMOVE TO A SAFE ARE A AND ALLOW GAS TO RELEASE.
Handling And Storage Precautions: STORE IN COOL(,< 125F), DRY,
WELL-VENTILATED AREA AWAY FROM SOURCES OF HEAT, IGNITION, DIRECT SUNLIGHT.
COMPRESSED GASES PRESENT SAFETY HAZARD. STORE AWAY FROM OXIDIZERS, OXIGEN,
CHLORINE, FLUORINE, H EAVILY TRAFFICKED AREAS, EMERGENCY EXITS. POST "NO
SMOKING OR NO OPEN FLAMES " SIGNS.
Other Precautions: ELECTRICAL EQUIPMENT SHOULD BE NON-SPARKING. MOVE CYLINDERS
WITH HAND TRUCK. DO NOT DRAG, ROLL, DROP, STRIKE EACH OTHER. SECURE FIRMLY.
DO NOT HEAT CYLINDER OR USE OILS OR GREASE ON GAS-HANDLING FITTI NGS OR
EQUIPMENT. USE DESIGNATED CGA FITTINGS. DO NOT USE ADAPTERS. USE CHECK VALVE
OR TRAP IN DISCH ARGE LINE.
==========
Fire and Explosion Hazard Information
==========
Flash Point Method: CC
Flash Point: <-10.C, 14.F
Autoignition Temp: =465.C, 869.F
Lower Limits: 1.8
Upper Limits: 9.6
Extinguishing Media: EXTINGUISH ISOBUTYLENE FIRES BY SHUTTING OFF THE SOURCE OF
THE GAS. USE WATER SPRAY OR A FOAM AGENT TO COOL FIRE-EXPOSED CONTAINERS,
STRUCTURES AND EQUIPMENT.
Fire Fighting Procedures: STRUCTURAL FIREFIGHTERS MUST WEAR SELF-CONTAINED
BREATHING APPARATUS AND FULL PROTECTIVE EQUIPMENT. THE BEST FIRE-FIGHTING
TECHNIQUE MAY BE SIMPLY TO LET THE BURNING GAS ESCAPE FROM THE PRESSURIZED CY
LINDER, TANK CAR, OR PIPELINE. STOP THE LEAK BEFORE EXTINGUISHING FIRE.
LEAKING GAS COULD EXPLOSIVELY RE-IGNITE.
Unusual Fire/Explosion Hazard: WHEN INVOLVED IN A FIRE, THIS MATERIAL MAY
IGNITE AND PRODUCE TOXIC GASES, INCLUDING CARBON MONOXIDE AND CARBON DIOXIDE.
==========
Control Measures
==========
Respiratory Protection: MAINTAIN OXYGEN LEVELS ABOVE 19.5% IN THE WORKPLACE.
USE SUPPLIED AIR RESPIRATORY PROTECTION IF OXYGEN LEVELS ARE BELOW 19.5% OR
DURING EMERGENCY RESPONSE TO A RELEASE OF ISOUTYLENE. IF RESPIRATORY PR

OTECTION IS REQUIRED, FOLLOW THE REQUIREMENTS OF THE FEDERAL OSHA RESPIRATORY
STANDARD (29 CFR 1910.134) OR EQUIVALENT STATE STANDARDS.
Ventilation: USE ADEQUATE VENTILATION. LOCAL EXHAUST VENTILATION IS PERFERRED,
BECAUSE IT PREVENTS ISOBUTYLENE DISPERSION INTO THE WORKPLACE BY EMLIMINATING
IT AT THE SOURCE
Protective Gloves: RESISTANT TO TEARS. USE LOW-TEMPERATURE PROTECTIVE GLOVED
(E.G., KEVLAR)
Eye Protection: SPLASH GOGGLES OR SAFETY GLASSES.
Other Protective Equipment: USE BODY PROTECTION . TRANSFER OF LARGE QUANTITIES
UNDER PRESSURE MAY REQUIRE PROTECTIVE EQUIPMET TO PROTECT FROM SPLASHES OF
LIQUIDFIED PRODUCT AS WELL AS FIRE RETARANAT ITEMS.
Work Hygienic Practices: AS WITH ALL CHEMICALS, AVOID GETTING ISOBUTYLENE IN
YOU. DO NOT EAT OR DIRNK WHILE HANDLING CHEMICALS. BEWARE OF ANY SIGNS OF
DIZZINESS OR FATIGUE; EXPOSURES TO FATAL CONCENTRATIONS OF ISOBUTYLENE COULD
Supplemental Safety and Health: (CONTD. FROM FIRST AID) DO NOT USE HOT WATER.
IF WARM WATER NOT AVAILABLE, OR IMPRACTICAL TO USE, WRAP AFFECTED PARTS
GENTLY IN BLANKETS. (SEE OTHER INFORMATION)
==========
Physical/Chemical Properties
==========
HCC: G2
Boiling Point: =-6.9C, 19.6F
Melt/Freeze Pt: =-140.C, -220.F
Vapor Pres: 39 PSIA
Vapor Density: 0.15LB/FT3
Spec Gravity: 1.997
PH: NA
Solubility in Water: INSOLUBLE
Appearance and Odor: COLORLESS LIQUID/ GAS WITH THE UNPLEASANT ODOR OF BURNING
COAL.
==========
Reactivity Data
==========
Stability Indicator: YES
Stability Condition To Avoid: CONTACT WITH INCOMPATIBLE MATERIALS AND EXPOSURE
TO HEAT, SPARKS, AND ORTHER SOURCES OF IGNITION. CYLINDERS EXPOSED TO HIGH
TEMPERATURES OR DIRECT FLAME CAN RUPTURE OR BURST.
Materials To Avoid: STRONG OXIDIZERS (E.G., CHLORINE, BROMINE PENTAFLUORIDE,
OXYGEN, OXYGEN DIFLUORIDE, AND NITROGEN TRIFLUORIDE).
Hazardous Decomposition Products: WHEN IGNITED IN THE PRESENCE OF OXYGEN, THIS
GAS WILL BURN TO PRODUCE CARBON MONOXIDE AND CARBON DIOXIDE.

Hazardous Polymerization Indicator: NO
Conditions To Avoid Polymerization: WILL NOT OCCUR.

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Toxicological Information

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Toxicological Information: LC50 (RAT, INHALATION): 620 G/M3/ 4 HOURS; LC50 (MOUSE, INHALATION): 415 G/M3/ 2 HOUR. ISOBUTYLENE IS NOT FOUND ON FEDERAL OSHA Z LIST, NTP, IARC, CAL/OSHA, AND THEREFORE IS NEITHER CONSIDERED TO BE N OR SUSPECTED TO BE A CANCER-CAUSING AGENT BY THESE AGENCIES. PRODUCT MAY BE MILDLY IRRITATING TO THE MUCOUS MEMBRANES. IN ADDITION, CONTACT WITH RAPIDLY EXPANDING GASES CAN CAUSE FROSTBITE TO EXPOSED TISSUE. ISOBUTYLENE IS NOT KNOWN TO CAUSE SENSITIZATION IN HUMANS. NO MUTAGENIC EFFECTS, NO EMBRYOTOXIC EFFECTS, NO TERATOGENIC EFFECTS, NO REPRODUCTIVE TOXICITY EFFECTS HAVE BEEN DESCRIBED FOR BUTYLE NE.

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Ecological Information

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Ecological: ENVIRONMENTAL STABILITY: THIS GAS WILL BE DISSIPATED RAPIDLY IN WELL-VENTILATED AREAS. EFFECTS OF MATERIAL ON PLANTS OR ANIMALS: ANY ADVERSE EFFECT ON ANIMALS WOULD BE RELATED TO OXYGEN-DEFICIENT ENVI RONMENTS. NO ADVERSE EFFECT IS ANTICIPATED TO OCCUR TO PLANT LIFE, EXCEPT FOR FROST PRODUCED IN THE PRESENCE OF RAPIDLY EXPANDING GASES. EFFECT OF CHEMICAL ON AQUATIC LIFE: NO EVIDENCE IS CURRENTLY AV AILABLE ON THE EFFECTS OF ISOBUTYLENE ON AQUATIC LIFE.

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MSDS Transport Information

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Transport Information: THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION. PROPER SHIPPING NAME: ISOBUTYLENE; CLASS: 2.1 (FLAMMABLE GAS); UN 1055; PKG: N/A; DOT LABELS REQUIRED: FLAMMABLE GAS; NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 115. ALTERNATE DESCRIPTION: PSN: PETROLEUM GASES, LIQUIDFIED; CLASS: 2.1 (FLAMMABLE GAS); UN 1075; PKG N/A; DOT LABEL REQUIRE D: FLAMMABLE GAS; NORTH AMERICAN EMERGENCY GUIDEBOOK NUMBER: 115; MARINE POLLUTANT: ISOBUTYLENE IS NOT CLASSIFIED BY THE DOT AS A MARINE POLLUTANT (AS DEFINED BY 49 CFR 172.101, APPENDIX B). CANADA: SAME AS ABOVE.

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Regulatory Information

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Sara Title III Information: ISOBUTYLENE IS NOT SUBJECT TO THE REPORTING

REQUIREMENTS OF SECTION 302, 304, AND 313 OF TITLE I I I OF THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT. U.S. SARA THRESHOLD PLANNING QUANTITY: N/A. U. S. CERCLA REPORTABLE QUANTITY (RQ): NOT APPLICIABLE.ING RE

Federal Regulatory Information: ISOBUTYLENE IS LISTED ON THE U.S. TSCA INVENTORY. ISOBUTYLENE IS SUBJECT TO REPORTING REQUIREMENTS OF SECTION 112(R) OF THE CLEAN AIR ACT. THRESHOLD QUANTITY FOR THIS GAS IS 10,000 LB. DEPENDING ON SP ECIFIC OPERATIONS INVOLVING USE OF ISOBUTYLENE, REGULATIONS OF THE PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS MAY BE APPLICABLE (29 CFR 1910.119) UNDER THIS REGULATION ISOBUTYLENE IS NOT LISTED IN APPENDIX A; HOWEVER, ANY PROCESS THAT INVOLVES A FLAMMABLE GAS ON-SITE, IN ONE LOCATION, I N QUANTITIES OF 10,000 LB (4,553 KG) OR GREATER IS COVERED UNDER THIS REGULATION UNLESS IT IS USED AS A FUEL.

State Regulatory Information: CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): ISOBUTYLENE IS NOT ON THE CALIFORNIA PROPOSITION 65 LISTS. PRODUCT COVERED UNDER FOLLOWING STATE REGULATIONS: AK: DESIGNATED TOXIC AND HAZARDOUS SUBSTANCES. CA: PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS; FL:SUBSTANCE LIST; MA: SUBSTANCE LIAT; MN:LIST OF HAZARDOUS SUBSTANCES; NJ: RIGHT TO KNOW HAZARDOUS SUBSTANCE LIST; PA: HAZARDOUS SUBSTANCE LIST; RI: HAZARDOUS SUBSTANCE LIST; TX: HAZARDOUS SUBSTANCE LIST: WV: HAZARDOUS SUBSTANCE LIST; WI: TOXIC AND HAZARDOUS SUBSTANCES.

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Other Information

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Other Information: (CONTD. FROM FIRST AID) DO NOT USE HOT WATER. IF WARM WATER NOT AVAILABLE, WRAP AFFECTED PARTS IN BLANKETS. ALTERNATIVELY, IF FINGERS OR HANDS ARE FORTBITTEN, PLACE IN ARMPIT. HAVE VICTIM GENTLY EXERC ISE AFFECTED PARTS WHILE BEING WARMED. SEEK MEDICAL ATTENTION. TAKE COPY OF LABEL AND MSDS TO PHYSICIAN WITH VICTIM. NFPA RATING: HEALTH: 1; FLAMMIBILITY: 4; REACTIVITY: 0. RATINGS: HEALTH: 1; FLAMMABILITY: 4; REACTIVITY: 0; PROTECTIVE EQUIPMENT: B. CANADIAN W SYMBOLS: CLASS A: COMPRESSED GAS; CLASS B1: FLAMMABLE GAS.

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Transportation Information

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Responsible Party Cage: UO451
Trans ID NO: 156921
Product ID: ISOBUTYLENE-C4H8
MSDS Prepared Date: 01/16/1998
Review Date: 05/14/2001
MFN: 1

Multiple KIT Number: 0
Unit Of Issue: EA
Container QTY: 1
Type Of Container: CYLINDER
Additional Data: TRANSPORTATION DATA PER MANUFACTURER'S MSDS.
==========
Detail DOT Information
==========
DOT PSN Code: HTR
DOT Proper Shipping Name: ISOBUTYLENE
DOT PSN Modifier: SEE ALSO PETROLEUM GASES, LIQUEFIED
Hazard Class: 2.1
UN ID Num: UN1055
Label: FLAMMABLE GAS
Special Provision: 19
Packaging Exception: 306
Non Bulk Pack: 304
Bulk Pack: 314,315
Max Qty Pass: FORBIDDEN
Max Qty Cargo: 150 KG
Vessel Stow Req: E
Water/Ship/Other Req: 40
==========
Detail IMO Information
==========
IMO PSN Code: IRQ
IMO Proper Shipping Name: ISOBUTYLENE
IMDG Page Number: 2147
UN Number: 1055
UN Hazard Class: 2(2.1)
IMO Packaging Group: -
Subsidiary Risk Label: -
EMS Number: 2-07
MED First Aid Guide NUM: 310
==========
Detail IATA Information
==========
IATA PSN Code: OHI
IATA UN ID Num: 1055
IATA Proper Shipping Name: ISOBUTYLENE
IATA UN Class: 2.1
IATA Label: FLAMMABLE GAS
Packing Note Passenger: FORB
Max Quant Pass: FORB
Max Quant Cargo: 150KG
Packaging Note Cargo: 200
Exceptions: A1
==========
Detail AFI Information
==========
AFI PSN Code: OHI
AFI Proper Shipping Name: ISOBUTYLENE
AFI Hazard Class: 2.1
AFI UN ID NUM: UN1055
Special Provisions: P4
Back Pack Reference: A6.3, A6.5

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HAZCOM Label
==========
Product ID: ISOBUTYLENE-C4H8
Cage: UO451
Assigned IND: Y
Company Name: AIRGAS INC
Street: 259 RADNOR-CHESTER RD SUITE 100
City: RADNOR PA
Zipcode: 19087-5240
Health Emergency Phone: (800)424-9300
Label Required IND: Y
Date Of Label Review: 05/14/2001
Status Code: A
Label Date: 05/14/2001
Origination Code: F
Eye Protection IND: YES
Skin Protection IND: YES
Signal Word: DANGER
Respiratory Protection IND: YES
Health Hazard: Moderate
Contact Hazard: Moderate
Fire Hazard: Severe
Reactivity Hazard: None
Hazard And Precautions: FLAMMABLE LIQUID AND GAS UNDER PRESSURE. CAN FORM EXPLOSIVE MIXTURES WITH AIR. MAY CAUSE FROSTBITE. KEEP AWAY FROM HEAT (< 125F), FLAMES, AND SPARKS. STORE AND USE WITH ADEQUATE VENTILATION. MOST SIGN IFICANT HAZARD IS OXYGEN-DEFICIENT ATOMSPHERES.
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HCL/
MURIATIC ACID

OLIN CORPORATION

HCL (MURIATIC ACID), CPE298002

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MSDS Safety Information

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FSC: 6810
NIIN: 00-045-8918
MSDS Date: 03/28/1997
MSDS Num: CHVMT
Product ID: HCL (MURIATIC ACID), CPE298002
MFN: 02
Responsible Party
Cage: 99530
Name: OLIN CORPORATION
Address: 501 MERRITT 7
Box: 4500
City: NORWALK CT 06856-4500
Info Phone Number: 203-356-3449
Emergency Phone Number: 800-OLIN-911(1-800-654-6911)
Published: Y

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Contractor Summary

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Cage: 99530
Name: OLIN CORPORATION
Address: 501 MERRITT 7
Box: 4500
City: NORWALK CT 06856-4500
Phone: 203-750-3000/800-511-MSDS

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Item Description Information

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Ingredients

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Cas: 7647-01-0
RTECS #: MW4025000
Name: HYDROCHLORIC ACID (SARA 302/313) (CERCLA)
% Wt: 8-38
OSHA PEL: C 5 PPM
ACGIH TLV: C 5 PPM
EPA Rpt Qty: 5000 LBS
DOT Rpt Qty: 5000 LBS

Cas: 7732-18-5
Name: WATER
% Wt: 62-93
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)

Name: SUP DAT: OCCUR TO ENTIRE GI TRACT, INCL STOM & INTESTINES,
CHARACTERIZED BY NAUS, VOMIT, DIARR, ABDOM PAIN,

Name: ING 3: BLEEDING, &/TISS ULCERATION. INGEST CAUSES SEVERE DAMAGE TO GI
TRACT W/POTENTIAL TO CAUSE PERFORATION.

Name: ING 4: CHRONIC: INHAL: RPTD/PRLNG EXPOS TO CONCS >ACCEPTED OCCUP LIMS
MAY CAUSE DENTAL DISCOLORATION & EROSION

Name: ING 5: OF TEETH. SKIN: RPTD CONT W/MIST HAS BEEN REPORTED TO CAUSE CONT
DERM (SKIN RASH). PRLNG/RPT EXPOS W/LIQ

Name: ING 6: MAY CAUSE PERM DMG. INGEST: INGEST OF SIGNIFICANT AMTS IS UNLIKELY
BECAUSE OF ITS ACUTE CORR ACTION.

Name: FIRST AID PROC: INHAL: IF PERS EXPERIENCES NAUS, HDCH/DIZZ, PERS SHOULD
STOP WORK IMMED & MOVE TO FRESH AIR

Name: ING 8: UNTIL THESE SYMPS DISAPPEAR. IF BRTHG IS DFCLT, ADMIN OXYGEN, KEEP
PERS WARM & AT REST. CALL MD. IN THE

Name: ING 9: EVENT THAT INDIVIDUAL INHALES ENOUGH VAP TO LOSE CONSCIOUSNESS,
PERS SHOULD BE MOVED TO FRESH AIR AT ONCE

Name: ING 10: & MD SHOULD BE CALLED IMMED. IF BRTHG HAS STOPPED, ARTF RESP
SHOULD BE GIVEN IMMED. IN ALL CASES, ENSURE

Name: ING 11: ADEQUATE VENTILATION AND PROVIDE RESPIRATORY PROTECTION BEFORE
THE PERSON RETURNS TO WORK.

Name: SPILL PROC: REQS. HAZ CONCS IN AIR MAY BE FOUND IN LOC SPILL AREA &
IMMED DOWNWIND. AIR RELEASE. VAPS MAY BE

Name: ING 13: SUPPRESSED BY USE OF WATER FOG/VAP SUPPRESSANT FOAM. DIKE &
CONTAIN ALL RUN-OFF WATER FOR TREATMENT AS

Name: ING 14: HAZ WASTE. WATER RELEASE: THIS MATL IS HVR/AIR & SOL IN
WATER. CONTAIN CONTAM WATER BY BLDG A DIKE OF

Name: ING 15: COMPATIBLE ABSORBS. VACUUM/PUMP MATL TO NEUT CONTR & TREAT.
LAND SPILL: COMPATIBLE ABSORBS: SAND, CLAY

Name: ING 16: SOIL & COMMERCIAL ABSORBS. SPILL RESIDUERS: DISP OF PER
GUIDELINES UNDER WASTE DISP. THIS MATL MAY BE

Name: ING 17: NEUT FOR DISP; YOU ARE REQUESTED TO CONT OCEAN AT 800-OLIN-911
BEFORE BEGINNNING ANY SUCH OPERATION.
==========
Health Hazards Data
==========
LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Route Of Entry Inds - Inhalation: YES

Skin: YES
Ingestion: YES
Carcinogenicity Inds - NTP: NO
IARC: NO
OSHA: NO
Effects of Exposure: ACUTE: INHAL: MIST/VAP/HYDROGEN CHLORINE GAS MAY CAUSE
IRRIT OF MUC MEMB & RESP TRACT W/SYMPS OF BURNING, CHOKING * COUGHING. AT
EXPOS CONCS >TLV, DMG MAY OCCUR TO MUC MEMB (ULCERATIONS OF NOSE &
THRO AT) & RESP TRACT. AT THESE HIGH CONCS, SEV BRTHG DFCLTYS MAY OCCUR
WHICH MAY BE DELAYED IN ONSET & MAY (EFTS OF OVEREXP)
Explanation Of Carcinogenicity: NOT RELEVANT.
Signs And Symptions Of Overexposure: HLTH HAZ: BE DUE TO PULM EDEMA (FLUID IN
LUNG) /LARYNGEAL EDEMA/SPASM. SKIN: HYDROFLUORIC ACID MIST MAY RAPIDLY CAUSE
SKIN INFLAMM & BURNS. DIRECT CONT OF LIQ WILL BE CORR TO SKIN & CAN
CAUSE SEV IRRI T &/BURNS CHARACTERIZED BY REDNESS, SWELL & SCAB FORM.
POTENTIAL FOR SCARRING & ULCERATION OF CONTACTED TISS (SUP DAT)
Medical Cond Aggravated By Exposure: RESPIRATORY AND CARDIOVASCULAR DISEASE.
First Aid: EYES: IMMED FLUSH W/LGE AMTS OF WATER FOR AT LEAST 15 MIN, OCCAS
LIFTING UPPER & LOWER EYELIDS. CALL MD AT ONCE. SKIN: IMMED FLUSH W/WATER
FOR AT LEAST 15 MIN. CALL MD. IF CLTHG COMES IN CONT W/PROD, IT SHOULD BE
REMOVED IMMED & LAUNDERED BEFORE REUSE. INGEST: IMMED DRINK LGE QTYS OF
WATER. DO NOT INDUCE VOMIT. CALL MD AT ONCE. DO NOT GIVE ANYTHING BY MOUTH IF
PERS IS UNCON/HAVING CONVLS.

==========
Handling and Disposal
==========
Spill Release Procedures: FOR ALL TRANSPORTATION ACCIDENTS, CALL CHEMTREC AT
800-424-9300. REPORTABLE QUANTITY: THIS PROD IS SUBJECT TO REPORTABLE QTY
W/RESPECT TO HYDROFLUORIC ACID. RQ'S ARE SUBJECT TO CHANGE & REFERENCE
SHOU LD BE MADE TO 40 CFR 302.4 FOR CURRENT
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Methods: CARE MUST BE TAKEN TO PVNT ENVIRON CONTAM FROM USE OF
MATL. THE USER HAS THE RESPONSIBILITY TO DISP OF UNUSED MATL, RESIDUES &
CONTRS IN COMPLIANCE W/ALL RELEVANT LOC, STATE & FED LAWS & REGS
REGARDIN G TREATMENT, STOR & DISP FOR HAZ & NON HAZ WASTES
Handling And Storage Precautions: DO NOT TAKE INTERNALLY. AVOID CONT W/SKIN,
EYES & CLTHG. AVOID BRTHG MIST/VAP. STORE IN COOL, CLEAN, WELL-VENTED
AREA. DO NOT STORE >100F (>38C).

Other Precautions: DO NOT EXPOSE TO DIRECT LIGHT. SHELF LIFE LIMITATIONS: 1
YEAR. GLASS/POLYETHYLENE CONTRS REC. WHEN SHIPPED W/OXIDIZERS, MUST BE SEPARATED BY 18 INCHES, W/WOOD PALLETS & ABSORB MATL IN BETWEEN.

==========

Fire and Explosion Hazard Information

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Extinguishing Media: ON SMALL FIRES, USE DRY CHEMICAL OR CARBON DIOXIDE. ON
LARGE FIRE, USE WATER.
Fire Fighting Procedures: WEAR NIOSH APPROVED SCBA & FULL PROTECTIVE
EQUIPMENT (FP N). USE WATER TO COOL CONTAINERS EXPOSED TO FIRE.
Unusual Fire/Explosion Hazard: NOT COMBUSTIBLE BUT CONTACT WITH COMMON METALS
PRODUCES FLAMMABLE HYDROGEN GAS. MAY ALSO RELEASE CHLORINE GAS BY REACTION
WITH OXIDIZING AGENTS.

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Control Measures

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Respiratory Protection: NONE SPECIFIED BY MANUFACTURER.ALLY REQUIRED. IF
VAPORS, MISTS, OR AEROSOLS ARE GENERATED, WEAR A NIOSH APPROVED FULL
FACEPIECE, EQUIPPED WITH CHEMICAL CARTRIDGES APPROVED FOR HYDROGEN CHLORIDE.
Ventilation: N/R EXHST VENT IS REC IF VAPS, MIST/AEROSOLS ARE
GENERATED.OTHERWISE, USE GOOD GENERAL ROOM VENTILATION.
Protective Gloves: NEOPRENE GLOVES.
Eye Protection: ANSI APRV CHEM SFTY GOGGS&FFACE SHLD(FPN
Other Protective Equipment: ANSI APPRVD EMER EYEWASH & DELUGE SHOWER (FP N).
BOOTS, APRON.FULL IMPERMEABLE SUIT REC IF EXPOS TO LGE PORTION OF BODY.
Work Hygienic Practices: UPON CONTACT WITH SKIN OR EYES, WASH OFF WITH WATER.
Supplemental Safety and Health: MATLS TO AVOID: METALLIC OXIDES, MAGNESIUM,
OLEUM, PERCHLORIC ACID, ZINC. EFTS OF OVEREXP: ALSO EXISTS. EYE: EXPOS TO
MIST MAY RSLT IN IRRIT &/SEV BURNS W/PERM DMG & POSS LOSS OF SIGHT.
DIRECT CONT W/ LIQ WILL BE CORR TO EYE W/RSLTG SEV BURNS, POTENTIAL VISUAL
IMPAIRMENT/LOSS OF SIGHT. INGEST: IRRIT &/BURNS CAN

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Physical/Chemical Properties

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B.P. Text: >212F,100C
M.P/F.P Text: -101F,-74C
Vapor Pres: <210 @ 20C
Vapor Density: 1.3
Spec Gravity: 1.035-1.188
PH: <1
Evaporation Rate & Reference: APPROX 1 (WATER=1)
Solubility in Water: COMPLETE
Appearance and Odor: CLEAR, COLORLESS LIQUID; PUNGENT, SUFFOCATING ODOR
Percent Volatiles by Volume: 100

==========
Reactivity Data
==========
Stability Indicator: YES
Stability Condition To Avoid: HEAT, EXPOSURE TO SUNLIGHT.
Materials To Avoid: ALKALINE MATLS, ALUMINUM, AMINES, CARBONATES, IRON, SULFURIC ACID, HYDROXIDES, LEATHER & OTHER FABRICS, (SUP DAT)
Hazardous Decomposition Products: FLAMM HYDROGEN GAS BY REACTION W/MANY METALS (E.G. ALUMINUM). CHLORINE GAS IS RELEASED BY REACTION W/OXIDIZING AGENTS.
Hazardous Polymerization Indicator: NO
Conditions To Avoid Polymerization: NOT RELEVANT.
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Toxicological Information
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Ecological Information
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MSDS Transport Information
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Regulatory Information
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Other Information
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HAZCOM Label
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Product ID: HCL (MURIATIC ACID), CPE298002
Cage: 99530
Company Name: OLIN CORPORATION
Street: 501 MERRITT 7
PO Box: 4500
City: NORWALK CT
Zipcode: 06856-4500
Health Emergency Phone: 800-OLIN-911; (1-800-654-6911)
Label Required IND: Y
Date Of Label Review: 06/23/1998
Status Code: C
Label Date: 06/23/1998
Origination
Chronic Hazard IND: Y
Eye Protection IND: YES
Skin Protection IND: YES
Signal Word: DANGER
Respiratory Protection IND: YES
Health Hazard: Slight
Contact Hazard: Severe
Fire Hazard: None
Reactivity Hazard: None
Hazard And Precautions: ACUTE: INHAL: MIST/VAP/HCL GAS MAY CAUSE IRRIT OF MUCOUS MEMB & RESP TRACT W/BURN SYMPS, CHOKE & COUGH. AT EXPOS >TLV, MAY DMG MUC MEMB & RESP TRACT. AT HIGH CONC, SEV BRTHG DFCLTYS WHICH MAY BE DELAY ED IN ONSET & BE DUE TO PULM EDEMA, LARYNGEAL

EDEMA/SPASM. SKIN: HCL ACID MIST MAY CAUSE INFLAM & BURNS. DIRECT CONT OF
LIQ IS CORR CAUSING SEV IRRIT &/BURNS & ULCER OF CONTACTED TISS. EYE:
EXPOS TO M IST MAY CAUSE IRRIT &/SEV BURNS W/PERM DMG & POSS SIGHT
LOSS. INGEST: IRRIT &/BURNS CAN OCCUR TO GI TRACT. CHRONIC: RPTD/PRLNG
EXPOS TO HI CONC MAY CAUSE DENTAL DISCOLOR & EROSION. SKIN: DERM. PERM DM
G. INGEST: INLIKELY BECAUSE OR ACUTE CORR ACTION.

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information is formulated for use by elements of the Department of Defense.
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and assume responsibility for the suitability of this information to their
particular situation regardless of similarity to a corresponding Department
of Defense or other government situation.

MSA Sanitizer

MINE SAFETY APPLIANCES CO -- 34337 CLEANER-SANITIZER II

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MSDS Safety Information

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FSC: 6840
NIIN: 00-570-5299
MSDS Date: 02/03/1992
MSDS Num: BQQFT
Product ID: 34337 CLEANER-SANITIZER II
MFN: 03
Responsible Party
Cage: 55799
Name: MINE SAFETY APPLIANCES CO
Address: 3880 MEADOWBROOK RD
City: MURRYSVILLE PA 15668-1753
Info Phone Number: 412-325-1313
Emergency Phone Number: 412-325-1313
Review Ind: Y
Published: Y

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Contractor Summary

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Cage: 40912
Name: MINE SAFETY APPLIANCE (REPLACED BY CAGE 55799)
Address: 201 N BRADDOCK AVENUE
Box: 426
City: PITTSBURGH PA 15230
Phone: 412-967-3000
Cage: 55799
Name: MINE SAFETY APPLIANCES CO DBA MSA
Address: 3880 MEADOWBROOK RD
City: MURRYSVILLE PA 15668-1753
Phone: 724-733-9272

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Item Description Information

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Item Manager: S9G
Item Name: SANITIZER-DETERGENT,GENERAL PURPOSE
Specification Number: NONE
Type/Grade/Class: NONE
Unit of Issue: BX
Quantitative Expression: 000000000024OZ
UI Container Qty: 0
Type of Container: BOX OF 12 PKT

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Ingredients

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Cas: 68424-85-1
Name: ALKYL DIMETHYL BENZYL AMMONIYUM CHLORIDE
% Wt: 2.5
Other REC Limits: NONE RECOMMENDED
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED

Cas: 497-19-8
RTECS #: VZ4050000
Name: SODIUM CARBONATE

% Wt: 25-50
Other REC Limits: NONE RECOMMENDED
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED

Cas: 144-55-8
RTECS #: VZ0950000
Name: SODIUM BICARBONATE
% Wt: 10-25
Other REC Limits: NONE RECOMMENDED
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED

Cas: 7758-29-4
RTECS #: YK4570000
Name: SODIUM PHOSPHATE, TRIBASIC (SARA III)
% Wt: 10-25
Other REC Limits: NONE RECOMMENDED
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
EPA Rpt Qty: 5000 LBS
DOT Rpt Qty: 5000 LBS

Cas: 7732-18-5
RTECS #: ZC0110000
Name: WATER
% Wt: 5-10
Other REC Limits: NONE RECOMMENDED
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED

Cas: 7601-54-9
RTECS #: TC9490000
Name: SODIUM PHOSPHATE, TRIBASIC (SARA III)
% Wt: 1-10
Other REC Limits: NONE RECOMMENDED
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
EPA Rpt Qty: 5000 LBS
DOT Rpt Qty: 5000 LBS

Cas: 127087-87-0
Name: NONOXYNOL-10
% Wt: 1-5
Other REC Limits: NONE RECOMMENDED
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED

Cas: 64-17-5
RTECS #: KQ6300000
Name: ETHYL ALCOHOL (ETHANOL)
% Wt: <1
Other REC Limits: NONE RECOMMENDED
OSHA PEL: 1000 PPM
ACGIH TLV: 1000 PPM; 9293
==========
Health Hazards Data

==========
LD50 LC50 Mixture: ORAL RAT LD50 IS UNKNOWN
Route Of Entry Inds - Inhalation: NO
Skin: NO
Ingestion: YES
Carcinogenicity Inds - NTP: NO
IARC: NO
OSHA: NO
Effects of Exposure: ACUTE: INHALATION OF DUST MAY CAUSE IRRITATION OF RESPIRATORY TRACT. CONTACT MAY CAUSE SKIN AND EYE IRRITATION OR BURNS. INGESTION MAY CAUSE BURNS TO MOUTH, THROAT, ABDOMEN, SWELLING OF LARYNX, MUSCLE PARALYSIS, AND CONVULSIONS. CHRONIC: NONE SPECIFIED BY MANUFACTURER.
Explanation Of Carcinogenicity: THE PRODUCT CONTAINS NO INGREDIENT THAT IS LISTED BY IARC, NTP OR OSHA AS A CARCINOGEN.
Signs And Symptions Of Overexposure: INHALED: COUGHING, SHORTNESS OF BREATH, WHEEZING, SNEEZING. EYES: CORNEAL BURNS, PAIN, TEARING, REDNESS, BLURRED VISION. SKIN: BURNS, PAIN, REDNESS. INGESTED: BURNS TO MOUTH, THROAT, ABDOMEN, SEVERE S WELLING OF LARYNX, MUSCLE PARALYSIS, CONVULSIONS.
Medical Cond Aggravated By Exposure: NO INFORMATION
First Aid: INHALED: MOVE TO FRESH AIR. IF SYMPTOMS DEVELOP, SEE DOCTOR. EYES: FLUSH WITH LOTS OF WATER FOR 15 MINUTES, HOLD LIDS OPEN. SEE DOCTOR. SKIN: REMOVE CONTAMINATED CLOTHES. WASH WITH SOAP AND WATER. SEE DOCTOR IF BURNED. INGESTED: IF CONSCIOUS, DRINK MILK, RAW EGG WHITE, OR GELATIN SOLUTION AND LARGE QUANTITIES OF WATER. AVOID ALCOHOL. GET IMMEDIATE MEDICAL ATTENTION!
==========
Handling and Disposal
==========
Spill Release Procedures: SWEEP UP AND PLACE IN CONTAINER FOR DISPOSAL. AVOID CREATING DUST.
Neutralizing Agent: NONE GIVEN BY MANUFACTURER.
Waste Disposal Methods: DISPOSE IN ACCORDANCE WITH ALL FEDERAL, STATE AND LOCAL REGULATIONS.
Handling And Storage Precautions: STORE IN A COOL, DRY PLACE.
Other Precautions: READ MANUFACTURER'S INSTRUCTIONS AND THEN FOLLOW THEM!
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Fire and Explosion Hazard Information
==========
Flash Point Text: UNKNOWN
Lower Limits: UNKNOWN
Upper Limits: UNKNOWN
Extinguishing Media: USE WATER SPRAY OR FOG, CARBON DIOXIDE, FOAM, OR DRY CHEMICAL.
Fire Fighting Procedures: WEAR FIRE FIGHTING PROTECTIVE EQUIPMENT AND A FULL FACED SELF CONTAINED BREATHING APPARATUS.
Unusual Fire/Explosion Hazard: PRODUCT IS NON-REACTIVE AND DOES NOT READILY SUPPORT COMBUSTION.

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Control Measures
==========
Respiratory Protection: NONE NORMALLY REQUIRED.
Ventilation: NORMAL ROOM VENTILATION.
Protective Gloves: RUBBER
Eye Protection: SAFETY GLASSES
Other Protective Equipment: NONE SPECIFIED BY MANUFACTURER. : EYE WASH STATION.
Work Hygienic Practices: WASH HANDS AFTER USE AND BEFORE EATING, DRINKING, OR
SMOKING. LAUNDER CONTAMINATED CLOTHES BEFORE REUSE.
==========
Physical/Chemical Properties
==========
HCC: V7
B.P. Text: UNKNOWN
M.P/F.P Text: UNKNOWN
Decomp Text: UNKNOWN
Vapor Pres: UNKNOWN
Vapor Density: UNKNOWN
Spec Gravity: POWDER
Evaporation Rate & Reference: UNKNOWN
Solubility in Water: APPRECIABLE
Appearance and Odor: WHITE POWDER, FRAGRANT, PLEASING ODOR PH 1% SOL'N = 9.5-10.5
Corrosion Rate: UNKNOWN
==========
Reactivity Data
==========
Stability Indicator: YES
Stability Condition To Avoid: NONE
Materials To Avoid: OXIDIZING AGENTS NOTE SOAP & DETERGENTS DEACTIVATE THE GERMICIDE IN THE PRODUCT.
Hazardous Decomposition Products: NONE GIVEN BY MANUFACTURER (SUPPLIER).
Hazardous Polymerization Indicator: NO
Conditions To Avoid Polymerization: NOT RELEVANT
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Toxicological Information
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Ecological Information
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MSDS Transport Information
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Regulatory Information
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Other Information
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Transportation Information
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Responsible Party Cage: 55799
Trans ID NO: 77126

Product ID: 34337 CLEANER-SANITIZER II
MSDS Prepared Date: 02/03/1992
Review Date: 05/10/1993
MFN: 3
Net Unit Weight: 24 OZ
Multiple KIT Number: 0
Review IND: Y
Unit Of Issue: BX
Container QTY: 0
Type Of Container: BOX OF 12 PKT

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Detail DOT Information

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DOT PSN Code: ZZZ
DOT Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION

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Detail IMO Information

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IMO PSN Code: ZZZ
IMO Proper Shipping Name: NOT REGULATED FOR THIS MODE OF TRANSPORTATION

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Detail IATA Information

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IATA PSN Code: ZZZ
IATA Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION

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Detail AFI Information

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AFI PSN Code: ZZZ
AFI Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION

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HAZCOM Label

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Product ID: LABEL COVERED UNDER EPA REGS - HAZCOM LABEL NOT AUTHORIZED

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MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: NON-FLAMMABLE GAS MIXTURE

Containing One or More of the Following Components in a Nitrogen Balance Gas: Oxygen,
0.0015-23.5%; Methane, 0.0005-2.5%; Carbon Monoxide, 0.0005-1.0%; Hydrogen
Sulfide, 0.001-0.025%

SYNONYMS: Not Applicable
CHEMICAL FAMILY NAME: Not Applicable
FORMULA: Not Applicable
Document Number: 50018

Note: The Material Safety Data Sheet is for this gas mixture supplied in cylinders with 33 cubic feet (935 liters) or less gas capacity (DOT - 39 cylinders). This
MSDS has been developed for various gas mixtures with the composition of components within the ranges listed in Section 2 (Composition and Information on
Ingredients). Refer to the product label for information on the actual composition of the product.

PRODUCT USE: Calibration of Monitoring and Research
Equipment
SUPPLIER/MANUFACTURER'S NAME: AIR LIQUIDE AMERICA CORPORATION
ADDRESS: 821 Chesapeake Drive
Cambridge, MD 21613
EMERGENCY PHONE: CHEMTREC: 1-800-424-9300
BUSINESS PHONE: 1-410-228-6400
General MSDS Information 1-713/868-0440
Fax on Demand: 1-800/231-1366

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL
NAME
CAS # mole % EXPOSURE LIMITS IN AIR
ACGIH OSHA
TLV STEL PEL STEL IDLH OTHER
ppm ppm ppm ppm ppm ppm
Oxygen 7782-44-7 0.0015 -
23.5%
There are no specific exposure limits for Oxygen. Oxygen levels should be maintained
above 19.5%.
Methane 74-82-8 0.0005 -
2.5%
There are no specific exposure limits for Methane. Methane is a simple asphyxiant (SA).
Oxygen levels should be maintained above 19.5%.
Hydrogen Sulfide 7783-06-4 0.001-
0.025 %
10 15 20 C
10
(Vacated
1989 PEL)

50 ppm
(10 minute
maximum
peak)
15 (Vacated
1989 PEL)
100 NIOSH REL: 10
ppm C (10
minutes)
DFG-MAK: 15
ppm
NE = Not Established. C = Ceiling Limit. See Section 16 for Definitions of Terms Used.
NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

2. COMPOSITION and INFORMATION ON INGREDIENTS (Continued)

CHEMICAL
NAME
CAS # mole % EXPOSURE LIMITS IN AIR
ACGIH OSHA
TLV STEL PEL STEL IDLH OTHER
ppm ppm Ppm ppm ppm ppm
Carbon Monoxide 630-08-0 0.0005 -
1.0%
25 NE 50
35
(Vacated
1989 PEL)
200 C
(Vacated
1989 PEL)
1200 NIOSH REL: 35
(TWA); 200 C
DFG MAK: 30
Nitrogen 7727-37-9 Balance There are no specific exposure limits for Nitrogen. Nitrogen is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.
NE = Not Established. C = Ceiling Limit. See Section 16 for Definitions of Terms Used.
NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This product is a colorless gas which has a rotten-egg odor (due to the presence
of Hydrogen Sulfide). The odor cannot be relied on as an adequate warning of the presence of this product,
because olfactory fatigue occurs after over-exposure to Hydrogen Sulfide. Hydrogen Sulfide and Carbon
Monoxide (another component of this gas mixture) are toxic to humans in relatively low concentrations. Overexposure
to this gas mixture can cause skin or eye irritation, nausea, dizziness, headaches, collapse, unconsciousness, coma, and death. Additionally, releases of this product may produce oxygen-deficient
atmospheres (especially in small confined spaces or other poorly-ventilated environments); individuals in such
atmospheres may be asphyxiated.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF
EXPOSURE: The most significant route of over-exposure for this
product is by inhalation.

INHALATION: Due to the small size of an individual cylinder of

this product, no unusual health effects from over-exposure to the product are anticipated under routine circumstances of use. A potential health hazard associated with this product is the potential of inhalation of Hydrogen Sulfide, a component of this gas mixture. Such over-exposures may occur if this product is used in a confined space or other poorly-ventilated area. Overexposures to Hydrogen Sulfide can cause dizziness, headache, and nausea. Over-exposure to this gas could result in respiratory arrest, coma, or unconsciousness, due to the presence of Hydrogen Sulfide. Continuous inhalation of low concentrations of Hydrogen Sulfide may cause olfactory fatigue, so that the odor is no longer an effective warning of the presence of this gas. A summary of exposure concentrations and observed effects are as follows:

CONCENTRATION OF
HYDROGEN SULFIDE OBSERVED EFFECT

0.3-30 ppm Odor is unpleasant.
50 ppm Eye irritation. Dryness and irritation of nose, throat.
Slightly higher than 50 ppm Irritation of the respiratory system.
100-150 ppm Temporary loss of smell.
200-250 ppm Headache, vomiting nausea. Prolonged exposure may lead to lung damage. Exposures of 4-8 hours can be fatal.
300-500 Swifter onset of symptoms. Death occurs in 1-4 hours.
500 ppm Headache, excitement, staggering, and stomach ache after brief exposure. Death occurs within 0.5 - 1 hour of exposure.
> 600 ppm Rapid onset of unconsciousness, coma, death.
> 1000 ppm Immediate respiratory arrest.

NOTE: This product contains a maximum of 250 ppm Hydrogen Sulfide. The higher concentration values here are presented to delineate the complete health effects which have been observed for humans after exposure to Hydrogen Sulfide.

HEALTH
FLAMMABILITY
REACTIVITY
PROTECTIVE EQUIPMENT
3
0
0
EYES RESPIRATORY HANDS BODY
(BLUE)
(RED)
(YELLOW)
For routine industrial applications
HAZARDOUS MATERIAL INFORMATION SYSTEM
B
See Section 8

3. HAZARD IDENTIFICATION (Continued)

Inhalation over-exposures to atmospheres containing more than the Threshold Limit Value of Carbon Monoxide
(25 ppm), another component of this gas mixture, can result in serious health consequences. Carbon Monoxide
is classified as a chemical asphyxiant, producing a toxic action by combining with the hemoglobin of the blood
and replacing the available oxygen. Through this replacement, the body is deprived of the required oxygen, and
asphyxiation occurs.
Since the affinity of Carbon Monoxide for hemoglobin is about 200-300 times that of oxygen, only a small
amount of Carbon Monoxide will cause a toxic reaction to occur. Carbon Monoxide exposures in excess of 50
ppm will produce symptoms of poisoning if breathed for a sufficiently long time. If this product is released in a
small, poorly ventilated area (i.e. an enclosed or confined space), symptoms which may develop include the
following:

CONCENTRATION OF
CARBON MONOXIDE OBSERVED EFFECT

All exposure levels: Over-exposure to Carbon Monoxide can be indicated by the lips and fingernails turning bright red.
200 ppm: Slight symptoms (i.e. headache) after several hours of exposure.
400 ppm: Headache and discomfort experienced within 2-3 hours of exposure.
1,000 -2000 ppm: Within 30 minutes, slight palpitations of the heart occurs. Within 1.5 hours, there is a tendency to stagger.
200-2500 ppm: Within 2 hours, there is mental confusion, headaches, and nausea. Unconsciousness within 30 minutes.
>2500 ppm: Potential for collapse and death before warning symptoms.
Additionally, if mixtures of this product contain less than 19.5% Oxygen and are released in a small, poorly
ventilated area (i.e. an enclosed or confined space), an oxygen-deficient environment may occur. Individuals
breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness,
drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. Under some circumstances of
over-exposure, death may occur. The following effects associated with various levels of oxygen are as follows:

CONCENTRATION OF OXYGEN OBSERVED EFFECT

12-16% Oxygen: Breathing and pulse rate increased, muscular coordination slightly disturbed.
10-14% Oxygen: Emotional upset, abnormal fatigue, disturbed respiration.
6-10% Oxygen: Nausea, vomiting, collapse, or loss of consciousness.
Below 6%: Convulsive movements, possible respiratory collapse, and death.

SKIN and EYE CONTACT: Hydrogen Sulfide, a component of this gas mixture, may be irritating to the skin.
Inflammation and irritation of the eyes can occur at very low airborne concentration of Hydrogen Sulfide (less
than 10 ppm). Exposure over several hours may result in “gas eyes” or “sore eyes” with symptoms of

scratchiness, irritation, tearing and burning. Above 50 ppm of Hydrogen Sulfide, there is an intense tearing,
blurring of vision, and pain when looking at light. Over-exposed individuals may see rings around bright lights.
Most symptoms disappear when exposure ceases. However, in serious cases, the eye can be permanently
damaged.
HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Over-exposure to this gas
mixture may cause the following health effects:
ACUTE: Due to the small size of the individual cylinder of this product, no unusual health effects from exposure
to the product are anticipated under routine circumstances of use. However, Hydrogen Sulfide and Carbon
Monoxide (components of this gas mixture) are toxic to humans. Over-exposure to this gas mixture can cause
nausea, dizziness, headaches, collapse, unconsciousness, coma, and death. Due to the presence of Hydrogen
Sulfide, over-exposures to this gas mixture can also irritate the skin and eyes; severe eye contamination can
result in blindness.
CHRONIC: Severe over-exposures to Hydrogen Sulfide, a component of this gas mixture, which do not result in
death, may cause long-term symptoms such as memory loss, paralysis of facial muscles, or nerve tissue
damage. In serious cases of over-exposure, the eyes can be permanently damaged. Skin disorders and
respiratory conditions may be aggravated by repeated over-exposures to this gas product. Refer to Section 11
(Toxicology Information) for additional information on the components of this product.
TARGET ORGANS: Respiratory system, blood system, central nervous system effects, cardiovascular system,
reproductive system, skin, eyes.

4. FIRST-AID MEASURES

**RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS PRODUCT WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-
Contained Breathing Apparatus must be worn.**
No unusual health effects are anticipated after exposure to this product, due to the small cylinder size. If any
adverse symptom develops after over-exposure to this product, remove victim(s) to fresh air as quickly as
possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation
if necessary.
SKIN EXPOSURE: If irritation of the skin develops after exposure to this gas mixture, immediately begin

decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated
clothing, taking care not to contaminate eyes. Victim must seek immediate medical attention.
EYE EXPOSURE: If irritation of the eye develops after exposure to this gas mixture, open victim's eyes while
under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for
15 minutes. Seek medical assistance immediately, preferably an ophthalmologist.
Victim(s) who experience any adverse effect after over-exposure to this product must be taken for medical
attention. Rescuers should be taken for medical attention if necessary. Take a copy of the label and the MSDS
to physician or other health professional with victim(s).

5. FIRE-FIGHTING MEASURES

FLASH POINT, (method): Not applicable.
AUTOIGNITION TEMPERATURE: Not applicable.
FLAMMABLE LIMITS (in air by volume, %):
Lower (LEL): Not applicable.
Upper (UEL): Not applicable.
FIRE EXTINGUISHING MATERIALS: Non-flammable gas
mixture. Use extinguishing media appropriate for surrounding fire.
UNUSUAL FIRE AND EXPLOSION HAZARDS: This gas mixture
contains toxic gases, Hydrogen Sulfide and Carbon Monoxide,
and presents an health hazard to firefighters. This gas mixture is
not flammable; however, containers, when involved in fire, may
rupture or burst in the heat of the fire.
Explosion Sensitivity to Mechanical Impact: Not Sensitive.
Explosion Sensitivity to Static Discharge: Not Sensitive.
SPECIAL FIRE-FIGHTING PROCEDURES: Structural firefighters must wear Self-Contained Breathing
Apparatus and full protective equipment.

6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Due to the small size and content of the cylinder, an accidental release of this product
presents significantly less risk of over-exposure to Hydrogen Sulfide and Carbon Monoxide, the toxic
components of this product, and other safety hazards related to the remaining components of this product, than a
similar release from a larger cylinder. However, as with any chemical release, extreme caution must be used
during emergency response procedures. In the event of a release in which the atmosphere is unknown, and in
which other chemicals are potentially involved, evacuate immediate area. Such releases should be responded to
by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a
leak, clear the affected area, protect people, and respond with trained personnel.
For emergency disposal, secure the cylinder and slowly discharge the gas to the atmosphere in a well-ventilated

area or outdoors. Allow the gas mixture to dissipate. If necessary, monitor the surrounding area (and the original
area of the release) for Hydrogen Sulfide, Carbon Monoxide, and Oxygen. Hydrogen Sulfide and Carbon
Monoxide level must be below exposure level listed in Section 2 (Composition and Information on Ingredients)
and Oxygen levels must be above 19.5% before non-emergency personnel are allowed to re-enter area.
If leaking incidentally from the cylinder, contact your supplier.
4
0
0 **HEALTH**
FLAMMABILITY
REACTIVITY
OTHER
NFPA RATING

7. HANDLING and USE

WORK PRACTICES AND HYGIENE PRACTICES: Be aware of any signs of dizziness or fatigue, especially if
work is done in a poorly ventilated area; exposures to fatal concentrations of this product could occur without any
significant warning symptoms, due to olfactory fatigue or oxygen deficiency. Do not attempt to repair, adjust, or
in any other way modify cylinders containing a gas mixture with Hydrogen Sulfide or Carbon Monoxide. If there
is a malfunction or another type of operational problem, contact nearest distributor immediately. Eye wash
stations/safety showers should be near areas where this product is used or stored. All work operations should be
monitored in such a way that emergency personnel can be immediately contacted in the event of a release. All
work practices should minimize releases of Hydrogen Sulfide and Carbon Monoxide-containing gas mixtures.
STORAGE AND HANDLING PRACTICES: Cylinders should be firmly secured to prevent falling or being
knocked-over. Cylinders must be protected from the environment, and preferably kept at room temperature
(approximately 21°C, 70°F). Cylinders should be stored in dry, well-ventilated areas, away from sources of heat,
ignition, and direct sunlight. Protect cylinders against physical damage.
Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full
containers from being stored for long periods of time. These cylinders are not refillable.
WARNING! Do not
refill DOT 39 cylinders. To do so may cause personal injury or property damage.
SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: WARNING! Compressed gases can present
significant safety hazards. During cylinder use, use equipment designed for these specific cylinders. Ensure all
lines and equipment are rated for proper service pressure.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices
indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and
tagged-out safely. Always use product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: No special ventilation systems or engineering controls are
needed under normal circumstances of use. As with all chemicals, use this product in well-ventilated areas. If
this product is used in a poorly-ventilated area, install automatic monitoring equipment to detect the levels of
Oxygen, Hydrogen Sulfide, and Carbon Monoxide.

RESPIRATORY PROTECTION: No special respiratory protection is required under normal circumstances of
use. Use supplied air respiratory protection if Carbon Monoxide levels exceed the exposure levels given in
Section 2 (Composition and Information on Ingredients) or if oxygen levels are below 19.5%, or if either level is
unknown during emergency response to a release of this product. If respiratory protection is required for
emergency response to this product, follow the requirements of the Federal OSHA Respiratory Protection
Standard (29 CFR 1910.134) or equivalent State standards. The following NIOSH respiratory protection
recommendations for Hydrogen Sulfide and Carbon Monoxide are provided for further information.

NIOSH/OSHA RECOMMENDATIONS FOR HYDROGEN SULFIDE CONCENTRATIONS IN AIR:

UP TO 100 ppm: Powered air-purifying respirator with cartridge(s) to protect against hydrogen sulfide;
gas mask with canister to protect against hydrogen sulfide; or SAR; or full-facepiece SCBA.

Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive pressure, full-facepiece
SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.

Escape: Gas mask with canister to protect against hydrogen sulfide; or escape-type SCBA

NOTE: The IDLH concentration for Hydrogen Sulfide is 100 ppm.

NIOSH/OSHA RECOMMENDATIONS FOR CARBON MONOXIDE CONCENTRATIONS IN AIR:

UP TO 350 ppm Supplied Air Respirator (SAR)

UP TO 875 ppm Supplied Air Respirator (SAR) operated in a continuous flow mode.

UP TO 1200 ppm Gas mask with canister to protect against carbon monoxide; or full-facepiece SCBA; or
full-facepiece Supplied Air Respirator (SAR).

Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive pressure, full-facepiece
SCBA; or positive pressure, full-facepiece Supplied Air Respirator (SAR) with an auxiliary positive pressure SCBA.

Escape: Gas mask with canister to protect against carbon monoxide; or escape-type SCBA.
NOTE: End of Service Life Indicator (ESLI) required for gas masks.
NOTE: The IDLH concentration for Carbon Monoxide is 1200 ppm.
EYE PROTECTION: Safety glasses.
HAND PROTECTION: No special protection is needed under normal circumstances of use.
BODY PROTECTION: No special protection is needed under normal circumstances of use.

9. PHYSICAL and CHEMICAL PROPERTIES

Unless otherwise specified, the following information is for Nitrogen, the main component of this gas mixture.
GAS DENSITY @ 32°F (0°C) and 1 atm: .072 lbs/ ft^3 (1.153 kg/m^3)
BOILING POINT: -320.4°F (-195.8°C)
FREEZING/MELTING POINT @ 10 psig: -345.8°F (-210°C)
SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 0.906 **pH**: Not applicable.
SOLUBILITY IN WATER vol/vol @ 32°F (0°C) and 1 atm: 0.023 **MOLECULAR WEIGHT:** 28.01
EVAPORATION RATE (nBuAc = 1): Not applicable. **EXPANSION RATIO:** Not applicable.
ODOR THRESHOLD: 0.13 ppm (Hydrogen Sulfide) **SPECIFIC VOLUME (ft^3/lb)**: 13.8
VAPOR PRESSURE @ 70°F (21.1°C) (psig): Not applicable.
COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.
APPEARANCE AND COLOR: This product is a colorless gas which has an rotten egg-like odor, due to the presence of Hydrogen Sulfide.
HOW TO DETECT THIS SUBSTANCE (warning properties): Continuous inhalation of low concentrations of Hydrogen Sulfide (a component of this gas mixture) may cause olfactory fatigue, so that there are no distinct warning properties. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation. Wet lead acetate paper can be used for leak detection.
The paper turns black in the presence of Hydrogen Sulfide. Cadmium chloride solutions can also be used.
Cadmium solutions will turn yellow upon contact with Hydrogen Sulfide.

10. STABILITY and REACTIVITY

STABILITY: Normally stable in gaseous state.
DECOMPOSITION PRODUCTS: The thermal decomposition products of Methane include carbon oxides. The decomposition products of Hydrogen Sulfide include water and sulfur oxides. The other components of this gas mixture do not decompose, per se, but can react with other compounds in the heat of a fire.
MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Titanium will burn in Nitrogen (the main component of this product). Lithium reacts slowly with Nitrogen at ambient temperatures. Components of this product (Hydrogen Sulfide, Methane) are also incompatible with strong oxidizers (i.e. chlorine, bromine

pentafluoride, oxygen, oxygen difluoride, and nitrogen trifluoride). Carbon Monoxide is mildly corrosive to nickel
and iron (especially at high temperatures and pressures). Hydrogen Sulfide is corrosive to most metals, because
it reacts with these substances to form metal sulfides.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials. Cylinders exposed to high temperatures or
direct flame can rupture or burst.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicology data are available for the components of this product:

NITROGEN: There are no specific toxicology data for Nitrogen.
Nitrogen is a simple asphyxiant, which acts to displace oxygen in the
environment.

METHANE: There are no specific toxicology data for Methane.
Methane is a simple asphyxiant, which acts to displace oxygen in the
environment.

HYDROGEN SULFIDE:
LCLo (inhalation, human) = 600 ppm/30 minutes
LDLO (inhalation, man) = 5.7 mg/kg; central nervous system,
pulmonary effects
LCLo (inhalation, human) = 800 ppm/5 minutes
LC_{50} (inhalation, rat) = 444 ppm
LC_{50} (inhalation, mouse) = 673 ppm/1 hour
LCLo (inhalation, mammal) = 800 ppm/5 minutes

CARBON MONOXIDE:
TCLo (inhalation, mouse) = 65 ppm/24 hours (7-18 preg): rep. effects
TCLo (inhalation, mouse) = 8 pph/1 hour (female 8D post): ter. effects
TCLo (inhalation, human) = 600 mg/m^3/10 minutes
LCLo (inhalation, man) = 4000 ppm/30 minutes
TCLo (inhalation, man) = 650 ppm/45 minutes: central nervous system
and blood system effects.
LCLo (inhalation, human) = 5000 ppm/5 minutes
LCLo (inhalation, dog) = 4000 ppm/46 minutes
LCLo (inhalation, rabbit) = 4000 ppm
LC_{50} (inhalation, rat) = 1811 ppm/4 hours
LC_{50} (inhalation, guinea pig) = 2450 ppm/4 hours
LC_{50} (inhalation, guinea pig) = 5718 ppm/4 hours
LCLo (inhalation, mammal) = 5000 ppm/5 minutes
LD_{50} (inhalation, wild bird) = 1334 ppm

11. TOXICOLOGICAL INFORMATION (Continued)

SUSPECTED CANCER AGENT: The components of this gas mixture are not found on the following lists:
FEDERAL OSHA Z LIST, NTP, CAL/OSHA, and IARC; therefore, they are not considered to be, nor suspected to
be, cancer-causing agents by these agencies.

IRRITANCY OF PRODUCT: Hydrogen Sulfide, a component of this gas mixture, is irritating to the eyes, and
may be irritating to the skin.

SENSITIZATION OF PRODUCT: The components of this gas mixture are not known to be skin or respiratory
sensitizers.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of this gas
mixture on the human reproductive system.

Mutagenicity: This gas mixture is not expected to cause mutagenic effects in humans.
Embryotoxicity: This gas mixture contains components that may cause embryotoxic effects in humans; however,
due to the small total amount of the components, embryotoxic effects are not expected to occur.
Teratogenicity: This gas mixture is not expected to cause teratogenic effects in humans due to the small cylinder
size and small total amount of all components. Carbon Monoxide, a component of this gas mixture which
exists up to 1%, can cause teratogenic effects in humans. Severe exposure to Carbon Monoxide during
pregnancy has caused adverse effects and the death of the fetus. In general, maternal symptoms are an
indicator of the potential risk to the fetus since Carbon Monoxide is toxic to the mother before it is toxic to the
fetus.
Reproductive Toxicity: This gas mixture is not expected to cause adverse reproductive effects in humans.
A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will
propagate through generation lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e.
within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A
teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across
generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing respiratory conditions may be
aggravated by over-exposure to this product. Carbon Monoxide, a component of this gas mixture, can aggravate
some diseases of the cardiovascular system, such as coronary artery disease and angina pectoris. Because of
the presence of Hydrogen Sulfide, eye disorders or skin problems may be aggravated by over-exposure to this
product.
RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate over-exposure. Hyperbaric oxygen is
the most efficient antidote to Carbon Monoxide poisoning, the optimum range being 2-2.5 atm. A special mask,
or, preferably, a compression chamber to utilize oxygen at these pressures is required. Avoid administering
stimulant drugs. Be observant for initial signs of pulmonary edema in the event of severe inhalation overexposures.
BIOLOGICAL EXPOSURE INDICES (BEIs): Biological Exposure Indices (BEIs) are applicable for this product,
as follows:
BIOLOGICAL EXPOSURE INDICES (BEIs) for components of this product are as follows:
CHEMICAL DETERMINANT SAMPLING TIME BEI
CARBON MONOXIDE
• Carboxyhemoglobin in blood
• Carbon monoxide in end-exhaled air

• End of shift
• End of shift
• 3.5% of hemoglobin
• 20 ppm

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: The gas will be dissipated rapidly in well-ventilated areas. The following environmental data are applicable to the components of this product.

HYDROGEN SULFIDE: Water Solubility = 1 g/242 mL at 20☜C.

CARBON MONOXIDE: Water solubility = 3.3 ml/100 cc at 0 ☜C, 2.3 ml at 20°C.

NITROGEN: Water Solubility = 2.4 volumes Nitrogen/100 volumes water at 0°C; 1.6 volumes Nitrogen/100 volumes water at 20°C.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: No evidence is currently available on this product's effects on plant and animal life. Hydrogen Sulfide and Carbon Monoxide, components of this product, can be deadly to exposed animal life, producing symptoms similar to those experienced by humans. This gas mixture may also be harmful to plant life.

12. ECOLOGICAL INFORMATION (Continued)

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on this product's effects on aquatic life. The presence of more than a trace of Carbon Monoxide (a component of this product) is a hazard to fish. The following aquatic toxicity data are available for Hydrogen Sulfide (another component of this gas mixture):

TLm (Asellussp) = 0.111 mg/L/96 hour
TLm (Cranfgonyx sp) =1.07 mg/L/96 hour
TLm (Gammarrus) = 0.84 mg/L/96 hour
LC_{50} (fly inhalation) = 380 mg/m^3/960 minutes
LC_{50} (fly inhalation) = 1500 mg/m^3/7 minutes
TLm (Lepomis macrochirus, bluegill sunfish) = 0.0478 mg/L/96 hour
TLm (Lepomis macrochirus, bluegill sunfish) = 0.0448 mg/L/96 hour at 21-22 °C
TLm (Pimephlaes promelas, fathead minnow) = 0.0071-0.55 mg/L/96 hour
TLm (Salvenilis foninalis, brook trout) = 0.0216-0.038 mg/L/96 hour at 8-12.5 °C

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Cylinders with undesired residual product may be safely vented outdoors with the proper regulator. For further information, refer to Section 16 (Other Information).

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Compressed gases, n.o.s. (Nitrogen, Hydrogen Sulfide)

HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)
UN IDENTIFICATION NUMBER: UN 1956
PACKING GROUP: Not applicable.
DOT LABEL(S) REQUIRED: Non-Flammable Gas
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 126
MARINE POLLUTANT: The components of this gas mixture are not classified by the DOT as Marine Pollutants
(as defined by 49 CFR 172.101, Appendix B).
SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated
vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles can present
serious safety hazards. If transporting these cylinders in vehicles, ensure these cylinders are not exposed to
extremely high temperatures (as may occur in an enclosed vehicle on a hot day). Additionally, the vehicle
should be well-ventilated during transportation.
Note: DOT 39 Cylinders ship in a strong outer carton (overpack). Pertinent shipping information goes on the
outside of the overpack. DOT 39 Cylinders do not have transportation information on the cylinder itself.
TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS
CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian
Shipments.

15. REGULATORY INFORMATION

SARA REPORTING REQUIREMENTS: This product is subject to the reporting requirements of Sections 302,
304, and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

COMPONENT	SARA 302	SARA 304	SARA 313
Oxygen	NO	NO	NO
Methane	NO	NO	NO
Carbon Monoxide	NO	NO	NO
Nitrogen	NO	NO	NO
Hydrogen Sulfide	YES	YES	YES

SARA THRESHOLD PLANNING QUANTITY: Hydrogen Sulfide = 500 lbs.
TSCA INVENTORY STATUS: The components of this gas mixture are listed on the TSCA Inventory.
CERCLA REPORTABLE QUANTITY (RQ): Hydrogen Sulfide = 100 lbs.
OTHER U.S. FEDERAL REGULATIONS:
• Hydrogen Sulfide and Carbon Monoxide are subject to the reporting requirements of CFR 29 1910.1000.

• Hydrogen Sulfide and Methane are subject to the reporting requirements of Section 112(r) of the Clean Air
Act. The Threshold Quantity for each of these gases is 10,000 pounds and so this mixture will not be
affected by the regulation.

15. REGULATORY INFORMATION (Continued)

OTHER U.S. FEDERAL REGULATIONS (Continued):
• Depending on specific operations involving the use of this gas mixture, the regulations of the Process Safety
Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Hydrogen Sulfide is
listed in Appendix A of this regulation. The Threshold Quantity for Hydrogen Sulfide under this regulation
is 1500 lbs (and so one cylinder of this product will not be affected by this regulation).
• This gas mixture does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82).
• Nitrogen and Oxygen are not listed Regulated Substances, per 40 CFR, Part 68, of the Risk Management for
Chemical Releases. Hydrogen Sulfide is listed under this regulation in Table 1 as a Regulated Substance
(Toxic Substance), in quantities of 10,000 lbs (4,553 kg) or greater. Carbon Monoxide and Methane are
listed under this regulation in Table 3, as Regulated Substances (Flammable), in quantities of 10,000 lbs
(4,553 kg) or greater, and so this mixture will not be affected by the regulation.
OTHER CANADIAN REGULATIONS: This gas mixture is categorized as a Controlled Product, Hazard Classes
A and D2A, as per the Controlled Product Regulations.
STATE REGULATORY INFORMATION: The components of this gas mixture are covered under the following
specific State regulations:
**Alaska - Designated Toxic and
Hazardous Substances: Carbon
Monoxide, Hydrogen Sulfide,
Methane.
California - Permissible Exposure
Limits for Chemical Contaminants:
Carbon Monoxide, Nitrogen,
Hydrogen Sulfide, Methane.
Florida - Substance List: Oxygen,
Carbon Monoxide, Hydrogen Sulfide
Illinois - Toxic Substance List:
Carbon Monoxide, Methane,
Hydrogen Sulfide.
Kansas - Section 302/313 List: No.
Massachusetts - Substance List:
Oxygen, Carbon Monoxide,
Hydrogen Sulfide, Methane.
Minnesota - List of Hazardous
Substances: Carbon Monoxide,
Hydrogen Sulfide, Methane.
Missouri - Employer Information/Toxic
Substance List t: Hydrogen Sulfide,
Methane.
New Jersey - Right to Know
Hazardous Substance List: Oxygen,
Carbon Monoxide, Nitrogen,
Methane.
North Dakota - List of Hazardous
Chemicals, Reportable Quantities:
Hydrogen Sulfide.
Pennsylvania - Hazardous Substance
List: Oxygen, Carbon Monoxide,
Nitrogen, Hydrogen Sulfide,
Methane.
Rhode Island - Hazardous Substance
List: Oxygen, Carbon Monoxide,**

Nitrogen, Hydrogen Sulfide,
Methane.
Texas - Hazardous Substance List:
Hydrogen Sulfide.
West Virginia - Hazardous Substance
List: Hydrogen Sulfide.
Wisconsin - Toxic and Hazardous
Substances: Hydrogen Sulfide
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CALIFORNIA PROPOSITION 65: Carbon Monoxide (a component of this product) is on the California
Proposition 65 lists as a chemical known to the State of California to cause birth defects or other reproductive
harm.

16. OTHER INFORMATION

INFORMATION ABOUT DOT-39 NRC (Non-Refillable Cylinder) PRODUCTS

DOT 39 cylinders ship as hazardous materials when full. Once the cylinders are relieved of pressure (empty)
they are not considered hazardous material or waste. Residual gas in this type of cylinder is not an issue
because toxic gas mixtures are prohibited. Calibration gas mixtures typically packaged in these cylinders are
Nonflammable n.o.s., UN 1956. A small percentage of calibration gases packaged in DOT 39 cylinders are
flammable or oxidizing gas mixtures.
For disposal of used DOT-39 cylinders, it is acceptable to place them in a landfill if local laws permit. Their
disposal is no different than that employed with other DOT containers such as spray paint cans, household
aerosols, or disposable cylinders of propane (for camping, torch etc.). When feasible, we recommended
recycling for scrap metal content. Air Liquide America will do this for any customer that wishes to return
cylinders to us prepaid. All that is required is a phone call to make arrangements so we may anticipate arrival.
Scrapping cylinders involves some preparation before the metal dealer may accept them. We perform this
operation as a service to valued customers who want to participate.

16. OTHER INFORMATION (Continued)

MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to
create additional, unexpected hazards. Obtain and evaluate the safety information for each component before
you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety
evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or
death.
Further information about the handling of compressed gases can be found in the following pamphlets published

by: Compressed Gas Association Inc. (CGA), 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-
4102. Telephone: (703) 412-0900.
P-1 "Safe Handling of Compressed Gases in Containers"
AV-1 "Safe Handling and Storage of Compressed Gases"
"Handbook of Compressed Gases"

PREPARED BY: CHEMICAL SAFETY ASSOCIATES, Inc.
9163 Chesapeake Drive, San Diego, CA 92123-1002
619/565-0302
Fax on Demand: 1-800/231-1366

This Material Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard, 29 CFR, 1910.1200. Other government regulations must be reviewed for applicability to this product. To the best of Air Liquide America Corporation's knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness are not guaranteed and no warranties of any type, either express or implied, are provided. The information contained herein relates only to this specific product. If this product is combined with other materials, all component properties must be considered. Data may be changed from time to time. Be sure to consult the latest edition.

PENTANE

1. Product Identification

Synonyms: Normal Pentane; n-Pentane; Amyl hydride
CAS No.: 109-66-0
Molecular Weight: 72.15
Chemical Formula: CH3(CH2)3CH3
Product Codes:
J.T. Baker: 9331, 9333, T007
Mallinckrodt: 1916, 6145, 6172, V557

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Pentane	109-66-0	98 - 100%	Yes

3. Hazards Identification

Emergency Overview

DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED. AFFECTS CENTRAL NERVOUS SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.

Potential Health Effects

Inhalation:
Vapors have a mild narcotic effect. Symptoms of overexposure may include drowsiness and irritation of the respiratory passages. Greater exposure may cause unconsciousness and death.
Ingestion:
Tends to vaporize when swallowed causing aspiration into the lungs. The result can be a rapid fall in oxygen content with asphyxia and consequent brain damage or cardiac arrest.
Skin Contact:
Causes skin irritation, cracking or flaking due to dehydration and defatting action.
Eye Contact:
Very high vapor concentrations and liquid may cause irritation, redness, and pain.
Chronic Exposure:

Prolonged skin contact may cause drying, cracking, and dermatitis.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin conditions or impaired respiratory function may be more susceptible to the effects of this substance.

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4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Call a physician immediately.
Skin Contact:
Remove any contaminated clothing. Wash skin with soap or mild detergent and water for at least 15 minutes. Wash clothes before reuse. Get medical attention if irritation develops or persists.
Eye Contact:
Wash thoroughly with running water. Get medical advice if irritation develops.

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5. Fire Fighting Measures

Fire:
Flash point: -49C (-56F) CC
Autoignition temperature: 260C (500F)
Flammable limits in air % by volume:
lel: 1.5; uel: 7.8
Extremely Flammable Liquid and Vapor! Vapor may cause flash fire.
Explosion:
Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Vapors can flow along surfaces to distant ignition source and flash back. Sensitive to static discharge.
Fire Extinguishing Media:
Dry chemical, foam or carbon dioxide. Water may be ineffective. Water spray may be used to keep fire exposed containers cool.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. This highly flammable liquid must be kept from sparks, open flame, hot surfaces, and all sources of heat and ignition. Vapor explosion hazard exists indoors, outdoors, or in sewers.

---

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and

unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures.

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

---

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. DANGER! DO NOT OPEN Unless Contents Are At Room temperature (72F) or Below. Allow at least 24 hours for material to cool to room temperature before opening container. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
1000 ppm (TWA)
-ACGIH Threshold Limit Value (TLV):
600 ppm (TWA)
NIOSH (REL) TWA 350 mg/m3, 1800 mg/m3Ceiling
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134). This substance has questionable warning properties.
Skin Protection:
Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure.
Eye Protection:

Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:
Clear, colorless solution.
Odor:
Mild, gasoline-like.
Solubility:
Insoluble in water.
Specific Gravity:
0.63 20C/4C
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
36C (97F)
Melting Point:
-130C (-202F)
Vapor Density (Air=1):
2.5
Vapor Pressure (mm Hg):
426 @ 20C (68F)
Evaporation Rate (BuAc=1):
28.6

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong oxidizers.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

---

11. Toxicological Information

Inhalation, rat, LC50: 364 g/m3/4H

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--------\Cancer Lists\----------------------------------------------------
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Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Pentane (109-66-0)	No	No	None

12. Ecological Information

Environmental Fate:
When released into the soil, this material may biodegrade to a moderate extent. When released into the soil, this material is not expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material may biodegrade to a moderate extent. When released to water, this material is expected to quickly evaporate. When released into the water, this material is expected to have a half-life of less than 1 day. This material has an estimated bioconcentration factor (BCF) of less than 100. This material has a log octanol-water partition coefficient of greater than 3.0. This material is not expected to significantly bioaccumulate. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life between 1 and 10 days.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: PENTANES
Hazard Class: 3
UN/NA: UN1265
Packing Group: II
Information reported for product/size: 20L

International (Water, I.M.O.)

Proper Shipping Name: PENTANES
Hazard Class: 3
UN/NA: UN1265

Packing Group: II
Information reported for product/size: 20L

---

15. Regulatory Information

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  --------\Chemical Inventory Status - Part 1\----------------------------

  Ingredient                                        TSCA  EC   Japan
Australia
  ----------------------------------------------  ----  ---  -----  -----
  Pentane (109-66-0)                                Yes  Yes   Yes    Yes

  --------\Chemical Inventory Status - Part 2\----------------------------
                                                            --Canada--
  Ingredient                                        Korea  DSL   NDSL
Phil.
  ----------------------------------------------  -----  ---   ----  ----

  Pentane (109-66-0)                                Yes   Yes   No     Yes

  --------\Federal, State & International Regulations - Part 1\-----------

                                              -SARA 302-    ------SARA 313-

  Ingredient                                  RQ    TPQ     List  Chemical
Catg.
  ----------------------------------------  ---   -----   ----  ---------

  Pentane (109-66-0)                          No    No      No         No

  --------\Federal, State & International Regulations - Part 2\-----------

                                                          -RCRA-    -TSCA-
  Ingredient                                  CERCLA     261.33     8(d)
  ----------------------------------------  ------     ------    ------
  Pentane (109-66-0)                          No         No         Yes


Chemical Weapons Convention:  No     TSCA 12(b):  Yes    CDTA:  No
SARA 311/312:  Acute: Yes      Chronic: Yes  Fire: Yes Pressure: Yes
Reactivity: No          (Pure / Liquid)
```

Australian Hazchem Code: 3[Y]E
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **1** Flammability: **4** Reactivity: **0**

Label Hazard Warning:

DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED. AFFECTS CENTRAL NERVOUS SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.

Label Precautions:

Keep away from heat, sparks and flame.
Keep container closed.
Use only with adequate ventilation.
Avoid breathing vapor or mist.
Avoid contact with eyes, skin and clothing.
Wash thoroughly after handling.
DO NOT OPEN Unless Contents Are At Room Temperature (72F) or Below For At Least 24 Hours.

Label First Aid:

Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. In all cases, get medical attention.

Product Use:

Laboratory Reagent.

HEXANE

1. Product Identification

Synonyms: Hexanes,Normal Hexane; Hexyl Hydride; Hexane 95%
CAS No.: 110-54-3 (n-hexane)
Molecular Weight: 86.18
Chemical Formula: CH3(CH2)4CH3 n-hexane
Product Codes: 9262, 9304, 9308, N168

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Hexane	110-54-3	85 - 100%	Yes
Methylcyclopentane	96-37-7	1 - 2%	Yes
Trace amount of Benzene (10 ppm)	071-43-2	*	No

3. Hazards Identification

Emergency Overview

DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE CENTRAL AND PERIPHERAL NERVOUS SYSTEMS.

Potential Health Effects

The health hazards addressed are for the major component: n-hexane.

Inhalation:
Inhalation of vapors irritates the respiratory tract. Overexposure may cause lightheadedness, nausea, headache, and blurred vision. Greater exposure may cause muscle weakness, numbness of the extremities, unconsciousness and death.
Ingestion:
May produce abdominal pain, nausea. Aspiration into lungs can produce severe lung damage

and is a medical emergency. Other symptoms expected to parallel inhalation.
Skin Contact:
May cause redness, irritation, with dryness, cracking.
Eye Contact:
Vapors may cause irritation. Splashes may cause redness and pain.
Chronic Exposure:
Repeated or prolonged skin contact may defat the skin and produce irritation and dermatitis. Chronic inhalation may cause peripheral nerve disorders and central nervous system effects.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance. May affect the developing fetus.

---

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Remove any contaminated clothing. Wipe off excess from skin. Wash skin with soap and water for at least 15 minutes. Get medical attention if irritation develops or persists.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:
BEI=2,5-hexadione in urine, sample at end of shift at workweeks end, 5 mg/g creatine. Also, measure n-hexane in expired air. Analgesics may be necessary for pain management, there is no specific antidote. Monitor arterial blood gases in cases of severe aspiration.

---

5. Fire Fighting Measures

Fire:
Flash point: -23C (-9F) CC
Autoignition temperature: 224C (435F)
Flammable limits in air % by volume:
lel: 1.2; uel: 7.7
Extremely Flammable Liquid and Vapor! Vapor may cause flash fire. Dangerous fire hazard when exposed to heat or flame.
Explosion:
Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Contact with oxidizing materials may cause extremely violent combustion.Explodes when mixed @ 28C with dinitrogen tetraoxide. Sensitive to static discharge.

Fire Extinguishing Media:
Dry chemical, foam or carbon dioxide. Water may be ineffective.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Water spray may be used to keep fire exposed containers cool. Vapors can flow along surfaces to distant ignition source and flash back. Vapor explosion hazard exists indoors, outdoors, or in sewers.

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6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

---

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from direct sunlight and any area where the fire hazard may be acute. Store in tightly closed containers (preferably under nitrogen atmosphere). Outside or detached storage is preferred. Inside storage should be in a standard flammable liquids storage room or cabinet. Separate from oxidizing materials. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
N-Hexane [110-54-3]:
-OSHA Permissible Exposure Limit (PEL): 500 ppm (TWA)
-ACGIH Threshold Limit Value (TLV): 50 ppm (TWA), Skin
other isomers of hexane
-ACGIH Threshold Limit Value (TLV): 500 ppm (TWA),1000ppm (STEL)
Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134).

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:

Clear, colorless liquid.

Odor:

Light odor.

Solubility:

Insoluble in water.

Specific Gravity:

0.66

pH:

No information found.

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

ca. 68C (ca. 154F)

Melting Point:

ca. -95C (ca. -139F)

Vapor Density (Air=1):

3.0

Vapor Pressure (mm Hg):

130 @ 20C (68F)

Evaporation Rate (BuAc=1):

9

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10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Heat will contribute to instability.

Hazardous Decomposition Products:
May produce acrid smoke and irritating fumes when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong oxidizers.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

---

11. Toxicological Information

N-Hexane: Oral rat LD50: 28710 mg/kg. Irritation eye rabbit: 10 mg mild. Investigated as a tumorigen, mutagen and reproductive effector.

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  --------\Cancer Lists\-------------------------------------------------

                                          ---NTP Carcinogen---
  Ingredient                              Known    Anticipated    IARC
Category
  ------------------------------------    -----    -----------    ---------

  Hexane (110-54-3)                        No          No            None
  Methylcyclopentane (96-37-7)             No          No            None
  Trace amount of Benzene  (10 ppm)        Yes         No              1
  (071-43-2)
```

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12. Ecological Information

Environmental Fate:
When released into the soil, this material may biodegrade to a moderate extent. When released into the soil, this material is not expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material may biodegrade to a moderate extent. When released to water, this material is expected to quickly evaporate. When released into the water, this material is expected to have a half-life between 1 and 10 days. This material has an estimated bioconcentration factor (BCF) of less than 100. This material has a log octanol-water partition coefficient of greater than 3.0. This material is not expected to significantly bioaccumulate. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life between 1 and 10 days.
Environmental Toxicity:
No information found.

---

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options.

State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

---

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: HEXANES
Hazard Class: 3
UN/NA: UN1208
Packing Group: II
Information reported for product/size: 215L

International (Water, I.M.O.)

Proper Shipping Name: HEXANES
Hazard Class: 3
UN/NA: UN1208
Packing Group: II
Information reported for product/size: 215L

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15. Regulatory Information

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  --------\Chemical Inventory Status - Part 1\----------------------------

  Ingredient                                          TSCA  EC   Japan
Australia
  ------------------------------------------------  ----  ---  -----  -----

  Hexane (110-54-3)                                   Yes  Yes   Yes    Yes
  Methylcyclopentane (96-37-7)                        Yes  Yes   No     Yes
  Trace amount of Benzene  (10 ppm) (071-43-2)        Yes  Yes   Yes    Yes

  --------\Chemical Inventory Status - Part 2\----------------------------

                                                                --Canada--
  Ingredient                                          Korea  DSL   NDSL
Phil.
  ------------------------------------------------  -----  ---   ----  ----

  Hexane (110-54-3)                                   Yes   Yes   No     Yes
  Methylcyclopentane (96-37-7)                        Yes   Yes   No     Yes
  Trace amount of Benzene  (10 ppm) (071-43-2)        Yes   Yes   No     Yes

  --------\Federal, State & International Regulations - Part 1\-----------

                                                -SARA 302-    ------SARA 313-

  Ingredient                                    RQ    TPQ     List  Chemical
Catg.
```

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  ----------------------------------------  ---   -----   ----  ---------

  Hexane (110-54-3)                          No    No      Yes        No
  Methylcyclopentane (96-37-7)               No    No      No         No
  Trace amount of Benzene  (10 ppm)          No    No      Yes        No
  (071-43-2)

  --------\Federal, State & International Regulations - Part 2\-----------

                                                          -RCRA-    -TSCA-
  Ingredient                                 CERCLA     261.33     8(d)
  ----------------------------------------  ------     ------    ------
  Hexane (110-54-3)                          5000       No         No
  Methylcyclopentane (96-37-7)               No         No         No
  Trace amount of Benzene  (10 ppm)          10         U019       No
  (071-43-2)

Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: Yes      Chronic: Yes  Fire: Yes Pressure: No
Reactivity: No          (Mixture / Liquid)
```

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: 3[Y]E
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **1** Flammability: **3** Reactivity: **0**
Label Hazard Warning:
DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE CENTRAL AND PERIPHERAL NERVOUS SYSTEMS.
Label Precautions:
Keep away from heat, sparks and flame.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Avoid breathing vapor or mist.
Avoid contact with eyes, skin and clothing.
Label First Aid:
Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give

oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. In all cases call a physician.

Product Use:

Laboratory Reagent.

SULFURIC ACID, 52 - 100 %

1. Product Identification

Synonyms: Oil of vitriol; Babcock acid; sulphuric acid
CAS No.: 7664-93-9
Molecular Weight: 98.08
Chemical Formula: H2SO4 in H2O
Product Codes:
J.T. Baker: 5030, 5137, 5374, 5802, 5815, 5858, 5859, 5868, 5889, 5897, 5961, 5971, 5997, 6902, 9671, 9673, 9674, 9675, 9676, 9679, 9680, 9681, 9682, 9684, 9687, 9691, 9693, 9694
Mallinckrodt: 21201, 2468, 2876, 2878, 2900, 2904, 3780, 4222, 5524, 5557, H644, H850, H976, H996, V651, XL003

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Sulfuric Acid	7664-93-9	52 - 100%	Yes
Water	7732-18-5	0 - 48%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR CONTACTED WITH SKIN. HARMFUL IF INHALED. AFFECTS TEETH. WATER REACTIVE. CANCER HAZARD. STRONG INORGANIC ACID MISTS CONTAINING SULFURIC ACID CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.

Potential Health Effects

Inhalation:
Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. Symptoms may include irritation of the nose and throat, and labored breathing. May cause lung edema, a medical emergency.

Ingestion:
Corrosive. Swallowing can cause severe burns of the mouth, throat, and stomach, leading to death. Can cause sore throat, vomiting, diarrhea. Circulatory collapse with clammy skin, weak and rapid pulse, shallow respirations, and scanty urine may follow ingestion or skin contact. Circulatory shock is often the immediate cause of death.
Skin Contact:
Corrosive. Symptoms of redness, pain, and severe burn can occur. Circulatory collapse with clammy skin, weak and rapid pulse, shallow respirations, and scanty urine may follow skin contact or ingestion. Circulatory shock is often the immediate cause of death.
Eye Contact:
Corrosive. Contact can cause blurred vision, redness, pain and severe tissue burns. Can cause blindness.
Chronic Exposure:
Long-term exposure to mist or vapors may cause damage to teeth. Chronic exposure to mists containing sulfuric acid is a cancer hazard.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

---

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician immediately.
Ingestion:
DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Call a physician immediately.
Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Excess acid on skin can be neutralized with a 2% solution of bicarbonate of soda. Call a physician immediately.
Eye Contact:
Immediately flush eyes with gentle but large stream of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Call a physician immediately.

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5. Fire Fighting Measures

Fire:
Concentrated material is a strong dehydrating agent. Reacts with organic materials and may cause ignition of finely divided materials on contact.
Explosion:
Contact with most metals causes formation of flammable and explosive hydrogen gas.
Fire Extinguishing Media:
Dry chemical, foam or carbon dioxide. Do not use water on material. However, water spray may be used to keep fire exposed containers cool.
Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Structural firefighter's protective clothing is ineffective for fires involving this material. Stay away from sealed containers.

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6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB® or TEAM® 'Low Na+' acid neutralizers are recommended for spills of this product.

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7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, always add the acid to water; never add water to the acid. When opening metal containers, use non-sparking tools because of the possibility of hydrogen gas being present. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
For Sulfuric Acid:
- OSHA Permissible Exposure Limit (PEL) -
1 mg/m3 (TWA)
- ACGIH Threshold Limit Value (TLV) -
0.2 mg/m3(T) (TWA) for sulfuric acid - A2 Suspected Human Carcinogen for sulfuric acid contained in strong inorganic mists.

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, a full facepiece respirator with an acid gas cartridge and particulate filter (NIOSH type N100 filter) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P particulate filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres. Where respirators are required, you must have a written program covering the basic requirements in the OSHA respirator standard. These include training, fit testing, medical approval, cleaning, maintenance, cartridge change schedules, etc. See 29CFR1910.134 for details.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:

Clear oily liquid.

Odor:

Odorless.

Solubility:

Miscible with water, liberates much heat.

Specific Gravity:

1.84 (98%), 1.40 (50%), 1.07 (10%)

pH:

1 N solution (ca. 5% w/w) = 0.3; 0.1 N solution (ca. 0.5% w/w) = 1.2; 0.01 N solution (ca. 0.05% w/w) = 2.1.

% Volatiles by volume @ 21C (70F):

No information found.

Boiling Point:

ca. 290C (ca. 554F) (decomposes at 340C)

Melting Point:

3C (100%), -32C (93%), -38C (78%), -64C (65%).

Vapor Density (Air=1):

3.4

Vapor Pressure (mm Hg):

1 @ 145.8C (295F)

Evaporation Rate (BuAc=1):

No information found.

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Concentrated solutions react violently with water, spattering and liberating heat.
Hazardous Decomposition Products:
Toxic fumes of oxides of sulfur when heated to decomposition. Will react with water or steam to produce toxic and corrosive fumes. Reacts with carbonates to generate carbon dioxide gas, and with cyanides and sulfides to form poisonous hydrogen cyanide and hydrogen sulfide respectively.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Water, potassium chlorate, potassium perchlorate, potassium permanganate, sodium, lithium, bases, organic material, halogens, metal acetylides, oxides and hydrides, metals (yields hydrogen gas), strong oxidizing and reducing agents and many other reactive substances.
Conditions to Avoid:
Heat, moisture, incompatibles.

---

11. Toxicological Information

Toxicological Data:
Oral rat LD50: 2140 mg/kg; inhalation rat LC50: 510 mg/m3/2H; standard Draize, eye rabbit, 250 ug (severe); investigated as a tumorigen, mutagen, reproductive effector.
Carcinogenicity:
Cancer Status: The International Agency for Research on Cancer (IARC) has classified "strong inorganic acid mists containing sulfuric acid" as a known human carcinogen, (IARC category 1). This classification applies only to mists containing sulfuric acid and not to sulfuric acid or sulfuric acid solutions.

```
  --------\Cancer Lists\--------------------------------------------------

                                          ---NTP Carcinogen---
  Ingredient                              Known    Anticipated    IARC
Category
  ------------------------------------   -----    -----------    ---------

  Sulfuric Acid (7664-93-9)                No          No            None
  Water (7732-18-5)                        No          No            None
```

---

12. Ecological Information

Environmental Fate:
When released into the soil, this material may leach into groundwater. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition. When released into the air, this material may be removed from the atmosphere to a moderate extent by dry deposition.
Environmental Toxicity:
LC50 Flounder 100 to 330 mg/l/48 hr aerated water/Conditions of bioassay not specified; LC50 Shrimp 80 to 90 mg/l/48 hr aerated water /Conditions of bioassay not specified; LC50

Prawn 42.5 ppm/48 hr salt water /Conditions of bioassay not specified.
This material may be toxic to aquatic life.

---

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

---

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: SULFURIC ACID (WITH MORE THAN 51% ACID)
Hazard Class: 8
UN/NA: UN1830
Packing Group: II
Information reported for product/size: 440LB

International (Water, I.M.O.)

Proper Shipping Name: SULFURIC ACID (WITH MORE THAN 51% ACID)
Hazard Class: 8
UN/NA: UN1830
Packing Group: II
Information reported for product/size: 440LB

---

15. Regulatory Information

```
  --------\Chemical Inventory Status - Part 1\----------------------------

  Ingredient                                          TSCA  EC   Japan
Australia
  ------------------------------------------------  ----  ---  -----  -----
  Sulfuric Acid (7664-93-9)                          Yes  Yes   Yes    Yes
  Water (7732-18-5)                                  Yes  Yes   Yes    Yes

  --------\Chemical Inventory Status - Part 2\----------------------------

                                                              --Canada--
  Ingredient                                          Korea  DSL   NDSL
Phil.
  ------------------------------------------------  -----  ---   ----  ----

  Sulfuric Acid (7664-93-9)                           Yes   Yes   No     Yes
  Water (7732-18-5)                                   Yes   Yes   No     Yes
```

```
  --------\Federal, State & International Regulations - Part 1\-----------

                                              -SARA 302-    ------SARA 313-

  Ingredient                                  RQ    TPQ     List  Chemical
Catg.
  ----------------------------------------  ---   -----   ----  ---------

  Sulfuric Acid (7664-93-9)                   1000  1000    Yes        No
  Water (7732-18-5)                           No    No      No         No

  --------\Federal, State & International Regulations - Part 2\-----------

                                                            -RCRA-    -TSCA-
  Ingredient                                  CERCLA     261.33     8(d)
  ----------------------------------------  ------     ------    ------
  Sulfuric Acid (7664-93-9)                   1000       No         No
  Water (7732-18-5)                           No         No         No


Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  Yes
SARA 311/312:  Acute: Yes      Chronic: Yes  Fire: No  Pressure: No
Reactivity: Yes         (Pure / Liquid)
```

Australian Hazchem Code: 2P
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **2** Other: **Water reactive**
Label Hazard Warning:
POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR CONTACTED WITH SKIN. HARMFUL IF INHALED. AFFECTS TEETH. WATER REACTIVE. CANCER HAZARD. STRONG INORGANIC ACID MISTS CONTAINING SULFURIC ACID CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe mist.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Do not contact with water.
Label First Aid:
In all cases call a physician immediately. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.

Wash clothing before re-use. Excess acid on skin can be neutralized with a 2% bicarbonate of soda solution. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

Product Use:

Laboratory Reagent.

SODIUM HYDROXIDE

1. Product Identification

Synonyms: Caustic soda; lye; sodium hydroxide solid; sodium hydrate
CAS No.: 1310-73-2
Molecular Weight: 40.00
Chemical Formula: NaOH
Product Codes:
J.T. Baker: 1508, 3717, 3718, 3721, 3722, 3723, 3728, 3734, 3736, 5045, 5565
Mallinckrodt: 7001, 7680, 7708, 7712, 7772, 7798

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Sodium Hydroxide	1310-73-2	99 - 100%	Yes

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES BURNS TO ANY AREA OF CONTACT. REACTS WITH WATER, ACIDS AND OTHER MATERIALS.

Potential Health Effects

Inhalation:
Severe irritant. Effects from inhalation of dust or mist vary from mild irritation to serious damage of the upper respiratory tract, depending on severity of exposure. Symptoms may include sneezing, sore throat or runny nose. Severe pneumonitis may occur.
Ingestion:
Corrosive! Swallowing may cause severe burns of mouth, throat, and stomach. Severe scarring of tissue and death may result. Symptoms may include bleeding, vomiting, diarrhea, fall in blood pressure. Damage may appears days after exposure.
Skin Contact:
Corrosive! Contact with skin can cause irritation or severe burns and scarring with greater exposures.

Eye Contact:
Corrosive! Causes irritation of eyes, and with greater exposures it can cause burns that may result in permanent impairment of vision, even blindness.
Chronic Exposure:
Prolonged contact with dilute solutions or dust has a destructive effect upon tissue.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

---

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician, immediately. Wash clothing before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:
Perform endoscopy in all cases of suspected sodium hydroxide ingestion. In cases of severe esophageal corrosion, the use of therapeutic doses of steroids should be considered. General supportive measures with continual monitoring of gas exchange, acid-base balance, electrolytes, and fluid intake are also required.

---

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard. Hot or molten material can react violently with water. Can react with certain metals, such as aluminum, to generate flammable hydrogen gas.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire. Adding water to caustic solution generates large amounts of heat.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

---

6. Accidental Release Measures

Ventilate area of leak or spill. Keep unnecessary and unprotected people away from area of spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust. Do not flush caustic residues to the sewer. Residues from spills can be diluted with water, neutralized with dilute acid such as acetic, hydrochloric or sulfuric. Absorb neutralized caustic residue on clay, vermiculite or other inert substance and package in a suitable container for disposal.
US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

---

7. Handling and Storage

Keep in a tightly closed container. Protect from physical damage. Store in a cool, dry, ventilated area away from sources of heat, moisture and incompatibilities. Always add the caustic to water while stirring; never the reverse. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product. Do not store with aluminum or magnesium. Do not mix with acids or organic materials.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
- OSHA Permissible Exposure Limit (PEL):
2 mg/m3 Ceiling
- ACGIH Threshold Limit Value (TLV):
2 mg/m3 Ceiling

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a half facepiece particulate respirator (NIOSH type N95 or better filters) may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest.. A full-face piece particulate respirator (NIOSH type N100 filters) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are

not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:
White, deliquescent pellets or flakes.
Odor:
Odorless.
Solubility:
111 g/100 g of water.
Specific Gravity:
2.13
pH:
13 - 14 (0.5% soln.)
% Volatiles by volume @ 21C (70F):
0
Boiling Point:
1390C (2534F)
Melting Point:
318C (604F)
Vapor Density (Air=1):
> 1.0
Vapor Pressure (mm Hg):
Negligible.
Evaporation Rate (BuAc=1):
No information found.

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Very hygroscopic. Can slowly pick up moisture from air and react with carbon dioxide from air to form sodium carbonate.
Hazardous Decomposition Products:
Sodium oxide. Decomposition by reaction with certain metals releases flammable and explosive hydrogen gas.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Sodium hydroxide in contact with acids and organic halogen compounds, especially

trichloroethylene, may causes violent reactions. Contact with nitromethane and other similar nitro compounds causes formation of shock-sensitive salts. Contact with metals such as aluminum, magnesium, tin, and zinc cause formation of flammable hydrogen gas. Sodium hydroxide, even in fairly dilute solution, reacts readily with various sugars to produce carbon monoxide. Precautions should be taken including monitoring the tank atmosphere for carbon monoxide to ensure safety of personnel before vessel entry.

Conditions to Avoid:

Moisture, dusting and incompatibles.

---

11. Toxicological Information

Irritation data: skin, rabbit: 500 mg/24H severe; eye rabbit: 50 ug/24H severe; investigated as a mutagen.

```
  --------\Cancer Lists\-------------------------------------------------

                                          ---NTP Carcinogen---
  Ingredient                              Known    Anticipated    IARC
Category
  ------------------------------------   -----    -----------    ---------

  Sodium Hydroxide (1310-73-2)             No          No            None
```

---

12. Ecological Information

Environmental Fate:

No information found.

Environmental Toxicity:

No information found.

---

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

---

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: SODIUM HYDROXIDE, SOLID

Hazard Class: 8

UN/NA: UN1823

Packing Group: II

Information reported for product/size: 300LB

International (Water, I.M.O.)

Proper Shipping Name: SODIUM HYDROXIDE, SOLID
Hazard Class: 8
UN/NA: UN1823
Packing Group: II
Information reported for product/size: 300LB

---

15. Regulatory Information

```
  --------\Chemical Inventory Status - Part 1\----------------------------

  Ingredient                                        TSCA  EC   Japan
Australia
  ----------------------------------------------  ----  ---  -----  -----

  Sodium Hydroxide (1310-73-2)                       Yes  Yes   Yes    Yes

  --------\Chemical Inventory Status - Part 2\----------------------------

                                                             --Canada--
  Ingredient                                        Korea  DSL   NDSL
Phil.
  ----------------------------------------------  -----  ---   ----  ----

  Sodium Hydroxide (1310-73-2)                       Yes   Yes   No    Yes

  --------\Federal, State & International Regulations - Part 1\-----------

                                                -SARA 302-    ------SARA 313-

  Ingredient                                    RQ    TPQ     List  Chemical
Catg.
  ----------------------------------------  ---   -----   ----  ---------

  Sodium Hydroxide (1310-73-2)              No    No      No         No

  --------\Federal, State & International Regulations - Part 2\-----------

                                                            -RCRA-    -TSCA-
  Ingredient                                    CERCLA     261.33     8(d)
  ----------------------------------------  ------     ------    ------
  Sodium Hydroxide (1310-73-2)              1000       No         No


Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: Yes      Chronic: No   Fire: No  Pressure: No
Reactivity: Yes         (Pure / Solid)
```

Australian Hazchem Code: 2R

Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **1**
Label Hazard Warning:
POISON! DANGER! CORROSIVE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES BURNS TO ANY AREA OF CONTACT. REACTS WITH WATER, ACIDS AND OTHER MATERIALS.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe dust.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.
Product Use:
Laboratory Reagent.

Buffer Solution (Phosphate), pH 7

1. Product Identification

Synonyms: None
CAS No.: Not applicable to mixtures.
Molecular Weight: Not applicable to mixtures.
Chemical Formula: Not applicable to mixtures.
Product Codes: 5608

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Potassium Phosphate Monobasic	7778-77-0	< 1%	No
Sodium Phosphate, Dibasic	7558-79-4	< 1%	No
Water	7732-18-5	> 99%	No

3. Hazards Identification

Emergency Overview

As part of good industrial and personal hygiene and safety procedure, avoid all unnecessary exposure to the chemical substance and ensure prompt removal from skin, eyes and clothing.

Potential Health Effects

Inhalation:
No adverse health effects via inhalation.
Ingestion:
Not expected to be a health hazard via ingestion. Large oral doses may cause irritation to the gastrointestinal tract.
Skin Contact:
Not expected to be a health hazard from skin exposure.
Eye Contact:
No adverse effects expected.

Chronic Exposure:
No information found.
Aggravation of Pre-existing Conditions:
No information found.

---

4. First Aid Measures

Not expected to require first aid measures.
Inhalation:
Remove to fresh air. Get medical attention for any breathing difficulty.
Ingestion:
If large amounts were swallowed, give water to drink and get medical advice.
Skin Contact:
Wash exposed area with soap and water. Get medical advice if irritation develops.
Eye Contact:
Wash thoroughly with running water. Get medical advice if irritation develops.

---

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire.
Special Information:
Use protective clothing and breathing equipment appropriate for the surrounding fire.

---

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Contain and recover liquid when possible. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust.

---

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
None established.
Ventilation System:
In general, dilution ventilation is a satisfactory health hazard control for this substance. However, if conditions of use create discomfort to the worker, a local exhaust system should be considered.
Personal Respirators (NIOSH Approved):
Not expected to require personal respirator usage.
Skin Protection:
Wear protective gloves and clean body-covering clothing.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Odorless.
Solubility:
Complete (100%)
Specific Gravity:
No information found.
pH:
7
% Volatiles by volume @ 21C (70F):
ca. 99
Boiling Point:
No information found.
Melting Point:
No information found.
Vapor Density (Air=1):
Not applicable.
Vapor Pressure (mm Hg):
Not applicable.
Evaporation Rate (BuAc=1):
No information found.

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
No information found.
Hazardous Polymerization:

Will not occur.
Incompatibilities:
No information found.
Conditions to Avoid:
Heat.

---

11. Toxicological Information

No LD50/LC50 information found relating to normal routes of occupational exposure.

```
  --------\Cancer Lists\-----------------------------------------------------

                                          ---NTP Carcinogen---
  Ingredient                              Known    Anticipated    IARC
Category
  -------------------------------------   -----    -----------    ---------

  Potassium Phosphate Monobasic            No          No            None
  (7778-77-0)
  Sodium Phosphate, Dibasic                No          No            None
  (7558-79-4)
  Water (7732-18-5)                        No          No            None
```

---

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

---

13. Disposal Considerations

Dilute with water and flush to sewer if local ordinances allow, otherwise, whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

---

14. Transport Information

Not regulated.

---

15. Regulatory Information

```
  --------\Chemical Inventory Status - Part 1\---------------------------
```

Ingredient	TSCA	EC	Japan	Australia
Potassium Phosphate Monobasic (7778-77-0)	Yes	Yes	Yes	Yes
Sodium Phosphate, Dibasic (7558-79-4)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\----------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Potassium Phosphate Monobasic (7778-77-0)	Yes	Yes	No	Yes
Sodium Phosphate, Dibasic (7558-79-4)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313- List	Chemical Catg.
Potassium Phosphate Monobasic (7778-77-0)	No	No	No	No
Sodium Phosphate, Dibasic (7558-79-4)	No	No	No	No
Water (7732-18-5)	No	No	No	No

--------\Federal, State & International Regulations - Part 2\----------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Potassium Phosphate Monobasic (7778-77-0)	No	No	No
Sodium Phosphate, Dibasic (7558-79-4)	5000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: No Chronic: No Fire: No Pressure: No
Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: None allocated.
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **0** Flammability: **0** Reactivity: **0**

Label Hazard Warning:

As part of good industrial and personal hygiene and safety procedure, avoid all unnecessary exposure to the chemical substance and ensure prompt removal from skin, eyes and clothing.

Label Precautions:

None.

Label First Aid:

Not applicable.

Product Use:

Laboratory Reagent.

Attachment 9
Chemical-Specific Training Form

CH2MHILL

CHEMICAL-SPECIFIC TRAINING FORM

Location:	Project # :
HCC:	Trainer:

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

The HCC shall use the product MSDS to provide the following information concerning each of the products listed above.

☐ Physical and health hazards

☐ Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)

☐ Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of MSDSs, chemical inventories, and CH2M HILL's written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

Attachment 10
Biological Hazard Information

Tick-Borne Pathogens

There are six tick-borne pathogens that present a significant field hazard, and in some areas account for more than half of our serious field incidents. These procedures should be applied during any field activity where vegetation is present.

Hazard Control

The methods for controlling exposure to ticks include, in order of most-preferred to least:

- Avoiding tick habitats and ceasing operations in heavily infested areas
- Reducing tick abundance through habitat disruption or application of acracide
- Personal protection through use of repellants and protective clothing
- Frequent tick inspections and proper hygiene

Vaccinations are not available and preventative antibiotic treatment after a bite is generally not recommended.

Avoidance and Reduction of Ticks

To the extent practical, tick habitats should be avoided. In areas with significant tick infestation, consider stopping work and withdrawing from area until adequate tick population control can be achieved. Stopping and withdrawing should be considered as seriously as entering an area without proper energy control or with elevated airborne contaminants – tickborne pathogens present risk of serious illness!

In areas where significant population density or infestation exists, tick reduction should be considered. Tick reduction can be achieved by disrupting tick habitats and/or direct population reduction through the use of tick-toxic pesticides (Damminix, Dursban, Sevin, etc.).

Habitat disruption may include only simple vegetative maintenance such as removing leaf litter and trimming grass and brush. Tick populations can be reduced between 72 and 100% when leaf litter alone is removed. In more heavily infested areas, habitat disruption may include grubbing, tree trimming or removal, and pesticide application (Damminix, Dursban, Sevin, etc.). This approach is practical in smaller, localized areas or perimeter areas that require occasional access. Habitat controls are to be implemented with appropriate health and safety controls, in compliance with applicable environmental requirements, and may be best left to the property owner or tenant, or licensed pesticide vendor. Caution should be exercised when using chemical repellents or pesticides in or around areas where environmental or industrial media samples will be collected for analysis.

Personal Protection

After other prevention and controls are implemented, personal protection is still necessary in controlling exposure to ticks. Personal protection must include all of the following steps:

- So that ticks may be seen on your clothing wear light-colored clothing. Full-body New Tyvek (paper-like disposable coveralls) may also be used.
- To prevent ticks from getting underneath clothing tuck pant legs into socks or tape to boots.
- Wear long-sleeved shirts, a hat, and high boots.
- Apply DEET repellent to exposed skin or clothing per product label.

- Apply permethrin repellent to the outside of boots and clothing before wearing, per product label.
- Frequently check for ticks and remove from clothing.
- At the end of the day search your entire body for ticks (particularly groin, armpits, neck and head) and shower.
- To prevent pathogen transmission through mucous membranes or broken/cut skin, wash or disinfect hands and/or wear surgical-style nitrile gloves anytime ticks are handled.

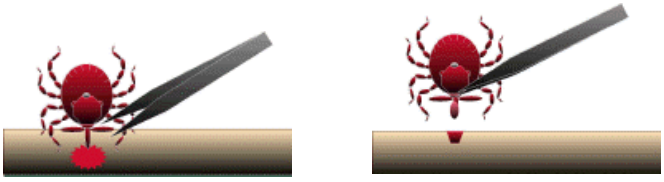
Pregnant individuals and individuals using prescription medications should consult with their physician and/or pharmacists before using chemical repellents. Because human health effects may not be fully known, use of chemical repellents should be kept to a minimum frequency and quantity. Always follow manufacturers' use instructions and precautions. Wash hands after handling, applying, or removing protective gear and clothing. Avoid hand-to-face contact, eating, drinking, smoking, etc. when applying or using repellents. Remove and wash clothes per repellent product label. Chemical repellents should not be used on infants and children.

Vaccinations are generally not available for tick-borne pathogens. Although production of the LYMErix™ lyme disease vaccination has been ceased, vaccination may still be considered under specific circumstances and with concurrence from the consulting physician. Preventative antibiotic treatment in non-ill individuals who have had a recent tick bite is recommended in specific cases only.

Tick Removal

1. Use fine-tipped tweezers or shield your fingers with a tissue, paper towel, or nitrile gloves.

2. Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. (If this happens, remove mouthparts with tweezers. Consult your healthcare provider if infection occurs.)



3. Do not squeeze, crush, or puncture the body of the tick because its fluids (saliva, hemolymph, gut contents) may contain infectious organisms. Releasing these organisms to the outside of the tick's body or into the bite area may increase the chance of infectious organism transmission.

4. Do not handle the tick with bare hands because infectious agents may enter through mucous membranes or breaks in the skin. This precaution is particularly directed to individuals who remove ticks from domestic animals with unprotected fingers. Children, elderly persons, and immunocompromised persons may be at greater risk of infection and should avoid this procedure.

5. After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.

6. You may wish to save the tick for identification in case you become ill. Your doctor can use the information to assist in making an accurate diagnosis. Place the tick in a plastic bag and put it in your freezer. Write the date of the bite on a piece of paper with a pencil and place it in the bag.

Note: Folklore remedies such as petroleum jelly or hot matches do little to encourage a tick to detach from skin. In fact, they may make matters worse by irritating the tick and stimulating it to release additional saliva, increasing the chances of transmitting the pathogen. These methods of tick removal should be avoided. In addition, a number of tick removal devices have been marketed, but none are better than a plain set of fine tipped tweezers.

First-Aid and Medical Treatment

Tick bites should always be treated with first-aid. Clean and wash hands and disinfect the bite site after removing embedded tick. Consult a healthcare professional if infection or symptoms and effects of tick-borne illnesses are develop.

Medical treatment for tick-borne infections include antibiotics and other medical interventions. Diagnosis of specific illness involves both clinical and laboratory confirmations. Preventative antibiotic treatment in non-ill individuals who have had a recent tick bite is recommended in specific cases only.

Previously infected individuals are not conferred immunity – re-infection from future tick bites can occur even after a person has contracted a tick-borne disease.

Hazard Recognition

An important step in controlling tick related hazards is understanding how to identify ticks, their habitats, their geographical locations, and signs & symptoms of tick-borne illnesses.

Tick Identification

There are five varieties of hard-bodied ticks that have been associated with tick-borne pathogens. These tick varieties include:

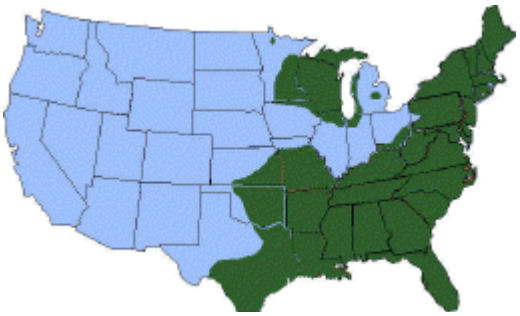
- Deer (Black Legged) Tick (eastern and pacific varieties)
- Lone Star Tick
- Dog Tick
- Rocky Mountain Wood Tick

These varieties and their geographical locations are illustrated on the following page.

Tick Habitat

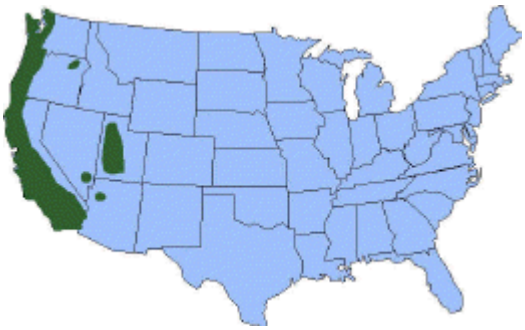
In eastern states, ticks are associated with deciduous forest and habitat containing leaf litter. Leaf litter provides a moist cover from wind, snow, and other elements. In the north-central states, is generally found in heavily wooded areas often surrounded by broad tracts of land cleared for agriculture. On the Pacific Coast, the bacteria are transmitted to humans by the western black-legged (deer) tick and habitats are more diverse. Here, ticks have been found in habitats with forest, north coastal scrub, high brush, and open grasslands. Coastal tick populations thrive in areas of high rainfall, but ticks are also found at inland locations.

Deer Tick



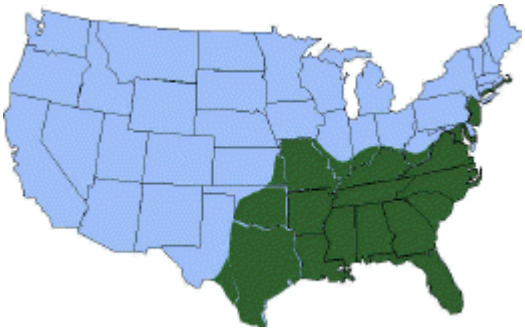
Distribution of Deer Tick (dark green)

From Left: adult female, adult male, nymph, and larvae Deer Tick (cm scale)



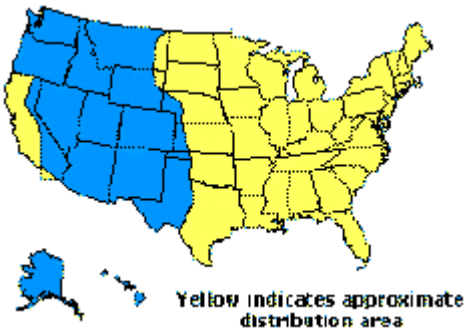
Distribution of Pacific Deer Tick (dark green)

Lone Star Tick

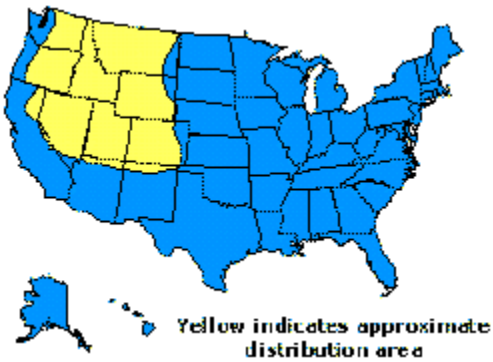


Distribution of Lone Star Tick (Green)

Dog Tick



Rocky Mountain Wood Tick



Illnesses and Signs & Symptoms

There are six notifiable tick-borne pathogens that cause human illness in the United States. These pathogens may be transmitted during a tick bite – normally hours after attachment. The illnesses, presented in approximate order of most common to least, include:

- Lyme (bacteria)
- RMSF (bacteria)
- Ehrlichiosis (bacteria)
- STARI (Southern Tick-Associated Rash Illness) (bacteria)
- Tularemia (Rabbit Fever) (bacteria)
- Babesia (protozoan parasite)

Symptoms will vary based on the illness, and may develop in infected individuals typically between 3 and 30 days after transmission. Some infected individuals will not become ill or may develop only mild symptoms. These illnesses present with some or all of the following signs & symptoms: fever, headache, muscle aches, stiff neck, joint aches, nausea, vomiting, abdominal pain, diarrhea, malaise, weakness, small solid, ring-like, or spotted rashes. The bite site may be red, swollen, or develop ulceration or lesions. A variety of long-term symptoms may result when untreated, including debilitating effects and death.

Poison Oak, Ivy and Sumac

Poison oak, ivy and sumac plants are the single most common cause of allergic skin reactions in the United States. They are caused by contact with urushiol (you-ROO-shee-ol), which is found in the sap of the plants. It is colorless or pale yellow oil that oozes from any cut or crushed part of the plant, including the roots, stems and leaves. The oil is active year round. Reaction to Poison Oak, Ivy, and Sumac ranges from no reaction to a severe "rhus" dermatitis. Rhus is the class of poisonous plants which includes poison oak, poison ivy, poison sumac, mango, and other urushiol containing plants. 3 of 4 people will develop dermatitis on contact with urushiol.

Contact with urushiol can occur in three ways: direct, indirect and airborne particles. Direct contact is touching the sap of the toxic plant, while indirect contact involves touching something which has urushiol on it, such as personal protective equipment (PPE), clothes, boots, field equipment, or any items that have come in contact with the plant (including your hands). Airborne urushiol particles, such as burning plants or spray from a weed whacker, may also contact the skin or be inhaled, causing internal inflammation.

The rash caused by urushiol can affect almost any part of the body, especially where the skin is thin, such as the face. The rash does not spread, although it may seem to when it breaks out in new areas. Actually, what happens is the urushiol absorbs more slowly into thicker skin, such as found on the forearms, legs and trunk.

Identification

Poison Oak

Poison oak shrubs are usually 12" to 30" high, or a tree-climbing vine, with triple leaflets and short, smooth hair underneath. A project site in Portland had 8′ tall poison oak bushes. Early berries are fuzzy and white; later, dun-colored. Plants are red and dark green in Spring and

Summer, with yellowing leaves anytime especially in dry areas. Leaves may achieve bright reds in Fall, but the plant loses its (yellowed, then brown) leaves in Winter, leaving toxic stems. All parts of the plant remain toxic throughout the seasons.

Poison Ivy

Poison ivy plants are frequently found around lakes and streams in the Midwestern and the Eastern parts of the United States and are commonly found growing along trails and roadsides. Poison ivy grows as a woody, ropelike vine that can grow along fences or up trees, a trailing shrub on the ground, or a free-standing shrub. It normally has three leaflets (groups of leaves all on the same small stem coming off the larger main stem), but may vary from groups of three to nine. Poison ivy leaves are green in the summer and red in the fall with yellow or green flowers and white berries.

Poison Sumac

Poison sumac plants grow in boggy areas, especially in the Southeastern United States. Typically, poison sumac grows as a rangy shrub up to 15 feet tall. The plants are found to have seven to 13 smooth-edged leaflets and can have glossy pale yellow or cream-colored berries.

Primary contamination from poison oak, ivy or sumac, results from contact with bruised or broken plant parts that release "toxicodendrol", an oily resin containing the toxic chemical "urushiol".

Poison Ivy

Poison Sumac

Poison Oak

Exposure

Contamination with poison oak, ivy or sumac can happen through several pathways. These include

- Direct skin contact with any part of the plant.
- Contact with clothing that has been contaminated
- Contact from removing shoes that have been contaminated. (your shoes are coated with oil)
- Sitting in a vehicle that has become contaminated
- Contact with any objects or tools that have become contaminated.

Exposure to poison oak, ivy or sumac often becomes an OSHA recordable illness. The dermatitis is so severe that many people seek medical care and get prescription cortisone creams or steroid shots to reduce the suffering caused by the itch. If exposed, refer to the CH2M HILL HSE&Q Injury and Illness Reporting brochure for proper action to take if contaminated.

Best Work Practices

If you must work on a site that has been identified to potentially contain poison oak, ivy or sumac, the following precautions are necessary:

Identify plants containing urushiol – The best way to prevent exposure is to recognize the plant and avoid working in areas where poison oak, ivy or sumac is present.

If you must work in areas with urushiol containing plants, contact you project manager and health and safety manager to determine the best procedures to prevent contamination.

Do not drive vehicles onto the site where it will come into contact with poison oak, ivy or sumac. Vehicles which need to work in the area, such as drill rigs or heavy equipment must be washed and decontaminated as soon as possible after leaving the site.

All tools used in the area, including those used to cut back the plants, surveying instruments used in the area, air monitoring equipment or other test apparatus must be decontaminated before they are placed back into the site vehicle. If on-site decontamination is not possible, use plastic to wrap any tools or equipment until they can be decontaminated. If working on or near the ground surface, place plastic on the ground to cover the grass and foliage.

Personal protective equipment (PPE), including tyvek coveralls, gloves, and boot covers must be worn. PPE and plastic used to cover the ground must be placed into separate plastic bags and sealed if they are not disposed immediately into a trash receptacle.

Shower as soon as possible to remove any potential contamination. Any body part with suspected or actual exposure should be washed with "Tecnu" or other product designed for removing urushiol. If you do not have Tecnu wash with cold water. Do not take a bath, as the oils can form and invisible film on top of the water and contaminate your entire body upon exiting the bath.

- Zanfel™ may also be used to treat exposed areas that are experiencing signs and symptoms of poison oak, ivy or sumac contamination. The CH2M HILL warehouses carry Zanfel™ products, which must be carried in First Aid Kits as deemed appropriate. Refer to the Zanfel™ information guide below for specific product and contact information.
- Use products such as IvyBlock™ to prevent poison oak, ivy and sumac contamination. IvyBlock™ is approved by the FDA to prevent the rash caused by poison oak, ivy and sumac.

If there is exposure use the following first aid procedures, or others you may find to alleviate the pain and itching.

Poison Oak, Ivy, and Sumac First Aid

Are there any of these problems?

- Swelling in the throat, tongue and/or lips
- A hard time breathing or swallowing
- Weakness, dizziness
- Bluish lips and mouth
- Unconsciousness

YES

Give First Aid

Seek Emergency Care

Use emergency kit with adrenalin, if available, and Get Emergency Care.

NO

Do you have any of these problems?

- Skin that is very bright red.
- Pus.
- Rash that has spread to the mouth, eyes or genitals.
- Rash on large areas of the body or the face.

YES

Give First Aid

See Doctor

Give first aid before seeing doctor:

- Take a hot shower (only after rash develops), put the rash area in hot water or pour hot water over it. Make sure the water is not too hot to burn the skin. The hot water causes itching at first, but brings relief later. Do not use soap.
- Take an over-the-counter antihistamine, such as Benadryl, as stated on the label.
- For weeping blisters:
- Mix 2 teaspoons of baking soda in 1 quarter (4 cups) of water.
- Dip squares of gauze in this mixture.
- Cover the blisters with the wet gauze for 10 minutes, four times a day. (Do not apply this to the eyes.)

NO

Provide Self-Care

Urushiol Plant Facts

Urushiol Oil is Potent

- Only 1 nanogram (billionth of a gram) needed to cause rash
- Average is 100 nanograms for most people
- 1/4 ounce of urushiol is all that is needed to cause a rash in every person on earth
- 500 people could itch from the amount covering the head of a pin
- Specimens of urushiol several centuries old have found to cause dermatitis in sensitive people.
- 1 to 5 years is normal for urushiol oil to stay active on any surface including dead plants
- Derived from **urushi**, Japanese name for lacquer

Myth	**Fact**
Poison oak, ivy, and sumac are contagious	Rubbing the rashes won't spread poison ivy to other parts of your body (or to another person). You spread the rash only if **urushiol oil** -- the sticky, resinlike sugbstance that causes the rash -- has been left on your hands.
You can catch poison ivy simply by being near the plants	Direct contact is needed to release **urusiol oil**. Stay away from forest fires, direct burning, or anything else that can cause the oil to become airborne such as a lawnmower, trimmer, etc.
Leaves of three, let them be	Poison sumac has 7 to 13 leaves on a branch, although poison ivy and oak have 3 leaves per cluster
Do not worry about dead plants	**Urushiol** oil stays active on any surface, including dead plants, for up to 5 years.
Breaking the blisters releases **urushiol** oil that can spread	Not true. But your wounds can become infected and you may make the scarring worse. In very extreme cases, excessive fluid may need to be withdrawn by a doctor.

New Cream to Treat Exposure to Poison Plants

Exposure to poison oak, ivy and sumac can be uncomfortable, and in some cases the rash can become so severe that medical care is required. A new product is available Zanfel™ (www.zanfel.com) that helps prevent blistering and itching from becoming severe. If you are working in an area with poison oak, ivy or sumac, you can obtain this cream by contacting your regional Safety Program Assistants (SPAs):

Commercial Sector ESBG: Julie Yeager

Please remember, the cream does not replace preventative measures, including:

- Avoiding contact with poison oak, ivy and sumac.
- Wearing Tyvek coveralls and gloves to prevent contact.
- Washing with Tecnu® (or a similar product) after potential exposure.
- Washing clothing and decontaminating equipment with an oil-cutting detergent.

More information about Zanfel (from Zanfel):

Zanfel™ is an effective wash for urushiol-induced contact dermatitis. Urushiol is the toxin known to cause the itching and rash associated with poison oak, ivy, sumac, poisonwood, and related plants. Zanfel works by surrounding urushiol and bonding with it, thereby enabling it to be rinsed away. Unlike some products that require use within 10-20 minutes of contact or that required continued use until the rash is gone (which can take up to 5 weeks), Zanfel offers relief at any stages of the reaction and often with only one wash. Individuals with particularly severe reactions may require additional washes. Most individuals experience relief from the itching within 30 seconds of application. The rash will begin to subside within hours if the reaction is mild to moderate. Severe and systemic cases will still require medical attention. Severe cases are defined as breakouts that are present on more than 15-percent of the body, and new breakouts continue to develop after day 4.

BROWN RECLUSE SPIDER

Its size - Adult brown recluse spiders have a leg span about the size of a quarter. Their body is about 3/8 inches long and about 3/16 inches wide. Males are slightly smaller in body length than females, but males have proportionally longer legs. Both sexes are venomous

Recluse spiders have been known to habitat most of the lower 48 states; however its typical range is shown on the attached map.

- If bitten stay calm, immediately apply ice to the bite and to try and collect the spider (said even a mangled part of the spider might help a professional with a diagnosis) and go to the ER.

- Shake out clothing and shoes before getting dressed.
- Inspect bedding and towels before use.
- Wear gloves when handling firewood, lumber, and rocks (be sure to inspect the gloves for spiders before putting them on).
- Remove bedskirts and storage boxes from underneath beds. Move the bed away from the wall.
- Exercise care when handling cardboard boxes (recluse spiders often are found in the space under folded cardboard flaps)

Attachment 11
Drug Testing Hospital Kit Notice

HOSPITAL KIT NOTICE

You are receiving this package because you are listed as a Project Manager and/or Superintendent/CM who is managing a CCI project or an INC project which requires drug testing. The items in the package, known as a 'hospital kit', are needed if there is a serious injury requiring medical care on your project.

It is your responsibility to make certain that this hospital kit is onsite at all times while construction is in progress.

For minor injuries - Hospital Kits are **NOT** required. After the injury is treated, the injured employee will be tested at the emergency care clinic or you can take the injured employee to the usual laboratory collection facility. Both the emergency care clinic and the laboratory collection facility already have drug testing kits and you will only be responsible to provide them with your normal Custody and Control Form (CCF) in order for the employee to be tested.

For more serious injuries that require hospital, ambulance, or paramedic care, we need to provide the collector with the 'hospital kit' in order for the drug test specimen to be properly collected. This package *contains everything that the medical provider will need* to collect the sample. It is critical that the 'hospital kit' accompanies all injured employee(s) to the hospital so they will get drug tested. If more than one employee is injured, you must send one kit for each employee that is to receive care at the hospital. After the kit is used, you must immediately contact Elaine Senecal/ORL to get a replacement kit. These kits must remain onsite and be available for emergencies at all times.

Location for Edgewater, New jersey

Contact Elaine Senecal (407-423-0001 x240) for location nearest your project site location.

CH2M HILL Personnel also need on-line training:

http://www.int.ch2m.com/safety_counts/Training_Basic_Modules/Drug_desc.html

Attachment 12
Incident Report Form, Root Cause Investigation, and Honeywell Incident Reporting Information

CH2MHILL

Incident Report Form (Hardcopy)

Fax completed form to:
425.462.5957
CH2M HILL Seattle Office
Attention: Corporate HS&E Department

Type of Incident (Select at least one)

- ☐ Injury/Illness
- ☐ Environmental/Permit Issue
- ☐ Property Damage
- ☐ Near Miss
- ☐ Spill/Release
- ☐ Other

General Information (Complete for all incident types)

Preparer's Name: _____ Preparer's Employee Number: _____
Date of Report: _____ Date of Incident: _____ Time of Incident: _____ am/pm

Type of Activity (Provide activity being performed that resulted in the incident)

- ☐ Asbestos Work
- ☐ Confined Space Entry
- ☐ Construction Mgmt- Haz Waste
- ☐ Construction Mgmt - Non-Haz Waste
- ☐ Demolition
- ☐ Drilling-Haz Waste
- ☐ Drilling-Non Haz Waste
- ☐ Drum Handling
- ☐ Electrical Work
- ☐ Excavation Trench-Haz Waste
- ☐ Excavation Trench-Non Haz
- ☐ Facility Walk Through
- ☐ General Office Work
- ☐ Keyboard Work
- ☐ Laboratory
- ☐ Lead Abatement
- ☐ Motor Vehicle Operation
- ☐ Moving Heavy Object
- ☐ Other (Specify) _____
- ☐ Process Safety Management
- ☐ Tunneling
- ☐ Welding
- ☐ Wetlands Survey
- ☐ Working from Heights
- ☐ Working in Roadways
- ☐ WWTP Operation

Location of Incident (Select one)

- ☐ Company Premises (CH2M HILL Office: _____)
- ☐ Field (Project #: _____ Project/Site Name: _____ Client: _____)
- ☐ In Transit (Traveling from: _____ Traveling to: _____)
- ☐ At Home

Geographic Location of Incident (Select region where the incident occurred)

- ☐ Northeast
- ☐ Southeast
- ☐ Northwest
- ☐ Southwest
- ☐ Corporate
- ☐ Canadian
- ☐ Asia Pacific
- ☐ Europe Middle East
- ☐ Latin America

If a CH2M HILL subcontractor was involved in the incident, provide their company name and phone number: _____

Describe the Incident (Provide a brief description of the incident): _____

_____

_____

Injured Employee Data (Complete for Injury/Illness incidents only)

If CH2M HILL employee injured

Employee Name: _____ Employee Number: _____

If CH2M HILL Subcontractor employee injured

Employee Name: _____ Company: _____

Injury Type

- ☐ Allergic Reaction
- ☐ Amputation
- ☐ Asphyxia
- ☐ Bruise/Contusion/Abrasion
- ☐ Burn (Chemical)
- ☐ Burn/Scald (Heat)
- ☐ Cancer
- ☐ Carpal Tunnel
- ☐ Concussion
- ☐ Cut/Laceration
- ☐ Dermatitis
- ☐ Dislocation
- ☐ Electric Shock
- ☐ Foreign Body in eye
- ☐ Fracture
- ☐ Freezing/Frost Bite
- ☐ Headache
- ☐ Hearing Loss
- ☐ Heat Exhaustion
- ☐ Hernia
- ☐ Infection
- ☐ Irritation to eye
- ☐ Ligament Damage
- ☐ Multiple (Specify) _____
- ☐ Muscle Spasms
- ☐ Other (Specify) _____
- ☐ Poisoning (Systemic)
- ☐ Puncture
- ☐ Radiation Effects
- ☐ Strain/Sprain
- ☐ Tendonitits
- ☐ Wrist Pain

Part of Body Injured

- ☐ Abdomen
- ☐ Ankle(s)
- ☐ Arms (Multiple)
- ☐ Back
- ☐ Blood
- ☐ Body System
- ☐ Buttocks
- ☐ Chest/Ribs
- ☐ Ear(s)
- ☐ Elbow(s)
- ☐ Eye(s)
- ☐ Face
- ☐ Finger(s)
- ☐ Foot/Feet
- ☐ Hand(s)
- ☐ Head
- ☐ Hip(s)
- ☐ Kidney
- ☐ Knee(s)
- ☐ Leg(s)
- ☐ Liver
- ☐ Lower (arms)
- ☐ Lower (legs)
- ☐ Lung
- ☐ Mind
- ☐ Multiple (Specify) _____
- ☐ Neck
- ☐ Nervous System
- ☐ Nose
- ☐ Other (Specify) _____
- ☐ Reproductive System
- ☐ Shoulder(s)
- ☐ Throat
- ☐ Toe(s)
- ☐ Upper Arm(s)
- ☐ Upper Leg(s)
- ☐ Wrist(s)

Nature of Injury

- ☐ Absorption
- ☐ Bite/Sting/Scratch
- ☐ Cardio-Vascular/Respiratory System Failure
- ☐ Caught In or Between
- ☐ Fall (From Elevation)
- ☐ Fall (Same Level)
- ☐ Ingestion
- ☐ Inhalation
- ☐ Lifting
- ☐ Mental Stress
- ☐ Motor Vehicle Accident
- ☐ Multiple (Specify) _____
- ☐ Other (Specify) _____
- ☐ Overexertion
- ☐ Repeated Motion/Pressure
- ☐ Rubbed/Abraded
- ☐ Shock
- ☐ Struck Against
- ☐ Struck By
- ☐ Work Place Violence

Initial Diagnosis/Treatment Date: _____

Type of Treatment

- ☐ Admission to hospital/medical facility
- ☐ Application of bandages
- ☐ Cold/Heat Compression/Multiple Treatment
- ☐ Cold/Heat Compression/One Treatment
- ☐ First Degree Burn Treatment
- ☐ Heat Therapy/Multiple treatment
- ☐ Multiple (Specify) _____
- ☐ Heat Therapy/One Treatment
- ☐ Non-Prescriptive medicine
- ☐ None
- ☐ Observation
- ☐ Other (Specify) _____
- ☐ Prescription- Multiple dose
- ☐ Prescription- Single dose
- ☐ Removal of foreign bodies
- ☐ Skin Removal
- ☐ Soaking therapy- Multiple Treatment
- ☐ Soaking Therapy- One Treatment
- ☐ Stitches/Sutures
- ☐ Tetanus
- ☐ Treatment for infection
- ☐ Treatment of 2nd /3rd degree burns
- ☐ Use of Antiseptics – multiple treatment
- ☐ Use of Antiseptics – single treatment
- ☐ Whirlpool bath therapy/multiple treatment
- ☐ Whirlpool therapy/single treatment
- ☐ X-rays negative
- ☐ X-rays positive/treatment of fracture

CH2MHILL

Number of days doctor required employee to be off work: _____
Number of days doctor restricted employee's work activity: _____
Equipment Malfunction : Yes ☐ No ☐ Activity was a Routine Task: Yes ☐ No ☐
Describe how you may have prevented this injury: _____
_____

Physician Information
Name: _____
Address: _____
City: _____
Zip Code: _____
Phone: _____

Hospital Information
Name: _____
Address: _____
City: _____
Zip Code: _____
Phone: _____

Property Damage (Complete for Property Damage incidents only)

Property Damaged: _____ Property Owner: _____
Damage Description: _____
Estimated Amount: $ _____

Spill or Release (Complete for Spill/Release incidents only)

Substance (attach MSDS): _____ Estimated Quantity: _____
Facility Name, Address, Phone No.: _____
Did the spill/release move off the property where work was performed?: _____
Spill/Release From: _____ Spill/Release To: _____

Environmental/Permit Issue (Complete for Environmental/Permit Issue incidents only)

Describe Environmental or Permit Issue: _____
Permit Type: _____
Permitted Level or Criteria (e.g., discharge limit): _____
Permit Name and Number (e.g., NPDES No. ST1234): _____
Substance and Estimated Quantity: _____
Duration of Permit Exceedence: _____

Verbal Notification (Complete for all incident types)(Provide names, dates and times)

CH2M HILL Personnel Notified: _____
Client Notified: _____

Witnesses (Complete for all incident types)

Witness Information (First Witness)
Name: _____
Employee Number (CH2M HILL):_____
Address: _____
City: _____
Zip Code:_____
Phone: _____

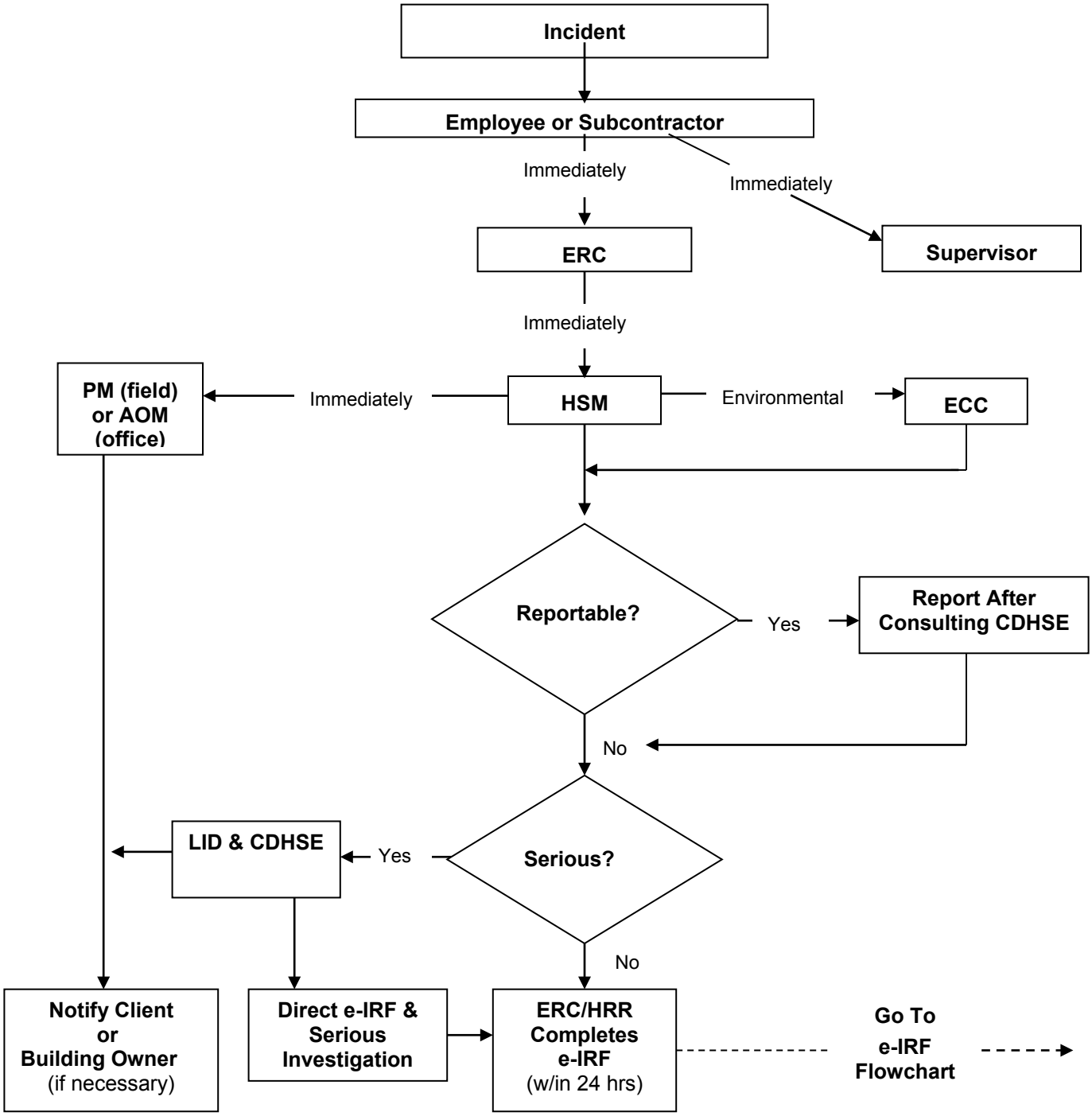
Witness Information (Second Witness)
Name: _____
Employee Number (CH2M HILL: _____
Address: _____
City: _____
Zip Code:_____
Phone :_____

Additional Comments:
_____
_____

CH2MHILL

Incident Reporting and Investigation
Standard of Practice HSE-111

Incident Notification and Reporting Flowchart



CH2MHILL

Incident Reporting and Investigation
Standard of Practice HSE-111

Investigation Guidelines

1.0 Introduction

This guideline is provided to assist in accessing, completing, and reviewing an incident investigation. It is important to remember the following when conducting an investigation:

- Gather relevant facts, focusing on fact finding, not fault finding.
- Draw conclusions, pitting facts together into a probable scenario.
- Determine incident root cause(s), which are basic causes on why an unsafe act/condition existed.
- Develop and implement solutions, matching all identified root causes with solutions.

2.0 Documentation

The following should be included in the IRF to document the incident.

Description

- Provide a description of the event and the sequence of events and actions that took place prior to the incident. Start with the incident event and work backwards in time through all of the preceding events that directly contributed to the incident. The information should identify why the event took place as well as who was involved, when and where the event took place, and what actions were taken.

Cause Analysis

Using the form and flowchart in Attachment 11-1, the root cause of the incident will be determined. This form must be retained in the project and/or regional HS&E files.

Immediate Causes—List the substandard actions or conditions that directly affected the incident. The following are examples of immediate causes:

> ***Substandard Actions***: Operating equipment without authority; failure to warn; failure to secure; operating at improper speed; making safety device inoperable; using defective equipment; failing to use PPE; improper loading; improper lifting; improper position for task; under influence of alcohol or drugs; horseplay.
>
> ***Substandard Conditions:*** Exposure to hazardous materials; exposure to extreme temperatures; improper lighting; improper ventilation; congestion; exposure to fire and explosive hazard; defective tools, equipment, or materials; exposure to extreme noise; poor ventilation; poor visibility; poor housekeeping.

Basic Causes—List the personal and job factors that caused the incident. The following are examples of basic causes:

Personal Factors: Capability; knowledge; skill; stress; motivation.

Job Factors: Abuse or misuse; engineering; maintenance; purchasing; supervision; tools and equipment; wear and tear; work standards.

Corrective Action Plan

Include all corrective actions taken or those that should be taken to prevent recurrence of the incident. Include the specific actions to be taken, the employer and personnel responsible for implementing the actions, and a time frame for completion. Be sure the corrective actions address the causes. For example, training may prevent recurrence of an incident caused by a lack of knowledge, but it may not help an incident caused by improper motivation.

The following are examples of management programs that may be used to control future incidents. These programs should be considered when determining specific corrective actions.

Management Programs: Accident/incident analysis; emergency preparedness; engineering controls; general promotion; group meetings; health control; hiring and placement; leadership and administration; management training; organizational rules; personal protective equipment; planned inspections; program audits; program controls; purchasing controls; task analysis and procedures; task observation

3.0 Attachments

Attachment 12-1 Root Cause Analysis Form and Flowchart

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Incident Reporting and Investigation
Standard of Practice HSE-111
Attachment 12-1: Investigation Guidelines

Root Cause Analysis Form and Flowchart

Root Cause Analysis Form

Root Cause Analysis (RCA)

Root Cause Categories (RCC): Select the RCC numbered below that applies for the root cause (RC) and/or contributing factor (CF) in the first column, then describe the specific root cause and corrective actions in each column.

1. **Lack of skill or knowledge**
2. **Lack of or inadequate operational procedures or work standards**
3. **Inadequate communication of expectations regarding procedures or work standards**
4. **Inadequate tools or equipment**
5. **Correct way takes more time and/or requires more effort**
6. **Short-cutting standard procedures is positively reinforced or tolerated**
7. **Person thinks there is no personal benefit to always doing the job according to standards**

RCC #	Root Cause(s)	Corrective Actions	RC[1]	CF[2]	Due Date	Completion Date	Date Verified

[1] RC = Root Cause; [2] CF = Contributing Factors (check which applies)

Investigation Team Members

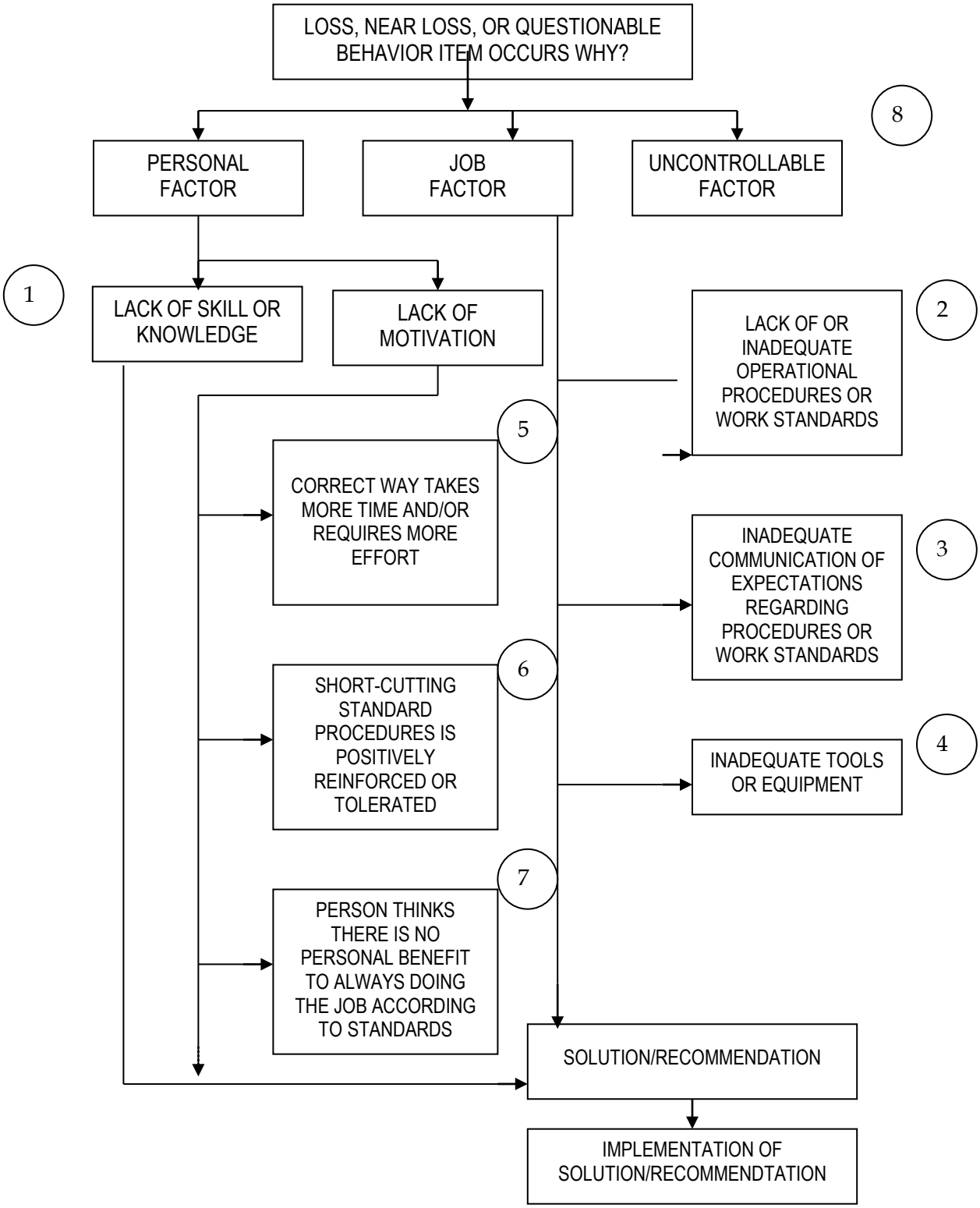
Name	Job Title	Date

Results of Solution Verification and Validation

Reviewed By

Name	Job Title	Date

Root Cause Analysis Flowchart



HONEYWELL INCIDENT TIER Event Reporting Procedure

1. APPLICABILITY

1.1 This procedure is applicable to all Honeywell organizations and majority owned subsidiaries worldwide. It establishes the minimum requirements that shall be met by all organizations. In addition to complying with this procedure, organizations shall ensure compliance with all applicable national, state, and local regulations.

2. OVERVIEW

2.1 Conformance to this procedure will ensure all required Health, Safety, Environmental and Security related events are reported to the appropriate contacts and systems in an established period of time.

2.2 This procedure establishes the requirements for completing and posting an annual summary of the prior years' recordable safety events from February 1 thru April 30.

3. DEFINITIONS

3.1 Definitions for underlined text are found at the end of this document. A master list of definitions for all Honeywell HSEMS Standards is also available.

4. REQUIREMENTS

4.1 Documented Procedures

4.1.1 Each Honeywell Strategic Business Group (SBG) must either adopt this procedure or develop its own equivalent SBG procedure.

4.1.2 Each Honeywell site or organization must customize either this procedure by using attachment 6.1, or its SBG's equivalent procedure. Review this procedure for any additional country requirements and add additional country requirements to the appropriate organizations procedure.

4.2 Responsibilities

4.2.1 Corporate HSE&R – Responsible for informing corporate leadership concerning HS&E events, coordinating level of response, conference calls, and meetings. Responsible for the organization and activities of the Corporate Recordkeeping Committee.

4.2.2 Site Leader – Accountable for ensuring events (Tier 1, 2 or 3) are reported as described within the procedure. Responsible for signing

the annual summary of recordable safety events and accountable for the information on this summary being true, accurate, and complete.

4.2.3 Site Health, Safety & Environmental (HSE) – Responsible for reporting HSE events as described within this procedure, utilizing designated reporting systems to enter information, assuring the truth, accuracy, and completeness of information entered, and ensuring the annual summary is visibly posted throughout the required time period.

4.3 Events shall be investigated according to the requirements in HSEMS 701, Incident Investigation.

4.4 Event Reporting System

4.4.1 Reporting shall be accomplished using the secure HSE&R intranet Event Tracking System (http://hser.honeywell.com/hser/index.jsp). Prior to first use of the intranet system, users shall register for access by completing the Event Tracking Registration Form.

4.4.2 If user experiences technical difficulties, inquiries can be made by contacting the system administrator for assistance.

4.4.3 All data entries into the event tracking system are classified into three different levels of notification; Tier 1, Tier 2 and Tier 3. The Event Reporting Process for Tier Events (attachment 6.3) explains the process and steps to be taken when reporting an event.

4.5 Injury and Illness Classification

4.5.1 All employee and contractor employee work-related injuries and illnesses shall be classified for recordability using the Honeywell Global Recordkeeping Requirements.

4.5.2 If an employee or contractor employee injury or illness is initially assessed as “Not Recordable”, the Recordkeeping Coach shall be used to evaluate the classification.

4.5.2.1 If the Recordkeeping Coach indicates that the injury or illness is likely “Recordable”, the site must enter the case as a Recordable Tier 1 or Tier 2 Event.

4.5.2.1.1. If the site wishes to pursue a recordability exemption, site HSE personnel should complete the Recordability Exemption form and forward it to the SBG HSE leader.

4.5.2.1.2. If the SBG HSE leader agrees with the request for recordability exemption, the SBG HSE leader forwards the form to the Chair of the Recordkeeping Review Committee.

4.5.2.1.3. The three members of the Recordkeeping Review Committee will each review the case and provide their assessment of recordability.

4.5.2.1.4. If the Recordkeeping Review Committee agrees that the case is not recordable, the SBG leader and site HSE leader will be notified, and the Event Tracking System entry can be updated to reflect the proper classification.

4.5.2.1.5. If the Recordkeeping Review Committee determines that the case is recordable, the SBG leader and site HSE leader will be notified. If the SBG leader and site HSE leader request further review, the case will be sent to Honeywell's External Recordkeeping Consultant for review.

4.5.2.1.6. The opinion of Honeywell's External Recordkeeping Consultant will be communicated to the SBG and site HSE leader and is binding.

4.6 Reporting of Events with Multiple Components

4.6.1 If a single incident results in multiple items that qualify as reportable events under this procedure, each reportable event must be entered into the Event Tracking System as a unique entry.

4.6.1.1 After the initial entry, subsequent entries should reference the event number of the initial entry.

4.7 Event Reporting – Tier 1 Event

4.7.1 A Tier 1 event requires locations/organizations to immediately (within two hours) contact Corporate HSE&R via the Corporate Call List and the SBE/SBU/SBG HSE leader by telephone at any time including weekends and holidays.

4.7.1.1 The SBG Leader or designee can make the corporate notification.

4.7.1.2 A voicemail message or e-mail notification is not an acceptable means of notification.

4.7.2 The corporate HSE&R leader receiving the call shall contact additional members of the Corporate Call List , including the Corporate VP HSE&R.

4.7.3 If there is any doubt as to the potential significance of an event, the SBE/SBU/SBG HSE leader should be contacted to help determine the appropriate reporting Tier.

4.7.4 Tier 1 events shall be reported into the Honeywell Event Tracking System within one business day of the event even if information about the event is incomplete.

4.7.4.1 The initial event report is a preliminary report due within one business day and should include the pertinent factual details (with no guesses, assumptions or speculation) known at the time the report is entered into the Event Tracking System.

4.7.4.2 Event reports shall be updated as the situation evolves and additional information is determined. Updates shall continue until the event is considered closed with all corrective actions completed.

4.7.5 Tier 1 safety injury and illness events will automatically populate the electronic version of the HON Form 300. A current list of all of an organization's Tier 1 and Tier 2 safety events can be printed from the Event Tracking System at any time.

4.7.6 The location may create and print the optional HON Form 301.

4.8 Event Reporting – Tier 2 Event

4.8.1 Tier 2 events shall be reported into the Honeywell Event Tracking System within one business day.

4.8.1.1 The initial event report is a preliminary report due within one business day and should include the pertinent factual details (with no guesses, assumptions or speculation) known at the time the report is entered into the system.

4.8.1.2 Event reports shall be updated as the situation evolves and additional information is determined. Updates shall continue until the event is considered closed with all corrective actions completed.

4.8.1.3 Tier 2 safety injury and illness events will automatically populate the electronic version of the Honeywell Form 300 A current list of all of an organization's Tier 1 and Tier 2 safety events can be printed from the Event Tracking System at any time.

4.8.1.4 The location may create and print the optional HON Form 301.

4.9 Event Reporting – Tier 3 Event

4.9.1 The following Tier 3 events **shall** be entered into the event tracking system within seven (7) calendar days.

4.9.1.1 Employee, contractor or visitor injuries/illnesses where first-aid treatment or evaluation is provided by a Medical or Para-Medical Professional.

4.9.1.2 A regulatory agency inspection that does not otherwise qualify as a Tier 1 or Tier 2 event, (and may still be ongoing) with no notice of fine, penalty or corrective action.

4.9.2 The following Tier 3 events **may** be entered into the event tracking system as directed by the SBG for reporting.

4.9.2.1 Employee, contractor or visitor injuries/illnesses injury/illness where first-aid treatment or evaluation is provided by someone other than a Medical or Para-Medical Professional.

4.9.2.2 Significant Near misses

4.9.2.3 Operations successes at facilities (i.e., ISO Certification, VPP, OHSAS, local or state recognition, etc.)

4.9.3 Tier 3 first-aid events that have been entered into the Event Tracking System will be automatically entered on the HON First Aid Form (300B). Additional first-aid events can be added to the form by hand, which would provide the site with a complete first-aid log.

4.10 Annual Posting of Honeywell Forms

4.10.1 The HON Form 300 is the site log of work-related injuries and illnesses. This log shall be available upon request, but is not posted.

4.10.2 The HON Form 300A is the summary of work-related injuries and illnesses. The data from the HON Form 300 will be automatically summarized on the HON Form 300A.

4.10.2.1 In January of each year, the Site Leader shall sign the completed HON Form 300A for the previous year certifying that all entries are true, accurate, and complete.

4.10.3 The HON Form 300A shall be posted in a conspicuous location from February 1 to April 30 documenting the information from the prior year. This must be posted even if the site had no Tier 1 or Tier 2 Safety events the previous year.

4.10.4 After the annual posting period, the HON Form 300A shall be placed in a secure file with the HON Form 300.

4.11 Data Privacy

4.11.1 In countries with applicable data privacy laws:

4.11.1.1 Appropriate notice shall be given to individuals from whom or about whom information is collected. The Data Privacy Function should be contacted to assist with providing appropriate notice.

4.11.1.2 A process shall be put in place for individuals whose information is contained in these records to review information pertaining to them and to request correction if the information is not accurate.

4.11.1.3 Steps shall be taken to notify the records collection/database to the national data protection authority, where required. The data privacy function should be contacted to determine whether such notification is required and, if so, what steps need to be taken to notify the records collection/database.

4.11.2 Records shall be stored in a location (physical or virtual) that is secure and not accessible except to those who have a legitimate reason to see the records. Appropriate access controls shall be put in place to ensure that records can be and are accessed only by those who have been authorized to see them.

4.11.3 If an employee experiences one of the following types of injuries or illnesses, the employee's name shall not be printed on a hard copy printout of the Form 300. Within the event tracking system, click the box corresponding to the event(s) that meet these criteria. This action will prevent the employee's name from being printed on the Form 300; instead, it will print " Privacy Case #__"

4.11.3.1 An injury or illness to an intimate body part or the reproductive system

4.11.3.2 An injury or illness resulting from a sexual assault

4.11.3.3 Mental Illness

4.11.3.4 HIV infection, hepatitis, or tuberculosis

4.11.3.5 Needlestick injuries and cuts from sharp objects that are contaminated with another person's blood or other potentially infectious material

4.11.3.6 Other illnesses, if the employee voluntarily requests that his or her name not be entered on the log.

4.11.4 A separate, confidential list of the case number and employee names for privacy concern cases can be printed through the event tracking system.

4.12 Records

4.12.1 Records required by the Event Reporting Procedure shall be retained for (the greater of) either six years or the applicable national regulatory requirement. Refer to the Honeywell Records and Information Management website. This includes the following:

4.12.1.1 Honeywell Form 300 log

4.12.1.2 Honeywell Form 300A (annual summary)

4.12.1.3 Honeywell First Aid Form (300B)

4.12.1.4 Honeywell Form 301 (Injuries and Illnesses Incident Report)

4.12.1.5 Privacy Case Concerns

4.12.1.6 Incident Investigation Reports

4.13 Audit and Program Review

4.13.1 The Organization shall perform a documented annual evaluation of the entire Event Reporting Process. This evaluation can be done as part of the annual HSE Self-Assessment (SAT).

4.13.2 The annual evaluation shall include a thorough review of the following:

4.13.2.1 The Organization's Event Reporting Procedure to determine if it meets all Corporate and SBG requirements.

4.13.2.2 Consistent with any applicable data privacy requirements, a comparison between national or insurance reporting requirements, such as worker's compensation, and cases in the Event Tracking System. The reasons for any variance shall be investigated and documented.

4.13.2.3 Appropriate accident reports, HON and regulatory required accident logs (HON Form 300), and first-aid logs (HON Form 300B).

4.13.2.4 Verification the summary (HON Form 300A) was posted.

4.13.2.5 The availability of all records required to be maintained by this procedure.

4.13.2.6 The accuracy of classification and Event Tracking System entry of Recordable injuries and illnesses.

4.13.3 The results of the evaluation shall be included as part of the SBG HSEMS Management Review. All actions that are necessary to improve the process shall be documented and completed.

5. Related Documents

5.1 Incident Investigation (HSEMS 701)

5.2 Honeywell Global Recordkeeping Requirements

5.3 Allegations of Adverse Health Effects and Substantial Risk Reporting (HLTH-19)

5.4 TRAC - The Risk Assessment Committee (HSEMS 605)

6. Attachments

6.1 Sample Site Level Event Reporting Procedure

6.2 Honeywell Corporate Call List

6.3 Event Reporting Process for Tier Events

7. Revision Log

Revision Date	Revised by	Brief Description of Change

8. Definitions

Accident	AN UNPLANNED EVENT RESULTING IN PERSONAL INJURY OR ILLNESS, EQUIPMENT OR PROPERTY DAMAGE, OR AN ENVIRONMENTAL EXCURSION.
Adverse Environmental Impact	• Results in a significant and negative effect to the environment OR • Involves community, property owners, regulatory agencies, governmental officials or other non-Honeywell parties and presents a situation that results in interactions with these parties beyond those that are routine or expected as part of permitted activities. Examples of significant and negative effects that meet this criteria include, but are not limited, to the following: the upset or shutdown of a community wastewater treatment facility, contamination of a drinking water supply, wildlife fatalities (such as a fish kill), unplanned closure or restriction of public transportation routes, property damage or impairment (such as distress of vegetation, compromise to the ongoing use), aesthetic degradation (such as color, odor, noise) that draws community interest, neighborhood evacuations or a call to shelter-in-place, or any act triggering a subsequent inquiry or response by an agency or other governmental entity.
Contractor	An organization that provides services to Honeywell for maintenance, repair, capital improvement, minor renovations, new installations, specialty work, etc.
Contractor Employee	A non-Honeywell individual that provides services to Honeywell and works under the direct day-to-day supervision of a member of the Contractor organization.
Due Diligence Finding	HSE recommendations arising out of due diligence activities must be entered in the Event Tracking system within 2 weeks of a site being assigned a Site ID number in the system.
Employee	An individual employed by Honeywell, a subsidiary of Honeywell or anyone that is working for Honeywell and who is directly supervised on a day-to-day basis by

	a Honeywell employee.
Excursion	A release to air, water or soil which exceeds a numerical limit imposed by law, regulation, permit, ordinance, agency order or agreement, or which requires notification to a government agency.
HON Form 300	THIS IS THE SITE'S ANNUAL LOG OF RECORDABLE WORK-RELATED INJURIES AND ILLNESSES. TIER 1 AND TIER 2 EMPLOYEE WORK-RELATED INJURIES AND ILLNESSES ARE TRACKED ON THIS ELECTRONIC FORM.
HON Form 300A	This is the site's annual summary of recordable work-related injuries and illnesses. It summarizes the detailed data from the HON Form 300.
HON First Aid Form (300B)	This is the site's annual log of first-aid injuries. Tier 3 work-related injuries and illnesses are tracked on this electronic form.
HON Form 301	Optional outside the US. This form can be used to document a recordable work-related injury/illness event. Note: In the US, some state workers' compensation, insurance, or other reports may be acceptable substitutes.
Incident	An Accident or Near Miss occurrence that either did or could have resulted in personal injury or illness, equipment or property damage, or an environmental excursion.
Medical and Para-Medical Professionals	Personnel with licensure or certification that authorizes them to perform medical treatment independently as defined by the scope of practice for their profession or to perform medical treatment under the direction of a physician. (i.e., Doctor, Nurse, LPN, Physicians Assistant, Emergency Medical Technician, Paramedic, etc.)
Near Miss	An unplanned event that could have reasonably resulted in personal injury or illness, equipment or property damage, or an environmental excursion.
Notice of Violation (NOV)	A written notice from a government entity which alleges that a Honeywell entity is not in compliance with law, permit, order, or agreement.
Operations Success	Cost reductions, location or business certifications or awards, staffing changes or other activities or accomplishments that document the beneficial role of HSE&R.
Privacy Case	An injury or illness that is of a sensitive nature. Examples include injury or illness to an intimate body part, sexual assault, mental illness, etc.
Recordable	An injury or illness that is classified as Recordable using Honeywell Global Recordkeeping Requirements.
Significant	An occurrence that is anything other than routine in the setting in which is occurs, which is important to people, property or the environment. An occurrence that may contribute to additional events in the future if left uncontrolled.
Site Leader	The operating manager who has responsibility for a particular facility or organization. The Site Leader could also be called the General Manager, Plant Manager, Facility Manager, Area Manager, etc., depending on the particular business entity.
Spill	A release of material from a primary containment. Spills that are not also excursions are generally small in nature, do not violate government requirements, and do not require reporting to a government agency.
Tier 1	A Tier 1 event requires locations/organizations to immediately (**within two hours**) contact Corporate HSE&R and the SBE/SBU/SBG HSE leader by telephone at any time including weekends and holiday and enter a report into the Honeywell Event Tracking System within **one business day**. • One or more on-site or off-site fatalities involving an employee, contractor

	employee or visitor that are or may be work-related. • A single work-related on-site or off-site incident resulting in three or more employees, contractors or visitors being admitted to a hospital. • Any off-site fatalities to the general public that allegedly are or may be related to Honeywell. • Any security incident that may be immediately dangerous to life or property, including, bomb threats, intentional explosions, chemical releases, radiation releases, or releases of biological/chemical agents. • Fires that: (a) resulted in significant property damage, or, regardless of the level of damage, (b) were extinguished by a fire department using other than handheld fire extinguishers, or (c) were extinguished by a fire suppression system (other than an integrated fire suppression system within a piece of equipment) or (d) significantly halted operations. • Suspicious materials, package or letter for which outside authorities were called in to investigate. • Serious injuries or illnesses in the general public allegedly associated with a company-related incident, event or release to air, water or soil. • A release to air, water or soil that has an Adverse Environmental Impact which includes a release that triggers a regulatory inquiry. • Events generating community activism or adverse media coverage not associated with an episodic event at the national/international level. • Government representatives alleging or suggesting criminal non-compliance of any kind. • A regulatory agency inspection with notice of fine, penalty or corrective action that has a directive or other type of injunctive device designed or likely to halt, curtail, or restrict operations.
Tier 2	Tier 2 events shall be reported into the Honeywell Event Tracking System within **one business day**. • Employee or contract employee lost workday injuries/illnesses. • Any on-site or off-site injuries/illnesses involving an employee, contractor employee or visitor that are or may be work-related and are significant enough to be recordable. • Minor injuries or illnesses in the general public that allegedly are associated with a company-related incident, event or release to air, water or soil. • Suspicious activities in or around Honeywell facilities or processes that may present a potential security risk. • Fires extinguished using handheld fire extinguisher(s) or an integrated fire suppression system internal to a piece of equipment that did minimal property damage, and did not halt operations. • Allegations of previously unknown health or environmental effects caused by products, processes, emissions or discharges Allegations of Adverse Health Effects, Hlth-19. • An environmental excursion that does not also trigger Tier 1 reporting. • Discovery of potential or actual evidence of contaminated soil or groundwater from current or former operations that does not otherwise meet the definition of an adverse environmental impact. • Written notification from a governmental agency alleging non-compliance of any kind. • Proposal or imposition of an HSER fine, penalty or corrective action.

	• Receipt of a non-routine request for information from a governmental agency. • A regulatory agency inspection (excluding those that are Tier 1 Events) with notice of fine, penalty or corrective action. • All HSE audits, including Corporate audits, Peer review, the annual SAT (Self assessment tool), audits for external HSE certification processes, and SBU audits or special initiatives. • Any evaluations made by third parties such as HSE consultants or contracted HSE services. Recommendations from such evaluations must be entered as recommendations in the Event Tracking System. • Significant community activism or adverse media coverage not associated with an episodic event at the local/state level. • Notice of an allegation from a third party or regulatory agency of environmental impacts from operations on current or formerly operated Honeywell facilities. • Demands, including voluntary agreements, to conduct a site investigation or remedial measures to respond to environmental impacts from operations on current or formerly operated Honeywell facilities. • Receipt of an information request or special notice letter associated with the disposal, transportation or storage of hazardous substances by Honeywell or its predecessors. • Identification of any condition or circumstance which falls under the criteria of "Issues requiring TRAC approval" for which TRAC approval was NOT obtained. The Risk Assessment Committee (TRAC) - HSEMS 605
Tier 3	The following Tier 3 events **shall** be entered into the event tracking system within **seven (7) calendar days**: • On-site or off-site employee, contractor employee or visitor injuries/illnesses where first-aid treatment or evaluation is provided by a Medical or Para-Medical Professional. • A regulatory agency inspection (which is not a Tier 1 or Tier 2 Event, and may still be underway) with no notice of fine, penalty or corrective action. The following Tier 3 events **may** be entered into the event tracking system as directed by the SBG for reporting: • Employee, contractor or visitor injuries/illnesses injury/illness where first-aid treatment or evaluation is provided by someone other than a Medical or Para-Medical professional. • Significant near misses • Stewardship outreach events with customers, suppliers and/or communities, Operations successes at facilities (i.e., ISO Certification, VPP, OHSAS, local or state recognition, etc.)
Vendor/Supplier	A non-Honeywell individual involved in the sale or supply of items for a particular use by the site. Individual may have multiple Honeywell Points of Contact and does not physically reside within the confines of the site.
Visitor	Any individual entering a Honeywell facility for business or personal reasons and not fitting the definition of: contractor, contract employee, or sub-contractor; vendor/supplier; and/or delivery/pickup personnel.

Attachment 13
Working Alone Documents

Project Information:

Project:	Location:
Task Description:	
Reason for Working Alone:	

Hazard Assessment and Response Actions:

Potential Hazard or Emergency Situation	**Control Measures/Response Actions**
No Communication (bad reception or absence of a radio or cell phone)	Test radio or cell phone to ensure coverage Do not perform work until reliable communication is established Cease work if communications are interrupted
Fire/explosion	Do not attempt to fight fire; retreat to a safe location Call 911; report nature and location of fire/explosion Secure site and provide assistance to emergency responders
Severe Weather	Leave the work area and seek appropriate shelter Notify CH2M HILL contact of situation and location
Personal Security/Violence	Remain calm, try not to aggravate the situation Retreat to a safe location and notify your contact Call 911 to report any threat of violence or criminal activity
Medical Emergency/Injury (able to self-report)	Call 911 or use emergency radio channel no.____ Provide name, exact location, and nature of injury or emergency situation
Medical Emergency/Injury (may be unable to self-report)	Implement Personal Accountability Safety System • Make/model:_____ • System limitations •
Medical Emergency/Injury (may be unable to self-report)	Implement periodic call in system • Lone worker provides planned schedule and work locations to call-in contact prior to beginning work • Lone worker calls call-in contact every hour • Call-in contact verifies worker location/schedule and logs call • If call is not received at scheduled time, attempt to contact or locate lone worker • Call 911 if an emergency situation is suspected or contact with lone worker is not made within a maximum of 10 minutes. • Provide name, last known location, and planned activities information to 911 emergency contact. • Notify CH2M HILL Project or Task Manager

Notification and Emergency Contacts:

Function	Name/Organization	Contact Numbers
Emergency (Fire, Medical, Police)	City of XXXX	911
Client Emergency/Security Contact		
Lone Worker Contact	CH2M HILL	Radio Cell
Call-in Contact	CH2M HILL	Radio Office Cell
Health and Safety Manager	CH2M HILL	Office Cell
Project/Task Manager	CH2M HILL	Office Cell

Lone Worker Safety Plan Review and Approval:

Responsible Health and Safety Manager	Project or Task Manager
Name/Date:	Name/Date:

Authorized Lone Worker Safety Plan Review:

Name of Authorized Personnel	Review Signature/Date

A new CH2M HILL Core Standard for "Working Alone" was recently published on the Virtual Office at the Health, Safety, Environment, and Quality (HSEQ) website. This core standard applies enterprise-wide, and all business group employees should review the standard and become familiar with the requirements.

Environmental Services personnel do not normally work alone on field projects. Usually the "buddy system" is used, or our work is performed in the vicinity of others who would be available to provide assistance. In this way, if an employee becomes injured or ill, first aid or emergency support can be summoned immediately. If you become injured or ill in an area where others are not present, necessary emergency support may not be available, and this can lead to even more serious consequences.

With this new core standard, current field work and associated safety plans should be reviewed for compliance with requirements, and supplemented as needed. All future safety plans should identify any tasks that require working alone, and include adequate precautions for working alone.

Project and/or task managers have the primary action to identify current and future field work that requires working alone, and coordinating with their Regional or Program Health and Safety Managers to ensure that appropriate precautions are specified in the plan and implemented in the field. Shown below are the minimum acceptable methods for assigning work to ensure that it is conducted safely and emergency assistance is available when needed.

Project or Task Manager assigns field work considering the potential hazards of working alone, and ensures that safe work practices are included in the safety plan

Use of the "Buddy System"	Work in the vicinity of others	Working alone
• Most common type of field work assignment • A fellow worker can assist with the task at hand, and if an emergency situation develops, can provide first aid and ensure that emergency assistance is summoned • Required for hazardous waste site work and other potentially hazardous operations such as confined space entry and high voltage electrical work	• For field work at operating facilities, plant sites, and in the general community • Site emergency procedures are generally well known • Others are available in case of emergency • Not reliable when others are not working nearby, such as in remote locations of an operating facility, or when work is conducted off-hours or on the weekend. • When not reliable, additional precautions listed under "working alone" should be used	• Least desirable work method as others are not readily available to provide or summon emergency assistance • Evaluate eliminating the need to work alone by rescheduling work to normal operating hours, assigning a buddy, etc. • Document and implement precautions such as: – Maintain continuous open line of communication (e.g. radio or cellphone) – Implement regular check-in times with assigned person who can summon help – Use a remote monitoring device such as a wireless PASS (Personal Alert Safety System)

Appendix 14
Vehicle Accident Guidelines and Stop Work Order

Vehicle Accident Guidance—ESBG

Remember that if you a renting a non-CH2M HILL owned vehicle (short-term rental) in the U.S., you should carry the insurance card from the state where your driver's license is issued.

If you operate a fleet vehicle, carry the insurance card where the vehicle is registered.

Please see link below to print out an insurance card (for **CH2M HILL employees** only). The page shows state-specific restrictions and the definitions of hired, owned, etc., vehicles.

https://communities.int.ch2m.com/legal/insurance/Shared%20Documents/AutoID_Cards.aspx?PageView=Shared

For ALL Vehicles if you are in an accident:

1. **Call the Police--**For any vehicle accident/damage, it is recommended that the local police (or site security/emergency services if working on a client site that provides such services) be called to determine if a report needs to be filed. In some instances, a report may not be required (during accident alerts, or in public parking lots). Document that the authorities were called and follow up with any guidance they give you. State requirements vary. If a report is filed, obtain a copy.

2. Notify Supervisor, (and PM/RHSM if working on a project site)

3. If you are injured, call 911 for emergency medical treatment or 1-866-893-2514 to contact the CH2M HILL Occupational Nurse/Physician for minor injuries. If you feel you have not been injured, contact the RHSM for guidance on whether calling the CH2M HILL Occupation Nurse/Physician is applicable.

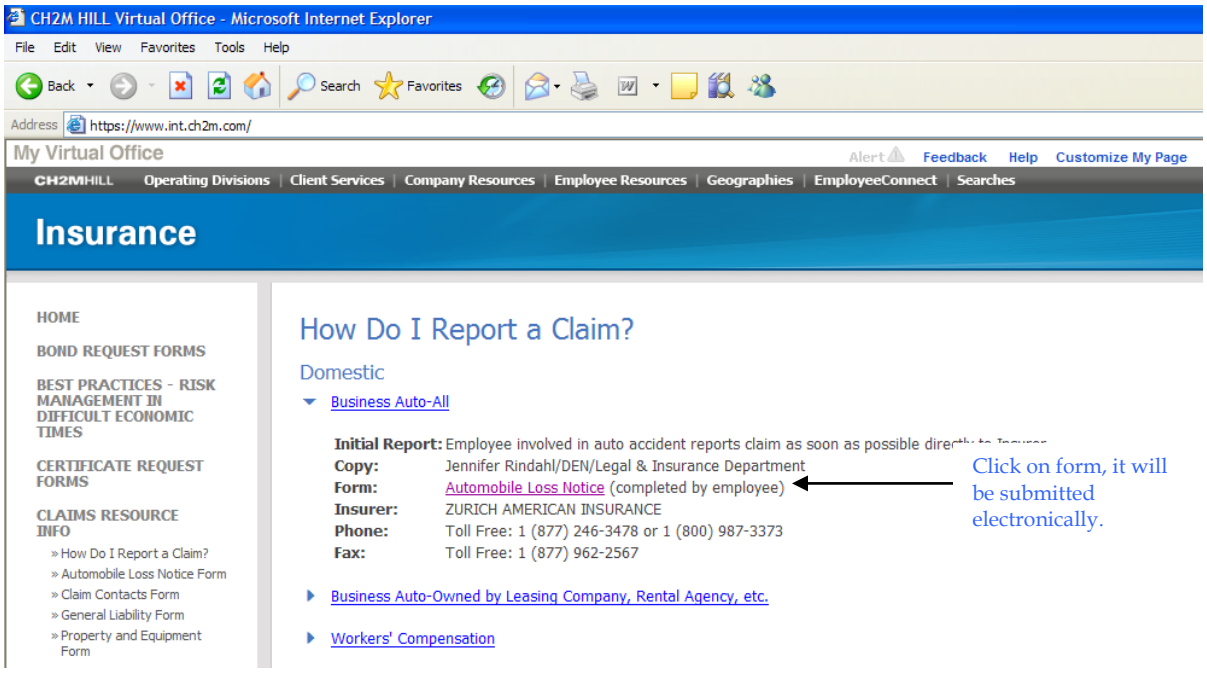
4. Complete a HITS report on the VO.

Additional Steps for FLEET VEHICLES:

Definition: These are vehicles **rented for greater than 90 days** or rentals that are **leased** (either through ARI [Automotive Rental, Inc.] or leases from other companies [older fleet vehicles]).

Report the accident to the following:

1. Fill out and Auto Loss Notice on the Virtual Office (click "Company Resources," then "Corporate Groups," then "Insurance"). See screen shot below.



2. Contact Zurich (1-877-246-3478 or 1-800-987-3373).

3. Contact Linda George/DEN at 720-286-2057.

Note: If you are an ES employee that happens to use an **OMI vehicle** on a project and get into an accident, you must also contact Michelle Garlington/DEN (720-286-4273).

Additional Steps for RENTALS:

1. Fill out and Auto Loss Notice on the Virtual Office (click "Company Resources," then "Corporate Groups," then "Insurance"). See screen shot above.

2. Call 1-800-VISA-911 (**only** if the car has been **rented for less than 31 days**—they provide some additional physical damage coverage in this time period).

3. Call Zurich (1-877-246-3478 or 1-800-987-3373).

4. Call the rental company (Budget, National, Enterprise, etc.).

5. Call Linda Anderson/DEN at 720-286-2041

For Personally Owned Vehicles (POVs):

CH2M HILL does not provide auto insurance for POVs, it is responsibility of the owner. If you are in a vehicle accident conducting company business, contact the police as above, supervisor, and 911 or CH2M HILL's occupational nurse/physician as stated above. Complete a HITS report. Refer to the Employee Handbook/Policies, assistance for meeting personal insurance deductibles (up to $500) is available with proof of insurance and deductible.

If using your POV for extended project use, notify the PM to make sure a rental car is not needed. Check your insurance policy for guidance on using the POV for business use.

Additional Resources:

Business Auto Insurance Manual
https://www.int.ch2m.com/webuploads/newsgenerator/travel/news/business_auto_manual[1].pdf

Claims Resource Manual
https://www.int.ch2m.com/intrnl/voffice/corp/insurance/InsHome.asp

Stop Work Order

REPORT PREPARED BY:

Name:	**Title:**	**Signature:**	**Date:**

ISSUE OF NONPERFORMANCE:

Description:	Date of Nonperformance:
	_____

SUBCONTRACTOR SIGNATURE OF NOTIFICATION:

Name:	**Title:**	**Signature:**	**Date:**

**** Corrective action is to be taken immediately. Note below the action taken, sign and return to CCI.* Work may not resume until authorization is granted by CH2M HILL Constructors, Inc. Representative,***

SUBCONTRACTOR'S CORRECTIVE ACTION

Description:	Date of Nonperformance:
	_____

SUBCONTRACTOR SIGNATURE OF CORRECTION

Name:	**Title:**	**Signature:**	**Date:**