# WORK PLAN
# BASEWIDE INVESTIGATION AND STUDIES SUPPORT

## TREATABILITY STUDY WORK PLAN

**SITE 4**
**NAVAL WEAPONS INDUSTRIAL RESERVE PLANT BETHPAGE**
**BETHPAGE, NEW YORK**

**Prepared for:**

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**CTO WE08-05**

**June 2015**

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## List of Acronyms

| | |
|---|---|
| bgs | below ground surface |
| CAMP | Community Air Monitoring Plan |
| CFR | Code of Federal Regulation |
| CLEAN | Comprehensive Long-Term Environmental Action Navy |
| COC | Concentration of Contaminates Of Concern |
| CTO | Contract Task Order |
| EDD | Electronic Data Delivery |
| HCI | Hydrochloric acid |
| $HNO_3$ | Nitric acid |
| HWF | Hot Water Flushing |
| IDW | Investigation Derived Waste |
| LTSE | Low Temperature Steam Extraction |
| mL | Milliliter |
| NAPL | Non Aqueous Phase Liquid |
| NAVFAC MIDLANT | Naval Facilities Engineering Command, Mid-Atlantic |
| NIRIS | Naval Installation Restoration Information System |
| NWIRP | Naval Weapons Industrial Reserve Plant |
| NYSDEC | New York State Department of Environmental Conservation |
| NYSDOH | New York State Department of Health |
| pH | Negative logarithm of the hydrogen ion concentration/power of the hydrogen ion |
| PID | Photoionization Detector |
| PM | Project Manager |
| RDM | Regional Data Manager |
| RPM | Restoration Program Manager |
| SOPs | Standard Operating Procedures |
| SPLP | Synthetic Precipitation Leaching Procedure |
| SSHO | Site Safety and Health Officer |
| SVOC | Semivolatile Organic Compound |
| TAL | Target Analyte List |
| U.S. EPA | United States Environmental Protection Agency |
| VOAs | Volatile Organic Analysis |
| VOCs | Volatile Organic Compounds |

# 1.0 PROJECT BACKGROUND

## 1.1 Introduction

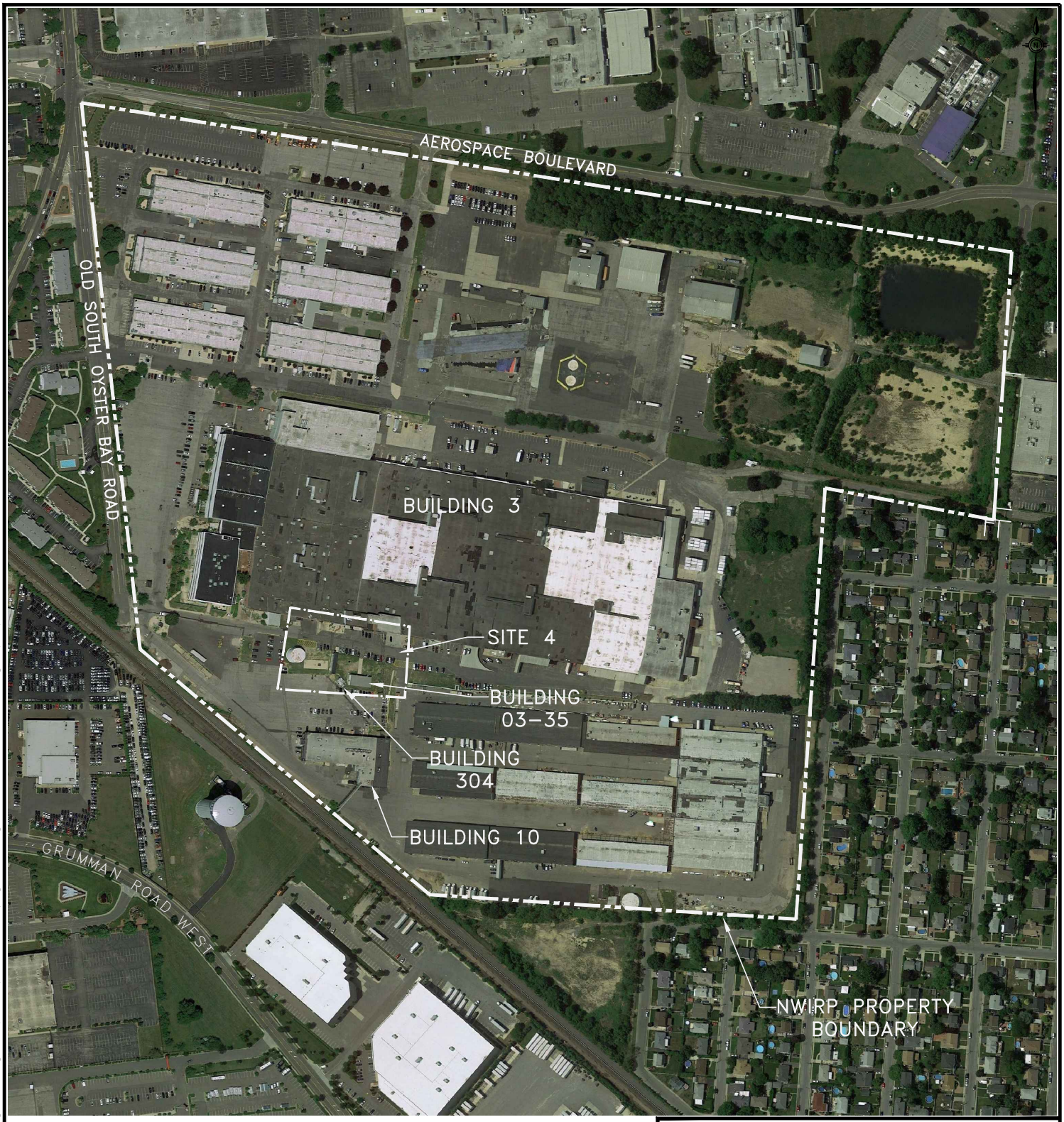
Under the direction of the Naval Facilities Engineering Command, Mid-Atlantic (NAVFAC MIDLANT), Resolution Consultants is supporting the Navy with environmental activities at Naval Weapons Industrial Reserve Plant (NWIRP) Bethpage. This Work Plan is associated with the Contract Task Order (CTO) WE08 Modification 05, under the Comprehensive Long-Term Environmental Action Navy (CLEAN) program. This Work Plan presents the planned scope of work to conduct a treatability study that will evaluate the effectiveness of hot water flushing/low temperature steam extraction and high temperature steam extraction in meeting the Site 4 cleanup goals presented in the Proposed Plan (NAVY 2014). The bench test will evaluate the effectiveness of recovering Non Aqueous Phase Liquid (NAPL), meeting the soil clean-up levels, and reducing the potential for contaminants to leach to groundwater. The results of this bench test will be incorporated into the preliminary (30%) remedial design.

## 1.2 Site 4 Background

Site 4 is located on a 9-acre parcel being retained by the Navy to complete environmental investigation and remediation. Site 4 is located south of Plant No. 3 between Plant No. 3 and Building 03-35 (Figure 1-1). Environmental concerns were first identified at Site 4 during a 1997 investigation by Northrup Grumman Corporation that identified former underground storage tanks (USTs) and petroleum contaminated soil in the area. The USTs reportedly contained No. 6 Fuel Oil, and were removed between 1980 and 1984. Since then, petroleum-contaminated soil and semi-solid petroleum NAPL have been identified above and below the water table (approximately 50 feet below ground surface [bgs]). Clean soils have been confirmed at a depth of 73 feet bgs.

The Navy evaluated remedial alternatives for the Site in a Feasibility Study/Corrective Measures Study (TT NUS 2013). Steam Injection and NAPL Recovery was selected as the preferred remedy in the Proposed Plan (TT NUS 2014).

The Navy conducts its environmental cleanup work for the former NWIRP Bethpage (including Site 4) under CERCLA and the Defense Environmental Restoration Program. The Navy is the lead agency for the CERCLA cleanup. The New York State Department of Environmental Conservation (NYSDEC), with assistance from the New York State Department of Health (NYSDOH), is the lead state agency providing regulatory consultation to the Navy.




## NOTES

1. GOOGLE EARTH PRO IMAGERY – 06/19/2014

0 400 800

SCALE IN FEET

FIGURE 1–1
SITE LOCATION MAP
TREATABILITY STUDY WORK PLAN–SITE 4
NAVAL WEAPONS INDUSTRIAL
RESERVE PLANT BETHPAGE
BETHPAGE, NEW YORK

| | |
|---|---|
| REQUESTED BY: PD | DWG DATE: 11MAY2015 |
| DRAWN BY: JDL | DWG NO: 13596 |

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## 1.3 Approach

This treatability study has been developed to collect data needed to complete the remedial design of the preferred remedial alternative which includes steam injection and NAPL recovery to treat impacted soils. There are two components to the scope of work and each are described in this Work Plan.

- Collection of the Bulk Soil Sample — Advancement of soil boring(s) to assess subsurface conditions and collect analytical samples and bulk soil for treatability testing.

- Completion of the Treatability Study — Bench testing will be performed by Terra Therm and includes hot water flushing/ and steam enhanced extraction testing. Also, non-aqueous phase liquid (NAPL) transport properties will be evaluated. Analytical samples will be collected in the field, and throughout the course of the bench testing as described in Section 4.

All work completed under this CTO will conform to applicable United States Environmental Protection Agency (U.S. EPA), New York State Department of Environmental Conservation (NYSDEC) and Navy guidance.

# 2.0 TREATABILITY STUDY

## 2.1 Objectives

The bench test will evaluate the effectiveness of recovering NAPL, meeting the soil clean-up levels, and reducing the potential for contaminants to leach to groundwater. The objectives of the treatability study are as follows:

- Determine the effectiveness of hot water flushing(140°F) to remove NAPL and reduce the concentration of COCs.
- Determine the effectiveness of steam enhanced extraction (212°F) to remove NAPL and reduce the concentration of COCs.
- Understand NAPL characteristics (density, viscosity, surface tension) over a range of temperatures.
- Understand the leaching potential of PAHs following the bench-scale thermal simulations.

## 2.2 Project Scope

The scope of work addressed in this Work Plan includes the following:

- Mobilizing personnel, equipment, and materials/supplies
- Conducting utility mark-outs
- Setting up the support facilities, including a decontamination pad, etc.
- Implementing the Community Air Monitoring plan (CAMP)
- Installing soil boring(s) and collecting bulk soil for treatability testing
- Managing investigation derived waste
- Equipment decontamination and demobilization
- Performing the treatability study and associated analytical sampling

## 2.3 Treatability Study Procedures

Resolution Consultants will complete a treatability study on impacted soil located at Site 4 at NWIRP Bethpage. The impacted soil is anticipated to be between 45 and 65 feet below ground surface. Components of the treatability study are provided below. All work will be performed in accordance with Resolution Consultants Standard Operating Procedures (SOPs), provided in Appendix A.

## 2.4 Base and Site Access and Security

Activities associated with this Project will be completed at Site 4. Resolution Consultants will coordinate site access. All field personnel will provide appropriate identification and training information.

The site is located in a secure area, but subcontractors are responsible for providing security measures required to protect their equipment and materials. Work will be conducted between 7:00 AM and 5:00 PM during daylight hours. No work will take place on weekends or holidays. There is a staging area on-site for the drilling subcontractor to store equipment, if necessary.

## 2.5 Mobilization

Mobilization of personnel, equipment, and materials/supplies will not be initiated until the Navy has authorized site access and agreed to the schedule.

## 2.6 Utility Mark-Out and Clearance

Prior to mobilization, New York One Call Center will be contacted. Utilities located on Navy owned property will be located by a private utility locating company. Prior to drilling, each boring location will be pre-cleared to 5 feet bgs.

## 2.7 Construction Facilities

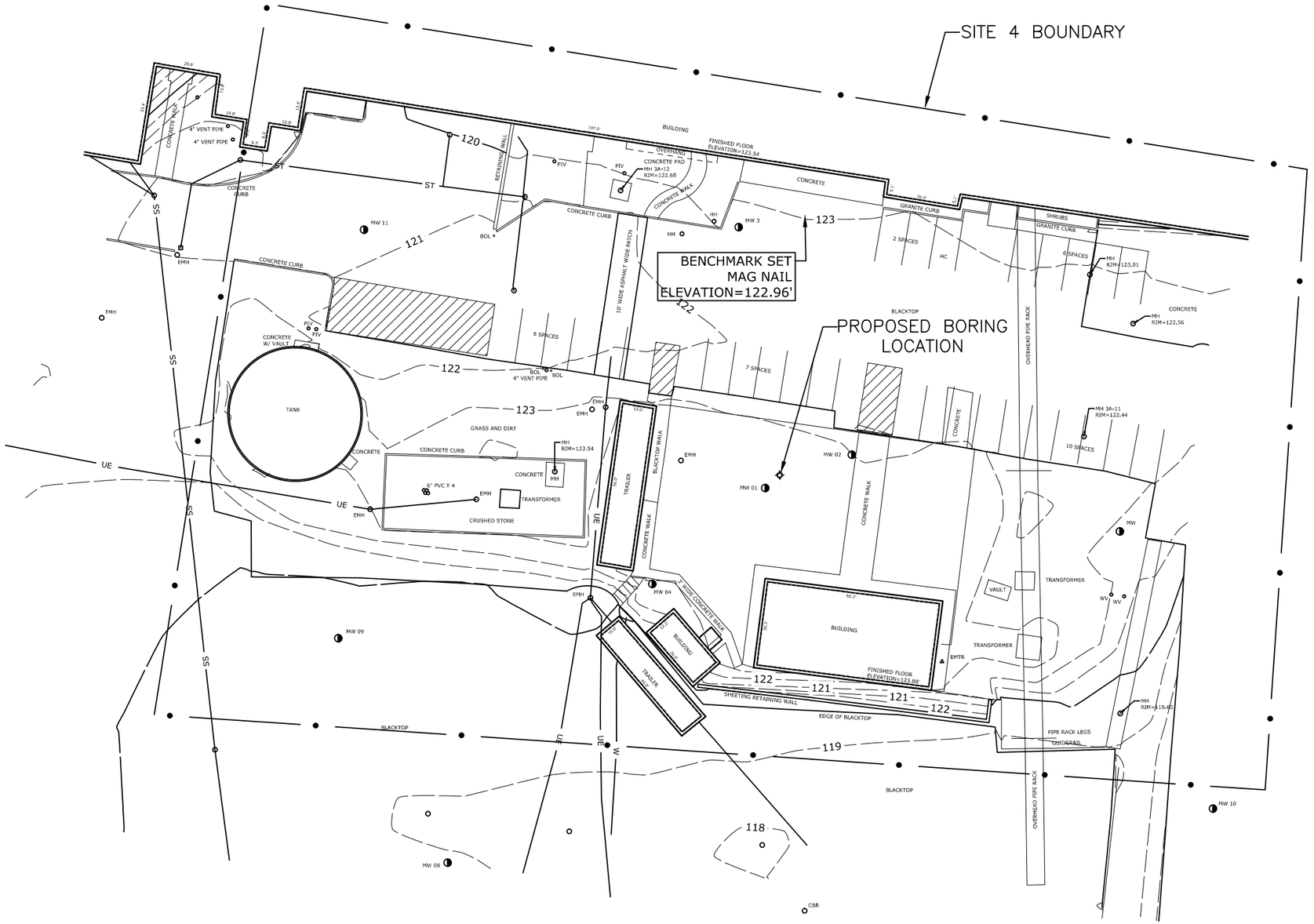
The Subcontractor will supply and set up the construction facilities in the staging area at the start of the project. The facilities will include:

- Decontamination pad — an appropriately sized decontamination pad will be set up to clean equipment and tooling.

- Miscellaneous items — equipment staging area, spill kit, etc.

## 2.8 Soil Boring Installation and Soil Sampling

At least one soil boring will be advanced to approximately 70 feet bgs using Rotosonic drilling techniques. The soil boring will be installed at the location shown on Figure 2-1. Additional soil borings may be required to collect the required amount of impacted soil for laboratory testing (approximately 10 gallons). The impacted soil is expected to be encountered between 45 and 65 feet bgs.




MAP NOTES

1. TOPOGRAPHIC INFORMATION SHOWN HEREON WAS COMPILED FROM AN ACTUAL FIELD SURVEY CONDUCTED ON DECEMBER 9, 2014.
2. NORTH ORIENTATION IS GRID NORTH BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM, LONG ISLAND ZONE, NAD 83 AS OBTAINED FROM GPS OBSERVATION.
3. VERTICAL DATUM SHOWN HEREON IS NAVD 88 AS OBTAINED FROM GPS OBSERVATION.
4. THE LOCATION OF UNDERGROUND IMPROVEMENTS OR ENCROACHMENTS, IF ANY EXIST, OR AS SHOWN HEREON, ARE NOT CERTIFIED. THERE MAY BE UNDERGROUND UTILITIES, THE EXISTENCE OF WHICH ARE NOT KNOWN TO THE UNDERSIGNED. SIZE AND LOCATION OF ALL UNDERGROUND UTILITIES AND STRUCTURES MUST BE VERIFIED BY THE APPROPRIATE AUTHORITIES. DIG SAFELY NEW YORK MUST BE NOTIFIED PRIOR TO CONDUCTING TEST BORINGS, EXCAVATION AND CONSTRUCTION.

LEGEND

| | | |
|---|---|---|
| ⊙ | | Proposed Boring Location |
| ▭ | CBCI | Catch Basin Curb Inlet |
| ○ | CBR | Catch Basin Round |
| □ | CBS | Catch Basin Square |
| ○ | DMH | Drainage Manhole |
| ○ | EMH | Electric Manhole |
| △ | EMTR | Electric Meter |
| ○ | HH | Hand Hold |
| ○ | MH | Manhole |
| ◑ | MW | Monitoring Well |
| | PVC | Poly Vinyl Chloride |
| ○ | PIV | Post Indicator Valve |
| | RCP | Reinforced Concrete Pipe |
| ○ | SMH | Sanitary Manhole |
| ○ | TMH | Telephone Manhole |
| ○ | WV | Water Valve |
| —UE— | | Underground Electric Line |
| —SS— | | Underground Sanitary Sewer Line |
| —W— | | Underground Water Line |

0 40 80

SCALE IN FEET

FIGURE 2–1
SOIL BORING LOCATION MAP
TREATABILITY STUDY WORK PLAN–SITE 4
NAVAL WEAPONS INDUSTRIAL
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BETHPAGE, NEW YORK

| | |
|---|---|
| REQUESTED BY: PD | DWG DATE: 11MAY2015 |
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NAVFAC Naval Facilities Engineering Command

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The soil boring will be continuously logged. Should additional soil boring(s) be needed to collect the required sample volume, they will be logged only in the impacted zone. Soils will be screened for volatile organic compounds (VOCs) utilizing a photoionization detector (PID). Each soil core will be photo logged.

Once the required soil volume is collected (approximately 10 gallons), the soil will be homogenized in the field and a baseline sample of the homogenized soil will be collected for analysis. Additional information about analytical sampling can be found in Section 2.11.

Following completion of the soil boring, the borehole will be abandoned by grouting the borehole with Volclay (or similar) high-solids bentonite slurry. The slurry will be installed from the bottom of the borehole using a tremie pipe. The borehole will be patched using cold asphalt patch or soil (as applicable) to restore the surface.

## 2.9 Equipment Decontamination

The Subcontractor will be responsible for decontamination by pressurized steam cleaning of all down hole equipment (i.e., rods, bits, split spoons, and casing) prior to the start of work during the mobilization phase, at the completion of the work prior to demobilization, and in between borings, as applicable. Additional information regarding decontamination can be found in Section 4.2.

## 2.10 Demobilization

Following the completion of soil sampling, the Subcontractor will demobilize all equipment, materials, and construction facilities from the Site. If not already completed, all waste will be transported to the on-site staging area.

## 2.11 Analytical Sampling

Analytical samples will be collected as shown on Table 2-1 and Table 2-2. Table 2-3 presents the laboratory glassware that will be used.

Each sample will be labeled with the prefix “Site4TS-*-**”. The first asterisk will be used to identify the initial test and filled in with one of the following abbreviations.

- Field Baseline — FB
- Steam Enhanced Extraction — SEE1 or SEE2
- Hot Water Flush — HWF1 or HWF2

The double asterisk will be used to identify the individual components of the test according to the following abbreviations.

- Baseline — B
- Post Treatment — PT
- Leachate — L

**Table 2-1**
**Summary of Soil Analytical Samples**

| | VOCs 8260C | SVOCs 8270D | TAL Metals 6010C/7471B | SPLP VOCs 1312/8260C | SPLP SVOCs 1312/8270D | SPLP Metals 1312/6010C/7470A |
|---|---|---|---|---|---|---|
| **Field Sampling** | | | | | | |
| Field Baseline | X | X | X | X | X | X |
| Field Duplicate | X | X | X | X | X | X |
| Aqueous Field Blank | X | X | X | X | X | X |
| Aqueous Equipment Blank | X | X | X | X | X | X |
| Aqueous Trip Blank[1] | X | X | X | X | X | X |
| **Total** | **5** | **5** | **5** | **5** | **5** | **5** |
| **Hot Water Flushing Test** | | | | | | |
| Column 1 (24 hours) | X[2] | X | | X[2] | X | |
| Column 2 (48 hours) | X[2] | X | | X[2] | X | |
| Column 1 (24 hours) Final | X[2] | X | X[3] | X[2] | X | X[3] |
| Column 2 (48 hours) Final | X[2] | X | X[3] | X[2] | X | X[3] |
| Aqueous Trip Blank[1] | XX[2] | XX | XX | XX[2] | XX | XX |
| **Total** | **6** | **6** | **4** | **6** | **6** | **4** |
| **Steam Enhanced Extraction Test** | | | | | | |
| Column 1 (24 hours) | X[2] | X | | X[2] | X | |
| Column 2 (48 hours) | X[2] | X | | X[2] | X | |
| Column 1 (24 hours) Final | X[2] | X | X[3] | X[2] | X | X[3] |
| Column 2 (48 hours) Final | X[2] | X | X[3] | X[2] | X | X[3] |
| Aqueous Trip Blank[1] | XX[2] | XX | XX | XX[2] | XX | XX |
| **Total** | **6** | **6** | **4** | **6** | **6** | **4** |

***Notes:***
VOC = Volatile organic compound
SVOC = Semivolatile organic compound
TAL = Target analyte list
SPLP = Synthetic Precipitation Leaching Procedure

[1] Trip blanks are required to be sent with every shipment to the laboratory. The number of trip blanks shown in this table is an estimate and may vary depending on frequency and timing of shipments to the laboratory.

[2] VOC analysis may be omitted based on the results of the field baseline sample. If VOCs are not significantly detected, the analysis will be omitted.

[3] Metals analysis may be omitted based on the results of the field baseline sample. If Metals are not significantly detected, the analysis will be omitted.

**Table 2-2**
**Summary of Aqueous Analytical Samples**

| | VOCs 8260C | SVOCs 8270D | TAL Metals 6010/7470A |
|---|---|---|---|
| **Leachate Samples** | | | |
| HWF Column 2 — First Flush | X | X | X |
| HWF Column 2 — Final Flush | X | X | X |
| **Total[1]** | **2** | **2** | **2** |

***Notes:***
HWF = Hot Water Flushing
VOC = Volatile organic compound
SVOC = Semivolatile organic compound
TAL = Target analyte list
[1] Trip blanks are required for every shipment to the laboratory. Trip blanks are not shown for the leachate samples because it is assumed they will be submitted with the soil samples. The number of trip blanks shown in this table is an estimate and may vary depending on frequency and timing of shipments to the laboratory.

**Table 2-3**
**Summary Glassware, Preservative, and Hold Times**

| Matrix | Analytical Group | Analytical and Preparation Method / SOP Reference | Containers | Sample Volume | Preservation Requirements | Maximum Holding Time |
|---|---|---|---|---|---|---|
| Soil | VOCs | SW-846 5035, 8260B | *3 X40-mL VOA vials | 5 g | 5 mL reagent water, cool to ≤ 6 °C | 48 hours to freezing, 14 days to analysis |
| | | | *1 X 40-mL VOA vial | 5 g | 5 mL methanol, cool to ≤ 6 °C | |
| | SVOCs | SW-846 3540C or 3550C, 8270C, 8270C_SIM | 1 X 4-oz wide-mouth jar | 30 g | Cool to ≤ 6 °C | 14 days to extraction, 40 days to analysis |
| | Metals | SW-846 3050B, 6010C | | 2 g | None | 6 months to analysis |
| | | SW-846 3050B, 6020A | | 2 g | None | |
| | | SW-846 7471A | | 0.6 g | Cool to ≤ 6 °C | 28 days to analysis |
| Water | VOCs | SW-846 5030B, 8260B | 3 X 40-mL VOA vials | 40 mL | HCl to pH < 2, cool to ≤ 6 °C. | 14 days to analysis |
| | SVOCs | SW-846 3510C or 3520C, 8270C, 8270C_SIM | 2 X 1- L amber glass bottles | 1000 mL | Cool to ≤ 6 °C | 7 days to extraction 40 days to analysis |
| | Metals | SW846 3010A, 6010C, 6020A | 1 X 250-mL polyethylene bottle | 50 mL | $HNO_3$ to pH<2 | 6 months to analysis |
| | | | | 50 mL | | |
| | | SW7470A | | 25 mL | | 28 days to analysis |

***Notes:***
* = Sample volume will be collected using the Terra Core sampler
SOP = Standard Operating Procedures
VOCs = Volatile Organic Compounds
SVOCs = Semivolatile Organic Compound
mL = milliliter
g = grams
$HNO_3$ = Nitric acid
VOA = Volatile Organic Analysis
HCl = Hydrochloric acid
pH = Negative logarithm of the hydrogen ion concentration/power of the hydrogen ion

The laboratory will perform all of the internal quality control procedures specified in the Standard associated with the laboratory test. Quality control procedures for sample handling and documentation are described in the applicable ASTM Standards.

All data will be reviewed by the Project Chemist or CTO Manager upon receipt to ensure completeness and compliance with project objectives. Formal data validation will not be performed.

## 2.12 Bench Testing

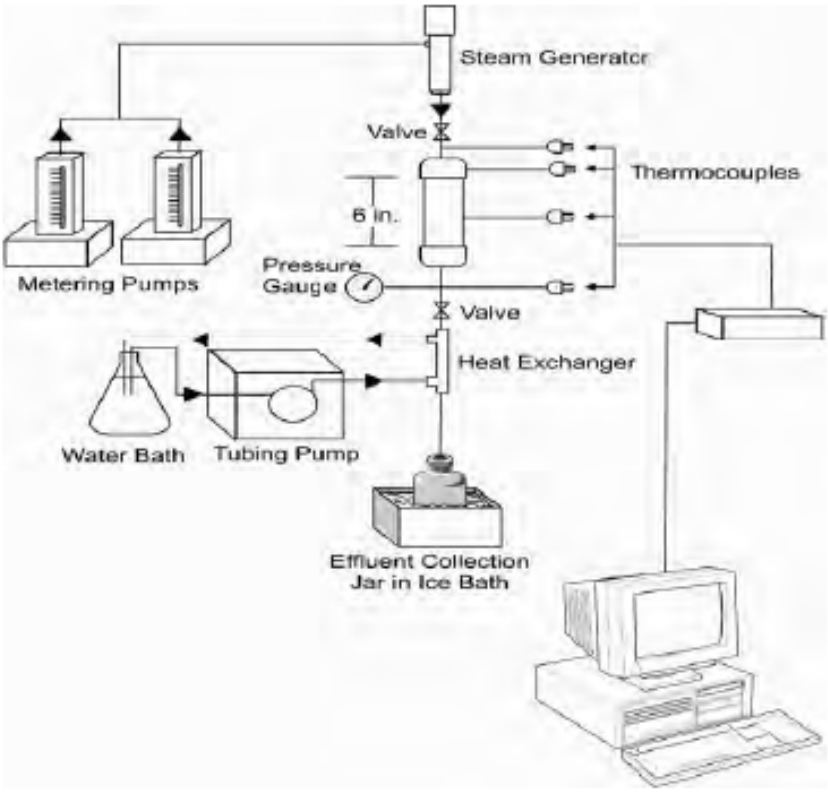
The following sections summarize the bench testing to be performed by TerraTherm. TerraTherm's laboratory plan can be found in Appendix B.

### Hot Water Flushing Test

Under the direction of Resolution Consultants, TerraTherm will conduct the Hot Water Flushing Test as described in Appendix B. Hot water (~140°F) will be used to simulate treatment with low temperature steam. Two soil columns will be set up as presented in Figure 2-2. Baseline samples of each core will be collected for VOCs, SVOCs, and Synthetic Precipitation Leaching Procedure (SPLP) analysis. The soil column temperature will be maintained at 140°F for each test. The initial test will run until 30 pore volumes are flushed. The second column, or intermediate test, will run 15 pore volumes flush in order to generate data at an intermediate interval. Two columns are necessary to obtain intermediate data because the columns cannot be sampled mid test without disturbing the core and compromising the test. For each test, temperature will be recorded at 1 hour intervals. NAPL release will be monitored, including recording the volume of NAPL recovered and conducting a visual inspection of NAPL properties. Recordings will be taken of the amount of pore volumes flushed during treatment.

At the conclusion of the tests, the soil columns will be allowed to reach ambient temperature before sampling for VOCs, SVOCs, TAL metals, and SPLP analysis. The soil columns will also be inspected and photo documented. The inspection will include an evaluation of the presence of visual NAPL and a determination of the percent saturation of the pore spaces will be made. The liquid that passes through the column during the first flush and the final flush will also be containerized and sampled for VOCs, SVOCs and TAL metals.

**Figure 2-2 Conceptual Laboratory Set-Up**




**Steam Enhanced Extraction Test**

Under the direction of Resolution Consultants, TerraTherm will conduct the Steam Enhanced Extraction Test as described in Appendix B. The soil column temperature will be maintained at 212°F using steam in replicate high temperature steam extraction. Two soil columns will be set up as presented in Figure 2-2. Baseline samples will be collected from each column for VOCs, SVOCs and SPLP analysis. One column will be flushed with steam for 2 pore volumes. This test will simulate a typical steam injection that would be suitable for removal of NAPL and removal of the volatile chemicals. The second test will be conducted for approximately 6 pore volume flushes. This test will simulate a typical steam injection that would be suitable for the removal of NAPL, volatile, and semi-volatile chemicals. Pressure cycling (letting steam pressure build in the soil column, releasing the pressure and repeating this cycle) will begin when steam is observed at the column outlet. Pressure cycling will continue until the pore volume flushes are complete, as pressure cycling will remove additional NAPL. The soil column temperature will be maintained at approximately 212°F for the high temperature steam extraction test.

Two columns are necessary to obtain intermediate data because the columns cannot be sampled without disturbing the tests; the two pore volume column is providing the intermediate results. For each test, temperature will be recorded at 1 hour intervals. NAPL release will be monitored, recording the volume of NAPL recovered and conducting a visual inspection of NAPL properties. The number of pore volumes flushed during bench test will be recorded.

At the conclusion of the tests, the soil columns will be allowed to reach ambient temperature before sampling for VOCs, SVOCs, TAL metals, and SPLP analysis. The soil columns will also be inspected and photo documented. The liquid that passes through the column will also be containerized and sampled for SVOCs and TAL metals. The inspection will include an evaluation of the presence of visual NAPL and a determination of the percent saturation of the pore spaces will be made.

### Evaluation of NAPL Transport Properties

NAPL samples will be collected and analyzed for density as a function of temperature (ASTM D7263 mod), viscosity as a function of temperature (ASTM D445), as well as surface and interfacial tension as a function of temperature (ASTM D971).

## 2.13 Reporting

Upon completion of field and laboratory testing activities, a Treatability Study Summary Report will be prepared and will include the following elements:

- Description of the treatability study procedures
- Presentation of the treatability study results, including field measurements and observations and treatability and leachability laboratory data
- Treatability study conclusions and recommendations

## 3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Project personnel include the Project Manager (PM), Site Supervisor, Site Safety and Health Officer (SSHO), and subcontractors. Responsibilities of the project personnel are described in the following sections.

### 3.1 Project Manager

The NWIRP Bethpage CTO Manager, Mr. Brian Caldwell will provide project continuity and be responsible for overall coordination of the work covered under this Work Plan. The CTO Manager will have overall responsibility to coordinate with the Navy Restoration Program Manager (RPM).

### 3.2 Site Supervisor

The Site Supervisor will ensure that filed activities are performed according to this Work Plan. The Site Supervisor's responsibilities include:

- Overseeing work performed by the field team
- Coordinating subcontract activities at the site
- Verifying subcontractors are performing the work according to this Work Plan
- Monitoring work progress and schedule and updating the CTO Manager daily

Timely reporting of significant problems encountered to the CTO Manager to allow discussion with the Navy RPM prior to making any changes as needed.

### 3.3 Site Safety and Health Officer

The SSHO will be responsible for managing, implementing, and enforcing Resolution Consultants' Site Specific HASP included as Appendix C. The SSHO will be a competent person that can identify existing and predictable hazards in the working environment or working conditions that are dangerous to personnel, and who has authorization to take prompt corrective measures to eliminate them. The Site Safety and Health Officer is required to have completed the 8-hour HAZWOPER Supervisor Training Course in accordance with 29 Code of Federal Regulation 1910.120 (e)(4). The SSHO will have the authority and is responsible for the following actions:

- Verifying that work is performed in accordance with the HASP

- Inspect site activities to identify safety and occupational health deficiencies

- Stop work if unacceptable safety and health conditions exist, and take necessary action to reestablish and maintain safe working conditions

- Leading daily Tailgate Safety Meetings prior to the start of work

- Ensure all field personnel, including any subcontractor personnel, assigned to the project have satisfied requirements for training and medical surveillance as specified by 29 Code of Federal Regulation (CFR) 1910.120, and that records of training and medical approval are available and maintained for each person

- Operate and maintain air monitoring equipment required at a site for airborne contaminants and prepare air monitoring reports

- Maintain all required safety and health records (e.g., OSHA 300 Logs, incident/accident reports, training certificates and qualifications, equipment checklists, safety plans, air monitoring data and reports, etc.) throughout the life of the project

- Select an alternate SSHO by name and inform him/her of their duties, in the event that the SSHO must leave or is absent from the site.

## 3.4 Subcontractors

Subcontractors will be selected by Resolution Consultants to perform specified tasks under this project, for utility locating, soil boring installation, bench testing, and analytical sampling. The subcontractors will be responsible for safely performing the tasks in accordance with this Work Plan and their own HASP.

# 4.0 WASTE MANAGEMENT AND ENVIRONMENTAL PROTECTION

## 4.1 Community Air Monitoring Plan

Resolution Consultants will conduct perimeter air monitoring and work zone monitoring in accordance with the CAMP. A copy of the CAMP is provided in as an Attachment to the HASP located in Appendix C.

If necessary, dust control measures will be implemented to minimize the potential for dust generation during investigation activities. Dust control measures will include water spraying and limiting dust generating activities. If necessary, odor control measures will be implemented at the site to minimize the potential exposure to nuisance odors, including containerizing or covering impacted soil.

## 4.2 Decontamination

The Subcontractor will be responsible for decontamination by pressurized steam cleaning of all down hole equipment (i.e., rods, bits, split spoons, and casing) prior to the start of work during the mobilization phase, at the completion of the work prior to demobilization, and in between borings, as applicable. The Subcontractor should be aware that during the period of performance, some equipment may come into contact with substances including VOCs, SVOCs, and metals. The drill rig will be decontaminated using a pressure washer. The Subcontractor will provide the equipment and Liquinox to conduct the decontamination. Resolution Consultants will provide guidance on these procedures, as applicable. The Subcontractor will transport decontamination fluids to a FRAC tank onsite for disposal by Resolution Consultants. Decontamination will be conducted above a water tight container to capture the impacted water. The Subcontractor will construct a decontamination pad for the decontamination of the drill rig and equipment. The drill rig and tooling will be decontaminated prior to demobilization from the site. Decontamination fluid will be containerized as indicated below.

## 4.3 Good Housekeeping

The following are the material management practices that will be used to reduce the risk of spills or other accidental exposure of materials and substances:

- Designate areas for equipment maintenance and repair.
- Designate areas for equipment decontamination.

- Provide protected storage areas for chemicals, paints, and other potentially toxic materials.

- Store all materials in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure.

Conduct daily inspections of the area to ensure proper use and disposal of materials on site.

## 4.4 Spill Control Practices

In addition to the good housekeeping and material management practices discussed above, the following practices will be followed for spill prevention and cleanup:

- Materials and equipment necessary for spill cleanup will be kept near the drill rig. Equipment and materials will include but will not be limited to rags, gloves, goggles, absorbent material, and plastic and metal containers specifically designed for this purpose.

- All spills will be cleaned immediately after discovery.

- Spills of toxic or hazardous material will be reported to the appropriate Base, State, and/or local government agency, as required.

## 4.5 Investigation Derived Wastes

All investigation derived waste (IDW), including soil cuttings, spent drilling fluids, and decontamination fluids, will be transported by the drilling subcontractor to the staging area and transferred to roll offs for solid waste or to a FRAC tank for liquids. The storage containers will be provided by Resolution Consultants. The staging area is located approximately one half mile away from the site. Drill cuttings and slurries will not be allowed to discharge to nearby storm catch basins/drains or the sanitary sewer.

Resolution Consultants will be responsible for disposing of all IDW generated at the completion of the work. Prior to being transported off-site, wastes will be properly characterized and profiled for disposal. Waste disposal will be approved as required and the intended facility will confirm their acceptance of the waste prior to transport.

## 5.0 HEALTH AND SAFETY

Resolution Consultants has prepared a HASP for other site activities conducted under this CTO which meets the requirements of 29 CFR 1910.120. The HASP is included as Appendix C. Work performed by the field team will be conducted according to the HASP. Field personnel will be required to read and acknowledge understanding of the HASP.

The HASP is intended to cover Resolution Consultants employees and site visitors. Subcontractors will be responsible for their own health and safety and will work under their own HASPs. All site work will be conducted by personnel that have 40 hour OSHA training.

## 6.0 SCHEDULE

It is anticipated that the treatability study test will be completed in 3 weeks, from mobilization of drilling equipment and start of drilling to the completion of the bench testing. The anticipated schedule is presented below.

- Implement field work/investigation in May/June 2015
- Preparation of the Treatability Study Summary Report July 2015
- Preparation of the 30% Remedial Design July 2015

## 7.0 REFERENCES

Tetra Tech NUS. *Proposed Plan Site 4, Former Underground Storage Tanks, Free Product, Petroleum and Chlorinated Solvent-Contaminated Soil*, Naval Weapons Industrial Reserve Plant Bethpage, New York. October 2014.

— *Feasibility Study/Corrective Measures Study, Site 4 (Area of Concern 22) Former Underground Storage Tanks*, Naval Weapons Industrial Reserve Plant Bethpage, New York. February 2013.

# Appendix A
# Standard Operating Procedures

# Utility Clearance

# Procedure 3-01

## 1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) describes the process for determining the presence of subsurface utilities and other cultural features at locations where planned site activities involve the physical disturbance of subsurface materials.

1.2 This procedure is the Program-approved professional guidance for work performed by Resolution Consultants under the Comprehensive Long-Term Environmental Action Navy (CLEAN) contract (Contract Number N62470-11-D-8013).

1.3 The procedure applies to the following activities: soil gas surveying, excavating, trenching, drilling of borings and installation of monitoring and extraction wells, use of soil recovery or slide-hammer hand augers, and all other intrusive sampling activities.

1.4 The primary purpose of the procedure is to minimize the potential for damage to underground utilities and other subsurface features, which could result in physical injury, disruption of utility service, or disturbance of other subsurface cultural features.

1.5 If there are procedures, whether it be from Resolution Consultants, state, and/or federal, that are not addressed in this SOP and are applicable to utility clearance, those procedures should be added as an appendix to the project specific SAP.

1.6 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

## 2.0 Safety

2.1 Field and subcontractor personnel shall adhere to a site-specific health and safety plan (HASP).

## 3.0 Terms and Definitions

3.1 **Utility**

For the proposes of this SOP, a utility is defined as a manmade underground line or conduit, cable, pipe, vault or tank that is, or was, used for the transmission of material or energy (e.g., gas, electrical, telephone, steam, water or sewage, product transfer lines, or underground storage tanks).

3.2 **As-Built Plans**

As-built plans are plans or blueprints depicting the locations of structures and associated utilities on a property.

3.3 **One-Call**

The Utility Notification Center is the one-call agency for nationwide call before you dig. The Utility Notification Center is open 24 hours a day, and accepts calls from anyone planning to dig. The phone number 811 is the designated call before you dig phone number that directly connects you to your local one-call center. Additional information can be found at www.call811.com.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Calling before you dig ensures that any publicly owned underground lines will be marked so that you can dig around them safely. Having the utility lines marked not only prevents accidental damage to the lines, but prevents property damage and personal injuries that could result in breaking a line.

The following information will need to be provided when a call is placed to One-Call:

- Your name, phone number, company name (if applicable), and mailing address.
- What type or work is being done.
- Who the work is being done for.
- The county and city the work is taking place in.
- The address or the street where the work is taking place.
- Marking instructions, (specific instructions as to where the work is taking place).

Under normal circumstances it takes between 2 to 5 days from the time you call (not counting weekends or holidays) to have the underground lines marked. Because these laws vary from state to state, exactly how long it will take depends on where your worksite is located. You will be given an exact start time and date when your locate request is completed, which will comply with the laws in your area.

In the event of an emergency (any situation causing damage to life or property, or a service outage), lines can be marked sooner than the original given time if requested.

3.4 **Toning**

Toning is the process of surveying an area utilizing one or more surface geophysical methods to determine the presence or absence of underground utilities. Typically, toning is conducted after identifying the general location of utilities and carefully examining all available site utility plans. Each location is marked according to the type of utility being identified. In addition, areas cleared by toning are flagged or staked to indicate that all identified utilities in a given area have been toned.

## 4.0 Training and Qualifications

4.1 The **Contract Task Order (CTO) Manager** is responsible for verifying that these utility locating procedures are performed prior to the initiation of active subsurface exploration.

4.2 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

4.3 The **Field Manager** is responsible for ensuring that all utility locating activities are performed in accordance with this procedure.

4.4 All **Field Personnel** are responsible for the implementation of this procedure.

## 5.0 Equipment and Supplies

5.1 Equipment and supplies necessary for locating subsurface utilities will be provided by the subcontractor; however, the project **Field Manager/Field Personnel** will provide any additional equipment and supplies as needed as well as maintain information regarding the utility clearance activities in the field logbook.

## 6.0 Procedure

Proceed wtih the following steps where subsurface exploration will include excavations, drilling, or any other subsurface investigative method that could damage utilities at a site. In addition to the steps outlined below, always exercise caution while conducting subsurface exploratory work.

6.1 **Prepare Preliminary Site Plan**

- Prepare a preliminary, scaled site plan depicting the proposed exploratory locations as part of the project specific Sampling and Analysis Plan (SAP) or Work Plan. Include as many of the cultural and natural features as practical in this plan.

6.2 **Review Background Information**

- Search existing plan files to review the as-built plans to identify the known location of utilities at the site. Plot the locations of utilities identified onto a preliminary, scaled site plan. Inform the CTO Manager if utilities lie within close proximity to a proposed exploration or excavation location. The CTO Manager will determine if it is necessary to relocate proposed sampling or excavation locations.
- Include the utility location information gathered during previous investigations (e.g., remedial investigation or remedial site evaluation) in the project design documents for removal or remedial actions. In this manner, information regarding utility locations collected during implementation of a CTO can be shared with the subcontractor during implementation of a particular task order. In many instances, this will help to reduce the amount of additional geophysical surveying work the subcontractor may have to perform.
- Conduct interviews with onsite and facility personnel familiar with the site to obtain additional information regarding the known and suspected locations of underground utilities. In addition, if appropriate, contact shall be made with local utility companies to request their help in locating underground lines. Pencil in the dimensions, orientation, and depth of utilities, other than those identified on the as-built plans, at their approximate locations on the preliminary plans. Enter the type of utility, the personnel who provided the information, and the date the information was provided into the field log.
- During the pre-field work interviewing process, the interviewer will determine which site personnel should be notified in the event of an incident involving damage to existing utilities. Record this information in the field logbook with the corresponding telephone numbers and addresses.

6.3 **Site Visit/Locate Utilities/Toning**

- Prior to the initiation of field activities, the Field Task Manager or similarly qualified field personnel shall visit the site and note existing structures and evidence of associated utilities, such as fire hydrants, irrigation systems, manhole and vault box covers, standpipes, telephone switch boxes, free-standing light poles, gas or electric meters, pavement cuts, and linear depression. Compare notes of the actual site configuration to the preliminary site plan. Note deviations in the field logbook and on the preliminary site plan. Accurately locate or survey and clearly mark with stakes, pins, flags, paint, or other suitable devices all areas where subsurface exploration is proposed. These areas shall correspond with the locations drawn on the preliminary site plan.
- Following the initial site visit by the Field Task Manager, a trained utility locating subcontractor will locate, identify, and tone all utilities depicted on the preliminary site plan. The Field Task Manager or similarly qualified field personnel shall visit the site and identify the areas of subsurface disturbance with white spray paint, chalk, white pin flags or some other easily identifiable marking. The utility locator should utilize appropriate sensing equipment to attempt to locate utilities that might not have appeared on the as-built plans. At a minimum, the utility subcontractor should utilize a metal detector and/or magnetometer; however, it is important to consider the possibility that non-metallic utilities or tanks might be present at the site. Use other appropriate surface geophysical methods such as Ground Penetrating Radar, Radiodetection, etc. as appropriate. Clear proposed exploration areas of all utilities in the immediate area where subsurface exploration is proposed. Clearly tone all anomalous areas. Clearly identify all toned areas on the preliminary site plan. All utilities near the area of subsurface disturbance should also be marked out by the utility subcontractor using the universal colors for subsurface utilities (i.e., red – electric; blue – water; green – sewer; yellow – gas; etc.). After toning the site and plotting all known or suspected buried utilities on the preliminary site plan, the utility locator shall provide the Field Task Manager with a copy of the completed preliminary

site plan. Alternatively, the Field Task Manager or designee shall document the results of the survey on the preliminary site plan.

- Report to the Field Task Manager anomalous areas detected and toned that are in close proximity to the exploration or excavation areas. The Field Task Manager shall determine the safe distance to maintain from the known or suspected utility. It may be necessary to relocate the proposed exploration or excavation areas. If this is required, the Field Task Manager or designee shall relocate them and clearly mark them using the methods described above. Completely remove the markings at the prior location. Plot the new locations on the site plan and delete the prior locations from the plan. In some instances, such as in areas extremely congested with subsurface utilities, it may be necessary to dig by hand or use techniques such as air knife to determine the location of the utilities.

6.4 **Prepare Site Plan**

- Prior to the initiation of field activities, draft a final site plan that indicates the location of subsurface exploration areas and all known or suspected utilities present at the site. Provide copies of this site plan to the Navy Technical Representative (NTR), the CTO Manager, and the subcontractor who is to conduct the subsurface exploration/excavation work. Review the site plan with the NTR to verify its accuracy prior to initiating subsurface sampling activities.

## 7.0 Quality Control and Assurance

7.1 Utility locating must incorporate quality control measures to ensure conformance to these and the project requirements.

## 8.0 Records, Data Analysis, Calculations

8.1 A bound field logbook will be kept detailing all activities conducted during the utility locating procedure.

8.2 The logbook will describe any changes and modifications made to the original exploration plan. The trained utility locator shall prepare a report and keep it in the project file. Also, a copy of the final site plan will be kept in the project file.

## 9.0 Attachments or References

Department of Defense, United States (DoD). 2005. *Uniform Federal Policy for Quality Assurance Project Plans, Part 1: UFP-QAPP Manual.* Final Version 1. DoD: DTIC ADA 427785, EPA-505-B-04-900A. In conjunction with the U. S. Environmental Protection Agency and the Department of Energy. Washington: Intergovernmental Data Quality Task Force. March. On-line updates available at: http://www.epa.gov/fedfac/pdf/ufp_qapp_v1_0305.pdf.

| Author | Reviewer | Revisions (Technical or Editorial) |
|---|---|---|
| Caryn DeJesus<br>Senior Scientist | Bob Shoemaker<br>Senior Scientist | Rev 0 – Initial Issue (June 2012) |

# Logbooks

# Procedure 3-02

## 1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) describes the activities and responsibilities pertaining to the identification, use, and control of logbooks and associated field data records.

1.2 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

## 2.0 Safety

2.1 In order to keep the logbook clean, store it in a clean location and use it only when outer gloves used for PPE have been removed.

## 3.0 Terms and Definitions

3.1 **Logbook**

A logbook is a bound field notebook with consecutively numbered, water-repellent pages that is clearly identified with the name of the relevant activity, the person assigned responsibility for maintenance of the logbook, and the beginning and ending dates of the entries.

3.2 **Data Form**

A data form is a predetermined format utilized for recording field data that may become, by reference, a part of the logbook (e.g., soil boring logs, trenching logs, surface soil sampling logs, groundwater sample logs, and well construction logs are data forms).

## 4.0 Training and Qualifications

4.1 The **Contract Task Order (CTO) Manager** or **designee** is responsible for determining which team members shall record information in field logbooks and for obtaining and maintaining control of the required logbooks. The **CTO Manager** shall review the field logbook on at least a monthly basis. The **CTO Manager** or **designee** is responsible for reviewing logbook entries to determine compliance with this procedure and to ensure that the entries meet the project requirements.

4.2 A knowledgeable individual such as the **Field Manager**, **CTO Manager**, or **Program Quality Manager** shall perform a technical review of each logbook at a frequency commensurate with the level of activity (weekly is suggested, or, at a minimum, monthly). Document these reviews by the dated signature of the reviewer on the last page or page immediately following the material reviewed.

4.3 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

4.4 The **Field Manager** is responsible for ensuring that all **field personnel** follow these procedures and that the logbook is completed properly and daily. The **Field Manager** is also responsible for submitting copies to the **CTO Manager**, who is responsible for filing them and submitting a copy (if required by the CTO Statement of Work).

4.5 The **logbook user** is responsible for recording pertinent data into the logbook to satisfy project requirements and for attesting to the accuracy of the entries by dated signature. The **logbook user** is also responsible for safeguarding the logbook while having custody of it.


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4.6 All **field personnel** are responsible for the implementation of this procedure.

## 5.0 Equipment and Supplies

5.1 Field logbooks shall be bound field notebooks with water-repellent pages.

5.2 Pens shall have indelible black ink.

## 6.0 Procedure

6.1 The field logbook serves as the primary record of field activities. Make entries chronologically and in sufficient detail to allow the writer or a knowledgeable reviewer to reconstruct the applicable events. Store the logbook in a clean location and use it only when outer gloves used for personal protective equipment (PPE) have been removed.

6.2 Individual data forms may be generated to provide systematic data collection documentation. Entries on these forms shall meet the same requirements as entries in the logbook and shall be referenced in the applicable logbook entry. Individual data forms shall reference the applicable logbook and page number. At a minimum, include names of all samples collected in the logbook even if they are recorded elsewhere.

6.3 Enter field descriptions and observations into the logbook, as described in Attachment 1, using indelible black ink.

6.4 Typical information to be entered includes the following:

- Dates (month/day/year) and times (military) of all on-site activities and entries made in logbooks/forms;
- Site name and description;
- Site location by longitude and latitude, if known;
- Weather conditions, including temperature and relative humidity;
- Fieldwork documentation, including site entry and exit times;
- Descriptions of, and rationale for, approved deviations from the work plan (WP) or field sampling plan;
- Field instrumentation readings;
- Names, job functions, and organizational affiliations of on-site personnel;
- Photograph references;
- Site sketches and diagrams made on site;
- Identification and description of sample morphology, collection locations, and sample numbers;
- Sample collection information, including dates (month/day/year) and times (military) of sample collections, sample collection methods and devices, station location numbers, sample collection depths/heights, sample preservation information, sample pH (if applicable), analysis requested (analytical groups), etc., as well as chain-of-custody (COC) information such as sample identification numbers cross-referenced to COC sample numbers;
- Sample naming convention;
- Field quality control (QC) sample information;
- Site observations, field descriptions, equipment used, and field activities accomplished to reconstruct field operations;


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- Meeting information;
- Important times and dates of telephone conversations, correspondence, or deliverables;
- Field calculations;
- PPE level;
- Calibration records;
- Contractor and subcontractor information (address, names of personnel, job functions, organizational affiliations, contract number, contract name, and work assignment number);
- Equipment decontamination procedures and effectiveness;
- Laboratories receiving samples and shipping information, such as carrier, shipment time, number of sample containers shipped, and analyses requested; and
- User signatures.

6.5 The logbook shall reference data maintained in other logs, forms, etc. Correct entry errors by drawing a single line through the incorrect entry, then initialing and dating this change. Enter an explanation for the correction if the correction is more than for a mistake.

6.6 At least at the end of each day, the person making the entry shall sign or initial each entry or group of entries.

6.7 Enter logbook page numbers on each page to facilitate identification of photocopies.

6.8 If a person's initials are used for identification, or if uncommon acronyms are used, identify these on a page at the beginning of the logbook.

6.9 At least weekly and preferably daily, the **preparer** shall photocopy and retain the pages completed during that session for backup. This will prevent loss of a large amount of information if the logbook is lost.

## 7.0 Quality Control and Assurance

7.1 Review per Section 4.2 shall be recorded.

## 8.0 Records, Data Analysis, Calculations

8.1 Retain the field logbook as a permanent project record. If a particular CTO requires submittal of photocopies of logbooks, perform this as required.

8.2 Deviations from this procedure shall be documented in field records. Significant changes shall be approved by the **Program Quality Manager**.

## 9.0 Attachments or References

9.1 Attachment 1 – Description of Logbook Entries

9.2 Department of Defense, United States (DoD). 2005. *Uniform Federal Policy for Quality Assurance Project Plans, Part 1: UFP-QAPP Manual*. Final Version 1. DoD: DTIC ADA 427785, EPA-505-B-04-900A. In conjunction with the U. S. Environmental Protection Agency and the Department of Energy. Washington: Intergovernmental Data Quality Task Force. March. On-line updates available at: http://www.epa.gov/fedfac/pdf/ufp_qapp_v1_0305.pdf.


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| Author | Reviewer | Revisions (Technical or Editorial) |
|---|---|---|
| Mark Kromis<br>Program Chemist | Chris Barr<br>Program Quality Manager | Rev 0 – Initial Issue |


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# Attachment 1
# Description of Logbook Entries

Logbook entries shall be consistent with Section A.1.4 *Field Documentation SOPs* of the UFP-QAPP Manual (DoD 2005) and contain the following information, as applicable, for each activity recorded. Some of these details may be entered on data forms, as described previously.

| Name of Activity | For example, Asbestos Bulk Sampling, Charcoal Canister Sampling, Aquifer Testing. |
|---|---|
| Task Team Members and Equipment | Name all members on the field team involved in the specified activity. List equipment used by serial number or other unique identification, including calibration information. |
| Activity Location | Indicate location of sampling area as indicated in the field sampling plan. |
| Weather | Indicate general weather and precipitation conditions. |
| Level of PPE | Record the level of PPE (e.g., Level D). |
| Methods | Indicate method or procedure number employed for the activity. |
| Sample Numbers | Indicate the unique numbers associated with the physical samples. Identify QC samples. |
| Sample Type and Volume | Indicate the medium, container type, preservative, and the volume for each sample. |
| Time and Date | Record the time and date when the activity was performed (e.g., 0830/08/OCT/89). Use the 24-hour clock for recording the time and two digits for recording the day of the month and the year. |
| Analyses | Indicate the appropriate code for analyses to be performed on each sample, as specified in the WP. |
| Field Measurements | Indicate measurements and field instrument readings taken during the activity. |
| Chain of Custody and Distribution | Indicate chain-of-custody for each sample collected and indicate to whom the samples are transferred and the destination. |
| References | If appropriate, indicate references to other logs or forms, drawings, or photographs employed in the activity. |
| Narrative (including time and location) | Create a factual, chronological record of the team's activities throughout the day including the time and location of each activity. Include descriptions of general problems encountered and their resolution. Provide the names and affiliations of non-field team personnel who visit the site, request changes in activity, impact the work schedule, request information, or observe team activities. Record any visual or other observations relevant to the activity, the contamination source, or the sample itself.<br>It should be emphasized that logbook entries are for recording data and chronologies of events. The logbook author must include observations and descriptive notations, taking care to be objective and recording no opinions or subjective comments unless appropriate. |
| Recorded by | Include the signature of the individual responsible for the entries contained in the logbook and referenced forms. |
| Checked by | Include the signature of the individual who performs the review of the completed entries. |

# Recordkeeping, Sample Labeling, and Chain-of-Custody

# Procedure 3-03

## 1.0 Purpose and Scope

1.1 The purpose of this standard operating procedure is to establish standard protocols for all field personnel for use in maintaining field and sampling activity records, writing sample logs, labeling samples, ensuring that proper sample custody procedures are utilized, and completing chain-of-custody/analytical request forms.

1.2 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

## 2.0 Safety

Not applicable.

## 3.0 Terms and Definitions

3.1 **Logbook**

A logbook is a bound field notebook with consecutively numbered, water-repellent pages that is clearly identified with the name of the relevant activity, the person responsible for maintenance of the logbook, and the beginning and ending dates of the entries.

3.2 **Chain-of-Custody**

Chain-of-custody (COC) is documentation of the process of custody control. Custody control includes possession of a sample from the time of its collection in the field to its receipt by the analytical laboratory, and through analysis and storage prior to disposal.

## 4.0 Training and Qualifications

4.1 The **CTO Manager** is responsible for determining which team members shall record information in the field logbook and for checking sample logbooks and COC forms to ensure compliance with these procedures. The **CTO Manager** shall review COC forms on a monthly basis at a minimum.

4.2 The **CTO Manager** and **Program Quality Manager** are responsible for evaluating project compliance with the Project Procedures Manual.

4.3 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

4.4 The **Laboratory Project Manager** or **Sample Control Department Manager** is responsible for reporting any sample documentation or COC problems to the **CTO Manager** or **CTO Laboratory Coordinator** within 24 hours of sample receipt.

4.5 The **Field Manager** is responsible for ensuring that all **field personnel** follow these procedures. The **CTO Laboratory Coordinator** is responsible for verifying that the COC/analytical request forms have been completed properly and match the sampling and analysis plan. The **CTO Manager** or **CTO Laboratory Coordinator** is responsible for notifying the **laboratory**, **data managers**, and **data validators** in writing if analytical request changes are required as a corrective action. These small changes are different from change orders, which involve changes to the scope of the subcontract with


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the laboratory and must be made in accordance with a respective contract (e.g., CLEAN remedial action contract).

4.6 All **field personnel** are responsible for following these procedures while conducting sampling activities. **Field personnel** are responsible for recording pertinent data into the logbook to satisfy project requirements and for attesting to the accuracy of the entries by dated signature.

# 5.0 Procedure

This procedure provides standards for documenting field activities, labeling the samples, documenting sample custody, and completing COC/analytical request forms. The standards presented in this section shall be followed to ensure that samples collected are maintained for their intended purpose and that the conditions encountered during field activities are documented.

## 5.1 Recordkeeping

The field logbook serves as the primary record of field activities. Make entries chronologically and in sufficient detail to allow the writer or a knowledgeable reviewer to reconstruct each day's events. Field logs such as soil boring logs and ground-water sampling logs will also be used. These procedures are described in Procedure 3-02, *Logbooks*.

## 5.2 Sample Labeling

Affix a sample label with adhesive backing to each individual sample container. Place clear tape over each label (preferably prior to sampling) to prevent the labels from tearing off, falling off, being smeared, and to prevent loss of information on the label. Record the following information with a waterproof marker on each label:

- Project name or number (optional);
- COC sample number;
- Date and time of collection;
- Sampler's initials;
- Matrix (optional);
- Sample preservatives (if applicable); and
- Analysis to be performed on sample (this shall be identified by the method number or name identified in the subcontract with the laboratory).

These labels may be obtained from the analytical laboratory or printed from a computer file onto adhesive labels.

## 5.3 Custody Procedures

For samples intended for chemical analysis, sample custody procedures shall be followed through collection, transfer, analysis, and disposal to ensure that the integrity of the samples is maintained. Maintain custody of samples in accordance with the U.S. Environmental Protection Agency (EPA) COC guidelines prescribed in EPA *NEIC Policies and Procedures*, National Enforcement Investigations Center, Denver, Colorado, revised May 1986; EPA *RCRA Ground Water Monitoring Technical Enforcement Guidance Document* (TEGD); *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA OSWER Directive 9355 3-01); Appendix 2 of the *Technical Guidance Manual for Solid Waste Water Quality Assessment Test (SWAT) Proposals and Reports*; and *Test Methods for Evaluating Solid Waste* (EPA SW-846)

A description of sample custody procedures is provided below.

### 5.3.1 Sample Collection Custody Procedures

According to the U.S. EPA guidelines, a sample is considered to be in custody if one of the following conditions is met:

- It is in one's actual physical possession or view;
- It is in one's physical possession and has not been tampered with (i.e., it is under lock or official seal);
- It is retained in a secured area with restricted access; and
- It is placed in a container and secured with an official seal such that the sample cannot be reached without breaking the seal.

Place custody seals on sample containers immediately after sample collection and on shipping coolers if the cooler is to be removed from the sampler's custody. Place custody seals in such a manner that they must be broken to open the containers or coolers. Label the custody seals with the following information:

- Sampler's name or initials; and
- Date and time that the sample/cooler was sealed.

These seals are designed to enable detection of sample tampering. An example of a custody seal is shown in Attachment 1.

**Field personnel** shall also log individual samples onto COC forms (carbon copy or computer generated) when a sample is collected. These forms may also serve as the request for analyses. Procedures for completing these forms are discussed in Section 7.4, indicating sample identification number, matrix, date and time of collection, number of containers, analytical methods to be performed on the sample, and preservatives added (if any). The **samplers** will also sign the COC form signifying that they were the personnel who collected the samples. The COC form shall accompany the samples from the field to the laboratory. When a cooler is ready for shipment to the analytical laboratory, the **person delivering the samples for transport** will sign and indicate the date and time on the accompanying COC form. One copy of the COC form will be retained by the **sampler** and the remaining copies of the COC form shall be placed inside a self-sealing bag and taped to the inside of the cooler. Each cooler must be associated with a unique COC form. Whenever a transfer of custody takes place, **both parties** shall sign and date the accompanying carbon copy COC forms, and the **individual relinquishing the samples** shall retain a copy of each form. One exception is when the samples are shipped; the **delivery service personnel** will not sign or receive a copy because they do not open the coolers. The **laboratory** shall attach copies of the completed COC forms to the reports containing the results of the analytical tests. An example COC form is provided in Attachment 2.

### 5.3.2 Laboratory Custody Procedures

The following custody procedures are to be followed by an **independent laboratory** receiving samples for chemical analysis; the procedures in their Naval Facilities Engineering Service Center-evaluated Laboratory Quality Assurance Plan must follow these same procedures. A **designated sample custodian** shall take custody of all samples upon their arrival at the analytical laboratory. The **custodian** shall inspect all sample labels and COC forms to ensure that the information is consistent, and that each is properly completed. The **custodian** will also measure the temperature of the temperature blank in the coolers upon arrival using either a National Institute for Standards and Technology calibrated thermometer or an infra-red temperature gun. The **custodian** shall note the condition of the samples including:

- If the samples show signs of damage or tampering;
- If the containers are broken or leaking;
- If headspace is present in sample vials;
- If proper preservation of samples has occurred (made by pH measurement, except volatile organic compounds [VOCs] and purgeable total petroleum hydrocarbons [TPH] and temperature). The pH of VOC and purgeable TPH samples will be checked by the **laboratory analyst** after the sample aliquot has been removed from the vial for analysis; and
- If any sample holding times have been exceeded.

All of the above information shall be documented on a sample receipt sheet by the **custodian**.

Discrepancies or improper preservation shall be noted by the **laboratory** as an out-of-control event and shall be documented on an out-of-control form with corrective action taken. The out-of-control form shall be signed and dated by the **sample control custodian** and **any other persons** responsible for corrective action. An example of an out-of-control form is included as Attachment 4.

The **custodian** shall then assign a unique laboratory number to each sample and distribute the samples to secured storage areas maintained at 4 degrees Celsius (soil samples for VOC analysis are to be stored in a frozen state until analysis). The unique laboratory number for each sample, COC sample number, client name, date and time received, analysis due date, and storage shall also be manually logged onto a sample receipt record and later entered into the laboratory's computerized data management system. The **custodian** shall sign the shipping bill and maintain a copy.

**Laboratory personnel** shall be responsible for the care and custody of samples from the time of their receipt at the laboratory through their exhaustion or disposal. Samples should be logged in and out on internal laboratory COC forms each time they are removed from storage for extraction or analysis.

### 5.4 Completing COC/Analytical Request Forms

COC form/analytical request form completion procedures are crucial in properly transferring the custody and responsibility of samples from field personnel to the laboratory. This form is important for accurately and concisely requesting analyses for each sample; it is essentially a release order from the analysis subcontract.

Attachment 2 is an example of a generic COC/analytical request form that may be used by **field personnel**. Multiple copies may be tailored to each project so that much of the information described below need not be handwritten each time. Attachment 3 is an example of a completed site-specific COC/analytical request form, with box numbers identified and discussed in text below.

COC forms tailored to each CTO can be drafted and printed onto multi-ply forms. This eliminates the need to rewrite the analytical methods column headers each time. It also eliminates the need to write the project manager, name, and number; QC Level; TAT; and the same general comments each time.

Complete one COC form per cooler. Whenever possible, place all VOC analyte vials into one cooler in order to reduce the number of trip blanks. Complete all sections and be sure to sign and date the COC form. One copy of the COC form must remain with the field personnel.

Box 2 **Bill To:** List the name and address of the person/company to bill only if it is not in the subcontract with the laboratory.

Box 3 **Sample Disposal Instructions:** These instructions will be stated in the Master Service Agreement or each CTO statement of work with each laboratory.

**Shipment Method:** State the method of shipment (e.g., hand carry or air courier via FedEx or DHL).

**Comments:** This area shall be used by the field team to communicate observations, potential hazards, or limitations that may have occurred in the field or additional information regarding analysis (e.g., a specific metals list, samples expected to contain high analyte concentrations).

Box 4 **Cooler No.:** This will be written on the inside or outside of the cooler and shall be included on the COC. Some laboratories attach this number to the trip blank identification, which helps track samples for VOC analysis. If a number is not on the cooler, field personnel shall assign a number, write it on the cooler, and write it on the COC.

**QC Level:** Enter the reporting quality control (QC) requirements (e.g., Full Data Package, Summary Data Package).

**Turnaround time (TAT):** TAT will be determined by a sample delivery group (SDG), which may be formed over a 14-day period, not to exceed 20 samples. Once the SDG has been completed, standard TAT is 21 calendar days from receipt of the last sample in the SDG. Entering NORMAL or STANDARD in this field will be acceptable. If quicker TAT is required, it shall be in the subcontract with the laboratory and reiterated on each COC to remind the laboratory.

Box 5 **Type of Containers:** Write the type of container used (e.g., 1-liter glass amber, for a given parameter in that column).

**Preservatives:** Field personnel must indicate on the COC the correct preservative used for the analysis requested. Indicate the pH of the sample (if tested) in case there are buffering conditions found in the sample matrix.

Box 6 **Sample Identification (ID) Number:** This is typically a five-character alphanumeric identifier used by the contractor to identify samples. The use of this identifier is important since the laboratories are restricted to the number of characters they are able to use. Sample numbering shall be in accordance with the project-specific sampling and analysis plan.

**Description (Sample ID):** This name will be determined by the location and description of the sample, as described in the project-specific sampling and analysis plan. This sample identification should not be submitted to the laboratory, but should be left blank. If a computer COC version is used, the sample identification can be input, but printed with this block black. A cross-referenced list of the COC Sample Number and sample identification must be maintained separately.

**Date Collected:** Record the collection date in order to track the holding time of the sample. Note: For trip blanks, record the date it was placed in company with samples.

**Time Collected:** When collecting samples, record the time the sample is first collected. Use of the 24-hour military clock will avoid a.m. or p.m. designations (e.g., 1815 instead of 6:15 p.m.). Record local time; the laboratory is responsible for calculating holding times to local time.

**Lab ID:** This is for laboratory use only.


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Box 7 **Matrix/QC:** Identify the matrix (e.g., water, soil, air, tissue, fresh water sediment, marine sediment, or product). If a sample is expected to contain high analyte concentrations (e.g., a tank bottom sludge or distinct product layer), notify the laboratory in the comment section. Mark an "X" for the sample(s) that have extra volume for laboratory QC matrix spike/matrix spike duplicate (MS/MSD) purposes. The sample provided for MS/MSD purposes is usually a field duplicate.

Box 8 **Analytical Parameters:** Enter the parameter by descriptor and the method number desired (e.g., BTEX 8260B, PAHs 8270C, etc.). Whenever practicable, list the parameters as they appear in the laboratory subcontract to maintain consistency and avoid confusion.

If the COC does not have a specific box for number of sample containers, use the boxes below the analytical parameter, to indicate the number of containers collected for each parameter.

Box 9 **Sampler's Signature:** The person who collected samples must sign here.

**Relinquished By:** The person who turned over the custody of the samples to a second party other than an express mail carrier, such as FedEx or DHL, must sign and date here.

**Received By:** Typically, a representative of the receiving laboratory signs and dates here. Or, a field crew member who delivered the samples in person from the field to the laboratory might sign here. A courier, such as FedEx or DHL, does not sign here because they do not open the coolers. It must also be used by the prime contracting laboratory when samples are to be sent to a subcontractor.

**Relinquished By:** In the case of subcontracting, the primary laboratory will sign and date the Relinquished By space and fill out an additional COC to accompany the samples being subcontracted.

**Received By (Laboratory):** This space is for the final destination (e.g., at a subcontracted laboratory). A representative of the final destination (e.g., subcontracted laboratory) must sign and date here.

Box 10 **Lab No. and Questions:** This box is to be filled in by the laboratory only.

Box 11 **Control Number:** This number is the "COC" followed by the first contractor identification number in that cooler, or contained on that COC. This control number must be unique (i.e., never used twice). Record the date the COC is completed. It should be the same date the samples are collected.

Box 12 **Total # of Containers:** Sum the number of containers in that row.

Box 13 **Totals:** Sum the number of containers in each column. Because COC forms contain different formats depending on who produced the form, not all of the information listed in items 1 to 13 may be recorded; however, as much of this information as possible shall be included.

## 6.0 Quality Control and Assurance

6.1 Recordkeeping, sample labeling, and chain-of-custody activities must incorporate quality control measures to ensure accuracy and completeness.

6.2 Deviations from this procedure or the project-specific CTO work plan shall be documented in field records. Significant changes shall be approved by the **Program Quality Manager**.

## 7.0 Records, Data Analysis, Calculations

7.1 The COC/analytical request form shall be faxed approximately daily to the **CTO Laboratory Coordinator** for verification of accuracy. Following the completion of sampling activities, the sample

logbook and COC forms will be transmitted to the **CTO Manager** for storage in project files. The **data validators** shall receive a copy also. The original COC/analytical request form shall be submitted by the **laboratory** along with the data delivered. Any changes to the analytical requests that are required shall be made in writing to the laboratory. A copy of this written change shall be sent to the data validators and placed in the project files. The reason for the change shall be included in the project files so that recurring problems can be easily identified.

7.2 Deviations from this procedure or the project-specific sampling and analysis plan shall be documented in the records. Significant changes shall be approved by the **Program Quality Manager**.

## 8.0 Attachments or References

8.1 Attachment 1 – Chain-of-Custody Seal

8.2 Attachment 2 – Generic Chain-of-Custody/Analytical Request Form

8.3 Attachment 3 – Sample Completed Chain-of-Custody

8.4 Attachment 4 – Sample Out-of-Control Form

8.5 Environmental Protection Agency, United States (EPA). 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA.* Interim Final. EPA/540/G-89/004. Office of Emergency and Remedial Response. October.

8.6 EPA. 1992. *RCRA Groundwater Monitoring Draft Technical Guidance*. EPA/530/R-93/001. Office of Solid Waste. November.

8.7 EPA. 1997. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846. 3rd ed., Final Update IIIA. Office of Solid Waste.

8.8 Water Resources Control Board, State of California. 1988. *Technical Guidance Manual for Solid Waste Water Quality Assessment Test (SWAT) Proposals and Reports*. August.

8.9 Procedure 3-02, *Logbooks.*

| Author | Reviewer | Revisions (Technical or Editorial) |
|---|---|---|
| Mark Kromis<br>Program Chemist | Chris Barr<br>Program Quality Manager | Rev 0 – Initial Issue |


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# Attachment 1
# Chain-of-Custody Seal

**CHAIN-OF-CUSTODY SEAL**

| | | | |
|---|---|---|---|
| *[LABORATORY]* | SAMPLE NO. | DATE | SEAL BROKEN BY |
| | SIGNATURE | | DATE |
| | PRINT NAME AND TITLE *(Inspector, Analyst or Technician* | | |


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# Attachment 2
# Generic Chain-of-Custody / Analytical Request Form

M901376

**CHAIN OF CUSTODY RECORD** Page ____ of ____

| | | |
|---|---|---|
| Client/Project Name: | Project Location: | Analysis Requested |
| Project Number: | Field Logbook No.: | |
| Sampler: (Print Name) /Affiliation: | Chain of Custody Tape No.: | |
| Signature: | Send Results/Report to: | |

| Field Sample No./ Identification | Date | Time | Grab | Comp | Sample Container (Size/Mat'l) | Sample Type (Liquid, Sludge, Etc.) | Preservative | Field Filtered | | | | | | | Lab I.D. | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| | | | | |
|---|---|---|---|---|
| Relinquished by: (Print Name) | Date: | Received by: (Print Name) | Date: | Analytical Laboratory (Destination): |
| Signature: | Time: | Signature: | Time: | |
| Relinquished by: (Print Name) | Date: | Received by: (Print Name) | Date: | |
| Signature: | Time: | Signature: | Time: | |
| Relinquished by: (Print Name) | Date: | Received by: (Print Name) | Date: | |
| Signature: | Time: | Signature: | Time: | Serial No. |


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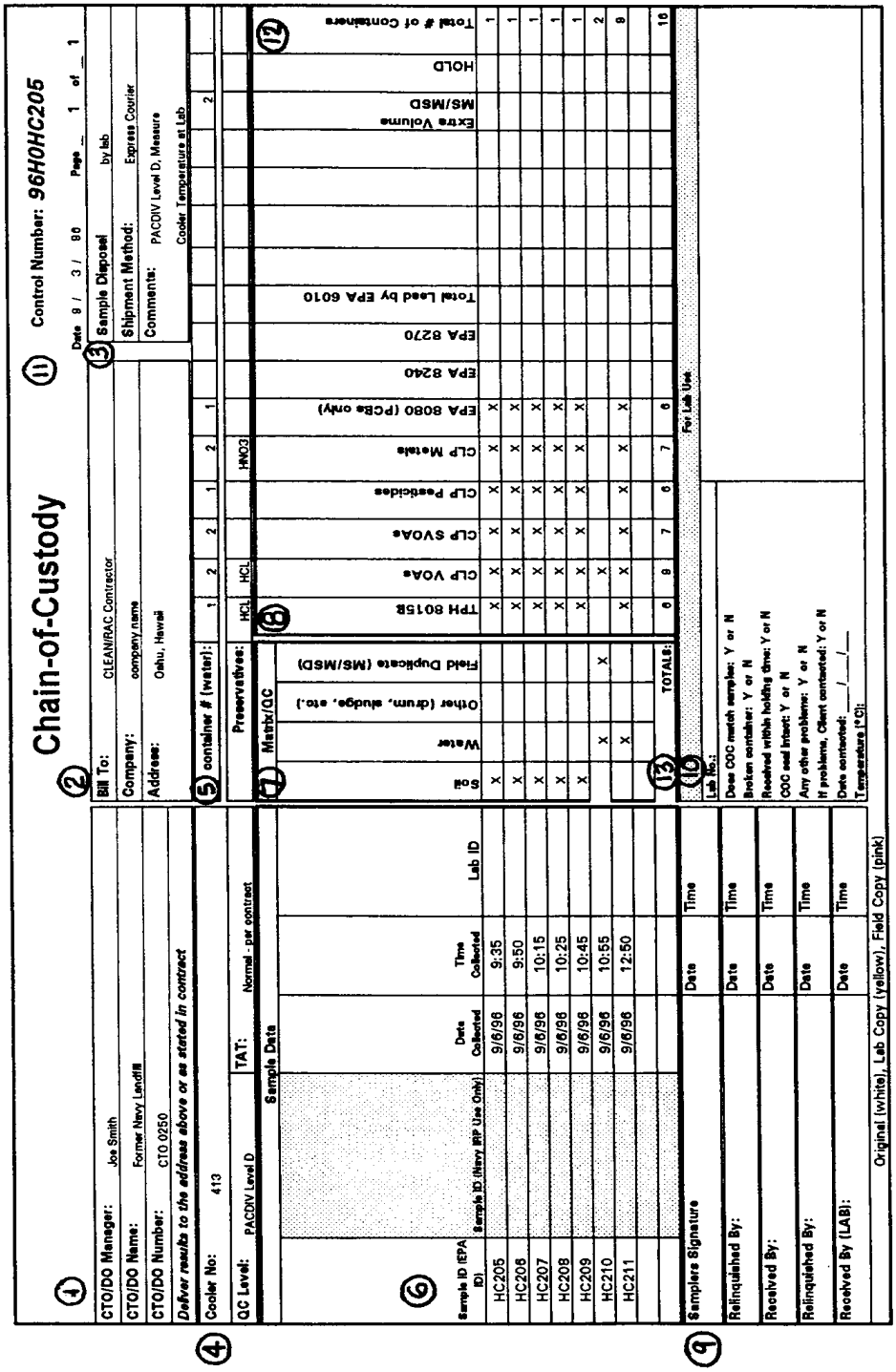
# Attachment 3
# Sample Completed Chain-of-Custody



Chain-of-Custody

Control Number: 96H0HC205

Date 9 / 3 / 96 Page 1 of 1

CTO/DO Manager: Joe Smith
CTO/DO Name: Former Navy Landfill
CTO/DO Number: CTO 0250
Deliver results to the address above or as stated in contract
Cooler No: 413
QC Level: PACDIV Level D
TAT: Normal - per contract

Bill To: CLEAN/RAC Contractor
Company: company name
Address: Oahu, Hawaii
Sample Disposal: by lab
Shipment Method: Express Courier
Comments: PACDIV Level D, Measure
Cooler Temperature at Lab

container # (water): 1 2
Preservatives: HCL HCL
Matrix/QC: Soil, Water, Other (drum, sludge, etc.), Field Duplicate (MS/MSD)

| Sample ID (EPA ID) | Sample ID (Navy RIP Use Only) | Date Collected | Time Collected | Lab ID | Soil | Water | Other (drum, sludge, etc.) | Field Duplicate (MS/MSD) | TPH 8015B | CLP VOAs | CLP SVOAs | CLP Pesticides | CLP Metals | EPA 8080 (PCBs only) | EPA 8240 | EPA 8270 | Total Lead by EPA 6010 | Extra Volume MS/MSD | HOLD | Total # of Containers |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HC205 | | 9/6/96 | 9:35 | | X | | | | X | X | X | X | X | X | | | | | | 1 |
| HC206 | | 9/6/96 | 9:50 | | X | | | | X | X | X | X | X | X | | | | | | 1 |
| HC207 | | 9/6/96 | 10:15 | | X | | | | X | X | X | X | X | X | | | | | | 1 |
| HC208 | | 9/6/96 | 10:25 | | X | | | | X | X | X | X | X | X | | | | | | 1 |
| HC209 | | 9/6/96 | 10:45 | | X | | | | X | X | X | X | X | X | | | | | | 1 |
| HC210 | | 9/6/96 | 10:55 | | | X | | X | | X | X | | | | | | | | | 2 |
| HC211 | | 9/6/96 | 12:50 | | | X | | | X | X | X | X | X | X | | | | | | 8 |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | TOTALS: | | | | 0 | 8 | 7 | 6 | 7 | 6 | | | | | | 16 |

For Lab Use
Lab No.:
Does COC match samples: Y or N
Broken container: Y or N
Received within holding time: Y or N
COC seal intact: Y or N
Any other problems: Y or N
If problems, Client contacted: Y or N
Date contacted: ___/___/___
Temperature (°C):

Samplers Signature — Date — Time
Relinquished By: — Date — Time
Received By: — Date — Time
Relinquished By: — Date — Time
Received By (LAB): — Date — Time

Original (white), Lab Copy (yellow), Field Copy (pink)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# Attachment 4
# Sample Out-of-Control Form

| OUT OF CONTROL FORM | Status | Date | Initial |
|---|---|---|---|
| | Noted OOC | | |
| | Submit for CA* | | |
| | Resubmit for CA* | | |
| | Completed | | |

| | |
|---|---|
| Date Recognized: | By: |
| Dated Occurred: | Matrix |
| Parameter (Test Code): | Method: |
| Analyst: | Supervisor: |

| Samples Affected (List by Accession AND Sample No.) |
|---|
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| 1. Type of Event (Check all that apply) | | 2. Corrective Action (CA)* (Check all that apply) | |
|---|---|---|---|
| | Calibration Corr. Coefficient <0.995 | | Repeat calibration |
| | %RSD>20% | | Made new standards |
| | Blank >MDL | | Reran analysis |
| | Does not meet criteria: | | Sample(s) redigested and rerun |
| | Spike | | Sample(s) reextracted and rerun |
| | Duplicate | | Recalculated |
| | LCS | | Cleaned system |
| | Calibration Verification | | Ran standard additions |
| | Standard Additions | | Notified |
| | MS/MSD | | Other (please explain) |
| | BS/BSD | | |
| | Surrogate Recovery | | |
| | Calculations Error | | |
| | Holding Times Missed | | |
| | Other (Please explain | Comments: | |

| 3. Results of Corrective Action | |
|---|---|
| | Return to Control (indicated with) |
| | Corrective Actions Not Successful - DATA IS TO BE FLAGGED with _____. |

| | |
|---|---|
| Analyst: | Date: |
| Supervisor: | Date: |
| QA Department: | Date: |


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# Sample Handling, Storage, and Shipping

# Procedure 3-04

## 1.0 Purpose and Scope

1.1 This standard operating procedure describes the actions to be used by personnel engaged in handling, storing, and transporting samples. The objective is to obtain samples of actual conditions with as little alteration as possible.

1.2 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

## 2.0 Safety

2.1 Avoid lifting heavy coolers with back muscles; instead, use leg muscles or dollies.

2.2 Wear proper gloves, such as blue nitrile and latex, as defined in the project-specific health and safety plan, when handling sample containers to avoid contacting any materials that may have spilled out of the sample containers.

## 3.0 Terms and Definitions

None.

## 4.0 Training and Qualifications

4.1 The **Contract Task Order (CTO) Manager** and the **Laboratory Project Manager** are responsible for identifying instances of non-compliance with this procedure and ensuring that future sample transport activities comply with this procedure.

4.2 The **Field Manager** is responsible for ensuring that all samples are shipped according to this procedure.

4.3 **Field personnel** are responsible for the implementation of this procedure.

4.4 The **Program Quality Manager** is responsible for ensuring that sample handling, storage, and transport activities conducted during all CTOs comply with this procedure.

4.5 All **field personnel** are responsible for the implementation of this procedure.

## 5.0 Procedure

5.1 **Handling and Storage**

Immediately following collection, label all samples according to Procedure 3-03, *Recordkeeping, Sample Labeling, and Chain-of-Custody*. The lids of the containers shall not be sealed with duct tape, but may be covered with custody seals or placed directly into self-sealing bags. Place the sample containers in an insulated cooler with frozen gel packs (e.g., “blue ice”) or ice in double, sealed self-sealing bags. Samples should occupy the lower portion of the cooler, while the ice should occupy the upper portion. Place an absorbent material (e.g., proper absorbent cloth material) on the bottom of the cooler to contain liquids in case of spillage. Fill all empty space between sample containers with Styrofoam® “peanuts” or other appropriate material. Prior to shipping, wrap glass sample containers on the sides, tops, and bottoms with bubble wrap or other appropriate padding and/or surround them in Styrofoam to


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prevent breakage during transport. Pack all glass containers for water samples in an upright position, never stacked or on their sides. Prior to shipment, replace the ice or cold packs in the coolers so that samples will be maintained as close to 4 degrees Celsius (°C) as possible from the time of collection through transport to the analytical laboratory. Ship samples within 24 hours or on a schedule allowing the laboratory to meet holding times for analyses. The procedures for maintaining sample temperatures at 4°C pertain to all field samples.

## 5.2 Shipping

Follow all appropriate U.S. Department of Transportation regulations (e.g., 49 Code of Federal Regulations [CFR], Parts 171-179) for shipment of air, soil, water, and other samples. Elements of these procedures are summarized below.

### 5.2.1 Hazardous Materials Shipment

**Field personnel** must state whether any sample is suspected to be a hazardous material. A sample should be assumed hazardous unless enough evidence exists to indicate it is non-hazardous. If not suspected to be hazardous, shipments may be made as described in the Section 5.2.2 for non-hazardous materials. If hazardous, follow the procedures summarized below.

Any substance or material that is capable of posing an unreasonable risk to life, health, or property when transported is classified as hazardous. Perform hazardous materials identification by checking the list of dangerous goods for that particular mode of transportation. If not on that list, materials can be classified by checking the Hazardous Materials Table (49 CFR 172.102 including Appendix A) or by determining if the material meets the definition of any hazard class or division (49 CFR Part 173), as listed in Attachment 2.

All **persons shipping hazardous materials** must be properly trained in the appropriate regulations, as required by HM-126F, Training for Safe Transportation of Hazardous Materials (49 CFR HM-126F Subpart H). The training covers loading, unloading, handling, storing, and transporting of hazardous materials, as well as emergency preparedness in the case of accidents. **Carriers**, such as commercial couriers, must also be trained. Modes of shipment include air, highway, rail, and water.

When shipping hazardous materials, including bulk chemicals or samples suspected of being hazardous, the proper shipping papers (49 CFR 172 Subpart C), package marking (49 CFR 172 Subpart D), labeling (49 CFR 172 Subpart E), placarding (49 CFR 172 Subpart F, generally for carriers), and packaging must be used. Attachment 1 shows an example of proper package markings. Refer to a copy of 49 CFR each time hazardous materials/potentially hazardous samples are shipped.

According to Section 2.7 of the International Air Transport Association Dangerous Goods Regulations publication, very small quantities of certain dangerous goods may be transported without certain marking and documentation requirements as described in 49 CFR Part 172; however, other labeling and packing requirements must still be followed. Attachment 2 shows the volume or weight for different classes of substances. A “Dangerous Goods in Excepted Quantities” label must be completed and attached to the associated shipping cooler (Attachment 3). Certain dangerous goods are not allowed on certain airlines in any quantity.

As stated in item 4 of Attachment 4, the Hazardous Materials Regulations do not apply to hydrochloric acid (HCl), nitric acid ($HNO_3$), sulfuric acid ($H_2SO_4$), and sodium hydroxide (NaOH) added to water samples if their pH or percentage by weight criteria is met. These samples may be shipped as non-hazardous materials as discussed below.

### 5.2.2 Non-Hazardous Materials Shipment

If the samples are suspected to be non-hazardous based on previous site sample results, field screening results, or visual observations, if applicable, then samples may be shipped as non-hazardous.

When a cooler is ready for shipment to the laboratory, place two copies of the chain-of-custody form inside a self-sealing bag and tape it to the inside of the insulated cooler. Then, seal the cooler with waterproof tape and label it with "Fragile," "This-End-Up" (or directional arrows pointing up), or other appropriate notices. Place chain-of-custody seals on the coolers as discussed in Procedure 3-03, *Recordkeeping, Sample Labeling, and Chain-of-Custody*.

### 5.2.3 Shipments from Outside the Continental United States

Shipment of sample coolers to the United States from locations outside the continental United States is controlled by the U.S. Department of Agriculture (USDA) and is subject to their inspection and regulation. A "USDA Soil Import Permit" is required to prove that the receiving analytical laboratory is certified by the USDA to receive and properly dispose of soil. In addition, all sample coolers must be inspected by a **USDA representative**, affixed with a label indicating that the coolers contain environmental samples, and accompanied by shipping forms stamped by the **USDA inspector** prior to shipment.

In addition, the U.S. Customs Service must clear samples shipped from U.S. territorial possessions or foreign countries upon entry into the United States. As long as the commercial invoice is properly completed (see below), shipments typically pass through U.S. Customs Service without the need to open coolers for inspection.

Completion and use of proper paperwork will, in most cases, minimize or eliminate the need for the USDA and U.S. Customs Service to inspect the contents. Attachment 5 shows an example of how paperwork may be placed on the outside of coolers for non-hazardous materials. For hazardous materials, refer to Section 5.2.1.

In summary, tape the paperwork listed below to the outside of the coolers to accompany sample shipments. If a shipment is made up of multiple pieces (e.g., more than one cooler), the paperwork need only be attached to one cooler, provided that the **courier** agrees. All other coolers in the shipment need only to be taped and have the address and chain-of-custody seals affixed.

1. **Courier Shipping Form & Commercial Invoice:** See Attachment 6 and Attachment 7 for examples of the information to be included on the commercial invoices for soil and water, respectively. Place the courier shipping form and commercial invoice inside a clear, plastic, adhesive-backed pouch that adheres to the package (typically supplied by the courier) and place it on the cooler lid as shown in Attachment 5.

2. **Soil Import Permit (soil only):** See Attachment 8 and Attachment 9 for examples of the soil import permit and soil samples restricted entry labels, respectively. The **laboratory** shall supply these documents prior to mobilization. The USDA often stops shipments of soil without these documents. Staple together the 2-inch × 2-inch USDA label (described below) and soil import permit, and place them inside a clear plastic pouch. The **courier** typically supplies the clear, plastic, adhesive-backed pouches that adhere to the package.

   Placing one restricted entry label as shown in Attachment 5 (covered with clear packing tape) and one stapled to the actual permit is suggested.

   The USDA does not control water samples, so the requirements for soil listed above do not apply.

3. **Chain-of-Custody Seals:** The **laboratory** should supply the seals. **CTO personnel** must sign and date these. At least two seals should be placed in such a manner that they stick to both the cooler lid and body. Placing the seals over the tape (as shown in Attachment 5), then covering it with clear packing tape is suggested. This prevents the seal from coming loose and enables detection of tampering.

4. **Address Label:** Affix a label stating the destination (laboratory address) to each cooler.

5. **Special Requirements for Hazardous Materials:** See Section 5.2.1.

Upon receipt of sample coolers at the laboratory, the **sample custodian** shall inspect the sample containers as discussed in Procedure 3-03, *Recordkeeping, Sample Labeling, and Chain-of-Custody*. The samples shall then be immediately extracted and/or analyzed, or stored in a refrigerated storage area until they are removed for extraction and/or analysis. Whenever the samples are not being extracted or analyzed, they shall be returned to refrigerated storage.

## 6.0 Quality Control and Assurance

6.1 Sample handling, storage, and shipping must incorporate quality control measures to ensure conformance to these and the project requirements.

## 7.0 Records, Data Analysis, Calculations

7.1 Maintain records as required by implementing these procedures.

7.2 Deviations from this procedure or the project-specific sampling and analysis plan shall be documented in field records. Significant changes shall be approved by the **Program Quality Manager**.

## 8.0 Attachments or Reference

8.1 Attachment 1 – Example Hazardous Material Package Marking

8.2 Attachment 2 – Packing Groups

8.3 Attachment 3 – Label for Dangerous Goods in Excepted Quantities

8.4 Attachment 4 – SW-846 Preservative Exception

8.5 Attachment 5 – Non-Hazardous Material Cooler Marking Figure for Shipment from Outside the Continental United States

8.6 Attachment 6 – Commercial Invoice – Soil

8.7 Attachment 7 – Commercial Invoice – Water

8.8 Attachment 8 – Soil Import Permit

8.9 Attachment 9 – Soil Samples Restricted Entry Labels

8.10 NAVSEA T0300-AZ-PRO-010. *Navy Environmental Compliance Sampling and Field Testing Procedures Manual*. August 2009.

8.11 Procedure 3-03, *Recordkeeping, Sample Labeling, and Chain-of-Custody*.

| Author | Reviewer | Revisions (Technical or Editorial) |
|---|---|---|
| Mark Kromis<br>Program Chemist | Chris Barr<br>Program Quality Manager | Rev 0 – Initial Issue |


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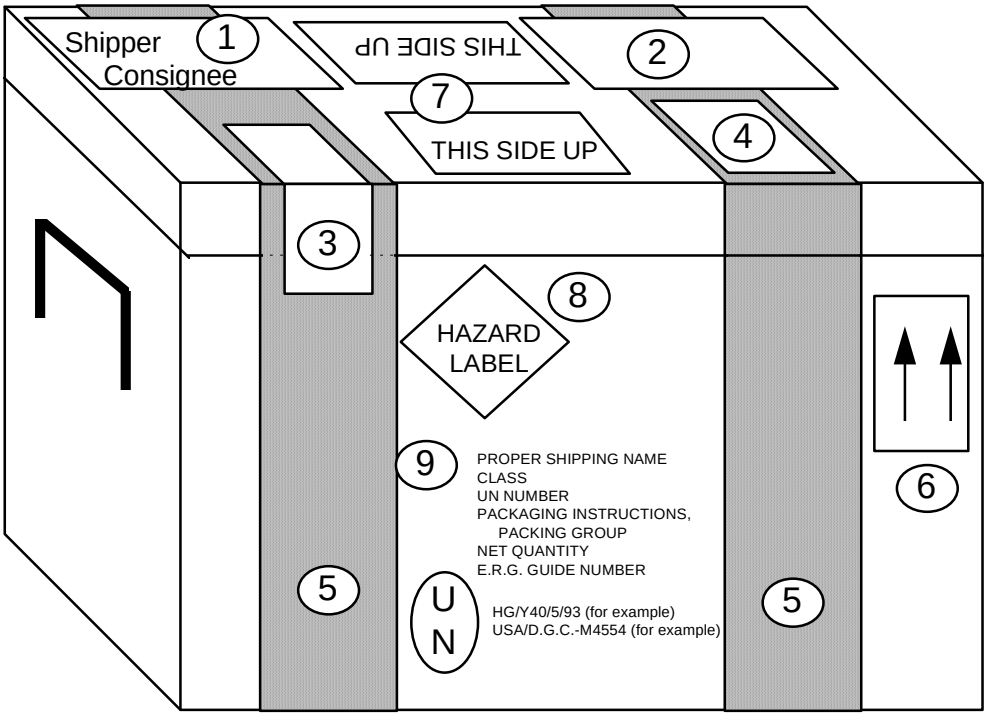
# Attachment 1
# Example Hazardous Material Package Marking




1. **AIR BILL/COMMERCIAL INVOICE**
2. **USDA PERMIT (Letter to Laboratory from USDA)**
3. **CUSTODY SEAL**
4. **USDA 2" X 2" SOIL IMPORT PERMIT**
5. **WATERPROOF STRAPPING TAPE**
6. **DIRECTION ARROWS STICKER - TWO REQUIRED**
7. **THIS SIDE UP STICKERS**
8. **HAZARD LABEL**
9. **HAZARDOUS MATERIAL INFORMATION**
10. **PACKAGE SPECIFICATIONS**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# Attachment 2
# Packing Groups

| PACKING GROUP OF THE SUBSTANCE | PACKING GROUP 1 | | PACKING GROUP II | | PACKING GROUP III | |
|---|---|---|---|---|---|---|
| CLASS or DIVISION of PRIMARY or SUBSIDIARY RISK | Packagings | | Packagings | | Packagings | |
| | Inner | Outer | Inner | Outer | Inner | Outer |
| 1: Explosives | ---------- Forbidden (Note A) ---------- | | | | | |
| 2.1: Flammable Gas | ---------- Forbidden (Note B) ---------- | | | | | |
| 2.2: Non-Flammable, non-toxic gas | ---------- See Notes A and B ---------- | | | | | |
| 2.3: Toxic gas | ---------- Forbidden (Note A) ---------- | | | | | |
| 3. Flammable liquid | 30 mL | 300 mL | 30 mL | 500 mL | 30 mL | 1 L |
| 4.1 Self-reactive substances | Forbidden | | Forbidden | | Forbidden | |
| 4.1: Other flammable solids | Forbidden | | 30 g | 500 g | 30 g | 1 kg |
| 4.2: Pyrophoric substances | Forbidden | | Not Applicable | | Not Applicable | |
| 4.2 Spontaneously combustible substances | Not Applicable | | 30 g | 500 g | 30 g | 1 kg |
| 4.3: Water reactive substances | Forbidden | | 30 g or 30 mL | 500 g or 500 mL | 30 g or 30 mL | 1 kg or 1 L |
| 5.1: Oxidizers | Forbidden | | 30 g or 30 mL | 500 g or 500 mL | 30 g or 30 mL | 1 kg or 1 L |
| 5.2: Organic peroxides (Note C) | See Note A | | 30 g or 30 mL | 500 g or 250 mL | Not Applicable | |
| 6.1: Poisons - Inhalation toxicity | Forbidden | | 1 g or 1 mL | 500 g or 500 mL | 30 g or 30 mL | 1 kg or 1 L |
| 6.1: Poisons - oral toxicity | 1 g or 1 mL | 300 g or 300 mL | 1 g or 1 mL | 500 g or 500 mL | 30 g or 30 mL | 1 kg or 1 L |
| 6.1: Poisons - dermal toxicity | 1 g or 1 mL | 300 g or 300 mL | 1 g or 1 mL | 500 g or 500 mL | 30 g or 30 mL | 1 kg or 1 L |
| 6.2: Infectious substances | ---------- Forbidden (Note A) ---------- | | | | | |
| 7: Radioactive material (Note D) | ---------- Forbidden (Note A) ---------- | | | | | |
| 8: Corrosive materials | Forbidden | | 30 g or 30 mL | 500 g or 500 mL | 30 g or 30 mL | 1 kg or 1 L |
| 9: Magnetized materials | ---------- Forbidden (Note A) ---------- | | | | | |
| 9: Other miscellaneous materials (Note E) | Forbidden | | 30 g or 30 mL | 500 g or 500 mL | 30 g or 30 mL | 1 kg or 1 L |

***Note A:*** *Packing groups are not used for this class or division.*
***Note B:*** *For inner packagings, the quantity contained in receptacle with a water capacity of 30 mL. For outer packagings, the sum of the water capacities of all the inner packagings contained must not exceed 1 L.*
***Note C:*** *Applies only to Organic Peroxides when contained in a chemical kit, first aid kit or polyester resin kit.*
***Note D:*** *See 6.1.4.1, 6.1.4.2, and 6.2.1.1 through 6.2.1.7, radioactive material in excepted packages.*
***Note E:*** *For substances in Class 9 for which no packing group is indicated in the List of Dangerous Goods, Packing Group II quantities must be used.*


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# Attachment 3
# Dangerous Goods in Excepted Quantities

**DANGEROUS GOODS IN EXCEPTED QUANTITIES**

This package contains dangerous goods in excepted small quantities and is in all respects in compliance with the applicable international and national government regulations and the IATA Dangerous Goods Regulations.

_____

Signature of Shipper

_____ _____

Title Date

_____

_____

Name and address of Shipper

This package contains substance(s) in Class(es)
(check applicable box(es))

| Class: | 2 | 3 | 4 | 5 | 6 | 8 | 9 |
|---|---|---|---|---|---|---|---|
| | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

and the applicable UN Numbers are:


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# Attachment 4
# SW-846 Preservative Exception

| Measurement | Vol. Req. (mL) | Container[2] | Preservative[3,4] | Holding Time[5] |
|---|---|---|---|---|
| MBAS | 250 | P, G | Cool, 4ºC | 48 Hours |
| NTA | 50 | P, G | Cool, 4ºC | 24 Hours |

1. More specific instructions for preservation and sampling are found with each procedure as detailed in this manual. A general discussion on sampling water and industrial wastewater may be found in ASTM, Part 31, p. 72-82 (1976) Method D-3370.

2. Plastic (P) or Glass (G). For metals, polyethylene with a polypropylene cap (no liner) is preferred.

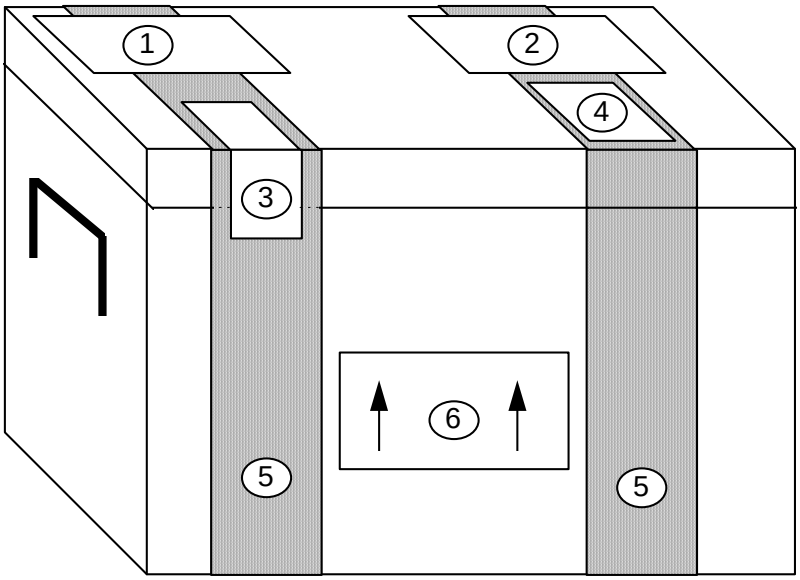
3. Sample preservation should be performed immediately upon sample collection. For composite samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then samples may be preserved by maintaining at 4ºC until compositing and sample splitting is completed.

4. When any sample is to be shipped by common carrier or sent through the United States Mail, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. for the preservation requirements of Table 1, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentration of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid ($HNO_3$) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid ($H_2SO_4$) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).

5. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of sample under study are stable for the longer time, and has received a variance from the Regional Administrator. Some samples may not be stable for the maximum time period given in the table. A permittee, or monitoring laboratory, is obligated to hold the sample for a shorter time if knowledge exists to show this is necessary to maintain sample stability.

6. Should only be used in the presence of residual chlorine.

# Attachment 5
# Non-Hazardous Material Cooler Marking Figure for Shipment from Outside the Continental United States




1. **AIR BILL/COMMERCIAL INVOICE**
2. **USDA PERMIT (Letter to Laboratory from USDA)**
3. **CUSTODY SEAL**
4. **USDA 2" X 2" SOIL IMPORT PERMIT**
5. **WATERPROOF STRAPPING TAPE**
6. **DIRECTION ARROWS STICKER - TWO REQUIRED**

# Attachment 6
# Commercial Invoice – Soil

| | |
|---|---|
| DATE OF EXPORTATION<br>1/1/94 | EXPORT REFERENCES (i.e., order no., invoice no., etc.)<br><CTO #> |
| SHIPPER/EXPORTER (complete name and address)<br>Joe Smith<br>Ogden<br>c/o <hotel name><br><hotel address> | CONSIGNEE<br>Sample Receipt<br><Lab Name><br><Lab Address> |
| COUNTRY OF EXPORT<br>Guam, USA | IMPORTER - IF OTHER THAN CONSIGNEE |
| COUNTRY OF ORIGIN OF GOODS<br>Guam, USA | |
| COUNTRY OF ULTIMATE DESTINATION<br>USA | |

INTERNATIONAL AIR WAYBILL NO. _____ (NOTE: All shipments must be accompanied by a Federal Express International Air Waybill)

| MARKS/NOS | NO. OF PKGS | TYPE OF PACKAGING | FULL DESCRIPTION OF GOODS | QTY | UNIT OF MEASURE | WEIGHT | UNIT VALUE | TOTAL VALUE |
|---|---|---|---|---|---|---|---|---|
| | 3 | coolers | Soil samples for laboratory analysis only | | | | $1.00 | $3.00 |

| TOTAL NO. OF PKGS. | TOTAL WEIGHT | TOTAL INVOICE VALUE |
|---|---|---|
| 3 | | $3.00 |

Check one
☐ F.O.B.
☐ C&F
☐ C.I.F.

THESE COMMODITIES ARE LICENSED FOR THE ULTIMATE DESTINATION SHOWN.

DIVERSION CONTRARY TO UNITED STATES LAW IS PROHIBITED.

I DECLARE ALL THE INFORMATION CONTAINED IN THIS INVOICE TO BE TRUE AND CORRECT

SIGNATURE OF SHIPPER/EXPORTER (Type name and title and sign)

| Joe Smith, Ogden | Joe Smith | 1/1/94 |
|---|---|---|
| Name/Title | Signature | Date |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# Attachment 7
# Commercial Invoice – Water

| | |
|---|---|
| DATE OF EXPORTATION<br>1/1/94 | EXPORT REFERENCES (i.e., order no., invoice no., etc.)<br><COC #> |
| SHIPPER/EXPORTER (complete name and address)<br>Joe Smith<br>Ogden<br>c/o <hotel name><br><hotel address> | CONSIGNEE<br>Sample Receipt<br><Lab Name><br><Lab Address> |
| COUNTRY OF EXPORT<br>Guam, USA | IMPORTER - IF OTHER THAN CONSIGNEE |
| COUNTRY OF ORIGIN OF GOODS<br>Guam, USA | |
| COUNTRY OF ULTIMATE DESTINATION<br>USA | |

INTERNATIONAL AIR WAYBILL NO. _____ (NOTE: All shipments must be accompanied by a Federal Express International Air Waybill)

| MARKS/NOS | NO. OF PKGS | TYPE OF PACKAGING | FULL DESCRIPTION OF GOODS | QTY | UNIT OF MEASURE | WEIGHT | UNIT VALUE | TOTAL VALUE |
|---|---|---|---|---|---|---|---|---|
| | 3 | coolers | Water samples for laboratory analysis only | | | | $1.00 | $3.00 |
| | TOTAL NO. OF PKGS. | | | | | TOTAL WEIGHT | | TOTAL INVOICE VALUE |
| | 3 | | | | | | | $3.00 |

Check one
☐ F.O.B.
☐ C&F
☐ C.I.F.

THESE COMMODITIES ARE LICENSED FOR THE ULTIMATE DESTINATION SHOWN.

DIVERSION CONTRARY TO UNITED STATES LAW IS PROHIBITED.

I DECLARE ALL THE INFORMATION CONTAINED IN THIS INVOICE TO BE TRUE AND CORRECT

SIGNATURE OF SHIPPER/EXPORTER (Type name and title and sign)

Joe Smith, Ogden _____ Joe Smith _____ 1/1/94 _____



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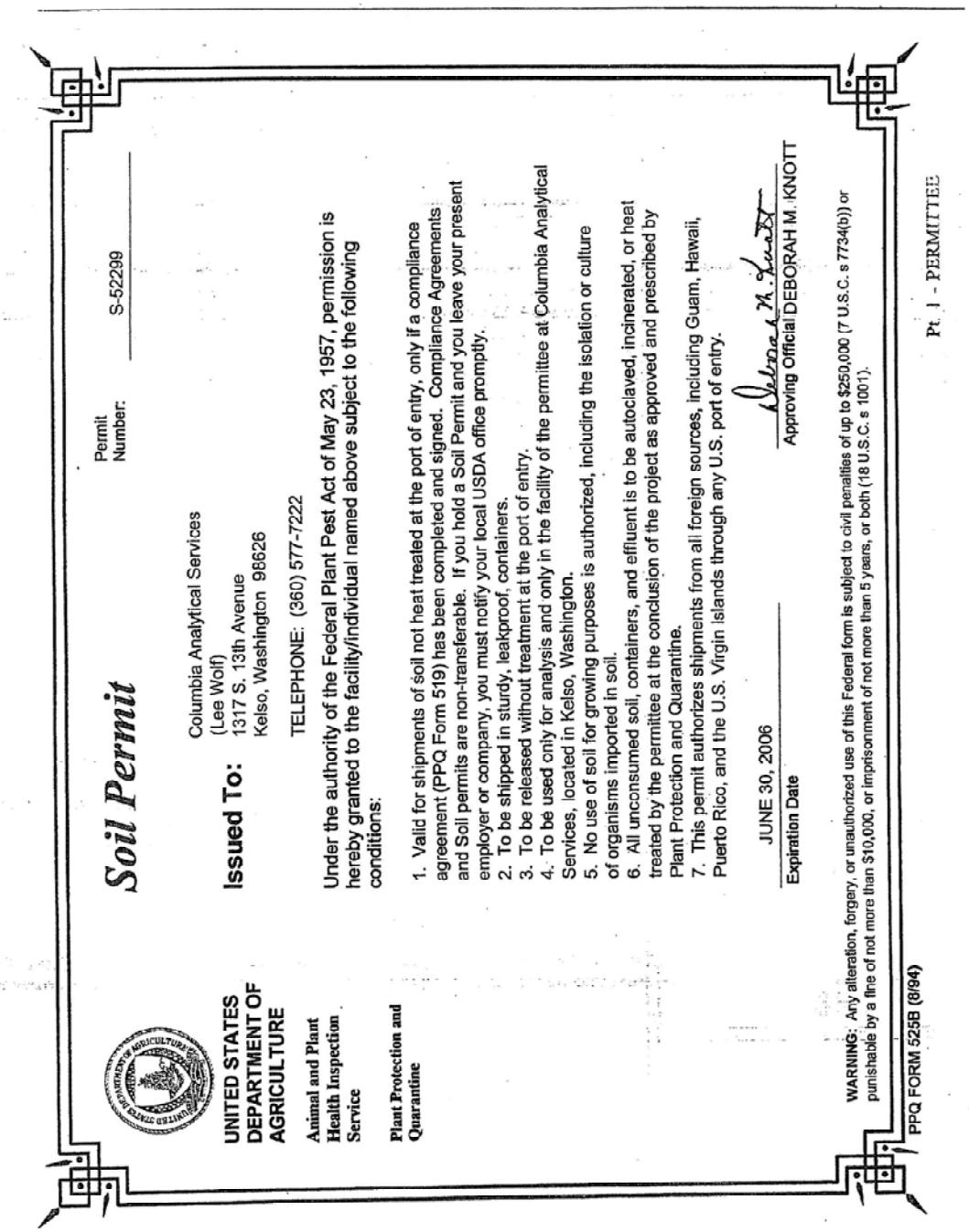
# Attachment 8
# Soil Import Permit



UNITED STATES DEPARTMENT OF AGRICULTURE

Animal and Plant Health Inspection Service

Plant Protection and Quarantine

**Soil Permit**

Permit Number: S-52299

**Issued To:** Columbia Analytical Services
(Lee Wolf)
1317 S. 13th Avenue
Kelso, Washington 98626

TELEPHONE: (360) 577-7222

Under the authority of the Federal Plant Pest Act of May 23, 1957, permission is hereby granted to the facility/individual named above subject to the following conditions:

1. Valid for shipments of soil not heat treated at the port of entry, only if a compliance agreement (PPQ Form 519) has been completed and signed. Compliance Agreements and Soil permits are non-transferable. If you hold a Soil Permit and you leave your present employer or company, you must notify your local USDA office promptly.
2. To be shipped in sturdy, leakproof, containers.
3. To be released without treatment at the port of entry.
4. To be used only for analysis and only in the facility of the permittee at Columbia Analytical Services, located in Kelso, Washington.
5. No use of soil for growing purposes is authorized, including the isolation or culture of organisms imported in soil.
6. All unconsumed soil, containers, and effluent is to be autoclaved, incinerated, or heat treated by the permittee at the conclusion of the project as approved and prescribed by Plant Protection and Quarantine.
7. This permit authorizes shipments from all foreign sources, including Guam, Hawaii, Puerto Rico, and the U.S. Virgin Islands through any U.S. port of entry.

JUNE 30, 2006
Expiration Date

Approving Official DEBORAH M. KNOTT

**WARNING:** Any alteration, forgery, or unauthorized use of this Federal form is subject to civil penalties of up to $250,000 (7 U.S.C. s 7734(b)) or punishable by a fine of not more than $10,000, or imprisonment of not more than 5 years, or both (18 U.S.C. s 1001).

PPQ FORM 525B (8/94)

Pt. 1 - PERMITTEE



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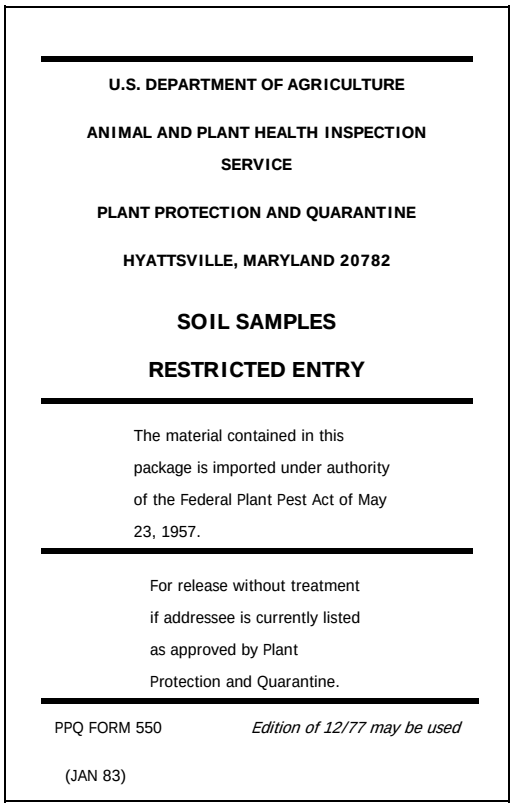
# Attachment 9
# Soil Samples Restricted Entry Labels



U.S. DEPARTMENT OF AGRICULTURE

ANIMAL AND PLANT HEALTH INSPECTION SERVICE

PLANT PROTECTION AND QUARANTINE

HYATTSVILLE, MARYLAND 20782

**SOIL SAMPLES**

**RESTRICTED ENTRY**

The material contained in this package is imported under authority of the Federal Plant Pest Act of May 23, 1957.

For release without treatment if addressee is currently listed as approved by Plant Protection and Quarantine.

PPQ FORM 550 *Edition of 12/77 may be used*

(JAN 83)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# Investigation Derived Waste Management

# Procedure 3-05

## 1.0 Purpose and Scope

This standard operating procedure (SOP) describes activities and responsibilities of the United States (U.S.) Navy Environmental Restoration (ER) Program, Naval Facilities Engineering Command, Atlantic (NAVFAC Atlantic) with regard to management of investigation-derived waste (IDW). The purpose of this procedure is to provide guidance for the minimization, handling, labelling, temporary storage, inventory, classification, and disposal of IDW generated under the ER Program. This procedure will also apply to personal protective equipment (PPE), sampling equipment, decontamination fluids, non-IDW trash, non-indigenous IDW, and hazardous waste generated during implementation of removal or remedial actions. The information presented will be used to prepare and implement work plans (WPs) for IDW-related field activities. The results from implementation of WPs will then be used to develop and implement final IDW disposal plans.

If there are procedures whether it be from Resolution Consultants, state and/or federal that are not addressed in this SOP and are applicable to IDW then those procedures may be added as an appendix to the project specific SAP.

This procedure applies to all Navy ER projects performed in the NAVFAC Atlantic Area of Responsibility.

This procedure shall serve as management-approved professional guidance for the ER Program and is consistent with protocol in the Uniform Federal Policy-Quality Assurance Project Plan (DoD 2005). As professional guidance for specific activities, this procedure is not intended to obviate the need for professional judgment during unforeseen circumstances. Deviations from this procedure while planning or executing planned activities must be approved by both the Contract Task Order (CTO) Manager and the Quality Assurance (QA) Manager or Technical Director, and documented.

This procedure was developed to serve as management-approved professional guidance for the management of IDW generated under the ER Program. It focuses on the requirements for minimizing, segregating, handling, labeling, storing, and inventorying IDW in the field. Certain drum inventory requirements related to the screening, sampling, classification, and disposal of IDW are also noted in this procedure.

## 2.0 Safety

The health and safety considerations for the work associated with this SOP, including both potential physical and chemical hazards, will be addressed in the project Health and Safety Plan (HASP). In the absence of a HASP, work will be conducted according to the CTO WP and/or direction from the **Site Safety Officer (SSO)**.

All **Field Personnel** responsible for IDW management must adhere to the HASP and must wear the PPE specified in the site-specific HASP. Generally, this includes, at a minimum, steel-toed boots or steel-toed rubber boots, safety glasses, American National Standards Institute-standard hard hats, and hearing protection (if heavy equipment is in operation). If safe alternatives are not achievable, discontinue site activities immediately.

## 3.0 Terms and Definitions

None.


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## 4.0 Training and Qualifications

4.1 The **CTO Manager** is responsible for ensuring that IDW management activities comply with this procedure. The **CTO Manager** is responsible for ensuring that all personnel involved in IDW management shall have the appropriate education, experience, and training to perform their assigned tasks.

4.2 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

4.3 The **Field Manager** is responsible for ensuring that all IDW is managed according to this procedure.

4.4 All **Field Personnel** are responsible for the implementation of this procedure.

## 5.0 Equipment and Supplies

The equipment and supplies required for implementation of this SOP include the following:

- Containers for waste (e.g., [U.S. Department of Transportation] DOT approved 55-gallon open and closed top drums) and material to cover waste to protect from weather (e.g., plastic covering);
- Hazardous /non-hazardous waste drum labels (weatherproof);
- Permanent marking pens;
- Inventory forms for project file;
- Plastic garbage bags, zip lock storage bags, roll of plastic sheeting; and
- Steel-toed boots, chemical resistant gloves, coveralls, safety glasses, and any other PPE required in the HASP.

## 6.0 Procedure

The following procedures are used to handle the IDW.

### 6.1 Drum Handling

6.1.1 IDW shall be containerized using DOT approved drums. The drums shall be made of steel or plastic, have a 55-gallon capacity, be completely painted or opaque, and have removable lids (i.e., United Nations Code 1A2 or 1H2). Typically 55-gallon drums are used, however small drums may be used depending on the amount of waste generated. New steel drums are preferred over recycled drums.

6.1.2 Recycled drums should not be used for hazardous waste, PCBs or other regulated shipments. For short-term storage of liquid IDW prior to discharge, double-walled bulk steel or plastic storage tanks may be used. For this scenario, consider the scheduling and cost-effectiveness of this type of bulk storage, treatment, and discharge system versus longer-term drum storage.

6.1.3 For long-term IDW storage at other project locations, the DOT approved drums with removable lids are recommended. Verify the integrity of the foam or rubber sealing ring located on the underside of some drum lids prior to sealing drums containing IDW liquids.

6.1.4 If the ring is only partially attached to the drum lid, or if a portion of the ring is missing, select another drum lid with a sealing ring that is in sound condition.

6.1.5 To prepare IDW drums for labeling, wipe clean the outer wall surfaces and drum lids of all material that might prevent legible and permanent labeling. If potentially contaminated material adheres to the outer surface of a drum, wipe that material from the drum, and segregate the paper towel or rag used to remove the material with visibly soiled PPE and


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disposable sampling equipment. Label all IDW drums and place them on pallets prior to storage.

## 6.2 Labelling

6.2.1 Containers used to store IDW must be properly labelled. Two general conditions exist: 1) from previous studies or on-site data, waste characteristics are known to be either hazardous or nonhazardous; or 2) waste characteristics are unknown until additional data are obtained.

6.2.2 For situations where the waste characteristics are known, the waste containers should be packaged and labelled in accordance with state regulations and any federal regulations that may govern the labelling of waste.

6.2.3 The following information shall be placed on all non-hazardous waste labels:

- Description of waste (i.e., purge water, soil cuttings);
- Contact information (i.e., contact name and telephone number);
- Date when the waste was first accumulated.

6.2.4 The following information shall be placed on all hazardous waste labels:

- Description of waste (i.e., purge water, soil cuttings);
- Generator information (i.e., name, address, contact telephone number);
- EPA identification number (supplied by on-site client representative);
- Date when the waste was first accumulated.

6.2.5 When the final characterization of a waste is unknown, a notification label should be placed on the drum with the words “waste characterization pending analysis” and the following information included on the label:

- Description of waste (i.e., purge water, soil cuttings);
- Contact information (i.e., contact name and telephone number);
- Date when the waste was first accumulated.

6.2.6 Once the waste has been characterized, the label should be changed as appropriate for a nonhazardous or hazardous waste.

6.2.7 Waste labels should be constructed of a weatherproof material and filled out with a permanent marker to prevent being washed off or becoming faded by sunlight. It is recommended that waste labels be placed on the side of the container, since the top is more subject to weathering. However, when multiple containers are accumulated together, it also may be helpful to include labels on the top of the containers to facilitate organization and disposal.

6.2.8 Each container of waste generated shall be recorded in the field notebook used by the person responsible for labelling the waste. After the waste is disposed of, either by transportation off-site or disposal on-site in an approved disposal area, an appropriate record shall be made in the same field notebook to document proper disposition of IDW.


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## 6.3 Types of Site Investigation Waste

Several types of waste are generated during site investigations that may require special handling. These include solid, liquid, and used PPE, as discussed further below.

Solid Waste

Soil cuttings from boreholes will typically be placed in containers unless site specific requirements allow for soil cuttings to be placed back into the borehole after drilling is complete. Drilling mud generated during investigation activities shall be collected in containers. Covers should be included on the containers and must be secured at all times and only open during filling activities. The containers shall be labelled in accordance with this SOP. An inventory containing the source, volume, and description of material put in the containers shall be logged on prescribed forms and kept in the project file.

Non-hazardous solid waste can be disposed on-site in the designated site landfill or in a designated evaporation pond if it is liquefied. Hazardous wastes must be disposed off-site at an approved hazardous waste landfill.

Liquid Waste

Groundwater generated during monitoring well development, purging, and sampling can be collected in truck-mounted containers and/or other transportable containers (i.e., 55-gallon drums). Lids or bungs on drums must be secured at all times and only open during filling or pumping activities. The containers shall be labelled in accordance with this SOP. Non-hazardous liquid waste can be disposed of in one of the designated lined evaporation ponds on-site. Hazardous wastes must be handled separately and disposed off-site at an approved hazardous waste facility.

Personal Protective Equipment

PPE that is generated throughout investigation activities shall be placed in plastic garbage bags. If the solid or liquid waste that was being handled is characterized as hazardous waste, then the corresponding PPE should also be disposed as hazardous waste. If not, all PPE should be disposed as non-hazardous waste in the designated on-site landfill. Trash that is generated as part of field activities may be disposed of in the landfill as long as the trash was not exposed to hazardous media.

## 6.4 Waste Accumulation On-Site

6.4.1 Solid, liquid, or PPE waste generated during investigation activities that are classified as nonhazardous or “characterization pending analysis” should be disposed of as soon as possible. Until disposal, such containers should be inventoried, stored as securely as possible, and inspected regularly, as a general good practice.

6.4.2 Solid, liquid, or PPE waste generated during investigation activities that are classified as hazardous shall not be accumulated on-site longer than 90 days. All hazardous waste containers shall be stored in a secured storage area. The following requirements for the hazardous waste storage area must be implemented:

- Proper hazardous waste signs shall be posted as required by any state or federal statutes that may govern the labelling of waste;
- Secondary containment to contain spills;
- Spill containment equipment must be available;
- Fire extinguisher;
- Adequate aisle space for unobstructed movement of personnel.

6.4.3 Weekly storage area inspections shall be performed and documented to ensure compliance with these requirements. Throughout the project, an inventory shall be maintained to itemize the type and quantity of the waste generated.

6.5 **Waste Disposal**

6.5.1 Solid, liquid, and PPE waste will be characterized for disposal through the use of client knowledge, laboratory analytical data created from soil or groundwater samples gathered during the field activities, and/or composite samples from individual containers.

6.5.2 All waste generated during field activities will be stored, transported, and disposed of according to applicable state, federal, and local regulations. All wastes classified as hazardous will be disposed of at a licensed treatment storage and disposal facility or managed in other approved manners.

6.5.3 In general, waste disposal should be carefully coordinated with the facility receiving the waste. Facilities receiving waste have specific requirements that vary even for non-hazardous waste, so characterization should be conducted to support both applicable regulations and facility requirements.

6.6 **Regulatory Requirements**

The following federal and state regulations shall be used as resources for determining waste characteristics and requirements for waste storage, transportation, and disposal:

- Code of Federal Regulations (CFR), Title 40, Part 261;
- CFR, Title 49, Parts 172, 173, 178, and 179.

6.7 **Waste Transport**

A state-certified hazardous waste hauler shall transport all wastes classified as hazardous. Typically, the facility receiving any waste can coordinate a hauler to transport the waste. Shipped hazardous waste shall be disposed of in accordance with all RCRA/USEPA requirements. All waste manifests or bills of lading will be signed either by the client or the client's designee.

## 7.0 Quality Control and Assurance

7.1 Management of IDW must incorporate quality control measures to ensure conformance to these and the project requirements.

## 8.0 Records, Data Analysis, Calculations

8.1 Maintain records as required by implanting the procedures in this SOP.

8.2 Deviations from this procedure or the sampling and analysis plan shall be documented in field records. Significant changes shall be approved by the **Program Quality Manager**.

## 9.0 Attachments or References

Department of Defense, United States (DoD). 2005. *Uniform Federal Policy for Quality Assurance Project Plans, Part 1: UFP-QAPP Manual.* Final Version 1. DoD: DTIC ADA 427785, EPA-505-B-04-900A. In conjunction with the U. S. Environmental Protection Agency and the Department of Energy. Washington: Intergovernmental Data Quality Task Force. March. On-line updates available at: http://www.epa.gov/-fedfac/pdf/ufp_qapp_v1_0305.pdf.

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1997a. *Sending Wastes Off Site? OSC and RPM Responsibilities under the Off-Site Rule*. EPA/540-F-97-006, Office of Solid Waste and Emergency Response. September.

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NAVFAC NW Standard Operating Procedure Number I-F, *Equipment Decontamination.*

NAVFAC NW Standard Operating Procedure Number III-D, *Logbooks.*

| Author | Reviewer | Revisions (Technical or Editorial) |
|---|---|---|
| Mark Kromis<br>Program Chemist | Chris Barr<br>Program Quality Manager | Rev 0 – Initial Issue (May 2012) |

# Equipment Decontamination

# Procedure 3-06

## 1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) describes methods of equipment decontamination, to be used for activities where samples for chemical analysis are collected or where equipment will need to be cleaned before leaving the site or before use in subsequent activities.

1.2 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review.

## 2.0 Safety

It is the responsibility of the **Site Safety Officer (SSO)** to set up the site zones (i.e., exclusion, transition, and clean) and decontamination areas. Generally the decontamination area is located within the transition zone, upwind of intrusive activities, and serves as the washing area for both personnel and equipment to minimize the spread of contamination into the clean zone. Typically, for equipment, a series of buckets are set up on a visqueen-lined bermed area. Separate spray bottles containing cleaning solvents as described in this procedure or the Contract Task Order (CTO) Work Plan (WP) and distilled water are used for final rinsing of equipment. Depending on the nature of the hazards and the site location, decontamination of heavy equipment, such as augers, pump drop pipe, and vehicles, may be accomplished using a variety of techniques.

All **Field Personnel** responsible for equipment decontamination must adhere to the site-specific health and safety plan (HSP) and must wear the personal protective equipment (PPE) specified in the site-specific HSP. Generally this includes, at a minimum, Tyvek® coveralls, steel-toed boots with boot covers or steel-toed rubber boots, safety glasses, American National Standards Institute-standard hard hats, and hearing protection (if heavy equipment is in operation). Air monitoring by the **SSO** may result in an upgrade to the use of respirators and cartridges in the decontamination area; therefore, this equipment must be available on site. If safe alternatives are not achievable, discontinue site activities immediately.

In addition to the aforementioned precautions, the following sections describe safe work practices that will be employed.

2.1 **Chemical Hazards associated with Equipment Decontamination**

- Avoid skin contact with and/or incidental ingestion of decontamination solutions and water.
- Utilize PPE as specified in the site-specific HSP to maximize splash protection.
- Refer to material safety data sheets, safety personnel, and/or consult sampling personnel regarding appropriate safety measures (i.e., handling, PPE including skin and respiratory).
- Take the necessary precautions when handling detergents and reagents.

2.2 **Physical Hazards associated with Equipment Decontamination**

- To avoid possible back strain, it is recommended to raise the decontamination area 1 to 2 feet above ground level.
- To avoid heat stress, over exertion, and exhaustion, it is recommended to rotate equipment decontamination among all site personnel.


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- Take necessary precautions when handling field sampling equipment.

## 3.0 Terms and Definitions

None.

## 4.0 Training and Qualifications

4.1 The **CTO Manager** is responsible for ensuring that decontamination activities comply with this procedure. The **CTO Manager** is responsible for ensuring that all personnel involved in equipment decontamination shall have the appropriate education, experience, and training to perform their assigned tasks.

4.2 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

4.3 The **Field Manager** is responsible for ensuring that all field equipment is decontaminated according to this procedure.

4.4 All **Field Personnel** are responsible for the implementation of this procedure.

## 5.0 Procedure

Decontamination of equipment used in soil/sediment sampling, groundwater monitoring, well drilling and well development, as well as equipment used to sample groundwater, surface water, sediment, waste, wipe, asbestos, and unsaturated zone, is necessary to prevent cross-contamination and to maintain the highest integrity possible in collected samples. Planning a decontamination program requires consideration of the following factors:

- Location where the decontamination procedures will be conducted
- Types of equipment requiring decontamination
- Frequency of equipment decontamination
- Cleaning technique and types of cleaning solutions appropriate to the contaminants of concern
- Method for containing the residual contaminants and wash water from the decontamination process
- Use of a quality control measure to determine the effectiveness of the decontamination procedure

The following subsections describe standards for decontamination, including the frequency of decontamination, cleaning solutions and techniques, containment of residual contaminants and cleaning solutions, and effectiveness.

### 5.1 Decontamination Area

Select an appropriate location for the decontamination area at a site based on the ability to control access to the area, the ability to control residual material removed from equipment, the need to store clean equipment, and the ability to restrict access to the area being investigated. Locate the decontamination area an adequate distance away and upwind from potential contaminant sources to avoid contamination of clean equipment.

### 5.2 Types of Equipment

Drilling equipment that must be decontaminated includes drill bits, auger sections, drill-string tools, drill rods, split barrel samplers, tremie pipes, clamps, hand tools, and steel cable. Decontamination of monitoring well development and groundwater sampling equipment includes submersible pumps, bailers, interface probes, water level meters, bladder pumps, airlift pumps, peristaltic pumps, and lysimeters. Other sampling equipment that requires decontamination includes, but is not limited to, hand trowels,

hand augers, slide hammer samplers, shovels, stainless-steel spoons and bowls, soil sample liners and caps, wipe sampling templates, composite liquid waste samplers, and dippers. Equipment with a porous surface, such as rope, cloth hoses, and wooden blocks, cannot be thoroughly decontaminated and shall be properly disposed of after one use.

### 5.3 Frequency of Equipment Decontamination

Decontaminate down-hole drilling equipment and equipment used in monitoring well development and purging prior to initial use and between each borehole or well. Down-hole drilling equipment, however, may require more frequent cleaning to prevent cross-contamination between vertical zones within a single borehole. When drilling through a shallow contaminated zone and installing a surface casing to seal off the contaminated zone, decontaminate the drilling tools prior to drilling deeper. Initiate groundwater sampling by sampling groundwater from the monitoring well where the least contamination is suspected. Decontaminate groundwater, surface water, and soil sampling devices prior to initial use and between collection of each sample to prevent the possible introduction of contaminants into successive samples.

### 5.4 Cleaning Solutions and Techniques

Decontamination can be accomplished using a variety of techniques and fluids. The preferred method of decontaminating major equipment, such as drill bits, augers, drill string, and pump drop-pipe, is steam cleaning. To steam clean, use a portable, high-pressure steam cleaner equipped with a pressure hose and fittings. For this method, thoroughly steam wash equipment and rinse it with potable tap water to remove particulates and contaminants.

A rinse decontamination procedure is acceptable for equipment such as bailers, water level meters, new and re-used soil sample liners, and hand tools. The decontamination procedure shall consist of the following: (1) wash with a non-phosphate detergent (Alconox®, Liquinox®, or other suitable detergent) and potable water solution; (2) rinse with potable water; (3) spray with laboratory-grade isopropyl alcohol; (4) rinse with deionized or distilled water; and (5) spray with deionized or distilled water. If possible, disassemble equipment prior to cleaning. Add a second wash at the beginning of the process if equipment is very soiled.

Decontaminating submersible pumps requires additional effort because internal surfaces become contaminated during usage. Decontaminate these pumps by washing and rinsing the outside surfaces using the procedure described for small equipment or by steam cleaning. Decontaminate the internal surfaces by recirculating fluids through the pump while it is operating. This recirculation may be done using a relatively long (typically 4 feet) large-diameter pipe (4-inch or greater) equipped with a bottom cap. Fill the pipe with the decontamination fluids, place the pump within the capped pipe, and operate the pump while recirculating the fluids back into the pipe. The decontamination sequence shall include: (1) detergent and potable water; (2) potable water rinse; (3) potable water rinse; and (4) deionized water rinse. Change the decontamination fluids after each decontamination cycle.

Solvents other than isopropyl alcohol may be used, depending upon the contaminants involved. For example, if polychlorinated biphenyls or chlorinated pesticides are contaminants of concern, hexane may be used as the decontamination solvent; however, if samples are also to be analyzed for volatile organics, hexane shall not be used. In addition, some decontamination solvents have health effects that must be considered. Decontamination water shall consist of distilled or deionized water. Steam-distilled water shall not be used in the decontamination process as this type of water usually contains elevated concentrations of metals. Decontamination solvents to be used during field activities will be specified in the CTO WP.

Rinse equipment used for measuring field parameters, such as pH (indicates the hydrogen ion concentration – acidity or basicity), temperature, specific conductivity, and turbidity with deionized or distilled water after each measurement. Also wash new, unused soil sample liners and caps with a fresh


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detergent solution and rinse them with potable water followed by distilled or deionized water to remove any dirt or cutting oils that might be on them prior to use.

5.5 **Containment of Residual Contaminants and Cleaning Solutions**

A decontamination program for equipment exposed to potentially hazardous materials requires a provision for catchment and disposal of the contaminated material, cleaning solution, and wash water.

When contaminated material and cleaning fluids must be contained from heavy equipment, such as drill rigs and support vehicles, the area must be properly floored, preferably with a concrete pad that slopes toward a sump pit. If a concrete pad is impractical, planking can be used to construct solid flooring that is then covered by a nonporous surface and sloped toward a collection sump. If the decontamination area lacks a collection sump, use plastic sheeting and blocks or other objects to create a bermed area for collection of equipment decontamination water. Situate items, such as auger flights, which can be placed on metal stands or other similar equipment, on this equipment during decontamination to prevent contact with fluids generated by previous equipment decontamination. Store clean equipment in a separate location to prevent recontamination. Collect decontamination fluids contained within the bermed area and store them in secured containers as described below.

Use wash buckets or tubs to catch fluids from the decontamination of lighter-weight drilling equipment and hand-held sampling devices. Collect the decontamination fluids and store them on site in secured containers, such as U.S. Department of Transportation-approved drums, until their disposition is determined by laboratory analytical results. Label containers in accordance with Procedure 3-05, *IDW Management*.

## 6.0 Quality Control and Assurance

A decontamination program must incorporate quality control measures to determine the effectiveness of cleaning methods. Quality control measures typically include collection of equipment blank samples or wipe testing. Equipment blanks consist of analyte-free water that has been poured over or through the sample collection equipment after its final decontamination rinse. Wipe testing is performed by wiping a cloth over the surface of the equipment after cleaning. These quality control measures provide "after-the fact" information that may be useful in determining whether or not cleaning methods were effective in removing the contaminants of concern.

## 7.0 Records, Data Analysis, Calculations

Any project where sampling and analysis is performed shall be executed in accordance with an approved sampling and analysis plan. This procedure may be incorporated by reference or may be incorporated with modifications described in the plan.

Deviations from this procedure or the sampling and analysis plan shall be documented in field records. Significant changes shall be approved by the **Program Quality Manager**.

## 8.0 Attachments or References


8.1 ASTM Standard D5088. 2008. *Standard Practice for Decontamination of Field Equipment Used at Waste Sites.* ASTM International, West Conshohocken, PA. 2008. DOI: 10.1520/D5088-02R08. www.astm.org.

8.2 NAVSEA T0300-AZ-PRO-010. *Navy Environmental Compliance Sampling and Field Testing Procedures Manual*. August 2009.

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# Soil and Rock Classification

## Procedure 3-16

## 1.0 Purpose and Scope

1.1 The purpose of this document is to define the standard operating procedure (SOP) to thoroughly describe the physical characteristics of the sample and classify it according to the Unified Soil Classification System (USCS).

1.2 This procedure is the Program-approved professional guidance for work performed by Resolution Consultants under the Comprehensive Long-Term Environmental Action Navy (CLEAN) contract (Contract Number N62470-11-D-8013).

1.3 As guidance for specific activities, this procedure does not obviate the need for professional judgment. Deviations from this procedure while planning or executing planned activities must be approved in accordance with Program requirements for technical planning and review. If there are procedures whether it be from Resolution Consultants, state and/or federal that are not addressed in this SOP and are applicable to surface water sampling then those procedures may be added as an appendix to the project specific SAP.

1.4 It is fully expected that the procedures outlined in this SOP will be followed. Procedural modifications may be warranted depending upon field conditions, equipment limitations, or limitations imposed by the procedure. Substantive modification to this SOP will be approved in advance by the Program Quality Manager. Deviations to this SOP will be documented in the field records.

## 2.0 Safety

2.1 Depending upon the site-specific contaminants, various protective programs must be implemented prior to sampling. All **field sampling personnel** responsible for sampling activities must review the project-specific health and safety plan (HASP) paying particular attention to the control measures planned for the sampling tasks. Conduct preliminary area monitoring to determine the potential hazard to field sampling personnel. If significant contamination is observed, minimize contact with potential contaminants in both the vapor and liquid phase through the use of respirators and disposable clothing.

2.2 In addition, observe standard health and safety practices according to the project-specific HASP. Suggested minimum protection during well sampling activities includes inner disposable vinyl gloves, outer chemical-protective nitrile gloves, rubberized steel-toed boots, and an American National Standards Institute-standard hard hat. Half-face respirators and cartridges and Tyvek® suits may be necessary depending on the contaminant concentrations, and shall always be available on site.

2.3 Daily safety briefs will be conducted at the start of each working day before any work commences. These daily briefs will be facilitated by the **Site Safety Officer (SSO)** or designee to discuss the day's events and any potential health risk areas covering every aspect of the work to be completed. Weather conditions are often part of these discussions. As detailed in the HASP, everyone on the field team has the authority to stop work if an unsafe condition is perceived until the conditions are fully remedied to the satisfaction of the SSO.

2.4 The health and safety considerations for the work associated with soil classification include:

- At no time during classification activities are personnel to reach for debris near machinery that is in operation, place any samples in their mouth, or come in contact with the soils/rocks without the use of gloves.
- Stay clear of all moving equipment and be aware of pinch points on machinery. Avoid wearing loose fitting clothing.
- When using cutting tools, cut away from yourself. The use of appropriate, task specific cutting tools is recommended.
- To avoid heat/cold stress as a results of exposure to extreme temperatures and PPE, drink electrolyte replacement fluids (1 to 2 cups per hour is recommended) and in case of extreme cold, wear insulating clothing.

## 3.0 Terms and Definitions

None.

## 4.0 Interference

None.

## 5.0 Training and Qualifications

5.1 The **Contract Task Order (CTO) Manager** is responsible for ensuring that the soil and rock classification procedures comply with this procedure. The **CTO Manager** is responsible for ensuring that all personnel involved in soil and rock classification shall have the appropriate education, experience, and training to perform their assigned tasks.

5.2 The **Program Quality Manager** is responsible for ensuring overall compliance with this procedure.

5.3 The **Field Manager** is responsible for ensuring that all project **field personnel** follow these procedures.

5.4 Field personnel are responsible for the implementation of this procedure. Minimum qualifications for **field sampling personnel** require that one individual on the field team shall have a minimum of 6 months of experience with soil and rock classification.

5.5 The **project geologist** and/or **task manager** is responsible for directly supervising the soil and rock classification procedures to ensure that they are conducted according to this procedure, and for recording all pertinent data collected. If deviations from the procedure are required because of anomalous field conditions, they must first be approved by the **Program Quality Manager** and then documented in the field logbook and associated report or equivalent document.

## 6.0 Equipment and Supplies

6.1 The following equipment list contains materials which may be needed in carrying out the procedures outlined in this SOP. Not all equipment listed below may be necessary for a specific activity. Additional equipment may be required, pending field conditions.

- Personal protective equipment (PPE) and other safety equipment, as required by the HASP
- Field log book and pen with indelible ink
- Boring log

- Munsell Soil Color Chart
- Scoopula, spatula, and/or other small hand tools
- California Sampler
- Hand-held penetrometer

# 7.0 Calibration or Standardization

None.

# 8.0 Procedure

## 8.1 Soil Classification

The basic purpose of the classification of soil is to thoroughly describe the physical characteristics of the sample and to classify it according to an appropriate soil classification system. The USCS was developed so that soils could be described on a common basis by different investigators and serve as a "shorthand" description of soil. A classification of a soil in accordance with the USCS includes not only a group symbol and name, but also a complete word description.

Describing soil on a common basis is essential so that soil described by different site qualified personnel is comparable. Site individuals describing soil as part of site activities *must* use the classification system described herein to provide the most useful geologic database for all present and future subsurface investigations and remedial activities.

The site geologist or other qualified individual shall describe the soil and record the description in a boring log, logbook, and/or electronic field data collection device. The essential items in any written soil description are as follows:

- Classification group name (e.g., silty sand)
- Color, moisture, and odor
- Range of particle sizes and maximum particle size
- Approximate percentage of boulders, cobbles, gravel, sand, and fines
- Plasticity characteristics of the fines
- In-place conditions, such as consistency, density, and structure
- USCS classification symbol

The USCS serves as ”shorthand“ for classifying soil into 15 basic groups:

GW[1] Well graded (poorly sorted) gravel (>50 percent gravel, <5percent fines)

GP[1] Poorly graded (well sorted) gravel (>50percent gravel, <5percent fines)

GM[1] Silty gravel (>50 percent gravel, >15 percent silt)

GC[1] Clayey gravel (>50 percent gravel, >15 percent clay)

SW[1] Well graded (poorly sorted) sand (>50 percent sand, <5 percent fines)

SP[1] Poorly graded (well sorted) sand (>50 percent sand, <5 percent fines)

[1] If percentage of fine is 5 percent to 15 percent, a dual identification shall be given (e.g., a soil with more than 50 percent poorly sorted gravel and 10 percent clay is designated GW-GC.

SM[1] Silty sand (>50 percent sand, >15 percent silt)

SC[1] Clayey sand (>50 percent sand, >15 percent clay)

ML[2] Inorganic, low plasticity silt (slow to rapid dilatancy, low toughness, and plasticity)

CL[2] Inorganic, low plasticity (lean) clay (no or slow dilatancy, medium toughness and plasticity)

MH[2] Inorganic elastic silt (no to slow dilatancy, low to medium toughness and plasticity)

CH[2] Inorganic, high plasticity (fat) clay (no dilatancy, high toughness, and plasticity)

OL Organic low plasticity silt or organic silty clay

OH Organic high plasticity clay or silt

PT Peat and other highly organic soil

Figure8-1 defines the terminology of the USCS. Flow charts presented in Figure 8-2 and indicate the process for describing soil. The particle size distribution and the plasticity of the fines are the two properties of soil used for classification. In some cases, it may be appropriate to use a borderline classification (e.g., SC/CL) if the soil has been identified as having properties that do not distinctly place the soil into one group.

### 8.1.1 Estimation of Particle Size Distribution

One of the most important factors in classifying a soil is the estimated percentage of soil constituents in each particle size range. Being proficient in estimating this factor requires extensive practice and frequent checking. The steps involved in determining particle size distribution are listed below:

1. Select a representative sample (approximately 1/2 of a 6-inch long by 2.5-inch diameter sample liner).
2. Remove all particles larger than 3 inches from the sample. Estimate and record the percent by volume of these particles. Only the fraction of the sample smaller than 3 inches is classified.
3. Estimate and record the percentage of dry mass of gravel (less than 3 inches and greater than 1/4 inch).
4. Considering the rest of the sample, estimate, and record the percentage of dry mass of sand particles (about the smallest particle visible to the unaided eye).
5. Estimate and record the percentage of dry mass of fines in the sample (do not attempt to separate silts from clays).
6. Estimate percentages to the nearest 5 percent. If one of the components is present in a quantity considered less than 5 percent, indicate its presence by the term “trace”.
7. The percentages of gravel, sand, and fines must add up to 100 percent. “Trace” is not included in the 100 percent total.

### 8.1.2 Soil Dilatancy, Toughness, and Plasticity

#### *8.1.2.1 Dilatancy*

To evaluate dilatancy, follow these procedures:

[2] If the soil is estimated to have 15 percent to 25 percent sand or gravel, or both, the words “with sand” or “with gravel” (whichever predominates) shall be added to the group name (e.g., clay with sand, CL; or silt with gravel, ML). If the soil is estimated to have 30 percent or more sand or gravel, or both, the words “sandy” or “gravely” (whichever predominates) shall be added to the group name (e.g., sandy clay, CL). If the percentage of sand is equal to the percent gravel, use “sandy.”


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1. From the specimen, select enough material to mold into a ball about 1/2 inch (12 millimeters [mm]) in diameter. Mold the material, adding water if necessary, until it has a soft, but not sticky, consistency.
2. Smooth the soil ball in the palm of one hand with the blade of a knife or small spatula. Shake horizontally, striking the side of the hand vigorously against the other hand several times. Note the reaction of water appearing on the surface of the soil. Squeeze the sample by closing the hand or pinching the soil between the fingers, and note the reaction as none, slow, or rapid in accordance with the criteria in Table 8-1. The reaction is the speed with which water appears while shaking, and disappears while squeezing.

**Table 8-1: Criteria for Describing Dilatancy**

| Description | Criteria |
|---|---|
| None | No visible change in specimen. |
| Slow | Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing. |
| Rapid | Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing. |

*8.1.2.2 Toughness*

Following the completion of the dilatancy test, shape the test specimen into an elongated pat and roll it by hand on a smooth surface or between the palms into a thread about 1/8 inch (3 mm) in diameter. (If the sample is too wet to roll easily, spread it into a thin layer and allow it to lose some water by evaporation.) Fold the sample threads and re-roll repeatedly until the thread crumbles at a diameter of about 1/8 inch. The thread will crumble at a diameter of 1/8 inch when the soil is near the plastic limit. Note the pressure required to roll the thread near the plastic limit. Also, note the strength of the thread. After the thread crumbles, lump the pieces together and knead it until the lump crumbles. Note the toughness of the material during kneading. Describe the toughness of the thread and lump as low, medium, or high in accordance with the criteria in Table 8-2.

**Table 8-2: Criteria for Describing Toughness**

| Description | Criteria |
|---|---|
| Low | Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft. |
| Medium | Medium pressure is required to roll the thread near the plastic limit. The thread and the lump have medium stiffness. |
| High | Considerable pressure is required to roll the thread near the plastic limit. The thread and the lump have very high stiffness. |


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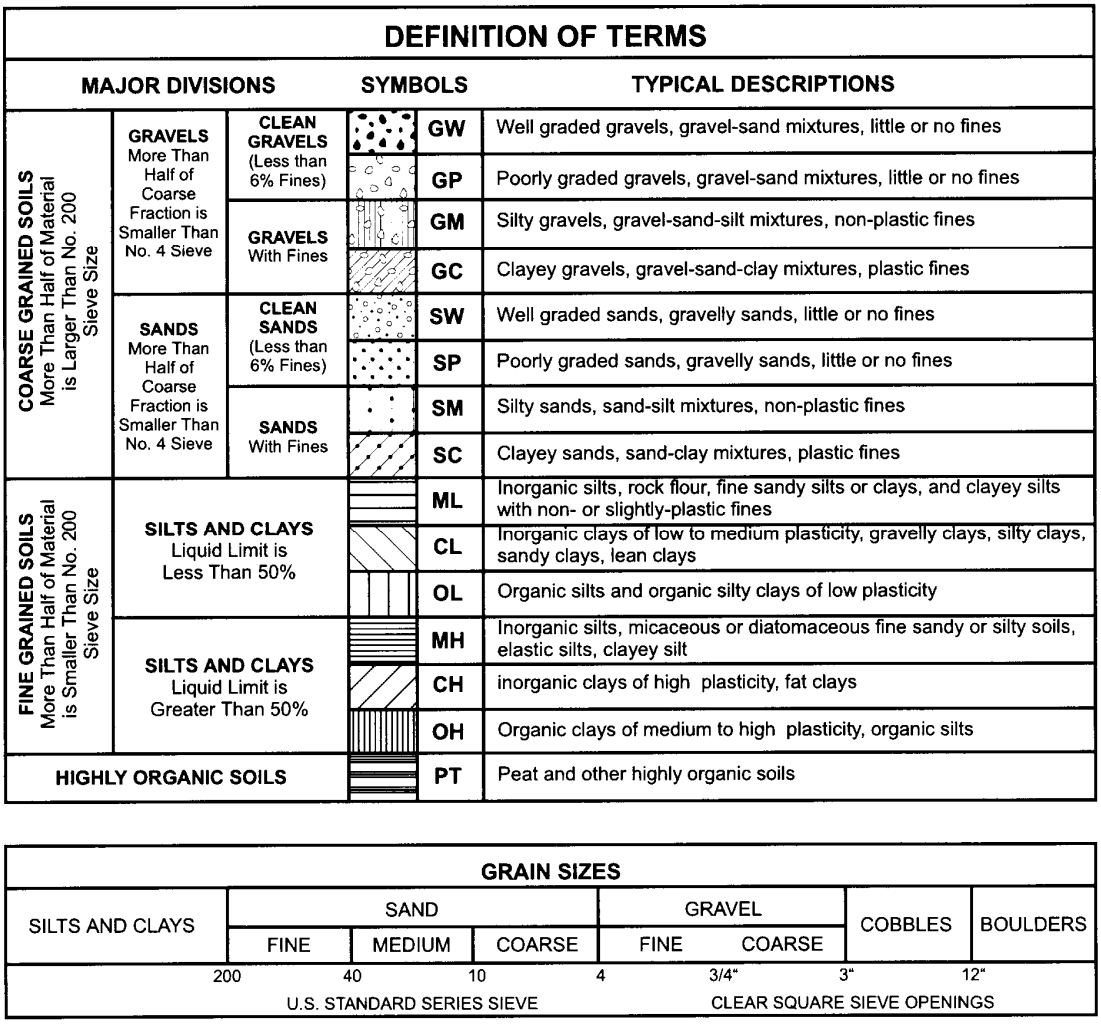


**Figure8-1: Unclassified Soil Classification System (USCS)**


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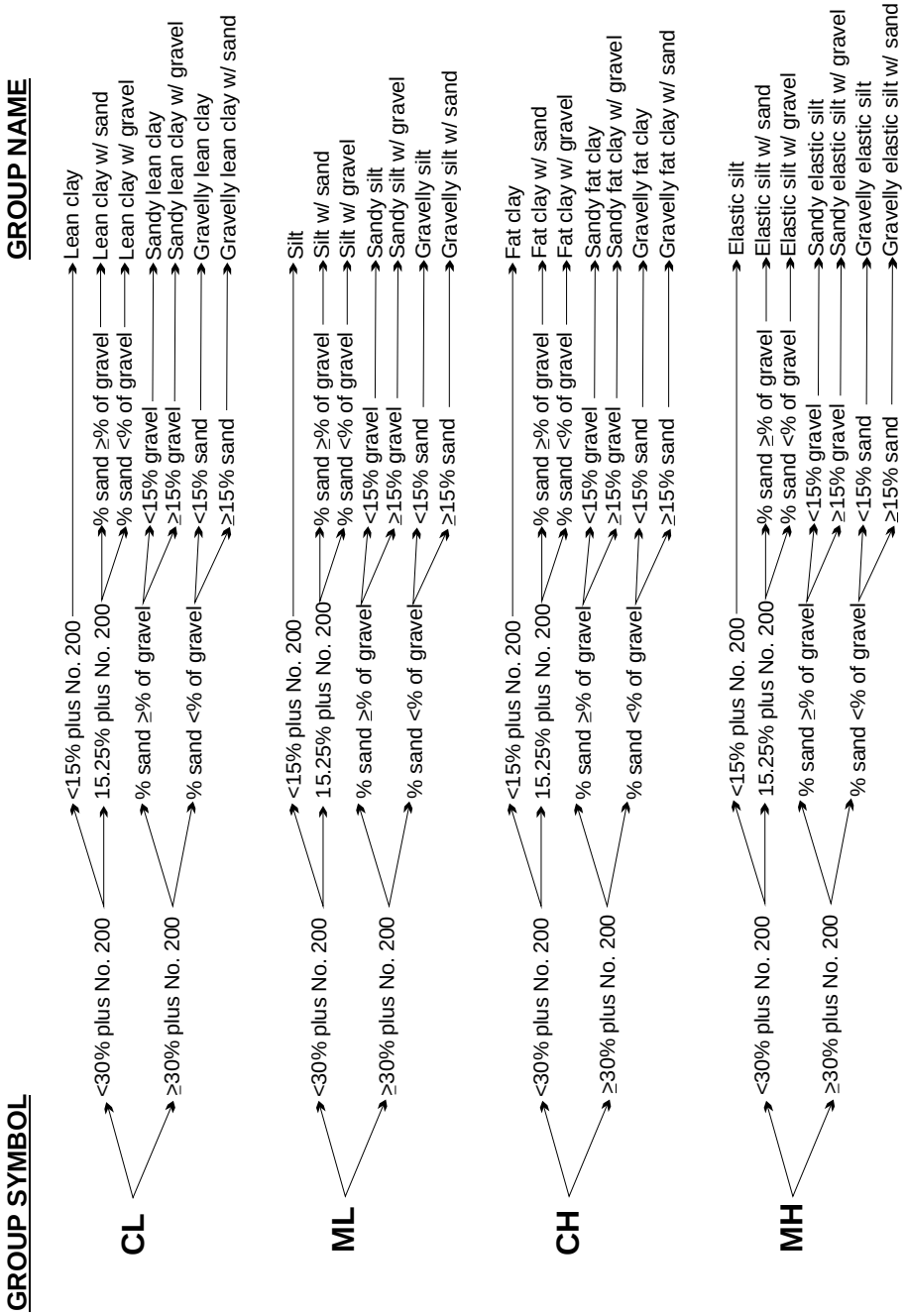


**Figure 8-2: Flow Chart for Fine Grain Soil Classification**


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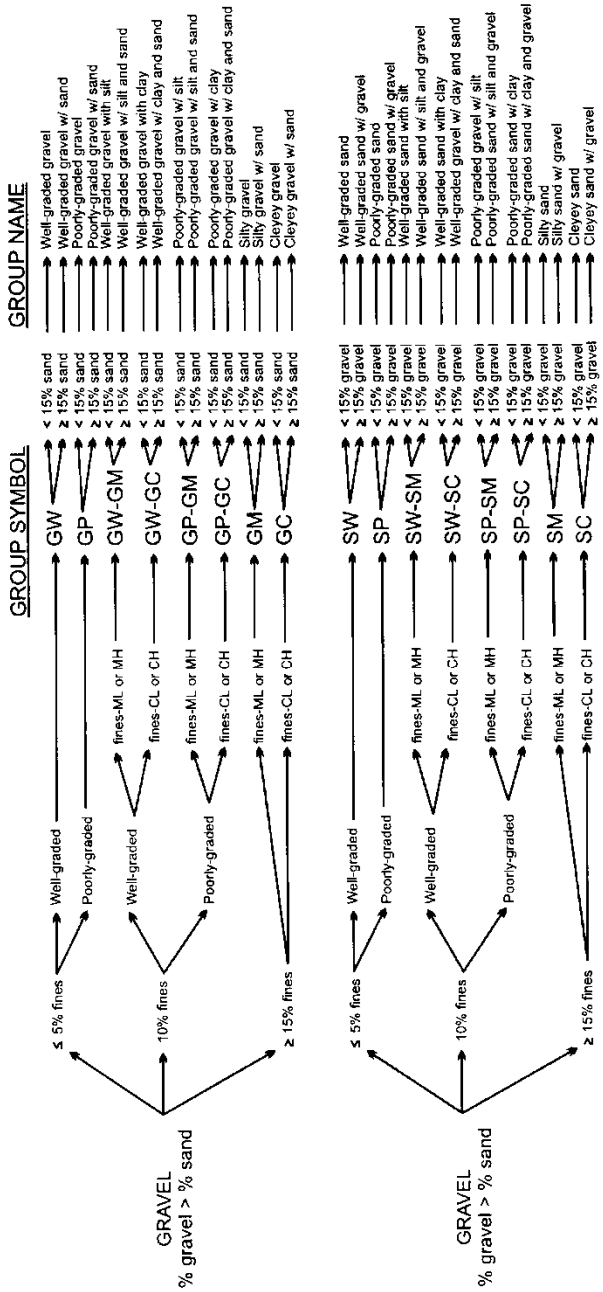


**Figure 8-3: Flow Chart for Soil with Gravel**


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#### *8.1.2.3 Plasticity*

The plasticity of a soil is defined by the ability of the soil to deform without cracking, the range of moisture content over which the soil remains in a plastic state, and the degree of cohesiveness at the plastic limit. The plasticity characteristic of clays and other cohesive materials is defined by the liquid limit and plastic limit. The liquid limit is defined as the soil moisture content at which soil passes from the liquid to the plastic state as moisture is removed. The test for the liquid limit is a laboratory, not a field, analysis.

The plastic limit is the soil moisture content at which a soil passes from the plastic to the semi-solid state as moisture is removed. The plastic limit test can be performed in the field and is indicated by the ability to roll a 1/8-inch (0.125-inch) diameter thread of fines, the time required to roll the thread, and the number of times the thread can be re-rolled when approaching the plastic limit.

The plasticity tests are not based on natural soil moisture content, but on soil that has been thoroughly mixed with water. If a soil sample is too dry in the field, add water prior to performing classification. If a soil sample is too sticky, spread the sample thin and allow it to lose some soil moisture.

Table 8-3 presents the criteria for describing plasticity in the field using the rolled thread method.

**Table 8-3: Criteria for Describing Plasticity**

| Description | Criteria |
|---|---|
| Non-Plastic | A 1/8-inch thread cannot be rolled. |
| Low Plasticity | The thread can barely be rolled. |
| Medium Plasticity | The thread is easy to roll and not much time is required to reach the plastic limit. |
| High Plasticity | It takes considerable time rolling the thread to reach the plastic limit. |

### 8.1.3 Angularity

The following criteria describe the angularity of the coarse sand and gravel particles:

- **Rounded** particles have smoothly-curved sides and no edges.
- **Subrounded** particles have nearly plane sides, but have well-rounded corners and edges.
- **Subangular** particles are similar to angular, but have somewhat rounded or smooth edges.
- **Angular** particles have sharp edges and relatively plane sides with unpolished surfaces. Freshly broken or crushed rock would be described as angular.

### 8.1.4 Color, Moisture, and Odor

The natural moisture content of soil is very important. Table **8-4** shows the terms for describing the moisture condition and the criteria for each.

**Table 8-4: Soil Moisture Content Qualifiers**

| Qualifier | Criteria |
|---|---|
| Dry | Absence of moisture, dry to the touch |
| Moist | Damp but no visible water |
| Wet | Visible water, usually soil is below water table |

Color is described by hue and chroma using the Munsell Soil Color Chart (Munsell 2000). For uniformity, all site geologists shall utilize this chart for soil classification. Doing so will facilitate correlation of geologic units between boreholes logged by different geologists. The Munsell Color Chart is a small booklet of numbered color chips with names like “5YR 5/6, yellowish-red.” Note mottling or banding of colors. It is particularly important to note and describe staining because it may indicate contamination.


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In general, wear a respirator if strong organic odors are present. If odors are noted, describe them if they are unusual or suspected to result from contamination. An organic odor may have the distinctive smell of decaying vegetation. Unusual odors may be related to hydrocarbons, solvents, or other chemicals in the subsurface. An organic vapor analyzer may be used to detect the presence of volatile organic contaminants.

### 8.1.5 In-Place Conditions

Describe the conditions of undisturbed soil samples in terms of their density/consistency (i.e., compactness), cementation, and structure utilizing the following guidelines:

#### *8.1.5.1 Density/Consistency*

Density and consistency describe a physical property that reflects the relative resistance of a soil to penetration. The term “density” is commonly applied to coarse to medium-grained sediments (i.e., gravels, sands), whereas the term “consistency” is normally applied to fine-grained sediments (i.e., silts, clays). There are separate standards of measure for both density and consistency that are used to describe the properties of a soil.

The density or consistency of a soil is determined by observing the number of blows required to drive a 1 3/8-inch (35 mm) diameter split barrel sampler 18 inches using a drive hammer weighing 140 lbs (63.5 kilograms [kg]) dropped over a distance of 30 inches (0.76 meters). Record the number of blows required to penetrate each 6 inches of soil in the field boring log during sampling. The first 6 inches of penetration is considered to be a seating drive; therefore, the blow count associated with this seating drive is recorded, but not used in determining the soil density/consistency. The sum of the number of blows required for the second and third 6 inches of penetration is termed the “standard penetration resistance,” or the “N-value.” The observed number of blow counts must be corrected by an appropriate factor if a different type of sampling device (e.g., Modified California Sampler with liners) is used. For a 2 3/8-inch inner diameter (I.D.) Modified California Sampler equipped with brass or stainless steel liners and penetrating a cohesionless soil (sand/gravel), the N-value from the Modified California Sampler must be divided by 1.43 to provide data that can be compared to the 1 3/8-inch diameter sampler data.

For a cohesive soil (silt/clay), the N-value for the Modified California Sampler should be divided by a factor of 1.13 for comparison with 1 3/8-inch diameter sampler data.

Drive the sampler and record blow counts for each 6-inch increment of penetration until one of the following occurs:

- A total of 50 blows have been applied during any one of the three 6-inch increments; a 50-blow count occurrence shall be termed “refusal” and noted as such on the boring log.
- A total of 150 blows have been applied.
- The sampler is advanced the complete 18 inches without the limiting blow counts occurring, as described above.

If the sampler is driven less than 18 inches, record the number of blows per partial increment on the boring log. If refusal occurs during the first 6 inches of penetration, the number of blows will represent the N-value for this sampling interval. Table 8-5 and Table 8-6 present representative descriptions of soil density/consistency vs. N-values.


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**Table 8-5: Measuring Soil Density with a California Sampler – Relative Density (Sands, Gravels)**

| Description | Field Criteria (N-Value) | |
|---|---|---|
| | 1 3/8 in. ID Sampler | 2 in. ID Sampler using 1.43 factor |
| Very Loose | 0–4 | 0–6 |
| Loose | 4–10 | 6–14 |
| Medium Dense | 10–30 | 14–43 |
| Dense | 30–50 | 43–71 |
| Very Dense | > 50 | > 71 |

**Table 8-6: Measuring Soil Density with a California Sampler – Fine Grained Cohesive Soil**

| Description | Field Criteria (N-Value) | |
|---|---|---|
| | 1 3/8 in. ID Sampler | 2 in. ID Sampler using 1.13 factor |
| Very Soft | 0–2 | 0–2 |
| Soft | 2–4 | 2–4 |
| Medium Stiff | 4–8 | 4–9 |
| Stiff | 8–16 | 9–18 |
| Very Stiff | 16–32 | 18–36 |
| Hard | > 32 | > 36 |

For undisturbed fine-grained soil samples, it is also possible to measure consistency with a hand-held penetrometer. The measurement is made by placing the tip of the penetrometer against the surface of the soil contained within the sampling liner or shelby tube, pushing the penetrometer into the soil a distance specified by the penetrometer manufacturer, and recording the pressure resistance reading in pounds per square foot (psf). The values are as follows ( Table 8-7):

**Table 8-7: Measuring Soil Consistency with a Hand-Held Penetrometer**

| Description | Pocket Penetrometer Reading (psf) |
|---|---|
| Very Soft | 0–250 |
| Soft | 250–500 |
| Medium Stiff | 500–1000 |
| Stiff | 1000–2000 |
| Very Stiff | 2000–4000 |
| Hard | >4000 |

Consistency can also be estimated using thumb pressure using Table 8-8.

**Table 8-8: Measuring Soil Consistency Using Thumb Pressure**

| Description | Criteria |
|---|---|
| Very Soft | Thumb will penetrate soil more than 1 inch (25 mm) |
| Soft | Thumb will penetrate soil about 1 inch (25 mm) |
| Firm | Thumb will penetrate soil about 1/4 inch (6 mm) |
| Hard | Thumb will not indent soil but readily indented with thumbnail |
| Very Hard | Thumbnail will not indent soil |


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### 8.1.5.2 *Cementation*

Cementation is used to describe the friability of a soil. Cements are chemical precipitates that provide important information as to conditions that prevailed at the time of deposition, or conversely, diagenetic effects that occurred following deposition. Seven types of chemical cements are recognized by Folk (1980). They are as follows:

- Quartz – siliceous
- Chert – chert-cemented or chalcedonic
- Opal – opaline
- Carbonate – calcitic, dolomitic, sideritic (if in doubt, calcareous should be used)
- Iron oxides – hematitic, limonitic (if in doubt, ferruginous should be used)
- Clay minerals – if the clay minerals are detrital or have formed by recrystallization of a previous clay matrix, they are not considered to be a cement. Only if they are chemical precipitates, filling previous pore space (usually in the form of accordion-like stacks or fringing radial crusts) should they be included as “kaolin-cemented,” “chlorite-cemented,” etc.
- Miscellaneous minerals – pyritic, collophane-cemented, glauconite-cemented, gypsiferous, anhydrite-cemented, baritic, feldspar-cemented, etc.

The degree of cementation of a soil is determined qualitatively by utilizing finger pressure on the soil in one of the sample liners to disrupt the gross soil fabric. The three cementation descriptors are as follows:

- Weak – friable; crumbles or breaks with handling or slight finger pressure
- Moderate – friable; crumbles or breaks with considerable finger pressure
- Strong – not friable; will not crumble or break with finger pressure

### 8.1.5.3 *Structure*

This variable is used to qualitatively describe physical characteristics of soil that are important to incorporate into hydrogeological and/or geotechnical descriptions of soil at a site. Appropriate soil structure descriptors are as follows:

- Granular – spherically shaped aggregates with faces that do not accommodate adjoining faces
- Stratified – alternating layers of varying material or color with layers at least 6 mm (1/4 inch) thick; note thickness
- Laminated – alternating layers of varying material or color with layers less than 6 mm (1/4 inch) thick; note thickness
- Blocky – cohesive soil that can be broken down into small angular or subangular lumps that resist further breakdown
- Lensed – inclusion of a small pocket of different soil, such as small lenses of sand, should be described as homogeneous if it is not stratified, laminated, fissured, or blocky. If lenses of different soil are present, the soil being described can be termed homogeneous if the description of the lenses is included
- Prismatic or Columnar – particles arranged about a vertical line, ped is bounded by planar, vertical faces that accommodate adjoining faces; prismatic has a flat top; columnar has a rounded top
- Platy – particles are arranged about a horizontal plane


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*8.1.5.4 Other Features*

- Mottled – soil that appears to consist of material of two or more colors in blotchy distribution
- Fissured – breaks along definite planes of fracture with little resistance to fracturing (determined by applying moderate pressure to sample using thumb and index finger)
- Slickensided – fracture planes appear polished or glossy, sometimes striated (parallel grooves or scratches)

8.1.6 **Development of Soil Description**

Develop standard soil descriptions according to the following examples. There are three principal categories under which all soil can be classified. They are described below.

*8.1.6.1 Coarse-grained Soil*

Coarse-grained soil is divided into sands and gravels. A soil is classified as a sand if over 50 percent of the coarse fraction is "sand-sized." It is classified as a gravel if over 50 percent of the coarse fraction is composed of "gravel-sized" particles.

The written description of a coarse-grained soil shall contain, in order of appearance: Typical name including the second highest percentage constituent as an adjective, if applicable (underlined); grain size of coarse fraction; Munsell color and color number; moisture content; relative density; sorting; angularity; other features, such as stratification (sedimentary structures) and cementation, possible formational name, primary USCS classification, secondary USCS classification (when necessary), and approximate percentages of minor constituents (i.e., sand, gravel, shell fragments, rip-up clasts) in parentheses.

Example: POORLY-SORTED SAND WITH SILT, medium- to coarse-grained, light olive gray, 5Y 6/2, saturated, loose, poorly sorted, subrounded clasts, SW/SM (minor silt with approximately 20 percent coarse-grained sand-sized shell fragments, and 80 percent medium-grained quartz sand, and 5 percent to 15 percent ML).

*8.1.6.2 Fine-grained Soil*

Fine-grained soil is further subdivided into clays and silts according to its plasticity. Clays are rather plastic, while silts have little or no plasticity.

The written description of a fine-grained soil should contain, in order of appearance: Typical name including the second highest percentage constituent as an adjective, if applicable (underlined); Munsell color; moisture content; consistency; plasticity; other features, such as stratification, possible formation name, primary USCS classification, secondary USCS classification (when necessary), and the percentage of minor constituents in parentheses.

Example: SANDY LEAN CLAY, dusky red, 2.5 YR 3/2, moist, firm, moderately plastic, thinly laminated, CL (70 percent fines, 30 percent sand, with minor amounts of disarticulated bivalves [about 5 percent]).

*8.1.6.3 Organic Soil*

For highly organic soil, describe the types of organic materials present as well as the type of soil constituents present using the methods described above. Identify the soil as an organic soil, OL/OH, if the soil contains enough organic particles to influence the soil properties. Organic soil usually has a dark brown to black color and may have an organic odor. Often, organic soils will change color, (e.g., from black to brown) when exposed to air. Some organic soils will lighten in color significantly when air-dried. Organic soils normally will not have a high toughness or plasticity. The thread for the toughness test will be spongy.

8.2 Example: ORGANIC CLAY, black, 2.5Y, 2.5/1, wet, soft, low plasticity, organic odor, OL (100 percent fines), weak reaction to HCl.

## 8.3 Rock Classification


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The purpose of rock classification is to thoroughly describe the physical and mineralogical characteristics of a specimen and to classify it according to an established system. The generalized rock classification system described below was developed because, unlike the USCS for soils, there is no universally accepted rock classification system. In some instances, a more detailed and thorough rock classification system may be appropriate. Any modifications to this classification system, or the use of an alternate classification system should be considered during preparation of the site work plan. Both the CTO Manager and the QA Manager or Technical Director must approve any modifications to this classification system, or the use of another classification system.

Describing rock specimens on a common basis is essential so that rocks described by different site geologists are comparable. Site geologists describing rock specimens as a part of investigative activities must use the classification system described herein, or if necessary, another more detailed classification system. Use of a common classification system provides the most useful geologic database for all present and future subsurface investigations and remedial activities.

In order to provide a more consistent rock classification between geologists, a rock classification template has been designated as shown in **Error! Reference source not found.**. The template includes classification of rocks by origin and mineralogical composition. When classifying rocks, all site geologists shall use this template.

The site geologist shall describe the rock specimen and record the description in a boring log or logbook. The items essential for classification include (i.e., metamorphic foliated):

- Classification Name (i.e., schist)
- Color
- Mineralogical composition and percent
- Texture/Grain size (i.e., fine-grained, pegmatitic, aphlitic, glassy)
- Structure (i.e., foliated, fractured, lenticular)
- Rock Quality Designation (sum of all core pieces greater than two times the diameter of the core divided by the total length of the core run, expressed as a percentage)
- Classification symbol (i.e., MF)

Example: Metamorphic foliated schist: Olive gray, 5Y, 3/2, Garnet 25 percent, Quartz 45 percent, Chlorite 15 percent, Tourmaline 15 percent, Fine-grained with Pegmatite garnet, highly foliated, slightly wavy, MF.

## 9.0 Quality Control and Assurance

None


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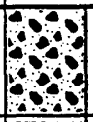
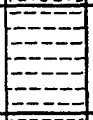
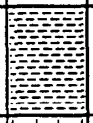
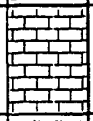
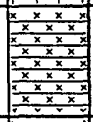
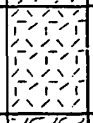
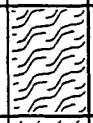
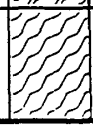
| DEFINITION OF TERMS | | | | | |
|---|---|---|---|---|---|
| PRIMARY DIVISIONS | | | SYMBOLS | | SECONDARY DIVISIONS |
| SEDIMENTARY ROCKS | Clastic Sediments | CONGLOMERATE |  | CG | Coarse-grained Clastic Sedimentary Rock types including: Conglomerates and Breccias |
| | | SANDSTONE |  | SS | Clastic Sedimentary Rock types including: Sandstone, Arkose and Greywacke |
| | | SHALE |  | SH | Fine-grained Clastic Sedimentary Rock types including: Shale, Siltstone, Mudstone and Claystone |
| | Chemical Precipitates | CARBONATES |  | LS | Chemical Precipitates including: Limestone, Crystalline Limestone, Fossiliferous Limestone Micrite and Dolomite |
| | | EVAPORITES |  | EV | Evaporites including: Anhydrite, Gypsum, Halite, Travertine and Caliche |
| IGNEOUS ROCKS | | EXTRUSIVE (Volcanic) | | IE | Volcanic Rock types including: Basalt, Andesite, Rhyolite, Volcanic Tuff, and Volcanic Breccia |
| | | INTRUSIVE (Plutonic) |  | II | Plutonic Rock types including: Granite, Diorite and Gabbro |
| METAMORPHIC ROCKS | | FOLIATED |  | MF | Foliated Rock types including: Slate, Phyllite, Schist and Gneiss |
| | | NON-FOLIATED |  | MN | Non-foliated Rock types including: Metaconglomerate, Quartzite and Marble |

**Figure 8-4: Rock Classification System**



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## 10.0 Data and Records Management

10.1 Document soil classification information collected during soil sampling onto the field boring logs, field trench logs, and into the field notebook. Copies of this information shall be sent to the **CTO Manager** for the project files.

10.2 Field notes will be kept during coring activities in accordance with SOP 3-03 – Recordkeeping, Sample Labeling, and Chain of Custody. The information pertinent to soil classification activities includes chronology of events, sample locations (x,y,z), time/date, sampler name, methods (including type of core liner/barrel, if applicable), sampler penetration and acceptability, sample observations, and the times and type of equipment decontamination. Deviations to the procedures detailed in the SOP should be recorded in the field logbook.

## 11.0 Attachments or References


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| *Author* | *Reviewer* | *Revisions (Technical or Editorial)* |
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| | | |



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# Direct Push Sampling Techniques

# Procedure 3-17

## 1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) provides guidance on the use of direct push techniques for the United States Navy Environmental Restoration (ER) Program, Naval Facilities Engineering Command, Atlantic (NAVFAC Atlantic).

1.2 This procedure is the Program-approved professional guidance for work performed by Resolution Consultants under the Comprehensive Long-Term Environmental Action Navy (CLEAN) contract (Contract Number N62470-11-D-8013).

1.3 This procedure shall serve as management-approved professional guidance for the ER Program and is consistent with protocol in the Uniform Federal Policy-Quality Assurance Project Plan (DoD 2005). As professional guidance for specific activities, this procedure is not intended to obviate the need for professional judgment during unforeseen circumstances. Deviations from this procedure while planning or executing planned activities must be approved by both the Contract Task Order (CTO) Manager and the Quality Assurance (QA) Manager or Technical Director, and documented.

1.4 If there are procedures whether it be from Resolution Consultants, state and/or federal that are not addressed in this SOP and are applicable to direct push sampling then those procedures may be added as an appendix to the project specific SAP.

## 2.0 Safety

2.1 Field personnel shall perform work in accordance with the site-specific health and safety plan (HASP). During monitoring well installation, subcontractors in direct contact with potentially contaminated media shall wear the proper personal protective equipment (PPE) as outlined in the site-specific health and safety plan. Failure to comply will result in disciplinary action.

2.2 If circumstances warrant, a real-time immediate response instrument, such as a Miniram Dust Monitor, organic vapor analyzer, HNu, Thermo, Draeger or Sensidyne tubes, or explosimeter, should be used to monitor the work area. When real/time instrument response exceeds the permissible exposure limit, personnel shall don the appropriate PPE and alternate control measures to ensure personnel safety. If safe control measures are not achievable, field activities shall be discontinued immediately. Company-specific HASPs offer guidelines on air surveillance and on selection of PPE. In addition, the site-specific HASP includes an air monitoring program and suggested PPE.

2.3 In addition to the aforementioned precautions and depending upon the type of contaminant expected, employ the following safe work practices:

Particulate or Metal Compounds

1. Avoid skin contact and/or incidental ingestion of soil.
2. Wear protective clothing, steel-toed boots, gloves, safety glasses, and hearing protection as warranted.

VOCs

1. Avoid breathing constituents venting from holes by approaching upwind, and/or by use of respiratory protection.


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2. Pre-survey the area with a flame ionization detector (FID) or photoionization detector (PID) prior to sampling.

3. If monitoring results indicate organic vapors that exceed action levels as specified in the site-specific HASP, sampling activities may need to be conducted in Level C protection. At a minimum, skin protection will be required by use of gloves and Tyvek or other media that is protective against the media being encountered.

Flammable or Explosive Conditions

1. Monitor explosive gases as continuously as possible using an explosimeter and oxygen meter.

2. Place all ignition sources upwind or crosswind of the borehole.

3. If explosive gases exceed the designated action levels as specified in the site-specific HASP, cease operations and evaluate conditions.

Physical Hazards Associated With Soil Sampling

1. To avoid possible back strain associated with sample collection, use the large muscles of the legs, not the back, when retrieving soil samplers.

2. Stay clear of all moving equipment, and avoid wearing loose fitting clothing.

3. To avoid slip/trip/fall hazards, be wary of open trenches, pits, or holes.

4. Be aware of restricted mobility due to PPE.

5. To avoid hand, wrist, arm, shoulder, and back trauma due to the use of slide hammers or hand augers, rotate sampling among field personnel

## 3.0 Terms and Definitions

3.1 Direct push techniques are methods for subsurface sampling or monitoring that involve the application of downward pressure (usually supplied through hydraulic means) without the benefit of cutting tool rotation to enter soil. A variety of systems are available under several trade names, such as GeoProbe®. Equipment may be skid-mounted, trailered, or mounted directly on the frame of a vehicle.

## 4.0 Interferences

4.1 Potential interferences could result from cross-contamination between samples or sample locations. Minimization of the cross contamination will occur through the following:

- The use of clean sampling tools at each location as necessary.
- Avoidance of material that is not representative of the media to be sampled.

## 5.0 Training and Qualifications

### 5.1 Qualifications and Training

The individual executing these procedures must have read, and be familiar with, the requirements of this SOP.

### 5.2 Responsibilities

5.2.1 The **CTO Manager** is responsible for ensuring that these standard direct push technique procedures are followed during projects conducted under the ER Program and that a qualified individual conducts or supervises the projects. A qualified individual for subsurface sampling or monitoring using direct push techniques is defined as a person with a degree in geology, hydrogeology, or geotechnical/civil engineering with at least 1 year of experience supervising soil boring construction using conventional drilling or direct push techniques. The CTO Manager


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or designee is responsible for ensuring that all personnel involved in direct push sampling techniques shall have the appropriate education, experience, and training to perform their assigned tasks as specified in Chief of Naval Operations Instruction 5090.1c (DON 2007).

5.2.2 The Program Quality Manager is responsible for ensuring overall compliance with this procedure.

5.2.3 The Field Manager is responsible for ensuring that all field personnel follow these procedures.

5.2.4 All Field Personnel are responsible for the implementation of this procedure.

5.2.5 The Field Personnel and/or Field Manager is responsible for directly supervising the direct push sampling procedures to ensure that they are conducted according to this procedure, and for recording all pertinent data collected during sampling.

## 6.0 Equipment and Supplies

In addition to those materials provided by the subcontractor, the project **Field Manager/Field Personnel** will require:

- Boring Logs;
- Spoons or scoops;
- Sample kit (bottles, labels, custody records and tape, cooler, ice), if laboratory analysis is required;
- Sample collection pan;
- Folding rule or tape measure;
- Plastic sheeting;
- Utility knife;
- Equipment decontamination materials (as described in SOP 3-06, *Equipment Decontamination*);
- Health and safety equipment (as required by HASP); and
- Field project notebook/pen.

## 7.0 Procedure

Direct push techniques may be used as a cost-effective alternative to conventional drilling techniques for obtaining subsurface soil and groundwater samples and for monitoring subsurface conditions.

### 7.1 Method Selection

Base the decision to use direct push techniques on: (1) their ability to achieve the required information at the required level of quality control and (2) their cost-effectiveness compared to conventional drilling methods. Major limitations of direct push techniques are their inability to penetrate rock or cobbles and a shallow maximum depth of penetration. The capabilities of direct push systems vary significantly among vendors. Consider these differences in capabilities when evaluating the method for a subsurface exploration program.

Use direct push techniques to obtain groundwater samples for confirmatory analyses only if the screen placement method protects the screen from clogging during installation and allows the installation of a sand-pack around the exterior of the well screen.

### 7.2 Inspection of Equipment

Inspect direct push equipment prior to use for signs of fluid leakage, which could introduce contaminants to the soil. If, at any time during equipment operation, fluid is observed leaking from the rig, cease

operations and immediately repair or contain the leak. Collect, containerize, and label soil and other materials affected by the leak for proper disposal (see SOP 3-05, *IDW Management*).

### 7.3 Preparation of Work Site

Inspect the work site prior to commencing operations to ensure that no overhead hazards exist that could impact the direct push equipment, and the work area should cleared and/or marked by the local underground utility locating service (e.g., DigSafe). In addition, clear locations planned for subsurface exploration using either geophysical methods and/or hand excavate locations to a depth of 2 to 3 feet prior to soil penetration, unless it is certain (by virtue of subsurface clearing activities) that no utilities or other hazardous obstructions will be encountered in the first 2 to 3 feet. Hand excavation may be waived when it is not practical.

Locate the direct push rig so that it is downslope from the penetration point, if the work is to be performed on a grade. Locate the rig downwind or crosswind of the penetration point, if possible. Cover the area surrounding, and in the vicinity of, the penetration point with plastic. Establish required exclusion zones using plastic tape or cones to designate the various areas.

### 7.4 Equipment Decontamination

To avoid cross-contamination, thoroughly decontaminate equipment used for direct push exploration and sampling as described in SOP 3-06, *Equipment Decontamination*. Decontaminate sampling tools and downhole equipment between each sampling event and between penetration points. At a minimum, steam clean or wash and rinse the equipment. Collect, containerize, and label all wash and rinse water for proper disposal. Clean equipment (e.g., drive rods and samplers) shall not come into contact with contaminated soils or other contaminated materials. Keep equipment on plastic or protect it in another suitable fashion. Store push rods and other equipment removed from a hole on plastic sheeting until properly decontaminated.

### 7.5 Soil Sampling

This SOP assumes that the subcontractor will perform sampling; therefore, detailed procedures regarding sample acquisition are not provided. Vendors of direct push equipment offer a variety of sampling systems designed specifically for their equipment. Both continuous and discreet soil samples may be obtained using sampling equipment similar to that described in Procedure 3-21, *Surface and Subsurface Soil Sampling*. The preferred methods for soil sampling using direct push techniques use brass or stainless steel split-tube samplers that are driven through the horizon to be sampled. Use plastic sample tubes (e.g., Macro-Core Samplers) only for screening purposes or, in the case of confirmatory sampling, if samples will not be analyzed for volatile organic compounds (VOCs) or semivolatile organic compounds (SVOCs).

### 7.6 Groundwater Sampling

Direct push vendors offer numerous methods for obtaining groundwater samples. Key differences among methods involve: (1) the maximum well diameter achievable; (2) the ability to protect the well screen from exposure to contaminated overburden soils during installation; (3) the ability to install packing around the screen; (4) flexibility in the size, materials of construction, and design of well screens; and (5) the ability to convert sampling points into permanent monitoring wells. The limitations and abilities of a given system must be thoroughly understood and matched to the needs of the project before committing to the collection of groundwater samples using direct push techniques.

Use direct push techniques only to collect screening samples unless it is confirmed that the system:

1. Effectively protects the well screen from exposure to contaminated overburden soils during installation
2. Allows the installation of effective packing around the well screen

3. Allows the well screen to be effectively sealed against the downward infiltration of overlying groundwater or surface precipitation
4. Is constructed of materials compatible with the intended sampling and analysis goals of the project
5. Allows the use of a well screen properly sized and slotted for the needs of the project

Additional information on the collection of groundwater samples can be found in SOP 3-14 Monitoring Well Sampling.

It is the responsibility of the **CTO Manager** to evaluate and determine the appropriateness of direct push systems prior to committing to their use on any project involving groundwater sampling. As part of this evaluation, it is recommended to obtain concurrence from regulatory authorities in advance for the method selection.

### 7.7 Borehole Abandonment

Methods for abandoning boreholes created with direct push systems will vary among vendors. Coordinate the desired method for abandonment with the vendor in the planning stages of the project to ensure proper abandonment.

Some direct push boreholes will close naturally as the drive rods and sampling tools are withdrawn. This may occur in loose, unconsolidated soils, such as sands. Close all boreholes using one of the procedures described in this procedure, unless natural caving precludes such closure.

The three methods for closing direct push boreholes are:

1. Add granulated or pelletized bentonite and hydrate in layers, proceeding from the bottom of the hole to the surface.
2. Pour premixed cement/water (or cement/water/bentonite) mixture into the hole.
3. Fill the entire hole with granular or pelletized bentonite and hydrate by means of a previously emplaced water tube that is gradually withdrawn as water is supplied to the bentonite.

The second method is recommended. For shallow holes less than 10 feet in depth, pour a cement/water/bentonite mix directly into the opening using a funnel. For deeper holes, use a conductor (tremie) pipe to carry the grout mix to the far reaches of the borehole. Lower the conductor pipe to within 2 inches of the bottom and gradually withdraw it as grout is added, keeping the lower end of the pipe submerged in grout at all times.

The recommended grout mixture for well abandonment is 7 to 9 gallons of water per 94-pound bag of Portland cement, with 3 percent to 5 percent by weight of powdered bentonite added to the mixture. Commercial products, such as Volcay are acceptable with pre-approval of the **CTO Manager**.

Seal boreholes to within 0.5 to 2.0 feet of the surface. Inspect the abandoned borehole after 24 hours to ensure that grout shrinkage does not occur. If significant shrinkage has occurred, re-grout the borehole. Fill the remaining portion of the hole with local topsoil or appropriate paving materials.

## 8.0 Quality Control and Assurance

8.1 Collection of representative samples will be ensured through adherence to the procedures in this SOP and the sampling strategy outlined in the SAP. The field quality control samples identified in the SAP must be collected. These samples may include field duplicates, equipment rinsate blanks, trip blanks, and matrix spike/matrix spike duplicates

## 9.0 Records, Data Analysis, Calculations

9.1 Various forms are required to ensure that adequate documentation is made of the sample collection activities. These forms may include:

- Boring logs;
- Field logbook;
- Sample collection records;
- Chain-of-custody forms; and
- Shipping labels.

9.2 Boring logs (Attachment 1) will provide visual and descriptive information for samples collected at each soil boring and are often the most critical form of documentation generated during a soil sampling program.

9.3 The field logbook is kept as a general log of activities and should not be used in place of the boring log.

9.4 Chain-of-custody forms are transmitted with the samples to the laboratory for sample tracking purposes.

9.5 Shipping labels are required is sample coolers are to be transported to a laboratory by a third party (courier service).

## 10.0 Attachments or References

10.1 Attachment 1 – Boring Log

10.2 NAVSEA T0300-AZ-PRO-010. *Navy Environmental Compliance Sampling and Field Testing Procedures Manual*. August 2009.

10.3 Department of Defense, United States (DoD). 2005. *Uniform Federal Policy for Quality Assurance Project Plans, Part 1: UFP-QAPP Manual*. Final Version 1. DoD: DTIC ADA 427785, EPA-505-B-04-900A. In conjunction with the U. S. Environmental Protection Agency and the Department of Energy. Washington: Intergovernmental Data Quality Task Force. March. On-line updates available at: http://www.epa.gov/fedfac/pdf/ufp_qapp_v1_0305.pdf.

10.4 Department of the Navy (DON). 2007. *Navy Environmental and Natural Resources Program Manual*. OPNAV Instruction 5090.1c. October.

10.5 SOP 3-05, *IDW Management.*

10.6 SOP 3-06, *Equipment Decontamination.*

10.7 SOP 3-21, *Surface and Subsurface Soil Sampling.*

| Author | Reviewer | Revisions (Technical or Editorial) |
|---|---|---|
| Mark Kromis<br>Program Chemist | Chris Barr<br>Program Quality Manager | Rev 0 – Initial Issue (May 2012) |


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# Attachment 1
# Boring Log

RESOLUTION CONSULTANTS

**Boring ID:**

Page 1 of _____

| | | |
|---|---|---|
| Project Name: | Drilling Company: | Type of Surface Material: |
| Project Number: | Drilling Method: | Patching Material: |
| Date Started Drilling: | Rig Type: | Drilling Water Level: |
| Date Finished Drilling: | Core Size: | Boring Total Depth (bgs): |
| Physical Location: | | Logged By: |

(Note: bgs = below ground surface)

| Depth Range | Recovery ft/ft | PID (ppm) | Moisture Content | GA Class. | USCS | GA Class: Garfield Avenue Sites classification & Modified Unified Soil Clasiffication System | |
|---|---|---|---|---|---|---|---|
| | | | | | | Ground Surface Cover and Thickness: | Sample name & #: |
| 0-1 | | | | | | | |
| 1-2 | | | | | | | |
| 2-3 | | | | | | | |
| 3-4 | | | | | | | |
| 4-5 | | | | | | | |
| 5-6 | | | | | | | |
| 6-7 | | | | | | | |
| 7-8 | | | | | | | |
| 8-9 | | | | | | | |
| 9-10 | | | | | | | |
| 10-11 | | | | | | | |
| 11-12 | | | | | | | |
| 12-13 | | | | | | | |
| 13-14 | | | | | | | |
| 14-15 | | | | | | | |
| 15-16 | | | | | | | |
| 16-17 | | | | | | | |
| 17-18 | | | | | | | |
| 18-19 | | | | | | | |
| 19-20 | | | | | | | |

| Stratigraphic Unit Intervals: | | Comments: |
|---|---|---|
| 1.) | 5.) | |
| 2.) | 6.) | |
| 5.) | 6.) | |


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# Operation and Calibration of a Photoionization Detector

# Procedure 3-20

## 1.0 Purpose and Scope

### 1.1 Purpose and Applicability

1.1.1 This standard operating procedure (SOP) describes the procedures that will be followed by field staff for operation and calibration of a photoionization detector (PID). The PID is primarily used by AECOM personnel for safety and survey monitoring of ambient air, determining the presence of volatiles in soil and water, and detecting leakage of volatiles.

1.1.2 PIDs routinely used by field personnel include the Photovac Microtip, Thermoelectron 580EZ, and MiniRAE 2000. Personnel responsible for using the PID should first read and thoroughly familiarize themselves with the instrument instruction manual.

### 1.2 Principle of Operation

1.2.1 The PID is a non-specific vapor/gas detector. The unit generally consists of a hand-held probe that houses a PID, consisting of an ultraviolet (UV) lamp, two electrodes, and a small fan which pulls ambient air into the probe inlet tube. The probe is connected to a readout/control box that consists of electronic control circuits, a readout display, and the system battery. Units are available with UV lamps having an energy from 9.5 electron volts (eV) to 11.7 eV.

1.2.2 The PID analyzer measures the concentration of trace gas present in the atmosphere by photoionization. Photoionization occurs when an atom or molecule absorbs a photon of sufficient energy to release an electron and become a positive ion. This will occur when the ionization potential of the molecule (in electron volts (eV)) is less than the energy of the photon. The source of photons is an ultraviolet lamp in the probe unit. Lamps are available with energies ranging from 9.5 eV to 11.7 eV. All organic and inorganic vapor/gas compounds having ionization potentials lower than the energy output of the UV lamp are ionized and the resulting potentiometric change is seen as a positive reading on the unit. The reading is proportional to the concentration of organics and/or inorganics in the vapor.

1.2.3 Sample gases enter the probe through the inlet tube and enter the ion chamber where they are exposed to the photons emanating from the UV lamp. Ionization occurs for those molecules having ionization potentials near to or less than that of the lamp. A positive- biased polarizing electrode causes these positive ions to travel to a collector electrode in the chamber. Thus the ions create an electrical current which is amplified and displayed on the meter. This current is proportional to the concentration of trace gas present in the ion chamber and to the sensitivity of that gas to photoionization.

1.2.4 In service, the analyzer is first calibrated with a gas of known composition equal to, close to, or representative of that to be measured. Gases with ionization potentials near to or less than the energy of the lamp will be ionized. These gases will thus be detected and measured by the analyzer. Gases with ionization potentials greater than the energy of the lamp will not be detected. The ionization potentials of the major components of air, i.e., oxygen, nitrogen, and carbon dioxide, range from about 12.0 eV to 15.6 eV and are not ionized by any of the lamps available. Gases with ionization potentials near to or slightly higher than the lamp are partially ionized, with low sensitivity.

### 1.3 Specifications

1.3.1 Refer to the manufacturer's instructions for the technical specifications of the instrument being used. The operating concentration range is typically 0.1 to 2,000 ppm isobutylene equivalent.


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## 2.0 Safety

2.1 The health and safety considerations for the work associated with this SOP, including both potential physical and chemical hazards, will be addressed in the project Health and Safety Plan (HASP). In the absence of a HASP, work will be conducted according to the Contract Task Order (CTO) Work Plan (WP) and/or direction from the **Site Safety Officer (SSO)**.

2.2 Only PIDs stamped Division I Class I may be used in explosive atmospheres. Refer to the project HASP for instructions pertaining to instrument use in explosive atmospheres.

## 3.0 Terms and Definitions

None.

## 4.0 Interferences

4.1 Regardless of which gas is used for calibration, the instrument will respond to all analytes present in the sample that can be detected by the type of lamp used in the PID.

4.2 Moisture will generate a positive interference in the concentration measured for a PID and is characterized by a slow increase in the reading as the measurement is made. Care must be taken to minimize uptake of moisture to the extent possible. Refer to the manufacturers' instructions for care, cleaning, and maintenance.

4.3 Uptake of soil into the PID must be avoided as it will compromise instrument performance by blocking the probe, causing a positive interference, or dirtying the PID lamp. Refer to the manufacturers' instructions for care, cleaning, and maintenance.

4.4 The user should listen to the pitch of the sampling pump. Any changes in pitch may indicate a blockage and corrective action should be initiated.

## 5.0 Training and Qualifications

5.1 **Qualifications and Training**

The individual executing these procedures must have read, and be familiar with, the requirements of this SOP.

5.2 **Responsibilities**

5.2.1 The CTO Manager is responsible for ensuring that the operation and calibration activities comply with this procedure. The CTO Manager is responsible for ensuring that all personnel involved in the operation and calibration shall have the appropriate education, experience, and training to perform their assigned tasks.

5.2.2 The Program Quality Manager is responsible for ensuring overall compliance with this procedure.

5.2.3 The Field Manager is responsible for ensuring that all operation and calibration activities are conducted according to this procedure.

5.2.4 All Field Personnel are responsible for the implementation of this procedure.

## 6.0 Equipment and Supplies

- Calibration Gas: Compressed gas cylinder of isobutylene in air or similar stable gas mixture of known concentration. The selected gas should have an ionization potential similar to that of the vapors to be monitored, if known. The concentration should be at 50-75% of the range in which the instrument is to be calibrated;


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- Regulator for calibration gas cylinder;
- Approximately 6 inches of Teflon® tubing;
- Tedlar bag (optional);
- Commercially-supplied zero grade air (optional);
- "Magic Marker" or “Sharpie” or other waterproof marker;
- Battery charger;
- Moisture traps;
- Spare lamps;
- Manufacturer’s instructions; and
- Field data sheets or logbook/pen.

# 7.0 Procedure

## 7.1 Preliminary Steps

7.1.1 Preliminary steps (battery charging, check-out, calibration, maintenance) should be conducted in a controlled or non-hazardous environment.

## 7.2 Calibration

7.2.1 The PID must be calibrated in order to display concentrations in units equivalent to ppm. First a supply of zero air (ambient air or from a supplied source), containing no ionizable gases or vapors is used to set the zero point. A span gas, containing a known concentration of a photoionizable gas or vapor, is then used to set the sensitivity.

7.2.2 Calibrate the instrument according to the manufacturer’s instructions. Record the instrument model and identification number, the initial and adjusted meter readings, the calibration gas composition and concentration, and the date and the time in the field records.

7.2.3 If the calibration cannot be achieved or if the span setting resulting from calibration is 0.0, then the lamp must be cleaned (Section 7.4).

## 7.3 Operation

7.3.1 Turn on the unit and allow it to warm up (minimum of 5 minutes). Check to see if the intake fan is functioning; if so, the probe will vibrate slightly and a distinct sound will be audible when holding the probe casing next to the ear. Also, verify on the readout display that the UV lamp is lit.

7.3.2 Calibrate the instrument as described in Section 7.2, following the manufacturer’s instructions. Record the calibration information in the field records.

7.3.3 The instrument is now operational. Readings should be recorded in the field records.

7.3.4 When the PID is not being used or between monitoring intervals, the unit may be switched off to conserve battery power and UV lamp life; however, a “bump” test should be performed each time the unit is turned on and prior to taking additional measurements. To perform a bump test, connect the outlet tubing from a Tedlar bag containing a small amount of span gas to the inlet tubing on the unit and record the reading. If the reading is not within the tolerance specified in the project plan, the unit must be recalibrated.

7.3.5 At the end of each day, recheck the calibration. The check will follow the same procedures as the initial calibration (Section 7.2) except that no adjustment will be made to the instrument. Record the information in the field records.


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7.3.6 Recharge the battery after each use (Section 7.4).

7.3.7 When transporting, ensure that the instrument is packed in its stored condition in order to prevent damage.

7.4 **Routine Maintenance**

7.4.1 Routine maintenance associated with the use of the PID includes charging the battery, cleaning the lamp window, replacing the detector UV lamp, replacing the inlet filter, and replacing the sample pump. Refer to the manufacturer's instructions for procedures and frequency.

7.4.2 All routine maintenance should be performed in a non-hazardous environment.

7.5 **Troubleshooting Tips**

7.5.1 One convenient method for periodically confirming instrument response is to hold the sensor probe next to the tip of a magic marker. A significant reading should readily be observed.

7.5.2 Air currents or drafts in the vicinity of the probe tip may cause fluctuations in readings.

7.5.3 A fogged or dirty lamp, due to operation in a humid or dusty environment, may cause erratic or fluctuating readings. The PID should never be operated without the moisture trap in place.

7.5.4 Moving the instrument from a cool or air-conditioned area to a warmer area may cause moisture to condense on the UV lamp and produce unstable readings.

7.5.5 A zero reading on the meter should not necessarily be interpreted as an absence of air contaminants. The detection capabilities of the PID are limited to those compounds that will be ionized by the particular probe used.

7.5.6 Many volatile compounds have a low odor threshold. A lack of meter response in the presence of odors does not necessarily indicate instrument failure.

7.5.7 When high vapor concentrations enter the ionization chamber in the PID the unit can become saturated or "flooded". Remove the unit to a fresh air environment to allow the vapors to be completely ionized and purged from the unit.

## 8.0 Quality Control and Assurance

8.1 The end use of the data will determine the quality assurance requirements that are necessary to produce data of acceptable quality. These quality assurance requirements will be defined in the site-specific workplan or Sampling and Analysis Plan (SAP), hereafter referred to as the project plan.

8.2 Calibration of the PID will be conducted at the frequency specified in the project plan. In the absence of project-specific guidance, calibration will be performed at the beginning of each day of sampling and will be checked at the end of the sampling day or whenever instrument operation is suspect. The PID will sample a calibration gas of known concentration. The instrument must agree with the calibration gas within ±10%. If the instrument responds outside this tolerance, it must be recalibrated.

8.3 Checks of the instrument response (Section 7.5) should be conducted periodically and documented in the field records.

## 9.0 Records, Data Analysis, Calculations

Safety and survey monitoring with the PID will be documented in a bound field logbook, or on standardized forms, and retained in the project files. The following information is to be recorded:

- Project name and number;
- Instrument manufacturer, model, and identification number;


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- Operator's signature;
- Date and time of operation;
- Calibration gas used;
- Calibration check at beginning and end of day (meter readings before adjustment);
- Span setting after calibration adjustment;
- Meter readings (monitoring data obtained);
- Instances of erratic or questionable meter readings and corrective actions taken; and
- Instrument checks and response verifications – e.g., battery check, magic marker response (Section 7.5) or similar test.

## 10.0 Attachments or References

United States Environmental Protection Agency. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM). USEPA, Region 4, SESD, Enforcement and Investigations Branch, Athens, GA. November 2001.

| Author | Reviewer | Revisions (Technical or Editorial) |
|---|---|---|
| Robert Shoemaker<br>Senior Scientist | Chris Barr<br>Program Quality Manager | Rev 0 – Initial Issue (May 2012) |


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# Surface and Subsurface Soil Sampling Procedures

# Procedure 3-21

## 1.0 Purpose and Scope

1.1 This standard operating procedure (SOP) describes the procedures for soil sampling. The procedure includes surface and subsurface sampling by various methods using hand auguring, test pit, direct-push, and split-spoon equipment.

1.2 The procedure includes soil sampling for volatile organic compounds (VOCs). For project specific information (e.g. sampling depths, equipment to be used, and frequency of sampling), refer to the Sampling and Analysis Plan (SAP), which takes precedence over these procedures. Surface soil sampling, typically considered to be up to two feet below ground surface by EPA standards, is typically accomplished using hand tools such as shovels or hand augers. Test pit samples are considered subsurface samples, although normally collected via hand tools similar to surface soil sampling or by excavation machinery. Direct-push and split-spoon sampling offer the benefit of collecting soil samples from a discrete or isolated subsurface interval, without the need of extracting excess material above the target depth. These methods dramatically reduce time and cost associated with disposal of material from soil cuttings when compared to test pit sampling. In addition, direct-push and split-spoon sampling methods can obtain samples at targeted intervals greater than 15 feet in depth, allowing for discrete depth soil sampling while speeding up the sampling process. Direct-push methods work best in medium to fine-grained cohesive materials such as medium to fine sands, silts, and silty clay soils. Split-spoon sampling works well in all types of soil, but is somewhat slower than direct-push methods. Samples are composited so that each sample contains a homogenized representative portion of the sample interval. Due to potential loss of analytes, samples for volatile analysis are not composited. Samples for chemical analysis can be collected by any of the above-mentioned sampling methods, as disturbed soil samples. Undisturbed samples are collected, sealed, and sent directly to the laboratory for analysis. For undisturbed samples, the samples are not homogenized.

## 2.0 Safety

2.1 The health and safety considerations for the work associated with this SOP, including both potential physical and chemical hazards, will be addressed in the project Health and Safety Plan (HASP). In the absence of a HASP, work will be conducted according to the Contract Task Order (CTO) Work Plan (WP) and/or direction from the **Site Safety Officer (SSO)**.

2.2 Before soil sampling commences, appropriate entities (e.g. DigSafe, local public works departments, company facilities) must be contacted to assure the anticipated soil sampling locations are marked for utilities, including electrical, telecommunications, water, sewer, and gas.

## 3.0 Terms and Definitions

None.

## 4.0 Interferences

4.1 Low recovery of soil from sampling equipment will prevent an adequate representation of the soil profile and sufficient amount of soil sample. If low recovery is a problem, the hole may be offset and re-advanced, terminated, or continued using a larger diameter sampler.


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4.2 Asphalt in soil samples can cause false positive results for hydrocarbons. To ensure samples are free of asphalt, do not collect samples that may contain asphalt. If the collection of samples potentially containing asphalt is unavoidable, note the sampling depths at which the presence of asphalt are suspected.

4.3 Instrumentation interferences addressed in SOPs for Calibration of the Photoionization Detector (PID), Headspace Screening for Total Volatile Organics, and Equipment Decontamination must also be considered.

4.4 Cross contamination from sampling equipment must be prevented by using sampling equipment constructed of stainless steel that is adequately decontaminated between samples.

# 5.0 Training and Qualifications

5.1 **Qualifications and Training**

The individual executing these procedures must have read, and be familiar with, the requirements of this SOP.

5.2 **Responsibilities**

5.2.1 The CTO Manager is responsible for ensuring that soil sampling activities comply with this procedure. The CTO Manager is responsible for ensuring that all personnel involved in soil sampling shall have the appropriate education, experience, and training to perform their assigned tasks.

5.2.2 The Program Quality Manager is responsible for ensuring overall compliance with this procedure.

5.2.3 The Field Manager is responsible for ensuring that all soil sampling activities are conducted according to this procedure.

5.2.4 All Field Personnel are responsible for the implementation of this procedure.

# 6.0 Equipment and Supplies

The depth at which samples will be collected and the anticipated method of sample collection (direct-push, split-spoon, hand auger, shovel, or test pits) will be presented in the SAP. The following details equipment typically needed for soil sampling, based on the various methods. See the SAP for specific detail of equipment and supply needs.

6.1 Depending on the nature of suspected contamination, field screening instrumentation may be used for direct sampling. Appropriate instrumentation and calibration standards should be available. If volatile organic contaminants are suspected and a PID will be used, refer to the equipment and instrumentation listed in SOP 3-20 Operation and Calibration of a Photoionization Detector. Equipment in this SOP includes but is not limited to:

- PID/FID;
- Calibration gas; and
- Tedlar® gas bags (for calibration).

6.2 If field screening methods include jar headspace screening for volatile organics, refer to the equipment and procedure in SOP 3-19 Headspace Screening for Total VOCs. Equipment in this SOP includes but is not limited to:

- Clean soil (“drillers jars”) jars; and
- Aluminium foil.


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6.3 Appropriate decontamination procedures must be followed for sampling equipment. Refer to SOP 3-06 Equipment Decontamination. Equipment in this SOP includes but is not limited to:

- Phosphate-free detergent;
- Isopropyl Alcohol;
- Tap water;
- Deionized Ultra-Filtered (DIUF) Water;
- Plastic buckets or washbasins;
- Brushes; and
- Polyethylene sheeting.

6.4 The following general equipment is needed for all soil sampling, regardless of method:

- Stainless steel bowls;
- Stainless steel trowels;
- Appropriate sample containers for laboratory analysis;
- Personal Protective Equipment (PPE);
- Logbook;
- Cooler and ice for preservation; and
- Stakes and flagging to document sampling location.

6.5 The following additional equipment is needed for volatile organic sampling:

- Electronic pan scale and weights for calibration; and
- Syringes or other discrete soil core samplers.

6.6 The following additional equipment may be needed for surface and test pit soil sampling:

- Hand Auger

6.7 The following additional equipment may be needed for soil sampling from direct push and/or split-spoon equipment:

- Tape measure or folding carpenter's rule for recording the length of soil recovered.

Note: All subsurface drilling equipment will be provided and maintained by the subcontractor.

# 7.0 Procedure

7.1 **General Soil Sampling Procedure for All Soil Sampling Methods**

7.1.1 Record the weather conditions and other relevant on-site conditions.

7.1.2 Select the soil sampling location, clear vegetation if necessary, and record the sampling location identification number and pertinent location details.

7.1.3 Verify that the sampling equipment is properly decontaminated, in working order, and situated at the intended sampling location.

7.1.4 Place polyethylene sheeting on the ground and assemble all necessary sampling equipment on top of it. Cover surfaces onto which soils or sampling equipment will be placed (i.e. tables with polyethylene sheeting).

7.1.5 Follow the appropriate procedures listed below for either surface, split-spoon, direct push, or test pit sample collection (7.2, 7.3, 7.4, and 7.5 respectively).

7.1.6 Collect soil samples according to procedures listed in Section 7.6 depending on project specific analyses.

7.1.7 Record date/time, sample ID, and sample descriptions in the field logbook or field form. A sketch or description of the location may also be recorded so the sample location can be re-constructed, especially if the location will not be recorded using global positioning satellite (GPS) equipment.

7.1.8 Immediately label the sample containers and place them on ice, if required for preservation. Complete the chain-of-custody form(s) as soon as possible.

7.1.9 Dispose of all excess excavated soil in accordance with the SAP.

7.1.10 If required, mark the sample location with a clearly labelled wooden stake or pin flag. If the location is on a paved surface, the location may be marked with spray paint.

7.1.11 Decontaminate the sampling equipment according to SOP 3-06 Equipment Decontamination.

## 7.2 Surface Sampling

7.2.1 The criteria used for selecting surface soil locations for sampling may include the following:

- Visual observations (soil staining, fill materials);
- Other relevant soil characteristics;
- Site features;
- Screening results;
- Predetermined sampling approach (i.e. grid or random); and
- Sampling objectives as provided in the SAP.

7.2.2 The following procedures are to be used to collect surface soil samples. Surface soils are considered to be soils that are up to two feet below ground surface, though state regulations and project objectives may define surface soils differently; therefore, the SAP should be consulted for direction on the depth from which to collect the surface soil samples. Sampling and other pertinent data and information will be recorded in the field logbook and/or on field forms. Photographs may be taken as needed or as specified in the SAP.

1. Gently scrape any vegetative covering until soil is exposed. Completely remove any pavement.
2. Remove soil from the exposed sampling area with a trowel, hand auger, or shovel. Put soils within the sampling interval in a stainless steel bowl for homogenizing. Monitor the breathing zone and sampling area as required in the HASP.
3. For VOC analyses, collect representative soil samples directly from the recently-exposed soil using a syringe or other soil coring device (e.g., TerraCore®, EnCore®). Follow procedures in Section 7.6.1 for VOC sampling.
4. Collect sufficient soil to fill all remaining sample jars into a stainless steel bowl. Homogenize the soil samples to obtain a uniform soil composition which is representative of the total soil sample collected according to the following procedure:

    a) Remove all rocks and non-soil objects using a stainless steel spoon or scoop.

b) Form a cone shaped mound with the sample material, then flatten the cone and split the sample into quarters.

c) Use the stainless steel spoon/scoop to mix the quarter samples that are opposite.

d) After mixing the opposite quarters, reform the cone shaped mound.

e) Repeat this procedure a minimum of five (5) times, removing any non-soil objects and breaking apart any clumps.

## 7.3 Split-Spoon Sampling

7.3.1 At each boring location, the frequency and depth of split-spoon samples will be determined from the SAP. Split-spoon samples may be collected continuously, intermittently, or from predetermined depths.

7.3.2 Split-spoon samplers shall be driven into undisturbed soil by driving the spoon ahead of the drill augers/casing. In cohesive soils, or soils where the borehole remains open (does not collapse), two split-spoon samples may be taken prior to advancing the augers/casing.

7.3.3 After split-spoons are retrieved, open the split-spoon and measure the recovery of soil. If a PID will be used for screening, immediately scan the recovered sample for VOCs using the PID. Scan the recovered soil boring by making a hole in the soil with a decontaminated trowel and placing the PID inlet very close to the hole. Be very careful not to get soil on the tip of the PID. Take PID readings every 6 inches along the split-spoon and/or in any areas of stained or disturbed soil. Record the highest PID reading and the depth at which it was observed along with all other pertinent observations. If required in the SAP, VOC and headspace samples should be collected (see Section 7.6.1) prior to logging the sample.

7.3.4 If headspace screening for VOCs is required in the SAP, collect a soil sample (as defined in the SAP) and perform headspace screening according to SOP 3-19 Headspace Screening for Total VOCs.

7.3.5 Soils collected using the split-spoon sampler will be logged by the field representative using the procedure required in the SAP.

7.3.6 Collect the remainder of the sample volume required into a stainless steel bowl. Homogenize the soil so the material is uniform in composition and representative of the total soil sample collected. Follow homogenizing techniques as described in Section 7.2.

7.3.7 The SAP may specify that intervals to be sent to the laboratory be determined by visual observation and/or highest PID screening or headspace results, which can only be determined once the boring is complete. In this instance, a VOC sample should be collected at each interval. The remainder of the soil from that interval will be set aside in a clearly labelled stainless steel bowl covered with aluminium foil. Once the boring has been completed and the sample interval has been determined, the remainder of the soil can be homogenized according to Section 7.2 and submitted for laboratory analysis.

7.3.8 Once a boring is complete and all required samples have been collected, the boring must be completed as specified in the SAP (e.g., completed as a monitoring well, backfilled with bentonite, etc).

## 7.4 Direct Push Sampling

At each boring location, the frequency of direct-push samples will be determined from the SAP. Typically, samples with direct-push equipment are collected in 4 foot (ft) intervals, but smaller (e.g., 2 ft) and larger (e.g., 5 ft) intervals are also possible.

1. Sample using Macro-Core samplers with acetate liners to obtain discrete soil samples at the depths specified in the SAP.

2. Cut open the acetate liner. If required in the SAP, immediately scan the recovered soil boring for VOCs using a PID by making a hole in the soil with a decontaminated trowel and placing the PID inlet very close to the hole. Be very careful not to get soil on the tip of the PID. Take PID readings every 6 inches along the split-spoon and/or in any areas of stained or disturbed soil. Record the

highest PID reading and the depth at which it was observed along with all other pertinent observations. VOC and headspace samples, if required in the SAP should be collected (see Section 7.6.1) prior to logging the sample.

3. If required in the SAP, collect a soil sample (as defined in the SAP) and perform headspace screening according to SOP 3-19 Headspace Screening for Total VOCs.

4. Soils collected using the direct-push sampler will be logged by the by the field representative using the procedure required in the SAP.

5. Collect the remainder of the sample into a stainless steel bowl. Homogenize the soil collected so that the material is uniform in composition and representative of the total soil sample collected. Follow homogenizing techniques as described in Section 7.2.

6. Once a boring is complete and all required samples have been collected, the boring must be completed as specified in the SAP (e.g., completed as a monitoring well, backfilled with bentonite, etc).

## 7.5 Test Pit Sampling

7.5.1 Excavate the test pit to the desired depth.

7.5.2 Using the excavator bucket, collect soil samples as specified in the SAP. Collect a sample and perform screening analyses as required by the SAP. If VOCs contamination is suspected, perform headspace screening according to SOP 3-19 Headspace Screening for Total VOCs.

7.5.3 Collect the sample from center of the bucket to avoid potential contamination from the bucket.

7.5.4 VOC samples should also be collected from an undisturbed section soil in the excavator bucket. The top layer of exposed soil should be scraped away just prior to collecting the VOC samples.

7.5.5 Collect the remainder of the sample volume required into a stainless steel bowl. Homogenize the soil so the material is uniform in composition and representative of the total soil sample collected. Follow homogenizing techniques as described in Section 7.2.

7.5.6 Dispose of all excavated soil according to the SAP.

## 7.6 Sample Collection Methods

7.6.1 Volatile Organics Sampling

For soils collected for analyses of volatile organics, including Volatile Petroleum Hydrocarbons (VPH) or other purgable compounds, a closed system is maintained. From collection through analysis, the sample bottles are not opened. The bottle kit for a routine field sample for these analyses will typically include three 40-mL VOA vials and one soil jar. Two 40-mL VOA vials will contain either 5 mL reagent water or 5 mL sodium bisulfate and magnetic stir bars (i.e., low level vials). The third VOA vial will contain 15 mL methanol with no magnetic stir bar (i.e., high level vial). These vials are usually provided by the laboratory and are pre-weighed, with the tare weight recorded on the affixed sample label. No additional sample labels are affixed to the VOA vials, as addition of a label would alter the vial weight. All information is recorded directly on the sample label using an indelible marker. The soil jar is provided for percent solids determination. For VOC or VPH analyses, samples are collected prior to sample homogenization. Collect the VOC sample in accordance with the procedure described below.

1. Determine the soil volume necessary for the required sample weight, typically 5 grams:

   a) Prepare a 5 mL sampling corer (e.g., Terra Core®) or cut-off plastic syringe.

   b) Tare the sampler by placing it on the scale, and zeroing the scale.

   c) Draw back the plunger to the 5 gram mark or 5mL (5cc) mark on cut-off syringe, and insert the open end of the sampler into an undisturbed area of soil with a twisting motion, filling the


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sampler with soil. Note the location of the plunger with respect to the milliliter (cc) or other graduation printed on the sampler.

d) Weigh the filled sampler, and remove or add soil until the desired weight is obtained. Note the location of the plunger which corresponds to this weight. Do not use this sample for laboratory analysis.

2. Once the required soil volume has been determined, pull the plunger back to this mark and hold it there while filling the syringe for each sample.

3. Collect 5 grams of soil using the cut-off syringe or Terra Core® sample device. Extrude the 5-grams of soil into one of the low level 40-mL VOA vials. Quickly wipe any soil from the threads of the VOA vial with a clean Kimwipe® and immediately close the vial. It is imperative that the threads be free from soil or other debris prior to replacing the cap on the vial in order to maintain the closed system necessary for the analysis.

4. Gently swirl the vial so that all of the soil is fully wetted with the preservative.

5. Fill the other low level 40 mL VOA vial in this manner.

6. Repeat the process for the high level VOA vials, only for the high level VOA vial three 5 gram aliquots (i.e., 15 grams total) should be extruded into the high level VOA vial.

   NOTE: Depending on the laboratory, some high level VOA vials only contain 5 mL or 10 mL of methanol. If this is the case, either 5 grams total or 10 grams total, respectively, should be extruded into the high level VOA vial. In other words, the mass of soil in grams should be identical to the volume of methanol in mL (i.e., 1:1 ratio of soil to methanol).

7. Collect any additional QC sample collected (e.g., field duplicate, MS, and MSD) in the same manner as above.

8. Fill the 4-oz glass jar with soil from the same area for percent moisture determination.

7.6.2 Soil Sampling Method (All other analyses except VOC/VPH)

When all the required soil for a sampling location has been obtained, the soil can be homogenized as described in section 7.2. Collect sufficient volume to fill all of the remaining sample containers at least ¾ full for all other analyses. Homogenize the soil in a decontaminated stainless steel bowl, removing rocks, sticks, or other non-soil objects and breaking apart any lumps of soil prior to filling the remaining sample containers.

NOTE: Soil samples must contain greater than 30% solids for the data to be considered valid.

## 8.0 Quality Control and Assurance

8.1 Sampling personnel should follow specific quality assurance guidelines as outlined in the SAP. Proper quality assurance requirements should be provided which will allow for collection of representative samples from representative sampling points. Quality assurance requirements outlined in the SAP typically suggest the collection of a sufficient quantity of field duplicate, field blank, and other samples.

8.2 Quality control requirements are dependent on project-specific sampling objectives. The SAP will provide requirements for equipment decontamination (frequency and materials), sample preservation and holding times, sample container types, sample packaging and shipment, as well as requirements for the collection of various quality assurance samples such as trip blanks, field blanks, equipment blanks, and field duplicate samples.


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## 9.0 Records, Data Analysis, Calculations

All data and information (e.g., sample collection method used) must be documented on field data sheets, boring logs, or within site logbooks with permanent ink. Data recorded may include the following:

- Weather conditions;
- Arrival and departure time of persons on site;
- Instrument type, lamp (PID), make, model and serial number;
- Calibration gas used;
- Date, time and results of instrument calibration and calibration checks;
- Sampling date and time;
- Sampling location;
- Samples collected;
- Sampling depth and soil type;
- Deviations from the procedure as written; and
- Readings obtained.

## 10.0 Attachments or References

SOP 3-06, *Equipment Decontamination*

SOP 3-19, *Headspace Screening for Total VOCs*

SOP 3-20, *Operation and Calibration of a Photoionization Detector*

| Author | Reviewer | Revisions (Technical or Editorial) |
|---|---|---|
| Robert Shoemaker<br>Senior Scientist | Chris Barr<br>Program Quality Manager | Rev 0 – Initial Issue (May 2012) |


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# 5-001-Safe Work Standards and Rules

## 1.0 Purpose and Scope

1.1 Demonstrates Resolution Consultants' commitment to the establishment and maintenance of workplaces free from recognized hazards.

1.2 This procedure applies to all Resolution Consultants based employees and operations.

## 2.0 Terms and Definitions

2.1 **Safety Violation:** Not following verbal or written safety policies, rules and procedures (e.g., guidelines, rules, horse play, failure to wear selected personal protection equipment (PPE), abuse of selected PPE, etc.).

2.2 **Safe Work Practices:** The do's and don'ts about carrying out a task or use of equipment, informing the worker about the hazards present and providing direction on how to safeguard against the hazard. Safe Work Practices are generally guidelines only.

2.3 **Safe Job Procedures:** Written step-by-step set of instructions about completing a specific task safely including control measures and responding to emergency situations.

## 3.0 References

3.1 Resolution Consultants Employee Handbook

## 4.0 Procedure

### 4.1 Standard Operating Procedures (SOPs)

4.1.1 Safe Work Practices and Safe Job Procedures are embodied in the SH&E Standard Operating Procedures and are available on Resolution Consultants' SH&E website.

4.1.2 Specific Safe Work Practices and Safe Job Procedures have been developed in conjunction with employees and with particular input from those who have significant experience.

4.1.3 SOPs have been developed to provide clear instruction regarding the safety and reporting requirements of staff and operations.

### 4.2 Inspections and Audits

4.2.1 **Project Managers,** supervisors and **Regional SH&E Managers** shall conduct project audits and office inspections to identify safe work practices and potential safety violations.

### 4.3 Roles and Responsibilities

4.3.1 All managers and supervisors are responsible for compliance with all SOPs and governmental requirements, and will be held responsible to prevent or bring any violations to the attention of the appropriate level of Management for corrective actions as per employing JV partner policies.

4.3.2 **Project Managers** (Including field task managers, supervisors) have overall responsibility for implementation of, and compliance with, this procedure.

4.3.3 **Regional SH&E Managers** provide guidance as to safe work standards, rules, requirements and guidelines.

4.3.4 **Human Resource Managers** (from employing JV partner) provide guidance and direction to managers and supervisors implementing the disciplinary process for safety violations (as defined in the Employee Handbook).

4.3.5 **Employees** are responsible for adhering to all Resolution Consultants safe work standards, rules, requirements and instructions and to provide input as appropriate.

4.4 Any employee who wilfully disregards Resolution Consultants or client safety standards, rules or requirements is subject to disciplinary action.


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## 5.0 Records

None.

## 6.0 Attachments

5-001 Safety Rules


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# 5-001-Safety Rules

## 1.0 Rules for all Employees

1.1 Work in a manner that will not put oneself, other personnel or equipment or facilities at risk.

1.2 Identify hazardous conditions and activities in the work environment consistent with the job and training.

1.3 If a hazard cannot be eliminated, report it to the manager or supervisor promptly.

1.4 Implement established control methods consistent with project procedures and/or training.

1.5 Cooperate and comply with all Resolution Policies and Standard Operating Procedures.

1.6 Immediately report all acts of aggression, verbal or physical threats, assaults, sexual or other harassment to your supervisor or manager.

1.7 Take any safety training required for your job function or tasks.

1.8 Use or wear all personal protective equipment, devices or clothing required in accordance with manufacturers' instructions and Resolution training and/or procedures.

1.9 Do not perform any work task or activity which you believe is unsafe. Inform your supervisor immediately.

1.10 Immediately report all incidents (including near misses), injuries, property damage, spills, hazards, safety concerns and safety violations to your supervisor.

1.11 Report all observed unsafe acts, conditions, or behaviors that compromise the safety of Resolution employees, its clients, subconsultants, general contractors, or the public to your supervisor.

1.12 Keep all personal work areas clean from debris and tripping hazards.

1.13 Operate all Resolution vehicles and mobile equipment in accordance with applicable regulations.

1.14 Do not use or operate any equipment, machine or device that may endanger you or another worker.

1.15 Do not remove, damage, disable or make ineffective any protective safety, fire fighting or first aid equipment or devices.

1.16 Use only vehicles, equipment and tools that are in safe operating condition and maintained in accordance with manufacturer's specifications. Report, remove from service, or have repaired, any tool or equipment that is damaged, not working properly or may otherwise be hazardous if used.

1.17 Do not use any hand-held wireless device while driving a vehicle or performing other safety critical tasks like working near traffic or working with power tools.

1.18 When travelling, working alone or working away from the Resolution office, particularly in remote areas, follow applicable call-in procedures.

1.19 Do not bring firearms onto Resolution property or allow them on Resolution projects unless expressed permission is provided by management for the use in wildlife protection.

1.20 Do not smoke in areas designated as "NO SMOKING" or in any Resolution facility.

1.21 Do not use, sell or distribute, be under the influence, or have in their possession any controlled substances, drugs, or alcohol while performing work duties.


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## 2.0 Project or Field Work

2.1 Always report to site supervisor before performing work on site to determine specific requirements for the site or project. Follow all safety requirements, including Resolution's, or that of a client or prime contractor, as applicable.

2.2 Use only designated project entrances, parking areas and facilities.

2.3 Show or produce evidence of identification or required training if requested to gain entry to or while on a project.

2.4 Obey all warning signs (e.g., "Do Not Enter," "Eye, Hearing or Respiratory Protection Required," "Permit Required Confined Space," "Authorized Personnel Only").

2.5 Do not block, deface or remove any signage, barricade or fencing without approval.

2.6 Keep passageways clean and clear of debris, materials, hoses, cords, and tripping obstructions. Items should be moved to low activity areas or overhead.

2.7 Verify with the **Project Manager** that all required Permits are in place prior to commencing work.

2.8 Be aware of work going on, around or above you including contractor activities and public motor vehicles.

2.9 Do not work alone when performing high risk or remote work.

2.10 Personal cameras, video recorders, and other photographic equipment shall not be permitted on site without the **Project Manager** and client's approval.

2.11 Plan work tasks before beginning work and consider any hazards that may exist and how to avoid them through safe work practices or safe work procedures.


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# 5-002-Stop Work Authority for Unsafe Work

## 1.0 Purpose and Scope

1.1 This procedure establishes the requirements for Resolution personnel to stop work if they believe there is an imminent safety, health, or environmental risk as described below that will affect them, their co-workers, the public, or the environment.

1.2 This procedure applies to all Resolution-based employees and operations.

## 2.0 Terms and Definitions

2.1 **Discrepancy/Deficiency**: An omission or commission, a condition, or a situation that is in conflict with the procedures and requirements of Resolution's SH&E standards.

2.2 **Imminent Danger**: An impending or threatening situation that, if left uncorrected, is likely to result in serious injury, property damage, or environmental impairment.

2.3 **Potentially Dangerous**: Minor violations that present a low potential for serious injury, property damage, or environmental impairment.

2.4 **Stop Work Order**: A directive to cease Resolution-controlled work issued for failure to follow procedures, imminent danger situations/conditions, accumulation of safety violations, etc. The Stop Work Order will apply to Resolution and its direct subcontractors placed at risk by the situations or conditions.

## 3.0 References

None.

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 **Employees** are responsible for stopping all Resolution-directed work and for bringing it to the attention of the appropriate manager, Site Safety Officer, Project Manager, and/or Contractor representative any time an employee identifies a discrepancy, deficiency, or potentially dangerous condition or act that is likely to cause an unsafe or unhealthy situation or an imminent danger situation.

4.1.2 **Employees** may report unsafe working conditions anonymously, but they must provide sufficient detail and promptness to allow Resolution management and the SH&E staff to initiate corrective action.

4.1.3 **The Site Safety Officer** or **Local SH&E Representative** must initiate the development and implementation of corrective actions to eliminate the condition causing the Stop Work Order for Resolution employees and other personnel under Resolution's direct control affected by such condition. Report the details of the Stop Work Order and any corrective actions implemented to the **Project Manager** and the appropriate **Regional SH&E Manager**

4.1.4 **Project managers (field task managers, supervisors)**

- Verify that corrective actions taken appropriately address the conditions leading to the Stop Work Order.
- If Resolution has control over the circumstance that led to the condition, initiate additional corrective actions necessary to correct the conditions leading to the Stop Work Order. Otherwise, remain in communication with the persons or entities that are taking the corrective measures.
- Communicate such corrective actions and the effects of such corrective actions on the project/office to the client and/or Region Management.

- Ensure that documentation related to the Stop Work Order and corrective actions is placed in the project/office file.

4.1.5 **Regional Business line Managers (regional, district and office managers)**

- Provide support, in accordance with our contractual responsibilities for the project, for the implementation of corrective actions and communications with clients.
- Ensure that no reprimand or reprisal is associated with the initiation of a Stop Work Order.

4.1.6 **Regional SH&E Managers**

- Provide technical guidance for the development and implementation of corrective actions.
- Communicate with the SH&E group and assist with the development of Shared Learning and Safety Alert notices.
- Report all instances when Stop Work Authority has been implemented to the Resolution Consultants SH&E Manager.

## 4.2 Commitment

4.2.1 It is Resolution's policy and firm commitment that employees are expected to stop their work to prevent unacceptable exposure to workplace hazards, including unsafe conditions or worker behaviors, without fear of reprimand or reprisal.

4.2.2 Cases involving reprisal, reprimand, or any attempt to discourage the initiation of Stop Work Orders or reporting of unsafe or unhealthy conditions or situations within Resolution should be immediately reported to the employee's **Manager, Human Resources Representative**, and **Regional SH&E Manager, Resolution Consultants SH&E Manager**.

## 4.3 Authority

4.3.1 Resolution's stop work authority applies to all work controlled by Resolution, its employees, and Resolution -controlled subcontractor work activities. All Resolution personnel are authorized to stop work in the event of an identified unsafe condition. If the responsible organization fails to provide resolution, or if at any time their acts or failure to act cause substantial harm or imminent danger to the health and safety of project employees, the public, or the environment, Resolution may issue an order stopping work in whole or in part. In the event that Resolution issues a Stop Work Order, an order issued by Resolution Consultants SH&E Manager (or his designee) authorizing the resumption of work must be in place prior to restarting work.

4.3.2 In most cases, a Stop Work Order affects only those areas immediately involved in the hazardous situation. Resolution may issue a Stop Work Order for a portion of the work area(s) or for an entire work area when unacceptable risks exist that cannot be mitigated by reasonable engineering controls, administrative actions, or personal protective equipment. The Stop Work Order will remain in effect until the responsible organization resolves the problem(s) and brings the work area(s) to satisfactory conformance with established SH&E requirements. Work will not resume until appropriate corrective actions have been completed, ensuring that the condition has been rectified. The Stop Work Order will apply to Resolution and its direct subcontractors placed at risk by the situations or conditions.

## 4.4 Severity of Hazards

4.4.1 Imminent Danger Situations

- Upon becoming aware of an imminently dangerous situation that Resolution does not control, the employee should immediately inform the persons or entities in control of such imminently dangerous activities and his or her project manager about the situation. If the activities pertain to work that is controlled by Resolution, then the employee may stop the work upon discovering an imminently dangerous situation and then immediately notify his project manager, who may determine the appropriate further action to be taken (including the issuance of a formal Stop Work Order).

- "Stopping work" for Resolution -controlled work includes stabilizing an imminent danger situation to the extent that it can be left unattended for a prolonged period of time until the issue is resolved.
- The person requesting the work stoppage will notify the organization responsible for the work.
- The responsible organization will notify Resolution project/office management immediately of any stop work action(s) taken to rectify the situation.
- A Resolution's failure to comply with any Stop Work Order in whole or in part may result in disciplinary action. A Resolution subcontractor employee's failure to comply with any Stop Work Order may result in immediate removal from the project and/or office location.

4.4.2 Potentially Dangerous Situations

- Informal stop work interventions to correct minor conditions (e.g., to remind workers to put on their hard hats, safety glasses, etc.) do not require formal notification.
- If the minor condition cannot be corrected, a formal Stop Work Order must be issued and work must not be resumed until the situation has been eliminated.

### 4.5 Management-issued Stop Work Orders

4.5.1 **Project Managers** and/or **SH&E Managers** may issue a formal Stop Work Order for Resolution-controlled work in the following situations:

- Imminent danger exists involving the public or employee's safety and health or damage to the environment, facilities, or property.
- Continuing work or equipment usage will result in significant repair, rework, or removal.
- A project, or any segment of the project, is executed improperly or is out of compliance with applicable regulations or standards.

### 4.6 Resuming Work

4.6.1 Work associated with the affected area or operation will not resume unless all corrective actions identified in the applicable Stop Work Order have been completed and closed.

4.6.2 All personnel affected by the Stop Work Order will be instructed on the corrective actions and preventative measures taken.

## 5.0 Records

5.1 The completed Stop Work Order and any corrective action reports generated will be maintained at the project site for the duration of the project and placed in the closed project file.

## 6.0 Attachments

5-002 Stop Work Order

# 5-002- Stop Work Order

This form must be completed if any of the following criteria are met:

1. Imminent danger exists involving the public or employees' safety and health, the environment, facilities, or property.
2. Continuing work or equipment usage will result in significant repair, rework, or removal.
3. There is a discrepancy, deficiency, or potentially dangerous condition or act that is likely to cause an unsafe or unhealthy situation or an imminent danger situation.

| | | | |
|---|---|---|---|
| **Project Name:** | | | |
| **Project Manager:** | | **Project #:** | |
| **Reported by:** | | **Date/Time:** | |
| **Office:** | | **Address:** | |
| **Stop Work Order is the result of the following:** | | | |
| **Inspection/Audit** ☐ | **Environmental Impairment** ☐ | **Injury/Incident** ☐ | |
| **Unsafe Condition** ☐ | **Unsafe Behavior/Act** ☐ | **Improper Scope of Work** ☐ | |
| **Other** ☐ | | | |
| **Stop Work Order (Describe):** | | | |
| | | | |

***All Stop Work Orders will be sent to the Regional SH&E Manager for Review***

### Return to Work

The above Stop Work Order issues/concerns have been corrected and documented. By signing below, I certify that the above Stop Work Order scenario has been corrected and work is safe to resume.

| Title | Print Name | Signature |
|---|---|---|
| Project Manager: | | |
| Individual/party issuing Stop Work Order: | | |
| Subcontractor Supervisor (if applicable): | | |


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# 05-004-Incident Reporting

## 1.0 Purpose and Scope

1.1 To document and report all SH&E incidents in a timely and accurate manner. Additionally, to gather that appropriate Lessons-Learned from all SH&E incidents and that all information required for regulatory reports is generated and filed as required for compliance.

1.2 This procedure applies to all Resolution Consultants based employees and operations.

## 2.0 Terms and Definitions

2.1 SH&E Incidents: The following events or situations as applied to Resolution Consultants employees and/or Resolution Consultants-controlled operations are considered SH&E Incidents:

2.1.1 Any injury or illness (including pain and soreness) to a Resolution Consultants employee, that could be potentially work related or become aggravated by the work environment. This includes Resolution Consultants subcontractor, temporary employee or third party contractor, performing work under the control of a Resolution Consultants operation.

2.1.2 Fire, explosion, or flash that is not an intended result of a remediation process, laboratory procedure, or other planned event.

2.1.3 Any accidents involving company-owned, rented, or leased vehicles (including personal vehicles used for company business).

2.1.4 Any breach of a numeric limit attached to a governmental permit or consent.

2.1.5 Any failure to perform the requirements of a non-numeric requirement contained in a government permit or consent.

2.1.6 Any failure to obtain a government permit or consent when required (including failure to obtain revisions before an existing permit or consent expires).

2.1.7 Any notice of violation or notice of non-compliance received from a regulatory authority with enforcement powers.

2.1.8 Property damage resulting from any Resolution Consultants or subcontractor activity.

2.1.9 Unexpected release or imminent release of a hazardous material.

2.1.10 Unexpected chemical exposures to workers or the public.

2.1.11 A safety, health or environmental related complaint from the public regarding Resolution Consultants activities.

2.1.12 SH&E-related incidents that could result in adverse public media interest concerning Resolution Consultants or a Resolution Consultants project.

2.1.13 Any inspection by a federal, provincial, or local safety, health, & environmental enforcement agency.

2.1.14 Any boating incident that includes the following:

2.1.15 Fatality.

2.1.16 A person disappeared from the vessel under circumstances that indicated death or injury.

2.1.17 A person was injured and required medical treatment beyond first aid.

2.1.18 Damage to vessels and other property totalled $2000 or more.

2.1.19 The boat was destroyed (physically destroyed or sinks).

2.2 Near-Miss Incidents: This is defined as an incident having the potential to cause injury, health effects, environmental impairment, or property damage as described in the above categories – but did not. For example:

2.2.1 A crane drops a 454 kilogram (1,000 pound) beam during a lift – and nobody is hurt, no equipment is damaged.


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2.2.2 A work crew is conducting a survey along the highway. A vehicle leaves the roadway and the vehicle enters the survey area at 80 kph (50 mph). The vehicle misses an employee by 1 meter (3 feet); the driver recovers control of the vehicle and leaves the area.

2.2.3 Awareness of an equipment recall or incident that occurs at another similar worksite.

2.2.4 Unsafe condition that could have caused an incident if not corrected.

2.2.5 Awareness of an equipment recall or incident that occurs at another similar worksite.

2.2.6 Unsafe condition that could have caused an incident if not corrected.

2.3 Significant Learning Experience: Defined as a near-miss incident that the affected group (i.e. project team, office staff, etc.) believes could have wide-ranging impacts throughout Resolution Consultants.

2.4 Serious SH&E Incident: Any SH&E Incident that meets/involves the following criteria:

2.4.1 Any amputation.

2.4.2 Hospitalization for treatment (admission).

2.4.3 Absence from work for more than 30 calendar days due to work-related injury/illness.

2.4.4 Any single event resulting in more than one employee requiring medical treatment.

2.4.5 Any SH&E-related Consent Agreement/Order/Lawsuit or enforcement action seeking more than $10,000 or alleging criminal activity.

2.4.6 Any spill or release of a hazardous material that is reportable to a government agency.

2.4.7 Any Notices of Violation.

2.4.8 Near miss incidents that, in the opinion of the SH&E Manager, Project Manager, or Contract Task Order Manager, may have otherwise resulted in any of the above.

2.5 **Fatality:** Loss of life of any Resolution Consultants employee, Resolution Consultants subcontractor personnel, client personnel or member of the general public that can be perceived to be related to work performed or controlled by Resolution Consultants.

2.6 **General Liability:** Incidents where Resolution Consultants could potentially be held liable.

2.7 **Resolution Consultants Recordable Injury: See *05-601 Recordkeeping* for definitions.**

2.8 **H&W:** Health and Welfare Human Resource office which manages all injury and illness claims.

2.9 **HR:** Human Resource office which manages all injury and illness claims.

2.10 **Lost Time Days:** The total number of days the injured person accumulates before returning back to regular duties.

2.11 **Lost Time Injury or Disease:** A work-related injury or disease that has caused a worker to be absent from his or her regular work following the day that the injury or awareness of the disease occurred.

2.12 **Restricted Work (also called "Modified Work"):** Where an injury is medically treated, but the person is not able to return to regular duties. The restricted duties are done within the limitation of the injured person's abilities. (Documentation may be required per regulatory requirements).

2.13 **Restricted Work Days:** The total number of restricted work days the injured person accumulates before being able to return to regular duties.

2.14 **Supervisor's Report of Incident (SRI):** Form used to document incidents which shall be completed within 24 hours.

2.15 **Support Services:** Resolution Consultants entities of Legal, Human Resources, Communications, SH&E Department, etc.

2.16 **WCB:** Workers Compensation Board

2.17 **WC Carrier:** Workers Compensation Insurance Carrier (US).


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## 3.0 References

3.1 05-606 Modified Duty Program

3.2 05-603 Incident Investigation and Review

3.3 05-601 Recordkeeping

## 4.0 Procedure

4.1 All incidents, regardless of type or severity, shall be reported to the on-site supervisor immediately.

4.2 All incidents, regardless of type or severity, shall be reported to the employer company safety representative by the supervisor as soon as possible but no later than the end of the current work shift.

4.3 Completed Supervisor's Report of Incident shall be submitted the supervisor, Regional SH&E Manager and the Resolution Consultants SH&E Manager within 24 hours.

4.4 Fatalities and serious SH&E incidents shall be reported to the Regional SH&E Manager and Resolution Consultants SH&E Manager as soon as reasonably possible but no more than 2 hours after the incident.

4.5 Where there is potential for criminal, civil or regulatory action against Resolution Consultants or any of its employees or subcontractors, Resolution Consultants' Contracts Task Order Manager shall be contacted prior to any external communication, correspondence, or meeting concerning any incident, governmental investigation, or environment impact. Resolution Consultants' Contracts Task Order Manager, or the Program Manager, may supplement this Policy or require additional measures to protect the best interests of Resolution Consultants and its employees.

4.6 **Roles and Responsibilities**

**4.6.1 Employees. Each employee involved in an SH&E incident will:**

4.6.1.1 Notify his/her supervisor immediately that an incident (including a near-miss) has occurred, the circumstances involved, the nature and extent of the injuries/illness, and whether medical treatment may be required. Except for emergency situations, affected employees are required to discuss their injury/illness status with their supervisor and Regional SH&E Manager or project SH&E Professional prior to obtaining medical treatment.

4.6.1.2 Assist supervisor in completing appropriate reporting and investigation forms. If issues are raised regarding the content prepared in the SRI, contact the Regional SH&E Manager for guidance.

**4.6.2 Supervisors. In an emergency/life-threatening situation, supervisors will:**

4.6.2.1 Use the appropriate local emergency phone numbers and seek immediate medical care for the employee.

4.6.2.2 Address any immediate corrective actions needed. Consult with the Regional SH&E Manager if guidance is required.

4.6.2.3 Call the Regional SH&E Manager and Resolution Consultants SH&E Manager as soon as the situation is stabilized, but not later than the end of the current work shift.

4.6.2.4 Complete the applicable forms and email to the supervisor and the Regional SH&E Manager within 24 hours of the incident.

4.6.2.5 Supervisor's Report of Incident or Near Miss/Observation Report (completed with assistance and acknowledgment from affected employees).

4.6.2.6 Federal/State/Province Specific Forms, if required (contact applicable Support Services for guidance).

4.6.2.7 Notify the appropriate line or lead manager (i.e. manager responsible for personnel involved/project oversight/business line, etc.).

4.6.2.8 As appropriate, initiate an Incident Investigation and Review per the requirements of 5-603 Incident Investigation and Review.

4.6.2.9 Completion of any external reporting requirements. For example, the U.S. Coast Guard CG-3865, Recreational Boating Accident Report may be required if the incident involved a boat (contact the SH&E Manager for clarification). See 5-004 Form 4 Incident Response and Reporting for further instruction.

4.6.2.10 Report all fatalities and/or serious SH&E incidents to the Resolution Consultants SH&E Manager and Program Manager as soon as reasonably possible but no more than 2 hours after the incident.

**4.6.3 Resolution Consultants SH&E Manager or Designee:**

4.6.3.1 Coordinate with the appropriate SH&E Incident Reporting Support Staff

4.6.3.2 Upon receipt of an Incident Notification, contact the supervisor to discuss the incident as well as short term and long term corrective actions.

4.6.3.3 Engage Resolution Consultants Medical Provider for non-urgent medical guidance, if needed.

4.6.3.4 Notify appropriate Manager of the incident

4.6.3.5 As appropriate, initiate or assist an Incident Investigation and Review.

4.6.3.6 Report all fatalities and/or serious SH&E incidents to the Contracts Task Order Manager and Program Manager as soon as reasonably possible but no more than 2 hours after the incident.

**4.6.4 Incident Reporting Support Staff:**

4.6.4.1 Inform appropriate personnel that have not already been notified of incidents.

4.6.4.2 Audit data of incident reporting system.

4.6.4.3 Coordinate with Regional SH&E Manager or designee for management of medical support.

4.6.4.4 Forward incident data to support agencies for insurance claims.

## 5.0 Records

5.1 Incident reports and supporting documentation are maintained in a secure file by the incident reporting support staff.

5.2 The completed Supervisor Report of Incident and supporting documents must be retained by the appropriate Resolution Consultants parent company. Records relating to occupational injury and accidents must be kept for up to 30 years, plus the length of employment.

## 6.0 Attachments

6.1 05-004-Form 1 Supervisor's Report of Incident

6.2 05-004-Form 2 Near-Miss Observation Report

6.3 05-004-Form 3 Supervisor's Incident Reporting Flowchart

6.4 05-004-Form 4 Incident Response and Reporting Instructions


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# 5-208-Personal Protective Equipment Program

## 1.0 Purpose and Scope

1.1 Provide an effective Personal Protective Equipment (PPE) Program to protect Resolution employees from potential workplace safety and health hazards.

1.2 This procedure applies to all Resolution employees and operations.

1.3 The proper use of appropriate PPE, in combination with effective engineering and administrative controls, can provide Resolution employees with protection against potential workplace hazards and can reduce the potential for workplace injury and illness.

## 2.0 Terms and Definitions

2.1 **PPE**: Personal Protective Equipment

2.2 **ANSI:** American National Standards Institute

## 3.0 References

3.1 Occupational Safety and Health Administration (OSHA) PPE standard (29 CFR 1910.132) requires Resolution to assess workplace(s) to determine if hazards that necessitate the use of PPE exist in the workplace, and, if such hazards are present, to

3.1.1 Select the appropriate types of PPE and

3.1.2 Provide employees with training about the use and care of the selected PPE.

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 **Regional SH&E Professional**

- Provide guidance to Project Managers, Field Task Managers, Supervisors, and field staff on the assessment of hazards and the selection of PPE.
- Provide training materials to Project Managers, Field Task Managers and Supervisors for employee training.

4.1.2 **Project Managers (Field Task Managers, Supervisors)**

- Conduct Hazard Assessments to identify hazards present and to specify PPE appropriate for those hazards.
- Determine which of your staff members will require employee-issued PPE.
- Approve the purchase of company-issued PPE.
- Verify that appropriate PPE is utilized by your employees when required or necessary.

4.1.3 **Employee**

- In accordance with your training and instructions, utilize appropriate PPE that has been issued to them when required or necessary.
- Inspect your PPE prior to use to confirm that it is functional, and maintain your PPE in a clean and functional condition.
- Follow instructions and manufacturers' guidance on the care, use, and storage of your PPE.
- Prior to using any type of PPE, confirm that it is in good shape, free of dirt and debris, and that you are familiar with its correct use. Always make sure PPE fits adequately to perform the use intended.
- Refrain from wearing PPE outside of the work area for which it is required if doing so would constitute a hazard.

## 4.2 Hazard Assessment for Office Locations

Office Hazard Analysis will be completed for applicable tasks as required in 29 CFR 1910.132 following the guidelines as specified in OSHA Pamphlet 3151-12R 2003 (Personal Protective Equipment),

## 4.3 Hazard Assessment for Off-Site Locations

4.3.1 HAZWOPER Locations

- Each Health and Safety Plan (HASP) that is prepared for waste site investigations/remediation includes a hazard assessment for each proposed field activity. Task-specific PPE requirements are listed in the HASP. Therefore, the HASP will serve as the certificate of hazard assessment for each project that involves off-site work activities that require the use of PPE.

4.3.2 All Other Off-Site Locations

- The Task Hazard Analysis will serve as the certificate of hazard assessment for projects that involves offsite work activities that require the use of PPE. The checklist will be reviewed with the entire field team prior to arriving at the site.

## 4.4 Training

4.4.1 Staff will receive adequate instruction on the correct use, limitations, and assigned maintenance duties for the equipment to be used. The following information, at a minimum, will be covered during PPE training:

- What PPE is required.
- When it is required.
- Why it is required.
- How to properly don, doff, adjust, and wear the PPE described.
- The limitations of the PPE, including its expected useful life.
- How to properly care for, maintain, and dispose of the PPE.

4.4.2 Field staff are responsible for confirming that they have reviewed the operation manual for the PPE before work commences.

4.4.3 All staff will receive an orientation to the hazards on the job site as well as initial Field Safety orientation that outlines appropriate PPE requirements.

4.4.4 Resolution Consultants employees who have participated in the 40-hour HAZWOPER training course are considered to have met the employee training requirements of the PPE standard. The training certificates that are issued as documentation of successful completion of the 40-hour HAZWOPER course will also serve as documentation of training as required by the PPE standard. Employees who have not participated in the HAZWOPER training will be provided PPE training specific to your assignment and/or location. The PPE Facts Sheets (attached) can serve as the basis for training.

## 4.5 Determining the Need for PPE

4.5.1 Using the Task Hazard Assessment or HASP, the need for the following types of PPE will be evaluated.

4.5.2 PPE will:

- Be selected and used in accordance with recognized standards and provide effective protection.
- Not in itself create a hazard to the wearer.
- Be compatible, so that one item of PPE does not make another item ineffective.
- Be maintained in good working order and in a sanitary condition.

4.5.3 Prior to entering any regulated work area, confirm that you have access to or are equipped with the following CSA-approved PPE, appropriate to the site hazards:

- Head Protection
- Eye & Face Protection
- Foot Protection
- Hi-Visibility Vests
- Hearing Protection

4.5.4 After the hazard assessments have been completed, the Project Manager will select the appropriate PPE for each job category or task, as necessary. The selected equipment will be indicated on the hazard assessment. PPE will be provided to each employee appropriate for the hazards present. All PPE selected and purchased by Resolution will meet or exceed the American National Standards Institute (ANSI) standards, Canadian Standards Association (CSA) standards, or other standards as dictated by provincial, territorial, or state legislation.

## 4.6 Eye and Face Protection

4.6.1 The OSHA standard requires that Resolution employees use appropriate eye and face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acid and caustic liquids, chemical gases or vapors, and injurious light radiation. The standard further requires that eye protection provide side protection when there is a hazard from flying objects.

## 4.7 Head Protection

4.7.1 Protective helmets (hard hats) are required when employees are working in areas where there is a potential for falling objects to cause injury to the head. When working near exposed electrical conductors that could contact the head, helmets designed to reduce electrical shock will be worn.

## 4.8 Foot Protection

4.8.1 Protective footwear is required when employees are working in areas where there is a danger of foot injuries from falling and rolling objects or from objects piercing the sole and where an employee's feet are exposed to electrical hazards.

## 4.9 Hand Protection

4.9.1 Appropriate hand protection is required when employee's hands are exposed to hazards such as those from skin absorption of harmful substances, severe cuts and lacerations, severe abrasions, punctures, chemical burns, thermal burns, or harmful temperature extremes.

4.9.2 Chemically Resistant Clothing

4.9.3 Chemically resistant clothing is required when there is significant potential for the employee to come in direct contact with the chemicals he/she is handling. Tasks that involve chemical handling will be evaluated for the potential of splashing or spilling.

4.9.4 High-Visibility Apparel

4.9.5 High-visibility apparel with reflective banding (ANSI Class II and III garment) is required for all field activities in close proximity to moving traffic and other modes of transportation (transit, airlines, marine, etc.), in proximity to heavy equipment operations, or whenever otherwise specified in a project HASP. Color of apparel (orange or lime) may be client/project-specific.

## 4.10 Personal Clothing

4.10.1 For personal safety on the job site, do not wear

- Loose or unsecured clothing or loose fitting cuffs.
- Greasy or oily clothing, gloves, or boots.
- Torn or ragged clothing.

4.10.2 Neck chains are hazardous and will be worn under clothing so that they do not hang out. Long hair will be tied back or otherwise confined.

4.10.3 Clothing made of synthetic fibres can be readily ignited and melted by electric flash or extreme heat sources. Cotton or wool fabrics are recommended for general use.

## 4.11 Specialized PPE

4.11.1 In addition to basic PPE, additional specialized PPE may be required to provide appropriate protection to the employee. Refer to applicable OH&S legislation and related Standard Operating Procedures for additional information on PPE requirements.

- Fall Protection: Only full body harnesses with shock-absorbing lanyards will be used for personal fall arrest.
- Respiratory Protection: Respiratory protection shall be selected based on the contaminant and concentration to which the employee will be exposed. Refer to*5-519 Respiratory Protection Program* and the task- or project-specific Baseline Hazard Assessments for specific requirements.
- Fire Resistant Clothing: Approved fire resistant outer clothing may be required at work locations with flammable or explosive materials or environments.
- Other Head Protection: Operators and passengers (if permitted) of all-terrain vehicles and snowmobiles will wear approved helmets.
- Chemical Protective Clothing: Approved chemical protection appropriate to the hazard will be worn. Review applicable Material Safety Data Sheets (MSDSs) for appropriate PPE.
- Protection from Drowning: Employees being transported by boat are required to wear life jackets. Employees exposed to any other drowning hazards are required to wear personal flotation devices. Life jackets and personal flotation devices will have the proper regulatory approval.

## 4.12 PPE Supplies

4.12.1 Each Resolution office will maintain a supply of safety equipment including safety glasses, gloves, and chemically resistant clothing based on the nature of their field activities. The Office Manager or designee will be responsible for maintaining this inventory. PPE that is required for large field efforts will be ordered by the Project Manager or their designee.

4.12.2 At a minimum, the office will review its PPE program annually.

## 4.13 Obtaining Personalized Safety Gear

4.13.1 The OSHA standard in 29 CFR 1910 - Subpart I / 29 CFR 1926 requires that protective equipment, including PPE for eyes, face, head, and extremities, protective clothing, and respiratory devices, be provided to employees wherever necessary by reason of hazards.

4.13.2 Employees are not expected to provide their own general PPE. Although each Resolution office stocks and issues various general issue safety gear such as hard hats, plan safety glasses, disposable gloves and coveralls, fall protection, and hearing protection, certain personalized safety gear such as prescription safety glasses, safety-toed (capped) boots, and cotton coveralls will be ordered and sized specifically for the user.

4.13.3 Most PPE will be provided to the employee at no charge, with the exception of the above personalized safety equipment (safety glasses, safety toed boots, washable coveralls). A partial cost reimbursement to the employee may be made based on legacy company practice or project stipulations.

4.13.4 Prescription Safety Glasses

- As with all hazards, staff will be notified of their potential for injury and will be provided with the appropriate PPE. If wearing contact lenses poses a hazard to the worker's eyes during work, the worker will be advised of the hazards and the alternatives to wearing contact lenses.
- Eligibility

- Employees will wear safety glasses during activities that involve exposure to eye hazards such as flying particles, chemical splash, or certain types of radiation such as ultraviolet light from welding operations. Typically, the following types of field activities will require the use of safety glasses:
  - Site investigation or remediation and construction activities.
  - Stack monitoring and other types of air emissions monitoring.
  - Audits and assessments in industrial or manufacturing facilities.
  - Activities conducted within laboratories.
  - Activities at client facilities where safety glasses are required.
- Eligibility to obtain prescription safety glasses will be determined by the employee's supervisor based upon the guidance above.

- Procurement of Prescription Safety Glasses
  - Except for eye examinations, associated prescription eyewear costs will be paid by Resolution. The employee may be asked to pay an optician's dispensing fee, which may be submitted on an expense report for reimbursement. Because eye examinations are not covered, employees who have had recent eye examinations should contact the eye care professional in advance to determine their procedure for handling a current prescription.
  - Employees who are eligible will be allowed to order one pair of prescription safety glasses every other year from the selection of glasses offered by the program.
  - Contact the Regional SH&E Professional for guidance on the procurement of prescription safety glasses.

4.13.5 Safety Toed Boots/Shoes

- Eligibility
  - Employees will wear safety boots/shoes during activities that pose the potential for foot injury from dropped objects or penetrations through the sole. Typically, safety toed boots/shoes will be required for the same type of activities, with the exception of laboratory activities, for which safety glasses are required. In addition, work around all types of heavy equipment will typically require the use of safety shoes.
  - Eligibility to obtain safety shoes will be determined by the employee's supervisor based upon the guidance above.

- Procurement of Safety Shoes
  - Eligible employees will be allowed to purchase one pair of safety shoes every other year.
  - Employees who have been authorized to purchase safety shoes by their supervisor should consult the Regional SH&E Manager for obtaining for detailed instructions on how and where to purchase the equipment. The style chosen (i.e., boot or shoe) should be determined based upon the application. For example, low cut shoes may be appropriate for audits and assessments in light industry applications, while safety boots will be more appropriate for environmental remediation, construction, and heavy industry work with significant foot hazards. Before purchasing, the employee is required to verify that the safety boots or shoes meet the specifications above.
  - After the purchase, an employee expense report, including a dated receipt for the shoes, should be submitted for approval and reimbursement. Resolution will reimburse the employee up to an amount that is specified by the SH&E Department or Regional Operations management.

4.13.6 Reusable Coveralls

- Eligibility

- Reusable cotton (or some other washable fabric) coveralls may be made available to employees who regularly perform field work based on conditions. Coveralls can be worn over personal clothing to help protect and keep them clean.
- Eligibility to obtain washable coveralls will be determined by the employee's supervisor based upon the guidance above.

## 5.0 Records

None.

## 6.0 Attachments

None.

# 05-209-Project Hazard Assessment and Planning

## 1.0 Purpose and Scope

1.1 Resolution Consultants and its employees must assess all projects and sites for anticipated hazards and plan to mitigate those hazards through a series of controls. This procedure establishes the requirements and provides the tools for this process of pre-work planning and risk assessment.

1.2 The objective is to enhance SH&E performance, to reduce losses due to injury, illness, property damage, or environmental impairment incident, and maintain regulatory compliance.

1.3 This procedure applies to all Resolution Consultants employees and operations.

## 2.0 Terms and Definitions

2.1 **Task Hazard Analysis (THA):** A THA *(05-209-Form 1 Task Hazard Analysis)* is a technique for evaluating the component parts of any work method or procedure for the purpose of:

- Identifying the SH&E hazards and risks connected with the work;
- Identifying and implementing control methods to eliminate, nullify, or reduce to a minimum the consequences of such hazards and risks; and,
- Evaluating the effectiveness of risk control measures and making modifications as needed.

2.2 **Plan:** A comprehensive document which outlines at length, in a report-style format, all of the operational controls necessary to mitigate the anticipated hazards for a project's sites and activities. Resolution Consultants will use two established planning templates:

- **Health and Safety Plan (HASP**) for work involving environmental contaminants (e.g., HAZWOPER), or
- **Safe Work Plan (SWP)** for all other SH&E planning documentation.

2.3 **High Risk Classification:** Any task where the identified hazard, if further controls are not implemented, has a combined severity and probability that is either catastrophic or very likely, or some combination thereof (but where the result is not minor or rare). (Refer to 0*5-209-Form 2 Hazard Identification, Classification and Controls* for further details.) The following may be classified as High Risk; consult the SH&E Department for clarification:

- Confined space,
- HAZWOPER,
- Contaminated sites,
- Radiation,
- Lead,
- Asbestos,
- Resolution Consultants camp or construction sites,
- Competent person requirements,
- Sites with potential for client system failures,
- Significant physical hazards (e.g., fall, water, equipment, etc.),
- Munitions and Explosives of Concern / Unexploded Ordnance (MEC-UXO) Ops
- Potential for significant environmental incident, or
- Sites with medical surveillance requirements.

## 3.0 References

None.


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## 4.0 Procedure

4.1 All projects must have a completed Task Hazard Analysis at a minimum. In addition, all field projects must have an Emergency Response Plan. These two documents may be all a project needs for administrative safety requirements, depending on the hazards identified.

4.2 The table below helps illustrate the further planning documentation which may be required, depending on the hazards identified in the THA.

| | | |
|---|---|---|
| **Task Hazard Analysis** | • Most basic requirement<br>• All sites and tasks including walk-through site visits | • Prepared by employees/supervisors<br>• Confirmed by **Project Manager** or designee |
| **Safe Work Plan (SWP)** | • High risk activities<br>• Complex projects with multiple stakeholders, long-duration<br>• Non-HAZWOPER | • SH&E Department review and guidance required |
| **Health & Safety Plan (HASP)** | • HAZWOPER regulated sites and all other sites with potential chemical exposures<br>• Client directed | • Only for sites with potential chemical exposures and Hazardous Waste Operations and Emergency Response (HAZWOPER)<br>• SH&E Department review and guidance required |

### 4.3 Task Hazard Analysis (THA)

4.3.1 A THA must be completed for all (routine and non-routine) tasks and sites.

4.3.2 A THA must be completed prior to the commencement of work so that all controls can be planned, equipment purchased/inspected, and staff adequately trained for the hazards.

4.3.3 The THA must identify all known and potential physical hazards as well as potential occupational exposures for noise, biological, or chemical contaminants, and environmental issues.

4.3.4 The assessment must include the identification and implementation of control measures to prevent worker injury, exposure and contamination.

4.3.5 Hazard identification and risk assessment must be ongoing. This requires the project team to consider the timing and frequency of the THA reviews, as affected by the following types of issues:

- The need to determine whether existing risk controls are effective and adequate,
- The need to respond to new hazards,
- The need to respond to changes that Resolution Consultants itself has made,
- The need to respond to feedback from monitoring activities, incident investigation, emergency situations or the results of testing of emergency procedures,
- Changes in legislation,
- External factors, e.g. emerging occupational health issues,
- Advances in control technologies,
- Changing diversity in the workforce, including contractors, or
- Changes proposed by corrective and preventive action.

4.3.6 THAs will be prepared by the supervisor and employee(s) directly responsible for the work.

4.3.7 Final drafts shall be submitted for review and approved by the **Project Manager** prior to commencing work activities.

4.3.8 Resolution Consultants subcontractors will prepare their own THA and submit them to the **Project Manager** for review and acceptance prior to the start of subcontracted work activities. These reviews are not approvals, and do not relieve the subcontractor for being responsible for their own safety on the project site.

4.3.9 The **Project Manager** shall maintain all approved/signed THA copies (including revisions) in the project files and make them available during project audits and for use during the training of new project personnel.

4.3.10 THAs shall be used to facilitate project SH&E tailgate meetings. Comments and suggestions relative to the completed THA shall be encouraged from attendees and incorporated into revised documents. Any modifications must be reviewed as corrective measures to confirm that no new hazards are created.

4.3.11 THAs that have been found to be inadequate or incomplete should be suitably annotated by the project management team to be used as lessons learned.

4.3.12 The THA will be reviewed by all personnel involved in the task, as well as any visitors or additional or new crews brought on to perform the work. This is a minimum of a one-time review and signature with supplement reviews conducted on a pre-determined basis by the **Project Manager** or their designee.

## 4.4 Planning Documents

4.4.1 An SH&E plan (in addition to the THA) may be required in the following circumstances:

- Tasks with high risk classification designations,
- Tasks with medium risk classification designations, where circumstances warrant, and/or
- Complex projects where it is necessary to communicate to numerous stakeholders and clearly define all controls including emergency response, incident reporting, inspections, security requirements, or other details.

4.4.2 The planning document shall be titled a **Safe Work Plan** UNLESS it involves Hazardous Waste Operations and Emergency Response (HAZWOPER) requirements, then it will be called a **Health and Safety Plan (HASP)** and will clearly address the specific requirements associated with the hazardous waste exposures.

4.4.3 Specific plan needs will vary for each project. In some cases it may be acceptable to utilize general (non-site/non-project-specific) SH&E procedural documentation prepared for the type of work activities being performed, while in others project/site/activity-specific documentation is required to be developed as part of the project planning process. The specific operational needs of individual projects will be determined as part of the initial coordination between the **Project Manager** and the SH&E Department.

4.4.4 The following requirements apply to all Resolution Consultants SH&E planning documentation:

- Preparation of the SH&E documentation can be performed by a member of the project team or the SH&E Department.
- All SH&E documentation (including draft versions of documents) will be approved by the SH&E Department prior to release for outside agency review (e.g., clients, regulatory agencies, etc.) and prior to its field implementation.
- All changes to approved SH&E documentation require concurrence from a designated member of the SH&E Department. This includes those made in response to changing field conditions or operational requirements and those made in response to regulator/client comments. Any written responses made to regulator/client comments also must be reviewed and approved by the SH&E Department.
- The SH&E documentation for any project lasting twelve (12) months or longer will be reviewed at periodic intervals determined by the SH&E Department, but at least annually. The **SH&E Representative** will review the changes and determine whether modifications are required to the existing SH&E planning documentation. This confirms that the documentation continues to reflect the current project scope and knowledge of site conditions, and that any revised regulatory requirements are properly addressed. The **Project Manager** will provide a master copy of the SH&E documentation to be maintained on site for reference by personnel, together with copies of any required SH&E-related records or operational documentation. The master copy must be current in all respects, and will include any changes or modifications made as work progresses.
- **Project Managers** will confirm that ALL plans and THAs have been reviewed with project personnel prior to implementation of field work. Sign-off and concurrence is mandatory and to be kept in the project records.

### 4.5 Roles & Responsibilities

4.5.1 **SH&E Department** responsibilities include the following:

- Assisting project management personnel to identify any necessary project-specific SH&E planning documentation required for all new and ongoing projects.
- Assisting in the preparation of necessary SH&E planning documentation.
- Reviewing and approving all SH&E planning documentation prior to its implementation for field activities.

4.5.2 **Project Manager (or their designee)** responsibilities include the following**:**

- Confirming the completion of SH&E planning documentation (THA, SWP or HASP), as required, that addresses the full range of project activities, safety risks and that all requirements and procedures are implemented and enforced during the field activities.
- Confirming SH&E requirements and Standard Operating Procedures are implemented successfully, including but not limited to:
  - Subcontractor evaluations
  - SH&E Training
  - Personal Protective Equipment
  - First aid and emergency response
  - Client requirements
- Contacting the SH&E Department to discuss SH&E planning documentation needs/ requirements at the start of each new project involving Resolution Consultants and at designated intervals (not to exceed one year) or when changes occur to the work operations or work location/ conditions, when work activities are modified/ changed, or when additional tasks are added to the work scope.
- Confirming that all SH&E planning documentation (draft or final) has been reviewed and approved by the SH&E Department prior to its use by Resolution Consultants personnel, or prior to release to outside agencies or organizations.
- Making appropriate resources available to protect the health and safety of Resolution Consultants employees, the environment and to comply with occupational health and safety, and environmental legislation and for the effective implementation of this procedure.

4.5.3 **Employee** responsibilities include the following**:**

- Participating in hazard identification training at the commencement of their employment with Resolution Consultants or prior to commencing field preparations.
- Reviewing and understanding the potential hazards and controls of the project before work commences.
- Complying with all required controls as identified in the THA and/or associated safety plans.

## 5.0 Records

5.1 Completed THAs, SWPs, and HASPs will be filed in their appropriate project file.

## 6.0 Attachments

6.1 05-209-Form 1 Task Hazard Analysis

6.2 05-209-Form 2 Hazard Identification, Classification and Controls


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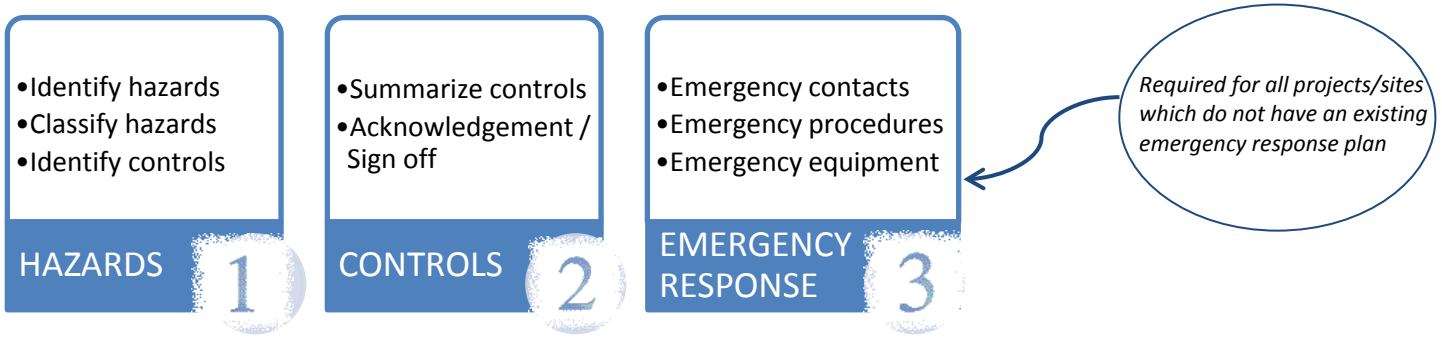
# 05-209-Form 1 Task Hazard Analysis

**This THA (worksheets 1 & 2) must be completed for all field work.**




## Hazard Identification

- **Natural (biological)** – bacteria, viruses, insects, plants, birds, and animals
- **Chemical** – exposure to chemical toxins, acute or chronic, by way of inhalation, ingestion or absorption
- **Physical** – slipping/tripping, being struck by moving objects, repetitive movement, strains from lifting
- **Environmental** – extreme heat or cold, noise, vibrations, magnetic fields, pressure extremes and air quality
- **Psychosocial** – stress, violence

## Hazard Classification

- Considers the potential severity of the outcome
- Considers the likelihood of the occurrence
- Used to prioritize and determine extent of required controls

## Controls

- **Elimination (first)** – choose a different process; modify an existing process; substitute with less hazardous substance
- **Engineering Controls (second)** – physically alter the plant or equipment design in order to circumvent possible hazards; place guards on machinery
- **Administrative Controls (third)** – change the job procedure and/or process; limit the amount of time an individual is in a hazardous environment through job rotation
- **Personal Protective Equipment (last option)** – provide employees with direct physical protection while working in a hazardous environment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| | | | |
|---|---|---|---|
| Project Name: | Project Number: | Client: | |
| Supervisor: | Project Manager: | Location: | |
| THA Developed By: | | Date: | |
| Task Name: | | Regularity of Task: One-time ☐ | Routine ☐ |

## TASK HAZARD ANALYSIS

| | Job Event Sequence *(List the major steps of the individual task)* | Hazards *(List primary hazards)* | Hazard Classification (*before controls*) Severity | Likelihood | Risk Level | Hazard Classification | Controls *(List controls that Resolution Consultants will implement)* |
|---|---|---|---|---|---|---|---|
| 1 | | | | | 0 | | |
| 2 | | | | | 0 | | |
| 3 | | | | | 0 | | |
| 4 | | | | | 0 | | |
| 5 | | | | | 0 | | |
| 6 | | | | | 0 | | |
| 7 | | | | | 0 | | |
| 8 | | | | | 0 | | |
| 9 | | | | | 0 | | |
| 10 | | | | | 0 | | |

## Hazard Classification Guidelines

### Severity

1 Remote potential for injury, property damage/$ loss, or env damage

2 Potential for minor first aid injury, property damage/$ loss, or environmental damage

3 Potential for moderate personnel injuries, including medical treatment, property damage/$ loss, environmental damage, or negative public impact

4 Potential for a serious injury, major property damage/$ loss, serious impact to the environment, and public health

5 Catastrophic damage to people, property/equipment, environment, or public health

### Likelihood of Occurrence

1 Very unlikely

2 Unlikely

3 Likely

4 Very likely

5 Certain

### Hazard Classification Matrix

| Likelihood \ Severity | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1 | 2 | 3 | 4 | 5 |
| 2 | 2 | 4 | 6 | 8 | 10 |
| 3 | 3 | 6 | 9 | 12 | 15 |
| 4 | 4 | 8 | 12 | 16 | 20 |
| 5 | 5 | 10 | 15 | 20 | 25 |

| Risk Level |
|---|
| Low |
| Medium |
| High |

Risk Level = Likelihood x Severity



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| | | |
|---|---|---|
| Project Name: | Project Number: | Client: |
| Supervisor: | Project Manager: | Location: |
| THA Developed By: | | Date: |
| Task Name: | | |

## SUMMARY OF CONTROLS

### Personal Protective Equipment (*check all that apply*)

- CSA/ANSI Safety-Toed Boots (Leather or Rubber)
- CSA/ANSI Safety Glasses or Goggles
- CSA/ANSI-approved Hard Hat
- CSA/ANSI Type II/III Reflective Traffic Safety Vest

### Air Monitoring (reference HASP monitoring plan)

☐ No air monitoring required ☐ Air monitoring required (*see procedures below*)

| Parameter | Location/Monitoring Interval | Response/Action Levels | Response Activity |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

| Required Training (associated with this THA) | Key SOPs (associated with this THA) | | Client & Other Requirements |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |

### Acknowledgement / Signatures

Project Manager / Supervisor (signature): Date:

| Name | Signature | Company | Date | Name | Signature | Company | Date |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
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| | | | |
|---|---|---|---|
| | Project Name: | Project Number: | Client: |
| | Supervisor: | Project Manager: | Location: |
| | THA Developed By: | | Date: |
| EMERGENCY RESPONSE PLAN | Task Name: | Regularity of Task: ☐ One-time | ☐ Routine |

| Check-in Procedures | | | |
|---|---|---|---|
| Check-in Times | Check-in Person | Phone Number | Cell Phone Number |
| | | | |
| Alternate: | | | |

| Emergency Coordinators / Key Personnel | | | |
|---|---|---|---|
| Name | Title | Phone Number | Cell Phone Number |
| | On-site First Aid Attendant | | |
| | Project Manager | | |
| | Site Supervisor | | |
| | Regional SH&E Manager | | |
| | Incident Reporting Line | | |
| | Client Contact | | |
| | | | |

| Emergency Agencies / Public Utilities | | | |
|---|---|---|---|
| Name | Type | Details | Phone Number |
| | Police | | |
| | Fire | | |
| | Ambulance | | |
| | Nearest Hospital / Clinic | | |
| | Poison Control Center | | |
| | Pollution / Environmental | | |
| | | | |

| Emergency Equipment & Supplies | | Other Emergency Plan Details |
|---|---|---|
| ☐ First Aid Kit - Type: | ☐ Eye Wash | |
| ☐ Blankets / Survival: | ☐ Spill Kit | |
| ☐ Fire Extinguishers Type: | ☐ Other: | |
| ☐ Communication Device | | |
| ☐ Vehicle Safety Equipment | | |


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# 05-209 Form 2 Hazard Identification, Classification & Controls

The following information is intended to guide staff in completing the Task Hazard Analysis.

## 1.0 Hazard Identification

1.1 Hazards occurring in the workplace may be:

- Natural (biological) – bacteria, viruses, insects, plants, birds, and animals
- Chemical – exposure to chemical toxins, acute or chronic, by way of inhalation, ingestion or absorption
- Physical – slipping/tripping, being struck by moving objects, repetitive movement, strains from lifting
- Environmental – extreme heat or cold, noise, vibrations, magnetic fields, pressure extremes and air quality
- Psychosocial – stress, violence

1.2 When identifying hazards, remember to consider the following:

- Routine and non-routine activities;
- Activities of all persons having access to the workplace (including contractors and visitors);
- Human behavior, capabilities and other human factors;
- Identified hazards originating outside the workplace capable of adversely affecting the health and safety of persons under the control of Resolution Consultants;
- Hazards created in the vicinity of the workplace by work-related activities under the control of Resolution Consultants;
- Infrastructure, equipment and materials at the workplace, whether provided by Resolution Consultants or others;
- Changes or proposed changes within Resolution Consultants;
- Modifications to the OH&S management system, including temporary changes, and their impacts on operations, processes, and activities;
- Any applicable legal obligations relating to risk assessment and implementation of necessary controls;
- The design of work areas, processes, installations, machinery/equipment, operating procedures and work organization, including their adaptation to human capabilities.

1.3 It is often useful to break the job or task down into a sequence of steps (“Job Event Sequence”) to help identify the primary hazards which may be encountered when you complete a job task. The “events” identified should be only as detailed as required to identify the primary hazards (e.g., drive to worksite; inspect bridge decking; take water samples, etc.)

## 2.0 Hazard Classification

Once identified, all hazards should be classified based on both their potential outcome and the probability of its occurrence as follows:

2.1 **Severity**

- Insignificant – no injuries, low environmental/financial impact = 1
- Minor – first aid required, some environmental/financial impact = 2
- Moderate – medical treatment required, contained environmental impact, high cost = 3
- Major – serious injury, severe environmental damage, major cost = 4


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- Catastrophic – death, environmental disaster, extensive damage, extended downtime for company or site, huge cost = 5

2.2 **Probability**

- Unlikely – Incident will probably not occur during the work activity = 1
- Rarely – Incident will rarely occur during the work activity = 2
- Possibly – Possibility of incident occurring sometime during the work activity = 3
- Likely – Likelihood of incident occurring sometime during the work activity = 4
- Very Likely – Likelihood of incident happening often during course of the work activity = 5

2.3 High Hazard – Practice or condition whose sum of severity and probability is greater than or equal to 8.

2.4 Medium Hazard – Practice or condition whose sum of severity and probability is equal to either 6 or 7.

2.5 Low Hazard – Practice or condition whose sum of severity and probability is less than or equal to 5.

2.6 Inputs to the hazard classification can include, but are not be limited to, information or data on the following:

- Details of location(s) where work is carried out,
- The proximity and scope for hazardous interaction between activities in the workplace,
- Security arrangements,
- The human capabilities, behavior, competence, training and experience of those who normally and/or occasionally carry out hazardous tasks,
- Toxicological data, epidemiological data and other health related information,
- The proximity of other personnel (e.g. cleaners, visitors, contractors, the public) who might be affected by hazardous work,
- Details of any work instructions, systems of work and/or permit-to-work procedures, prepared for hazardous tasks,
- Manufacturers' or suppliers' instructions for operation and maintenance of equipment and facilities,
- The availability and use of control measures (e.g. for ventilation, guarding, personal protective equipment (PPE), etc.),
- Abnormal conditions (e.g. the potential interruption of utility services such as electricity and water, or other process failures),
- Environmental conditions affecting the workplace,
- The potential for failure of plant and machinery components and safety devices or for their degradation from exposure to the elements or process materials,
- Details of access to, and adequacy/condition of emergency procedures, emergency escape plans, emergency equipment, emergency escape routes (including signage), emergency communication facilities, and external emergency support, etc.,
- Monitoring data related to incidents associated with specific work activities,
- The findings of any existing assessments relating to hazardous work activity,
- Details of previous unsafe acts either by the individuals performing the activity or by others (e.g. adjacent personnel, visitors, contractors, etc.),
- The potential for a failure to induce associated failures or disabling of control measures,
- The duration and frequency at which tasks are carried out,
- The accuracy and reliability of the data available for the risk assessment,


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- Any legal and other requirements which prescribe how the risk assessment has to be performed or what constitutes an acceptable risk, e.g. sampling methods to determine exposure,
- Use of specific risk assessment methods, or permissible exposure levels.

2.7 Considering all of the hazards associated with the job task (and using the Hazard Matrix), provide an overall classification for the job/task in the Task Hazard Analysis. This classification can be used as a guideline for prioritizing and determining the level and number of controls required.

## Hazard classification matrix

| Severity | | Probability | | | | |
|---|---|---|---|---|---|---|
| | | Very Likely | Likely | Possibly | Rarely | Unlikely |
| | | 5 | 4 | 3 | 2 | 1 |
| **Catastrophic** (death, environmental disaster, extensive damage, extended downtime for company or site, huge cost) | 5 | 10 | 9 | 8 | 7 | 6 |
| **Major** (serious injury, severe environmental damage, major cost) | 4 | 9 | 8 | 7 | 6 | 5 |
| **Moderate** (medical treatment required, contained environmental impact, high cost) | 3 | 8 | 7 | 6 | 5 | 4 |
| **Minor** (First aid required, some environmental/financial impact) | 2 | 7 | 6 | 5 | 4 | 3 |
| **Insignificant** (no injuries, low environmental/financial impact) | 1 | 6 | 5 | 4 | 3 | 2 |

**Probability: How likely is it to happen?**

| | |
|---|---|
| **Very Likely** | Likelihood of incident happening often during course of the work activity |
| **Likely** | Likelihood of incident occurring sometime during the work activity |
| **Possibly** | Possibility of incident occurring sometime during the work activity |
| **Rarely** | Incident will rarely occur during the work activity |
| **Unlikely** | Incident will probably not occur during the work activity |

**Hazard Classification:**

**HIGH**

**MED**

**LOW**

## 3.0 Hazard Control

Once identified and classified, all hazards must have an effective means of control which can be accomplished by using one or more of the following means of control:

### 3.1 Elimination (first)

- Choose a different process
- Modify an existing process
- Substitute with less hazardous substance

### 3.2 Engineering Controls (second)

- Physically alter the plant or equipment design in order to circumvent possible hazards
- Place guards on machinery
- Construct catwalks to divert traffic from hazardous areas

### 3.3 Administrative Controls (third)

- Affect the job procedure and/or process in order to reduce hazards
- Implement rules to change unsafe behaviors
- Limit the amount of time an individual is in a hazardous environment through job rotation

### 3.4 Personal Protective Equipment (fourth)

- Provide employees with direct physical protection while working in a hazardous environment

All identified hazards must have an effective means of control to minimize the potential for an incident; however, hazards with higher classifications should be addressed first and will undoubtedly require a variety of the types of controls mentioned above.


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# 05-210-Project Safety Meetings

## 1.0 Purpose and Scope

1.1 Establishes the requirements for conducting and documenting meetings on topics that are designed to promote Safety, Health & Environmental (SH&E) awareness and facilitate discussion regarding hazards and risks.

1.2 This procedure applies to all Resolution Consultants employees and operations in the performance of services directed and controlled by Resolution Consultants.

## 2.0 Terms and Definitions

None.

## 3.0 References

None.

## 4.0 Procedure

### 4.1 Project Initiation/Kick-off meeting

4.1.1 A project initiation/kick-off safety meeting will be conducted prior to the start of field operations. Discussion points for this meeting will come from the project-specific SH&E documentation (e.g., Health and Safety Plan (HASP), Safe Work Plan, Task Hazard Analysis, etc.). The meeting will involve representatives from all organizations with a direct contractual relationship with Resolution Consultants on the job site. Topics for this meeting will include:

- Communication to all participants regarding on site SH&E responsibilities and authority.
- Establishing safety points of contact for each organization and phase of work.
- Communication of organizational SH&E performance expectations.
- Identification of significant project SH&E issues, risks, and solutions.
- Coordination of organizational SH&E conflicts and interactions.

### 4.2 Timing of Meetings

4.2.1 Change in Scope/Activity– Conducted for all Resolution Consultants staff and site personnel with a direct contractual relationship with Resolution Consultants to discuss changes to scope or a new phase of work.

4.2.2 Periodic – Conducted at a regular, recurring frequency of not less than biweekly, but preferably once per week.

4.2.3 Daily – Daily safety discussions as part of daily routine project coordination meetings. Daily meetings are required for HAZWOPER activities and other activities as identified in the safety plan. Daily safety discussions will involve representatives from all organizations with a direct contractual relationship with Resolution Consultants on the job site.

4.2.4 Significant Personnel Turn-over – Conducted at the start of any workday where a new organization begins work on site or when more than 25 percent of the day's work force is new to the site.

4.2.5 Post-Incident – Conducted at the start of the work day following the occurrence of a significant incident as defined in *5-004 Incident Reporting*. All project initiation/kick-off safety meetings will be documented using the *5-210 Form 1 Tailgate Safety Meeting Log*.

4.2.6 All special situation safety meetings listed above will include review of applicable Task Hazard Analyses for the scope of services to be performed and be documented using the *5-210 Form 1 Tailgate Safety Meeting Log* or equivalent.

4.2.7 Daily safety discussions not otherwise required by HAZWOPER or the project safety plan will be documented.


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4.3 **Supplemental Training Meetings**

4.3.1 The PM, Site Supervisor or Site Safety Officer (SSO) will implement worker training on general safety topics as part of routine on-site training activities. Where such training is conducted it will be documented on the *5-210 Form 1 Tailgate Safety Meeting Log*.

## 4.4 Safety Orientation

4.4.1 All project employees will attend a project-specific safety orientation and training session prior to the start of any project and/or task.

4.4.2 The PM, site supervisor, or SSO will conduct the meeting based on project specifics (e.g., location, unique hazards and risks, client requirements, etc.) and any mandatory topics required by *5-003 SH&E Training*. The Regional SH&E Manager can provide examples of project safety orientation material for reference.

4.4.3 The depth/level of training will be commensurate with the job function(s) to be performed. Site visitors will receive general orientation and task-specific training.

4.4.4 At a minimum, employee orientation and training will consist of the items listed below:

- Identification of hazards associated with the individual's job function and responsibilities.
- Specific safety procedural instruction needed to perform his or her required job function or task.
- Content of the HASP and any Task Hazard Analyses (THA) in accordance with *5-209 Project Hazard Assessment and Planning*.

## 4.5 Periodic Safety Training Meetings

4.5.1 Sit-down safety training meetings will be scheduled and conducted throughout the duration of the project.

4.5.2 Meetings shall give project personnel an opportunity to maintain a high degree of safety awareness through timely and quality safety education. Meeting time will be used to discuss specific safety topics and obtain employee feedback.

4.5.3 Safety meetings will be conducted by the PM, Site Supervisor or SSO and supplemented by lead persons of the various crafts represented at the site (e.g., electrician, heavy equipment operator, foreman, inspector, resident engineer, etc.).

4.5.4 Topics for discussion will include SH&E hazards noted during routine and non-routine work situations and an explanation of job safety procedures unique to the project.

4.5.5 The PM and SSO will monitor safety meetings to ensure that subject matter is properly presented.

4.5.6 All periodic safety meetings will be documented using the Safety Training Log (Attachment 3). Sign-in of every meeting participant is required to ensure proper accountability and to meet Resolution Consultants project recordkeeping requirements.

4.5.7 Safety, Health and Environmental considerations will be discussed at every project meeting. Once on-site:

- All on-site personnel must review and acknowledge the form or plan at a “tailgate” or “toolbox” meeting.
- Any new or previously unidentified hazards must be documented on the form or plan as a Revision and acknowledged with initials by all on-site staff.
- The Project Safety Plan must be reviewed regularly as required and documented on the plan.

4.5.8 All signed copies of the field forms and project plans must be placed in the appropriate project folder.

## 4.6 Roles and Responsibilities

4.6.1 **SH&E manager** shall provide assistance to Project Managers (PM) as required to carry out the requirements of this Standard Operating Procedure (SOP), particularly in the area of making training materials available and providing spot-checks of proper documentation.

4.6.2 **Task Order Managers** shall ensure that PMs of projects within their areas of responsibility are conducting and properly documenting safety meetings in accordance with requirements of this SOP.

4.6.3 **Project Managers (field task managers, supervisors)** shall ensure that all employees and personnel under the control of Resolution Consultants (e.g., subcontractors, temporary agency

employees) assigned to projects within their areas of responsibility participate in project initiation/kick-off meetings, special situation meetings, task hazard analyses, on-site safety inspections, and supplemental training meetings.

## 5.0 Records

None.

## 6.0 Attachments

6.1 5-210 Form 1 Tailgate Safety Meeting Log


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# 05-210-Tailgate Safety Meeting Log

This sign-in log documents the topics of the tailgate safety briefing and individual attendance at the briefing. Personnel who perform work operations onsite are required to attend each safety briefing and acknowledge their ability to ask questions and receipt of such briefings daily. Please provide a brief narrative of the following topics as applicable to the Project.

| **Name of Meeting Leader** | **Signature** |
|---|---|
| | |

**PROJECT NAME & LOCATION**

| **PROJECT NO.** | **DATE/TIME** | **WEATHER CONDITIONS** |
|---|---|---|
| | | |

**TOPIC**
***Discussion – check one***

| | | | | | |
|---|---|---|---|---|---|
| Today's Scope of Work (All tasks) | ☐ yes | ☐ n/a | Access / Egress / Slips, Trips, & Falls | ☐ yes | ☐ n/a |
| Schedule / New Work / Scope Changes | ☐ yes | ☐ n/a | Smoking, Eating, & Drinking | ☐ yes | ☐ n/a |
| Reviewed Procedures, THA, etc. | ☐ yes | ☐ n/a | Washroom / Facilities Location | ☐ yes | ☐ n/a |
| Emergency Action Plan & Procedures | ☐ yes | ☐ n/a | Heat/Cold Stress | ☐ yes | ☐ n/a |
| Communications Protocol | ☐ yes | ☐ n/a | Exclusion Areas Barricades / Cones | ☐ yes | ☐ n/a |
| Required PPE | ☐ yes | ☐ n/a | Required Permits, Passes, Keys, etc. | ☐ yes | ☐ n/a |
| Required Monitoring / Instruments | ☐ yes | ☐ n/a | Decon Procedures / IDW Mgmt. | ☐ yes | ☐ n/a |
| Site Control / Work Zones / Security | ☐ yes | ☐ n/a | Eqpmt. Inspections/Safety Checklists | ☐ yes | ☐ n/a |

**COMMENTS/OTHER**

**Tailgate Meeting Attendees**

| **Print Name** | **Signature** |
|---|---|
| | |
| | |
| | |
| | |
| | |

**SIX QUESTIONS FOR SUCCESS** – As your final preparedness take two minutes to think through and answer these questions**:**

1. What are we about to do?
2. What equipment are we going to use?
3. Have I/we been trained to use this equipment?
4. Have I/we been trained to do this job?
5. How can I/we be hurt?
6. How can I/we prevent this incident?

*If you and your team aren't prepared to do the assigned work, STOP WORK, and take time to properly prepare.*

**END OF DAY SIGN-OFF:**

_____

Site Safety Officer Signature

☐ No Incidents Occurred

☐ Number of Near Misses/Observations Reported

☐ All Incidents Reported the Incident Reporting Line

**LESSONS LEARNED/COMMENTS/OTHER**

# 5-305- Hand and Power Tools

## 1.0 Purpose and Scope

1.1 This procedure provides Resolution Consultants' requirements for all manually-operated hand and power tools and equipment use, handling and storage.

1.2 Applies to all Resolution Consultants staff and field worksites.

## 2.0 Terms and Definitions

None.

## 3.0 References

3.1 5-305-Hand and Power Tools

3.2 5-410-Hazardous Energy Control

3.3 5-302-Electrical, General

3.4 5-208-Personal Protective Equipment Program

3.5 5-510-Hearing Conservation Program

## 4.0 Procedure

### 4.1 Roles and Responsibilities

**4.1.1** **Project Manager (Field Task Manager, Supervisor)** Each Manager/Supervisor must ensure that all aspects of this procedure are followed and adhered to on all Resolution Consultants projects, sites and locations. If a specific tool is not included in this work instruction section of this SOP, appropriate guidelines shall be established prior to work associated with that equipment, including following manufacturer's recommendations.

**4.1.2** **Regional SH&E Professionals** provides technical guidance and support as to this procedure.

**4.1.3** **Employees** shall not work with any tool that they are not familiar with without first obtaining training associated with that equipment. In addition, employees must following manufacturer's recommendations for its use and must not modify the equipment without first obtaining authorization from the manufacturer.

### 4.2 Restrictions

4.2.1 No employee shall use any hand tool, unless they are familiar with the use and operation of the equipment or have received specific instruction on its use and operation.

4.2.2 All tools will be used in accordance with manufacturer's specifications. Personnel involved in the performance of certain activities will not be permitted to smoke, eat, drink, or use smokeless tobacco, except during breaks (e.g., HAZWOPER-controlled work areas).

### 4.3 Training

4.3.1 Instruction in the proper use, safe handling, and maintenance of tools will be provided to employees unfamiliar with the tool.

### 4.4 Personal Protective Equipment

4.4.1 Lockout devices (padlocks, multiple lock hasps, tags), gloves appropriate to the task, safety-toed boots, as required, hard hats and eye & face protection, as required.


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4.5 **Inspections**

4.5.1 All tools must be inspected prior to each use. Any tool that is defective or has missing parts must not be used. Every broken or defective tool must be tagged or identified as such. Tagged tools will be returned to your supervisor for repair or replacement. Tagged tools will be immediately removed from service.

4.5.2 All tools must be inspected to manufacture's specifications according to tool rests and guard adjustment tolerances. All tools will be inspected to ascertain that all safety devices are present and functioning properly.

## 5.0 Records

None.

## 6.0 Attachments

None.

## 7.0 Records

None.

## 8.0 Attachments

None.


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# 5-306-Highway and Road Work

## 1.0 Purpose and Scope

1.1 To address potential hazards that may occur during highway construction and during work within the right of way of a public or private roadway.

1.2 This procedure applies to all Resolution Consultants employees and operations.

## 2.0 Terms and Definitions

2.1 **Personal Protective Equipment (PPE)**: Safety clothing and equipment worn by workers in traffic areas to provide protection and heightened visibility from physical hazards including moving vehicles and construction equipment.

2.2 **Traffic areas**: Any work area where workers are located within 20 feet of moving traffic, existing or anticipated.

2.3 **Traffic Control Plan**: A written document containing drawings and text that describes the physical controls to be established to isolate workers from moving vehicles.

2.4 **WOF:** Workers on foot.

## 3.0 References

3.1 None.

## 4.0 Procedure

4.1 **Roles and Responsibilities**

4.1.1 **Project/Lead Manager or Resident Engineer** is responsible for administering the procedure and for determining the measures and configuration of the temporary traffic control zone in accordance with specifications for workers, motorists, and pedestrians and the protection of Resolution Consultants employees within the contract. The Lead Manager will also see that employees assigned to work in traffic areas are trained in the use of traffic control systems and PPE.

4.1.2 **Site Safety Coordinator** is responsible to the lead manager for the implementation of safety and the internal traffic control plan within a highway construction/demolition worksite. The Site Safety Coordinator will

- Be responsible for traffic safety coordination on office projects.
- Be appointed by each office that has any field work involving Resolution Consultants staff working in or near traffic. This is not a dedicated role and may be a committee member.
- Receive training in the requirements of the governing transportation authority and the applicable OH&S legislation through training sanctioned by the respective authorities.
- Be involved in conducting hazard assessments, developing the mitigating strategies and Safe Job Procedures, and reviewing their implementation for any project where traffic is identified as a hazard to our team members.

4.2 **Personal Protective Equipment**

4.2.1 High visibility safety vest /apparel

4.2.2 Retro-reflective stripes (for night work)

4.2.3 Protective headwear (hard hat)

4.2.4 Two-way radio or other means of effective communication


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4.2.5 Traffic Accommodation equipment, as required by the traffic protection plan:

- A rooftop beacon light for the vehicle, where required
- Pylons, Glo-posts, flags, barricades and/or flagging tape, warning lights, flashing light boards
- Signage
- Flagging equipment, as required:
  - Daytime:
    - Flag person's "Stop and Slow" paddle
    - A blaze orange flag person's vest over white coveralls
    - Safety head protection (hard hat)
    - Drinking water
    - Bug repellent and/or sun screen as conditions warrant
    - Optional radio communication (if required)
  - Night time (additional requirements):
    - A retro-reflective "Stop and Slow" paddle
    - A flashlight fitted with a red signaling baton
    - Flashing yellow beacons set up in advance of the flag person

4.3 **Restrictions**

4.3.1 Applicable legislated requirements governing all aspects of traffic safety, including directing traffic, signage, PPE, traffic control devices in temporary construction, maintenance and utility work zones, will be reviewed in preparation for the site-specific traffic accommodation.

4.3.2 No personnel will be allowed onto the site without first reviewing the project-specific traffic protection plan.

4.4 **Training**

4.4.1 All staff will receive on-site orientation to the hazards and controls.

4.4.2 Only staff with appropriate flag person training will act as a flag person.

4.5 **Traffic Control Plan**

4.5.1 Transportation incidents and workers struck by vehicles or mobile equipment account for many fatal construction work injuries. Workers in highway construction activities including flagging, demolition, surveying, utility, clean-up, emergency responders, and others in areas where traffic exists are exposed to being struck by moving vehicles. Work zones are used to move traffic in an approved direction and are typically identified by signs, cones, barrels, and barriers.

4.5.2 The procedures appropriate for work in traffic areas will vary depending on the work environment. Very simple procedures are needed in an inactive parking lot, and more complex procedures are needed when working in a construction zone on a highway. Each Resolution Consultants project team shall prepare a project Health and Safety Plan (HASP) or Safe Work Plan (SWP) addressing traffic controls and worker protection appropriate for the team's project and exposures. Plans shall address the following if applicable:

- Attenuator vehicles
- Closures within a closure
- Communications
- Driving: seatbelts and rollover protection should be used on equipment and vehicles as stated by the manufacturer
- Night operations and work within traffic controls
- PPE

- Sanitation
- Signage
- Traffic control devices
- Traffic control plans and permits
- Training
- Work zone protections: various styles of concrete, water, sand, collapsible barriers, crash cushions, and truck mounted attenuators are available to limit motorist intrusions into the construction work zone
- Worker: heavy equipment interface

4.5.3 A Traffic Control Plan will be completed for the movement of vehicles in areas where workers are conducting other tasks.

4.5.4 Drivers, workers on foot (WOF), and pedestrians will be able to see and understand the routes they are to follow.

4.5.5 Where there are several projects, coordinated vehicle routes and communication between contractors will reduce vehicular struck-by incidents.

4.5.6 Hazard identification and plan development shall be performed in accordance with this procedure. The plans shall include the identification of the responsibility for personnel and implementation of the safety program under highway construction activities.

4.5.7 Other requirements for supporting activities such as excavations, heavy equipment usage, personal protective equipment, etc. shall be applicable and addressed in accordance with other Standard Operating Procedures.

- A traffic protection plan will be an integral part of the HASP or SWP whenever staff will be exposed to the hazards of vehicular traffic during project work (this may include surveys, drilling and soils inspections, bridge or overpass inspections, inspection of roadway construction projects).
- Work duration, road width, and traffic volume are some of the key considerations to be contemplated when designing a traffic protection plan. The traffic protection plan will address the specific vehicular hazards and describe the measures that will be implemented to protect employees.
- Traffic accommodation plans will be developed in consultation with a qualified supervisor or manager experienced in traffic control. In addition, a supervisor will be designated to oversee the implementation of the protection plan until work is completed.
- OH&S regulations and associated standards or guidebooks provide instruction on the use of traffic control devices in temporary construction, maintenance, and utility work zones for worker and motorist safety and to minimize the disruption of traffic flow.
- Schedule work to avoid periods of heavy traffic.
- Alert traffic of work ahead, by placing signs or cones well ahead of the work area.
- If the work area is being managed under a Traffic Control Plan or Traffic Accommodation Plan, obtain copies of these plans before commencing work.
- Traffic accommodation that is adequate in good weather conditions and daylight may not be adequate under adverse weather conditions and/or hours of darkness. Reassess the accommodation based on conditions.
- Traffic accommodation will be planned to provide safe conditions for the protection and safe passage of motorists, pedestrians, and employees at all work sites. It will include all areas located within the traveled portion of a roadway including shoulders, ditches, and boulevards.

4.6 **Short-Term Traffic Protection**

4.6.1 Always wear the appropriate PPE to maintain your visibility to vehicular traffic. Wear a tear-away fluorescent reflective vest (and retro-reflective stripes on the arms and legs for night work or during periods of limited visibility) at all times.

4.6.2 Pull your vehicles off as far to the right of the travelled portion of the road as possible. Confirm that the shoulder of the highway or street where you will park your vehicle is wide enough to allow for safe access to and egress from the vehicle.

4.6.3 Always park your vehicle at least 30 metres from the flag person station. The vehicle should be positioned between the flag person and the work crew.

4.6.4 Activate the four-way flashers for your vehicle prior to exiting the vehicle.

4.6.5 Plan an escape route prior to exiting the vehicle.

4.6.6 Load and unload materials or equipment from the passenger side of the vehicle.

4.6.7 Avoid turning your back to oncoming traffic.

4.6.8 Be aware of mobile equipment that may be operating in the work area.

4.6.9 Do not enter onto the travelled portion of the road except to cross the road. Road crossings should be made at a 90 degree angle to the direction of the road.

4.7 **Long-Term Traffic Protection**

4.7.1 Traffic accommodation will be provided BEFORE the work starts and will be maintained until the work is completed. This may mean 24 hours a day, 7 days a week.

4.7.2 Generally, for long-term duration work activities that are performed at construction projects, the Constructor for the project is required to develop a traffic protection plan.

4.7.3 If Resolution Consultants has assumed the role of Constructor for the project, the traffic protection plan will be developed and implemented prior to the commencement of work activities at the project.

4.7.4 If Resolution Consultants is not the Constructor for the project, the traffic protection plan for the project will be developed by our Client or a Constructor designated by the Client.

4.7.5 The traffic protection plan should be reviewed with Resolution Consultants employees during orientation to the Project. If the traffic protection plan is not discussed at the project-specific orientation, employees should discuss the issue with the Site Supervisor or Client contact for the Project.

4.8 **Signage**

4.8.1 Standard highway signs for information, speed limits, and work zones will assist drivers in identifying designated traffic paths.

4.8.2 Provide appropriate instructional signage such as: EVACUATION ROUTE; DO NOT ENTER; REDUCED SPEED AHEAD; ROAD CLOSED; and NO OUTLET.

4.8.3 Using standard highway signs for internal construction worksite traffic control will assist workers in recognizing the route they are to use at the construction site.

4.8.4 Traffic Signs

- Signage will be of acceptable standards, in good condition, clean, legible, and suited to the purpose.
- Signage will be secured or weighted.
- Routinely inspect signage for placement, cleanliness, and physical damage.
- Cover road traffic control signage when no activity is present.

4.9 **Traffic Control Devices**

4.9.1 Standard traffic control devices, signals, and message boards will instruct drivers to follow a path away from where work is being done.

4.9.2 The authority in charge will determine the approved traffic control devices such as cones, barrels, barricades, and delineator posts that will be used as part of the traffic control plan.

4.9.3 These standard devices should also be used inside the work zone.

4.10 **Work Zone Protections**

4.10.1 Various styles of concrete, water, sand, collapsible barriers, crash cushions, and truck-mounted attenuators shall be used to limit motorist intrusions into the construction work zone, as appropriate.

4.10.2 All Resolution Consultants staff shall be made aware of controls established by the Contractor.

4.10.3 Resolution Consultants staff shall wear the required safety equipment at all times including a hard hat, work boots, eye protection, and a high-visibility safety vest as a minimum and shall observe all project rules and requirements.

4.10.4 In the absence of a contractor, when Resolution Consultants staff are in the field alone—e.g., investigations, surveys—all appropriate DOT traffic control standards and devices shall be observed and placed in position.

4.10.5 The work zone shall be made safe by its separation from traffic.

4.11 **Flagging**

4.11.1 Flaggers and others providing temporary traffic control will wear high visibility clothing with a background of fluorescent yellow-green or orange-red and white, silver, yellow-green, orange, or yellow retro-reflective material.

4.11.2 In areas of traffic movement, PPE will make the worker visible for at least 1,000 feet so that the worker can be seen from any direction and will make the worker stand out from the background. Check the label or packaging to confirm that the garments are performance Class 2 or 3 (class requirement may be project-specific).

4.11.3 Drivers should be warned in advance with signs that there will be a flagger ahead.

4.11.4 Flaggers should use STOP/SLOW paddles, paddles with lights, or flags (flags should be used only in emergencies.). The STOP sign should be octagonal with a red background and white letters and border. The SLOW sign should be octagonal with an orange background and black letters and a border.

4.11.5 Flag Persons

- A traffic control person (flag person) will stand in a safe position, preferably on the driver's side of the lane under control, be clearly visible, have an unobstructed view of approaching traffic, and be positioned at least 25 m (80 ft) away from the work area unless circumstances or space requirements, such as working at or near an intersection, dictate otherwise.
- Flag persons will be trained and competent and will use appropriate PPE.
- Flag persons will be instructed in traffic control and flagging procedures, will be provided with sufficient breaks, and will not be permitted to work alone for extended periods as per local regulations.
- Flag persons will not get involved in needless conversation and will stay alert at their points of duty until relieved.
- Except for brief flagging operations, or in an emergency, "Flag Person Ahead" signs will be posted in advance of each flag person's station. Such signs will be removed promptly when the flagging operation terminates.

4.12 **Lighting**

4.12.1 Flagger stations should be illuminated. Lighting for workers on foot and equipment operators is to be at least 5 foot-candles or greater.

4.12.2 Where available lighting is not sufficient, flares or chemical lighting should be used.

4.12.3 Glare affecting workers and motorists should be controlled or eliminated.


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4.13 **Training**

4.13.1 Flaggers should be trained/certified and will use the signalling methods required by the authority in charge.

4.13.2 WOF, equipment operators, and drivers in internal work zones need to know the routes that construction vehicles will use.

4.13.3 Equipment operators and signal persons need to know the hand signals used on the worksite.

4.13.4 Operators and WOF need to know the visibility limits and the "blind spots" for each vehicle on site.

4.13.5 WOF should wear high visibility safety garments designated as Class 1, 2 or 3.

4.13.6 Workers should be made aware of the ways in which shift work and night work may affect their performance.

4.14 **Driving**

4.14.1 Seatbelts and rollover protection will be used on equipment and vehicles as stated by the manufacturer.

4.14.2 When pulling off to the side of the road, Resolution Consultants personnel will park their vehicles at minimum of 20 feet or the width of two traffic lanes from moving traffic.

4.15 **Night Operations and Work Within Traffic Controls**

4.15.1 Night work on roadways should not be done unless absolutely necessary and unless the work area is adequately lit.

4.15.2 Operations with night activities will have a written plan that addresses the safety issues of working at night. The plan will address, but is not limited to:

- Reflectivity
  - All equipment used in the work zone shall have DOT-approved reflective material placed to increase the visibility of the equipment.
  - All reflective surfaces shall be cleaned as required so that the reflectivity of the material is not degraded. Any areas of reflective surface that is damaged or obscured will be replaced.
  - Personnel working at night will have reflective tape on their hardhats and will wear retro-reflective vests at a minimum. The reflective bands on vests will be vertical and horizontal around the entire upper body.
  - Additional measures such as white disposable coveralls, reflective bands, and personal battery-operated strobe lights may be used when practical.
- Illumination
  - Whenever feasible and practical, light plants will be used to illuminate the work area.
  - On mobile operations, additional lighting on equipment may be used to illuminate the work area.
  - All equipment shall, at a minimum, have working strobe or warning beacon lights.
  - All equipment shall have working lights confirmed through daily visuals.
  - All flag persons will be placed in illuminated areas only.
  - All lighting is to be checked after setup to confirm that it is not blinding approaching traffic or other equipment in the work zone.
- Hazard Analysis and Communication
  - Prior to the start of any night operation, a detailed Hazard Analysis will be made addressing the possible hazards of night work. The Hazard Analysis will be reviewed with the crews and updated as needed. At the start of each shift, the Daily Safety Reminder will be used to reaffirm the provisions of the night work requirements as found in the hazard analysis and this policy.


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- The hazard analysis should also provide for:
  - The selection of a competent person responsible for maintaining surveillance on the work area to alert other workers of vehicles encroaching on the work zone.
  - A method to signal workers when vehicles encroach on the work zone.
  - A system to account for workers at all times, which may include a buddy system.
  - Emergency communication or warning signals used by a worker such as a radio, signal horn, or whistle, which will be used to call for help.

4.16 **Attenuator Vehicles**

4.16.1 Although not required, it is good construction practice to place an attenuator truck or pick-up truck (minimum) immediately ahead of workers in a work zone.

4.16.2 The vehicle of choice should be placed to provide the best protection for workers.

4.16.3 The tires should be placed so that when struck the vehicle will turn away from workers.

4.17 **Closures within a Closure**

4.17.1 On occasion, satellite operations may be performed under full freeway traffic closures. For this type of work, special precautions referred to as a "closure within a closure" is to be implemented in accordance with the following:

- Posted speed limits within closures should be set at 15 miles per hour.
- Signs are to be installed approximately 250 feet in advance of and behind the work zone to alert drivers who may approach from either direction of the upcoming work zone.
- The work area is to be completely delineated with Type 1 barricades (candlesticks).
- Any vehicle used for AECOM field work shall be equipped with a functioning rotating beacon placed on the roof of the vehicle.

## 5.0 Records

5.1 Traffic Protection Plans and completed Equipment Checklists will be maintained in project files.

## 6.0 Attachments

6.1 5-306 Form 1 Equipment Checklist

# 5-306-Form 1 Equipment Checklist

Name of Contractor:

Location: Project #:

Date: Time: Weather:

Person Conducting Inspection: Title:

*Note: As you conduct your inspection you should be able to answer each question with a **YES**. If the answer to any question is **NO,** this deficiency should be corrected as soon as possible.*

| | YES | NO | Deficiency Corrected? OK | N/A |
|---|---|---|---|---|
| Are accident prevention signs, tags clearly visible? | ☐ | ☐ | ☐ | ☐ |
| Are danger signs used where immediate hazards exist? | ☐ | ☐ | ☐ | ☐ |
| Are caution signs used to warn against potential hazards or to caution against unsafe practices? | ☐ | ☐ | ☐ | ☐ |
| Are exit signs posted at all exit locations? | ☐ | ☐ | ☐ | ☐ |
| Are proper visual warning signs posted prior to (in advance of) the work area? | ☐ | ☐ | ☐ | ☐ |
| Are flaggers provided with signs, signals, and barricades to provide the necessary protection? | ☐ | ☐ | ☐ | ☐ |
| Are flaggers using red lights when signalling during periods of darkness? | ☐ | ☐ | ☐ | ☐ |
| Are flaggers wearing highly visible warning garments? | ☐ | ☐ | ☐ | ☐ |
| Are the flaggers trained in proper flagging procedures? | ☐ | ☐ | ☐ | ☐ |
| Are warning garments worn at night reflectorized? | ☐ | ☐ | ☐ | ☐ |
| Are highly visible flags used by the flaggers at least 18 inches square? | ☐ | ☐ | ☐ | ☐ |
| Are barricades used to totally obstruct the passage of people and vehicles to protect the work area? | ☐ | ☐ | ☐ | ☐ |
| Do barricades meet the requirements set forth in the Manual of Uniform Traffic Control Devices? (MUTCD) | ☐ | ☐ | ☐ | ☐ |

**COMMENTS:**


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# 5-307 Housekeeping, Worksite

## 1.0 Purpose and Scope

1.1 This procedure provides Resolution Consultants' work practices as well as personal hygiene and work site sanitation standards for housekeeping.

1.2 Applies to all Resolution Consultants staff and field worksites.

## 2.0 Terms and Definitions

None.

## 3.0 References

None.

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 **Project Manager (Field Task Manager, Supervisor)** is responsible for the procedure's implementation and the details of addressing housekeeping policy within the construction/demolition worksite.

4.1.2 **SH&E Professionals** will monitor, assess, and report on project housekeeping when visiting locations.

4.1.3 Employees are responsible for reporting any areas of concern to the Site Supervisor for prompt resolution as well as for maintaining worksites that are free from debris, clutter, and slipping or tripping hazards.

### 4.2 Smoking, Eating, and Drinking

4.2.1 Eating and drinking will be permitted in designated areas at Resolution Consultant project sites and as specified on client sites. Smoking will be permitted only in areas designated in compliance with applicable local laws, regulations, legislation, and ordinances, by the Field Supervisor and situated in locations that are not in the immediate vicinity of activities associated with work site activities. Additionally, Field Supervisor will designate each smoking area giving primary consideration to those personnel who do not smoke.

4.2.2 Personnel involved in the performance of certain activities will not be permitted to smoke, eat, drink, or use smokeless tobacco, except during breaks (e.g., HAZWOPER-controlled work areas).

4.2.3 Site personnel will first wash hands and face after completing work activities and prior to eating or drinking.

### 4.3 Water Supply

4.3.1 Water supplies will be available for use on site and will comply with the following requirements:

4.3.2 Potable Water: An adequate supply of drinking water will be available for site personnel consumption. Potable water can be provided in the form of approved well or city water, bottled water, or drinking fountains. Where drinking fountains are not available, individual use cups will be provided as well as adequate disposal containers. Potable water containers will be properly identified and tape sealed in order to distinguish them from nonpotable water sources and protect the potable water integrity.

4.3.3 Nonpotable Water: Nonpotable water will not be used for drinking purposes. Nonpotable water may not be used for hand washing or other personal hygiene activities but may be used for other types of cleaning activities. All containers/supplies of nonpotable water used will be properly identified and labelled as such.

### 4.4 Toilet Facilities

4.4.1 Toilet facilities will be available for site personnel and visitors. Should subcontractor personnel be located on-site for extended periods, it may become necessary to obtain temporary toilet facilities.


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Exceptions to this requirement will apply to mobile crews where work activities and locations permit transportation to nearby toilet facilities.

4.4.2 A minimum of one toilet will be provided for every 20 site personnel, with separate toilets maintained for each sex, except where there are less than five total personnel on site. For mobile crews where work activities and locations permit use of nearby toilet facilities (e.g., gas station, or rest stop), on-site facilities are not required.

4.4.3 Washing Facilities

4.4.4 Hand and Face: Site personnel will wash hands and face after completing work activities and prior to breaks, lunch, or completion of workday.

4.4.5 Personal Cleaning Supplies: Cleaning supplies at Resolution Consultant project sites will consist of soap, water, and disposable paper towels or items of equal use/application (e.g., anti-bacterial gels, wipes, etc.).

## 4.5 Clothing and Personal Protective Equipment (PPE)

4.5.1 All PPE will be kept clean at all times and maintained in accordance with the manufacturer's, Resolution Consultant's. and applicable regulatory, legislative, or provincial requirements.

4.5.2 General Work Areas

4.5.3 At all times work areas will be kept free of dirt and debris that may impact the safety of site personnel and visitors. All trash receptacles will be emptied regularly.

4.5.4 Break Areas and Lunchrooms

Site personnel will observe the following requirements when using break areas and lunchrooms at Resolution Consultant project sites:

4.5.5 All food and drink items will be properly stored when not in use.

4.5.6 Food items will not be stored in personal lockers for extended periods in order to prevent the potential for vermin infestation.

4.5.7 Perishable foods will be refrigerated whenever possible.

4.5.8 All waste food containers will be discarded in trash receptacles.

4.5.9 All tables, chairs, counters, sinks, and similar surfaces will be kept clean and free of dirt, waste food, and food containers at all times.

4.5.10 Refrigerators used to store food items will be maintained at 45 degrees Fahrenheit and emptied of all unclaimed food items weekly. Refrigerators used to store food will be labelled as such so that only food and drinks are stored within the refrigerator.

4.5.11 Routine cleaning of refrigerators will also be performed on a regular basis.

## 4.6 Vermin Control

4.6.1 Every enclosed workplace shall be constructed, equipped, and maintained, so far as reasonably practicable, to prevent the entrance or harborage of rodents, insects, and other vermin.

4.6.2 A continuing and effective extermination program shall be instituted where the presence of rodents, insects, or other vermin is detected.

## 4.7 General Housekeeping

4.7.1 All work areas shall be kept clean to the extent that the nature of the work allows.

4.7.2 Every work area shall be maintained, so far as practicable, in a dry condition. Where wet processes are used, drainage shall be maintained and platforms, mats, or other dry standing places shall be provided, where practicable, or appropriate waterproof footgear shall be provided.

4.7.3 Protruding objects or placement of materials on paths or foot traffic areas present a problem with regard to slips, trips, falls, and puncture wounds. Personnel will use a reasonable amount of effort to keep slip, trip, and fall hazards to a minimum.


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4.7.4 Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) prior to disposal.

4.7.5 At no time will debris or trash be intermingled with waste PPE or contaminated materials.

4.7.6 Material and equipment must be placed, stacked, or stored in a stable and secure manner. Stacked material or containers must be stabilized as necessary by interlocking, strapping, or other effective means of restraint to protect the safety of workers.

4.7.7 An area in which material may be dropped, dumped, or spilled must be guarded to prevent inadvertent entry by workers or protected by adequate covers and guarding.

4.7.8 Floors, platforms, ramps, stairs, and walkways available for use by workers must be maintained in a state of good repair and kept free of slipping and tripping hazards. If such areas are taken out of service, the employer must take reasonable means for preventing entry or use.

4.7.9 Hazardous areas not intended to be accessible to workers must be secured by locked doors or equivalent means of security and must not be entered unless safe work procedures are developed and followed.

### 4.8 Worksite Offices and Trailers

Worksite offices and trailers will be maintained in accordance with *RC-103-Housekeeping, Office.*

## 5.0 Records

None.

## 6.0 Attachments

None.


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# 5-308-Manual Lifting, Field

## 1.0 Purpose and Scope

1.1 This procedure provides the requirements for use when performing manual materials handling activities (e.g., lifting/handling of items or materials).

1.2 This procedure applies to all field staff for Resolution Consultants operations.

## 2.0 Terms and Definitions

2.1 **Manual Materials Handling:** Moving or handling things by lifting, lowering, pushing, pulling, carrying, holding, or restraining.

2.2 **Team Handling:** Team handling occurs when more than one person is involved during the lift.

## 3.0 References

3.1 OSHA Technical Manual: http://www.osha.gov/dts/osta/otm/otm_vii/otm_vii_1.html

3.3 National Safety Council: www.nsc.org

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 The **Project Manager** will effectively implement the procedure, providing resources as required, and providing direction on proper lifting/handling techniques.

4.1.2 The **Resolution Consultants Health and Safety Manager** will assist in identifying activities with a high potential for lifting/handling strains/injuries as well as the associated mitigation strategies and training on proper lifting/manual materials handling techniques.

4.1.3 **Employees** are responsible for reviewing and following *5-308- Manual Lifting Safe Work Practices*.

### 4.2 Mechanical Controls

4.2.1 Mechanical equipment or assistance such as dollies, carts, come-alongs, or rollers are preferable to be used whenever possible rather than the employee physically moving materials.

4.2.2 Mechanical assistance will be of proper size, have wheels sized for the terrain, and be designed to prevent pinching or undue stress on wrists.

4.2.3 Objects to be moved will be secured to prevent falling and properly balanced to prevent tipping.

### 4.3 Administrative Controls

4.4 When significant, sustained lifting work is required, it is desirable to rotate employees to spread the work load among several people and thereby avoid fatigue.

4.5 Rotation is not simply performing a different job but instead is performing a job that utilizes a completely different muscle group from the ones that have been overexerted.

## 5.0 Records

None.

## 6.0 Attachments

None.


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# 5-309 Mobile or Heavy Equipment

## 1.0 Purpose and Scope

1.1 Outline the safe working requirements for working with and near mobile equipment and heavy equipment operation.

1.2 This procedure applies to all Resolution Consultants employees and operations.

## 2.0 Terms and Definitions

2.1 **Heavy equipment:** All excavating equipment include scrapers, loaders, crawler or wheel tractors, excavators, backhoes, bulldozers, off-highway trucks, graders, agricultural and industrial tractors, and similar equipment.

2.2 **Operator:** Any person who operates the controls while the heavy equipment in is motion or the engine is running.

2.3 **Ground personnel/workers:** Personnel performing work on the ground around heavy equipment (note: operators are considered ground personnel when outside of the equipment cab).

## 3.0 References

3.1 5-205 Equipment Inspections & Maintenance

## 4.0 Procedure

4.1 For work under Resolution Consultants' control, Project Managers are responsible for ensuring all equipment is in good working order and all equipment operators are qualified on the piece of machinery they are assigned.

4.2 Staff will confirm that all rented equipment arrives in proper working order with the manufacturer's operating manual before acceptance from the supplier.

4.3 The operator of mobile equipment is the only worker permitted to ride the equipment unless the equipment is a worker transportation vehicle.

4.4 A person will not operate mobile equipment unless the person has received adequate instruction and training in the safe use of the equipment, has demonstrated to a qualified supervisor or instructor competency in operating the equipment.

4.5 The operator of mobile equipment will operate the equipment safely, maintain full control of the equipment, and comply with the laws governing the operation of the equipment

4.6 **Communication**

4.6.1 Communication between site supervisors/managers, heavy equipment operators, and other site personnel is a key method of preventing serious injury or death during heavy equipment operations.

4.6.2 The following outline the communication requirements during heavy equipment operations:

- Site supervisors/managers shall confirm that all operators are notified/informed of when, where, and how many ground personnel will be working on site.
- Site supervisors/managers shall inform all ground personnel before changes are made in the locations of designated work areas.
- Prior to work initiating onsite the site supervisor/manager is to confirm all operators and ground personnel are trained on the hand signals that will be used to communicate between operators and ground personnel.
- Personnel working around heavy equipment operations are to maintain eye contact with operators to the greatest extent possible (always face equipment). Never approach equipment from a blind spot or angle.


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- All heavy equipment whose backup view can be obstructed shall be equipped with reverse warning devices (i.e., backup alarms) that can be significantly heard over equipment and other background noise. Reverse signaling lights shall be in working order.
- When feasible, two-way radios shall be used to verify the location of nearby ground personnel.
- When an operator cannot adequately survey the working or traveling zone, a guide shall use a standard set of hand signals to provide directions. Flags or other high visibility devices may be used to highlight these signals.

4.7 **Ground Personnel**

4.7.1 Ground clearance around heavy equipment may significantly reduce hazards posed during heavy equipment operations.

4.7.2 The following outline the clearance requirements during heavy equipment operations:

- Ground personnel shall always yield to heavy equipment.
- Ground personnel shall maintain a suitable “buffer” area of clearance from all active heavy equipment.
- A job-specific hazard analysis that identifies any special precautions shall be completed and communicated to all Resolution Consultants personnel.
- Site supervisors/managers shall designate areas of heavy equipment operation and confirm that all ground personnel are aware of designated areas. Designated areas shall include boundaries and travel routes for heavy equipment. Travel routes shall be set up to reduce crossing of heavy equipment paths and to keep heavy equipment away from ground personnel.
- When feasible, site supervisors/managers shall set up physical barriers (e.g., caution tape, orange cones, concrete jersey barriers) around designated areas and confirm that unauthorized ground personnel do not enter such areas.
- Operators shall stop work whenever unauthorized personnel or equipment enter the designated area and only resume when the area has been cleared.
- Operators shall only move equipment when aware of the location of all workers and when the travel path is clear.
- Ground personnel shall never stand between two pieces of heavy equipment or other objects (i.e., steel support beams, trees, buildings, etc.).
- Ground personnel shall never stand directly below heavy equipment located on higher ground.
- If working near heavy equipment, ground personnel shall stay out of the travel and swing areas (excavators, all-terrain forklifts, hoists, etc.) of all heavy equipment.
- Ground personnel shall never work near heavy equipment.
- Personnel shall keep all extremities, hair, tools, and loose clothing away from pinch points and other moving parts on heavy equipment.
- Personnel shall not talk on a cell phone while standing or walking on a roadway or other mobile equipment path.

4.7.3 At a minimum, all ground personnel and operators outside of heavy equipment shall wear the following:

- High visibility, reflective (Class 2) safety vest that is visible from all angles and made of fluorescent material and orange, white, or yellow reflective material (confirm that vest is not faded or covered with outer garments, dirt, etc.).
- Retro-reflective striping for arms and legs (night work)
- ANSI-CSA approved hard hat
- ANSI-CSA approved safety glasses with side shields
- ANSI-CSA approved work boots (unless project requirements are more stringent)
- ANSI-CSA approved hearing protection as needed
- Appropriate work clothes (i.e., full length jeans/trousers and a sleeved shirt; no tank, crew tops or other loose clothing permitted).

## 4.8 Prior to work commencing

4.8.1 All mobile equipment will be regularly inspected pre-shift and then regularly as required with the details of the inspection recorded in a log book.

4.8.2 The operator will report defects and conditions affecting the safe operation of the equipment to the supervisor or employer. Any repair or adjustment necessary for the safe operation of the equipment will be made before the equipment is used.

4.8.3 Exposed moving parts on mobile equipment which are a hazard to the operator or to other workers will be guarded and if a part will be exposed for proper function it will be guarded as much as is practicable consistent with the intended function of the component.

4.8.4 An approved Underwriter's Laboratories (UL) 4A40BC fire extinguisher should be present on all mobile equipment.

4.8.5 Inform the operators of the equipment that Resolution Consultants employees are in the area and inquire if there are any restricted areas or specific rules or requirements. In some industrial facilities, mobile equipment has the 'right of way'.

4.8.6 Where the operator will not have a full view of the path of travel, a signal person will be used on the ground that has a full view of the load, the operator, and the path.

4.8.7 Mobile equipment in which the operator cannot directly or by mirror or other effective device see immediately behind the machine will have an automatic audible warning device which activates whenever the equipment controls are positioned to move the equipment in reverse, and if practicable, is audible above the ambient noise level.

## 4.9 Operation

4.9.1 The operator of mobile equipment will operate the equipment safely, maintain full control of the equipment, and comply with the laws governing the operation of the equipment.

4.9.2 A supervisor will not knowingly operate or permit a worker to operate mobile equipment which is, or could create, an undue hazard to the health or safety of any person.

4.9.3 The operator of mobile equipment will not leave the controls unattended unless the equipment has been secured against inadvertent movement such as by setting the parking brake, placing the transmission in the manufacturer's specified park position, and by chocking wheels where necessary.

4.9.4 The operator will maintain the cab, floor and deck of mobile equipment free of material, tools or other objects which could create a tripping hazard, interfere with the operation of controls, or be a hazard to the operator or other occupants in the event of an accident.

4.9.5 If mobile equipment has seat belts required by law or manufacturer's specifications, the operator and passengers will use the belts whenever the equipment is in motion, or engaged in an operation which could cause the equipment to become unstable.

4.9.6 When approaching or crossing the intended path of travel of mobile equipment, establish eye contact with the operator of the mobile equipment and confirm that it is safe to proceed.

4.9.7 Have vehicle headlights on at all times when driving in the area.

4.9.8 Park motor vehicles off the haul roads, or away from the work areas.

4.9.9 Do not wear loose clothing where there is a danger of entanglement in rotating equipment.

4.9.10 Do not enter the swing area of machines such as cranes, mobile drill rigs, or excavators, without first making eye contact with the operator, and receiving permission to do so.

4.9.11 Stay out of the blind areas around mobile equipment and never assume that the equipment operators have seen them or are aware of their presence.

4.9.12 Maintain a distance of 60 cm (2 ft.) between the counterweight of swing machines and the nearest obstacle. If this distance cannot be maintained, the area will be barricaded or guarded to prevent access.

4.9.13 Vibration from moving traffic or mobile equipment can cause excavations or spoil piles to become unstable. Be aware of the risk and keep clear.

4.9.14 All heavy equipment shall be operated in a safe manner that will not endanger persons or property.


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4.9.15 All heavy equipment shall be operated at safe speeds.

4.9.16 Always move heavy equipment up and down the face of a slope. Never move equipment across the face of a slope.

4.9.17 Slow down and stay as far away as possible while operating near steep slopes, shoulders, ditches, cuts, or excavations.

4.9.18 When feasible, operators shall travel with the “load trailing”, if the load obstructs the forward view of the operator.

4.9.19 Slow down and sound horn when approaching a blind curve or intersection. Flagmen equipped with 2-way radio communications may be required to adequately control traffic.

4.9.20 Operators shall remain in cab while heavy equipment is being loaded.

4.9.21 Equipment shall be shut down prior to and during fueling. Do not smoke or use electrical devices while fueling. Fuel shall not be carried in or on heavy equipment, except in permanent fuel tanks or approved safety cans.

4.9.22 Turn off heavy equipment, place gear in neutral and set parking brake prior to leaving vehicle unattended. Buckets and blades are to be placed on the ground and with hydraulic gears in neutral. Heavy equipment parked on slopes shall have the wheels chocked.

4.9.23 Never jump on to or off of a piece of heavy equipment, always maintain 3-points of contact at a minimum.

4.9.24 Never exit heavy equipment while it is in motion.

4.9.25 Passengers shall only ride in heavy equipment designed for occupancy of passengers.

4.9.26 Never ride on the outside of a piece of heavy equipment (e.g., tailgates, buckets, steps, etc.).

4.9.27 Site vehicles will be parked in a designated parking location away from heavy equipment.

4.9.28 Operators shall never push/pull “stuck” or “broken-down” equipment unless a spotter determines that the area is cleared of all personnel around and underneath the equipment.

4.9.29 If designated for work in contaminated areas/zones, equipment shall be kept in the exclusion zone until work or the shift has been completed. Equipment will be decontaminated within designated decontamination areas.

4.9.30 Equipment left unattended at night adjacent to travelled roadways shall have appropriate lights or reflectors, or barricades equipped with appropriate lights or reflectors, to identify the location of that equipment, and shall not be closer than 6 feet (or the regulatory requirement for the work location) to the active roadway.

4.9.31 Pneumatic-tired earthmoving haulage equipment, with a maximum speed exceeding 15 miles per hour, shall be equipped with fenders on all wheels.

4.9.32 Lift trucks shall have the rated capacity clearly posted on the vehicle, and the ratings are not exceeded.

4.9.33 Steering or spinner knobs shall not be attached to steering wheels.

4.9.34 High lift rider industrial trucks shall be equipped with overhead guards.

4.9.35 When ascending or descending grades in excess of 5%, loaded trucks shall be driven with the load upgrade.

4.9.36 All belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other reciprocating, rotating or moving parts of equipment shall be guarded when exposed to contact by persons or when they otherwise create a hazard.

4.9.37 All hot surfaces of equipment, including exhaust pipes or other lines, shall be guarded or insulated to prevent injury and fire.

4.9.38 All equipment having a charging skip shall be provided with guards on both sides and open end of the skip area to prevent persons from walking under the skip while it is elevated.

4.9.39 Platforms, foot walks, steps, handholds, guardrails, and toeboards shall be designed, constructed, and installed on machinery and equipment to provide safe footing and access ways.

4.9.40 Substantial overhead protection shall be provided for the operators of fork lifts and similar equipment.

4.10 **Utilities**

4.10.1 When contacted by heavy equipment, aboveground and underground utilities may cause severe injuries or death as a result of electrocution, explosion, etc.

4.10.2 The following outline the requirements while performing heavy equipment operations that may lead to contact with aboveground or underground utilities:

- Always be aware of surrounding utilities.
- Confirm all equipment (i.e., dump trailers, loaders, excavators, etc.) is lowered prior to moving underneath of aboveground utilities.
- If equipment must travel underneath overhead utility lines, a spotter shall be utilized to communicate with the equipment operator about equipment clearance, etc.
- Confirm utilities are cleared and identified prior to beginning any earthmoving operation. Contact the local utility service providers for clearance prior to performing work. Confirm documentation of the contact is made; date, number; contact name, organization, etc.

4.11 **Training**

4.11.1 The operator or other qualified supervisor will provide all on-site personnel with an orientation to the mobile equipment and its associated hazards and controls.

4.11.2 Only designated, qualified personnel shall operate heavy equipment.

4.11.3 Operators shall have all appropriate local, state, or federal licenses or training to operate a designated piece of heavy equipment.

4.11.4 Operators shall be evaluated through documented experience and routine monitoring of activities unless the equipment is operated by a Resolution Consultants operator in which case a practical evaluation is needed. Operators shall be knowledgeable and competent in the operation of a designated piece of heavy equipment.

4.12 **Inspection and Maintenance**

4.12.1 Maintenance records for any service, repair or modification which affects the safe performance of the equipment will be maintained and be reasonably available to the operator and maintenance personnel during work hours.

4.12.2 Maintenance records will be maintained on the site or project for mobile equipment.

4.12.3 Servicing, maintenance and repair of mobile equipment will not be done when the equipment is operating, unless continued operation is essential to the process and a safe means is provided.

4.12.4 All heavy equipment shall have a documented inspection and if necessary, repaired prior to use. Operators shall not operate heavy equipment that has not been cleared for use. All machinery and mechanized equipment will be certified to be in safe operating condition (certification form attached) by a competent individual seven days prior to on-site operation, and is valid for one year.

4.12.5 All heavy equipment shall be inspected at a minimum to the manufacturer's recommendations prior to each work shift. All defects shall be reported to the site supervisor/manager immediately. Inspection records shall be maintained at the site. If a manufacturer's or company-specific inspection checklist is not provided, use the Heavy Equipment Pre-Operation Inspection Checklist (attached).

4.12.6 Defective heavy equipment shall be immediately taken out of service until repaired.

4.13 **Fueling and batteries**

4.13.1 Appropriate PPE shall be utilized when fueling or changing batteries (gloves, safety glasses, etc.)

4.13.2 A well-ventilated area shall be used for refueling.

4.13.3 Only the type and quality of fuel recommended by the engine manufacturer shall be used.

4.13.4 Fuel tanks shall not be filled while the engine is running. All electrical switches shall be turned off.

4.13.5 No one shall spill fuel on hot surfaces. Any spillage should be cleaned before starting an engine.


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4.13.6 Spilled fuel shall be cleaned with cotton rags or cloths; do not use wool or metallic cloth. If the spill results in ground impact, you shall immediately contact the Regional HSE professional for additional assistance.

4.13.7 Open flames, lighted smoking materials, or sparking equipment shall remain well away from the fueling area.

4.13.8 Heaters in carrier cabs shall be turned off when refueling the carrier or the drill rig.

4.13.9 Portable fuel containers shall not be filled completely to allow expansion of the fuel during temperature changes.

4.13.10 The fuel nozzle shall be kept in contact with the tank being filled to prevent static sparks from igniting the fuel.

4.13.11 Portable fuel containers shall not travel in the vehicle or carrier cab with personnel.

4.13.12 Fuel containers and transfer hoses shall be kept in contact with a metal surface during travel to prevent buildup of a static charge. If this is not possible then the use of a bonding strap shall be utilized to achieve bonding equilibrium.

4.13.13 Batteries shall be serviced in a ventilated area while wearing appropriate PPE.

4.13.14 When a battery is removed from a vehicle or service unit, the battery shall be disconnected ground post first.

4.13.15 When installing a battery, the battery shall be connected ground post last.

4.13.16 When charging a battery, cell caps shall be loosened prior to charging to permit gas to escape.

4.13.17 When charging a battery, the power source shall be turned off to the battery before either connecting or disconnecting charger loads to the battery posts.

4.13.18 Spilled battery acid shall be immediately flushed off the skin with a continuous supply of water.

4.13.19 Should battery acid get into the eyes, the eyes shall be flushed immediately with copious amounts of water and medical attention sought immediately.

4.13.20 To avoid battery explosions, the cells shall be filled with electrolytes. A flashlight (not an open flame) shall be used to check water electrolyte levels. Avoid creating sparks around battery by shorting across a battery terminal. Lighted smoking materials and flames shall be kept at least 25 feet away from battery-charging stations.

## 5.0 Records

5.1 Inspection records shall be maintained with the equipment.

## 6.0 Attachments

6.1 5-309 Form 1 Certification of Machinery and Mechanized Equipment

6.2 5-309 Form 2 Heavy Machinery Pre-Operation Checklist

6.3 5-309 Form 3 Brokk180 Safety Card


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# 5-309 Form 1 Certification of Machinery and Mechanized Equipment

## 1.0 General Guidelines

1.1 Subcontractor equipment shall comply with all applicable requirements for motor vehicles and material handling heavy equipment contained in 29 CFR 1926 Subpart O. Heavy equipment includes, but is not limited to, drill rigs, front end loaders, backhoes, trackhoes, bulldozers, forklifts, and similar equipment used for the implementation of the project Statement of Work.

## 2.0 Equipment Safety Inspections

2.1 The following presents general guidelines for certifying equipment is in safe operating condition before activities commence at the site and during site operations. The following guidelines are not meant to be all-inclusive.

1.1.1 All machinery and mechanized equipment will be certified to be in safe operating condition (using the attached form) by a competent individual seven days prior to onsite operation. This certification is valid for one year.

1.1.2 Equipment will be inspected on a daily basis by the owner/operator and daily logs will be maintained. All discrepancies shall be corrected prior to placing the equipment in service.

1.1.3 Inspections shall include, but are not limited to, all hydraulic lines and fittings for wear and damage, all cable systems and pull ropes for damage and proper installation, exhaust systems, brake systems, and drill controls, etc.

1.1.4 Drill rigs and related support equipment and vehicles shall be inspected by the driller in charge on a daily basis. These inspections shall be recorded on the Daily Drill Rig Checklist or on equivalent subcontractor forms.

1.1.5 Exhaustive preventive maintenance shall be conducted for all equipment according to manufacturer recommendations and/or the subcontractor's internal policies, schedules, and equipment SOPs.

1.1.6 Only designated qualified persons shall operate machinery and mechanized equipment.

1.1.7 The contractor shall maintain records of tests and inspections at the site and shall make the records available upon request of the designated authority; the records shall become part of the official project file.

1.1.8 Equipment found to not be in safe operating condition or to have a deficiency that affects the safe operation of the equipment shall immediately be taken out of service and its use shall be prohibited until safe conditions have been corrected.

1.1.9 All equipment shall be kept in the exclusion zone until work or the shift has been completed. Equipment will be decontaminated within designated decontamination areas.

1.1.10 Equipment with an obstructed rear view must have an audible alarm that sounds when equipment is moving in reverse.


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TO: Resolution Consultants

DATE:

FROM:

Project Name:

Project Location:

1. This form provides certification of machinery and mechanized equipment to be used on the referenced project for the following work:

| | |
|---|---|
| Description of equipment work: | |
| Project site: | |
| Subcontractor providing equipment:<br>Address: | |
| Dates (duration) of equipment work: | |

2. Inspection and certification of machinery and mechanized equipment, as required by Resolution Consultants, has been made prior to but within seven calendar days in advance of use on the project site. Recertification will be required for equipment that is used on the project site for more than one year.

| Identification of equipment (make, model, serial no.) | | Date of Certification |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |

3. The above listed equipment has been inspected and tested as indicated above, and is CERTIFIED TO BE IN SAFE OPERATING CONDITION BY THE FOLLOWING COMPETENT INDIVIDUAL:

| | | | |
|---|---|---|---|
| Name | | Title | |
| Company | | | |
| Signature | | Date | |

4. If there are any questions regarding this certification, please contact the following Resolution Consultants representative:



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# 5-309 Form 2 Heavy Equipment Pre-Operation Checklist

| **Project Name/Location:** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Number/Name:** | | | | | | | **Make/Model:** | | | | | | | | |
| **Hour meter reading:** | | | | | | | | | | | | | | | |
| **Check the following as appropriate** | **Operator Name/Date** | | | **Operator Name/Date** | | | **Operator Name/Date** | | | **Operator Name/Date** | | | **Operator Name/Date** | | |
| | | | | | | | | | | | | | | | |
| | **SAT** | **UNSAT** | **N/A** | **SAT** | **UNSAT** | **N/A** | **SAT** | **UNSAT** | **N/A** | **SAT** | **UNSAT** | **N/A** | **SAT** | **UNSAT** | **N/A** |
| 1. Operator qualified | | | | | | | | | | | | | | | |
| 2. Overhead guard (ROPS) | | | | | | | | | | | | | | | |
| 3. Horn | | | | | | | | | | | | | | | |
| 4. Lights | | | | | | | | | | | | | | | |
| 5. Parking brake | | | | | | | | | | | | | | | |
| 6. Service brakes | | | | | | | | | | | | | | | |
| 7. Steering | | | | | | | | | | | | | | | |
| 8. Oil level | | | | | | | | | | | | | | | |
| 9. Hydraulic oil level | | | | | | | | | | | | | | | |
| 10. Radiator fluid level | | | | | | | | | | | | | | | |
| 11. Major fluid leaks | | | | | | | | | | | | | | | |
| 12. Windows | | | | | | | | | | | | | | | |
| 13. Backup alarm | | | | | | | | | | | | | | | |
| 14. Tires (visual) | | | | | | | | | | | | | | | |


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| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15. Seat belts | | | | | | | | | | | | | | | |
| 16. Fuel leaks | | | | | | | | | | | | | | | |
| 17. Fire extinguisher | | | | | | | | | | | | | | | |
| 18. Fuel lines secure | | | | | | | | | | | | | | | |
| 19. Electrical lines | | | | | | | | | | | | | | | |
| 20. Exhaust components | | | | | | | | | | | | | | | |
| **Comments/Remarks:** | | | | | | | | | | | | | | | |



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# 5-309 Form 3 Brokk180 Safety Card

## 1.0 Objective/Overview

The Brokk 180 is an electric-powered hydraulic device used for demolishing concrete structures and refractory linings as well as excavating. This machine includes attachments designed exclusively for demolishing work (e.g., grapple, bucket, hydraulic hammer, etc.). By using the remote control unit, an operator can move the machine and attachments in different directions and speeds from afar.

## 2.0 Safe Operating Guidelines

2.1 Prior to use, complete a pre-operation inspection to determine if the unit is in safe working condition.

2.2 Position the unit to safely perform the intended task, then deploy the outriggers to stabilize the unit.

2.3 Confirm that the operator knows what the lifting capacity is; do not exceed the lifting capacity.

2.4 Complete a subsurface utility clearance prior to excavating.

2.5 Establish a minimum 15-foot clearance around the unit.

2.6 Do not allow debris to build-up around the unit. Maintain good housekeeping practices.

2.7 Prior to removing debris from under the boom, stop, disengage the unit, and position the boom so that the attachment is at rest on the ground.

2.8 Personnel operating the unit with the remote control device will be properly trained and certified by a competent person.

2.9 The operator will be able to maintain line of sight visual contact with the unit at all times to assess hazards and site security.

2.10 Maintenance in excess of preventive maintenance activities (e.g., lubrication, replenishing fluids, etc.) will be performed by manufacturer personnel ONLY.

2.11 All operations will comply with the manufacturer's recommended policies.

## 3.0 Potential Hazards

3.1 Flying debris.

3.2 Crush/impact/pinch from extendable boom, tracks, and tipping over.

3.3 Electrocution from subsurface utilities (when excavating).

3.4 Hearing loss.

## 4.0 Training Requirements

4.1 Review of applicable SOPs.

4.2 Complete knowledge and understanding of remote control functions.

4.3 Review and follow manufacturers' recommended policies and practices**.**


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## 5.0 Personal Protective Equipment (Level D ensemble)

5.1 Reflective traffic safety vest.

5.2 Hearing protection (ear plugs and/or ear muffs).

5.3 Leather gloves.

## 6.0 Other Safety Tips

6.1 Never stand under a raised boom.

6.2 Maintain a clearance of 15 feet around the unit while operating.

6.3 Pay close attention to power cords for potential tripping hazard and equipment entanglement.

6.4 Maintain line of sight visual contact with unit at all times (especially when operating from a distance).


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# 5-313-Configuration Clothing for Protection Against Ticks and Insects

## 1.0 Configuration of Clothing

1.1 Loose-cuff trousers must be tucked into socks, wrapped with duct tape (or equivalent) completely around the cuff of the sock up on to the surface of the pant leg to prevent entry of insects between the sock and pants, and preferably reverse-wrapped with “sticky” side out (see figure below). Once the clothing is configured, insect repellent containing DEET (or acceptable alternative) should be applied to the clothing.

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# 5-313-Insect Repellent Active Ingredient Product Information

## 1.0 Application of Insect Repellent

1.1 Immediately prior to the commencement of work in the field, an Resolution Consults -approved insect repellent shall be applied to exposed skin, and to the outer surface of pant leg cuffs tucked into socks, shirt tails tucked into pants at the waist, and shirt cuffs.

1.2 Table 1 provides a list of Resolution Consults-approved insect repellent active ingredients; employees may utilize any brand containing the minimum concentration of active ingredients as listed.

1.3 All products are registered with the EPA and recommended by the CDC.

1.4 Employees should select the Resolution Consults approved repellent which is best for them based on skin sensitivity/allergies, and personal preference, but be aware that reapplication frequency will be greater for Picaridin and lemon eucalyptus products.

1.5 Employees shall carefully read and comply with manufacturer recommendations and instructions on product labels prior to application. Repellent shall not be applied beneath clothing to minimize the potential for irritation and/or allergic reaction.

1.6 The chemical N,N-diethyl-*m*-toluamide (DEET) shall not be applied to Nomex™ fire retardant clothing as it reduces the effectiveness of the fabric.

**Table 1**
**Approved Insect Repellents**

| Active ingredient and minimum concentration | Products Available | Approximate Duration of Effectiveness | Notes and Web Link to Product Safety Information |
|---|---|---|---|
| Permethrin (0.5%) | -Repel® Permanone<br>-Coulston's Duranon™ | 2 weeks[1] | -Application to clothing and equipment only |
| DEET (23.8%) | -Deep Woods Off! ®<br>-Repel® Sportsmen Formula® | 5 hours[2] | -Cannot be applied to Nomex™ fabric |
| Picaridin (7%) | -Cutter Advanced™ | 4 hours[3] | -Protection equivalent to approximately 10% DEET |
| Oil of Lemon Eucalyptus (30%) | -Repel® Lemon Eucalyptus | 2 hours[2] | -Protection equivalent to approximately 7% DEET<br>-Natural, plant based product |

[1] – New York State Department of Health, 2007
[2] – Fradin and Day, 2002
[3] – Spectrum Brands, 2007

1.7 Repellent shall be reapplied multiple times daily over the course of the day at a frequency identified during the hazard assessment based on manufacturers' recommendations, the approximate effective period provided in Table 1, and other factors such as perspiration, precipitation, etc.

1.8 All approved repellents are available at most department or sporting goods stores.


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## Product Safety Information

Facts about the repellants recommended by Resolution Consults are available by clicking on the embedded link.

**National Pesticide Telecommunications Network Fact Sheet: Permethrin and Picaridin**

Picaridin

Picaridin Fact Sheet.pdf

Permethrin

Permethrin Fact Sheet.pdf

DEET

DEET Fact Sheet.pdf

Lemon Eucalyptus

Lemon Eucalyptus fact sheet.pdf


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# 5-313-Plants of Concern

## 1.0 Background

1.1 Poison ivy, oak and sumac (poisonous plants) pose a significant threat to Resolution Consultants employees due to the dermatitis that results from exposure to the oil on these plants, called urushiol.

1.2 Exposure to urushiol produces a rash that can be irritating and cause the exposed employee to scratch the infected area, increasing susceptibility for an infection to result from the rash.

1.3 It should be noted that each time an employee is exposed to urushiol, it increases the severity of the reaction they will have in subsequent exposures.

## 2.0 Treatment

2.1 In cases that involve severe rashes, medical treatment may be necessary to control the rash.

2.2 Employees that develop a rash as a result of exposure to poison ivy, oak or sumac should report the exposure immediately to their Supervisor, Project Manager and RSHEM.

**Figure 1**

**Distribution Map for Poison Ivy**

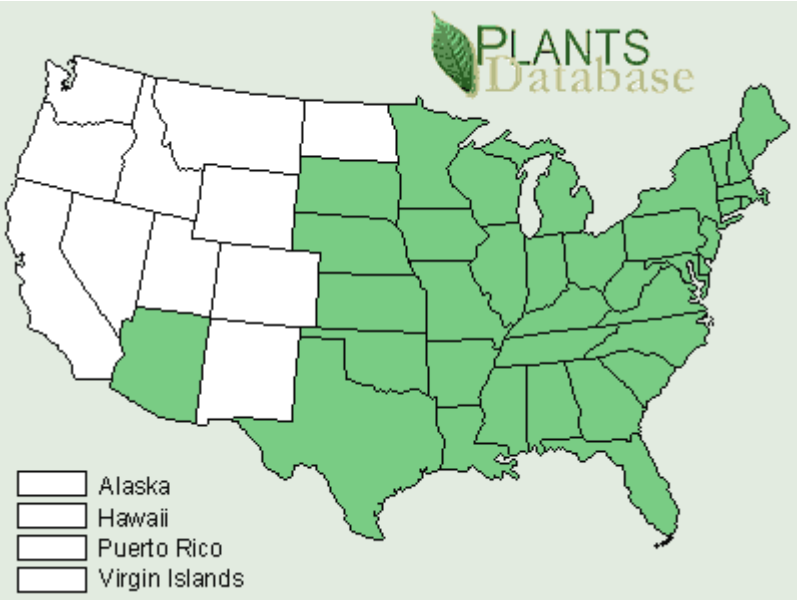



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**Figure 2**
**Distribution Map for Poison Oak**

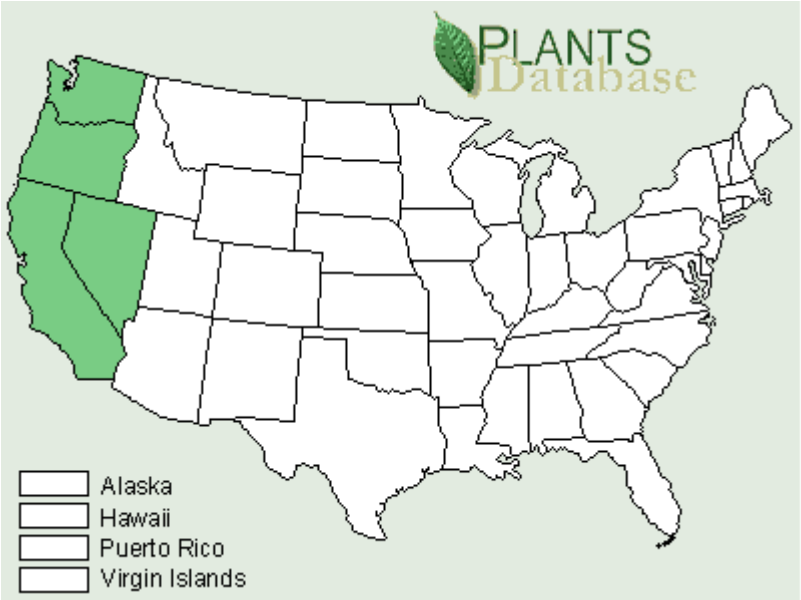
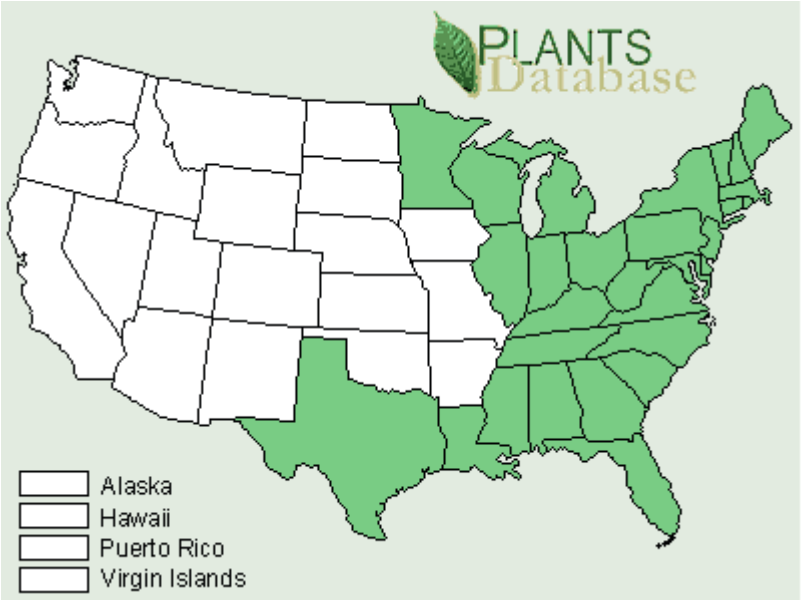



**Figure 3**
**Distribution Map for Poison Sumac**




Source for Figures 1, 2, and 3: http://www.tecnuextreme.com/plant-map.htm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# 5-313-Ticks

## 1.0 Background

1.1 The Public Health Agency of Canada (PHAC) works with the provinces, health authorities and other experts on research to define and monitor the occurrence of the ticks that carry *Borrelia burgdorferi*, the bacterium that causes Lyme disease. In Canada, the blacklegged tick (*Ixodes scapularis*; often referred to as a deer tick) and the western blacklegged tick (*Ixodes pacificus*) are the species known to transmit this disease-causing agent, as well as other less common agents.

1.2 In Quebec, blacklegged tick populations are becoming established in parts of the Monteregie and Estrie regions in the southeast of the province. In Ontario, populations can be found in Long Point; Point Pelee National Park; Rondeau Provincial Park; Turkey Point; Prince Edward Point National Wildlife Area and St. Lawrence Islands National Park in the Thousand Islands region of eastern Ontario. In Nova Scotia, blacklegged tick populations are found in the Lunenburg, Bedford and Shelburne areas. An established population has also been found in the southeastern corner of Manitoba. Western blacklegged ticks, on the other hand, are found in British Columbia; they are fairly widely distributed but populations are largest in the lower mainland, on Vancouver Island, and in the Fraser Valley.

**1.3** Although the distribution of blacklegged ticks in Canada appears to be limited, surveillance indicates that some of the established populations are spreading within certain areas of southern Canada. The potential expansion of localized tick populations makes it difficult to precisely define the geographic limits of any given population; however, people living in or visiting areas adjacent to established tick populations may have a greater chance of contact with blacklegged ticks. Although current evidence does not suggest a widespread distribution of blacklegged tick populations in Canada, the establishment of new populations appears to be an ongoing process. Hence, it is desirable to continue surveillance and to take precautions to reduce tick contact.

1.4 The rate of infection of ticks with the bacterium that causes Lyme disease varies. Infection rates are typically higher in adult ticks compared to the other stages (nymphs and larvae). Despite the lower rates of infection, people are most likely to acquire Lyme disease from a nymph because this stage is so small (see Figure 2) and thus more likely to go unnoticed and feed for a sufficient amount of time for the Lyme disease bacterium to be transmitted (24-36 hours). Infection rates are often greater in tick populations that have been established for long periods of time (such as Long Point) compared to newly established ones. As many as 60 percent of the adult ticks at Long Point are infected; however, infection rates in adults are more often between 10 and 25 percent at the other localities where ticks are established. Partly because of differences in the types of hosts that they feed upon, infection rates of the Lyme disease agent in *Ixodes pacificus* are much lower (1-3 percent) than *Ixodes scapularis*.

**1.5** While there is a higher risk of coming in contact with infected blacklegged ticks in areas where populations are established, there is also a low risk of Lyme disease being contracted almost anywhere in Canada because migratory birds transport infected ticks over large geographic distances. Surveillance data indicates that about 12 percent of the ticks detected outside of areas where tick populations are established, and likely transported there on migratory birds, are infected with the agent of Lyme disease.

**1.6** Source: http://www.phac-aspc.gc.ca/id-mi/tickinfo-eng.php


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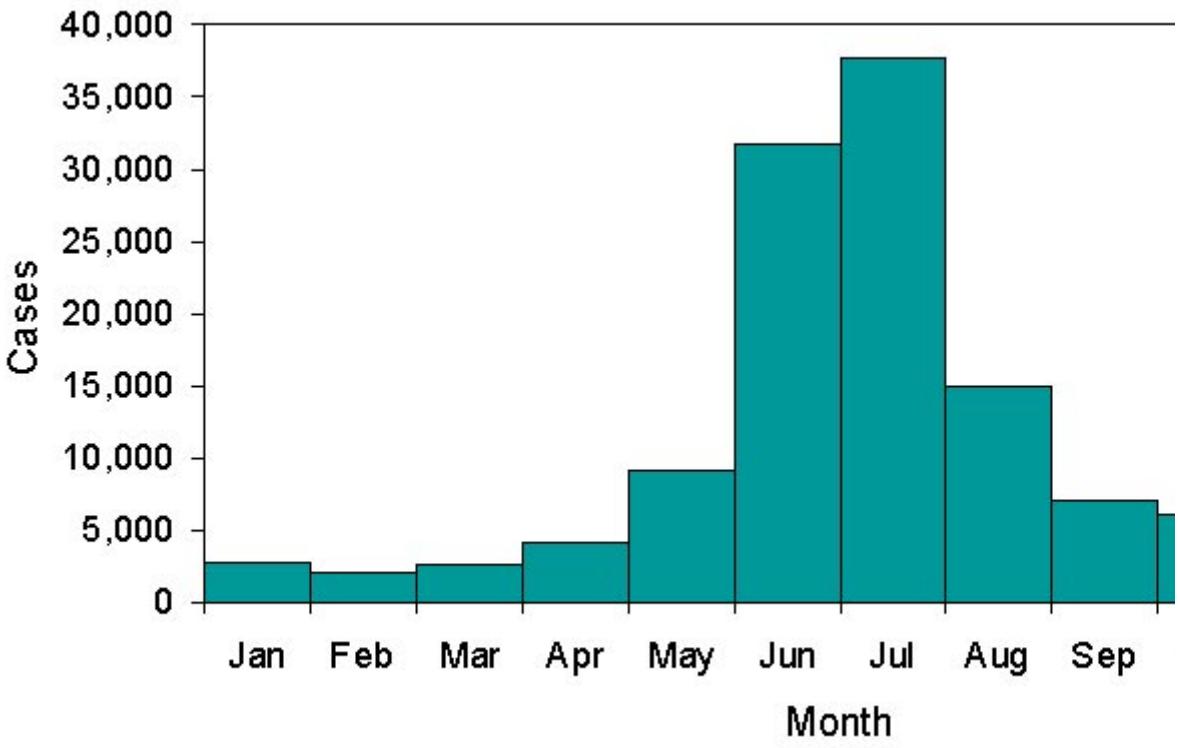
**Figure 1**

**Reported Cases of Lyme Disease by Month of Illness Onset United States, 1992-2004**




Lyme disease patients are most likely to have illness onset in June, July, or August and less likely to have illness onset from December through March.

Lyme disease likelihood = April through November http://www.cdc.gov/ncidod/dvbid/lyme/ld_rptmthofill.htm

## 2.0 Tick removal tips from CDC

http://www.cdc.gov/ncidod/dvrd/ehrlichia/Q&A/Q&A.htm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## 3.0 To Remove Attached Ticks

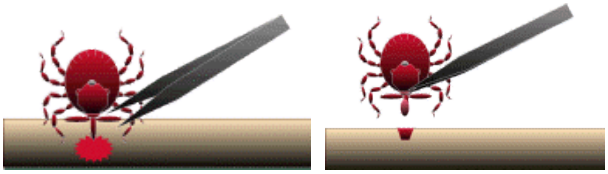
3.1 Use fine-tipped tweezers or notched tick extractor, and protect your fingers with a tissue, paper towel, or latex gloves (see figure). Persons should avoid removing ticks with bare hands.

3.2 Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. (If this happens, remove mouthparts with tweezers. Consult your health care provider if illness occurs.)

3.3 After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.

3.4 Do not squeeze, crush, or puncture the body of the tick because its fluids may contain infectious organisms. Skin accidentally exposed to tick fluids can be disinfected with iodine scrub, rubbing alcohol, or water containing detergents.

3.5 Save the tick for identification in case you become ill. This may help your doctor make an accurate diagnosis of potential diseases by determining what type of tick it is. Place the tick in a sealable plastic bag and put it in your freezer. Write the date of the bite on a piece of paper with a pencil and place it in the bag.



## 4.0 Devices Designed for Removing Ticks

4.1 **The Tick Tool - http://www.ticktool.com/index.html**

## 5.0 Folklore Remedies Don't Work

**5.1** Folklore remedies, such as the use of petroleum jelly or hot matches, do little to encourage a tick to detach from skin. In fact, they may make matters worse by irritating the tick and stimulating it to release additional saliva or regurgitate gut contents, increasing the chances of transmitting the pathogen. These methods of tick removal should be avoided.


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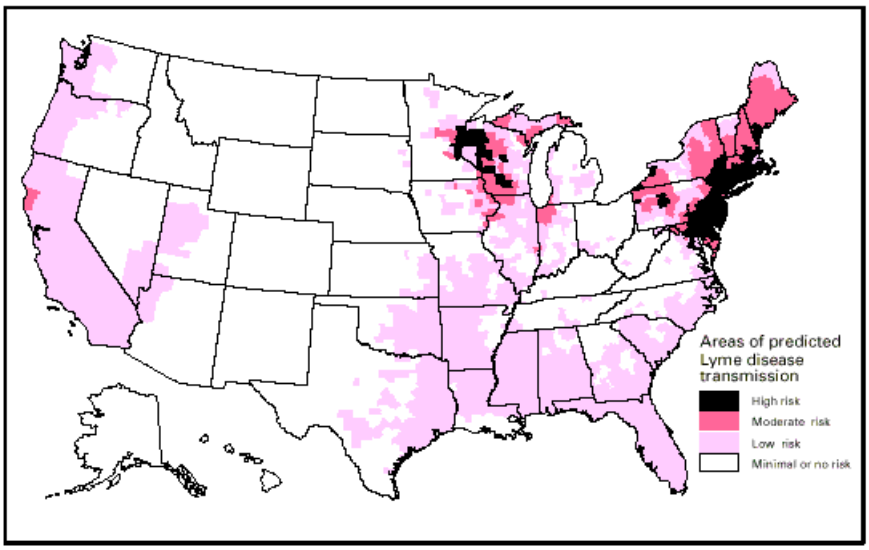
**Table 1**
**Common Tick-Borne Diseases in the U.S. and Information Resources**

| Disease | Tick Species | CDC Informational Web Pages |
|---|---|---|
| Lyme disease | • Black-legged or deer tick<br>• Western black legged tick | http://www.cdc.gov/ncidod/dvbid/lyme/ |
| Ehrlichiosis | • Lone star tick<br>• Black-legged or deer tick<br>• Western black legged tick | http://www.cdc.gov/Ncidod/dvrd/ehrlichia/Index.htm |
| Rocky Mountain spotted fever | • American dog tick<br>• Rocky Mountain wood tick<br>• Brown dog tick | http://www.cdc.gov/ncidod/dvrd/rmsf/index.htm |

## 6.0 Distribution

**Figure 2**
**Distribution Map for Lyme Disease Risk, U.S.**

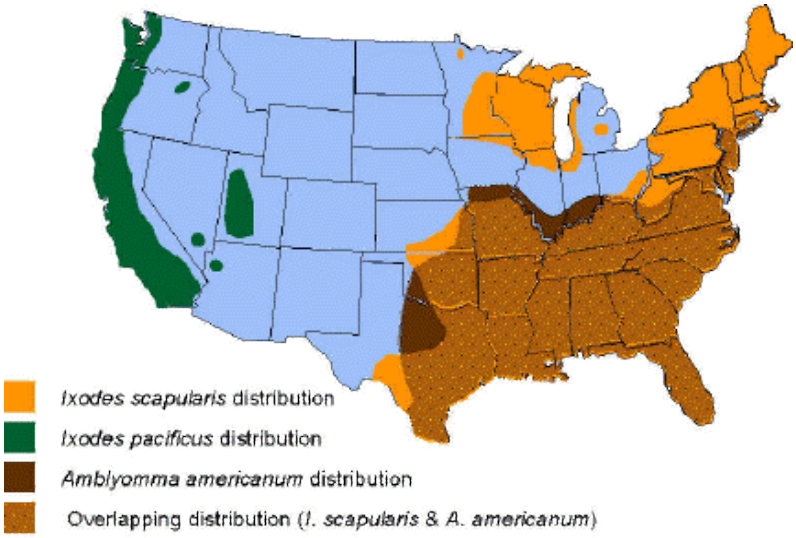



Note: This map demonstrates an approximate distribution of predicted Lyme disease risk in the United States. The true relative risk in any given county compared with other counties might differ from that shown here and might change from year to year. Risk categories are defined in the accompanying text. Information on risk distribution within states and counties is best obtained from state and local public health authorities.

Source: CDC, http://www.cdc.gov/ncidod/dvbid/lyme/riskmap.htm

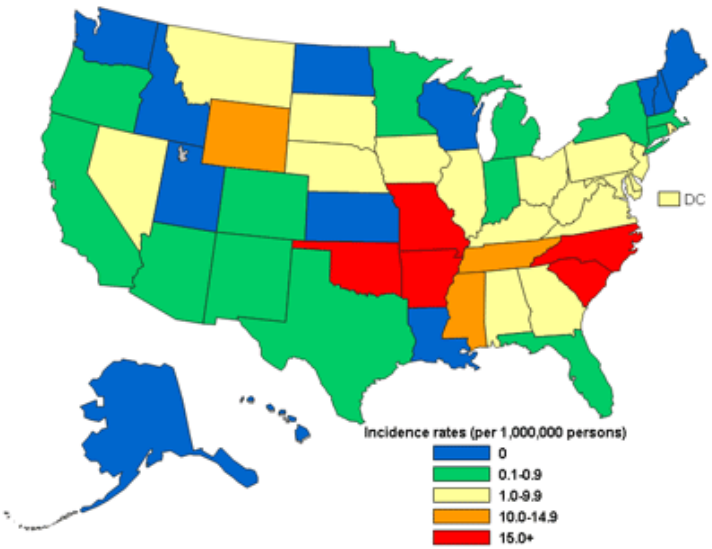
**Figure 3**
**Distribution Map of Vector**

**Tick Species for Human Ehrlichiosis, U.S.**




Source: CDC, http://www.cdc.gov/ncidod/dvrd/ehrlichia/Q&A/Q&A.htm

**Figure 4**
**Distribution Map of Annual Incidence**
**of Rocky Mountain Spotted Fever, U.S**




Data for calendar year 2002

Source: CDC, http://www.cdc.gov/ncidod/dvrd/rmsf/Epidemiology.htm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# 5-314 Working Alone and Remote Travel

## 1.0 Purpose and Scope

1.1 This Procedure establishes the requirements for communication and accountability between personnel at a work site to reduce the potential for incidents occurring to one employee without help readily available and to facilitate the rapid mustering of assistance to employees in the event of an emergency.

1.2 This procedure applies to all Resolution Consultants employees and operations.

## 2.0 Terms and Definitions

2.1 **Buddy System**: A system of organizing employees at a work site in such a manner that each employee is accompanied by at least one other employee or is escorted by a client or contractor representative during work site activities.

2.2 **Controlled Work Areas**: One or more designated work areas on a field project site where hazardous activities and/or strictly defined operations take place. Such controlled work areas include, but are not limited to, remediation or construction sites; a restricted radius where a critical lift operation will take place could be declared a controlled work area. On a HAZWOPER site, the controlled work area is divided into the exclusion zone, the contaminated reduction zone, and the support zone.

2.3 **Working Alone**: Performing work with no line of sight or direct voice communication with another person who is aware of your assignment and capable of initiating emergency response.

## 3.0 Procedure

3.1 Employees are discouraged from working alone on any site. If they will be out of contact with other employees, they will establish a buddy system or check-in procedure with another employee or responsible person.

3.2 When traveling alone, staff will take appropriate precautions, including notifying someone of their travel plans as well as carrying a communication device and safety equipment, as appropriate.

3.3 Managers will provide the resources (staff, communication devices, etc.) and plans (emergency response plans, check-in procedures, etc.) necessary so that employees are not working alone or have a buddy system in place.

3.4 No staff person shall work by themselves or out of contact with other personnel if they are conducting a hazardous job task. On the following tasks, a buddy system will be established:

- Working from heights
- Working in a confined space
- Working in a trench
- Lock out/tag out
- Working with electricity
- Working with power tools/equipment
- Working with hazardous substances or materials
- Working with material under pressure
- Working where there is a possible threat of violence
- Working in isolation from first aid services or immediate/emergency assistance
- Traveling in severe weather
- Working in avalanche areas
- Working on water or ice
- Working in remote or wilderness isolation
- Working in a controlled area
- Extreme heat or cold stress environments


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- Working around high traffic or mobile equipment

## 3.5 Office Work

3.5.1 Each office will have in place and will communicate as part of its local safety orientation its procedures for the safety and security of an employee working alone in the office.

3.5.2 Employees working in the office after regular working hours or in situations where they are working alone will keep the entrance to the office locked.

3.5.3 If the building is monitored by a security service, employees working in the office after regular working hours or working alone will notify the security guard of their presence and anticipated hours. If the building does not have a security service, it is advisable that a staff person working alone notify a family member, friend, or manager of his or her location.

3.5.4 During all working hours, employees shall stay alert to unauthorized entries into the building and to other suspicious activities and shall report them immediately.

3.5.5 Contact numbers to be used in case of emergency are posted at all major exits.

## 3.6 Field Work

3.6.1 Prior to work commencing, a hazard assessment shall be prepared for all assignments on which employees are to work alone (in accordance with 0*5-209 Hazard Assessment and Project Planning*). The hazard assessment shall consider travel time, weather, available communications, and the hazards associated with the task and work environment.

3.6.2 The assessment should also consider whether the employee assigned to work alone has sufficient training in the tasks to be performed to allow the employee to work safely alone. The employee's personal medical conditions may be considered if the employee has voluntarily made the medical condition known to the Supervisor or Project Manager.

3.6.3 The hazard assessment should identify the controls required for the safety of employees as applicable to the job task and location. Some controls associated with working alone or in remote isolation include a buddy system, standardized check-in times, specialized communication devices, and enhanced emergency supply kits.

## 3.7 Buddy System

3.7.1 When conducting hazardous work, staff will work with a buddy (another responsible individual) at all times.

3.7.2 Client or contractor personnel may be substituted for a Resolution Consultants employee's buddy only if they are designated by the client or contractor, are properly trained in this Standard Operating Procedure, and are properly trained in the site's emergency response procedures.

3.7.3 Once assigned as buddies, personnel shall remain in each other's line of sight and in direct voice contact at all times.

3.7.4 When unusual conditions do not permit line of sight and direct voice contact, the site supervisor will be informed. If permission from the site supervisor is obtained to continue the work, voice contact will be achieved using electronic communication devices such as, but not limited to, hand-held radio or cell phone.

3.7.5 When electronic communication devices are used, a protocol will be established and agreed to by each buddy to confirm that periodic effective and faultless communications are maintained:

- The person in communication with the field employee working alone will have direct communication with the employee at a frequency not to exceed each hour.
- The frequency shall be established considering task hazards, weather conditions, personal medical conditions, and the availability of emergency response.
- A missed communication event shall trigger emergency response procedures. The results of each communication event shall be documented in the project files.


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## 3.8 Check-In Procedures

3.8.1 All field crews will establish check-in procedures prior to leaving the office and confirmed with the assigned Check-In Person.

3.8.2 The timing and frequency of those check-in procedures schedule shall be established prior to the initiation of field operations and will vary depending on the task and location of the work.

- At a minimum, all crews will check-in by 5:00 p.m.
- Crews working in isolation or on hazardous sites will increase their check-in times accordingly (e.g., noon and 5:00 p.m.).

3.8.3 If crews will separate once they reach their field site, they will then be considered to be “working alone” and will establish a buddy system with the other members of the crew.

3.8.4 Staff working alone or in small crews in remote isolation will have an effective means of communication system including cell/radio/satellite phone as well as established check-in times.

3.8.5 The Check-In Procedure will be reviewed daily as part of the Task Hazard Analysis review or more frequently if there is a change in work arrangements that could adversely affect a worker's well-being or a report that the system is not working effectively.

## 3.9 Emergency Response Procedures (ERP)

3.9.1 All field staff AND the Check-In Person will be provided with the Emergency Response Plan (which is documented on the Task Hazard Analysis, if an ERP does not already exist for the site).

3.9.2 The Check-In Person will have access to a route map or understands their anticipated route of travel.

3.9.3 If communication is lost between buddies or a check-in time is missed, it will be assumed that an emergency situation exists (e.g., severe injury, illness, other accident situation), and the site’s emergency response procedures will be implemented. Site work will cease until the emergency is resolved and the site supervisor directs personnel to restart work.

3.9.4 The established contact person will follow the procedures below if a field staff member has missed a check-in:

- First, they will attempt to make contact with the field staff directly.
- If that fails to provide a response, they will contact other persons who may have been on site, including client supervisors, or other locations where the field staff might be (e.g., hotel, home, office).
- If the field staff still cannot be located, the emergency contact person notifies the project manager or manager responsible for the staff.
- Depending on the location and situation, they will then dispatch either another Resolution Consultants staff member, another on-site supervisor, or an appropriate emergency response agency (e.g., police) to travel to the last known location of the field staff.
- If the dispatched responder arrives at the site but cannot locate the field staff, the appropriate public emergency contacts (e.g., police, search and rescue) will be made and the staff members’ personal contacts shall be notified by Human Resources or the manager (if HR is unavailable).
- If the dispatched responder finds the crew in an emergency situation (medical, environmental, structural, etc.), the appropriate steps will be taken to isolate the hazard, administer first aid, and notify the appropriate agencies and emergency support services.

## 3.10 Training

3.10.1 All staff will receive an initial orientation that includes the hazards and controls associated with working alone.

3.10.2 If working in wilderness, all field staff will be able to orienteer using a map and compass—if not, the basic skills of orienteering will be provided by an experienced staff member before work commences.

3.10.3 Staff regularly working in remote, isolated wilderness locations will either participate in a wilderness survival course from a qualified provider (1 or 2 day) or will obtain management approval based on their level of experience/competence in wilderness situations.

## 4.0 Records

None.

## 5.0 Attachments

5.1 05-314 Form 1 Wilderness Isolation


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# 5-314 Form 1 Wilderness Isolation

## 1.0 Planning

1.1 Working in wilderness isolation presents many more potential hazards and should only be conducted by teams with documented experience, safety plans, and equipment appropriate for the tasks and conditions of the work.

1.2 A Safe Work Plan will be approved by the SH&E Manager.

## 2.0 Safety Equipment

2.1 All field staff should regularly carry a compass, fire starter, a small folding saw, and a map on their person.

2.2 All field staff should regularly carry a first aid kit and survival equipment applicable to the situation.

2.3 All field staff will be equipped with (or have access to) communication devices appropriate to the type of coverage anticipated in the project area.

2.4 When hiking long distances, it is recommended that a “mini survival kit” that includes the following items be carried:

- Lighter, matches, or a "flint' of fire steel
- Fire starter (tinder). Cotton balls with lip balm work well, or paper egg cartons with cotton balls and paraffin wax; if buying commercial fire starter, test it after several months.
- A whistle
- Heavy tinfoil (to melt snow, to cook on, or to boil water in)
- Some high-energy food
- A Mora knife or folding saw (Japanese tooth rake is best) or "camp chainsaw in a can"
- Cordage/rope (about 50 feet)
- Bear spray (and/or bear bangers)

2.5 When using an ATV or helicopter for isolated work, it is recommended that a survival bag or backpack that can be left at a known muster point be put together. This bag should include the following items:

- Additional fire starter (tinder)
- Matches, fire steel
- A multi-tool (like a Swiss Army knife)
- A folding saw
- 3-8'x6" tarps plus one 12 X 16" tarp or larger (or a tent)
- 100 " of utility cord or parachute cord
- A small pot
- Lean spoon
- A small stove (a small folding military stoves with trioxethelyne tablets will work well)
- Closed cell foam pads or several square feet of double-wall bubble insulation (the silver sided bubble wrap used in construction) to use as a sleeping pad or for hypothermia treatment
- Food
- Water
- Sleeping bag with a mylar bivy sack to be used as a vapor barrier inside


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## 3.0 Drinking Water

3.1 No surface water can be considered safe for human consumption without treatment. Even the cleanest looking spring water could be polluted. Untreated water may be contaminated with bacteria, viruses, or protozoa.

3.2 On short trips, carry treated water or obtain water from another safe source.

3.3 When field projects take you into remote isolation where there is the potential for not having access to clean drinking water, be sure to take the appropriate tools with you: a water filter, tin foil or a pot for boiling water, or tablets or chemicals for treating the water prior to consumption.

3.4 Generally, the chances of finding safe drinking water in the mountains increase as you gain altitude. Intense sunlight at high altitudes kills undesirable bacteria and viruses but harmful cysts are unaffected.

3.5 Runoff water from streams below glaciers is often cloudy with silt and should be filtered.

3.6 Well water, fast-moving rivers, and the deepest parts of lakes are the best locations to obtain water. Avoid stagnant water, shoreline water, and water close to human habitations and campsites.

3.7 During the winter, it is best to use an open water source or to obtain water through a hole in the ice. Check the safety of the ice first. Melting ice and snow consumes fuel and takes extra time. Eating snow or ice directly can lead to chilling and hypothermia and could also cause stomach cramps and headaches. Beware of colored snow, which indicates the presence of algae that could cause diarrhea if ingested. Even in winter, all water should be purified.

### 3.8 Water Treatment

3.8.1 Each method of water treatment has its advantages and disadvantages. Use only treated or boiled water for drinking, brushing teeth, or washing fruits and vegetables that will be eaten raw.

3.8.2 Boiling. Heat is the oldest, safest and most effective method of purifying water. Bring the water to a boil for at least one minute (adding one more minute for each 300 m (1000 ft.) above sea level. If the water is cloudy, filter it before boiling. Boiling will give your water a flat taste that can be remedied by pouring the water quickly back and forth from one clean container to another, by letting the water cool, or by adding a pinch of salt per litre of water.

3.8.3 Chemical Purification. When boiling is not practical because of time and lack of a heat source, disinfection with chlorine or iodine compounds may be effective. Use two water containers: one for treating water and the other for carrying purified water. After disinfection, shake the container vigorously. Wait five minutes. Shake it again with the lid loose so that some water leaks out to cleanse the mouth of the container. Disinfection alone may not kill some protozoa. Pass the water first through a filter with a pore size of 0.5 micron (absolute) or less to remove protozoa, then disinfect it to kill viruses and bacteria. Disinfection will give the water a peculiar taste. If you find it unpleasant, try using flavoured drink crystals or concentrated citrus juice to mask the taste of the disinfectant. Add drink powders or juice only after the treatment time has elapsed.

3.8.4 Filtration. Water filters for use in the wilderness are available, but be wary when making your choice. Avoid filters that allow particles larger than 0.5 microns to pass. Filters with a pore size of 0.1 to 0.3 micron can remove protozoa and bacteria but may not remove viruses. Filtration alone is insufficient to purify water; hence, it should be combined with disinfection to remove viruses. Follow the operating and maintenance instructions carefully.

**Table 1: Summary of Water Purification Methods**

| | Boiling | Chlorine | Iodine | Filters |
|---|---|---|---|---|
| Bacteria | E | E | E | M |
| Viruses | E | E | E | N |
| Protozoa | E | M | M | M |
| Chemicals | M | N | N | N |

E = effective M = may be effective (see text) N = not effective


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3.9 Some water-borne diseases are difficult to diagnose. If you are not feeling well and have recently drunk water from a source in the wild, inform your doctor that you may have consumed untreated water.


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# 5-405-Drilling, Boring, and Direct Push Probing

## 1.0 Purpose and Scope

1.1 Provides the minimum requirements to be followed when drilling and boring work are performed.

1.2 This procedure applies to all Resolution Consultants employees and operations.

## 2.0 Terms and Definitions

None.

## 3.0 References

None.

## 4.0 Procedure

4.1 All client on-site safety procedures shall be understood and adhered to.

4.2 Be aware of the provincial/territorial regulations that govern drill rig operations and exposed moving parts.

4.3 **Roles and Responsibilities**

4.3.1 **Project Manager or Resident Engineer** is responsible for ensuring that sound principles of safety is consistent with drilling practices.

4.3.2 **Site Safety Officer (SSO)** shall assist the **Project Manager** in compliance with the requirements of this procedure.

4.3.3 The **H&S Department** shall assist site management with guidance about this procedure.

4.3.4 **Resolution Consultants employees** engaged in project field activities shall be cognizant of contractor activities that may affect their safety and shall follow these procedures.

- Resolution Consultants has “Stop Work Authority” if unsafe conditions arise during drilling operations. “Unsafe drilling conditions” could be based on perceived and actual field observations.
- A pre-drill visual inspection of the drill rig and associated equipment will be conducted when equipment arrives onsite and an equipment and safety check list will be filled out.
- The drilling contractor and Resolution Consultant will conduct a walk around inspection before drilling activities begin. Notes will be kept in the field log book. Any deficiencies will be repaired before drilling begins.
- Resolution Consultants employee is not part of the drilling crew and will not participate in the drilling activity.

4.3.5 **Drilling Contractors**

- **Drilling contractors** have direct control over the application and operation of all drilling, boring, and probing equipment owned by their organization.
- It is the drilling **c**ontractor’s operator’s responsibility to implement safe work practices provided by the drilling contractor’s project management or supervisory staff supplemented by good judgment, safe control, and caution whenever operating drilling, boring, and probing equipment.

4.3.6 **Safety Representative**: It is the drilling contractor’s designate individual on site that is responsible person for safety for the drill crew. The safety person’s responsibilities include but are not limited to:

- Consider the “responsibility” for safety and the “authority” to enforce safety to be a matter of first importance.
- Be the leader in using proper personal protective equipment (PPE) and set an example in following the rules that are being enforced on others. See section 4.5 for PPE required by this SOP.


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- Enforce the use of proper safety equipment and take appropriate corrective action when proper PPE is not being used.
- Understand that the proper maintenance of tools and equipment and general housekeeping on the drill rig will provide an environment that promotes and enforces safety. See Sections 4.6 for housekeeping and maintenance requirements of this SOP.
- Ensure that the drilling operator has had adequate training and is thoroughly familiar with the rig, its controls, and its capabilities prior to commencement of drilling activities.
- Inspect the rig at least daily for any equipment deficiencies ensuring they are repaired, immediately (a suggested list of items to be inspected, but not all emcompassing, can be provided, if requested).
- Check and test all safety devices
- Ensure that all new rig workers are informed of safe operating practices on and around the rig. The safety person should ensure that each new employee reads and understands the safety procedures.
- Ensure that a first aid kit and fire extinguishers are available and properly maintained on each rig and on each additional vehicle, and that all field crew be trained in their uses.
- Maintain a list of addresses and telephone numbers of emergency assistance units (ambulance services, police, hospitals, etc.), and inform other members of the drill crew of its location.
- Observe the mental, emotional, and physical capability of workers to perform the assigned work in a proper and safe manner.
- Rig Crew and Other Field Personnel (Those employees involved in fieldwork): All personnel engaged in site activities are required to become thoroughly familiar with, and to conform to, the provisions of Resolution Consultants' safety plan, procedures, and such other safety directives as may be considered appropriate by **Project Managers**, **Safety Officers,** and **Supervisors**.
- Rig Workers: Personnel are encouraged to offer ideas, suggestions, or recommendations regarding any operational condition, procedure, or practice that may enhance the safety of site personnel or the public. Their primary responsibilities will be:
  - Perform all required work safely.
  - Familiarize themselves with and understand the plan, including proper use of personal protective equipment.
  - Report any unsafe conditions to supervisory personnel.
  - Be aware of signs and symptoms of thermal stress.
  - Have "Stop Work Authority" if unsafe conditions arise during drilling operations.

## 4.4 Training

4.4.1 All drilling operators and assistants shall have industry-standard safety training and be versed in the equipment to be utilized. This may include, but is not limited to, HAZWOPER, Petroleum Safety Training (or Construction Safety Training), and others as appropriate.

## 4.5 Personal Protective Equipment

- For most groundwater and soil drilling projects, PPE is dependent on hazard exposures and are outlined in the Statement of Work issued by Resolution Consultants. At a minimum:
- Hard hat: Hard hats shall be worn by everyone working at a drilling/boring site. Hats should meet the requirements of ANSI Z89 and be kept clean and in good repair with the headband and crown straps properly adjusted for the employee.
- Safety shoes: Safety shoes or boots shall be worn by all drilling personnel and all visitors to the site who observe operations within close proximity of the rig. Safety shoes or boots should meet the requirements of ANSI Z4 1.1.
- Safety glasses: All rig personnel shall wear safety glasses meeting the requirements of ANSI Z87.1.
- High Visibility Class II Safety Vest shall be worn by all **Resolution Consultants employees**. All rig personnel should attempt to wear high-visibility clothing that should be close fitting and not have large cuffs or loose material that can catch on rotating or translating components of the rig.


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- Hearing protection is optional but all rig personnel must be able to hear any safety warnings.
- Close fitting gloves and clothing: All rig personnel should wear gloves for hand protection against cuts and abrasions that could occur while handling wire rope or cable and from contact with sharp edges and burrs on drill rods and other drilling or sampling tools. Gloves should be close fitting and not have large cuffs or loose ties which can catch on rotating or translating components of the rig. If there is potential exposure to hazardous environmental media, then inner protective gloves maybe warranted.
- Other protective equipment: For some operations, the project may dictate use of other protective equipment. The management of the contractor and its safety person shall determine the requirements; Resolution Consultants will be informed of any changes to safety protocol and will note the changes in the field log book.
- When drilling, boring, or probing is performed in chemically or radiological contaminated ground, special protective equipment and clothing will probably be required.
- The clothing of the individual rig worker is not generally considered protective equipment; however, clothing should be close fitting and comfortable without loose ends, straps, draw strings or belts or otherwise unfastened parts that might catch on some rotating or translating component of the rig.
- Rings and jewellery should not be worn during a work shift.

## 4.6 Housekeeping

4.6.1 A key requirement for safe field operations is that the drilling contractor safety person and drill rig crew understands and fulfils the responsibility for maintenance and “housekeeping” on and around the drill rig, including the following:

- Suitable storage locations should be provided for all tools, materials, and supplies so that tools, materials, and supplies can be conveniently and safely handled without hitting or falling on a member of the crew or a visitor.
- Storage or transporting tools, materials, or supplies within or on the mast (derrick) of the rig should be avoided.
- Pipe, drill rods, probe rods, casing augers, and similar tooling should be orderly stacked on racks or sills to prevent spreading, rolling, or sliding.
- Penetration or other driving hammers should be placed at a safe location on the ground or be secured to prevent movement when not in use.
- Work areas, platforms, walkways, scaffolding and other accesses should be kept free of materials, debris and obstructions and substances such as ice, grease, or oil that could cause a surface to become slick or otherwise hazardous.
- All controls, control linkages, warning and operation lights, and lenses should be kept free of oil, grease, and/or ice.
- Do not store gasoline in any portable container other than a non-sparking, red safety container with a flame arrester in the fill spout and having the word “gasoline” easily visible.

## 4.7 Traffic Control

4.7.1 When operating near public vehicular and pedestrian traffic, the on-site personnel shall take every precaution necessary to see that the work zone is properly established, identified, and isolated from both moving traffic and passerby pedestrians.

4.7.2 All traffic control devices shall be installed, placed, and maintained in accordance with the Traffic Control Plan, client specifications, and/or the Manual of Uniform Traffic Control Devices (MUTCD). Traffic control devices shall consist of and not be limited to:

- Directional and informational signage;
- High visibility barricades, cones, or barrels;
- Lighting; and
- Other equipment and devices as required.


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## 4.8 Maintenance & Inspection

4.8.1 Good maintenance and thorough inspection will make operations safer. Maintenance tasks should be done safely by a qualified maintenance person. Inspection and maintenance tasks include but are not limited to the following requirements:

- Inspections shall be completed at the beginning of each day by the drilling operator and in the presence of an Resolution Consultants employee. (a suggested list of items to be inspected, but not all emcompassing, can be provided, if requested).
- PPE should be worn when performing maintenance on a rig or on drilling or probing tools.
- Drill rig repairs are the responsibility of the drilling contractor and all safety procedures outlined in the Contractor's health and safety plan during these activities will be supervised by the Contractor's Health and Safety representative.

## 4.9 Hand Tools

4.9.1 A large number of hand tools can be used on or around a drill or probe rig The drilling contractor will ensure that hand tools are in good working order and their crews are knowledgeable about their uses.

## 4.10 Clearing Work Areas

4.10.1 **Prior to set up, adequate site clearing and leveling should be performed to accommodate the rig and supplies and provide a safe working area. Clearing the site includes clearing the intended drilling area of underground utilities in accordance with *5-417-Utilities Underground*. Drilling or probing should not be commenced when tree limbs, unstable ground or site obstructions cause unsafe tool handling conditions.**

## 4.11 Drilling and Probing Operations

4.11.1 Drilling and probing operations will be conducted for the task outlined in the Statement of Work. These physical act of drilling and probing is the responsibility of the drilling contractor; but it must be done in a safe yet efficient manner. **Resolution Consultants employee is not part of the drilling crew and will not participate in the drilling activity.** The following safety measures shall be taken during drilling and probing operations on-site:

- Operations will be terminated during an electrical storm, and all crew members will move away from the rig. If lightning is observed, shut down all rig operations immediately.
- All site personnel are responsible for the health and safety of field operations, and includes Stop Work Authority" if unsafe conditions arise during drilling operations.
- Resolution Consultants employees will be vigilant of any changes in field conditions that may warrant stopping the activity and clearing personnel a safe distance from the drill rig. Once personnel are at a safe distance from the drill site, Resolution Consultants employee will immediately inform the drilling contractor's onsite supervisor, Resolution Consultants health and safety officer, and project manager of the issues. Drilling will not resume until the "All Clear" is obtained from Resolution Consultants' health and safety officer.

4.12 **Site Movement of Equipment**

4.12.1 **The drilling contractor is responsible for moving drill rig and** associated equipment from one location to another. If driving on public roads the driver must obey all vehicle laws.

4.13 **First Aid**

4.13.1 At least one member of the drilling crew (and if only one, preferably the drilling and safety supervisor) should be trained to perform first aid. Up to date first aid and CPR certifications will be required.

4.13.2 Resolution Consultant employee must also be trained in first aid and CPR and have current certification.

4.13.3 A first aid kit will be available and well maintained on each drill site and in each vehicle.

4.14 **Rig Alterations**

4.14.1 If Resolution Consultants employee determines that alterations to a rig or drilling or probing tools have been done outside manufacture's specification, that piece of equipment will not be used in the course of drilling operations..

## 5.0 Records

None.

## 6.0 Attachments

**Resolution Consultants' Inspection** Check List


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# 5-406 Electrical Lines, Overhead

## 1.0 Purpose and Scope

1.1 Provides the safe work requirements to be observed where overhead power lines are present on a job site.

1.2 This procedure applies to all Resolution Consultants employees and operations.

## 2.0 Terms and Definitions

2.1 Types of overhead lines:

2.1.1 Overhead power lines

2.1.2 Structural cable supports

2.1.3 Guy wires

2.1.4 Cable television / communication lines

## 3.0 References

None.

## 4.0 Procedure

4.1 An appropriate distance must be kept between equipment and overhead utility lines.

4.2 Employees must contact the power line operator before work is done or before equipment is operated within 15.25 metres (50 feet) of an energized overhead power line, in order to:

- determine the voltage of the power line, and
- establish the appropriate safe limit of approach distance as identified by provincial/territorial regulations.

4.3 The safe limit of approach distances do not apply to a load, equipment, or building that is transported under energized overhead power lines if the total height, including equipment transporting it, is less than 4.15 metres (13.5 feet).

4.4 **Employers** or **CTO Managers** must formally notify (using the Overhead Electrical Lines Acknowledgement form) all subcontractors or equipment operators of an energized overhead power line before work is done or equipment is operated in the vicinity of the power line at distances less than the safe limit of approach distances and obtain the operator's assistance in protecting workers involved.

4.5 Employees must not place earth or other material under or beside an overhead power line if doing so reduces the safe clearance to less than the safe limit of approach distances.

4.6 To maintain minimum safe clearances:

4.6.1 Install warning devices and signs (hang a sign from and mark all guy wires to warn traffic of low clearance; provide warning signage for all overhead services).

4.6.2 Install telescopic, nonconductive posts and flagging across right-of-way at the minimum allowable clearance as allowed by regulations for the line voltage.

4.6.3 Position signs or other devices to determine the “Danger Zone.”

4.6.4 Inform all on-site staff with the on-site clearances required.

4.6.5 Beware of atmospheric conditions, such as temperature, humidity, and wind, that may dictate more stringent safety procedures.

4.7 Operation of heavy equipment and cranes in areas with overhead power lines represents a significant hazard to all personnel on the job site. Accidental contact with an energized line or arcing between a


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high power line and grounded equipment can cause electrocution of equipment operators or nearby ground personnel, and damage to power transmission and operating equipment. Although maintaining a safe distance from all energized lines is the preferred means for control of this hazard, site conditions may not always accommodate this. If work will (or may) occur within 50 feet of any energized line, the procedures outlined below will be observed.

4.8 Overhead power lines will be identified on each job site before the work commences. For each identified line, the Project Manager must determine whether it is energized (and the operating voltage for energized lines), and whether work operations will require that activities with heavy equipment (excavators, loaders, cranes, etc.) will occur within 50 feet (15.25 metres) of the line. Unless verified, it will be assumed that all lines are energized.

4.9 Safe working distance is the minimum distance that must be maintained between any energized electrical line and any part of the operating equipment to maintain adequate safety margins and is based on the line voltage of the power line. Figure 4-1 lists the line voltages in kilovolts and the Minimum Safe Work Distance in the United States and Figure 4-2 indicates the Nominal Phase to Phase voltage rating in kilovolts for Canada. The following safe working distance criteria will be applied for all Resolution Consultants operations:

**Figure 4-1: United States Overhead Line Criteria**

| Line Voltage (Kilovolts) | Minimum Safe Working Distance |
|---|---|
| 0 – 50 | 10 feet |
| >50 – 200 | 15 feet |
| >200 – 350 | 20 feet |
| >350 – 500 | 25 feet |
| >500 – 750 | 35 feet |
| >750 – 1,000 | 45 feet |

Source: American National Standards Institute, Publication B30.5.

**Figure 4-2: Canadian Overhead Line Criteria**

| Column 1 | Column 2 |
|---|---|
| Nominal phase-to-phase voltage rating | Minimum Distance |
| Over 425 to 12,000 | 3.0 metres |
| Over 12,000 to 22,000 | 3.0 metres |
| Over 22,000 to 50,000 | 3.0 metres |
| Over 50,000 to 90,000 | 4.5 metres |
| Over 90,000 to 120,000 | 4.5 metres |
| Over 120,000 to 150,000 | 6.0 metres |
| Over 150,000 to 250,000 | 6.0 metres |
| Over 250,000 to 300,000 | 7.5 metres |
| Over 300,000 to 350,000 | 7.5 metres |
| Over 350,000 to 400,000 | 9.0 metres |

Source: Canada Occupational Health and Safety Regulations Electrical Safety- Subsection 8.5(6).


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4.10 Under no circumstances will any object pass closer than 3 metres to any energised, uninsulated electrical line.

4.11 Formally notify all subcontractors of Overhead Power lines.

4.12 **Acceptable Safety Procedures**

4.12.1 Where any work task will not allow the minimum safe working distance to be maintained at all times, an alternate means of protection must be identified and approved by the SH&E Department. In order of preference, acceptable procedures are

- De-energize the power line(s)/lockout by local utility authorities
- Install insulated sleeves on power lines
- Assign line spotters to assist the equipment operator

4.12.2 De-energize Power Lines

Elimination of electrical power provides the most acceptable means of ensuring safety of personnel. While temporary site power lines are under the control of the site manager (and can be de-energized locally), electrical distribution and transmission lines can be de-energized only by the owner of the line (generally the local electrical utility). Therefore, de-energizing of a line requires advance coordination with the line owner; generally, at least one week advance notice should be provided.

4.12.3 Install Insulating Sleeves

Insulating sleeves can be placed over power lines to provide a contact and arcing barrier if work must occur closer to the power lines than the accepted safe work distance. Although not as desirable as line de-energizing, the use of these sleeves can provide an acceptable alternative where electrical lines are required to remain in service.

As with de-energizing of distribution and transmission lines, placement of insulating sleeves can be performed only by the line owner. This requires advance coordination with the line owner; generally, at least one week advance notice should be provided. To install the sleeves, representatives of the line owner will require access to the job site.

4.12.4 Assign Line Spotters

A line spotter is a person located at ground level who is assigned to observe equipment operations, with the specific duty of assisting the equipment operator to ensure that no part of the equipment gets too close to an energized, unprotected electrical line.

Persons assigned to act as line spotters must meet the following requirements:

- While acting as a line spotter, no other duties may be performed (e.g., the line spotter cannot also act as the load spotter during a lifting operations).
- The spotter will have a radio or other direct means of communicating with the equipment operator at all times.
- The spotter will be positioned at a right angle to the equipment operator's line of sight to maximize the sight angles between the personnel.

**Under no circumstances will any portion of a piece of equipment pass closer than 10 feet to any energized, uninsulated electrical line.**

4.13 **Additional Safety Measures**

4.13.1 The following additional safety measures can be implemented as needed when working around energized power lines:

- Provide equipment with proximity warning devices. These provide an audible alarm if any part of the equipment gets too close to a line.
- Install ground safety stops. These prevent vehicles from accidentally entering hazardous areas.
- Equip cranes with a boom-cage guard. This prevents the boom from becoming energized if an electrical line is contacted.
- Utilize insulated links and polypropylene tag lines. These prevent the transmission of electricity to loads or tag line handlers if an electrical line is contacted.


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NOTE: These additional safeguards are intended as supplemental protection. Use of these measures is not permissible as a substitute for maintaining the safe working distance or implementation of the procedures in Section 4.1.

4.13.2 If an electrical power line is hit or an electrical arc occurs:

- All ground personnel must evacuate IMMEDIATELY to a distance of at least 50 feet (15.25 metres). DO NOT attempt to rescue any injured person until the line can be de-energized.
- The operator should remain in the cab until the line can be de-energized and should carefully try to extricate the equipment from the power line. This may not be possible where melting of insulator material or metal has occurred.
- Contact the line owner to report the line contact and request that the line be de-energized immediately.
- Once the line has been confirmed to be de-energized, the operator can safely evacuate the cab and rescue can commence for any injured personnel.
- Contact the SH&E Department to report the incident and implement any instructions provided.

If the operator must evacuate while the line is still energized (because of fire or other life-threatening condition) he/she should jump clear of the equipment (making sure to avoid touching the equipment and the ground simultaneously), and land upright and with feet together. Once on the ground, proceed in a direct line away from the equipment using a short, shuffling gait (feet touching, sliding each foot no more than 1 foot forward at a time) to minimize shock hazard from electrical energy being transmitted through the ground.

## 5.0 Records

None.

## 6.0 Attachments

None.


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# 5-417-Utilities, Underground

## 1.0 Purpose and Scope

1.1 Establishes requirements to ensure that underground installations are identified properly before excavation work commences.

1.2 This procedure applies to all Resolution Consultants employees and operations.

## 2.0 Terms and Definitions

2.1 **Underground Utilities:** All utility systems located beneath grade level, including, but not limited to, gas, electrical, water, compressed air, sewage, signaling and communications, etc.

2.2 **Ground Disturbance (GD):** Any indentation, interruption, intrusion, excavation, construction, or other activity in the earth's surface as a result of work that results in the vertical and/or horizontal penetration of the ground.

## 3.0 References

3.1 **American Public Works Association, Excavator's Damage Prevention Guide and One-Call System** Directory International 1990-1991, Utility Location and Coordination Committee.

## 4.0 Procedure

4.1 Ground disturbance may be conducted for a variety of purposes, including, but not limited to, exposing existing buried lines, soil sampling, remedial excavations, advancing soil borings, installing monitoring wells, or excavating test pits.

4.2 Improper ground disturbance may impact a buried pipeline or utility line and cause a major release of a hazardous substance, flood, electrocution, or high pressure gas/air/water. Serious injuries and significant property damage have resulted from insufficient/inadequate identification of underground installations during the course of ground disturbance work.

4.3 To control hazards associated with coming in contact with such installations, the American Public Works Association's (APWA) guidelines for the uniform identification of underground installations has been adopted.

4.4 **CTO Managers** are responsible for ensuring that all work, including the identification, location, and access to all underground utilities, is planned and performed in accordance with contract specifications and safety requirements.

4.4.1 The planning for associated work and avoidance of contacting underground utilities shall be part of the project safety planning in the HASP.

4.5 The **CTO Manager or Site Supervisor** is responsible for the execution of work in accordance with this and other associated Resolution Consultants SOPs, including:

- The review of the HASP.
- Verification that all steps have been taken to identify existing underground utilities in the area to be disturbed, including review of this procedure.

4.6 **Regional SH&E Professional** provides guidance as needed.

4.7 **Personal Protective Equipment**

- Long or short sleeved shirt (season dependent) and pants (coveralls/Nomex LILA for upstream oil and gas)
- Safety toe boots
- Hard hat
- Safety glasses
- High-visibility clothing
- Gloves


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- Respirator with organic vapor/particulate filter cartridge (for use when the exposure exceeds the occupational exposure limit stated on the MSDS), as required
- Hydrogen Sulfide (H2S) Monitor (for areas with known or suspected H2S)

## 4.8 Training

4.8.1 Individuals conducting underground surveys shall successfully complete a Ground Disturbance training course.

4.8.2 If clients have additional training requirements in order to conduct underground surveys individuals will be required to complete these requirements.

## 4.9 Underground Utility Lines

4.9.1 To avoid injury from electrical and other utilities on site, utility lines shall be located and marked prior to conducting any drilling or digging on site. If available, refer to site drawings and/or client interviews for information pertaining to utilities on site.

4.9.2 Types of underground lines (not an all enclusive list):

- Gas line
- Potable and non-potable water lines
- Sewer line
- Power line
- Cable television/communication line
- Cathodic protection lines
- Grounding cable
- Process piping/flow line
- Air line

4.9.3 Prior to conducting the ground disturbance, all utilities that pass within a 25-foot radius of the intrusive work. This is your search and control area. To do so, you need to do the following:

- Notify all pipeline and utility companies, and confirm that their notification requirements are fulfilled prior to conducting a ground disturbance.
- Identify pipelines, power lines, utilities, and irrigation canals in a 25-foot zone of the work area with a representative of the company/owner.
- On active and formerly active federal facilities, and any private property requiring intrusive ground activities, a properly trained (see Section 4.8) and competent third party utility locator shall be used.
- Get approval by a representative of the company/owner for work within a right-of-way (ROW) or within 15 feet of a line if there is no ROW.
- Prepare a site map identifying the search area, the ground disturbance area, and known underground utilities.
- Perform a site walk after all known utilities have been marked by the applicable locators. Confirm that these locations are not within the planned disturbance area.

4.9.4 Look for underground utility indicators, such as:

- Warning signs where pipelines cross roads or water courses.
- Cut lines, wells, underground tanks, or valves that may indicate the presence of pipelines.
- Ground settling from previous underground utility installations.
- If applicable talk to nearby landowners and residents.
- Vegetation appearing “different and/or depressed” from the surrounding vegetation (e.g., greener, taller, shorter, or more brown than surrounding vegetation).

4.9.5 When you are working within an underground utility right-of-way, you shall get written approval from the utility representative prior to doing your work.

4.9.6 Call the utility at least three full working days before you dig so the utility can be located and marked. No excavations will be performed until this is accomplished.

4.9.7 Excavations for the utility for repairs:

- All underground utilities where repairs are to be conducted shall be hand exposed or hydrovac'd within 3 feet of a mark out or within the distance required by the owner of the utility before operating any mechanized equipment.
- Make arrangements for supervision ("a Signal Person") during hand exposure.
- If for any reason these hand excavations are temporarily filled in, mark them.
- Make arrangements for supervision ("a Signal Person") during any mechanical excavation within 15 feet of the underground utility.
- Make arrangements for supervision ("a Signal Person") during backfilling of utilities.
- When exposing utilities do not damage utilities by shovels; **hand-picks should not be used**.
- Remember that all workers have the right and responsibility to refuse to carry out any work or procedures that they feel are unsafe.
- Remember that incidents, injuries, and near misses shall be reported immediately.
- Review the site-specific emergency response plan.

4.9.8 If a an underground facility is hit, stop the work immediately;

- Clear the area if there is eminent danger to life and property; notify first responders, if required.
- Once the area is deemed safe then immediately call
    - Resolution Consultants Health and Safety Officer, if safety issues are present
    - Resolution Consultants Project and Program Managers
    - Facility's responsible party
    - Utility owner
    - An individual on the project team will be identified prior to any ground disturbance that will be responsible for contacting required agencies and regulatory bodies, if required.
- At a minimum Resolution Consultants employee will report:
    - The location of the contact and type of damage
    - Safety pre-cautions taken
    - Any first responder actions
- A photographic record of damage (if safety allows) and all subsequent immediate actions should be collected, as well as documentation in the field log book.
- The government agencies may require a written record; therefore, Resolution Consultants will conduct an incident investigation to present to the client with lessons learned and any corrective actions that may be required.
- Work will not resume until repairs have been made and the utility is properly and completely located.

## 4.10 Identification of Installations

4.10.1 Extreme caution shall always be exercised when attempting to locate underground utilities. The location of utilities can be in some cases not consistent as shown on drawings, as indicated by the placement of surface signage, or as described by personnel. Coordination and planning of the job shall be required with the client or owner.

- Prior to digging and drilling operations, the client shall always be informed of the potential location(s) of underground utility systems.
- If a utility permit is required from the client or owner, it shall be obtained before any work begins.
    - The client or owner may or may not have knowledge of the utility; therefore, all utilities need to be independently located
- All underground installations shall be considered "live" and "operational".


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- If utilities are present within 10 lateral feet of the work area, the planned ground disturbance shall be offset laterally away from the marked underground utility.

4.10.2 **The State and/or** local One Call System or its equivalent will be called out in areas they are responsible for and a reference ticket obtained.

4.10.3 Line location documentation (or appropriate regional agency or company) provides a listing of companies that have registered buried facilities in the proposed work area. Some public utilities and private companies are not members of the One Call System. In order to give line operators sufficient time to respond to a request to locate, a minimum waiting period of 72 business hours is required prior to beginning work.

4.10.4 Once the underground installation has been identified, proper surface markings shall be made in accordance with the guidelines contained in this SOP or as contract-specified.

4.10.5 **Before any drilling activities begin, the drilling contractor's crew will be required to hand auger down at least 4-feet below ground surface at each boring location even if an underground survey has cleared the location for drilling.**

### 4.11 Surface Markings

4.11.1 Color-coded surface marks (paints or similar coatings) shall be used to indicate the type, location, and route of buried installations. Additionally, to increase visibility, color-coded vertical markers (temporary stakes or flags) shall supplement surface marks. Intrusive activities should begin immediately after utilities have been marked. If markings have faded or temporary stakes or flags are not present, the area will have to be re-survey.

### 4.12 Uniform Color-Coding

4.12.1 The colors and corresponding installation type are as follows unless otherwise contract-specified. These marking may be displayed with pin-flagging or surface painting.

4.12.2 Red: Electric Power Lines, Cables, Conduit, and Lighting Cables

4.12.3 Yellow: Gas, Oil, Stream, Petroleum, or Gaseous Materials

4.12.4 Orange: Communication, Alarm or Signal Lines, Cables, or Conduit

4.12.5 Green: Sewers and Drain Lines

4.12.6 White: Proposed Ground Disturbance area

4.12.7 Pink: Temporary Survey Markings

4.12.8 Purple: Nonpotable Water

## 5.0 Records

5.1 The following records on the identification of and response to underground utilities will be maintained in the project files:

5.1.1 All information regarding the identification of underground installations (this information can also be transferred to the appropriate drawings and/or prints and shall be available on site).

5.1.2 Drawings and/or prints shall be maintained for the life of this project.

5.1.3 Pre-drilling/excavation utility checklist

5.14 One-call tickets

## 6.0 Attachments

None.


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# 5-510-Hearing Protection Guidelines

## 1.0 Comparison

| Comparison of Hearing Protection | |
|---|---|
| **Ear Plugs** | **Ear Muffs** |
| ***Advantages:***<br>• small and easily carried<br>• convenient to use with other personal protection equipment (can be worn with ear muffs)<br>• more comfortable for long-term wear in hot, humid work areas<br>• convenient for use in confined work areas | ***Advantages:***<br>• less attenuation variability among users<br>• designed so that one size fits most head sizes<br>• easily seen at a distance to assist in the monitoring of their use<br>• not easily misplaced or lost<br>• may be worn with minor ear infections |
| ***Disadvantages:***<br>• requires more time to fit<br>• more difficult to insert and remove<br>• require good hygiene practices<br>• may irritate the ear canal<br>• easily misplaced<br>• more difficult to see and monitor usage | ***Disadvantages:***<br>• less portable and heavier<br>• more inconvenient for use with other personal protective equipment<br>• more uncomfortable in hot, humid work area<br>• more inconvenient for use in confined work areas<br>• may interfere with the wearing of safety or prescription glasses; wearing glasses results in breaking the seal between the ear muff and the skin and results in decreased hearing protection |

## 2.0 Care and Use

2.1 Follow the manufacturer's instructions.

2.2 Check hearing protection regularly for wear and tear.

2.3 Replace ear cushions or plugs that are no longer pliable.

2.4 Replace a unit when head bands are so stretched that they do not keep ear cushions snugly against the head.

2.5 Disassemble ear muffs to clean.

2.6 Wash ear muffs with a mild liquid detergent in warm water, and then rinse in clear warm water. Sound-attenuating material inside the ear cushions must not get wet.

2.7 Use a soft brush to remove skin oil and dirt that can harden ear cushions.

2.8 Squeeze excess moisture from the plugs or cushions and then place them on a clean surface to air dry.


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# 5-511 Heat Stress Prevention

## 1.0 Purpose and Scope

1.1 Establishes a heat stress prevention program to help ensure that employees know and recognize the symptoms of heat stress-related illnesses and are prepared to take appropriate corrective action.

1.2 This procedure applies to all Resolution Consultants employees and operations.

## 2.0 Terms and Definitions

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

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

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

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

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

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

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

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

2.9 **Sunburn**: Is caused by unprotected exposure to ultraviolet light that is damaging to the skin. The injury is characterized by red painful skin, blisters, and/or peeling.

## 3.0 References

3.1 5-003-SH&E Training

3.2 5-208-Personal Protective Equipment

3.3 5-314-Working Alone and Remote Travel

## 4.0 Procedures

### 4.1 Restrictions

4.1.1 Staff working in extreme heat or sun for extended periods of time away from a shelter or vehicle must not work alone.

4.1.2 Staff shall not be exposed to levels that exceed those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard.

4.1.3 Clothing corrections shall be applied in accordance with the heat stress and strain section of the ACGIH Standard.


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## 4.2 Roles and Responsibilities

4.2.1 Project Managers'/field task managers' responsibilities:

- Evaluate the need for heat stress prevention measures and incorporate as appropriate into the Health and Safety Plan.
- Implement heat stress prevention measures, as applicable, at each work site.
- Develop/coordinate a work-rest schedule, as applicable.
- Ensure heat stress hazard assessments/evaluations were completed for the planned activities.
- Assign personnel physically capable of performing the assigned tasks.
- Ensure that personnel are properly trained in the recognition of heat stress-related symptoms.

4.2.2 SH&E Managers' responsibilities:

- Provide heat stress awareness training.
- Assist project teams develop appropriate work-rest schedules.
- Conduct/support incident investigations related to potential heat stress-related illnesses.

4.2.3 Site Supervisors' responsibilities:

- Identify those tasks that may be most impacted by heat stress and communicate the hazard to the assigned employees.
- Ensure that employees have been trained on the recognition of heat stress-related illness.
- Ensure that adequate supplies of appropriate fluids are readily available to employees.
- Ensure that a proper rest area is available.
- Conduct heat stress monitoring, as applicable.
- Implement the work-rest schedule.
- Ensure that first aid measures are implemented once heat stress symptoms are identified.
- Ensure personnel are physically capable of performing the assigned tasks and are not in a physically compromised condition.
- Report all suspected heat stress-related illnesses.

4.2.4 Employees' responsibilities:

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

## 4.3 Controls

4.3.1 If staff are or may be exposed, the supervisor shall:

- Conduct a heat stress assessment to determine the potential for hazardous exposure of workers, and
- Develop and implement a heat stress exposure control plan.

4.3.2 If staff are or may be exposed, the supervisor shall implement engineering controls (e.g., shelters, cooling devises, etc.) to reduce the exposure of staff to levels below those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard.

4.3.3 If engineering controls are not practicable, the supervisor shall reduce the exposure of workers to levels below those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard by providing administrative controls, including a work-rest cycle or personal protective equipment, if the equipment provides protection equally effective as administrative controls.

4.3.4 If staff are or may be exposed, the supervisor shall provide and maintain an adequate supply of cool, potable water close to the work area for the use of a heat exposed worker.

4.3.5 If a staff person shows signs or reports symptoms of heat stress or strain, they shall be removed from the hot environment and treated by an appropriate first aid attendant, if available, or by a physician.


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4.3.6 Heat stress can be a significant field site hazard, especially for workers wearing CPC. The workforce will gradually work up to a full workload under potentially stressful conditions to allow for proper acclimation.

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

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

## 4.4 Symptoms and Treatment

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

4.4.2 Anyone exhibiting symptoms of heat stroke (red, dry skin, or unconsciousness) must be taken immediately to the nearest medical facility, taking steps to cool the person during transportation (clothing removal, wet the skin, air conditioning, etc.).

4.4.3 Severe heat stress (heat stroke) is a life-threatening condition that must be treated by a competent medical authority.

## 4.5 Prevention

4.5.1 All staff working in extreme heat or sun should understand the following guidelines for preventing and detecting heat exhaustion and heat stroke.

- If you experience heat exhaustion or heat stroke you must immediately seek shelter and water.
- Take frequent short breaks in areas sheltered from direct sunlight; eat and drink small amounts frequently.
- Try to schedule work for the coolest part of the day, early morning and evening.

4.5.2 Prevention of heat-related illnesses:

- Avoid strenuous physical activity outdoors during the hottest part of the day.
- Wear a hat and light-colored, loose-fitting clothing to reflect the sun.
- Avoid sudden changes of temperature. Air out a hot vehicle before getting into it.
- If you take diuretics, ask your doctor about taking a lower dose during hot weather.
- Drink 8 to 10 glasses of water per day. Drink even more if you are working or exercising in hot weather.
- Avoid caffeine and alcohol as they increase dehydration.
- If you exercise strenuously in hot weather, drink more liquid than your thirst seems to require.

## 4.6 Personal Protective Equipment

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

## 4.7 Work-Rest Schedule Practices

- Intake of fluid will be increased beyond that which satisfies thirst, and it is important to avoid "fluid debt," which will not be made up as long as the individual is sweating.
- Two 8-ounce glasses of water should be taken prior to beginning work, then up to 32 oz. per hour during the work shift; fluid replacement at frequent intervals is most effective.

- The best fluid to drink is water; liquids like coffee or soda do not provide efficient hydration and may increase loss of water.
- If commercial electrolyte drinks (e.g., Gatorade) are used, the drink should be diluted with water, or 8 ounces of water should be taken with each 8 ounces of electrolyte beverage.
- Additional salt is usually not needed and salt tablets should not be taken.
- Replacement fluids should be cool, but not cold.
- Breaks will be taken in a cool, shaded location, and any impermeable clothing should be opened or removed.
- Dry clothing or towels will be available to minimize chills when taking breaks.
- Manual labor will not be performed during breaks, other than paperwork or similar light tasks.
- Other controls that may be used include:
  - Scheduling work at night or during the cooler parts of the day (6 am–10 am, 3 pm–7 pm).
  - Erecting a cover or partition to shade the work area.
  - Wearing cooling devices such as vortex tubes or cooling vests beneath protective garments. If cooling devices are worn, only physiological monitoring will be used to determine work activity.

## 4.8 Evaluating the Work-Rest Schedule's Effectiveness

4.8.1 Once a work-rest schedule is established, the work supervisor must continually evaluate its effectiveness through observation of workers for signs/symptoms of heart stress. Measurement of each worker's vitals (e.g., pulse, blood pressure, and temperature) can provide additional information in determining if the schedule is adequate, and is accomplished as follows:

4.8.2 At the start of the workday each worker's baseline pulse rate (in beats per minute – bpm) is determined by taking a pulse count for 15 seconds and multiplying the result by four or an automated pulse count device may be utilized. Worker pulse rates can then be measured at the beginning and end of each break period to determine if the rest period allows adequate cooling by applying the following criteria:

- Each worker's maximum heart rate at the start of any break should be less than [180 minus worker's age] bpm. If this value is exceeded for any worker, the duration of the following work period will be decreased by at least 10 minutes.
- At the end of each work period all workers' heart rates must have returned to within +10% of the baseline pulse rate. If any worker's pulse rate exceeds this value the break period will be extended for at least 5 minutes, at the end of which pulse rates will be remeasured and the end-of-break criteria again applied.

4.8.3 Use a clinical thermometer or similar device to measure the oral/ear temperature at the beginning (before drinking liquids) and end of each break period and apply the following criteria:

- If the oral temperature exceeds 99.6$^{o}$F, shorten the next work cycle by one-third without changing the rest period.
- If the oral temperature still exceeds 99.6$^{o}$F (36.6$^{o}$C) at the beginning of the next rest period, shorten the following work cycle by one-third.

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

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

4.8.5 All physiological monitoring of heat stress will be documented using *5-511-Heat/Cold Stress Monitoring Log*.

## 4.9 Training

4.9.1 Project staff and their supervisors that may be exposed to the hazard will be oriented to the hazard and the controls prior to work commencing.

4.9.2 Those personnel potentially exposed to heat stress will receive training including, but not limited to

- Sources of heat stress, influence of protective clothing, and importance of acclimatization.
- How the body handles heat.
- Recognition of heat-related illness symptoms.
- Preventative/corrective measures.
  - Employees will be informed of the harmful effects of excessive alcohol consumption in the prevention of heat stress.
  - All employees will be informed of the importance of adequate rest and proper diet in the prevention of heat stress.
- First aid procedures for heat stress-related illnesses.

## 5.0 Records

None.

## 6.0 Attachments

6.1 5-511-FM Heat/Cold Stress Monitoring Log


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# 5-511 Form 1 Heat Stress Monitoring Log

The purpose of this form is to track entry into hot zones wearing chemically protective clothing and monitor employees for heat stress-related illness. It is the responsibility of the foreman or supervisor-in-charge to ensure that each person entering the hot zone completes the required information. Vital signs must be taken by a competent person.

| **Project Name:** | | | **Foreman/Supervisor:** | | | | | | | | | **Work/Rest Schedule1:** IN *(min)* OUT *(min)* | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date:** | **Water Provided[2]** | | **Acclimated[3]** | | **Initial Vitals[3]** | **Vital Signs and Time In/Out[4]** | | | | | | | | | | | |
| Employee Name | Yes | No | Yes | No | **Vitals** | In | Out | **Vitals** | In | Out | **Vitals** | In | Out | **Vitals** | In | Out |
| | | | | | **P** | | | **P** | | | **P** | | | **P** | | |
| | | | | | **BP** | | | **BP** | | | **BP** | | | **BP** | | |
| | | | | | **Temp** | | | **Temp** | | | **Temp** | | | **Temp** | | |
| | | | | | **P** | | | **P** | | | **P** | | | **P** | | |
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1. Please refer to 5-511 Heat Stress. Section 6.3 provides specific details on how to develop a work-rest schedule.
2. Each employee should be provided a sufficient amount of water or sports drink before entering the hot zone. Drinks such as coffee and cola should be discouraged.
3. A worker is "acclimated" if he/she has worked in a hot environment for at least 7 to 10 consecutive days. If a worker is acclimated, check "Yes." If a worker is not acclimated, check "No" and reduce the "Min In" by 50 percent for that employee until the 7- to 10-day period is reached.
4. "Vitals" refers to employee vital signs (e.g., pulse [P], blood pressure [BP], body temperature [Temp], etc.). Initial vitals must be taken and recorded before the start of work operations in the hot zone. Each time the employee exits the hot zone, vitals must be taken and evaluated for heat stress criteria. Section 6.4 of 5-511 Heat Stress provides specific instructions for taking and evaluating employee vital signs.
5. Body temperature vital signs will be recorded in °F.



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# 05-519-Respiratory Protection Program

## 1.0 Purpose and Scope

1.1 This procedure establishes methods that Resolution Consultants will use to prevent employee exposure to hazardous concentrations of airborne contaminants or to supply breathing-quality air to employees working in oxygen-deficient atmospheres.

1.2 This procedure applies to all Resolution Consultants employees and operations.

## 2.0 Terms and Definitions

2.1 **Air-purifying respirator:** A respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.

2.2 **Approved:** Equipment tested and listed by the Bureau of Mines, jointly by the Mining Enforcement and Safety Administration (MESA), and the National Institute for Occupational Safety and Health (NIOSH), or jointly by the Mine Safety and Health Administration (MSHA) and NIOSH.

2.3 **Assigned protection factor (APF):** The ratio of the ambient concentration of an airborne substance (outside the respirator) to the concentration of the substance inside the respirator. NIOSH defines this as 10 for an approved half-face respirator and 50 for an approved full-face respirator.

2.4 **Atmosphere-supplying respirator:** A respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere and includes supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.

2.5 **Breakthrough:** The first perception of an odor, taste or irritation experienced while wearing an air-purifying respirator. Breakthrough is generally an indication that the cartridges are saturated and are no longer filtering out the contaminant. Breakthrough can also be an indication of an improperly functioning respirator.

2.6 **Confined space:** An enclosure, such as a storage tank, process vessel, boiler, silo, tank car, pipeline, tube, duct, sewer, underground utility vault, tunnel, or pit, that has limited means of egress and poor natural ventilation and that may contain hazardous contaminants or be oxygen deficient.

2.7 **Canister or cartridge:** A container that has a filter, sorbent, or catalyst, or a combination of these items and that removes specific contaminants from the air passed through the container.

2.8 **Demand respirator:** An atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the facepiece by inhalation.

2.9 **Emergency situation:** Any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that may or does result in an uncontrolled significant release of an airborne contaminant.

2.10 **Employee exposure:** Exposure to a concentration of an airborne contaminant that would occur if the employee were not using respiratory protection.

2.11 **End-of-service-life indicator (ESLI):** A system that warns the respirator user of the approach of the end of adequate respiratory protection, for example, that the sorbent is approaching saturation or is no longer effective.

2.12 **Escape-only respirator:** A respirator intended to be used only for emergency exit.

2.13 **Filter or air purifying element:** A component used in respirators to remove solid or liquid aerosols from the inspired air.

2.14 **Filtering facepiece (dust mask):** A negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium.

2.15 **Fit factor:** A quantitative estimate of the fit of a particular respirator to a specific individual, typically estimating the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.

2.16 **Fit test:** The use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual. (See also Qualitative fit test QLFT and Quantitative fit test QNFT.)

2.17 **Helmet:** A rigid respiratory inlet covering that also provides head protection against impact and penetration.

2.18 **HASP:** Health and Safety Plan

2.19 **Hazardous atmosphere:** Any atmosphere, either immediately or not immediately dangerous to life or health, that is oxygen-deficient or that contains a toxic or disease-producing contaminant exceeding the legally established permissible exposure limit (PEL) or, where applicable, the Threshold Limit Value (TLV) established by the American Conference of Governmental Industrial Hygienists (ACGIH).

2.20 **High efficiency particulate air (HEPA) filter:** A filter that is at least 99.97% efficient in removing monodisperse particles of 0.3 micrometers in diameter. The equivalent NIOSH 42 CFR 84 particulate filters are the N100, R100, and P100 filters.

2.21 **Hood:** A respiratory inlet covering that completely covers the head and neck and may also cover portions of the shoulders and torso.

2.22 **Immediately dangerous to life or health (IDLH):** An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

2.23 **Loose-fitting facepiece:** A respiratory inlet covering that is designed to form a partial seal with the face.

2.24 **Maximum use concentration (MUC):** The protection factor (PF) of an approved respirator assembly times the permissible exposure limit (PEL). MUC = PF x PEL

2.25 **Negative pressure respirator (tight fitting):** A respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

2.26 **Oxygen deficient atmosphere:** An atmosphere with oxygen content below 19.5% by volume.

2.27 **Powered air-purifying respirator (PAPR):** A respirator that contains a blower that passes ambient air through an air-purifying component. Air-purifying respirators may be half-face (covering the nose and mouth) or full-face (covering the eyes, nose, and mouth).

2.28 **Physician or other licensed health care professional (PLHCP):** An individual whose legally permitted scope of practice (i.e., license, registration, or certification) allows him or her to independently provide or be delegated the responsibility to provide some or all of the health care services required by paragraph (e) of this section.

2.29 **Positive pressure respirator:** A respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

2.30 **Powered air-purifying respirator (PAPR):** An air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

2.31 **Program administrator:** The individual that has the responsibility to verify full compliance with this SOP and determines the need for medical evaluations or any other additional medical attention in regards to the use of a respirator.

2.32 **Pressure demand respirator:** A positive pressure atmosphere-supplying respirator that admits breathing air to the facepiece when the positive pressure is reduced inside the facepiece by inhalation.

2.33 **Qualitative fit test (QLFT):** A pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent.

2.34 **Quantitative fit test (QNFT):** An assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

2.35 **Respiratory inlet covering:** That portion of a respirator that forms the protective barrier between the user's respiratory tract and an air-purifying device or breathing air source, or both. It may be a facepiece, helmet, hood, suit, or a mouthpiece respirator with nose clamp.


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2.36 **Self-contained breathing apparatus (SCBA):** An atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.

2.37 **Service life:** The period of time that a respirator, filter or sorbent, or other respiratory equipment provides adequate protection to the wearer.

2.38 **Supplied-air respirator (SAR) or airline respirator:** An atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user.

2.39 **Tight-fitting facepiece:** A respiratory inlet covering that forms a complete seal with the face.

2.40 **User seal check:** An action conducted by the respirator user to determine if the respirator is properly sealed to the face.

## 3.0 References

3.1 The following standards apply to respiratory equipment:

| Association | Standard |
|---|---|
| **Canadian Standards Association (CSA)** | Z180.1-00, Compressed Breathing Air and Systems<br>Z94.4-02, Selection, Use and Care of Respirators |
| **Department of Labor - Occupational Safety and Health Administration** | 29 Code of Federal Regulation 1910. 134<br>29 Code of Federal Regulation 1926.103 |

## 4.0 Procedure

4.1 **Roles and Responsibilities**

4.1.1 **Program Administrator.** The Resolution Consultants **SH&E Manager** is the Respiratory Protection Program Administrator. The **Program Administrator** shall:

- Verify full compliance with this SOP.
- Determine the need for medical evaluations or any other additional medical attention related to the use of a respirator.
- Perform the program evaluations described in this SOP.

4.1.2 **Project manager (including Operations Field Manager, supervisors, etc.)** shall**:**

- Verify compliance with the respiratory protection program set forth in this procedure.
- Verify that only those employees who are medically qualified, properly trained, and fit tested are assigned to respirator work.
- Verify that respirators are provided, repaired, or replaced as may be required due to wear and deterioration.

4.1.3 **Site Safety Supervisor/Officer** shall**:**

- Monitor compliance with the various aspects of this program on jobsites.
- Provide technical assistance regarding respirator selection and use, evaluate the effectiveness of this program, and support respirator training and fit testing.
- Audit company compliance with this procedure on jobsites.

4.1.4 **Employees** shall**:**

- Will use the provided respiratory protection in accordance with instructions and training received.
- Will guard against damage to the respirator.
- Will report immediately any malfunction of the respirator to the supervisor or other responsible person.

### 4.2 Medical Surveillance

No employee shall be assigned to a task that requires the use of a respirator unless it has been determined that he/she is physically able to perform the work while using the required respirator.

4.2.1 Prior to wearing a respirator, employees will complete an initial baseline medical surveillance examination performed by a PLHCP.

4.2.2 Employees who continue to use respiratory protection will receive an annual medical surveillance examination.

4.2.3 Additional medical examinations will be provided to employees who wear respirators if/when:

- An employee reports medical signs or symptoms that are related to ability to use a respirator;
- A PLHCP, supervisor, or the respirator program administrator determines that an employee needs to be reevaluated;
- Information from the respiratory protection program, including observations made during fit testing and program evaluation, indicates a need for employee reevaluation; or
- A change occurs in workplace conditions (e.g., physical work effort, protective clothing, temperature, etc.) that may result in a substantial increase in the physiological burden placed on an employee.

4.2.4 All medical surveillance examinations shall occur during normal working hours; shall be convenient, understandable, and confidential; and the employee will be given chance to discuss results with examining physician.

### 4.3 Training

4.3.1 Project staff that may be exposed to the hazard will be oriented to the hazard and the controls prior to beginning work.

4.3.2 Atmospheric testing will be carried out by someone trained in the use, calibration, and interpretation of the test equipment.

4.3.3 Employees who may be required to use a breathing apparatus shall be properly trained in the operation, maintenance, cleaning and storage of the apparatus.

4.3.4 All staff will receive an orientation to the hazards on the job site as well as initial Field Safety training which outlines appropriate PPE requirements.

4.3.5 Employees who wear respiratory protection must receive training before they are assigned to a task that requires the use of respiratory protection.

4.3.6 Retraining shall be administered annually, and when the following situations occur:

- Changes in the workplace or the type of respirator render previous training obsolete;
- Inadequacies in the employee's knowledge or use of the respirator indicate that the employee has not retained the requisite understanding or skill; or
- Any other situation arises in which retraining appears necessary to verify safe respirator use.

4.3.7 Frequency of Training

- All employees who may have the need to wear respiratory protection are required to participate in Resolution Consultants' internal SH&E training program.
- In addition, Resolution Consultants' SH&E Department will conduct respirator training classes, as necessary, for those who may need to wear respiratory protection but did not participate in Resolution Consultants' HAZWOPER training classes.

4.3.8 Basic Respirator Training Program

Respirator training classes will include, at a minimum, the following:

- Instruction in the nature of the respiratory hazards, whether acute, chronic, or both, and a description of potential health effects if the respirators are not used.


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- Why the respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect of the respirator.
- The limitations and capabilities of the respirator.
- Proper fitting, including demonstrations and practice in wearing, adjusting, determining the fit of, and performing a user seal check each time respirator is donned.
- How to inspect, put on, use and remove the respirator.
- How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions.
- The procedures for maintenance and storage of the respirator.
- How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators.
- The general requirements of the OSHA and OH&S Respiratory Protection Standard.

## 4.4 Respirator Selection

4.4.1 Resolution Consultants' will maintain air purifying respirators and cartridges from at least two providers (i.e. MSA and North).

4.4.2 Prior to fit testing, the employee shall be allowed to pick the most comfortable respirator from the brands offered.

4.4.3 The type of respirator most commonly used by Resolution Consultants' staff is a cartridge type air purifying respirator (APR). Many different types of APRs exist, and field staff should always fit test an APR prior to use.

## 4.5 Fit Testing Procedures

4.5.1 A respirator that doesn't fit properly will not provide adequate protection.

4.5.2 Four types of tests can be used:

- Positive Pressure Sealing Check: Close off the exhalation valve and exhale gently. The fit is satisfactory if a slight positive pressure can be built up inside the face piece for a full 10 seconds without detecting any outward leakage of air between the sealing surface of the face piece and the wearer's face.
- Negative Pressure Sealing Check: Close off the inlet opening of the cartridges by covering them with the palm of the hands. Inhale gently and hold breath for at least 10 seconds. The face piece should collapse slightly with no detection of inward leakage of air into the face piece.
- Isoamyl Acetate Test (banana oil test): A tube or bottle of banana oil is held in front of and around the mask. The fit is adequate if the wearer does not detect the odor of bananas. During the test, the wearer should be demonstrating movements that approximate a normal working situation, including deep breathing, side-to-side and up-and-down head movements, and talking.
- Irritant Smoke Test (Stannic Chloride Test): The procedure is similar to that of the banana oil test except that an irritant smoke is used. The wearer of the mask will cough (involuntary reaction) if he/she detects the irritant smoke in the mask.

4.5.3 Fit Testing Frequency

Additional fit tests will be performed:

- Whenever there is an indication that changes in the employee's physical condition might have an effect on respirator fit. (Such conditions include, but are not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight.)
- Whenever there is an indication that changes in the employee's physical condition might have an effect on respirator fit. (Such conditions include, but are not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight.)
- If the employee notifies his/her supervisor or **Regional SH&E Manager** that the fit of his/her respirator is unacceptable.

4.5.4 Fit Testing Records

A written record of each fit test performed must be maintained in the employee's health and safety records. 0*5-519-Respiratory Equipment Fit Test* will be used to document each fit test.

## 4.6 Interference with Gas-Tight Seal

Respiratory protection can only be worn when it can be determined that there is no obstruction of contact between the wearer's skin and the sealing surfaces of the mask whatsoever. Such obstruction can include facial hair, head hair, and the temple bars of eye glasses.

4.6.1 Respirator wearers cannot be afforded protection from hazardous airborne contaminants when conditions prevent a complete gas-tight face seal.

4.6.2 Although eyeglass temple bars will interfere with the formation of a gas-tight face seal in the case of full-face respirators, this problem is correctable by use of internally mounted spectacle kits. Management and supervisors shall verify that employees under their supervision who regularly wear eyeglasses, and who will require the use of a full-face respirator, are provided with appropriate spectacle kits at company expense.

The use of contact lenses in hazardous atmospheres or in operations involving intense heat, molten metals or the potential for chemical splash shall be prohibited.

4.6.3 Because facial hair (even beard stubble) will interfere with a gas-tight seal, employees shall be required to be clean- shaven whenever the use of respiratory protection is specified.

4.6.4 Respiratory Protection will only be assigned to those employees without physical obstructions to a gas-tight face seal to jobs that may require the use of respiratory protection. Candidates for employment shall be made aware that their versatility may be limited if they cannot wear a respirator and that this can affect their job assignments.

## 4.7 Specification of Proper Level of Respiratory Protection

4.7.1 The **Regional SH&E Manager** or his/her designated and qualified representative is responsible for specifying the proper selection and use of all respiratory protective devices, including half-face and full-face air purifying respirators, airline respirators, and self-contained breathing apparatus. This information is generally specified as part of the written site-specific Health and Safety Plan (HASP).

4.7.2 Employees engaged in activities not covered by a HASP must consult with the **Regional SH&E Manager** or his/her designated representative to determine the proper equipment prior to use. Whenever appropriate, exposure levels will be measured to verify that the actual use conditions are within the limitations of the approvals specified by NIOSH/MSHA for the selected respirator.

4.7.3 Conditions Required for Air-Purifying Respirator (APR) Use

Air-purifying respirators (APR) shall only be specified for use when it can be determined that the following conditions exist:

- The oxygen concentration is greater than 19.5%.
- The contaminant is known and its concentration can be quantified.
- The airborne contaminant concentration is below its IDLH.
- A canister or cartridge is available which is approved for the contaminant.
- The contaminant concentration is below the concentration for which the canister is approved.
- The contaminant concentration is below the Maximum Use Concentration (MUC) of the respirator.

In all cases where OSHA has specified that a particular respirator be used (asbestos, formaldehyde, benzene, arsenic, lead, etc.), that respirator, or one providing equal or better protection, shall be specified.


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4.7.4 APR Filter and Chemical Cartridges

An adequate supply of the following cartridges shall be maintained in stock at each office location where respiratory protective equipment:

- High efficiency particulate air (HEPA) filter cartridges;
- Organic vapor cartridges; and
- Combination HEPA/acid gas/organic vapor cartridges

4.7.5 Change Out Schedule

Filter cartridges shall be changed out whenever an increase in breathing resistance is detected by the user.

When available, chemical cartridges that are equipped with end-of-service life indicators (ESLI) shall be utilized. In those cases, cartridges should be changed when indicated by the ESLI.

In the absence of cartridges equipped with an ESLI, employees shall change chemical cartridges on the following schedule:

- Immediately if breakthrough is perceived;
- In accordance with the change out schedule developed by the Regional SH&E Manager in the site-specific Health and Safety Plan (HASP); and
- After each day's use.

The change out schedule will be based upon the anticipated contaminant concentration, environmental conditions, employee work rate, and the specific data provided by manufacturer

When powered air-purifying respirators **(**PAPRs) are worn, the same rules apply with the exception that filter cartridges should be changed when airflow through the filter elements decreases to an unacceptable level, as indicated by the manufacturer's test device.

## 4.8 Air-Supplying Respirator Use

4.8.1 Conditions Requiring Use of Air-Supplying Respirators

Air-supplying respirators will be specified for use when it has been determined that any of the following conditions exist:

- The oxygen concentration is less than 19.5%;
- The contaminant is unknown or its concentration cannot be quantified;
- The airborne contaminant concentration is above its IDLH;
- An air-purifying respirator canister or cartridge that removes the contaminant is not available;
- The contaminant concentration is above the concentration for which an air-purifying canister or cartridge is approved; or
- The contaminant concentration is above the Maximum Use Concentration (MUC) of a full-face air-purifying respirator.

No employee may engage in an operation requiring the use of an air-supplied respirator unless a representative of the SH&E Department has reviewed the operation and approved its use.

The determination of the type of air-supplying respirator (i.e., SCBA, air-line, demand, pressure demand, etc.) which is appropriate for the job, outside standby persons, communication, proper training and equipment, notification procedures, and necessary action all require planning. Mandatory equipment including SCBA or SAR with auxiliary air supply & emergency appropriate retrieval equipment or equivalent rescue means will be made by the **Regional SH&E Manager** or his/her designated representative at the time of review. The need for any additional precautions (i.e.,

equipment specific training, on-site H&S support, etc.) will also be determined by the **Regional SH&E Manager**.

## 4.9 Minimum Procedures for IDLH atmospheres

4.9.1 One employee or, when needed, more than one employee shall be located outside the IDLH atmosphere. This employee shall be responsible for communicating with the employees in the IDLH atmosphere, alerting rescue services if needed, and restricting entrance to the IDLH area by untrained and unapproved persons.

4.9.2 Visual, voice, or signal line communication shall be maintained between the employee(s) in the IDLH atmosphere and the employee(s) located outside the IDLH atmosphere.

4.9.3 The employee(s) located outside the IDLH atmosphere shall be trained and equipped to provide effective emergency rescue or to initiate onsite rescue services.

4.9.4 If on-site rescue services are to be used, the Site Safety Officer shall confirm that the service is available to respond prior to any employees entering the IDLH area.

4.9.5 Employee(s) located outside the IDLH area and/or on-site rescue services shall be equipped with:

- Pressure demand or other positive pressure SCBAs, or a pressure demand or other positive pressure supplied-air respirator with auxiliary SCBA; and either
- Appropriate retrieval equipment for removing the employee(s) who enter(s) these hazardous atmospheres where retrieval equipment would contribute to the rescue of the employee(s) and would not increase the overall risk resulting from entry; or
- Equivalent means for rescue where retrieval equipment would create a hazard to the workers in the IDLH area.

## 4.10 Breathing Air Quality

Compressed air used for respiration shall be of high purity and shall meet, as a minimum, the requirements of the specification for Grade D breathing air as described in Compressed Gas Association Specification G-7.1 (ANSI Z86.1).

Oxygen shall NOT be used as a source of breathing air at any time in open-circuit SCBAs or air-line respirators.

4.10.1 Compressor Supplied Breathing Air

All compressors used for filling SCBA air cylinders or for supplying air-line respirators shall be equipped with the following safety and standby devices:

- The compressor intake shall be located to verify that only respirable (uncontaminated) air is admitted. This requires attention to the location of the compressor intake with respect to compressor engine exhaust, chemical storage or use areas, and suitable intake screening or filtration.
- Alarms to indicate compressor failure (such as low-pressure air horns, etc.) shall be installed in the system.
- A receiver of sufficient capacity to enable the respirator wearer to exit from a contaminated atmosphere shall be provided.

If an oil-lubricated compressor is used to supply breathing air, it shall be equipped with both of the following devices:

- A continuous reading carbon monoxide monitoring system set to alarm should the carbon monoxide concentration exceed 10 ppm; and,
- A high temperature alarm which will activate when the discharge air exceeds 110% of the normal operating temperature in degrees Fahrenheit.

An in-line purifying filter assembly to remove oil, condensed water, particulates, odors, and organic vapors shall be used in conjunction with the air compressor.


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Routine inspection and maintenance of air compressor shall be performed.

4.10.2 Compressed Air Cylinders

Breathing air cylinders shall be legibly identified with the word AIR by means of stenciling, stamping, or labeling as near to the valve end as practical.

Cylinders shall be stored and handled to prevent damage to the cylinder or valve.

Cylinders shall be stored upright with the protective valve cover in place and, in such a way (e.g. supported with substantial rope or chain in the upper one third of the cylinder, or in racks designed for this purpose) as to prevent the cylinder from falling.

Cylinders shall not be dropped, dragged, rolled, or allowed to strike each other or to be struck violently. Cylinders shall never be exposed to temperatures exceeding $125^0$ F. Cylinders with visible external damage, evidence of corrosion damage, or exposure to fire shall not be accepted or used.

Only cylinders within current hydrostatic test periods shall be used. Steel cylinders must be hydrostatically tested every five years and fiberglass wrapped aluminium cylinders must be tested every three years.

4.10.3 Compressed Air Cylinder Systems for Air-Line Respirators

Compressed air cylinder systems used to supply air-line respirators shall be equipped with low pressure warning bells (e.g., Scott Pak-Alarm) or similar warning devices to indicate air pressure in the manifold below 500 psi. When such systems are used, one employee shall be assigned as safety standby within audible range of the low pressure alarm.

Air-line hose couplings shall be incompatible with outlets for other gas systems to prevent inadvertently supplying air-line respirators with nonrespirable gases or oxygen.

The air pressure at the hose connection to air-line respiratory equipment shall be within the range specified in the approval of the equipment by the manufacturer.

4.10.4 Compressed Air Cylinder Systems for Recharging SCBAs

When a cascade system is used to recharge SCBA air cylinders, it shall be equipped with a high-pressure supply hose and coupling rated at a capacity of at least 3000 psi.

4.10.5 Escape/Egress Units

Escape/egress unit respirators are intended for use in areas where escape with a short-term (5 minutes) air supply is necessary.

They may be used as adjuncts to airline pressure demand respirators as a backup air supply or as independent emergency devices in areas where respiratory protection is not normally required.

Appropriate training shall be conducted and documented prior to assigning employees to tasks or locations subject to the use of these respirators.

Escape/egress units (5 minutes) shall never be used to enter a hazardous atmosphere or as primary standby respirators for confined space entry.

4.10.6 Respirator Inspection, Cleaning, Maintenance, and Storage

When respirator use is required, only properly cleaned and maintained NIOSH/MSHA approved respirators shall be used.

4.10.7 Inspection

- Respirators should be inspected before and after use. Those for emergency use should be inspected once per month.
- All connections, including gaskets, o-rings should be checked for damage and tightness.
- The face piece should be inspected for cracks and rubber or elastomer parts should be checked for deterioration and pliability.

- All respirators shall be inspected routinely by the user before, during, and after each use. Defects shall be reported to supervision. No defective respirator shall be issued or worn.
- Routinely used respiratory equipment shall be inspected by an individual qualified by experience or training to do the work.

4.10.8 Cleaning and Maintenance

- Respirator facepiece assemblies shall be cleaned and sanitized minimally after each day of use.
- Respiratory equipment shall not be passed from one person to another until it has been cleaned and sanitized.
- Respiratory equipment shall be maintained according to manufacturer's instructions.
- Where respirators are assigned to individual employees, management shall verify compliance with cleaning and maintenance requirements by periodic inspection and field audits of respiratory equipment.
- Respirators must be cleaned after each use and then placed into a clean bag for storage.
- Prior to cleaning, the filters, cartridges, or canisters must be removed and discarded.
- The respirator should then be inspected for any damaged parts (repair should only be done by trained personnel with the proper tools) and cleaned with a hot water/mild detergent solution.
- In field situations, a premoistened towelette (e.g., baby wipes) can be used. The mask should then be rinsed with clean warm water and dried.
- Alcohol should never be used to clean masks as it can damage the face pieces and rubber parts.

4.10.9 Storage

- Store clean respirators so that they are protected from dust, excessive moisture, damaging chemicals, temperature extremes and direct sunlight. They should be placed in a sealed plastic bag and stored in the original box.

When not in use, respirator facepieces shall be placed in clean Ziploc-style bags and stored to protect against dust, sunlight, extreme temperatures, excessive moisture, and damaging chemicals.

## 4.11 Hygiene

Employees must leave the work area to wash, change cartridges, or if they detect breakthrough or resistance.

## 4.12 Program Evaluation

4.12.1 The Regional SH&E Manager will conduct evaluations of the workplace as necessary to verify that the provisions of the current written program are being effectively implemented and that it continues to be effective.

4.12.2 The Regional SH&E Manager will regularly (i.e., during annual training) consult employees required to use respirators to assess their views on program effectiveness and to identify any problems. Any problems that are identified during this assessment shall be corrected. Factors to be assessed include but are not limited to:

- Respirator fit (including the ability to use the respirator without interfering with effective workplace performance);
- Appropriate respirator selection for the hazards to which the employee is exposed;
- Proper respirator use under the workplace conditions the employee encounters; and
- Proper respirator maintenance.

### 4.13 Costs

4.13.1 The costs for training, medical examinations, fit testing, respirators, and cleaning materials should be considered as operational costs for Resolution Consultants.

## 5.0 Records

### 5.1 Medical Records

Medical records under this section will be maintained at a minimum in accordance with 29 CFR 1910.1020.

### 5.2 Fit Test Records

Fit test records will include the name of the employee tested; the type of fit test performed; the specific style, make, model, and size of the respirator tested; the date of the test; and the pass/fail results for QLFTs or QNFT test documentation (i.e., strip charts).

### 5.3 Training Records

- Respiratory protection training records will be maintained by the employee with copies provided to their SH&E Coordinators or Administrators.
- On-site records of training and fit testing will be maintained as necessary.
- For situations where training is required by and provided by clients, copies of SH&E Records shall be maintained by Resolution Consultants.


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## 6.0 Respiratory Equipment Fit Test

| | | | |
|---|---|---|---|
| **Date of Testing:** | | **Respirator Type(s):** | |
| **Employee Name:** | | **Location:** | |
| **Method & Testing Agent:** | | | |
| **Test Exercise** | **Pass / Fail** | **Test Exercise** | **Pass / Fail** |
| Sensitivity Check | | Normal Breathing | |
| Deep Breathing | | Turning Head (side to side) | |
| Moving Head (up/down) | | Rainbow Passage* | |
| Bending Over | | Normal Breathing | |

**Successful Respirator Fit Determined:** ☐ **Yes** ☐ **No**

I certify that I have been tested with the respirator(s) listed above. I have also had the opportunity to ask questions and those questions have been answered to my satisfaction. I also understand that the above fit test is voided if respirator limitations are not followed or the respirator is not worn or if conditions (e.g., facial hair) prevent a good face seal.

| | |
|---|---|
| Employee Signature: | Date: |
| Signature of Tester: | Date: |

***Rainbow Passage.** "When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch with its path high above and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow."*


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| Date:<br>Tester: | MSA Comfo II HM<br>S ☐ M ☐ L ☐ | MSA Ultra Twin FM<br>S ☐ M ☐ L ☐ | North 7700 HM<br>S ☐ M ☐ L ☐ | North 7600 FM<br>S ☐ M/L ☐ | HM<br>S ☐ M ☐ L ☐ | FM<br>S ☐ M ☐ L ☐ |
|---|---|---|---|---|---|---|
| Qualitative Test Agent(s):<br>IAA ☐ Smoke ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ |
| Quantitative Test Device | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor |
| Date:<br>Tester: | MSA Comfo II HM<br>S ☐ M ☐ L ☐ | MSA Ultra Twin FM<br>S ☐ M ☐ L☐ | North 7700 HM<br>S ☐ M ☐ L ☐ | North 7600 FM<br>S ☐ M/L ☐ | HM<br>S ☐ M ☐ L ☐ | FM<br>S ☐ M ☐ L ☐ |
| Qualitative Test Agent(s):<br>IAA ☐ Smoke ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ |
| Quantitative Test Device | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor |
| Date:<br>Tester: | MSA Comfo II HM<br>S ☐ M ☐ L ☐ | MSA Ultra Twin FM<br>S ☐ M ☐ L ☐ | North 7700 HM<br>S ☐ M ☐ L ☐ | North 7600 FM<br>S ☐ M/L ☐ | HM<br>S ☐ M ☐ L ☐ | FM<br>S ☐ M ☐ L ☐ |
| Qualitative Test Agent(s):<br>IAA ☐ Smoke ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ | Pass ☐ Fail ☐ |
| Quantitative Test Device | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor | Overall Fit Factor |

Instructions

1. Complete the employee information at the top of the record (one record per employee).
2. Enter the date of the test and the name of the person conducting the fit test.
3. Circle the brand and model of respirator tested (e.g., MSA Comfo II, North 7700, etc.) or enter another brand and model in one of the last two columns.
4. Circle the size of the respirator tested.
5. For qualitative fit tests, circle the test agent used - IAA = Isoamyl Acetate, Smoke = Irritant Smoke (Stannic Chloride) and the outcome of the test (i.e., Pass or Fail).
6. For quantitative fit tests, enter the name of the instrument used and the overall fit factor measured by the test.
7. Keep a copy in the employee's training files and enter subsequent (e.g., annual) tests until the record is filled.


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# 5-520-Spill Response, Incidental

## 1.0 Purpose and Scope

1.1 This procedure defines the role of Resolution Consultants employees in the event of a chemical spill in Resolution Consultants offices, laboratories, or storage areas and during field investigations, including the appropriate containment procedures that Resolution Consultants employees will follow.

1.2 This procedure applies to all Resolution Consultants employees and operations.

## 2.0 Terms and Definitions

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

2.1.1 A release at or above a reportable quantity (RQ) of a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substance (40 CFR 302.8) is required to be reported to the National Response Center (NRC).

2.1.2 A hazardous chemical release at or above an RQ under the Emergency Planning and Community Right-to-Know Act (EPCRA) (Title III under the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 350-372) is required to be reported to state and local officials.

2.1.3 A release in violation of a facilities Spill Prevention, Control, and Countermeasure (SPCC) Plan (40 CFR 112).

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

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

## 3.0 References

3.1 40 CFR 302.8

3.2 40 CFR 350-372

3.3 40 CFR 112

3.4 5-101-Emergency Response Planning, Office

3.5 5-203-Emergency Response Planning, Field

3.6 5-208-Personal Protective Equipment Program

3.7 5-509-Hazardous Waste Operations and Emergency Response

3.8 5-605-Medical Surveillance Program

## 4.0 Procedure

### 4.1 Roles and Responsibilities

4.1.1 **Supervisor/Project Manager** shall become the individual in charge at the incident until relieved by more qualified personnel. All Resolution Consultants emergency responders and their communications shall be coordinated and controlled through this individual. The individual in charge shall implement the Incident Command System (ICS) and shall be responsible for the following tasks:

- Designate a safety officer who is knowledgeable about the operations being implemented at the emergency response site and who will have specific responsibility to identify and evaluate hazards and to provide direction on the safety of operations for the emergency at hand. If the safety officer judges activities to be an Immediately Dangerous to Life or Health (IDLH) and/or to involve an imminent danger condition, the safety officer shall have the authority to alter, suspend, or terminate those activities. The safety official shall immediately inform the individual in charge of the ICS of any actions needed to be taken to correct these hazards at the emergency scene.
- Identify all hazardous substances or conditions present and address as appropriate site analysis, use of engineering controls, maximum exposure limits, hazardous substance, and handling procedures.
- Implement appropriate emergency operations.
- Limit the number of emergency response personnel at the emergency site.
- Implement the buddy system in groups of two or more.
- Provide standby, backup personnel with equipment ready to provide assistance or rescue. Qualified basic life support personnel, as a minimum, shall also be standing by with medical equipment and transportation as necessary.
- Verify that personal protective equipment (PPE) meets, at a minimum; the criteria contained in 29 CFR 1910.156(e) when worn while performing firefighting operations beyond the incipient stage for any incident.
- Determine if employees, who are engaged in emergency response and exposed to hazardous substances presenting an inhalation hazard or potential inhalation hazard, wear positive pressure self-contained breathing apparatus, until such time that the individual in charge of the ICS determines through the use of air monitoring that a decreased level of respiratory protection is appropriate.
- When deemed necessary for meeting the tasks at hand, an approved, self-contained, compressed air breathing apparatus may be used with approved cylinders from other approved, self-contained, compressed air breathing apparatuses provided that such cylinders are of the same capacity and pressure rating. All compressed air cylinders used with self-contained breathing apparatuses shall meet U.S. Department of Transportation and National Institute for Occupational Safety and Health criteria.
- Ensure that the PPE worn is appropriate for the hazards to be encountered.
- Implement appropriate decontamination procedures after emergency operations have terminated.
- Responsibility for the emergency response shall be transferred upon arrival of a more qualified Resolution Consultants Incident Commander or a Public Service Incident Commander.

4.1.2 **Safety, Health and Environmental Manager** is responsible for the following:

- Provide technical assistance to the Incident Commander regarding the correct way to respond to the spill.
- Decide whether Resolution Consultants or an outside emergency response company will clean up the spill.
- Prepare project-specific Spill Response Plans when required.
- Report spills, as necessary, to state/provincial environmental agencies.
- Review the incident report and facilitate the post-response discussion.
- Review and revise this SOP as necessary based on recommendations from post-response discussions.

4.1.3 **Resolution Consultants Employees** are responsible for the following:

- Follow precautions and safe handling practices to avoid spills.

- Alert Supervisor/Project Manager to any deteriorating hazardous materials containers within the office or project area.
- Report all spills and leaks to the Supervisor/Project Manager immediately.
- Secure the spill area as quickly as possible and prevent the migration of exterior spilled materials or substances to drains or other openings.

4.1.4 **First Responder Awareness Level** are those employees who are likely to witness or discover a hazardous substance release and who have been trained to initiate an emergency response by notifying the proper authorities of the release. They take no further action beyond notifying the authorities of the release.

First responders at the awareness level shall have sufficient training or experience to demonstrate competency in the following areas:

- An understanding of what hazardous substances are and the risks associated with them in an incident.
- An understanding of the potential outcomes associated with an emergency created when hazardous substances are present.
- The ability to recognize the presence of hazardous substances in an emergency.
- The ability to identify the hazardous substances, if possible.
- An understanding of the role of the first responder awareness individual in the employer's emergency response plan, including site security and control and the U.S. Department of Transportation's Emergency Response Guidebook.
- The ability to realize the need for additional resources and to make appropriate notifications to the communication center.

4.1.5 **First Responder Operations Level** are individuals who respond to releases or potential releases of hazardous substances as part of the initial response to the site for the purpose of protecting nearby persons, property, or the environment from the effects of the release. They are trained to respond in a defensive fashion without actually trying to stop the release. Their function is to contain the release from a safe distance, keep it from spreading, and prevent exposures.

First responders at the operational level shall receive at least eight hours of training or have had sufficient experience to objectively demonstrate competency in the following areas in addition to those listed for the awareness level:

- Knowledge of the basic hazard and risk assessment techniques.
- Know how to select and use proper PPE provided to the first responder operational level.
- An understanding of basic hazardous materials terms.
- Know how to perform basic control, containment, and/or confinement operations within the capabilities of the resources and PPE available with their unit.
- Know how to implement basic decontamination procedures.
- An understanding of the relevant standard operating procedures and termination procedures.

4.1.6 **Hazardous Materials Technicians** are employees who respond to releases or potential releases for the purpose of stopping the release. They assume a more aggressive role than a first responder at the operations level in that they will approach the point of release in order to plug, patch, or otherwise stop the release of a hazardous substance.

Hazardous materials technicians shall receive at least 24 hours of training equal to the first responder operations level and in addition have competency in the following areas:

- Know how to implement the employer's emergency response plan.
- Know the classification, identification, and verification of known and unknown materials by using field survey instruments and equipment.
- Be able to function within an assigned role in the Incident Command System.

- Know how to select and use proper specialized chemical PPE provided to the hazardous materials technician.
- Understand hazard and risk assessment techniques.
- Be able to perform advance control, containment, and/or confinement operations within the capabilities of the resources and PPE available with the unit.
- Understand and implement decontamination procedures.
- Understand termination procedures.
- Understand basic chemical and toxicological terminology and behavior.

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

Hazardous materials specialists shall receive at least 24 hours of training equal to the technician level and in addition have competency in the following areas:

- Know how to implement the local emergency response plan.
- Understand classification, identification, and verification of known and unknown materials by using advanced survey instruments and equipment.
- Know the state emergency response plan.
- Be able to select and use proper specialized chemical PPE provided to the hazardous materials specialist.
- Understand in-depth hazard and risk techniques.
- Be able to perform specialized control, containment, and/or confinement operations within the capabilities of the resources and PPE available.
- Be able to determine and implement decontamination procedures.
- Have the ability to develop a site safety and control plan.
- Understand chemical, radiological, and toxicological terminology and behavior.

4.1.8 **On Scene Incident Commander,** who will assume control of the incident scene beyond the first responder awareness level, shall receive at least 24 hours of training equal to the first responder operations level and in addition have competency in the following areas:

- Know and be able to implement the employer's incident command system.
- Know how to implement the employer's emergency response plan.
- Know and understand the hazards and risks associated with employees working in chemical protective clothing.
- Know how to implement the local emergency response plan.
- Know the state emergency response plan and of the Federal Regional Response Team.
- Know and understand the importance of decontamination procedures.

4.1.9 **Skilled Support Personnel** who are skilled in the operation of certain equipment (such as mechanized earth moving or digging equipment or crane and hoisting equipment), who are needed temporarily to perform immediate emergency support work that cannot reasonably be performed in a timely fashion by Resolution Consultants' employees, and who will be or may be exposed to the hazards at an emergency response scene are not required to meet the training required. However, these Skilled Support Personnel shall be provided an initial briefing at the site prior to their participation in the emergency response. At a minimum, the initial briefing shall include instruction in the wearing of appropriate PPE, what chemical hazards are involved, and what duties are to be performed. All other appropriate safety

and health precautions provided to Resolution Consultants' own employees shall also be provided to any Skilled Support Personnel.

4.1.10 **Specialist Employees** are Resolution Consultants employees who, in the course of their regular job duties, work with and are trained in the hazards of specific hazardous substances and who will be called upon to provide technical advice or assistance at a hazardous substance release incident to the individual in charge shall receive training or demonstrate competency in the area of their specialization annually.

## 4.2 Emergency Response Plan

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

4.2.2 If contract does not require Resolution Consultants to provide emergency response services, then Resolution Consultants' SH&E Procedures found in the site specific Health and Safety Plan shall apply and employees shall evacuate from the danger area whenever an emergency occurs.

4.2.3 Upon completion of the emergency response, all followup remediation work shall be done in accordance with Resolution Consultants SH&E Procedure *5-509-Hazardous Waste Operations and Emergency Response.*

4.2.4 At a minimum, the emergency response plan shall address the following:

- Pre-emergency planning and coordination with outside parties
- Personnel roles, lines of authority, training, and communication
- Emergency recognition and prevention
- Safe distances and places of refuge
- Site security and control
- Evacuation routes and procedures
- Decontamination
- Emergency medical treatment and first aid
- Emergency alerting and response procedures
- Critique of response and follow-up
- PPE and emergency equipment

4.2.5 (Note: Local and state emergency response plans may need to be review and incorporated into the plan.)

## 4.3 Training

4.3.1 Training for responders shall be provided by Resolution Consultants' SH&E Manager or by individuals who have the training and/or academic credentials and instructional experience necessary to demonstrate competent instructional skills and a good command of the subject matter of the courses they are to teach. Employees who receive responder training shall also receive annual refresher training if their responding responsibilities continue.

4.3.2 Employees receiving initial and refresher responder training shall be issued a certificate indicating training competency. Copies of all training records shall be maintained by the Site Safety Officer.

## 4.4 Medical Surveillance

4.4.1 All employees participating in an emergency response shall participate in their respective employers Medical Surveillance and Monitoring Program.

## 4.5 Chemical Protective Clothing

4.5.1 Chemical protective clothing shall be worn in accordance with Resolution Consultants' *5-208-Personal Protective Equipment Program*.

## 4.6 Spill Response Equipment

4.6.1 All Resolution Consultant offices that store chemicals at their facility shall have the appropriate spill response equipment. Such equipment may include the following:

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

4.6.2 Spill response equipment shall be placed adjacent to areas where chemicals are routinely handled, stored, and/or where shipments are received. Similar types of spill response equipment shall also be available in any Resolution Consultants vehicle or rented vehicle in which chemicals are being transported. Access to the spill response equipment shall be designed to avoid likely spill locations.

## 4.7 Spill Response Equipment for Field Programs

4.7.1 The amount of chemicals being used during a field program will dictate the types and quantity of spill response equipment that is brought to the site. If several squirt bottles of decontamination solutions are all that is being brought to a site, a few spill pillows and a one-gallon bucket may be sufficient to respond to a spill of these materials. If gallons of chemicals are being delivered to the site in drums or bulk tanks, a greater variety of spill response equipment will be needed. As indicated previously, during these types of field programs, a separate spill plan will be incorporated into the project health and safety plan (HASP) and will provide a greater level of detail regarding the specific spill response effort for that field program.

## 4.8 Immediate Response

4.8.1 Evacuate all personnel that will not be involved in the clean up from the immediate area of the spill or release.

4.8.2 Take all reasonable measures to confine, repair, and remedy the effects of the spill; clean-up must be done by knowledgeable personnel and is in accordance with the product label and MSDS.

4.8.3 Use the appropriate equipment and PPE so that you do not expose yourself to any chemicals or hazardous substances.

4.8.4 Clean up teams shall be organized outside the spill area and re-enter for clean-up activities.

4.8.5 If it is not practicable to maintain the airborne concentration of a flammable gas or vapour below the applicable exposure limit, for example, in a temporary situation or an emergency,

- Only the minimum number of workers necessary for the work may be exposed,
- Every worker exposed must be adequately trained and equipped to safely perform the required duties,
- The concentration of the flammable gas or vapor must not exceed 20% of the lower explosive limit (LEL), and
- In a life-threatening emergency only, exposure of emergency response workers is permitted above 20% of the LEL, provided that only those qualified and properly trained and equipped workers necessary to correct the unsafe condition are exposed to the hazard and every possible effort is made to control the hazard while this is being done.

## 4.9 First Aid

4.9.1 In the event of an incident, refer to the MSDS labels to ensure proper first aid is administered for the hazardous material and call the nearest Poison Control Center or 911.

4.9.2 The American National Standards Institute (ANSI) Standard for Emergency Eyewash and Shower Equipment (ANSI Z358.1-1998) recommends that the affected body part must be flushed immediately and thoroughly for at least 15 minutes using a large supply of clean fluid under low pressure. However,

other references recommend a minimum 20-minute flushing period if the nature of the contaminant is not known. The flushing or rinsing time can be modified if the identity and properties of the chemical are known. For example, at least

- 5 minutes flushing time for mild irritants.
- 20 minutes for moderate to severe irritants.
- 20 minutes for nonpenetrating corrosives.
- 60 minutes for penetrating corrosives.
- If irritation persists, repeat the flushing procedure.

4.9.3 It is important to note that ingestion of any chemical is not likely to occur in the workplace. If ingestion does occur, evidence indicates that inducing vomiting is not necessary in most situations where there has been an occupational chemical ingestion. Induction of vomiting should only be recommended if the chemical has very high, short-term (acute) toxicity, and medical follow-up is not readily available. In these cases, first aiders should receive special training on how to safely and effectively induce vomiting in the appropriate circumstances.

4.9.4 In the unlikely event that there is an on-site release of a hazardous substance (e.g., H2S):

- Get out of the area (in an upwind direction).
- Sound an alarm.
- Assess situation.
- Put on a breathing apparatus.
- Rescue victim(s).
- Revive victim(s).
- Get medical aid.

## 4.10 Reporting

4.10.1 Should there be a spill or leak involving a hazardous product, employees shall immediately notify the Supervisor. The supervisor shall then make the appropriate notifications to both client and Resolution Consultants management.

4.10.2 “Dangerous occurrences” must be reported immediately to the police, employer, vehicle owner/leaser and the dangerous goods owner. Such events would include spills, bulk container damage, fire, explosion, and transportation accidents involving dangerous goods.

4.10.3 Confirm and seek direction on external reporting requirements.

- A major release of a hazardous substance must be reported to the appropriate provincial or territorial governing body for Occupational Health and Safety.
- All spills and releases must be reported to the governing regulatory body. Each jurisdiction has regulations governing the minimum quantities for reporting based on the type of product spilled or released.

4.10.4 If you have knowledge of spill, release, or unlawful discharge, notify authorities immediately. Reporting does not imply guilt or assign blame. You will need to report the following details.

- Location and time of spill.
- Description of circumstances leading to spill.
- Type and quantity of material or substance spilled.
- Details of any action taken at the site of the spill.
- Description of location of spill and immediately surrounding the area.
- Any additional information in respect of the spill that the Minister, environmental protection officer or person designated by regulations requires.


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## 5.0 Records

None.

## 6.0 Attachments

None.


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# Appendix B
# Treatability Study Laboratory Plan

# DRAFT WORK PLAN

## Thermal Treatability Study
## NWIRP Site #4
## Bethpage, NY
## Resolution Consultants, Inc.

**Prepared by:**


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**13 May 2015**

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# 1. Introduction

A bench-scale treatability study will be performed on contaminated soil from Site 4 of the Naval Weapons Industrial Reserve Plant, Bethpage located in Bethpage New York:

- Coarse Sand

Site 4 soils are contaminated with the following:

- #6 Fuel Oil, present as light non-aqueous phase liquid (LNAPL)
  - Chemicals of Concern include Polycyclic Aromatic Hydrocarbons (PAHs).

It should be noted that LNAPL is thought to be present in a solidified (or, at a minimum, very viscous) form in the impacted soil.

The objectives of the treatability study are as follows:

#1: Understand LNAPL characteristics (density, viscosity, surface tension) over a range of temperatures, as applicable

#2: Determine interim removal rates of PAHs from bench-scale thermal simulations

#3: Determine extent of PAH removal from bench-scale thermal simulations

#4: Understand the leaching potential of PAHs following the bench-scale thermal simulations

The following sections discuss the bench-scale testing that will be completed to evaluate the objectives presented above. Additional details are presented in the tables attached to this plan. The following acronyms defined here are referred to in the remainder of this document:

- Steam Enhanced Extraction (SEE)
- Hot Water Flush (HWF)

# 2. Site Geology & Background

Site 4 was impacted by a release of No. 6 Fuel Oil from underground storage tanks between 1940s and 1982. The release resulted in petroleum-contaminated soil and semi-solid petroleum product at a depth of approximately 20 to 71 ft bgs. Free product is not readily water soluble, lighter than water, generally very viscous and is mostly adsorbed onto site soils.

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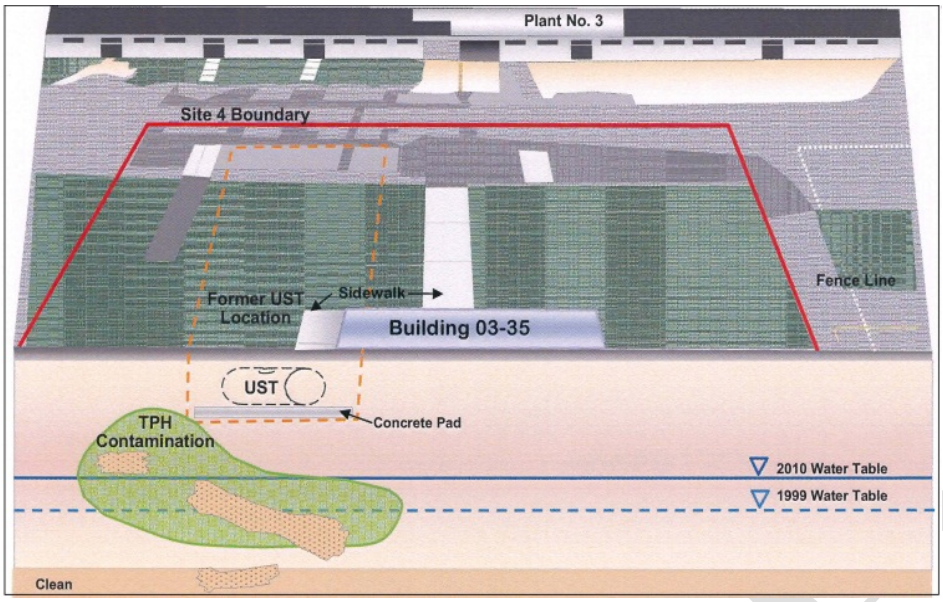


General site geology at the site includes the following:

- Gravel fill material at ground surface
- Fine to coarse sand with trace clay, gravel and silt to ~80 ft bgs (treatment from 20 – 71 ft bgs)

# 3. Sample Collection, Shipping & Storage

Resolution Consultants will collect impacted soil that will be used for the bench test in the field. The soil will be homogenized prior to sending to KEMRON. In addition, Resolution Consultants will be sending the (homogenized) soil for a field baseline chemical analysis.

It is possible that LNAPL may be mobile enough to collect a sample from existing wells on site. If this is the case, product may be collected and shipped directly to PTS for analysis.

It should be noted that all sample collection, transport/shipping, labeling, receiving, storage, and preparation will be performed in accordance with the following Standard Operating Procedures (SOPs) supplied by Resolution Consultants to TerraTherm via email on May 4, 2015 (and thus provided by TerraTherm to KEMRON via email on May 5, 2015). These procedures are generally considered good laboratory practice. Any exceptions to these procedures will be outlined in this Work Plan.

- 3-02 Logbooks
- 3-03 Recordkeeping, Sample Labeling, and Chain of Custody
- 3-04 Sample Handling Storage and Shipping
- 3-06 Equipment Decontamination
- 3-16 Soil and Rock Classification

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# 4. Analytical Testing of the Untreated Soil Material

As the first step of this treatability study, untreated soil characterization will be performed to provide a baseline for evaluating the effectiveness of contaminant removal for the various thermal treatment simulations included in this study and to provide physical/geotechnical parameters to prepare, in part, the necessary calculations for thermal testing protocols. Chemical baseline testing will be performed on each thermal test chamber (i.e. 2 SEE columns and 2 HWF columns).

The following testing will be performed on the untreated soil provided for the study, as shown in Table 1. It should be noted that for all chemical VOC/SVOC testing, the laboratory will provide sample chromatograms/total ion chromatograms.

In addition to the untreated soil testing performed at KEMRON, a "field baseline" will also be submitted by Resolution Consultants. If VOCs and/or metals are not significantly detected in the field baseline, VOCs and/or metals analyses may be omitted from the thermal treatability study.

**Table 1. Characterization of untreated materials**

| | Number of Samples | Matrix | Method | # analysis / sample | Total # of samples | Analytical Lab |
|---|---|---|---|---|---|---|
| SVOCs: PAHs only | 4 | Soil | EPA SW846 8270D | 1 | 4 | Katahdin |
| SPLP SVOCs (PAHs only) | 4 | Soil | EPA SW846 1312/8270D | 1 | 4 | Katahdin |
| VOCs (if needed) | 4 | Soil | EPA 8260C | 1 | 4 | Katahdin |
| SPLP VOCs (if needed) | 4 | Soil | EPA 1312/8270D | 1 | 4 | Katahdin |
| TAL Metals (if needed) | 4 | Soil | EPA 6010C/7471B | 1 | 4 | Katahdin |
| SPLP Metals (if needed) | 4 | Soil | EPA 1312/6010C/7471B | 1 | 4 | Katahdin |
| Bulk Density | 1 | Soil | ASTM D7263 | 1 | 1 | KEMRON |
| Solid Specific Gravity | 1 | Soil | ASTM D854 | 1 | 1 | KEMRON |
| Moisture Content | 1 | Soil | ASTM D2216 | 1 | 1 | KEMRON |
| Porosity | 1 | Soil | Calculation | 1 | 1 | KEMRON |

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# 5. LNAPL Generation

A sufficient amount of site soil contaminated with solidified LNAPL will be provided to ensure that LNAPL quantities generated from the following procedure, or similar, (performed by KEMRON in Atlanta GA) are sufficient for physical property testing stated later in this section:

- Necessary quantities (as estimated and provided for by Resolution Consultants) of site soil contaminated with solidified LNAPL will be heated to temperatures no greater than 100°C unless authorized by TerraTherm/Resolution Consultants. KEMRON will provide observations of LNAPL production and TerraTherm/Resolution Consultants will determine whether increasing temperatures to facilitate LNAPL release is required.
- During heating, materials will be agitated by physical means, i.e., stirring
- The observed phase separation will occur
- Liquefied LNAPL will be removed by decanting to achieve the final quantities required for testing, i.e., 2L

Materials will be shipped to PTS for analysis.

# 6. LNAPL Testing

LNAPL recovered from the site soil will be subjected to the following testing to observe heating effects on this material:

1. LNAPL will be tested at ambient temperatures, 50°C and 90°C; and the following will be measured at each temperature:

- Density
- Viscosity

2. LNAPL will be tested for the following at ambient temperatures and 50°C.

- Surface Tension

Note, accurate measurements at 50°C may not be attainable; therefore, a slightly lower temperature may be reported instead. Testing will include air/LNAPL, water/LNAPL, and water/air as a reference. Currently tap water will be used for the water source unless site groundwater is provided.

Density, viscosity and surface tension will be performed by PTS Laboratories in Santa Fe Springs under the direction of KEMRON. The data collected will directly contribute to full-scale expectations when heating LNAPL, i.e., magnitude of viscosity reductions and recoverability of the product.

3. Flash Point

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Flash point will be tested by KEMRON, unless LNAPL is mobile enough to be collected from wells onsite and shipped directly to PTS for analysis. In this case, PTS will perform the flash point analysis.

**Table 1. Characterization of LNAPL**

| Test | Number of Samples | Matrix | Method | # analysis / sample | Total # of samples | Analytical Lab |
|---|---|---|---|---|---|---|
| Density @ 3 temps (ambient, 50C, 90C) | 1 | NAPL | ASTM D7263 mod. | 3 | 3 | PTS Laboratories |
| Viscosity @ 3 temps (ambient, 50C, 90C) | 1 | NAPL | ASTM-D445 | 3 | 3 | PTS Laboratories |
| Surface Tension @ 3 temps (ambient, 50C, 90C) | 1 | NAPL | ASTM D971 | 3 | 3 | PTS Laboratories |
| Flash Point | 1 | NAPL | ASTM D3278 | 1 | 1 | KEMRON (or PTS) |

# 7. Thermal Treatment Testing

The heating study includes one heating method as described below. This heating method is included based on an understanding of the site geology/hydrogeology and represents simulations of the most likely full-scale in-ground treatment options.

An overview of the thermal testing is shown in Table 2.

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**Table 2. Overview of thermal treatability testing**

| Test | Duration | Samples treated | Total # of thermal tests |
|---|---|---|---|
| 15PV Hot Water Flush @ 55°C | Approx. 1 day | • Coarse Sand | 1 |
| 30PV Hot Water Flush @ 55°C | Approx. 3 days | • Coarse Sand | 1 |
| SEE- 2PV Flush | Approx. 1-3 days | • Coarse Sand | 1 |
| SEE- 6PV Flush | Approx. 3-5 days | • Coarse Sand | 1 |

## a. SEE Tests

Two Steam Enhanced Extraction (SEE) tests will be performed on the homogenized soil sample: 2x pore volume injection and 6x pore volume injection. Steam Enhanced Extraction (SEE) testing will be conducted using cylinder shaped reactors.

To facilitate the pore volume calculations, the porosity of the test sample should be measured. Total wet mass and volume of material will be recorded prior to testing.

Steam is generated by placing a box reactor containing the appropriate quantity of water calculated based on the pore volumes of steam to be passed through the soil into an oven separate from the soil test oven. This oven will be set to a temperature of approximately 110-115°C.

See Figure 1 for a schematic of the SEE treatment system, and Figure 2 for a photograph of the cylinder situated in an oven. Note that Figure 1 shows a tedlar bag collection for potential off-gas monitoring; however, off-gas monitoring is not planned for this project.

The SEE treatment cylinder is comprised of the following:

a) 2 end caps with ports to pass fluids through the test material
b) Thermal coupler ports along the length of the column for temperature monitoring

The SEE treatment column is vertical while packing so that the effluent side of the column is facing downward. The addition of clean sand at the top of the reactor, i.e., the steam inlet side, is used to ensure a completely filled reactor. A completely filled reactor is considered an industry standard for flow-through tests. The clean sand is prepared by sieving through a #60 sieve to obtain “coarse sand”. The sand will be washed with a 10%

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nitric acid solution, followed by a DI water rinse. The sand will be dried at 110°C until placed in the reactors.

To begin, the column/cylinder is vertically situated in the oven with the bottom valve open and the top valve closed. The temperature of the oven containing the column/cylinder is turned to 95°C approximately 1 hour before testing is to begin. It is important to not dry the sample out at this point.

Once the soil has reached 95°C, the temperature of the oven is turned to 100°C and steam addition begins by opening the top steam inlet valve. When adding steam, steam breakthrough should occur following the addition of 0.5 pore volumes of steam as water or less. There will be observable steam in the effluent stream.

After the observed steam breakthrough occurs, the steam pressure cycling is performed by allowing the top steam inlet valve to remain open, and closing the effluent on/off valve for a period of time (approximately 10-20 minutes), until the pressure and temperature (can be measured by temperature only) in the entire steel column has stabilized:

i. at approximately 5-10 psig; and
ii. at approximately 105-110°C.

Once the steady state is achieved:

i. the effluent valve is slowly opened to allow a controlled release of pressure;
ii. the column depressurizes;
iii. steam flows out of the bottom of the column for a minimum of 10 minutes into the condensing system;
iv. the pressure in the column drops to near atmospheric pressure;
v. the temperature drops to near 100°C; and
vi. a steady state is achieved, i.e., steady temperature and pressure.

To initiate a new pressure cycle, the effluent valve is closed again, and the process above is repeated. Each pressure cycle is estimated to last approximately 20-40 minutes.

Once the project specific prescribed volume of steam (2 pore volumes for the first test, and 6 pore volumes for the second test) is added over the specified duration the sample testing is completed. Following the testing, the valves on both ends of the column are closed, and the sample is allowed to cool to room temperature. The final weight and volume of the treated test residuals is measured and recorded prior to post-test sampling and analysis (take care to include the same end caps and valves as used before the SEE testing so the difference in weight is equal to a difference in sample weight).

Throughout the entire duration of SEE testing (i.e., from ambient temperatures to reaching treatment temperatures to cooling back to ambient temperature), the temperature of the soil is continuously monitored. Temperature monitoring is recorded at a minimum of one minute intervals using thermocouples with a data logger (or equivalent unit).

During the initial steam breakthrough and during the second half of the pressure cycling, effluents should be observed in the collection system:

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I. Steam will be observed in the condenser during steam breakthrough after the initial introduction of steam into the system
II. Steam and condensate/NAPL will be observed during the pressure release phase of pressure cycling (i.e., second half of pressure cycling)
III. The volume of aqueous condensate collected will be monitored as a check on the pore volume requirements stated in the Objectives for the test (2 PV for the first test, 6 PV for the second test).

Quality Control / Corrective Action Indicators include:

- Close monitoring of temperature to ensure expected temperatures are achieved and maintained;
- Notice any unusual spikes in temperature which may indicate the sample has dried out (i.e., all moisture removed) and requires correction (i.e. repeating testing);
- Ensure that the steam generated for injection is indeed steam and not hot water; and
- Ensure that steam is exiting the reactor not hot water which would also require correction

At the conclusion of each thermal evaluation, the following will be completed:

- The sample reactor will be removed from the oven, sealed, and chilled to 4$^{o}$C prior to homogenizing;
- Samples will be homogenized and subsampled for parameters listed in Table 3;
- The effluent liquids from the evaluation will be collected and weighed. Any organic phase present in the effluent will be separated and quantified apart from the aqueous phase. Effluent liquids and any NAPL present will be measured, weighed, and pH will be recorded.

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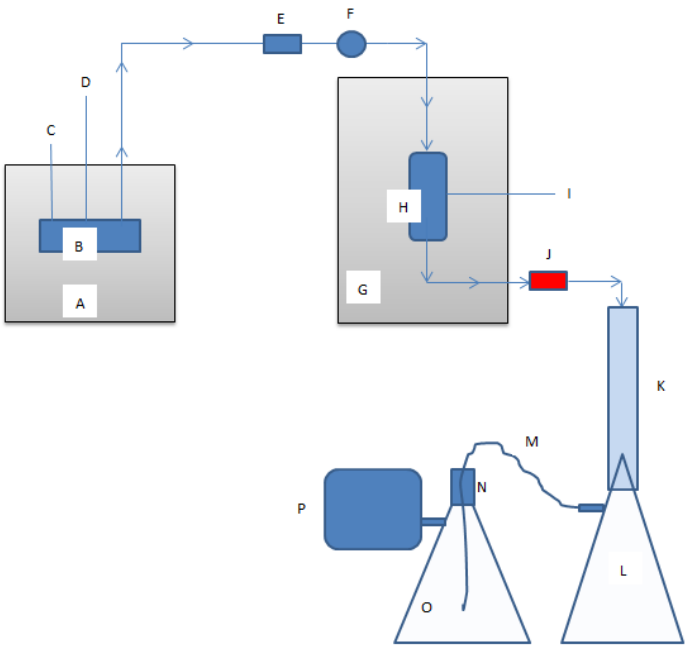


A- Steam generating oven
B- Steam generating reactor
C- Capped 0.25 in SS tubing to allow introduction of additional feed DI water if necessary.
D- Steam Box Thermocouple
E- Steam Inlet SS Ball Valve (Valve 1 or Top)
F- Pressure Transducer
G- Soil Column Heating Oven
H- Soil treatment Column
I- Soil Thermocouple
J- Off-gas SS Ball Valve (Valve 2 or Bottom)
K- Cold Water Condenser
L- Primary Condensate Collection Flask (vacuum Flask)
M- Additional off gas tubing
N- Stopper with additional off gas tubing penetrating down into flask
O- Secondary condensate collection flask (vacuum flask)
P- Tedlar Bag For PID monitoring

Arrowed lines represent steam and off gas lines indicating the direction of Steam / off-gas flow.

Note that the arrowed lines representing steam introduction and off-gas transfer will be wrapped in electric heat tape to keep the vapors in the vapor state, thus reducing the potential for condensing in the lines. NOTE: for this project, no off-gas monitoring will be conducted.

**Figure 1. SEE treatment schematic**

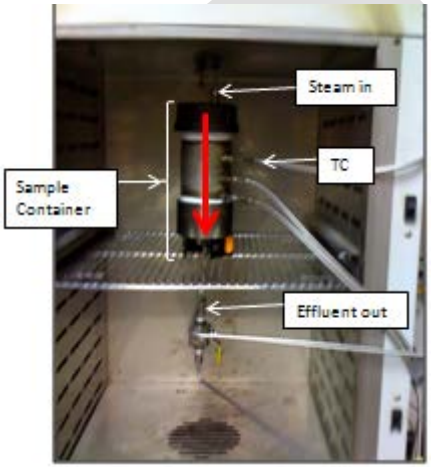


**Figure 2. Photograph of SEE treatment reactor in oven**

## b. HWF Tests

Hot water flushing at 55°C will be evaluated as treatment for the site material. Two different pore volume (PV) flushes will be evaluated: 15PV and 30PV. Hot water flushing rate will equal approximately 10 pore volumes per day in a 6-hour day.

The test sample preparation and equipment setup for the hot water flushing is very similar to the SEE testing. A stainless steel cylinder measuring 3 inches in diameter and 6 inches in length will contain the soil. A pre-cleaned and covered beaker will be placed on a heating / magnetic stirring plate to heat the water. The hot water flushing will be introduced from the top of the cylinder. This will ensure hot water contact with the entire sample and will allow for more accurate flow control.

A large glass beaker will be placed on a heating / magnetic stir plate and filled with the appropriate quantity of de-ionized water. The water will be heated to the operating temperature. The starting pH of the flush water will be confirmed to be near neutral and recorded on the data sheet. A thermocouple will be placed into the water heating reactor to ensure the appropriate water temperature is utilized. The saturated and spiked soil cylinder reactor will be placed into the same heating oven and connected to the treatment system (similar to SEE testing).

Once the soil in the reactor and the water reactor reaches the operating temperature (55°C), the air inlet and off-gas valves will be opened and a peristaltic pump will pump water from the water reactor into the soil cylinder reactor at a rate equal to 10 pore volumes (PV) of hot water per 6 hour day (1.666 PV/hour). For the 15PV test, the goal will be to complete the flushing in one day. For the 30 PV test, it is expected that the flushing will extend over multiple days. At the end of each 6 hour working day the valves will be closed and water injection and heating will be terminated. The next working day testing will commence again. This will be continued until a total of 30 PV of hot water has been passed through the system.

Off-gases and the hot water will be passed through a cold water condensing system and collected in a flush water collection flask. No off-gas monitoring is planned at this time.

At the conclusion of each thermal evaluation, the following will be completed:

- The sample reactor will be removed from the oven, sealed, and chilled to 4°C prior to homogenizing;
- Samples will be homogenized and subsampled for parameters listed in Table 3
- The effluent liquids from the evaluation will be collected and weighed. Any organic phase present in the effluent will be separated and quantified apart from the aqueous phase. Effluent liquids will be subjected to chemical analysis for the parameters listed in Table 3B.

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# 8. Analytical Testing of Thermally Treated Materials

Tables 3A and 3B present an overview of the analyses planned for the thermally treated materials. Table 4 presents the required sample containers, sample volumes, and preservatives.

Each sample will be labeled with the prefix "Site4TS-*-**". The first asterisk will be used to identify the initial test and filled in with one of the following abbreviations.

- Field Baseline — FB
- Steam Enhanced Extraction — SEE1 or SEE2 (Note: SEE1 = 2PV, SEE2 = 6PV)
- Hot Water Flush — HWF1 or HWF2 (Note: HWF1 = 15PV, HWF2= 30PV)

The double asterisk will be used to identify the individual components of the test according to the following abbreviations.

- Baseline — B
- Post Treatment — PT
- Leachate — L (Note: for HWF2 test [30PV], "first flush" and "final flush" will be collected as L1 and L2, respectively)

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## Table 3A. Analytical characterization of thermally treated materials (soil)

| | VOCs 8260C | SVOCs 8270D | TAL Metals 6010C/7471B | SPLP VOCs 1312/8260C | SPLP SVOCs 1312/8270D | SPLP Metals 1312/6010C/ 7470A | Moisture Content (ASTM D2216) |
|---|---|---|---|---|---|---|---|
| **Hot Water Flushing/Low Temperature Steam Extraction Test** | | | | | | | |
| HWF 15PV Flush Baseline | X[2] | X | | X[2] | X | | |
| HWF 30PV Flush Baseline | X[2] | X | | X[2] | X | | |
| HWF 15PV Flush Final | X[2] | X | X[3] | X[2] | X | X[3] | X |
| HWF 15PV Flush Final | X[2] | X | X[3] | X[2] | X | X[3] | X |
| Aqueous Trip Blank[1] | XX[2] | | | XX[2] | | | |
| **Total** | **6** | **6** | **4** | **6** | **6** | **4** | |
| **High Temperature Steam Extraction Test** | | | | | | | |
| SEE 2PV Flush Baseline | X[2] | X | | X[2] | X | | |
| SEE 6PV Flush Baseline | X[2] | X | | X[2] | X | | |
| SEE 2 PV Flush Final | X[2] | X | X[3] | X[2] | X | X[3] | X |
| SEE 6PV Flush Final | X[2] | X | X[3] | X[2] | X | X[3] | X |
| Aqueous Trip Blank[1] | XX[2] | XX | XX | XX[2] | XX | XX | |
| **Total** | **6** | **6** | **4** | **6** | **6** | **4** | **4** |

**Notes:**
VOC - volatile organic compound
SVOC - semivolatile organic compound
TAL - target analyte list
SPLP - Synthetic Precipitation Leaching Procedure

1 Trip blanks (VOCs only) are required to be sent with every shipment to the laboratory. The number of trip blanks shown in this table is an estimate and may vary depending on frequency and timing of shipments to the laboratory.

2 VOC analysis may be omitted based on the results of the field baseline sample. If VOCs are not significantly detected, the analysis will be omitted.

3 Metals analysis may be omitted based on the results of the field baseline sample. If Metals are not significantly detected, the analysis will be omitted.

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## Table 3B. Analytical characterization of thermally treated materials (Aqueous)

| | VOCs 8260C | SVOCs 8270D | TAL Metals 6010/7470A | pH (KEMRON) |
|---|---|---|---|---|
| **Leachate Samples** | | | | |
| HWF 15PV Flush Column 1 | | | | X |
| HWF 30PV Flush Column 2--First | X | X | X | X |
| HWF 30PV Flush Column 2-- Final | X | X | X | X |
| SEE 2PV Flush Column 1 | | | | X |
| SEE 6PV Flush Column 2 | | | | X |
| **Total[1]** | **2** | **2** | **2** | **6** |

**Notes:**
VOC - volatile organic compound
SVOC - semivolatile organic compound
TAL - target analyte list
[1] Trip blanks are required for every shipment to the laboratory. Trip blanks are not shown for the leachate samples because it is assumed they will be submitted with the soil samples. The number of trip blanks shown in this table is an estimate and may vary depending on frequency and timing of shipments to the laboratory.

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## Table 4. Sample Containers, Preservation, and Sample Volumes (provided by Katahdin Analytical)

| Matrix | Analytical Group | Analytical and Preparation Method/SOP Reference | Containers | Sample volume | Preservation Requirements | Maximum Holding Time |
|---|---|---|---|---|---|---|
| Soil | VOCs | SW-846 5035, 8260B | 3 X40-ml VOA vials | 5 g | 5 ml reagent water, cool to ≤ 6 °C | 48 hours to freezing, 14 days to analysis |
| | | | 1 X 2-oz wide-mouth jar for percent moisture only if VOA only sample | 5 g | Cool to ≤ 6 °C | |
| | | | 1 X 40-ml VOA vial | 5 g | 5 ml methanol, cool to ≤ 6 °C | |
| | SVOCs | SW-846 3540C or 3550C, 8270D, 8270D_SIM | 1 X 4-oz wide-mouth jar | 30 g | Cool to ≤ 6 °C | 14 days to extraction, 40 days to analysis |
| | Metals | SW-846 3050B, 6010C | | 2 g | None | 6 months to analysis |
| | | SW-846 3050B, 6020A | | 2 g | None | |
| | | SW-846 7471A | | 0.6 g | Cool to ≤ 6 °C | 28 days to analysis |
| Water | VOCs | SW-846 5030B, 8260B | 3 X 40-milliliter (mL) VOA vials | 40 milliliter (mL) | HCl to pH < 2, cool to ≤ 6 °C. | 14 days to analysis |
| | SVOCs | SW-846 3510C or 3520C, 8270D, 8270D_SIM | 2 X 1- liter (L) amber glass bottles ** | 1000 mL | Cool to ≤ 6 °C | 7 days to extraction 40 days to analysis |
| | Metals | SW846 3010A, 6010C, 6020A | 1 X 250-mL polyethylene bottle | 50 mL | $HNO_3$ to pH<2 | 6 months to analysis |
| | | | | 50 mL | | |
| | | SW7470A | | 25 mL | | 28 days to analysis |

** = 2L of sample may not be possible to obtain in some cases. KEMRON/TerraTherm will work with the analytical laboratory to determine the absolute minimum sample volume required (usually 1L) to obtain meaningful results without highly elevated reporting limits.

Draft

# 9. Reporting

Before initiating the bench-scale testing, a kick-off meeting will occur between Resolution Consultants, TerraTherm and KEMRON where an outline of the study parameters will be provided.

During the study, various data tables will be provided, i.e., untreated and treated analytical and physical property testing.

Upon completion of the study, a Treatability Study Report will be prepared by Kemron to present the results. Reference will be made where appropriate to the testing protocols as presented in the work plan. The attachments to the report will include data summary tables, thermal worksheets, thermal temperature logs, photos, analytical and physical property testing reports and complete data attachments.

The project completion schedule goal is to have the Treatability study completed in a matter of a few weeks. Expedited turnaround time is authorized for all analytical samples.

| | | | |
|---|---|---|---|
| Mobilization and Field Sample Collection | 4 days | Thu 5/28/15 | Tue 6/2/15 |
| Completion of Bench Test | 10 days | Wed 6/3/15 | Tue 6/16/15 |
| Lab Analysis/Results - Expedited TAT | 5 days | Wed 6/17/15 | Tue 6/23/15 |
| Internal Draft Bench Test Summary Report Submitted to Navy | 12 days | Wed 6/17/15 | Thu 7/2/15 |

Draft

# Appendix C
# Health and Safety Plan

# SITE HEALTH AND SAFEY PLAN
# Site 1 OU-2 Off Site TCE Groundwater Plume Investigation

**NAVAL WEAPONS INDUSTRIAL RESERVE PLANT (NWIRP)**
**BETHPAGE, NEW YORK**

**Prepared for:**

**Department of the Navy**
**Naval Facilities Engineering Command, Mid-Atlantic**
**9742 Maryland Ave.**
**Norfolk, VA 23511-3095**

**Contract Number N62470-11-D-8013**

**CTO WE15**

**Prepared by:**

**Resolution Consultants**
*A Joint Venture of AECOM & EnSafe*
**448 Viking Drive Suite 145**
**Virginia Beach, Virginia 23452**

**May 31, 2012**

## SITE HEALTH AND SAFETY PLAN

This Site Health and Safety Plan (HASP) was prepared for employees performing a specific, limited scope of work. It was prepared based on the best available information regarding the physical and chemical hazards known or suspected to be present on the project site. While it is not possible to discover, evaluate, and protect in advance against all possible hazards that may be encountered during the completion of this project, adherence to the requirements of the HASP will significantly reduce the potential for occupational injury.

By signing below, I acknowledge that I have reviewed and hereby approve the HASP for the Naval Weapons Industrial Reserve Plant (NWIRP) site in Bethpage, NY. This HASP has been written for the exclusive use of Resolution Consultants, their employees, and subcontractors. The plan is written for specified site conditions, dates, and personnel, and must be amended if these conditions change.

**Prepared/Reviewed by:**

Joshua C. Millard _____ May 31, 2012

Joshua Millard, PG Date
Geologist, 978-905-2409

Eleanor C. Vivaudou _____ May 31, 2012

Eleanor Vivaudou PE Date
CTO Manager

**Concurrence by:**

Michael Grasso _____ May 31, 2012

Michael Grasso CIH Date
District SH&E Manager, 607-282-0175

_____ May 31, 2012

Steven W. Skipper CIH, CSP Date
Resolution Consultants H&S Manager
903-367-4324

## Executive Summary

The purpose of this Site Health and Safety Plan (HASP) is to address health and safety concerns related to Resolution Consultants-managed activities at the Naval Weapons Industrial Reserve Plant (NWIRP) site, located in Bethpage, New York. The specific roles, responsibilities, authority, and requirements as they pertain to the safety of employees and the scope of services are discussed herein. The document is intended to identify known potential hazards and facilitate communication and control measures to prevent injury or harm. Additionally, provisions to control the potential for environmental impact from these activities are included where applicable.

**Table ES-1**
**Summary Table**

| | |
|---|---|
| Resolution Consultants SOW | *The objective of the soil boring and monitoring well installation, groundwater sampling, and laboratory analysis is to address data gaps associated with the onsite groundwater recovery system, and to define the source of chemicals of concern at the Bethpage Water District (BWD) Plant 6.*<br><br>*Resolution Consultants will provide vertical profile boring (VPB) and monitoring well installation oversight at four off site locations. Borings will be installed to the top of the Raritan Clay formation encountered at approximately 850 feet below ground surface. Split-spoon samples will be collected during advancement to profile the stratigraphy and confirm the surface of the Raritan formation. Groundwater samples will be collected during boring advancement at 50 and 20 foot intervals. Six monitoring wells will be installed at three of the VPB locations, and the screen intervals will be based on the groundwater results. The fourth VPB will be held in contingency, and no wells will be installed. Once the completion depth is reached, a natural gamma geophysical log will be performed from the ground surface to the boring termination depth. Following well installation, wells will be developed (estimated purge volume per well is 15,000 gallons), and one round of groundwater samples will be collected by low-purge and sampling methods. Completed VPBs and monitoring wells locations will be surveyed by a New York State licensed surveyor.* |
| Drilling Subcontractor (TBD) | The drilling subcontractor will advance VPBs by mud rotary drilling techniques, collect split-spoons, and install six 4-inch diameter monitoring wells. |

**Primary Physical Hazards**

| | | | | | |
|---|---|---|---|---|---|
| x | Underground Utilities | x | Traffic Control | x | Electrical Hazards |
| x | Overhead Utilities | x | Slips, Trips/Walking Surface | | Excavation & Trenching |
| x | Drill Rig Operations | x | Manual Lifting | | |

**Chemical Hazards, Monitoring, Action Levels**

| COC | Monitoring | Action levels |
|---|---|---|
| Trichloroethylene (TCE) | PID with 10.6eV | Upgrade to Level C at 5 ppm for VOCs |

All Resolution Consultants staff are bound by the provisions of this HASP and are required to participate in a preliminary project safety meeting to familiarize them with the anticipated hazards and respective onsite controls. The discussion will cover the entire HASP subject matter, putting emphasis on critical elements of the plan, such as the emergency response procedures, personal protective equipment, site control strategies, and monitoring requirements. In addition, daily tailgate safety meetings will be held to discuss: the anticipated scope of work, required controls, identify new hazards and controls, incident reporting, review the results of inspections, any lessons learned, or concerns from the previous day.

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## Attachments

Attachment A Site Maps
Attachment B Task Hazard Analysis
Attachment C Material Safety Data Sheets
Attachment D HASP Revision History
Attachment E Community Air Monitoring Plan

## LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ANSI | American National Standards Institute |
| APR | Air Purifying Respirator |
| BTEX | Benzene, Toluene, Ethyl benzene, Xylenes |
| $^{o}C$ | Degrees Celsius |
| CAS | Chemical Abstracts Service |
| CFR | Code of Federal Regulations |
| CGI | Combustible Gas Indicator |
| CIH | Certified Industrial Hygienist |
| CO | Carbon Monoxide |
| COC | Contaminant of Concern |
| CRZ | Contaminant Reduction Zone |
| CSP | Certified Safety Professional |
| dBA | Decibels on the A-weighted scale |
| DI | Deionized Water |
| DOT | Department of Transportation |
| EAP | Emergency Action Plan |
| ETPH | Extractable Total Petroleum Hydrocarbons |
| EC | Emergency Coordinator |
| ERPIMS | Environmental Restoration Program Information Management System |
| eV | Electron-volt |
| EZ | Exclusion Zone |
| FS | Feasibility Study |
| FSP | Field Sampling Plan |
| GFCI | Ground Fault Circuit Interrupters |
| GWPC | Groundwater Protection Criteria |
| HASP | Site Health and Safety Plan |
| HAZWOPER | Hazardous Waste Operations and Emergency Response |
| HSA | Hollow-Stem Auger |
| IDLH | Immediately Dangerous to Life or Health |
| IDW | Investigative-Derived Waste |
| mg/kg | Milligrams per kilogram |
| $mg/m^3$ | Milligrams per cubic meter |
| MSDS | Material Safety Data Sheet |

**List of Acronyms and Abbreviations (Continued)**

| | |
|---|---|
| MUTCD | Manual of Uniform Traffic Control Devices |
| NWIRP | Naval Weapons Industrial Reserve Plant |
| NCR | Nonconformance Report |
| NIOSH | National Institute for Occupational Safety and Health |
| NIST | National Institute of Standards and Technology |
| O2 | Oxygen |
| OSHA | Occupational Safety and Health Administration |
| PEL | Permissible Exposure Limit |
| PID | Photo Ionization Detector |
| PM | Project Manager |
| POL | Petroleum, Oil, and Lubricant |
| PPE | Personal Protective Equipment |
| ppm | Parts per million |
| PHSP | Programmatic Health and Safety Plan |
| REL | Recommended Exposure Limit |
| RTECS | Registry of Toxic Effects of Chemical Substances |
| SCBA | Self Contained Breathing Apparatus |
| SH&E | Safety, Health, and Environmental |
| SOP | Standard Operating Procedure |
| SOW | Statement of Work |
| SS | Site Supervisor |
| SSO | Site Safety Officer |
| STEL | Short Term Exposure Limit |
| SZ | Support Zone |
| TBD | To Be Determined |
| TCE | Trichloroethylene |
| THA | Task Hazard Analysis |
| ug/l | Micrograms per liter |
| USEPA | United States Environmental Protection Agency |
| UST | Underground Storage Tank |
| VOC | Volatile Organic Compound |

# 1.0 INTRODUCTION

This Site Health and Safety Plan (HASP) (including Attachments A-D) provides a general description of the levels of personal protection and safe operating guidelines expected of each employee or subcontractor associated with the environmental services being conducted by Resolution Consultants at the Naval Weapons Industrial Reserve Plant (NWIRP) site, located in Bethpage, New York. This HASP also identifies chemical and physical hazards known to be associated with the Resolution Consultants-managed activities addressed in this document.

HASP Supplements will be generated as necessary to address any additional activities or changes in site conditions, which may occur during field operations. All Supplements or changes to the HASP must be approved by the Resolution Consultants Health and Safety Manager or designee, and will be documented in the HASP Revision History (Attachment D).

## 1.1 General

The provisions of this HASP are mandatory for all Resolution Consultants personnel engaged in fieldwork associated with the environmental services being conducted at the subject site. A copy of this HASP, any applicable HASP Supplements, and the Resolution Consultants' Safety, Health, and applicable Environmental (SH&E) Procedures and Programmatic Health and Safety Plan (PHSP) shall be accessible on site and available for review at all times. Recordkeeping will be maintained in accordance with this HASP and the applicable Standard Operating Procedures (SOPs). In the event of a conflict between this HASP, the SOPs, and federal, provincial, state, and local regulations, workers shall follow the most stringent/protective requirements. Concurrence with the provisions of this HASP is mandatory for all personnel at the site covered by this HASP and must be signed on the acknowledgement page.

## 1.2 Project Policy Statement

Resolution Consultants is committed to protecting the safety and health of our employees and meeting our obligations with respect to the protection of others affected by our activities. We are also committed to protecting and preserving the natural environment and communities in which we operate. The safety of persons and property is of vital importance to the success of this project and accident prevention measures shall be taken toward the avoidance of needless waste and loss. It shall be the policy of this project that all operations be conducted safely. Onsite supervisors are responsible for those they supervise by maintaining a safe and healthy working environment in their areas of responsibility, and by fairly and uniformly enforcing safety and health rules and

requirements for all project personnel. Subcontractors shall comply with the requirements of this HASP, provisions contained within the contract document and all applicable rules, requirements and health, safety and environmental regulations. All practical measures shall be taken to promote safety and maintain a safe place to work. Contractors are wholly responsible for the prevention of accidents on work under their direction and shall be responsible for thorough safety and loss control programs and the execution of their own safety plans for the protection of workers.

## 1.3 References

This HASP conforms to the regulatory requirements and guidelines established in the following documents:

- Title 29, Part 1910 of the Code of Federal Regulations (29 CFR 1910), *Occupational Safety and Health Standards* (with special attention to Section 120, *Hazardous Waste Operations and Emergency Response*).
- Title 29, Part 1926 of the Code of Federal Regulations (29 CFR 1926), *Safety and Health Regulations for Construction*.
- National Institute for Occupational Safety and Health (NIOSH)/OSHA/U.S. Coast Guard (USCG)/US Environmental Protection Agency (USEPA), *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, Publication No. 85-115, 1985.
- Resolution Consultants, Programmatic Health and Safety Plan.

## 2.0 SITE INFORMATION AND SCOPE OF WORK

Resolution Consultants will conduct environmental services at three to four locations off site and in mostly residential neighborhoods approximately 1.4 to 1.75 miles to the south of the Naval Weapons Industrial Reserve Property (NWIRP) site. Exact locations will be determined following the completion of access agreements. Field operations will be managed out of a site office or trailer on site at 999 South Oyster Bay Road, where the investigation derived waste will be also be staged and prepared for transportation to an offsite disposal facility.

The objective of the soil boring and monitoring well installation, groundwater sampling, and laboratory analysis is to address data gaps associated with the onsite groundwater recovery system, and to define the source of chemicals of concern at the Bethpage Water District (BWD) Plant 6. Work will be performed in accordance with the applicable Statement of Work (SOW) and associated Sampling and analysis Plan developed for the site. Deviations from the listed SOW will require that the Resolution Consultants Health and Safety Manager or designee review and make changes to this HASP to ensure adequate protection of personnel and other property. All changes to this HASP must be documented in Attachment D.

The following is a summary of relevant data concerning the project site, and the work procedures to be performed. The Project Work Plan prepared by Resolution Consultants as a companion document to this HASP provides more detail concerning both site history and planned work operations.

### 2.1 Site Information

This section provides a general description and historical information associated with the site.

#### 2.1.1 General Description

NWIRP Bethpage is located in east-central Nassau County, Long Island, New York, approximately 30 miles east of New York City. The Navy's property totaled approximately 109 acres and was formerly a Government-Owned Contractor-Operated (GOCO) facility that was operated by the Northrop Grumman Corporation until September 1998. In 2002, approximately four acres (Plant No. 20) was transferred to Nassau County, and in April 2008, approximately 96-acres of property were transferred to Nassau County. NWIRP Bethpage is bordered on the north, west, and south by property owned or formerly owned by Northrop Grumman Corporation that covered approximately 500 acres, and on the east by a residential neighborhood. NIWIRP and NGC are a couple of the sources that contribute to the Site 1 OU-II off site VOC plume. Site 1 OU-II off site plume begins

south of the Northrop Grumman property, and extends just shy of the southern state parkway; it extends east of the property to approximately State Highway 135, and extends to the west to Wantagh parkway in the south and Jerusalem Parkway in the north. (see site map included as Attachment A). The majority of the site consists of residential neighborhoods.

The Upper Glacial Formation and the Magothy Formation comprise the aquifer of concern at the NWIRP. Regionally, these formations are generally considered to form a common, interconnected aquifer as the coarse nature of each unit near their contact and the lack of any regionally confining clay unit allows for the unrestricted flow of groundwater between the formations. The bottom of the Magothy Formation is the Raritan Clay Layer at a depth of approximately 700 to 800 feet bgs.

Groundwater is encountered at a depth of approximately 50 feet bgs at the facility. Historically, because of pumping and recharge at the facility, groundwater depths have been measured to range from 40 to 60 feet bgs. The regional groundwater flow in the area is to the south southeast. Groundwater generally sinks as it flows as a result of precipitation infiltration.

### 2.1.2 Site Background/History

The NWIRP Bethpage was established in the early 1940's. The plant's primary mission was the research prototyping, testing, design engineering, fabrication, and primary assembly of military aircraft. The facilities at NWIRP Bethpage included four plants used for assembly and prototype testing; a group of quality control laboratories, two warehouses complexes (north and south), a salvage storage area, storm and non-contact cooling water recharge basins, the Industrial Wastewater Treatment Plant, and several smaller support buildings. In 1998, operations ended at the facilities. The NWIRP was located within the secure portion of the NGC complex, and between the Navy and NGC totaled approximately 605 acres.

Operable Unit 2, Site 1 OU-II is the offsite groundwater VOC plume. The VOC-contaminated groundwater plume is an extensive (3,000 acres plus) area of VOC-contaminated groundwater that extends south of Hempstead Turnpike and extends to a depth of approximately 750 feet. Other sources of the groundwater contamination are present, including Northrop Grumman and the Hooker Ruco Superfund Sites. Three of the Bethpage Water District (BWD) well fields have been impacted by the plume and VOC treatment has been in place for over 10 years. Aqua New York (ANY) Well field has recently been impacted, and VOC (Trichloroethene [TCE]) concentrations are increasing in the well field. Construction of the GM-38 Area groundwater treatment plant (GWTP) offsite groundwater remediation system was completed in December 2009 to treat a hotspot area of TCE-contaminated groundwater. The GM-38 Area GWTP started partial operation with the

startup of recovery well (RW)-1, and full operation in March 2010 with the addition of recovery well RW-3. The GWTP is currently in operation. The Navy is negotiating with South Farmingdale Water District (SFWD) for treatment of one of its well fields.

In 2009, six vertical profile borings (VPB) were installed to establish depth specific contamination. The borings were drilled to a depth of 750 to 841 feet bgs. From 2010 to 2011, an additional 3 VPBs and 5 outpost monitoring wells were installed to further delineate TCE contamination. An additional 3 VPB will be installed near SFWD Plant 3. A well-head treatment remedy for ANY water supply wells located at the Seaman's Neck Road Facility is currently being implemented. An interim emergency treatment system is being installed and will be operated until the full-scale final well head treatment system is constructed. Construction completion is tentatively planned for winter 2013.

### 2.1.3 Previous Investigations

The following table summarizes investigations that have been completed at the NWIRP site since 1992.

**Table 2-1**
**Summary of Site Investigations**

| Date | Work Complete |
|---|---|
| 1992 | Phase 1 Remedial Investigation Report complete for site |
| 2000 | 3 VPB (38, 76, 77) |
| | 12 Monitoring wells were installed on site |
| 2001 | ROD for Northrop Grumman and NWIRPs |
| 2002 | 5 VPB (44, 45, 46, 50)installed in southern area |
| | even (GM-18Dm 21D, 75D2, 78D, 791, 79D) monitoring wells to support the On-site containment system effectiveness, |
| | 6 VPG installed in the GM 38 Area(40, 47, 48, 51, 42, 49C), |
| | conceptual design report for GM-38 area |
| | GM-39 and GM 73 installation |
| 2003 | ROD for OU-2 for NAVY only, |
| | Remedy analysis report for the GM 38 Area completed |
| 2004 | Installed 9 outpost wells BPOW1-1, 1-2, 1-3, 2-1, 2-2, 3-1. 3-2, 4-1, 4-2 to provide advance warning |
| | PDI for GM-38 |
| 2005 | BODM and remedial design for GM-38 |
| 2006 | Final Design for GM-38 area |
| 2009 | PDI for Offsite GM-75 |
| 2010 | Final O and M plan for GW treatment plan GM-38 |
| | SAP for O and M of GM-38 |
| | PDI to delineate gw South of GM-75 and GM-34 |
| | BOD Report for Well head at Aqua NY Seamans Neck Rd water plan |
| 2011 | BP OW2-1 and 2-2 repair and sampling |
| | Optimization of GM-38 |

**Table 2-1**
**Summary of Site Investigations**

| Date | Work Complete |
|---|---|
| 2012 | WP to VPB-130 N of S Farmingdale Water district Plant 3<br>VPB-131 nw of S Farmingdale Water district plant 3<br>VPB-132 N of S Farmingdale plant 6<br>VPB133WP addendum<br>Engineers report for wellhead treatment at Aqua NY Seamans Neck Road<br>Study of alternatives for plume management<br>Final Construction WP for installation of Emergency Treatment Liquid phase GAC units Aqua NY Inc Seamans Neck Road WP |

Investigation results indicate the presence a shallow, deep eastern, and deep western plume of VOCs in groundwater. The shallow plume contains relatively low TVOC concentrations (generally 50 ug/L or less) and is normally found at depths of 50 to 250 feet bgs The deeper contaminant plumes contain higher concentrations of TVOCs (100 to 10,000 ug/L) are typically found between 250 and 750 feet bgs. The western plume is directly south and southwest of NWIRP Bethpage. This plume is predominately TCE, but can contain other VOCs. Northrop Grumman Product Well GP-3, located on the western edge of the plume on Northrop Grumman property is screened at a depth of approximately 500 ft bgs and contains TVOC concentrations of 2,920 µg/L and includes TCE at 2,400 µg/L and vinyl chloride at 210 µg/L. The eastern plume is located southeast of NWIRP Bethpage. This plumes starts in the area of NWIRP Bethpage Site 1 and the Bethpage Community Park, continues south through the GM-38 Area. Total VOC (TVOC) concentrations ranging up to 7,754 µg/L, TCE at 18 µg/L, cis-1,2-DCE at 18 µg/L, and toluene at 1 µg/L. Samples collected at 285 feet bgs contained TVOC of 7,754 µg/L, which includes TCE at 5,200 µg/L, cis-1,2-DCE at 2,500 µg/L, 1,2-dichloroethane (1,2-DCA) at 35 µg/L, and 1,2-DCE at 19 µg/L. The eastern plume exhibits concentrations of TCE, PCE and degradation products on these chemicals.

## 2.2 Scope of Work

Resolution Consultants will provide vertical profile boring (VPB) and monitoring well installation oversight at four off site locations 1.4 to 1.75 miles to the south of the NWIRP site. Borings will be installed to the top of the Raritan Clay formation encountered at approximately 850 feet below ground surface. Split-spoon samples will be collected during advancement to profile the stratigraphy and confirm the surface of the Raritan formation. Groundwater samples will be collected during boring advancement at 50 and 20 foot intervals. Six monitoring wells will be installed at three of the VPB locations, and the screen intervals will be based on the groundwater results. The fourth VPB will be held in contingency, and no wells will be installed. Once the completion depth is reached, a natural gamma geophysical log will be performed from the ground

surface to the boring termination depth. Following well installation, wells will be developed (estimated purge volume per well is 15,000 gallons, and one round of groundwater samples will be collected by low-purge and sampling methods. Completed VPBs and monitoring wells locations will be surveyed by a New York State licensed surveyor.

### 2.2.1 Mobilization/Demobilization

Mobilization and demobilization represent pre- and post-task activities. These activities include, as appropriate for the project, driving to and from the site; initial site preparations, such as trailer and toilet facilities setup; and post-work activities, such as removing files and office equipment and general housekeeping. This activity does not represent any intrusive activities. Electrical hook-up and disconnect for office trailers must be performed by a licensed electrical subcontractor.

### 2.2.2 Vertical Profile Borings Advancement Oversight

Resolution Consultants personnel will oversee the advancement of four vertical profile borings by a licensed drilling contractor (TBD) using mud rotary drilling techniques, and installed to the top of the Raritan Clay layer which is approximately 850 feet below ground surface (fbgs). For each vertical profile boring, soil samples will be collected with a split spoon sampler. Once the completion depth is reached, a natural gamma geophysical log will be performed from the ground surface to the boring termination depth. At each VPB, groundwater will be collected on 50-foot intervals from a depth of 50 to 200 feet. Groundwater will be collected on 20 foot intervals form a depth of 200 to 850 fbgs. During drilling activities, appropriate air monitoring will be conducted and the appropriate chemical resistant PPE will be worn to protect against exposure. The major activities involved with advancing the VPBs at the properties down gradient of the NWIRP include the following:

- Pre-sampling event notifications and approval
- Utility clearance protocols pre-site mob and onsite
- Set-up for boring installation
- Monitor air quality in the workers breathing zone
- Log soils and screen with a PID
- Collect groundwater grab samples
- Perform gamma geophysical log

- Administrative activities

### 2.2.3 Monitoring Well Installation Oversight

Resolution Consultants personnel will be performing oversight for the installation of monitoring well pairs at VPB locations. A drilling subcontractor (TBD) will be utilized for the installation of monitoring wells (4-inch PVC typical) to a depth determined based on the results of the VPBs. The major activities involved with installation of monitoring wells are as follows:

- Pre-sampling event notifications and approval
- Set-up for boring/well installation
- Monitor air quality in the workers breathing zone
- Well construction
- Well Development
- Administrative activities

### 2.2.4 Groundwater Sample Collection

This activity will include the collection of one round of groundwater samples from the newly installed monitoring wells. Groundwater samples will be collected through low-flow sampling techniques using submersible pumps. The major activities involved with collecting groundwater samples from the site and surrounding properties include the following:

- Pre-sampling event notifications and approval
- Set-up for sampling activities
- Gauging of depth to groundwater, total well depth, and the thickness of non-aqueous phase liquid (NAPL), if present
- Groundwater samples from monitoring wells will be collected low-flow sampling techniques
- Sample prep and sample shipping
- Administrative activities

### 2.2.5 Topographic Survey

Resolution Consultants personnel will be performing oversight of the boring and well locations survey conducted at the end of the fieldwork by a New York State-licensed surveyor. The locations will be tied into the existing base map developed for the site.

### 2.2.6 Investigative-Derived Waste (IDW) Management

IDW will be collected and categorized as non-hazardous or hazardous. Potentially hazardous IDW (purge water, and decontamination fluids) will be tested and disposed of within 90 calendar days of completing the field activities. Potentially hazardous IDW waste will be staged onsite, then delivered to an IDW storage facility for processing. Non-hazardous IDW (normal trash) will be disposed of in a timely fashion during fieldwork.

### 2.2.7 Equipment Decontamination

Resolution Consultants and subcontractor personnel will perform decontamination of equipment used to perform work within controlled work areas. Resolution Consultants subcontractor will construct a decontamination pad either on site as space permits or in a centralized location. The gross soils on equipment will first be removed via dry methods (shovels, brooms) and then the equipment will be power washed to ensure all residual materials are removed from the equipment. Once inside the EZ, all equipment will stay within the impacted work zone. If at any point in time the equipment is to come out of the EZ, for other work or maintenance, it will be decontaminated.

Pre-cleaned and dedicated sampling materials/equipment will be used to collect the soil and groundwater samples for laboratory analysis. After the samples are collected, any disposable, or one-time use equipment (tubing, bladders) will placed in a plastic bag for disposal as IDW per accordance with the paragraph above. Non-disposable sampling and drilling equipment that contacted the soil and/or groundwater will be decontaminated between each sampling location. Gross sediments and/or contamination will first be removed from the sampling and drilling equipment. The equipment will then be washed with DI water and Alconox detergent and then rinsed with DI water.

### 2.2.8 Additional Work Operations

Operations at the site may require additional tasks not identified in this section or addressed in Attachment B, THAs. Before performing any task not covered in this HASP a THA must be prepared, and approved by the Resolution Consultants Health and Safety Manager or designee.

# 3.0 HAZARD ASSESSMENT (SAFETY)

## 3.1 Physical Hazards

The following physical hazards are anticipated to be present on the site. Additional hazards may be noted on the THAs developed for the individual tasks.

### 3.1.1 Slips, Trips, Falls, and Protruding Objects

A variety of conditions may exist that may result in injury from slips, trips, falls, and protruding objects. Slips and trips may occur as a result of wet, slippery, or uneven walking surfaces. To prevent injuries from slips and trips, always keep work areas clean; keep walkways free of objects and debris; and report/clean up liquid spills. Serious injuries may occur as a result of falls from elevated heights. Always wear fall protection while working at heights of 6 feet or greater above the next lower level. Protruding objects are any object that extends into the path of travel or working area that may cause injury when contacted by personnel. Always be aware of protruding objects and when feasible remove or label the protruding object with an appropriate warning.

### 3.1.2 Housekeeping

During site activities, work areas will be continuously policed for identification of excess trash and unnecessary debris. Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) prior to disposal. At no time will debris or trash be intermingled with waste PPE or contaminated materials. Additional information on the requirements of housekeeping can be found in S3NA 307 PR, *Housekeeping, Worksite*.

### 3.1.3 Manual Lifting

Most materials associated with investigation and remedial activities are moved by hand. The human body is subject to severe damage in the forms of back injury, muscle strains, and hernia if caution is not observed in the handling process. Whenever possible, use mechanical assistance to lift or move materials and at a minimum, use at least two people to lift, or roll/lift with your arms as close to the body as possible. For additional requirements, refer to S3NA 308 PR, *Manual Lifting* and S3NA 308 WI, *Manual Lifting Safe Work Practices*.

### 3.1.4 Utilities

Various forms of underground/overhead utility lines or pipes may be encountered during site activities. Prior to the start of intrusive operations, utility clearance is mandated, as well as obtaining authorization from all concerned public utility department offices. If insufficient data is available to accurately determine the location of the utility lines, Resolution Consultants will hand

clear to a depth of at least 5 feet below ground surface in the proposed areas of subsurface investigation. Should intrusive operations cause equipment to come into contact with utility lines, the SSO and Resolution Consultants Health and Safety Manager or designee will be notified immediately. Work will be suspended until the applicable utility agency is contacted and the appropriate actions for the particular situations can be taken. The phone number for the applicable state agency is provided in the Emergency Contacts list found in Section 8. For additional requirements, refer to S3NA 417 PR, *Utilities Underground*.

Ensure backhoe operator, truck drivers, etc. and signal person are aware of overhead power lines when working around overhead power lines. Overhead power and utility lines may be present on, or adjacent to, the site and represent a potential hazard during the mobilization/demobilization of equipment and supplies. Maintain a minimum of 10 feet between overhead power lines and the bucket and/or arm of the backhoe bed/cab of trucks, etc. Any deviation must be approved by the Resolution Consultants Health and Safety Manager or designee. Additional information on working adjacent to overhead power and utility lines can be found in S3NA 406 PR, *Electrical Lines, Overhead*.

### 3.1.5 Electrical hazards

Electrical and powered equipment may be used during a variety of site activities. Injuries associated with electrical and powered equipment include electric shock, cuts/lacerations, eye damage (from flying debris), and burns. To reduce the potential of injury from the hazards associated with electrical and powered equipment, always comply with the following:

- Use ground fault circuit interrupters (GFCIs) when using electrical powered tools/equipment. GFCIs prevent electrical shock by detecting the loss of electricity from a power cord and/or electrical device.
- Ensure generators are properly grounded, including the use of a grounding rod, driven to a depth of 3-feet.
- Wear ANSI-approved (Z87.1) safety glasses. Face shields may be required to provide additional face protection from flying debris.
- Wear appropriate work gloves. Work gloves may reduce the severity of burns and cuts/lacerations.

All temporary electric installations (site trailer, subpanels) will comply with OSHA (29 CFR 1926, Subpart K, and 29 CFR 1910, Subpart S) guidelines. Only qualified and competent individuals (licensed electrician) will provide electrical service/servicing. Refer to S3NA 410 PR, *Hazardous Energy Control*, for additional requirements and information.

### 3.1.6 Heavy Equipment and Vehicle Operations

Heavy equipment and site vehicles present serious hazards site personnel. Blind spots, failure to yield, and other situations may cause heavy equipment/vehicles to come into contact with personnel. To reduce the possibility of contact between equipment/traffic and personnel, always adhere to the following:

- Personnel must wear a high visibility, reflective safety vest at all times when working near heavy equipment and/or other vehicle traffic.
- Personnel must always yield to equipment/vehicle traffic and stay as far as possible from all equipment/vehicle traffic. Always maintain eye contact with operators.
- When feasible, place barriers between work areas and equipment/vehicle traffic.
- Always ensure reverse warning alarms are working and louder than surrounding noise. Personnel must report inoperative reverse warning alarms.
- Ensure Daily Equipment Safety Inspections are being performed and documentation filed at the site.

For additional requirements, refer to S3NA 309 PR, *Mobile or Heavy Equipment*.

### 3.1.7 Drilling Operations

Mud rotary drilling operations present their own set of hazards. Several basic precautions that should be taken include, but are not limited to, confirming locations of underground and overhead utilities, wearing of appropriate PPE and the avoidance of loose clothing or jewelry, staying clear of moving parts, knowing the locations of emergency shut-off switches. Other operational safety precautions regarding moving the drilling equipment, raising and lowering the derrick (mast), and drilling can be found in S3NA 405 PR, *Drilling and Boring*.

### 3.1.8 Dust and Odor Control

Specific controls will be in place to prevent dust generation. If dust is observed reaching or approaching the site boundary, activities causing the dust will be immediately stopped. Dust control measures (water spray, soil covers, slower work pace, or change in work activities) will be deployed prior to resuming work. Corrective measures will be documented in the daily report.

Due to the nature of the contaminant at the site, odors are not anticipated to be of concern. In the event that an odor complaint is received, the SS and/or SSO will immediately assess site conditions and determine the probable cause or causes. Appropriate odor mitigation measures will be deployed. These measures may include covering sediment piles, deploying odor suppressing foam, implementation of air monitoring or discontinuing activities that are generating the odor. Corrective measures will be documented in the daily report.

### 3.1.9 Spill Prevention

Work activities may involve the use of hazardous materials (e.g., fuels, solvents) or work involving drums or other containers. The following procedures will be used to prevent or contain spills:

- All hazardous material will be stored in appropriate containers
- Tops/lids will be placed back on containers after use.
- Containers of hazardous materials will be stored appropriately away from moving equipment.

At least one spill response kit, to include an appropriate empty container, materials to allow for booming or diking the area to minimize the size of the spill, and appropriate clean-up material (e.g., speedy dri) shall be available at each work site (more as needed).

- All hazardous commodities in use (e.g., fuels) shall be properly labeled.
- Containers shall only be lifted using equipment specifically manufactured for that purpose.
- For drums/containers, follow the procedures in S3NA 308 WI, *Manual Lifting Safe Work Practices*, to minimize spillage.

### 3.1.10 Noise Exposure Monitoring

When heavy equipment is in operation, it will be necessary to ensure that each exclusion zone fully encompasses all areas where hazardous noise levels are present (85 decibels on the A-weighted scale [dBA] or greater). If the sound pressure level exceeds 85 dBA at any location along the site perimeter, the exclusion zone (EZ) boundary will then be adjusted to fully encompass this region. During this project, all personnel working in the vicinity of the drilling rig (within EZ) will be required to use hearing protection. Refer to S3NA 510 PR, *Hearing Conservation Program*, for additional information and requirements.

### 3.1.11 Traffic Control

During certain work tasks, the establishment of traffic control to adequately protect workers and the public may be required on-site. Site specific requirements will be determined by the site supervisor/SSO on a case-by-case basis. Only approved traffic control devices per accordance with the Manual of Uniform Traffic Control Devices (MUTCD) will be used on public road ways per accordance with the applicable State regulatory guidance.

General traffic control precautions include placing a work vehicle between your worksite and oncoming traffic whenever possible. Not only is it a large, visible warning sign, but also if an oncoming car should fail to yield or deviate, the parked vehicle rather than your body would absorb the first impact of a crash. Turn the vehicle wheels so that if it was struck, it would swing away from the worksite. When using cones or other devices to modify traffic flow, ensure use of the proper taper length and device spacing to provide adequate warning distance to on-coming motor vehicles. In addition, proper PPE is to be worn during traffic operations, to include hardhat and high-visibility vests. Refer to S3NA 306 PR, Highway and Road Work, for additional requirements.

## 3.2 Biological Hazards

It is anticipated that numerous biological hazards will be present on the project site. Poisonous plants may be found along the tree lines, and adjacent to monitoring wells, along with ticks and other biting insects. Stinging insects, such as bees and wasps may build nests inside of monitoring wells or be within proximity of the work zone. Below is a discussion of the most common biological hazards found on project sites, and those anticipated to be of concern here.

### 3.2.1 Small Mammals

Working in the field either directly or indirectly with small mammals has inherent risks of injury or exposure to zoonotic diseases (infectious diseases that can be transmitted from animals to humans) that all field staff need to protect themselves against. The risks are usually higher when there is

direct contact with a wild animal, either through a break in the skin (blood), saliva, or excrement; however, there are also risks through air-borne diseases (e.g., Hantavirus).

Obviously, wildlife biologists directly handling wildlife, dead or alive, or working with wildlife feces or in enclosed habitats (such as caves), have an increased risk of exposure to a wider range of zoonotic diseases and should take extra precautions.

### 3.2.2 Venomous Animals

Some animals have the ability to inject venom. These include: rattlesnakes, black widow spiders, and scorpions. These all have limited distributions, so in most areas you are unlikely to encounter them. Other spiders possess venom but they are not harmful to humans. Shrews have poisonous saliva but the chance of being envenomated by them is extremely unlikely unless they are handled. If bitten by any of these animals special care should be taken to treat the wound as it may lead to complications due to the toxin.

A bite from a venomous snake, which may inject varying degrees of toxic venom, is rarely fatal but should always be considered a medical emergency.

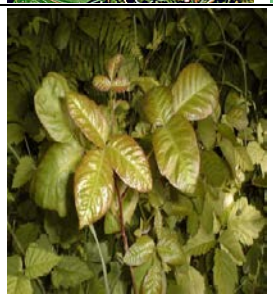
### 3.2.3 Poisonous Plants

Sensitivity to toxins generated by plants, insects and animals varies according to dosage and the ability of the victim to process the toxin; therefore, it is difficult to predict whether a reaction will occur, or how severe the reaction will be. Staff should be aware that there are a large number of organisms capable of causing serious irritations and allergic reactions. Some reactions will only erupt if a secondary exposure to sunlight occurs. Depending on the severity of the reaction, the result can result in severe scarring, blindness or even death.

Plants that field staff should recognize and take precautions to avoid include: Poison Sumac, Poison Ivy (terrestrial and climbing), Poison Oak, Giant Hogweed (or Giant Cow Parsnip), Wild Parsnip, Devil's Club and Stinging Nettle. Many others are extremely poisonous to eat (e.g., Poison Hemlock, Water Parsnip) – do not eat anything that has not been identified.

A large number of plants are not harmful to touch but may contain poisonous berries or foliage that could cause serious complications or death if they are ingested. It goes without saying not to eat any berries or plants that you are not absolutely sure of their identity. Examples of common poisonous or irritating plant species, common to the United States, are shown in Table 3-1.

**Table 3-1**
**Hazardous Plant Identification Guide**

| Species | Examples |
|---|---|
| **Poison Ivy**<br>• Grows in West, Midwest, Texas, East<br>• Several forms – vine, trailing shrub, or shrub<br>• Three leaflets (can vary 3-9)<br>• Leaves green in summer, red in fall<br>• Yellow or green flowers<br>• White berries | |
| **Poison Oak**<br>• Grows in the East (NJ to Texas), Pacific Coast<br>• 6-foot tall shrubs or long vines<br>• Oak-like leaves, clusters of three<br>• Yellow berries |  |

### 3.2.4 Insects

Insects for which precautionary measures should be taken include: mosquitoes (potential carriers of disease aside from dermatitis), black flies, wasps, bees, and ticks.

Wasps and bees will cause a painful sting to anyone if they are harassed. They are of most concern for individuals with allergic reactions who can go into anaphylactic shock. Also instances where an individual is exposed to multiple stings can cause a serious health concern for anyone. These insects are most likely to sting when their hive or nest is threatened.

Ticks can be encountered when walking in tall grass or shrubs. They crawl up clothing searching for exposed skin where they will insert mouthparts to drink blood. Most serious concern is possibility of contracting Lyme disease which is spread by the Black-legged or Deer Tick. Occasionally a tick can cause Tick Paralysis if it is able to remain feeding for several days. Full recovery usually occurs shortly after the tick is removed.

### 3.3 Ultraviolet Hazards

The 2010 historical UV Index for the Bethpage, NY area showed that worker's UV exposures were in the HIGH category beginning in May and lasting until September with worker's exposures in the EXTREME category from July through August. Workers performing field work outdoors may be susceptible to sunburn if not properly protected with sunscreen or protective clothing and hats. Skin can burn in minutes when the UV Index is VERY HIGH. Protective measures are advisable.

### 3.4 Weather Hazards

The Site Safety Officer will be attentive to daily weather forecasts for the project area each morning. Predicted weather conditions of potential field impact are to be included in safety briefings and the Task Hazard Analysis (THA) for that day. Weather changes should initiate a review and updates (THA) as necessary. Weather-related hazards will directly correlate to the type of weather involved. Hot, dry weather may cause greater dust emissions, particularly during intrusive activities. Rain may increase slip/trip hazards, particularly for ground workers.

Severe weather can occur with little warning. Employees will be vigilant for the potentials for storms, lightning, high winds, and flash flood events. Additionally, lightning strikes during electrical storms could also be a potential hazard. The following procedures will be implemented once thunder is heard or lightning spotted:

1. If thunder is heard, all site personnel are to be alert of any visible lightning flashes. The SSO will observe the storm front and track the direction it is moving. The SSO will continue to observe the storm front until it passes or until the prevailing direction is determined to be away from the site.

2. If lightning is observed, the SS or SSO are to be notified. When the next lightning flash is observed, a "second" count shall be initiated from the time the lightning is observed until the thunder from the strike is heard.

3. The following action guidelines shall be implemented once the "second" count is $\leq$ 30 seconds:
   a. "second" count > 30, the SS or SSO will continually observe the storm front. If the front is moving away, work will continue. If the front is moving towards the site, the SS will initially place workers on alert for potential evacuation.

b. "second" count ≤ 30, the SS will issue the evacuation command and all workers are to report to the break/lunch trailer. Work can be re-initiated once the front has passed by and thunder has not been heard for 30 minutes.

4. If lightning is observed and the storm front is moving away from or around the site and is > 20 miles away, work will be permitted to continue. The location of the storm can be confirmed via internet access to a local weather website that has a Doppler radar tracking system.

### 3.5 Hazard Analysis

Task Hazard Analyses (THAs) have been completed for oversight and groundwater sampling and are provided in (Attachment B) Others that are listed below will be completed by the field team and subcontractors prior to mobilization:

- Mud Rotary Drilling
- Split-spoon Sampling
- Geophysical Borehole Logging

As a result of unanticipated work activities or changing conditions, additional THAs may be required. All additional THAs will be reviewed and approved by the Resolution Consultants Health and Safety Manager or designee.

### 3.6 Task Specific SH&E Procedures

As discussed in Section 5.0, personnel may be exposed to a variety of chemical, physical, and radiological hazards resulting from task or equipment-specific activities. The controls for many of these hazards are discussed in SOPs found in the **Series 300 to 500** of the Resolution Consultants SH&E SOPs. Table 3-2 presents the SOPs applicable to this project.

**Table 3-2**
**Applicable SOPs**

| | SOP# | Title |
|---|---|---|
| | **S3NA 300 Series—Field(Common)** | |
| ☐ | S3NA-301-PR | Confined Spaces |
| ☒ | S3NA-302-PR | Electrical, General |
| ☐ | S3NA-303-PR | Excavation and Trenching |
| ☐ | S3NA-304-PR | Fall Protection |
| ☒ | S3NA-305-PR | Hand and Power Tools |
| ☒ | S3NA-306-PR | Highway and Road Work |
| ☒ | S3NA-307-PR | Housekeeping, Worksite |
| ☒ | S3NA-308-PR | Manual Lifting, Field |
| ☐ | S3NA-309-PR | Mobile or Heavy Equipment |
| ☐ | S3NA-310-PR | Rigging, Hoisting, Cranes and Lifting Devises |
| ☐ | S3NA-311-PR | Scaffolding |
| ☐ | S3NA-312-PR | Ladders and Stairways |
| ☒ | S3NA-313-PR | Wildlife, Plants and Insects |
| ☐ | S3NA-314-PR | Working Alone & Remote Travel |
| ☐ | S3NA-315-PR | Water, Working Around |
| | **S3NA 400 Series Field (Uncommon)** | |
| ☐ | S3NA-401-PR | Aircraft Charters |
| ☐ | S3NA-402-PR | All-Terrain Vehicles (ATVs) |
| ☐ | S3NA-403-PR | Avalanches |
| ☐ | S4NA(US)-404-PR | Commercial Motor Vehicles |
| ☒ | S3NA-405-PR | Drilling and Boring |
| ☒ | S3NA-406-PR | Electrical Lines, Overhead |
| ☐ | S3NA-407-PR | Electro-fishing |
| ☐ | S3NA-408-PR | Elevated Work Platforms and Aerial Lifts |
| ☐ | S3NA-409-PR | Forklifts (operation of) |
| ☐ | S3NA-410-PR | Hazardous Energy Control |
| ☐ | S3NA-411-PR | Machine Guarding |
| ☐ | S3NA-412-PR | Powder-Actuated Tools |
| ☐ | S4NA(US)-413-PR1 | Process Safety Management |
| ☐ | S4NA(US)-414-PR | Railway Sites |
| ☐ | S4NA(US)-415-PR | RCRA Regulated Facilities |
| ☐ | S3NA-416-PR | Tunnel and Underground Work |
| ☒ | S3NA-417-PR | Utilities, Underground |
| ☐ | S3NA-418-PR | Welding, Cutting and Other Hot Work |
| ☐ | S3NA-419-PR | Water, Marine Operations, Boating |
| ☐ | S3-NA420-PR | Water, Underwater Diving |

| | SOP# | Title |
|---|---|---|
| | **S3NA 500 Series—Industrial Hygiene** | |
| ☐ | S3NA-501-PR | Asbestos |
| ☐ | S3NA-502-PR | Benzene |
| ☐ | S3NA-503-PR | Blood borne Pathogen Program |
| ☐ | S3NA-504-PR | Cadmium |
| ☐ | S3NA-505-PR | Cold Stress Prevention |
| ☐ | S3NA-506-PR | Compressed Gases |
| ☒ | S3NA-507-PR | Hazardous Materials Communication / WHMIS |
| ☐ | S3NA-508-PR | Hazardous Materials Handling and Shipping |
| ☒ | S3NA-509-PR | Hazardous Waste Operations and Emergency Response Activities |
| ☒ | S3NA-510-PR | Hearing Conservation Program |
| ☒ | S3NA-511-PR | Heat Stress Prevention |
| ☐ | S3NA-512-PR | Laboratory Safety |
| ☐ | S3NA-513-PR | Lead |
| ☐ | S3NA-514-PR | Munitions and Explosives of Concern / Unexploded Ordnance (MEC-UXO) |
| ☐ | S3NA-515-PR | Nanotechnology |
| ☐ | S3NA-516-PR | Radiation Safety Programs |
| ☐ | S3NA-517-PR | Radiation, Non-Ionizing |
| ☐ | S3NA-518-PR | Radiation, Gauge Source program |
| ☒ | S3NA-519-PR | Respiratory Protection Program |
| ☒ | S3NA-520-PR | Spill Response, Incidental |

# 4.0 SH&E REQUIREMENTS (SAFETY)

## 4.1 HAZWOPER Qualifications

Personnel performing work at the job site must be qualified as HAZWOPER workers (unless otherwise noted in specific THAs or by the SSO), and must meet the medical monitoring and training requirements specified in the Resolution Consultants' SH&E Standard Operating Procedures.

If site monitoring procedures indicate that a possible exposure has occurred above the OSHA permissible exposure limit (PEL), employees may be required to receive supplemental medical testing to document any symptoms that may be specific to the particular materials present.

## 4.2 Site-Specific Safety Training

All Resolution Consultants personnel performing activities at the site will be trained in accordance with *S3NA-003-PR SH&E Training*. All personnel are required to remain current in all of their required training and evaluate their need for additional training when there is a change in work. In addition to the general health and safety training programs, personnel will be required to complete any supplemental task specific training developed for the tasks to be performed. Administration and compliance with the requirements for additional task-specific training will be the responsibility of the project or lead manager. Any additional required training that is completed will be documented and tracked in the project files.

## 4.3 Tailgate Meetings

Prior to the commencement of daily project activities, a tailgate meeting will be conducted by the SSO to review the specific requirements of this HASP, applicable THA. Attendance at the daily tailgate meeting is mandatory for all employees at the site covered by this HASP and must be documented on the attendance form. All safety training documentation is to be maintained in the project file by the SSO.

## 4.4 Hazard Communication

Hazardous materials that may be encountered as existing on-site environmental or physical/health contaminants during the work activities are addressed in this HASP and their properties, hazards and associated required controls will be communicated to all affected staff and subcontractors.

In addition, any employee or organization (contractor or subcontractor) intending to bring any hazardous material onto this Resolution Consultants-controlled work site must first provide a copy

of the item's Material Safety Data Sheet (MSDS) to the SSO for review and filing (the SSO will maintain copies of all MSDS on site). MSDS may not be available for locally-obtained products, in which case some alternate form of product hazard documentation will be acceptable in accordance with the requirements of S3NA-507-PR *Hazardous Materials Communication/WHMIS*.

All personnel shall be briefed on the hazards of any chemical product they use, and shall be aware of and have access to all MSDS.

All containers on site shall be properly labeled to indicate their contents. Labeling on any containers not intended for single-day, individual use shall contain additional information indicating potential health and safety hazards (flammability, reactivity, etc.).

Attachment C contains copies of MSDS for those items planned to be brought on site at the time this HASP is prepared. This information will be updated as required during site operations.

### 4.5 Confined Space Entry

It is anticipated that no confined space activities will be performed by Resolution Consultants staff for this project.

### 4.6 Hazardous, Solid, or Municipal Waste

If hazardous, solid, and/or municipal wastes are generated during any phase of the project, the waste shall be accumulated, labeled, and disposed of in accordance with applicable Federal, State, Provincial, Territorial and/or local regulations. Consult the Project Manager for further guidance.

### 4.7 General Safety Rules

All site personnel shall conduct themselves in a safe manner and maintain a working environment that is free of additional hazards, in adherence to S3NA-001-PR *Safe Work Standards and Rules and* S3NA-307-PR *Housekeeping, Worksite*.

#### 4.7.1 Housekeeping

During site activities, work areas will be continuously policed for identification of excess trash and unnecessary debris. Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) prior to disposal. At no time will debris or trash be intermingled with waste PPE or contaminated materials.

### 4.7.2 Smoking, Eating, or Drinking

Smoking, eating and drinking will not be permitted inside any controlled work area at any time. Field workers will first wash hands and face immediately after leaving controlled work areas (and always prior to eating or drinking). Consumption of alcoholic beverages is prohibited at any Resolution Consultants site. Smoking, eating or drinking must be in an approved area.

### 4.7.3 Personal Hygiene

The following personal hygiene requirements will be observed:

Water Supply: A water supply meeting the following requirements will be utilized:

- Potable Water: An adequate supply of potable water will be available for field personnel consumption. Potable water can be provided in the form of water bottles, canteens, water coolers, or drinking fountains. Where drinking fountains are not available, individual-use cups will be provided as well as adequate disposal containers. Potable water containers will be properly identified in order to distinguish them from non-potable water sources.
- Non-Potable Water: Non-potable water may be used for hand washing and cleaning activities. Non-potable water will not be used for drinking purposes. All containers of non-potable water will be marked with a label stating:

**Non-Potable Water**
**Not Intended for Drinking Water Consumption**

- Toilet Facilities: A minimum of one toilet will be provided for every 20 personnel on site, with separate toilets maintained for each sex except where there are less than 5 total personnel on site. For mobile crews where work activities and locations permit transportation to nearby toilet facilities on-site facilities are not required.
- Washing Facilities: Employees will be provided washing facilities (e.g., buckets with water and Alconox) at each work location. The use of water and hand soap (or similar substance) will be required by all employees following exit from the Exclusion Zone, prior to breaks, and at the end of daily work activities.

### 4.7.4 Buddy System

All field personnel will use the buddy system when working within any controlled work area. Personnel belonging to another organization on site can serve as "buddies" for Resolution Consultants personnel. Under no circumstances will any employee be present alone in a controlled work area. For areas not in controlled work areas, the procedures outlined in S3NA-314-PR *Working Alone and Remote Travel* will be followed at all times.

## 4.8 Stop Work Authority

All employees have the right and duty to stop work when conditions are unsafe, and to assist in correcting these conditions as outlined in S3NA-002-PR, *Stop Work Authority*. Whenever the SSO determines that workplace conditions present an uncontrolled risk of injury or illness to employees, immediate resolution with the appropriate supervisor shall be sought. Should the supervisor be unable or unwilling to correct the unsafe conditions, the SSO is authorized and required to stop work, which shall be immediately binding on all affected Resolution Consultants employees and subcontractors.

Upon issuing the stop work order, the SSO shall implement corrective actions so that operations may be safely resumed. Resumption of safe operations is the primary objective; however, operations shall not resume until the Resolution Consultants Health and Safety Manager or designee has concurred that workplace conditions meet acceptable safety standards.

## 4.9 Client Specific Safety Requirements

The client has specified no additional health and safety requirements.

# 5.0 EXPOSURE MONITORING PROCEDURES (HEALTH)

## 5.1 Contaminant Exposure Hazards

The following is a discussion of the hazards presented to worker personnel during this project from on-site chemical and radiological hazards known, suspected or anticipated to be present on site.

Exposure symptoms and applicable first aid information for each suspected site contaminant identified in the Scope of Work are located in the following subsections.

### 5.1.1 Volatile Organic Compounds

The volatile organic compounds (VOCs) detected in certain site soils and/or groundwater are the aromatic hydrocarbons benzene, ethylbenzene, toluene, and xylenes. Exposure to the vapors of these compounds, above their respective OSHA PELs, may produce irritation of the mucous membranes of the upper respiratory tract, nose, and mouth. Overexposure may also result in the depression of the central nervous system. Symptoms of such exposure include drowsiness, headache, fatigue, and "drunken-like" behaviors. Chronic and prolonged overexposure to the vapors of benzene may cause damage to the blood-forming organs and is known to cause leukemia in humans.

The OSHA PEL for benzene is 1 ppm. The OSHA PELs for ethylbenzene, toluene, and xylene are 100 ppm, 200 ppm, and 100 ppm, respectively. The American Conference of Governmental Industrial Hygienists (ACGIH) has recommended a threshold limit value (TLV) of 20 ppm for toluene and a TLV of 0.5 ppm for benzene.

### 5.1.2 Trichloroethylene

Trichloroethylene (TCE), also known as Ethylene trichloride, TCE, Trichloroethene, and Trilene, is a colorless liquid with a chloroform-like odor. This is the most commonly detected compound and at the highest concentrations at the site. TCE is a chlorinated hydrocarbon that was commonly used as an organic solvent in manufacturing for the degreasing of metal parts, as well as used in dry cleaning, to extract oils from soy, coconut, and palm, the decaffeination of coffee, as a desiccant in ethanol production, and as an anesthetic. Production and use of TCE lasted from the 1920s through the 1970s.

TCE is nearly insoluble in water, but miscible with most organic solvents. Industrial grade trichloroethylene contains small amounts of stabilizers (0.1% by weight) such as epichlorohydrin, which may increase the irritant effects. It is volatile, producing potentially toxic concentrations at

room temperature. Trichloroethylene is heavier than air and may cause asphyxiation in poorly ventilated or enclosed spaces and in low-lying areas. Trichloroethylene vapor is readily absorbed from the lungs, and inhalation is the main route of exposure. Trichloroethylene when exposed to sunlight decomposes photolytically. The ionization potential for TCE is 9.45 eV. The boiling point is 189$^{o}$F, the LEL is 8% and UEL is 10.5%.

The recognition odor threshold of trichloroethylene is 110 ppm, which is slightly higher than the OSHA PEL (100 ppm) and much higher than the ACGIH TLV of 10 ppm; thus, odor generally provides an inadequate indication of hazardous concentrations. The NIOSH recommended exposure limit (REL) is 2 ppm. The IDLH is 1,000 ppm.

Routes of entry consist of inhalation of vapor, absorption, ingestion, skin and eye contact. Points of attack consist of the blood, eyes, skin, respiratory system, heart, liver, kidneys, central nervous system. TCE is a potential carcinogen. Harmful effects and symptoms of short-term exposure consist of irritation of eyes and skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; and liver injury. Harmful effects and symptoms of long term exposure may cause loss of appetite, ataxia, fatigue, muscle weakness, headache, dizziness, memory loss, nervousness and irritability.

### 5.1.3 Vinyl Chloride

Vinyl chloride is a man-made, colorless gas, which is used principally as a monomer in plastics, specifically Polyvinyl chloride. Vinyl chloride is also a natural environmental break down product of other chlorinated hydrocarbons, and can be found in low concentrations where chlorinated solvents exist in soils. Short-term exposures have resulted in drowsiness, dizziness, and liver and kidney damage. Long term exposures have been associated with loss of muscular coordination, nerve damage, gastrointestinal damage, adverse effects on unborn animals and increased frequency of tumors. The EPA and OSHA consider vinyl chloride to be carcinogenic to humans. The exposure limit for vinyl chloride is 1 ppm in air. Vinyl chloride is also a flammable gas.

PEL = 1 ppm, STEL = 5 ppm Action Level = 0.5 ppm, PID factor = 0.6

### 5.1.4 cis-1,2-Dichloroethene

Also called 1,2-dichloroethylene, is a highly flammable, colorless liquid with a sharp, harsh odor. It is used to produce solvents and in chemical mixtures. There are two forms of 1,2-dichloroethene;

one is called cis-1,2-dichloroethene and the other is called trans-1,2-di-chloroethene. Sometimes both forms are present as a mixture.

1,2-Dichloroethene vapor is readily absorbed from the lungs, and inhalation is the main route of exposure. Inhalation of high levels of 1,2-dichloroethene can cause nauseous and drowsiness. The recognition odor threshold of 1,2-Dichloroethene vapor is 17 ppm, a concentration at which it is readily absorbed from the lungs, and inhalation is the main route of exposure. The recognition odor threshold of 1,2-Dichloroethene is 1.1 ppm which is lower than the OSHA PEL (200 ppm).

## 5.2 Real-Time Exposure Measurement

Monitoring shall be performed within the work area on site to detect the presence and relative levels of toxic substances. The data collected throughout monitoring shall be used to determine the appropriate levels of PPE. Table 5-1 specifies the real-time monitoring equipment that will be used for this project.

**Table 5-1**
**Monitoring Parameters and Equipment**

| Instrument | Manufacturer/Model* | Substances Detected |
|---|---|---|
| Photo Ionization Detector (PID) | RAE Systems mini-RAE Photovac Microtip HNu Model HNu (min. 10.6 eV lamp) | Organic Solvents |
| Detector tubes | Draeger or RAE Systems detector tubes for both benzene and vinyl chloride; detection limit must be <= 0.5 ppm. | Benzene, vinyl chloride |

*Or similar unit, as approved by the Resolution Consultants Health and Safety Manager or designee

### 5.2.1 Health and Safety Action Levels

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

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

Personnel should also be able to upgrade or downgrade their level of protection with the concurrence of SSO or the Resolution Consultants Health and Safety Manager or designee.

Reasons to upgrade:

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

Reasons to downgrade:

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

### 5.2.2 Monitoring Procedures

TCE presents an exposure hazard when suspended in dust, however; based on the current SOW, dust is not anticipated to be generated during field activities. Atmospheric monitoring will be conducted continuously during all activities within the work zone for precautionary purposes using a PID. The SSO will assess the atmosphere for acceptable concentrations/level prior to any personnel entering into the area.

**Table 5-2**
**Monitoring Procedures and Action Levels**

| Parameter | Location And Interval | Response Level (Meter units/ppm above background) | Response |
|---|---|---|---|
| VOCs (Total by PID) | Continuous in the worker's breathing zone or in the immediate work area for sustained reading of 2 minutes in duration. | < 1.0 ppm | Continue Level D or Modified Level D work and continue monitoring. |
| VOCs (Total by PID) | Continuous in the worker's breathing zone or in the immediate work area for sustained reading of 2 minutes in duration. | ≥ 1 ppm | Upgrade to Level C PPE (minimum GME/ P100 cartridges or equivalent chemical cartridge combined with P100). Continue environmental monitoring. Sample periodically (approx. every 15 minutes) with benzene and vinyl chloride detector tubes – if < 1 ppm for both noted, discontinue respirator use and continue periodic monitoring. If >1 ppm for either, cease work, exit the area, and contact the SSO or Resolution Consultants Health and Safety Manager or designee. |
| VOCs (Total by PID) | Continuous in the worker's breathing zone or in the immediate work area for sustained reading of 2 minutes in duration. | ≥ 15 ppm | Not consistent with chemical contamination and concentrations identified in the specifications. Cease work, exit the area, and contact the SSO or Resolution Consultants Health and Safety Manager or designee. |

#### 5.2.2.1 Monitoring Equipment Calibration

All instruments used will be calibrated at the beginning and end of each work shift, in accordance with the manufacturer's recommendations. If the owner's manual is not available, the personnel operating the equipment will contact the applicable office representative, rental agency, or manufacturer for technical guidance for proper calibration. If equipment cannot be pre-calibrated to specifications, site operations requiring monitoring for worker exposure or off-site migration of contaminants will be postponed or temporarily ceased until this requirement is completed.

#### 5.2.2.2 Personal Sampling

Should site activities warrant performing personal sampling (breathing zone) to better assess chemical exposures experienced by Resolution Consultants employees, the SSO, under the direction of a Certified Industrial Hygienist (CIH), Certified Safety Professional (CSP) will be responsible for specifying the monitoring required. Within five working days after the receipt of monitoring results,

the CIH or CSP will notify each employee, in writing, of the results that represent that employee's exposure. Copies of air sampling results will be maintained in the SSO project files.

If the site activities warrant, the subcontractor will ensure its employees' exposures are quantified via the use of appropriate sampling techniques. The subcontractor shall notify the employees sampled in accordance with health and safety regulations, and provide the results to the SSO for use in determining the potential for other employees' exposure.

## 5.3 Heat and Cold Stress

Heat and cold stress may vary based upon work activities, PPE/clothing selection, geographical locations, and weather conditions. To reduce the potential of developing heat/cold stress, be aware of the signs and symptoms of heat/cold stress and watch fellow employees for signs of heat/cold stress.

Heat stress can be a significant field site hazard, particularly for non-acclimated personnel operating in a hot, humid setting. Site personnel will be instructed in the identification of a heat stress victim, the first-aid treatment procedures for the victim and the prevention of heat stress casualties. Work-rest cycles will be determined and the appropriate measures taken to prevent heat stress as outlined in SH&E 616, *Heat Stress Prevention Program*.

### 5.3.1 Responding to Heat-Related Illness

The guidance that follows will be used in identifying and treating heat-related illness.

**Table 5-3**
**Identification and Treatment of Heat-Related Illness**

| Type of Heat-Related Illness | Description | First Aid |
|---|---|---|
| Mild Heat Strain | The mildest form of heat-related illness. Victims exhibit irritability, lethargy, and significant sweating. The victim may complain of headache or nausea. This is the initial stage of overheating, and prompt action at this point may prevent more severe heat-related illness from occurring. | • Provide the victim with a work break during which he/she may relax, remove any excess protective clothing, and drink cool fluids.<br>• If an air-conditioned spot is available, this is an ideal break location.<br>• Once the victim shows improvement, he/she may resume working; however, the work pace should be moderated to prevent recurrence of the symptoms. |
| Heat Exhaustion | Usually begins with muscular weakness and cramping, dizziness, staggering gait, and nausea. The victim will have pale, clammy moist skin and may perspire profusely. The pulse is weak and fast and the victim may faint unless they lie down. The bowels may move involuntarily. | • Immediately remove the victim from the work area to a shady or cool area with good air circulation (*avoid drafts or sudden chilling*).<br>• Remove all protective outerwear.<br>• Call a physician.<br>• Treat the victim for shock. (*Make the victim lie down, raise his or her feet 6–12 inches, and keep him/her cool by loosening all clothing*).<br>• If the victim is conscious, it may be helpful to give him/ her sips of water.<br>• Transport victim to a medical facility ASAP. |
| Heat Stroke | The most serious of heat illness, heat stroke represents the collapse of the body's cooling mechanisms. As a result, body temperature may rise to 104 degrees Fahrenheit or higher. As the victim progresses toward heat stroke, symptoms such as headache, dizziness, nausea can be noted, and the skin is observed to be dry, red, and hot. Sudden collapse and loss of consciousness follows quickly and death is imminent if exposure continues. Heat stroke can occur suddenly. | • Immediately evacuate the victim to a cool/shady area.<br>• Remove all protective outerwear and as much personal clothing as decency permits.<br>• Lay the victim on his/her back w/the feet slightly elevated.<br>• Apply cold wet towels or ice bags to the head, armpits, and thighs.<br>• Sponge off the bare skin with cool water.<br>• The main objective is to cool without chilling the victim.<br>• Give no stimulants or hot drinks.<br>• Since heat stroke is a severe medical condition requiring professional medical attention, emergency medical help should be summoned immediately to provide onsite treatment of the victim and proper transport to a medical facility. |

# 6.0 ENVIRONMENTAL PROGRAM (ENVIRONMENT)

## 6.1 Environmental Compliance and Management

This project and the individual tasks will comply with all federal, state, provincial, and local environmental requirements.

### 6.1.1 Air Emissions

Significant dust generation is not anticipated during drilling activities. Limited dust generation may occur during the drilling, and typical dust suppression techniques (application of water spray) will be used to suppress nuisance dust.

### 6.1.2 Hazardous Waste Management

All IDW generated during field activities will be containerized into 55-gallon drums, frac tanks or roll offs and characterized prior to disposal. All IDW is assumed to be non-hazardous based upon the available knowledge of the relevant site constituents. Any used PPE and sampling equipment will be bagged and sealed prior to its disposal as general refuse at location acceptable to the Navy base coordinator.

### 6.1.3 Wetlands Protection

There are no wetlands in or adjacent to the proposed work zone.

### 6.1.4 Critical Habitat Protection

There are no Critical Habitats in or adjacent to the proposed work zone.

# 7.0 PERSONAL PROTECTION EQUIPMENT

## 7.1 Personal Protective Equipment

The purpose of personal protective equipment (PPE) is to provide a barrier that will shield or isolate individuals from the chemical and/or physical hazards that may be encountered during work activities. S3NA-208-PR *Personal Protective Equipment Program* lists the general requirements for selection and usage of PPE. Table 7-1 lists the minimum PPE required during site operations and additional PPE that may be necessary. The specific PPE requirements for each work task are specified in the individual THAs.

By signing this HASP the employee agrees having been trained in the use, limitations, care, and maintenance of the protective equipment to be used by the employee at this project. If training has not been provided, request same of the PM/SSO for the proper training before signing.

**Table 7-1**
**Personal Protective Equipment**

| Type | Material | Additional Information |
|---|---|---|
| **Minimum PPE** | | |
| Safety Vest | ANSI Type II high-visibility | Must have reflective tape/be visible from all sides |
| Boots | | ANSI approved safety toe, fully enclosing (i.e., no open toe) |
| Safety Glasses | | ANSI Approved; ≥98% UV protection |
| Hard Hat | | ANSI Approved; recommended wide-brim |
| Work Uniform | | No shorts/cutoff jeans or sleeveless shirts |
| **Additional PPE:** | | |
| Hearing Protection | Ear plugs and/ or muffs | In hazardous noise areas |
| Leather Gloves | | If working with sharp objects or powered equipment. |
| Protective Chemical Gloves | Inner: Nitrile | Use during handling of all potentially impacted media. |
| Protective Chemical Coveralls | Tyvek | To avoid contact with impacted materials if determined necessary by SSO. |
| Protective Chemical Boots | Rubber Overboots | To avoid contact with impacted materials if determined necessary by SSO. |
| Sunscreen | SPF 30 or higher | |

## 7.2 PPE Doffing and Donning (Utilization) Information

The following information is to provide field personnel with helpful hints that, when applied, make donning and doffing of PPE a more safe and manageable task:

- Never cut disposable booties from your feet with basic utility knives. This has resulted in workers cutting through the booty and the underlying sturdy leather work boot, resulting in significant cuts to the legs/ankles. Use a pair of scissors or a package/letter opener (cut above and parallel with the work boot) to start a cut in the edge of the booty, then manually tear the material down to the sole of the booty for easy removal.

- When applying duct tape to PPE interfaces (wrist, lower leg, around respirator, etc.) and zippers, leave approximately one inch at the end of the tape to fold over onto itself. This will make it much easier to remove the tape by providing a small handle to grab while still wearing gloves. Without this fold, trying to pull up the tape end with multiple gloves on may be difficult and result in premature tearing of the PPE.

- Have a "buddy" check your ensemble to ensure proper donning before entering controlled work areas. Without mirrors, the most obvious discrepancies can go unnoticed and may result in a potential exposure situation.

- Never perform personal decontamination with a pressure washer.

## 7.3 Decontamination

### 7.3.1 General Requirements

All possible and necessary steps shall be taken to reduce or minimize contact with chemicals and contaminated/impacted materials while performing field activities (e.g., avoid sitting or leaning on, walking through, dragging equipment through or over, tracking, or splashing potential or known contaminated/impacted materials, etc.).

All personal decontamination activities shall be performed with an attendant (buddy) to provide assistance to personnel that are performing decontamination activities. Depending on specific site hazards, attendants may be required to wear a level of protection that is equal to the required level in the Exclusion Zone (EZ).

All persons and equipment entering the EZ shall be considered contaminated, and thus, must be properly decontaminated prior to entering the SZ.

Decontamination procedures may vary based on site conditions and nature of the contaminant(s). If chemicals or decontamination solutions are used, care should be taken to minimize reactions between the solutions and contaminated materials. In addition, personnel must assess the potential exposures created by the decontamination chemical(s) or solutions. The applicable Material Safety Data Sheets (MSDSs) must be reviewed, implemented, and filed by personnel contacting the chemicals/solutions.

All contaminated PPE and decontamination materials shall be contained, stored and disposed of in accordance with site-specific requirements determined by site management.

### 7.3.2 Decontamination Equipment

The equipment required to perform decontamination may vary based on site-specific conditions and the nature of the contaminant(s). The following equipment is commonly used for decontamination purposes:

- Soft-bristle scrub brushes or long-handled brushes to remove contaminants;
- Hoses, buckets of water or garden sprayers for rinsing;
- Large plastic/galvanized wash tubs or children's wading pools for washing and rinsing solutions;
- Large plastic garbage cans or similar containers lined with plastic bags for the storage of contaminated clothing and equipment;
- Metal or plastic cans or drums for the temporary storage of contaminated liquids; and
- Paper or cloth towels for drying protective clothing and equipment.

### 7.3.3 Personal/Equipment Decontamination

All equipment leaving the EZ shall be considered contaminated and must be properly decontaminated to minimize the potential for exposure and off-site migration of impacted materials. Such equipment may include, but is not limited to: sampling tools, heavy equipment, vehicles, PPE, support devices (e.g., hoses, cylinders, etc.), and various handheld tools.

All employees performing equipment decontamination shall wear the appropriate PPE to protect against exposure to contaminated materials. The level of PPE may be equivalent to the level of PPE required in the EZ. Other PPE may include splash protection, such as face-shields and splash suits,

and knee protectors. Following equipment decontamination, employees may be required to follow the proper personal decontamination procedures above.

The PPE to be used on-site is considered disposable and will be removed and containerized in the CRZ during decontamination activities. Suits and booties will be removed first, and gloves last. Personnel decontamination should consist of the following glove removal procedure:

- Grasp the cuff of the dominant hand and pull glove over the bulk of the hand, leaving the fingers inside the glove.
- Use the dominant hand to grasp the cuff of the non-dominant hand and pull the glove completely off (inside-out) and place inside of the dominant hand glove.
- Once removed, employee should only touch the inside material of the dominant hand glove.
- Thoroughly wash hands.

For larger equipment, a high-pressure washer may need to be used. Some contaminants require the use of a detergent or chemical solution and scrub brushes to ensure proper decontamination. Before heavy equipment and trucks are taken offsite, the SS and/or SSO will visually inspect them for signs of contamination. If contamination is present, the equipment must be decontaminated
For equipment, use the following steps for decontamination:

1. Remove majority of visible gross contamination in EZ.
2. Wash equipment in decontamination solution with a scrub brush and/or power wash heavy equipment.
3. Rinse equipment.
4. Visually inspect for remaining contamination.
5. Follow appropriate personal decontamination steps outlined above.

All decontaminated equipment shall be visually inspected for contamination prior to leaving the Contaminant Reduction Zone (CRZ). Signs of visible contamination may include an oily sheen,

residue or contaminated soils left on the equipment. All equipment with visible signs of contamination shall be discarded or re-decontaminated until clean. Depending on the nature of the contaminant, equipment may have to be analyzed using a wipe method or other means.

# 8.0 PROJECT HEALTH AND SAFETY ORGANIZATION

## 8.1 Project Manager - Eleanor Vivaudou

The Project Manager (PM) has overall management authority and responsibility for all site operations, including safety. The PM will provide the site supervisor with work plans, staff, and budgetary resources, which are appropriate to meet the safety needs of the project operations.

## 8.2 Site Supervisor

The site supervisor has the overall responsibility and authority to direct work operations at the job site according to the provided work plans. The PM may act as the site supervisor while on site.

### 8.2.1 Responsibilities

The site supervisor is responsible to:

- Discuss deviations from the work plan with the SSO and PM.
- Discuss safety issues with the PM, SSO, and field personnel.
- Assist the SSO with the development and implementation of corrective actions for site safety deficiencies.
- Assist the SSO with the implementation of this HASP and ensuring compliance.
- Assist the SSO with inspections of the site for compliance with this HASP and applicable SOPs.

### 8.2.2 Authority

The site supervisor has authority to:

- Verify that all operations are in compliance with the requirements of this HASP, and halt any activity that poses a potential hazard to personnel, property, or the environment.
- Temporarily suspend individuals from field activities for infractions against the HASP pending consideration by the SSO, the Resolution Consultants Health and Safety Manager or designee, and the PM.

### 8.2.3 Qualifications

In addition to being Hazardous Waste Operations and Emergency Response (HAZWOPER)-qualified (see Section 4.1), the Site Supervisor is required to have completed the 8-hour HAZWOPER Supervisor Training Course in accordance with 29 CFR 1910.120 (e)(4).

## 8.3 Site Safety Officer

### 8.3.1 Responsibilities

The SSO is responsible to:

- Update the site-specific HASP to reflect changes in site conditions or the scope of work. HASP updates must be reviewed and approved by the Resolution Consultants Health and Safety Manager or designee. Updates must be documented using the HASP Revision History in Attachment D.
- Be aware of changes in Resolution Consultants Safety Policies, Programmatic Health and Safety Plan (PSHP), or SOPs.
- Monitor the lost time incidence rate for this project and work toward improving it.
- Inspect the site for compliance with this HASP and the SOPs using the appropriate audit inspection checklist provided by the Resolution Consultants Health and Safety Manager or designee.
- Work with the site supervisor and PM to develop and implement corrective action plans to correct deficiencies discovered during site inspections. Deficiencies will be discussed with project management to determine appropriate corrective action(s).
- Contact the Resolution Consultants Health and Safety Manager or designee for technical advice regarding safety issues.
- Provide a means for employees to communicate safety issues to management in a discreet manner (e.g., suggestion box, etc.).
- Determine emergency evacuation routes, establishing and posting local emergency telephone numbers, and arranging emergency transportation.
- Check that all site personnel and visitors have received the proper training and medical clearance prior to entering the site.

- Establish any necessary controlled work areas (as designated in this HASP or other safety documentation).
- Present tailgate safety meetings and maintain attendance logs and records.
- Discuss potential health and safety hazards with the Site Supervisor, the Resolution Consultants Health and Safety Manager or designee, and the PM.

Select an alternate SSO by name and inform him/her of their duties, in the event that the SSO must leave or is absent from the site. The alternate SSO must be approved by the PM.

### 8.3.2 Authority

The SSO has authority to:

- Verify that all operations are in compliance with the requirements of this HASP.
- Issue a "Stop Work Order" under the conditions set forth in this HASP.
- Temporarily suspend individuals from field activities for infractions against the HASP pending consideration by the Resolution Consultants Health and Safety Manager or designee and the PM.

### 8.3.3 Qualifications

In addition to being HAZWOPER-qualified, the SSO is required to have completed the 8-hour HAZWOPER Supervisor Training Course in accordance with 29 CFR 1910.120 (e)(4).

## 8.4 Employees

### 8.4.1 Employee Responsibilities

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

- Understanding and abiding by the policies and procedures specified in the HASP and other applicable safety policies, and clarifying those areas where understanding is incomplete.
- Providing feedback to health and safety management relating to omissions and modifications in the HASP or other safety policies.
- Notifying the SSO, in writing, of unsafe conditions and acts.

### 8.4.2 Employee Authority

The health and safety authority of each employee assigned to the site includes the following:

- The right to refuse to work and/or stop work authority when the employee feels that the work is unsafe (including subcontractors or team contractors), or where specified safety precautions are not adequate or fully understood.
- The right to refuse to work on any site or operation where the safety procedures specified in this HASP or other safety policies are not being followed.
- The right to contact the SSO or the Resolution Consultants Health and Safety Manager or designee at any time to discuss potential concerns.
- The right and duty to stop work when conditions are unsafe, and to assist in correcting these conditions

## 8.5 Resolution Consultants Health and Safety Manager - Steve Skipper, CIH, CSP, CHMM

The Health and Safety Manager is assigned to provide guidance and technical support for the project. Duties include the following:

- Approving this HASP and any required changes.
- Approving the designated Site Safety Officer (SSO).
- Reviewing all personal exposure monitoring results.
- Investigating any reported unsafe acts or conditions.

The Health and Safety Manager may designate another safety professional as the direct liaison for this project; if that is the case, he will remain available for any or all of the tasks listed here or elsewhere in this HASP in lieu of the designee.

## 8.6 Subcontractors

The requirements for subcontractor selection and subcontractor safety responsibilities are outlined in S3NA-213-PR *Subcontractors*. Each Resolution Consultants subcontractor is responsible for assigning specific work tasks to their employees. Each subcontractor's management will provide qualified employees and allocate sufficient time, materials, and equipment to safely complete assigned tasks. In particular, each subcontractor is responsible for equipping its personnel with any required personnel protective equipment (PPE and all required training.

Resolution Consultants considers each subcontractor to be an expert in all aspects of the work operations for which they are tasked to provide, and each subcontractor is responsible for compliance with the regulatory requirements that pertain to those services. Each subcontractor is expected to perform its operations in accordance with its own unique safety policies and procedures, to ensure that hazards associated with the performance of the work activities are properly controlled. Copies of any required safety documentation for a subcontractor's work activities will be provided to Resolution Consultants for review prior to the start of onsite activities, if required.

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

## 8.7 Visitors

Authorized visitors (e.g., client representatives, regulators, Resolution Consultants management staff, etc.) requiring entry to any work location on the site will be briefed by the PM on the hazards present at that location. Visitors will be escorted at all times at the work location and will be responsible for compliance with their employer's health and safety policies. In addition, this HASP specifies the minimum acceptable qualifications, training and personal protective equipment which are required for entry to any controlled work area; visitors must comply with these requirements at all times.

### 8.7.1 Visitor Access

Visitors to any HAZWOPER controlled-work area must comply with the health and safety requirements of this HASP, and demonstrate an acceptable need for entry into the work area. All visitors desiring to enter any controlled work area must observe the following procedures:

1. A written confirmation must be received by Resolution Consultants documenting that each of the visitors has received the proper training and medical monitoring required by this HASP. Verbal confirmation can be considered acceptable provided such confirmation is made by an officer or other authorized representative of the visitor's organization.

2. Each visitor will be briefed on the hazards associated with the site activities being performed and acknowledge receipt of this briefing by signing the appropriate tailgate safety briefing form.

3. All visitors must be escorted by a Resolution Consultants employee.

If the site visitor requires entry to any EZ, but does not comply with the above requirements, all work activities within the EZ must be suspended. Until these requirements have been met, entry will not be permitted.

Unauthorized visitors, and visitors not meeting the specified qualifications, will not be permitted within established controlled work areas.

# 9.0 SITE CONTROL

## 9.1 General

The purpose of site control is to minimize potential contamination of workers, protect the public from site hazards, and prevent vandalism. The degree of site control necessary depends on the site characteristics, site size, and the surrounding community.

Controlled work areas will be established at each work location, and if required, will be established directly prior to the work being conducted. Diagrams designating specific controlled work areas will be drawn on site maps, posted in the support vehicle or trailer and discussed during the daily safety meetings. If the site layout changes, the new areas and their potential hazards will be discussed immediately after the changes are made. General examples of zone layouts have been developed for drilling and earth moving activities (e.g., excavating, trenching, drilling) and are attached to this section.

## 9.2 Controlled Work Areas

Each HAZWOPER controlled work area will consist of the following three zones:

- Exclusion Zone: Contaminated work area.
- Contamination Reduction Zone: Decontamination area.
- Support Zone: Uncontaminated or "clean area" where personnel should not be exposed to hazardous conditions.

Each zone will be periodically monitored in accordance with the air monitoring requirements established in this HASP. The Exclusion Zone and the Contamination Reduction Zone are considered work areas. The Support Zone is accessible to the public (e.g., vendors, inspectors).

### 9.2.1 Exclusion Zone

The Exclusion Zone is the area where primary activities occur, such as sampling, remediation operations, installation of wells, cleanup work, etc. This area must be clearly marked with hazard tape, barricades or cones, or enclosed by fences or ropes. Only personnel involved in work activities, and meeting the requirements specified in the applicable THA and this HASP will be allowed in an Exclusion Zone.

The extent of each area will be sufficient to ensure that personnel located at/beyond its boundaries will not be affected in any substantial way by hazards associated with sample collection activities.

- Drilling Activities: A distance equal to the height of the drilling mast (at minimum) in all directions will be cleared from the rig. The cleared area will be sufficient to accommodate movement of necessary equipment and soil sampling supplies. Vehicles and other hard barriers should be used where applicable to protect employees and public.
- GW Monitoring: A distance of 10 feet (minimum) will be cleared in all directions from the sampling location to accommodate additional sampling equipment. Vehicles and other hard barriers should be used where applicable to protect employees and public.

All personnel should be alert to prevent unauthorized, accidental entrance into controlled-access areas (the EZ and CRZ). If such an entry should occur, the trespasser should be immediately escorted outside the area, or all HAZWOPER-related work must cease. All personnel, equipment, and supplies that enter controlled-access areas must be decontaminated or containerized as waste prior to leaving (through the CRZ only).

### 9.2.2 Contamination Reduction Zone (CRZ)

The Contamination Reduction Zone is the transition area between the contaminated area and the clean area. Decontamination is the main focus in this area. The decontamination of workers and equipment limits the physical transfer of hazardous substances into the clean area. This area must also be clearly marked with hazard tape and access limited to personnel involved in decontamination.

### 9.2.3 Support Zone

The Support Zone is an uncontaminated zone where administrative and other support functions, such as first aid, equipment supply, emergency information, etc., are located. The Support Zone shall have minimal potential for significant exposure to contaminants (i.e., background levels).

Employees will establish a Support Zone (if necessary) at the site before the commencement of site activities. The Support Zone would also serve as the entry point for controlling site access.

## 9.3 Site Access Documentation

If implemented by the PM, all personnel entering the site shall complete the "Site Entry/Exit Log" located at the site trailer or primary site support vehicle.

## 9.4 Site Security

Site security is necessary to:

- Prevent the exposure of unauthorized, unprotected people to site hazards.
- Avoid the increased hazards from vandals or persons seeking to abandon other wastes on the site.
- Prevent theft.
- Avoid interference with safe working procedures.

To maintain site security during working hours:

1. Maintain security in the Support Zone and at access control points.
2. Establish an identification system to identify authorized persons and limitations to their approved activities.
3. Assign responsibility for enforcing authority for entry and exit requirements.
4. When feasible, install fencing or other physical barrier around the site.
5. If the site is not fenced, post signs around the perimeter and whenever possible, use guards to patrol the perimeter. Guards must be fully apprised of the hazards involved and trained in emergency procedures.
6. Have the PM approve all visitors to the site. Make sure they have valid purpose for entering the site. Have trained site personnel accompany visitors at all times and require them to wear the appropriate protective equipment.

To maintain site security during off-duty hours:

1. If possible, assign trained, in-house technicians for site surveillance. They will be familiar with the site, the nature of the work, the site's hazards, and respiratory protection techniques.

2. If necessary, use security guards to patrol the site boundary. Such personnel may be less expensive than trained technicians, but will be more difficult to train in safety procedures and will be less confident in reacting to problems around hazardous substances.

3. Enlist public enforcement agencies, such as the local police department, if the site presents a significant risk to local health and safety.

4. Secure the equipment.

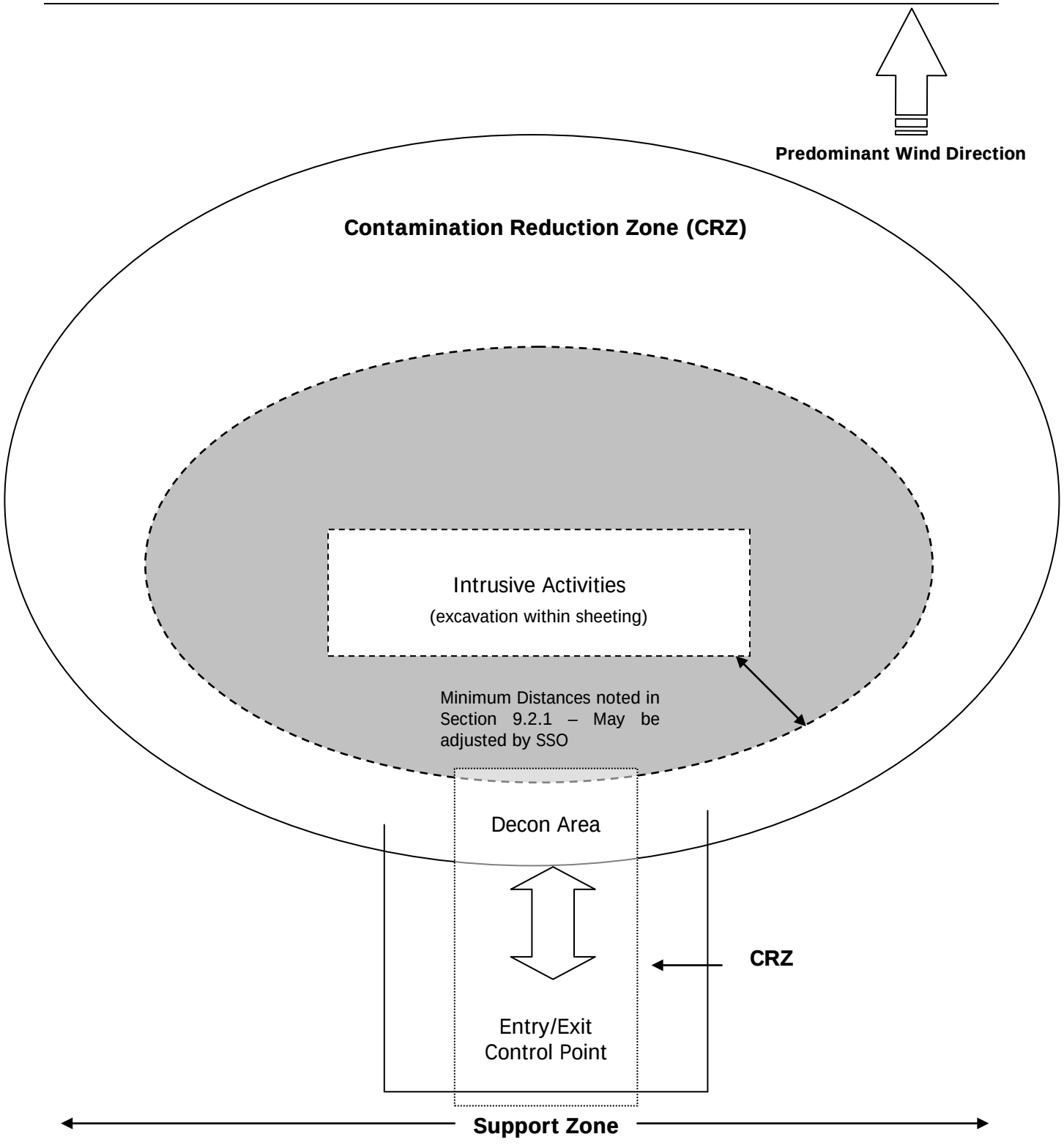



**Figure 9-1 Typical Site Control Layout**

# 10.0 EMERGENCY RESPONSE PLANNING

## 10.1 Emergency Action Plan

Although the potential for an emergency to occur is remote, an emergency action plan has been prepared for this project should such critical situations arise. The only significant type of onsite emergency that may occur is physical injury or illness to a member of the Resolution Consultants team. The Emergency Action Plan (EAP) will be reviewed by all personnel prior to the start of field activities and discussed by the project team prior to field activities. This discussion will be evaluated and documented in the project records.

### 10.1.1 Emergency Coordinator

The Site Safety Officer will carry out the duties of the Emergency Coordinator (EC), which include:

Implement the EAP based on the identified emergency condition.
Notify the appropriate project personnel and Resolution Consultants H&S Manager of the emergency (Table 10-2).
Verify emergency evacuation routes and muster points are accessible.
Conduct routine EAP drills and evaluate compliance with the EAP.

### 10.1.2 Site-Specific Emergency Procedures

Prior to the start of site operations, the EC will complete Table 10-1 with any site-specific information regarding evacuations, muster points, communication, and other site-specific emergency procedures.

**Table 10-1**
**Emergency Planning**

| Emergency | Evacuation Route | Muster Location |
|---|---|---|
| Chemical Spill | Upwind | Site vehicles |
| Fire/Explosion | Upwind | Site vehicles |
| Tornado/Severe Weather | Closest available tornado shelter | Building # (TBD by SSO) |
| Lightning | Closest available shelter | Vehicle/Site Trailer |
| **Additional Information** | | |
| Communication Procedures | Direct verbal communications, however; must be supplemented anytime voices cannot be clearly perceived above ambient noise levels (e.g.,, noise from heavy equipment; drilling rigs, backhoes, etc.) and anytime a clear line-of-sight cannot be easily maintained amongst all Resolution Consultants personnel because of distance, terrain or other obstructions.<br><br>Verbal communications will be adequate to warn employees of hazards associated with the immediate work area. Resolution Consultants personnel will bring a mobile phone to the site to ensure that communications with local emergency responders is maintained, when necessary. | |
| CPR/First Aid Trained Personnel | TBD | |
| Site-Specific Spill Response Procedures | Chemicals brought onsite will be limited to fuel for vehicles and small quantities of laboratory preservatives. In the event of a minor spill, sorbent material will be placed on the spill and then transferred to a container for disposal. Field personnel will immediately notify the PM who in turn will notify the account manager and the Department project representative. Follow Connecticut State Spill Response Procedures | |

### 10.1.3 Spill Containment Procedure

Work activities may involve the use of hazardous materials (e.g., fuels, solvents) or work involving drums or other containers. Procedures outlined below will be used to prevent or contain spills:

- All hazardous material will be stored in appropriate containers
- Tops/lids will be placed back on containers after use.
- Containers of hazardous materials will be stored appropriately away from moving equipment.

### 10.1.4 Safety Accident / Incident Reporting

All accidents and incidents that occur on-site during any field activity will be promptly reported to the SSO and the immediate supervisor.

If any Resolution Consultants employee is injured and requires medical treatment, the Site Supervisor will report the incident in accordance with Resolution Consultants' incident reporting procedures. A copy of the final Supervisor's Report of Incident will be provided to the Resolution Consultants Health and Safety Manager or designee before the end of the following shift.

If any employee of a subcontractor is injured, documentation of the incident will be accomplished in accordance with the subcontractor's procedures; however, copies of all documentation (which at a minimum must include the OSHA Form 301 or equivalent) must be provided to the SSO within 24 hours after the accident has occurred.

All accidents/incidents will be investigated. Copies of all subcontractor accident investigations will be provided to the SSO within five (5) days of the accident/incident.

### 10.1.5 Environmental Spill/Release Reporting

All environmental spills or releases of hazardous materials (e.g., fuels, solvents, etc.), whether in excess of the Reportable Quantity or not, will be reported according to the sequence identified in the *Site-Specific Spill Reporting Card (if applicable)*. In determining whether a spill or release must be reported to a regulatory agency, the Site Supervisor will assess the quantity of the spill or release and evaluate the reporting criteria against the state-specific reporting requirements, your applicable regulatory permit, and/or client-specific reporting procedures. To support the Site Supervisor and expedite the decision to report to a state regulatory agency, a site-specific Spill Reporting Card will be developed. **If reporting to a US state or Federal regulatory agency is required, Resolution Consultants has 15 minutes from the time of the spill/release to officially report it.**

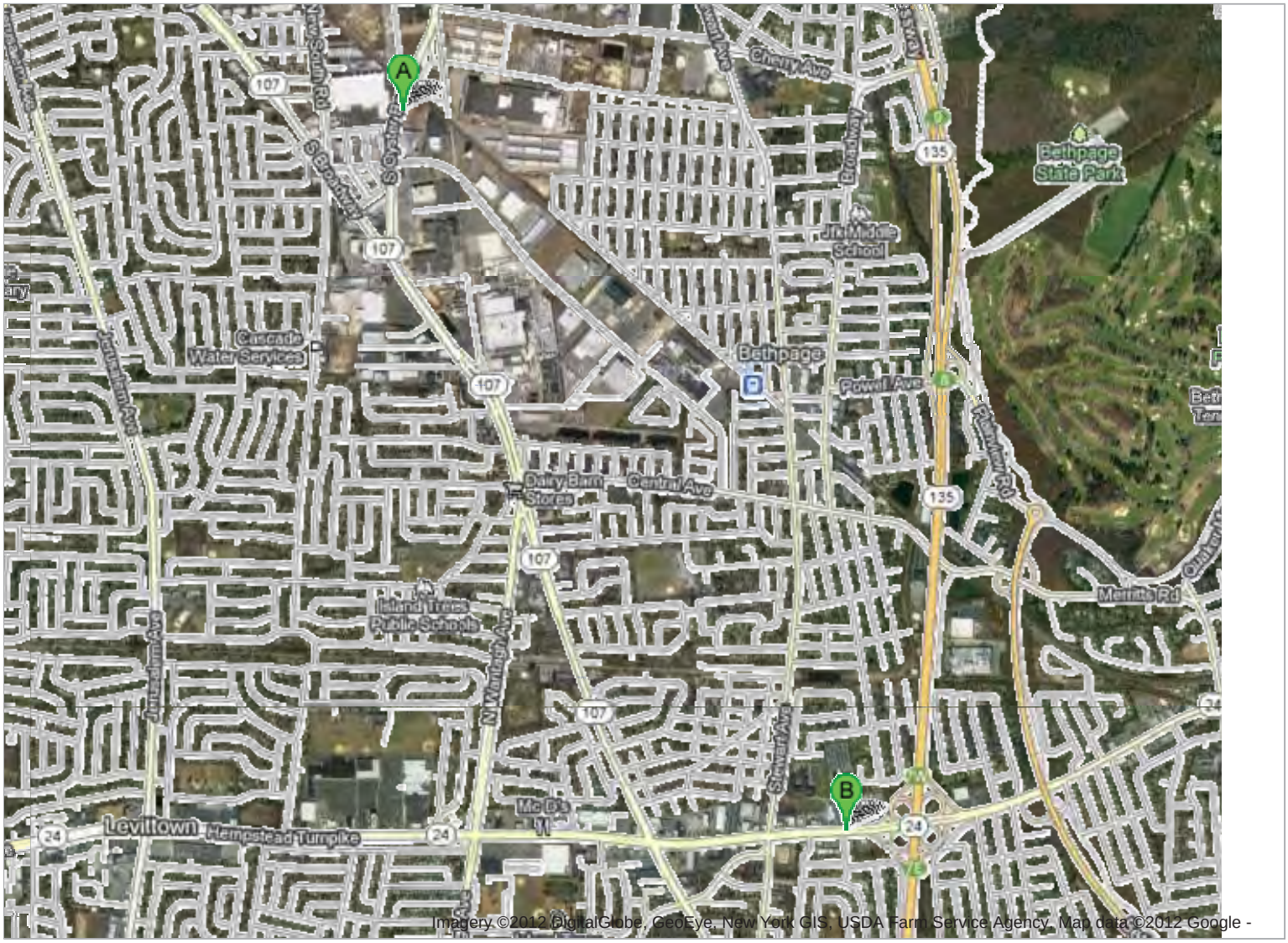
**Table 10-2**
**Emergency Contacts**

| Name | Title/Workstation | Telephone Number | Mobile Phone |
|---|---|---|---|
| **Emergency Coordinators / Key Personnel** | | | |
| Lora Fly | Client Contact | 757-341-2012 | |
| AL Taormina | Site Contact | 516-346-0344 | 516-702-5861 |
| Eleanor Vivaudou | Project Manager<br>Site Supervisor<br>Site Safety Officer | 914-227-3942 | 845-425-4980 |
| Steve Skipper | Program SH&E Manager | 903-367-4324 | 865-607-1082 |
| Phil Platcow | Regional SH&E Manager | | 617-899-5403 |
| Michael Grasso | District SH&E Manager<br>Level I Shipper (on-site)<br>Level II Shipper | | 607-282-0175 |
| Incident Reporting | Incident Reporting Line | (800) 348-5046 | |

| **Organization / Agency** | **Telephone Number** |
|---|---|
| Police Department (local) | 911 |
| Fire Department (local) | 911 |
| Ambulance Service (EMT will determine appropriate hospital for treatment) | 911 |
| Emergency Hospital (Use by site personnel is only for emergency cases) | |
| St. Joseph Hospital | |
| 4295 Hempstead Turnpike, Bethpage, NY | 516-520-2301 |
| Emergency Hospital Route: See Figure 10-1 (Note that much of the work will be at offsite locations closer to the hospital) | |
| WorkCare: 24-hr On-Call Occupational Nurse ***(Non-Emergency assistance only – Employees must notify SH&E prior to calling)*** | (800) 455-6155 |
| Poison Control Center | (800) 222-1222 |
| Pollution Emergency | (800) 292-4706 |
| National Response Center | (800) 424-8802 |
| Info-Trac: 24-hr Response Services– Account # 74984 | (800) 355-5053 |
| Title 3 Hotline | (800) 424-9346 |

| **Public Utilities** | **Telephone Number** |
|---|---|
| Cal Before You Dig - Dig Safely New York (NYS Code Rule 753 – One Call) – www.digsafelynewyork.com | 811<br>800-272-4480 |

Google




## Driving directions to St. Joseph Hospital

3D

(516) 520-2301

**999 S Oyster Bay Rd**
Bethpage, NY 11714

| | |
|---|---|
| **1.** Head **north** on **S Oyster Bay Rd** | 174 ft |
| **2.** Make a U-turn | 0.4 mi |
| **3.** Turn left onto **NY-107 S/S Broadway**<br>Continue to follow NY-107 S | 1.8 mi |
| **4.** Turn left onto **Hempstead Turnpike** | 0.5 mi |
| **5.** Turn left onto **Randal Dr** | 49 ft |

## 11.0 PERSONNEL ACKNOWLEDGEMENT

By signing below, the undersigned acknowledges that he/she has read and reviewed the Resolution Consultants Health and Safety Plan for the Naval Weapons Industrial Reserve Plant Site I OU2 at Bethpage, NY. The undersigned also acknowledges that he/she has been instructed in the contents of this document and understands the information pertaining to the specified work, and will comply with the provisions contained therein.

| Print Name | Signature | Organization | Date |
|---|---|---|---|
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# Attachment A

## Maps

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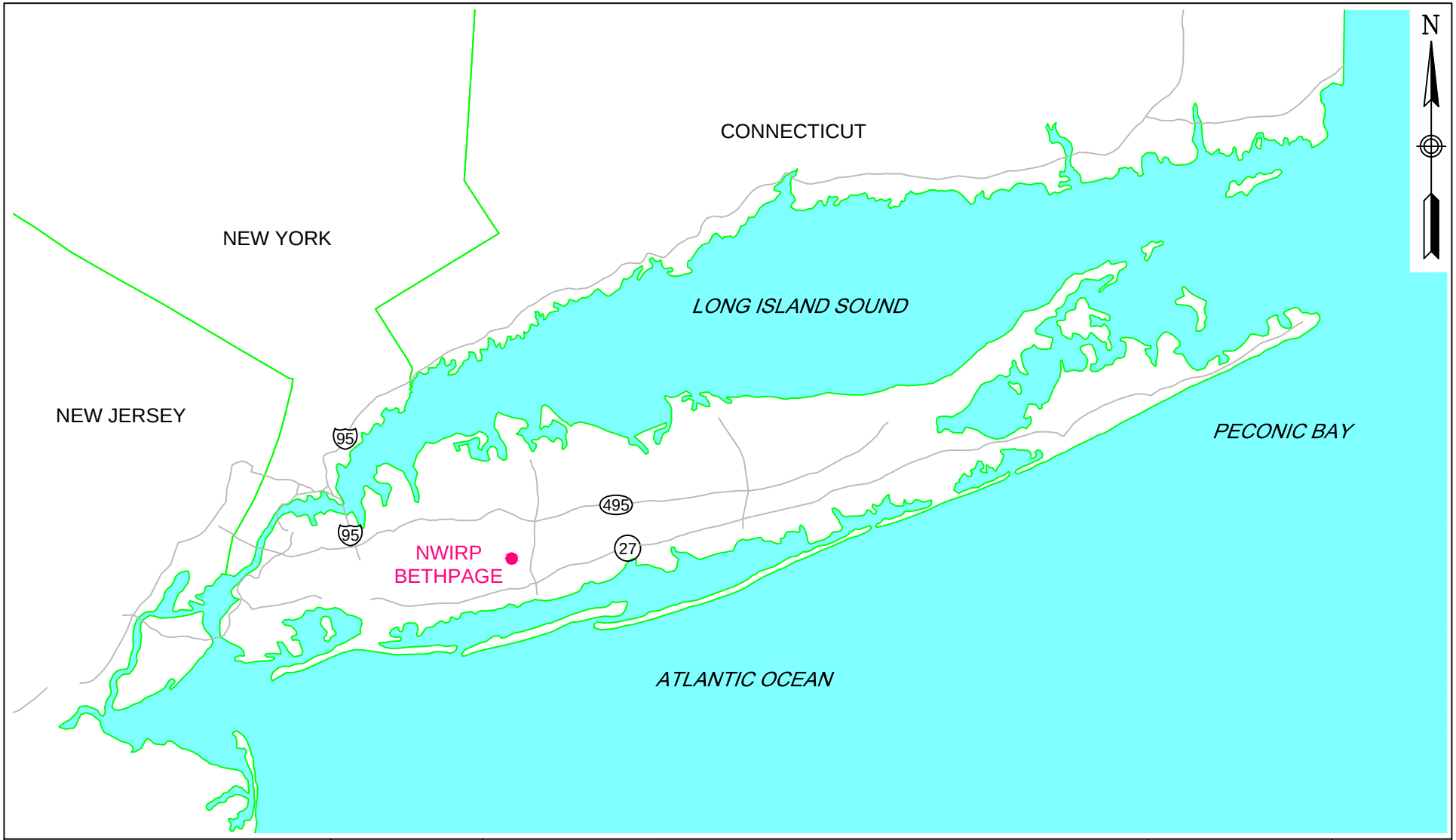



0 15 30

SCALE IN MILES

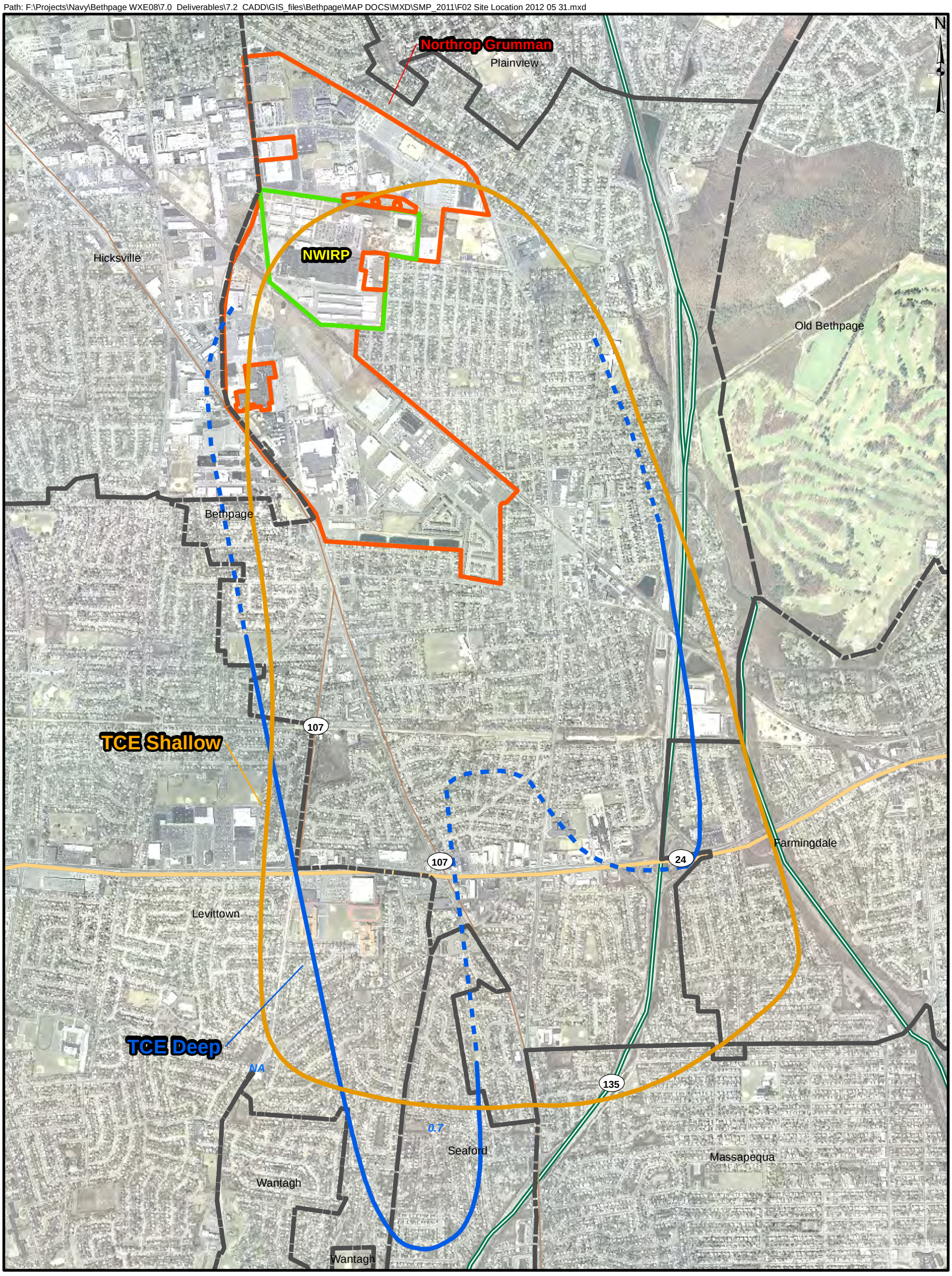
NAVFAC

Original map from Tetra Tech

GENERAL LOCATION MAP
NWIRP BETHPAGE
BETHPAGE, NEW YORK

| CONTRACT NUMBER | CTO NUMBER |
|---|---|
| N62470-11-D-8018 | WE15 |
| APPROVED BY -- | DATE -- |
| APPROVED BY -- | DATE -- |
| FIGURE NO. 1 | REV 0 |

Path: F:\Projects\Navy\Bethpage WXE08\7.0 Deliverables\7.2 CADD\GIS_files\Bethpage\MAP DOCS\MXD\SMP_2011\F02 Site Location 2012 05 31.mxd



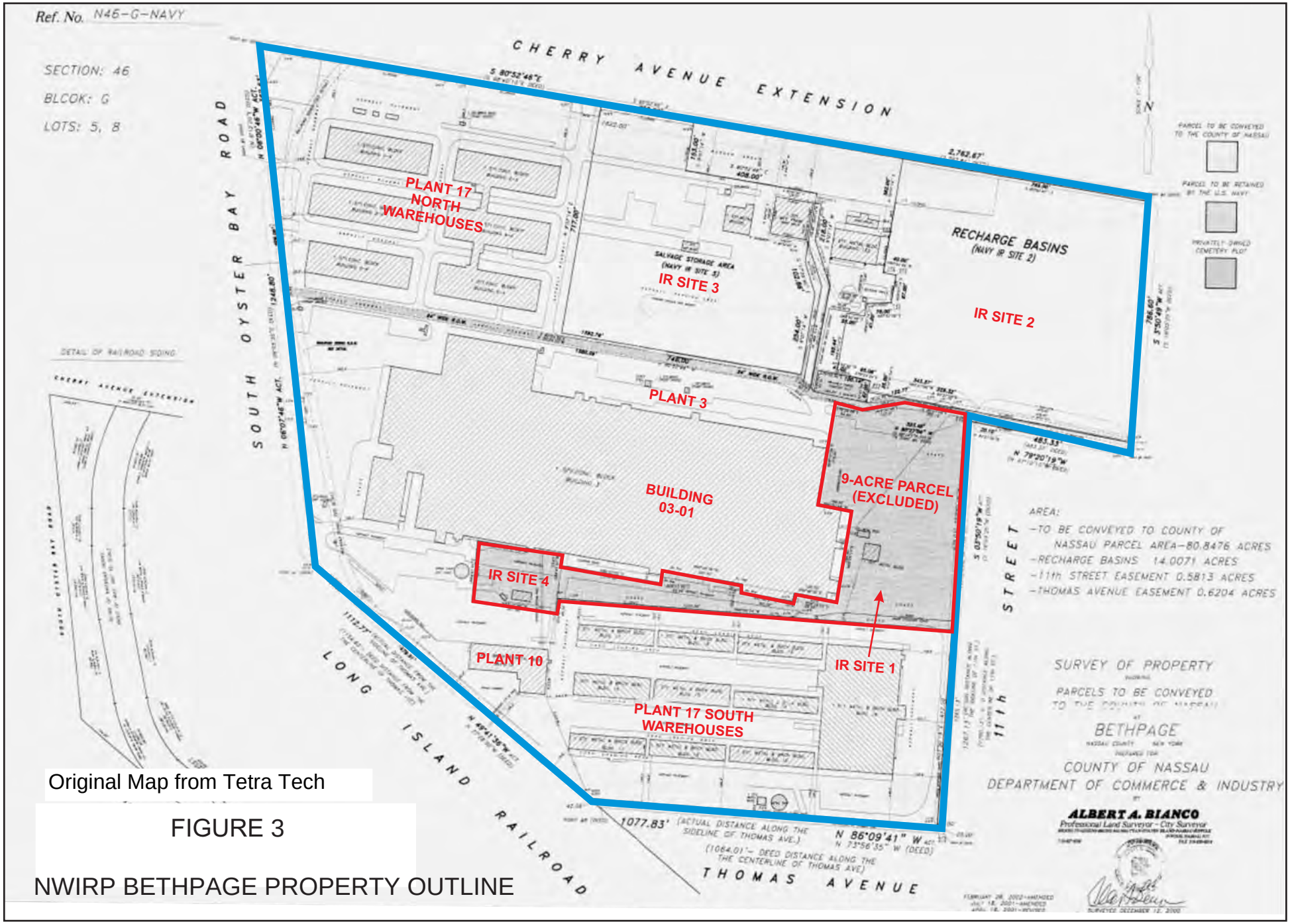

TCE Shallow 5 µg/L
TCE Deep 5 µg/L
Municipality
1997 Northrop Grumman
1997 NWIRP Bethpage

Original map from Tetra Tech

0 950 1,900 3,800
Feet

| | | | |
|---|---|---|---|
| DRAWN BY: MC | DATE: 8/10/11 | APPROXIMATE LOCATION OF OU2 SITE 1 SHALLOW AND DEEP PLUMES BETHPAGE, NEW YORK | CONTRACT NUMBER: N62470-11-D-8018 |
| CHECKED BY: DB | DATE: 8/10/11 | | CTO NUMBER: WE15 |
| REVISED BY: TT | DATE: 2/1/12 | | APPROVED BY: — DATE: — |
| SCALE: AS SHOWN | | | APPROVED BY: — DATE: — |
| | | | FIGURE NO.: 2 REV: 1 |

K:\Graphics\US Navy Bethpage\Outline of Subject Property.CDR




Original Map from Tetra Tech

FIGURE 3

NWIRP BETHPAGE PROPERTY OUTLINE

Path: F:\Projects\Navy\Bethpage WXE08\7.0 Deliverables\7.2 CADD\GIS_files\Bethpage\MAP DOCS\MXD\SMP_2011\F04 Proposed VPB 2012 05 31.mxd

Potential Vertical Profile Boring (VPB)
Vertical Profile Boring
Monitoring Well
Water Supply Well

0 90 180 360 Feet

NAVFAC

Original Map from Tetra Tech

POTENTIAL VPB LOCATIONS
FOR BWD PLANT 6
BETHPAGE, NEW YORK

| CONTRACT NUMBER | CTO NUMBER |
|---|---|
| N62470-11-D-8018 | WE15 |
| APPROVED BY | DATE |
| — | — |
| APPROVED BY | DATE |
| — | — |
| FIGURE NO. 4 | REV 1 |

## Attachment B

## Task Hazard Analysis

# S3NA-209-FM TASK HAZARD ANALYSIS

| | | | |
|---|---|---|---|
| RESOLUTION CONSULTANTS | Project Name: NWIRP, Bethpage | Project Number: 60266526 | Client: Dept of Navy |
| | Supervisor: Mark Kauffman | Project Manager: Eleanor Vivaudou | Location: Bethpage, New York |
| | THA Developed By: R. Purdy: Rev. Josh Millard | | Date: April 2012: Rev. May 30, 2012 |
| TASK HAZARD ANALYSIS | Task Name: Environment Program Support - Drilling Oversight | Regularity of Task: One-time ☐ | Routine ☑ |

| | Job Event Sequence (List the major steps of the individual task) | Hazards (List primary hazards) | Hazard Classification: Severity | Likelihood | Risk Level | Hazard Classification | Controls (List controls that AECOM will implement) |
|---|---|---|---|---|---|---|---|
| 1 | Driving to/from/on Site | Vehicular Incident | 3 | 2 | 6 | Medium | Slowly exit from parking spaces; Seek eye contact with other drivers or pedestrians. |
| | | -Injury | | | 0 | | Before changing lanes, signal well in advance, check mirrors and over shoulder |
| | | -Property Damage | | | 0 | | Maintain safe distances behind vehicles and stay out of other vehicles' blind spots. |
| | | -Vehicle Damage | | | 0 | | DRIVE DEFENSIVELY. Move eyes and scan mirrors at least every 2 seconds. |
| | | | | | | | Back into parking spaces (or "pull through") when appropriate |
| | | | | | | | Use a spotter when backing-up or maneuvering around objects or other vehicles |
| | | | | | | | Be familiar with the handling and operation of company or rental vehicles |
| | | | | | | | Assure tires are properly inflated and there is sufficient tread (including spare). |
| 2 | Oversight Activities | Slips/Trips/Falls | 2 | 3 | 6 | Medium | Wear Steel Toe Boots, walk with others when available |
| | | Biological Hazards | 2 | 2 | 4 | Low | Inspect area before walking through |
| | | Sun Burn | 3 | 3 | 9 | Medium | Use bug repellent and sun screen as necessary |
| | | Bug bites (ticks, mosquitoes) | 3 | 4 | 12 | Medium | Perform tick check at the end of site visit |
| | | Falling Object/Scrapes/Exposure | 3 | 4 | 12 | Medium | Don appropriate PPE (reflective vest, boots, hard hat, hearing protection) |
| | | Chemical Exposure | 2 | 2 | 4 | Low | Be aware of surroundings and maintain safe distance from construction equipment |
| | | Working Alone or Remotely | 2 | 2 | 4 | Low | Identify physical and chemical hazards as appropriate to specific tasks |
| | | | | | | | Make eye contact with equipment operator(s) |
| | | | | | | | Wear long sleeves, long pants, and eye protection. |
| | | | | | | | Maintain safe distance from edge of water, walk with others when available |
| | | | | | | | Be aware of location of nearest life ring |
| | | | | | | | Establish itinerary and communication or check-in schedule |

## Hazard Classification Guidelines

| Probability: | How likely is it to happen? |
|---|---|
| Very Likely | Likelihood of incident happening often during course of the work activity |
| Likely | Likelihood of incident occurring sometime during the work activity |
| Possibly | Possibility of incident occurring sometime during the work activity |
| Rarely | Incident will rarely occur during the work activity |
| Unlikely | Incident will probably not occur during the work activity |

Hazard Classification:

- HIGH
- MED
- LOW

| Severity | | Probability: Very Likely (5) | Likely (4) | Possibly (3) | Rarely (2) | Unlikely (1) |
|---|---|---|---|---|---|---|
| Catastrophic | 5 | 10 | 9 | 8 | 7 | 6 |
| Major | 4 | 9 | 8 | 7 | 6 | 5 |
| Moderate | 3 | 8 | 7 | 6 | 5 | 4 |
| Minor | 2 | 7 | 6 | 5 | 4 | 3 |
| Insignificant | 1 | 6 | 5 | 4 | 3 | 2 |

# S3NA-209-FM TASK HAZARD ANALYSIS

| | | | |
|---|---|---|---|
| RESOLUTION CONSULTANTS | Project Name: NWIRP, Bethpage | Project Number: 60266526 | Client: Dept of Navy |
| | Supervisor: Mark Kauffman | Project Manager: Eleanor Vivaudou | Location: Bethpage, New York |
| | THA Developed By: R. Purdy: Rev. Josh Millard | | Date: April 2012: Rev. May 30, 2012 |
| SUMMARY OF CONTROLS | Task Name: Environment Program Support - Drilling Oversight | | Regularity of Task: One-time ☐ Routine ☑ |

**Personal Protective Equipment** (*check all that apply*)

- ☑ CSA/ANSI Safety-Toed Boots (Leather or Rubber)
- ☑ CSA/ANSI Safety Glasses or Goggles
- ☑ CSA/ANSI-approved Hard Hat
- ☑ CSA/ANSI Type II/III Reflective Traffic Safety Vest
- ☑ Hearing protection
- ☑ NIOSH half or full face air purifying respirator w./P100, OV cartridges (change out daily if used)
- ☐
- ☐
- ☐
- ☐

**Air Monitoring** (reference HASP monitoring plan)

☐ No air monitoring required ☑ Air monitoring required (*see procedures below*)

| Parameter | Location/Monitoring Interval | Response/Action Levels | Response Activity |
|---|---|---|---|
| VOCs by PID | BZ, continuous | <1 ppm | level d |
| VOCs by PID | BZ, continuous | >1 ppm | Upgrade level C sample 15 min intevals with benzene and vinyl chloride draeger tubes of <1 ppm discontinue respirator use if either is >1.0 ppm - exit work area and contact SSO |
| VOCs by PID | BZ, continuous | >=15 ppm | cease work exit area call SSO |
| | | | |

| Required Training (associated with this THA) | Key SOPs (associated with this THA) | | Client & Other Requirements |
|---|---|---|---|
| 1 OSHA HAZWOPER 40-Hour | S3NA-306-PR Highway and Road Work | | All required site security clearance |
| 2 | S3NA-309-PR Mobile or Heavy Equipment | | |
| 3 | S3NA-313-PR Wildlife, Plants and Insects | | |
| 4 | S3NA-307-PR Housekeeping, Worksite | | |
| 5 | S3NA-314-PR Working Alone & Remote Travel | | |
| 6 | | | |

**Acknowledgement / Signatures**

Project Manager / Supervisor (signature): Date:

| Name | Signature | Company | Date | Name | Signature | Company | Date |
|---|---|---|---|---|---|---|---|
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# S3NA-209-FM TASK HAZARD ANALYSIS

| | | | |
|---|---|---|---|
| RESOLUTION CONSULTANTS | Project Name: NWIRP, Bethpage | Project Number: 60266526 | Client: Dept of Navy |
| | Supervisor: Mark Kauffman | Project Manager: Eleanor Vivaudou | Location: Bethpage, New York |
| | THA Developed By: R. Purdy: Rev. Josh Millard | | Date: April 2012: Rev. May 30, 2012 |
| EMERGENCY RESPONSE PLAN | Task Name: Environment Program Support - Drilling Oversight | Regularity of Task: One-time ☐ | Routine ☑ |

**Check-in Procedures**

| Check-in Times | Check-in Person | Phone Number | Cell Phone Number |
|---|---|---|---|
| | | | |
| Alternate: | | | |

**Emergency Coordinators / Key Personnel**

| Name | Title | Phone Number | Cell Phone Number |
|---|---|---|---|
| | On-site First Aid Attendant | | |
| Eleanor Vivaudou | CTO Manager | 845-425-4980 | 914-227-3942 |
| | | | |
| Mike Grasso | Regional SH&E Manager | 607-277-5716 | |
| Steve Skipper | Program Safety Manager | 903-367-4324 | 865-607-1082 |
| | Incident Reporting Line (BY THE END OF THE SHIFT) | | |
| Al Taormina | Client Point of Contact (Base) | 516 346 0344 | 516 702 5861 |
| Lora Fly | Client Contact (RPM) | 757-341-2012 | |
| | | | |

**Emergency Agencies / Public Utilities**

| Name | Type | Details | Phone Number |
|---|---|---|---|
| Police | Police | Emergencies | 911 |
| Fire | Fire | Emergencies | 911 |
| Ambulance | Medical | Emergencies | 911 |
| | | | |
| St. Joseph Hospital | Nearest Hospital / Clinic (off-base) | 4295 Hempstead Turnpike, Bethpage, NY | 516-520-2301 |
| | Poison Control Center | | 800-222-1222 |
| | | | |
| | | | |
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| | | | |
| | | | |

**Emergency Equipment & Supplies**

- ☑ First Aid Kit - Type:
- ☐ Blankets / Survival:
- ☐ Fire Extinguishers Type:
- ☑ Communication Device
- ☐ Vehicle Safety Equipment
- ☑ Eye Wash
- ☐ Spill Kit
- ☐ Other:

**Other Emergency Plan Details**

# S3NA-209-FM TASK HAZARD ANALYSIS

| | | | |
|---|---|---|---|
| RESOLUTION CONSULTANTS | Project Name: NWIRP, Bethpage | Project Number: 60266526 | Client: Dept of Navy |
| | Supervisor: Mark Kauffman | Project Manager: Eleanor Vivaudou | Location: Bethpage, New York |
| | THA Developed By: R. Purdy: Rev. Josh Millard | | Date: April 2012: Rev. May 30, 2012 |
| TASK HAZARD ANALYSIS | Task Name: Environment Program Support - Groundwater Sampling | | Regularity of Task: One-time ☐ Routine ☑ |

| | Job Event Sequence (List the major steps of the individual task) | Hazards (List primary hazards) | Hazard Classification: Severity | Likelihood | Risk Level | Hazard Classification | Controls (List controls that AECOM will implement) |
|---|---|---|---|---|---|---|---|
| 1 | Driving to/from/on Site | Vehicular Incident | 3 | 2 | 6 | Medium | Slowly exit from parking spaces; Seek eye contact with other drivers or pedestrians. |
| | | -Injury | | | 0 | | Before changing lanes, signal well in advance, check mirrors and over shoulder |
| | | -Property Damage | | | 0 | | Maintain safe distances behind vehicles and stay out of other vehicles' blind spots. |
| | | -Vehicle Damage | | | 0 | | DRIVE DEFENSIVELY. Move eyes and scan mirrors at least every 2 seconds. |
| | | | | | | | Back into parking spaces (or "pull through") when appropriate |
| | | | | | | | Use a spotter when backing-up or maneuvering around objects or other vehicles |
| | | | | | | | Be familiar with the handling and operation of company or rental vehicles |
| | | | | | | | Assure tires are properly inflated and there is sufficient tread (including spare). |
| 2 | Sampling | Slips/Trips/Falls | 2 | 3 | 6 | Medium | Wear Steel Toe Boots, walk with others when available |
| | | Biological Hazards | 2 | 2 | 4 | Low | Inspect area before walking through |
| | | Sun Burn | 3 | 3 | 9 | Medium | Use bug repellent and sun screen as necessary |
| | | Bug bites (ticks, mosquitoes) | 3 | 4 | 12 | Medium | Perform tick check at the end of site visit |
| | | Falling Object/Scrapes/Exposure | 3 | 4 | 12 | Medium | Don appropriate PPE (reflective vest, boots, hard hat, hearing protection) |
| | | | | | | | Be aware of surroundings and maintain safe distance from construction equipment |
| | | | | | | | Make eye contact with equipment operator(s) |
| | | Chemical Exposure | 2 | 2 | 4 | Low | Identify physical and chemical hazards as appropriate to specific tasks (preservatives) |
| | | | | | | | Wear long sleeves, long pants, and eye protection. |
| | | Working Alone or Remotely | 2 | 2 | 4 | Low | Establish itinerary and communication or check-in schedule |
| | | Ergonomics | 2 | 2 | 4 | Low | Use buddy system to carry heavy coolers |
| | | | | | | | Use equipment to move material whenever possible (carts, dollies, etc.) |

## Hazard Classification Guidelines

| Probability: | How likely is it to happen? |
|---|---|
| Very Likely | Likelihood of incident happening often during course of the work activity |
| Likely | Likelihood of incident occurring sometime during the work activity |
| Possibly | Possibility of incident occurring sometime during the work activity |
| Rarely | Incident will rarely occur during the work activity |
| Unlikely | Incident will probably not occur during the work activity |

Hazard Classification:

- HIGH
- MED
- LOW

| Severity | | Probability: Very Likely 5 | Likely 4 | Possibly 3 | Rarely 2 | Unlikely 1 |
|---|---|---|---|---|---|---|
| Catastrophic | 5 | 10 | 9 | 8 | 7 | 6 |
| Major | 4 | 9 | 8 | 7 | 6 | 5 |
| Moderate | 3 | 8 | 7 | 6 | 5 | 4 |
| Minor | 2 | 7 | 6 | 5 | 4 | 3 |
| Insignificant | 1 | 6 | 5 | 4 | 3 | 2 |

# S3NA-209-FM TASK HAZARD ANALYSIS

| | | | |
|---|---|---|---|
| RESOLUTION CONSULTANTS | Project Name: NWIRP, Bethpage | Project Number: 60266526 | Client: Dept of Navy |
| | Supervisor: Mark Kauffman | Project Manager: Eleanor Vivaudou | Location: Bethpage, New York |
| | THA Developed By: R. Purdy: Rev. Josh Millard | | Date: April 2012: Rev. May 30, 2012 |
| SUMMARY OF CONTROLS | Task Name: Environment Program Support - Groundwater Sampling | | Regularity of Task: One-time ☐ Routine ☑ |

**Personal Protective Equipment** (*check all that apply*)

- ☑ CSA/ANSI Safety-Toed Boots (Leather or Rubber)
- ☑ CSA/ANSI Safety Glasses or Goggles
- ☑ CSA/ANSI Type II/III Reflective Traffic Safety Vest
- ☐
- ☐
- ☐
- ☐
- ☐
- ☐
- ☐

**Air Monitoring** (reference HASP monitoring plan)

☑ No air monitoring required ☐ Air monitoring required (*see procedures below*)

| Parameter | Location/Monitoring Interval | Response/Action Levels | Response Activity |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

| Required Training (associated with this THA) | Key SOPs (associated with this THA) | | Client & Other Requirements |
|---|---|---|---|
| 1 OSHA HAZWOPER 40-Hour | S3NA-306-PR Highway and Road Work | S3NA-314-PR Working Alone & Remote Travel | All required site security clearance |
| 2 | S3NA-309-PR Mobile or Heavy Equipment | | |
| 3 | S3NA-313-PR Wildlife, Plants and Insects | | |
| 4 | S3NA-307-PR Housekeeping, Worksite | | |
| 5 | | | |
| 6 | | | |

**Acknowledgement / Signatures**

Project Manager / Supervisor (signature): Date:

| Name | Signature | Company | Date | Name | Signature | Company | Date |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
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# S3NA-209-FM TASK HAZARD ANALYSIS

| | | | |
|---|---|---|---|
| RESOLUTION CONSULTANTS | Project Name: NWIRP, Bethpage | Project Number: 60266526 | Client: Dept of Navy |
| | Supervisor: Mark Kauffman | Project Manager: Eleanor Vivaudou | Location: Bethpage, New York |
| | THA Developed By: R. Purdy: Rev. Josh Millard | | Date: April 2012: Rev. May 30, 2012 |
| EMERGENCY RESPONSE PLAN | Task Name: Environment Program Support - Groundwater Sampling | Regularity of Task: One-time ☐ | Routine ☑ |

## Check-in Procedures

| Check-in Times | Check-in Person | Phone Number | Cell Phone Number |
|---|---|---|---|
| | | | |
| Alternate: | | | |

## Emergency Coordinators / Key Personnel

| Name | Title | Phone Number | Cell Phone Number |
|---|---|---|---|
| | On-site First Aid Attendant | | |
| Eleanor Vivaudou | CTO Manager | 914-227-3942 | 845-425-4980 |
| | | | |
| Mike Grasso | Regional SH&E Manager | 607-277-5716 | |
| Steve Skipper | Program Safety Manager | 903-367-4324 | 865-607-1082 |
| | Incident Reporting Line (BY THE END OF THE SHIFT) | | |
| Al Taormina | Client Point of Contact (Base) | 516 346 0344 | 516 702 5861 |
| Lora Fly | Client Contact (RPM) | 757-341-2012 | |
| | | | |

## Emergency Agencies / Public Utilities

| Name | Type | Details | Phone Number |
|---|---|---|---|
| Police | Police | Emergencies | 911 |
| Fire | Fire | Emergencies | 911 |
| Ambulance | Medical | Emergencies | 911 |
| | | | |
| St. Joseph Hospital | Nearest Hospital / Clinic (off-base) | 4295 Hempstead Turnpike, Bethpage, NY | 516-520-2301 |
| | Poison Control Center | | 800-222-1222 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

## Emergency Equipment & Supplies

- ☑ First Aid Kit - Type:
- ☐ Blankets / Survival:
- ☐ Fire Extinguishers Type:
- ☑ Communication Device
- ☐ Vehicle Safety Equipment
- ☑ Eye Wash
- ☐ Spill Kit
- ☐ Other:

## Other Emergency Plan Details

## Attachment C

## Material Safety Data Sheets

# MATERIAL SAFETY DATA SHEET

# ALCONOX®

*Prepared to U.S. OSHA, CMA, ANSI, Canadian WHMIS, Australian WorkSafe, Japanese Industrial Standard JIS Z 7250:2000, and European Union REACH Regulations*

## SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

| | |
|---|---|
| PRODUCT NAME: | **ALCONOX®** |
| CHEMICAL FAMILY NAME: | Detergent. |
| PRODUCT USE: | Critical-cleaning detergent for laboratory, healthcare and industrial applications |
| U.N. NUMBER: | Not Applicable |
| U.N. DANGEROUS GOODS CLASS: | Non-Regulated Material |
| SUPPLIER/MANUFACTURER'S NAME: | Alconox, Inc. |
| ADDRESS: | 30 Glenn St., Suite 309, White Plains, NY 10603. USA |
| **EMERGENCY PHONE:** | **TOLL-FREE in USA/Canada** 800-255-3924 |
| | **International calls** 813-248-0585 |
| BUSINESS PHONE: | 914-948-4040 |
| DATE OF PREPARATION: | May 2011 |
| DATE OF LAST REVISION: | February 2008 |

## SECTION 2 - HAZARDS IDENTIFICATION

**EMERGENCY OVERVIEW:** This product is a white granular powder with little or no odor. Exposure can be irritating to eyes, respiratory system and skin. It is a non-flammable solid. The Environmental effects of this product have not been investigated.

US DOT SYMBOLS

Non-Regulated

CANADA (WHMIS) SYMBOLS

EUROPEAN and (GHS) Hazard Symbols

Signal Word: **Warning!**

**EU LABELING AND CLASSIFICATION:**

**Classification of the substance or mixture according to Regulation (EC) No1272/2008 Annex 1**
**EC# 205-633-8 This substance is not classified in the Annex I of Directive 67/548/EEC**
**EC# 268-356-1 This substance is not classified in the Annex I of Directive 67/548/EEC**
**EC# 231-838-7 This substance is not classified in the Annex I of Directive 67/548/EEC**
**EC# 231-767-1 This substance is not classified in the Annex I of Directive 67/548/EEC**
**EC# 207-638-8 Index# 011-005-00-2**
**EC# 205-788-1 This substance is not classified in the Annex I of Directive 67/548/EEC**

**GHS Hazard Classification(s):**

Eye Irritant Category 2A

**Hazard Statement(s):**

H319: Causes serious eye irritation

**Precautionary Statement(s):**

P260: Do not breath dust/fume/gas/mist/vapors/spray
P264: Wash hands thoroughly after handling
P271: Use only in well ventilated area.
P280: Wear protective gloves/protective clothing/eye protection/face protection/

**Hazard Symbol(s):**

[Xi] Irritant

**Risk Phrases:**
R20: Harmful by inhalation
R36/37/38: Irritating to eyes, respiratory system and skin

**Safety Phrases:**
S8: Keep container dry
S22: Do not breath dust
S24/25: Avoid contact with skin and eyes

**HEALTH HAZARDS OR RISKS FROM EXPOSURE:**

**ACUTE:** Exposure to this product may cause irritation of the eyes, respiratory system and skin. Ingestion may cause gastrointestinal irritation including pain, vomiting or diarrhea.

**CHRONIC:** This product contains an ingredient which may be corrosive.

**TARGET ORGANS:** ACUTE: Eye, respiratory System, Skin CHRONIC: None Known

## SECTION 3 - COMPOSITION and INFORMATION ON INGREDIENTS

| HAZARDOUS INGREDIENTS: | CAS # | EINECS # | ICSC # | WT % | HAZARD CLASSIFICATION; RISK PHRASES |
|---|---|---|---|---|---|
| Sodium Bicarbonate | 144-55-8 | 205-633-8 | 1044 | 33 - 43% | HAZARD CLASSIFICATION: None<br>RISK PHRASES: None |
| Sodium (C10 – C16) Alkylbenzene Sulfonate | 68081-81-2 | 268-356-1 | Not Listed | 10 – 20% | HAZARD CLASSIFICATION: None<br>RISK PHRASES: None |
| Sodium Tripolyphosphate | 7758-29-4 | 231-838-7 | 1469 | 5 - 15% | HAZARD CLASSIFICATION: None<br>RISK PHRASES: None |
| Tetrasodium Pyrophosphate | 7722-88-5 | 231-767-1 | 1140 | 5 - 15% | HAZARD CLASSIFICATION: None<br>RISK PHRASES: None |
| Sodium Carbonate | 497-19-8 | 207-638-8 | 1135 | 1 - 10% | HAZARD CLASSIFICATION: [Xi] Irritant<br>RISK PHRASES: R36 |
| Sodium Alcohol Sulfate | 151-21-3 | 205-788-1 | 0502 | 1 – 5% | HAZARD CLASSIFICATION: None<br>RISK PHRASES: None |
| Balance of other ingredients are non-hazardous or less than 1% in concentration (or 0.1% for carcinogens, reproductive toxins, or respiratory sensitizers). | | | | | |

**NOTE:** ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-2004 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR, EU Directives and the Japanese Industrial Standard *JIS Z 7250: 2000*.

## SECTION 4 - FIRST-AID MEASURES

Contaminated individuals of chemical exposure must be taken for medical attention if any adverse effect occurs. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to health professional with contaminated individual.

**EYE CONTACT:** If product enters the eyes, open eyes while under gentle running water for at least 15 minutes. Seek medical attention if irritation persists.

**SKIN CONTACT:** Wash skin thoroughly after handling. Seek medical attention if irritation develops and persists. Remove contaminated clothing. Launder before re-use.

**INHALATION:** If breathing becomes difficult, remove victim to fresh air. If necessary, use artificial respiration to support vital functions. Seek medical attention if breathing dificulty continues.

**INGESTION:** If product is swallowed, call physician or poison control center for most current information. If professional advice is not available, do not induce vomiting. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or who cannot swallow. Seek medical advice. Take a copy of the label and/or MSDS with the victim to the health professional.

**MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:** Pre-existing skin, or eye problems may be aggravated by prolonged contact.

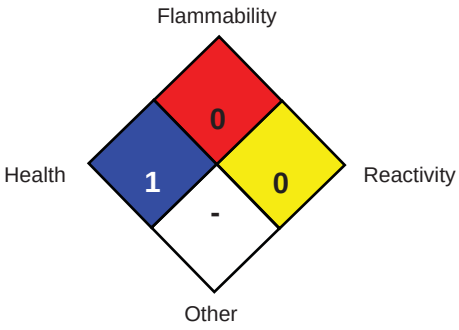
**RECOMMENDATIONS TO PHYSICIANS:** Treat symptoms and reduce over-exposure.

## SECTION 5 - FIRE-FIGHTING MEASURES

**FLASH POINT:** Not Flammable
**AUTOIGNITION TEMPERATURE**: Not Applicable
**FLAMMABLE LIMITS (in air by volume, %)**: Lower (LEL): NA Upper (UEL): NA
**FIRE EXTINGUISHING MATERIALS**: As appropriate for surrounding fire. Carbon dioxide, foam, dry chemical, halon, or water spray.

**UNUSUAL FIRE AND EXPLOSION HAZARDS**: This product is non-flammable and has no known explosion hazards.
Explosion Sensitivity to Mechanical Impact: Not Sensitive.
Explosion Sensitivity to Static Discharge: Not Sensitive
**SPECIAL FIRE-FIGHTING PROCEDURES**: Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Isolate materials not yet involved in the fire and protect personnel. Move containers from fire area if this can be done without risk; otherwise, cool with carefully applied water spray. If possible, prevent runoff water from entering storm drains, bodies of water, or other environmentally sensitive areas.

**NFPA RATING SYSTEM**




**HMIS RATING SYSTEM**

**HAZARDOUS MATERIAL IDENTIFICATION SYSTEM**

| | |
|---|---|
| HEALTH HAZARD (BLUE) | 1 |
| FLAMMABILITY HAZARD (RED) | 0 |
| PHYSICAL HAZARD (YELLOW) | 0 |

**PROTECTIVE EQUIPMENT**

| EYES | RESPIRATORY | HANDS | BODY |
|---|---|---|---|
| | See Sect 8 | | See Sect 8 |

For Routine Industrial Use and Handling Applications

**Hazard Scale:** **0** = Minimal **1** = Slight **2** = Moderate **3** = Serious **4** = Severe * = Chronic hazard

## SECTION 6 - ACCIDENTAL RELEASE MEASURES

**SPILL AND LEAK RESPONSE:** Personnel should be trained for spill response operations.
**SPILLS:** Contain spill if safe to do so. Prevent entry into drains, sewers, and other waterways. Sweep, shovel or vacuum spilled material and place in an appropriate container for re-use or disposal. Avoid dust generation if possible. Dispose of in accordance with applicable Federal, State, and local procedures (see Section 13, Disposal Considerations).

## SECTION 7 - HANDLING and STORAGE

**WORK PRACTICES AND HYGIENE PRACTICES:** As with all chemicals, avoid getting this product ON YOU or IN YOU. Wash thoroughly after handling this product. Do not eat, drink, smoke, or apply cosmetics while handling this product. Avoid breathing dusts generated by this product. Use in a well-ventilated location. Remove contaminated clothing immediately.

**STORAGE AND HANDLING PRACTICES:** Containers of this product must be properly labeled. Store containers in a cool, dry location. Keep container tightly closed when not in use. Store away from strong acids or oxidizers.

## SECTION 8 - EXPOSURE CONTROLS - PERSONAL PROTECTION

**EXPOSURE LIMITS/GUIDELINES:**

| Chemical Name | CAS# | ACGIH TWA | OSHA TWA | SWA |
|---|---|---|---|---|
| Sodium Bicarbonate | 144-55-8 | 10 mg/m³ Total Dust | 15 mg/m³ Total Dust | 10 mg/m³ Total Dust |
| Sodium (C10 – C16) Alkylbenzene Sulfonate | 68081-81-2 | 10 mg/m³ Total Dust | 15 mg/m³ Total Dust | 10 mg/m³ Total Dust |
| Sodium Tripolyphosphate | 7758-29-4 | 10 mg/m³ Total Dust | 15 mg/m³ Total Dust | 10 mg/m³ Total Dust |
| Tetrasodium Pyrophosphate | 7722-88-5 | 5 mg/m³ | 5 mg/m³ | 5 mg/m³ |
| Sodium Carbonate | 497-19-8 | 10 mg/m³ Total Dust | 15 mg/m³ Total Dust | 10 mg/m³ Total Dust |
| Sodium Alcohol Sulfate | 151-21-3 | 10 mg/m³ Total Dust | 15 mg/m³ Total Dust | 10 mg/m³ Total Dust |

Currently, International exposure limits are not established for the components of this product. Please check with competent authority in each country for the most recent limits in place.

**VENTILATION AND ENGINEERING CONTROLS:** Use with adequate ventilation to ensure exposure levels are maintained below the limits provided below. Use local exhaust ventilation to control airborne dust. Ensure eyewash/safety shower stations are available near areas where this product is used.

*The following information on appropriate Personal Protective Equipment is provided to assist employers in complying with OSHA regulations found in 29 CFR Subpart I (beginning at 1910.132) or equivalent standard of Canada, or standards of EU member states (including EN 149 for respiratory PPE, and EN 166 for face/eye protection), and those of Japan. Please reference applicable regulations and standards for relevant details.*

**RESPIRATORY PROTECTION:** Based on test data, exposure limits should not be exceeded under normal use conditions when using Alconox Detergent. Maintain airborne contaminant concentrations below guidelines listed above, if applicable. If necessary, use only respiratory protection authorized in the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), equivalent U.S. State standards, Canadian CSA Standard Z94.4-93, the European Standard EN149, or EU member states.

**EYE PROTECTION:** Safety glasses. If necessary, refer to U.S. OSHA 29 CFR 1910.133 or appropriate Canadian Standards.

**HAND PROTECTION:** Use chemical resistant gloves to prevent skin contact.. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

**BODY PROTECTION:** Use body protection appropriate to prevent contact (e.g. lab coat, overalls). If necessary, refer to appropriate Standards of Canada, or appropriate Standards of the EU, Australian Standards, or relevant Japanese Standards.

## SECTION 9 - PHYSICAL and CHEMICAL PROPERTIES

| | |
|---|---|
| **PHYSICAL STATE:** | Solid |
| **APPEARANCE & ODOR:** | White granular powder with little or no odor. |
| **ODOR THRESHOLD (PPM):** | Not Available |
| **VAPOR PRESSURE (mmHg):** | Not Applicable |
| **VAPOR DENSITY (AIR=1):** | Not Applicable. |
| **BY WEIGHT:** | Not Available |
| **EVAPORATION RATE (nBuAc = 1):** | Not Applicable. |
| **BOILING POINT (C°):** | Not Applicable. |
| **FREEZING POINT (C°):** | Not Applicable. |
| **pH:** | 9.5 (1% aqueous solution) |
| **SPECIFIC GRAVITY 20°C: (WATER =1)** | 0.85 – 1.1 |
| **SOLUBILITY IN WATER (%)** | >10% w/w |
| **COEFFICIENT OF WATER/OIL DIST.:** | Not Available |
| **VOC:** | None |
| **CHEMICAL FAMILY:** | Detergent |

## SECTION 10 - STABILITY and REACTIVITY

**STABILITY:** Product is stable
**DECOMPOSITION PRODUCTS:** When heated to decomposition this product produces Oxides of carbon (COx)
**MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE:** Strong acids and strong oxidizing agents.
**HAZARDOUS POLYMERIZATION:** Will not occur.
**CONDITIONS TO AVOID:** Contact with incompatible materials and dust generation.

## SECTION 11 - TOXICOLOGICAL INFORMATION

**TOXICITY DATA:** Toxicity data is available for mixture:

| | |
|---|---|
| CAS# 497-19-8 LD50 Oral (Rat) | 4090 mg/kg |
| CAS# 497-19-8 LD50 Oral (Mouse) | 6600 mg/kg |
| CAS# 497-19-8 LC50 Inhalation (Rat) | 2300 mg/m³ 2H |
| CAS# 497-19-8 LC50 Inhalation (Mouse) | 1200 mg/m³ 2H |
| CAS# 7758-29-4 LD50 Oral (Rat) | 3120 mg/kg |
| CAS# 7758-29-4 LD50 Oral (Mouse) | 3100 mg/kg |
| CAS# 7722-88-5 LD50 Oral (Rat) | 4000 mg/kg |

**SUSPECTED CANCER AGENT:** None of the ingredients are found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, IARC and therefore is not considered to be, nor suspected to be a cancer-causing agent by these agencies.
**IRRITANCY OF PRODUCT:** Contact with this product can be irritating to exposed skin, eyes and respiratory system.
**SENSITIZATION OF PRODUCT:** This product is not considered a sensitizer.
**REPRODUCTIVE TOXICITY INFORMATION:** No information concerning the effects of this product and its components on the human reproductive system.

## SECTION 12 - ECOLOGICAL INFORMATION

**ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.**
**ENVIRONMENTAL STABILITY:** No Data available at this time.
**EFFECT OF MATERIAL ON PLANTS or ANIMALS:** No evidence is currently available on this product's effects on plants or animals.

**EFFECT OF CHEMICAL ON AQUATIC LIFE:** No evidence is currently available on this product's effects on aquatic life.

## SECTION 13 - DISPOSAL CONSIDERATIONS

**PREPARING WASTES FOR DISPOSAL:** Waste disposal must be in accordance with appropriate Federal, State, and local regulations, those of Canada, Australia, EU Member States and Japan.

## SECTION 14 - TRANSPORTATION INFORMATION

**US DOT; IATA; IMO; ADR:**

**THIS PRODUCT IS NOT HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.**
**PROPER SHIPPING NAME:** Non-Regulated Material
**HAZARD CLASS NUMBER and DESCRIPTION:** Not Applicable
**UN IDENTIFICATION NUMBER:** Not Applicable
**PACKING GROUP:** Not Applicable.
**DOT LABEL(S) REQUIRED:** Not Applicable
**NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2004):** Not Applicable
**MARINE POLLUTANT:** None of the ingredients are classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B)

U.S. DEPARTMENT OF TRANSPORTATION (DOT) SHIPPING REGULATIONS:
This product is not classified as dangerous goods, per U.S. DOT regulations, under 49 CFR 172.101.

TRANSPORT CANADA, TRANSPORTATION OF DANGEROUS GOODS REGULATIONS:
This product is not classified as Dangerous Goods, per regulations of Transport Canada.

INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA):
This product is not classified as Dangerous Goods, by rules of IATA:

INTERNATIONAL MARITIME ORGANIZATION (IMO) DESIGNATION:
This product is not classified as Dangerous Goods by the International Maritime Organization.

EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD (ADR):

This product is not classified by the United Nations Economic Commission for Europe to be dangerous goods.

## SECTION 15 - REGULATORY INFORMATION

**UNITED STATES REGULATIONS**

**SARA REPORTING REQUIREMENTS:** This product is not subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act., as follows: None

**TSCA:** All components in this product are listed on the US Toxic Substances Control Act (TSCA) inventory of chemicals.

**SARA 311/312:**

Acute Health: Yes Chronic Health: No Fire: No Reactivity: No

**U.S. SARA THRESHOLD PLANNING QUANTITY:** There are no specific Threshold Planning Quantities for this product. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) may apply, per 40 CFR 370.20.

**U.S. CERCLA REPORTABLE QUANTITY (RQ):** None

**CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65):** None of the ingredients are on the California Proposition 65 lists.

**CANADIAN REGULATIONS:**

**CANADIAN DSL/NDSL INVENTORY STATUS:** All of the components of this product are on the DSL Inventory

**CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS:** No component of this product is on the CEPA First Priorities Substance Lists.

**CANADIAN WHMIS CLASSIFICATION and SYMBOLS:** This product is categorized as a Controlled Product, Hazard Class D2B as per the Controlled Product Regulations

**EUROPEAN ECONOMIC COMMUNITY INFORMATION:**

**EU LABELING AND CLASSIFICATION:**

**Classification of the mixture according to Regulation (EC) No1272/2008. See section 2 for details.**

**AUSTRALIAN INFORMATION FOR PRODUCT:**

**AUSTRALIAN INVENTORY OF CHEMICAL SUBSTANCES (AICS) STATUS:** All components of this product are listed on the AICS.

**STANDARD FOR THE UNIFORM SCHEDULING OF DRUGS AND POISONS:** Not applicable.

**JAPANESE INFORMATION FOR PRODUCT:**

**JAPANESE MINISTER OF INTERNATIONAL TRADE AND INDUSTRY (MITI) STATUS:** The components of this product are not listed as Class I Specified Chemical Substances, Class II Specified Chemical Substances, or Designated Chemical Substances by the Japanese MITI.

**INTERNATIONAL CHEMICAL INVENTORIES:**

Listing of the components on individual country Chemical Inventories is as follows:

| | |
|---|---|
| Asia-Pac: | Listed |
| Australian Inventory of Chemical Substances (AICS): | Listed |
| Korean Existing Chemicals List (ECL): | Listed |
| Japanese Existing National Inventory of Chemical Substances (ENCS): | Listed |
| Philippines Inventory if Chemicals and Chemical Substances (PICCS): | Listed |
| Swiss Giftliste List of Toxic Substances: | Listed |
| U.S. TSCA: | Listed |

## SECTION 16 - OTHER INFORMATION

**PREPARED BY:** Paul Eigbrett Global Safety Management, 10006 Cross Creek Blvd. Suite 440, Tampa, FL 33647

**Disclaimer:** To the best of Alconox, Inc. knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness is not guaranteed and no warranties of any type either express or implied are provided. The information contained herein relates only to this specific product.

**ANNEX:**

**IDENTIFIED USES OF ALCONOX® AND DIRECTIONS FOR USE**

**Used to clean:** Healthcare instruments, laboratory ware, vacuum equipment, tissue culture ware, personal protective equipment, sampling apparatus, catheters, tubing, pipes, radioactive contaminated articles, optical parts, electronic components, pharmaceutical apparatus, cosmetics manufacturing equipment, metal castings, forgings and stampings, industrial parts, tanks and reactors. Authorized by USDA for use in federally inspected meat and poultry plants. Passes inhibitory residue test for water analysis. FDA certified.

**Used to remove:** Soil, grit, grime, buffing compound, slime, grease, oils, blood, tissue, salts, deposits, particulates, solvents, chemicals, radioisotopes, radioactive contaminations, silicon oils, mold release agents.

**Surfaces cleaned:** Corrosion inhibited formulation recommended for glass, metal, stainless steel, porcelain, ceramic, plastic, rubber and fiberglass. Can be used on soft metals such as copper, aluminum, zinc and magnesium if rinsed promptly. Corrosion testing may be advisable.

**Cleaning method:** Soak, brush, sponge, cloth, ultrasonic, flow through clean-inplace. Will foam—not for spray or machine use.

**Directions:** Make a fresh 1% solution (2 1/2 Tbsp. per gal., 1 1/4 oz. per gal. or 10 grams per liter) in cold, warm, or hot water. If available use warm water. Use cold water for blood stains. For difficult soils, raise water temperature and use more detergent. Clean by soak, circulate, wipe, or ultrasonic method. Not for spray machines, will foam. For nonabrasive scouring, make paste. Use 2% solution to soak frozen stopcocks. To remove silver tarnish, soak in 1% solution in aluminum container. RINSE THOROUGHLY—preferably with running water. For critical cleaning, do final or all rinsing in distilled, deionized, or purified water. For food contact surfaces, rinse with potable water. Used on a wide range of glass, ceramic, plastic, and metal surfaces. Corrosion testing may be advisable.

# Benzene

## Material Safety Data Sheet

**CITGO Petroleum Corporation**
**P.O. Box 4689**
**Houston, TX 77210**

**MSDS No.** 03101
**Revision Date** 6/12/2009

**IMPORTANT: This MSDS is prepared in accordance with 29 CFR 1910.1200. Read this MSDS before transporting, handling, storing or disposing of this product and forward this information to employees, customers and users of this product.**

### Hazard Rankings

| | HMIS | NFPA |
|---|---|---|
| **Health Hazard** | * 3 | 2 |
| **Fire Hazard** | 3 | 3 |
| **Reactivity** | 0 | 0 |

*** = Chronic Health Hazard**

### Protective Equipment

**Minimum Recommended**
**See Section 8 for Details**

### Emergency Overview

**Physical State** Liquid.

**Color** Transparent, colorless. **Odor** Characteristic aromatic hydrocarbon.

**DANGER:**
**EXTREMELY FLAMMABLE LIQUID AND VAPOR, VAPOR MAY CAUSE FLASH FIRE.**
**Vapor may travel considerable distance to source of ignition and flash back.**
**Harmful or fatal if swallowed - can enter lungs and cause damage.**
**Breathing high concentrations can cause irregular heartbeats which may be fatal.**
**Contains Benzene - Cancer Hazard. Can cause leukemia and other blood disorders.**
**May be harmful if inhaled or absorbed through the skin.**
**Can cause eye, skin or respiratory tract irritation.**
**Overexposure can cause central nervous system (CNS) depression and/or other target organ effects.**
**Harmful to aquatic organisms.**

## SECTION 1. PRODUCT IDENTIFICATION

| | | | |
|---|---|---|---|
| **Trade Name** | Benzene | **Technical Contact** | (800) 248-4684 |
| **Product Number** | 03101 | **Medical Emergency** | (832) 486-4700 |
| **CAS Number** | 71-43-2 | **CHEMTREC Emergency (United States Only)** | (800) 424-9300 |
| **Product Family** | Aromatic hydrocarbon. | | |
| **Synonyms** | Benzol ;<br>CITGO® Material Code: 03101 | | |

## SECTION 2. COMPOSITION

| Component Name(s) | CAS Registry No. | Concentration (%) |
|---|---|---|
| Benzene | 71-43-2 | >99 |
| Toluene | 108-88-3 | <1 |

## SECTION 3. HAZARDS IDENTIFICATION

**Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.**

**Major Route(s) of Entry** Skin contact. Inhalation. Ingestion. Eye.

**Signs and Symptoms of Acute Exposure**

**Inhalation** Mist or vapor can irritate the throat and lungs. Breathing this material may cause central nervous system depression with symptoms including nausea, headache, dizziness, fatigue, drowsiness, or unconsciousness. Breathing high concentrations of this material, for example, in an enclosed space or by intentional abuse, can cause irregular heartbeats which can cause death.

**Eye Contact** This material can cause eye irritation with tearing, redness, or a stinging or burning feeling. Further, it can cause swelling of the eyes with blurred vision. Effects may become more serious with repeated or prolonged contact.

**Skin Contact** May cause skin irritation with redness, an itching or burning feeling, and swelling of the skin. Effects may become more serious with repeated or prolonged contact. Skin contact may cause harmful effects in other parts of the body.

**Ingestion** Swallowing this material may cause stomach or intestinal upset with pain, nausea, and/or diarrhea. Swallowing this material may cause effects similar to those described in the inhalation section (see "inhalation" above).

This material can get into the lungs during swallowing or vomiting. Small amounts in the lungs can cause lung damage, possibly leading to chronic lung dysfunction or death.

**Chronic Health Effects Summary** Benzene, a component of this product, is associated with blood disorders and may damage bone marrow, causing certain types of anemia. The International Agency for Research on Cancer (IARC) (1987, 2004, 2007) and the U.S. EPA (IRIS 2007) have determined that benzene is a human carcinogen. It is also capable of causing changes in living cells' genetic material (chromosomes) and is considered to be a mutagen.

This material and/or its components have been associated with developmental toxicity, reproductive toxicity, genotoxicity, immunotoxicity and/or carcinogenicity. Refer to Section 11 of this MSDS for additional health-related information.

**Conditions Aggravated by Exposure** Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include: Respiratory System, Central Nervous System (CNS), Heart (Cardiac), Blood-forming system

**Target Organs** May cause damage to the following organs: blood, kidneys, the reproductive system, liver, mucous membranes, heart, lymphatic system, immune system, skin, bone marrow, central nervous system (CNS), eye, lens or cornea, testes.

**Carcinogenic Potential** This material contains benzene at concentrations above 0.1%. Benzene is considered to be a known human carcinogen by OSHA, IARC and NTP.

**OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).**

| OSHA Health Hazard Classification | | | | OSHA Physical Hazard Classification | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Irritant | | Sensitizer | | Combustible | | Explosive | | Pyrophoric | |
| Toxic | X | Highly Toxic | | Flammable | X | Oxidizer | | Water-reactive | |
| Corrosive | | Carcinogenic | X | Compressed Gas | | Organic Peroxide | | Unstable | |

## SECTION 4. FIRST AID MEASURES

**Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.**

**Inhalation** Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately.

**Eye Contact** Flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. If easily accomplished, check for and remove contact lenses. If contact lenses cannot be removed, seek immediate medical attention. Do not use eye ointment. Seek medical attention.

**Skin Contact** Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.

**Ingestion** Do not induce vomiting. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.

**Notes to Physician** INHALATION: Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Administer supplemental oxygen with assisted ventilation, as required.

This material (or a component) sensitizes the heart to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material. Administration of sympathomimetic drugs should be avoided.

INGESTION: If ingested, this material presents a significant aspiration and chemical pneumonitis hazard. Induction of emesis is not recommended. Consider activated charcoal and/or gastric lavage. If patient is obtunded, protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position.

## SECTION 5. FIRE FIGHTING MEASURES

**NFPA Flammability Classification** NFPA Class-IB flammable liquid.

**Flash Point** Closed cup: -11.111°C (12°F). (Tagliabue (ASTM D-56))

**Lower Flammable Limit** AP 1.3% **Upper Flammable Limit** AP 7.1%

**Autoignition Temperature** AP 560°C (1040°F)

**Hazardous Combustion Products** Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons, aldehydes and other products of incomplete combustion.

**Special Properties** Flammable Liquid! This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. A vapor and air mixture can create an explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.

**Extinguishing Media**

SMALL FIRE: Use dry chemicals, carbon dioxide, foam, or inert gas (nitrogen). Carbon dioxide and inert gas can displace oxygen. Use caution when applying carbon dioxide or inert gas in confined spaces.
LARGE FIRE: Use foam, water fog, or water spray. Water fog and spray are effective in cooling containers and adjacent structures. However, water can cause frothing and/or may not extinguish the fire. Water can be used to cool the external walls of vessels to prevent excessive pressure, autoignition or explosion. DO NOT use a solid stream of water directly on the fire as the water may spread the fire to a larger area.

**Protection of Fire Fighters**

Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities of potential fire and explosion hazard if liquid enter sewers or waterways.

## SECTION 6. ACCIDENTAL RELEASE MEASURES

**Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.**

Flammable Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent spilled material from entering waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Prevent spilled material from entering sewers, storm drains, other drainage systems, and natural waterways. Dike far ahead of a liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbant pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all applicable local, state and federal laws and regulations.

## SECTION 7. HANDLING AND STORAGE

**Handling**

A spill or leak can cause an immediate fire or explosion hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Avoid contact with oxidizing agents. Do NOT breathe vapor. Use only with adequate ventilation and personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food and tobacco products. Do NOT take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Follow proper entry procedures, including compliance with 29 CFR 1910.146 prior to entering confined spaces such as tanks or pits. Use gloves constructed of impervious materials and protective clothing if direct

contact is anticipated. Use appropriate respiratory protection when concentrations exceed any established occupational exposure level (See Section 8) Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Non-equilibrium conditions may increase the fire hazard associated with this product. A static electrical charge can accumulate when this material is flowing through pipes, nozzles or filters and when it is agitated. A static spark discharge can ignite accumulated vapors particularly during dry weather conditions. Always bond receiving containers to the fill pipe before and during loading. Always confirm that receiving container is properly grounded. Bonding and grounding alone may be inadequate to eliminate fire and explosion hazards associated with electrostatic charges. Carefully review operations that may increase the risks associated with static electricity such as tank and container filling, tank cleaning, sampling, gauging, loading, filtering, mixing, agitation, etc. In addition to bonding and grounding, efforts to mitigate the hazards of an electrostatic discharge may include, but are not limited to, ventilation, inerting and/or reduction of transfer velocities. Dissipation of electrostatic charges may be improved with the use of conductivity additives when used with other mitigation efforts, including bonding and grounding. Always keep nozzle in contact with the container throughout the loading process.

Do NOT fill any portable container in or on a vehicle. Do NOT use compressed air for filling, discharging or other handling operations. Product container is NOT designed for elevated pressure. Do NOT pressurize, cut, weld, braze solder, drill, or grind on containers. Do NOT expose product containers to flames, sparks, heat or other potential ignition sources. Empty containers may contain material residues which can ignite with explosive force. Observe label precautions.

**Storage**

Keep container tightly closed. Store in a cool, dry, well-ventilated area. Store only in approved containers. Do not store with oxidizing agents. Do not store at elevated temperatures or in direct sunlight. Protect containers against physical damage. Head spaces in tanks and other containers may contain a mixture of air and vapor in the flammable range. Vapor may be ignited by static discharge. Storage area must meet OSHA requirements and applicable fire codes. Additional information regarding the design and control of hazards associated with the handling and storage of flammable and combustible liquids may be found in professional and industrial documents including, but not limited to, the National Fire Protection Association (NFPA) publications NFPA 30 ("Flammable and Combustible Liquid Code"), NFPA 77 ("Recommended Practice on Static Electricity") and the American Petroleum Institute (API) Recommended Practice 2003, (“Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents").

Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling or disposing of empty containers or waste residues of this product.

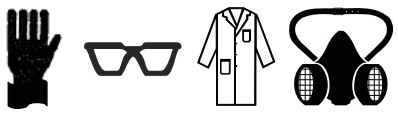
## SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

**Engineering Controls**

Provide ventilation or other engineering controls to keep the airborne concentrations of vapor or mists below the applicable workplace exposure limits indicated below. All electrical equipment should comply with the National Electrical Code. An emergency eye wash station and safety shower should be located near the work-station.

**Personal Protective Equipment**

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



**Eye Protection**

Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. Chemical goggles should be worn during transfer operations or when there is a likelihood of misting, splashing, or spraying of this material. A suitable emergency eye wash water and safety shower should be located near the work station.

**Hand Protection** Avoid skin contact. Use heavy duty gloves constructed of chemical resistant materials such as Viton®. Wash hands with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities or leaving work. DO NOT use gasoline, kerosene, solvents or harsh abrasives as skin cleaners.

**Body Protection** Avoid skin contact. Wear long-sleeved fire-retardant garments (e.g., Nomex®) while working with flammable and combustible liquids. Additional chemical-resistant protective gear may be required if splashing or spraying conditions exist. This may include an apron, boots and additional facial protection. If product comes in contact with clothing, immediately remove soaked clothing and shower. Promptly remove and discard contaminated leather goods.

**Respiratory Protection** For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134). For airborne vapor concentrations that exceed the recommended protection factors for organic vapor respirators, use a full-face, positive-pressure, supplied air respirator. Due to fire and explosion hazards, do not enter atmospheres containing concentrations greater than 10% of the lower flammable limit of this product.

**General Comments** Warning! Use of this material in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and/or inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

**Occupational Exposure Guidelines**

| **Substance** | **Applicable Workplace Exposure Levels** |
|---|---|
| Benzene | **ACGIH (United States). Skin**<br>TWA: 0.5 ppm 8 hour(s).<br>STEL: 2.5 ppm 15 minute(s).<br>**OSHA PEL (United States).**<br>ACTN: 0.5 ppm 8 hour(s).<br>TWA: 1 ppm 8 hour(s).<br>STEL: 5 ppm 15 minute(s). |
| Toluene | **ACGIH (United States).**<br>TWA: 20 ppm 8 hour(s).<br>**OSHA (United States).**<br>TWA: 200 ppm 8 hour(s).<br>CEIL: 300 ppm<br>PEAK: 500 ppm 1 times per shift, 10 minute(s). |

## SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

| | | | | | |
|---|---|---|---|---|---|
| **Physical State** | Liquid. | **Color** | Transparent, colorless. | **Odor** | Characteristic aromatic hydrocarbon. |
| **Specific Gravity** | 0.884 (Water = 1) | **pH** | Not applicable | **Vapor Density** | 2.8 (Air = 1) |
| **Boiling Range** | 80°C (176°F) | | | **Melting/Freezing Point** | 6°C (42°F) |
| **Vapor Pressure** | 76 mm Hg at 20°C (68°F ). | | | **Volatility** | 884 g/l VOC (w/v) |
| **Solubility in Water** | Slightly soluble in cold water (0.03%); miscible with most organic solvents. | | | **Viscosity (cSt @ 40°C)** | 1 to 2 |

**Flash Point** Closed cup: -11.111°C (12°F). (Tagliabue (ASTM D-56))

**Additional Properties**

C6-C7 Aromatic Hydrocarbons Content = 99.9 to 100 Wt.% (ASTM D-1319);
Average Density at 60°F = 7.365 lbs./gal. (ASTM D-2161);
Molecular Weight = 78.11;
Refractive Index at 20°C (-6.7°F) = 1.5011;
Odor Threshold = 4 to 34 ppm in air;
Aniline Cloud Point Temperature = 46°F (7.8°C) (ASTM D-611);
Kauri-Butanol (KB) Value = 110 (ASTM D-1133);
Dry Point Temperature = 176°F (80°C) (ASTM D-86);
Evaporation Rate = 4.5 when n-Butyl acetate = 1.0;
Heat Value = 17,673 Btu.
Conductivity <5 picosiemens/meter (unaddetized)

## SECTION 10. STABILITY AND REACTIVITY

**Chemical Stability** Stable.

**Hazardous Polymerization** Not expected to occur.

**Conditions to Avoid** Keep away from heat, sparks and flame.

**Materials Incompatibility** Strong acids, alkalies, and oxidizers such as liquid chlorine, other halogens, hydrogen peroxide and oxygen.

**Hazardous Decomposition Products** No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.

## SECTION 11. TOXICOLOGICAL INFORMATION

**For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.**

**Toxicity Data**

**Benzene**:

| | |
|---|---|
| ORAL (LD50): | Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse]. |
| INHALATION (LC50): (VAPOR): | Acute: 10000 ppm 7 hour(s) [Rat]. 9980 ppm 8 hour(s) [Mouse]. |

Studies of Workers Over-Exposed to Benzene:
Studies of workers exposed to benzene show clear evidence that over-exposure can cause cancer of the blood forming organs (acute myelogenous leukemia) and aplastic anemia, an often fatal disease. Studies also suggest over-exposure to benzene may be associated with other types of leukemia and other blood disorders. Some studies of workers exposed to benzene have shown an association with increased rates of chromosome aberrations in circulating lymphocytes. One study of women workers exposed to benzene suggested a weak association with irregular menstruation. However, other studies of workers exposed to benzene have not demonstrated clear evidence of an effect on fertility or reproductive outcome in humans. Benzene can cross the placenta and affect the developing fetus. Cases of aplastic anemia have been reported in the offspring of persons severely over-exposed to benzene.

Studies in Laboratory Animals:
Studies in laboratory animals indicate that prolonged, repeated exposure to high levels of benzene vapor can cause bone marrow suppression and cancer in multiple organ systems. Studies in laboratory animals show evidence of adverse effects on male reproductive organs following high levels of exposure but no significant effects on reproduction have been observed. Embryotoxicity has been reported in studies of laboratory animals but effects were limited to reduced fetal weight and skeletal variations.

## SECTION 12. ECOLOGICAL INFORMATION

**Ecotoxicity**

Analysis for ecological effects has not been conducted on this product. However, if spilled, this product, its storage tank water bottoms and sludge, and any contaminated soil or water may be hazardous to human, animal, and aquatic life. Also, the coating action associated with this product can be harmful or fatal to aquatic life and waterfowl. Volatile aromatic components may be released and canpossibly contribute to the creation of atmospheric smog.

**Environmental Fate**

Biodegradability: Rapidly biodegradable in aerobic conditions.

Partition Coefficient (log Kow): 2.3

Photodegradation: Based on similar materials, this product will have a significant tendency to partition to air. Hydrocarbons from this product which do partition to air are expected to rapidly photodegrade.Distribution: Principally to air.

## SECTION 13. DISPOSAL CONSIDERATIONS

**Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.**

Maximize material recovery for reuse or recycling. Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. Conditions of use may cause this material to become a "hazardous waste", as defined by federal or state regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal. Transportation, treatment, storage and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact your regional US EPA office for guidance concerning case specfic disposal issues.

## SECTION 14. TRANSPORT INFORMATION

**The shipping description below may not represent requirements for all modes of transportation, shipping methods or locations outside of the United States.**

**US DOT Status** A U.S. Department of Transportation regulated material.

**Proper Shipping Name** Benzene

**Hazard Class** DOT Class: 3 (Flammable liquid).

**Packing Group** PG II

**UN/NA Number** UN1114

**Reportable Quantity** 10 lbs

**Placard(s)**

**Emergency Response Guide No.** 130

**MARPOL III Status** Not a DOT "Marine Pollutant" per 49 CFR 171.8.

## SECTION 15. REGULATORY INFORMATION

| | |
|---|---|
| **TSCA Inventory** | This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory. |
| **SARA 302/304 Emergency Planning and Notification** | The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified. |
| **SARA 311/312 Hazard Identification** | The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories:<br>Fire, Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard |
| **SARA 313 Toxic Chemical Notification and Release Reporting** | >99%This product contains the following components in concentrations above *de minimis* levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA:<br>Benzene, CAS Number, 71-43-2, Concentration: 100% |
| **CERCLA** | The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are:<br>Benzene CAS No.: 71-43-2] RQ 10 lbs. (4.536 kg) Concentration: 100% |
| **Clean Water Act (CWA)** | This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802. |
| **California Proposition 65** | This material may contain the following components which are known to the State of California to cause cancer, birth defects or other reproductive harm, and may be subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):<br>Benzene: >99%<br>Toluene: <1% |
| **New Jersey Right-to-Know Label** | For New Jersey R-T-K labeling requirements, refer to components listed in Section 2. |
| **Additional Remarks** | For Industrial Use Only. Not intended or suitable for use in or around a household or dwelling. |

## SECTION 16. OTHER INFORMATION

**Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.**

**REVISION INFORMATION**

**Version Number** 5.1

**Revision Date** 6/12/2009

**ABBREVIATIONS**

| | | | |
|---|---|---|---|
| AP: Approximately | EQ: Equal | >: Greater Than | <: Less Than |
| NA: Not Applicable | ND: No Data | NE: Not Established | |

ACGIH: American Conference of Governmental Industrial Hygienists

AIHA: American Industrial Hygiene Association

IARC: International Agency for Research on Cancer

NIOSH: National Institute of Occupational Safety and Health

NPCA: National Paint and Coating Manufacturers Association

EPA: US Environmental Protection Agency

HMIS: Hazardous Materials Information System

OSHA: Occupational Safety and Health Administration

NTP: National Toxicology Program

NFPA: National Fire Protection Association

## DISCLAIMER OF LIABILITY

**THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.**

**THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.**

* * * * * END OF MSDS * * * * *

# Material Safety Data Sheet

## cis-1,2-Dichloroethylene, 97%

ACC# 97773

## Section 1 - Chemical Product and Company Identification

**MSDS Name:** cis-1,2-Dichloroethylene, 97%
**Catalog Numbers:** AC113380000, AC113380025, AC113380100
**Synonyms:** cis-Acetylene dichloride.
**Company Identification:**

Acros Organics N.V.
One Reagent Lane
Fair Lawn, NJ 07410

**For information in North America, call:** 800-ACROS-01
**For emergencies in the US, call CHEMTREC:** 800-424-9300

## Section 2 - Composition, Information on Ingredients

| CAS# | Chemical Name | Percent | EINECS/ELINCS |
|---|---|---|---|
| 156-59-2 | cis-1,2-Dichloroethylene | 97 | 205-859-7 |

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: Clear liquid. Flash Point: 6 deg C.
**Warning! Flammable liquid and vapor.** Harmful if inhaled. Unstabilized substance may polymerize. Causes eye and skin irritation. May be harmful if swallowed. May cause respiratory tract irritation.
**Target Organs:** Central nervous system, respiratory system, eyes, skin.

### Potential Health Effects

**Eye:** Causes moderate eye irritation.
**Skin:** Causes moderate skin irritation. May cause dermatitis.
**Ingestion:** May cause gastrointestinal irritation with nausea, vomiting and diarrhea. May be harmful if swallowed. May cause central nervous system depression.
**Inhalation:** May cause respiratory tract irritation. May cause narcotic effects in high concentration. Eye irritation, vertigo, and nausea were reported in humans exposed at 2200 ppm.
**Chronic:** Not available. Some German investigators reported fatty degeneration of the liver upon repeated narcotic doses in rats and

## Section 4 - First Aid Measures

**Eyes:** In case of contact, immediately flush eyes with plenty of water for a t least 15 minutes. Get medical aid.
**Skin:** In case of contact, flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid if irritation develops and persists. Wash clothing before reuse.
**Ingestion:** If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical aid.
**Inhalation:** If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
**Notes to Physician:** Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Vapors may form an explosive mixture with air. Use water spray to keep fire-exposed containers cool. Flammable liquid and vapor. Fire or excessive heat may result in violent rupture of the container due to bulk polymerization. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas. Hazardous polymerization may occur under fire conditions.
**Extinguishing Media:** Use water fog, dry chemical, carbon dioxide, or regular foam.
**Flash Point:** 6 deg C ( 42.80 deg F)
**Autoignition Temperature:** 440 deg C ( 824.00 deg F)
**Explosion Limits, Lower:**9.70 vol %
**Upper:** 12.80 vol %
**NFPA Rating:** (estimated) Health: 2; Flammability: 3; Instability: 2

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.
**Spills/Leaks:** Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Remove all sources of ignition. Use a spark-proof tool. Provide ventilation.

## Section 7 - Handling and Storage

**Handling:** Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Use spark-proof tools and explosion proof equipment. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Avoid ingestion and inhalation. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames. Use only with adequate ventilation. Pure vapor will be uninhibited and may polymerize in vents or other confined spaces.
**Storage:** Keep away from sources of ignition. Store in a tightly closed container. Flammables-area. Store protected from light and air.

## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower.
**Exposure Limits**

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| cis-1,2-Dichloroethylene | 200 ppm TWA | none listed | none listed |

**OSHA Vacated PELs:** cis-1,2-Dichloroethylene: No OSHA Vacated PELs are listed for this chemical.
**Personal Protective Equipment**
**Eyes:** Wear chemical splash goggles.
**Skin:** Wear appropriate protective gloves to prevent skin exposure.
**Clothing:** Wear appropriate protective clothing to prevent skin exposure.
**Respirators:** Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

## Section 9 - Physical and Chemical Properties

**Physical State:** Liquid
**Appearance:** Clear
**Odor:** Pleasant odor
**pH:** Not available.
**Vapor Pressure:** 201 mm Hg @ 25 deg C
**Vapor Density:** 3.34 (air=1)
**Evaporation Rate:**Not available.
**Viscosity:** Not available.
**Boiling Point:** 60 deg C @ 760 mm Hg
**Freezing/Melting Point:**-80 deg C
**Decomposition Temperature:**Not available.
**Solubility:** Insoluble.
**Specific Gravity/Density:**1.2800
**Molecular Formula:**C2H2Cl2
**Molecular Weight:**96.94

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable under normal temperatures and pressures. This material is a monomer and may polymerize under certain conditions if the stabilizer is lost.
**Conditions to Avoid:** Light, ignition sources, exposure to air, excess heat.
**Incompatibilities with Other Materials:** Strong oxidizing agents, strong bases, copper.
**Hazardous Decomposition Products:** Hydrogen chloride, phosgene, carbon monoxide, carbon dioxide.
**Hazardous Polymerization:** May occur.

## Section 11 - Toxicological Information

**RTECS#:**
**CAS#** 156-59-2: KV9420000
**LD50/LC50:**
CAS# 156-59-2:
Inhalation, rat: LC50 = 13700 ppm;
.

**Carcinogenicity:**
CAS# 156-59-2: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

**Epidemiology:** No data available.
**Teratogenicity:** No data available.
**Reproductive Effects:** No data available.
**Mutagenicity:** No data available.
**Neurotoxicity:** No data available.
**Other Studies:**

## Section 12 - Ecological Information

No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
**RCRA P-Series:** None listed.
**RCRA U-Series:** None listed.

## Section 14 - Transport Information

| | US DOT | Canada TDG |
|---|---|---|
| **Shipping Name:** | DOT regulated - small quantity provisions apply (see 49CFR173.4) | 1,2-DICHLOROETHYLENE |
| **Hazard Class:** | | 3 |
| **UN Number:** | | UN1150 |
| **Packing Group:** | | II |

## Section 15 - Regulatory Information

### US FEDERAL

**TSCA**
CAS# 156-59-2 is listed on the TSCA inventory.
**Health & Safety Reporting List**
None of the chemicals are on the Health & Safety Reporting List.
**Chemical Test Rules**
None of the chemicals in this product are under a Chemical Test Rule.
**Section 12b**
None of the chemicals are listed under TSCA Section 12b.
**TSCA Significant New Use Rule**
None of the chemicals in this material have a SNUR under TSCA.
**CERCLA Hazardous Substances and corresponding RQs**
None of the chemicals in this material have an RQ.
**SARA Section 302 Extremely Hazardous Substances**
None of the chemicals in this product have a TPQ.
**Section 313** No chemicals are reportable under Section 313.
**Clean Air Act:**
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
**Clean Water Act:**
None of the chemicals in this product are listed as Hazardous Substances under the CWA.
None of the chemicals in this product are listed as Priority Pollutants under the CWA.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
**OSHA:**
None of the chemicals in this product are considered highly hazardous by OSHA.
**STATE**
CAS# 156-59-2 can be found on the following state right to know lists: Pennsylvania, Massachusetts.

**California Prop 65**

California No Significant Risk Level: None of the chemicals in this product are listed.

### European / International Regulations

**European Labeling in Accordance with EC Directives**
**Hazard Symbols:**
XN F
**Risk Phrases:**

R 11 Highly flammable.
R 20 Harmful by inhalation.
R 52/53 Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

**Safety Phrases:**

S 16 Keep away from sources of ignition - No smoking.
S 29 Do not empty into drains.
S 7 Keep container tightly closed.
S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

**WGK (Water Danger/Protection)**

CAS# 156-59-2: No information available.

**Canada - DSL/NDSL**

CAS# 156-59-2 is listed on Canada's NDSL List.

**Canada - WHMIS**

WHMIS: Not available.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

**Canadian Ingredient Disclosure List**

## Section 16 - Additional Information

**MSDS Creation Date:** 2/09/1998
**Revision #5 Date:** 3/16/2007

*The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.*

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# MATERIAL SAFETY DATA SHEET

# BENTONITE CLAY

# MSDS

## 1. PRODUCT NAME AND COMPANY IDENTIFICATION

| | |
|---|---|
| **Product Name:** | **BENTONITE CLAY, SODIUM TYPE** |
| **Product Use:** | Personal Care Formulations |
| **Company Name:** | Natural Sourcing |
| **Company Address:** | 341 Christian Street, Oxford, CT 06478, USA |
| **Date Issued:** | 6/1/2008 |
| **Emergency Telephone Number:** | **Chemtrec Tel: (800) 262-8200** |

## 2. COMPOSITION/INGREDIENT INFORMATION

| | |
|---|---|
| **Ingredients:** | 100% natural mineral, raw material, montmorillonite. Naturally occurring hydrated aluminosilicate of sodium, calcium, magnesium, and iron. |
| **Preservatives & Solvents:** | None |
| **Other Gases & Liquids:** | None |
| **Other Solids:** | Respirable crystalline silica (CAS #s 7631-86-9 and 14808-60-7). Estimated quantity less than 2%. |
| **CAS #:** | 1302-78-9 |

## 3. HAZARDS IDENTIFICATION

| | |
|---|---|
| **Eyes:** | Mechanical irritant |
| **Skin:** | Possible drying resulting in dermatitis |
| **Ingestion:** | Not expected to be a hazard |
| **Inhalation:** | Short term exposure to dust levels exceeding the PEL may cause irritation of respiratory tract resulting in a dry cough.<br><br>Chronic exposure to free silica contain in airborne bentonite dust where levels are higher than TLVs may lead to development of silicosis or other respiratory problems. Persistent dry cough and labored breathing upon exertion are symptomatic.<br><br>To use in complete safety, respect exposure limits. |
| **Risk of Slips/Falls:** | Dampening the floor while cleaning a clay storage site may render it extremely slippery. Dry cleaning is recommended if people are required to continue working on the site. |

## 4. FIRST AID MEASURES

| | |
|---|---|
| **Eyes:** | Flush with plenty of water or eye wash solution for 15 minutes. Get medical attention if irritation persists. |
| **Skin:** | Due to its use in cosmetics, no adverse effects are expected. May dry mucous and skin. Wash with soap and water. |

| | |
|---|---|
| **Ingestion:** | No information |
| **Inhalation:** | Remove to fresh air. If symptoms of irritation persist, seek medical advice. Inhalation may aggravate respiratory illness. |
| **Medical Conditions Generally Aggravated by Exposure:** | Individuals with pulmonary and/or respiratory disease, including but not limited to asthma and bronchitis should be precluded from exposure to dust. |

## 5. FIRE FIGHTING MEASURES

| | |
|---|---|
| **Extinguishing Media:** | N/A |
| **Special Firefighting Procedures:** | N/A |
| **Unusual Fire & Explosion Hazards:** | N/A |
| **Note:** | Will not burn |

## 6. ACCIDENTAL RELEASE MEASURES (STEPS FOR SPILLS)

| | |
|---|---|
| **Precautions:** | Avoid dust formation. In the event of a high level exposure to volatile dust, wear a protective mask and safety goggles. |
| **Methods for Cleaning Up:** | Sweep up or vacuum small spills carefully. For large spills, use water sprays or ventilated evacuation systems to prevent dust prevention. Use caution when using water - very slippery when wet. Dispose of according to local regulations. |

## 7. HANDLING AND STORAGE

**Handling**

| | |
|---|---|
| **Safe Handling:** | Avoid dust formation. Provide appropriate ventilation where dust forms. In the event where there is insufficient ventilation wear suitable breathing equipment. |

**Storage**

| | |
|---|---|
| **Requirements for Storage Areas and Containers:** | Store in closed containers below 30°C in well ventilated areas. Very slippery when wet. |

## 8. EXPOSURE CONTROL/PERSONAL PROTECTION

| | |
|---|---|
| **Exposure Value Limits:** | Respect the regulatory provisions for dust (inhalable and breathable) and crystalline silica. |
| **Eye:** | Safety glasses should be worn. |
| **Skin/Body:** | Gloves should be worn. |
| **Respiratory:** | Use NIOSH/MSHA approved respirators for silica bearing dust. |
| **Ventilation:** | Provide appropriate ventilation and filters in places where dust may be generated. |
| **Other:** | Evaluate need based on application. Slip proof shoes may be worn where spills may occur. |
| **Work/Hygiene Practice:** | Normal work and hygiene practices |

## 9. PHYSICAL AND CHEMICAL PROPERTIES

| | |
|---|---|
| **Physical State:** | Powder |
| **Color:** | Grey |
| **Odor:** | Characteristic |
| **Solubility in Water:** | Insoluble |
| **Vapor Density:** | >1 |

| | |
|---|---|
| **Specific Gravity:** | 2.45-2.6 |

## 10. STABILITY AND REACTIVITY

| | |
|---|---|
| **Stability:** | Stable |
| **Incompatibility (Materials to Avoid):** | N/A |
| **Hazardous Decomposition or Byproducts:** | N/A |
| **Conditions to Avoid:** | N/A |

## 11. TOXICOLOGICAL INFORMATION

| | |
|---|---|
| **Exposure Limits: OSHA PEL @ 8 hr. TWA)** | 15 mg/m3 (total dust)<br>5 mg/m3 (respirable dust)<br>Reparable crystalline silica : 0.1 mg/m3 |
| **Signs & Symptoms of Exposure:** | Prolonged or high exposure to respirable dust may cause shortness of breath and other respiratory effects. |
| **Carcinogenicity:** | The international agency for research on cancer has determined that crystalline silica inhaled in the form of quartz or crystobalite in conjunction with the use of these materials from occupational sources is carcinogenic to humans. (Group 1 – carcinogenic to humans) (Refer to IARC monograph 68, Silica, some silicates and organic fibers published June 1997). The National Toxicology Program classifies respirable crystalline silica as "reasonable anticipated to be a carcinogen". For further information, see: "Adverse Effects of Crystalline Silica Exposure" published by the American Thoracic Society, medical section of the American Lung Association, American Journal of Respiratory and Critical Care Medicine, Volume 155, pages 761-765, 1997.<br><br>The small quantities of crystalline silica (quartz) found in this material are, under normal conditions, naturally coated with an unremovable layer of amorphous silica and/or clay. IARC (Vol 68, 1997, pp 191-192) states that crystalline silica (quartz) can differ in toxicity depending on the minerals with which it is combined, citing studies in IARC (Vol 42, 1987, p 86) which states that the toxic effect of crystalline silica (quartz) is reduced by the protective effect…. Due mainly to clay minerals….". |

## 12. ECOLOGICAL INFORMATION

| | |
|---|---|
| **Ecotoxicity:** | No known ecological hazards are associated with this product. |

## 13. DISPOSAL CONSIDERATIONS

| | |
|---|---|
| **Waste Disposal Methods:** | Dispose of according to local, state and federal regulations, and in a manner that does not pose a risk due to emission of breathable dust. |

## 14. TRANSPORT INFORMATION

| | |
|---|---|
| **DOT Classification:** | Not classified |

## 15. REGULATORY INFORMATION

No Information

## 16. ADDITIONAL INFORMATION

This information is provided for documentation purposes only.

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This safety sheet cannot cover all possible situations which the user may experience during processing. Each aspect of your operation should be examined to determine if, or where, additional precautions may be necessary. All health and safety information contained in this bulletin should be provided to your employees or customers.

# Fisher Scientific

Part of Thermo Fisher Scientific

# Material Safety Data Sheet

**Creation Date** 24-Aug-2009 **Revision Date** 23-Sep-2009 **Revision Number** 1

## 1. PRODUCT AND COMPANY IDENTIFICATION

**Product Name** Hydrochloric acid, Trace Metal Grade

**Cat No.** A508-4; A508-212; A508-500; A508P212; A508P500; A508SK212

**Synonyms** Muriatic acid; Hydrogen chloride, HCl

**Recommended Use** Laboratory chemicals

**Company**
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

**Emergency Telephone Number**
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 703-527-3887

## 2. HAZARDS IDENTIFICATION

**DANGER!**

**Emergency Overview**

Causes burns by all exposure routes. May be harmful if inhaled.

**Appearance** Colorless **Physical State** Liquid **odor** pungent

**Target Organs** Skin, Respiratory system, Eyes, Gastrointestinal tract (GI), Liver, Kidney, Teeth

**Potential Health Effects**

**Acute Effects**
**Principle Routes of Exposure**

| | |
|---|---|
| **Eyes** | Causes burns. |
| **Skin** | Causes burns. May be harmful in contact with skin. |
| **Inhalation** | Causes burns. May be harmful if inhaled. |
| **Ingestion** | Causes burns. May be harmful if swallowed. |

**Chronic Effects** Experiments have shown reproductive toxicity effects on laboratory animals. May cause adverse liver effects. May cause adverse kidney effects. Chronic exposure to corrosive fumes/gases may cause erosion of the teeth followed by jaw necrosis. Bronchial irritation with chronic cough and frequent attacks of pneumonia are common. Gastrointestinal disturbances may also be seen.

See Section 11 for additional Toxicological information.

**Aggravated Medical Conditions** Preexisting eye disorders. Skin disorders.

## 3. COMPOSITION/INFORMATION ON INGREDIENTS

Haz/Non-haz

| Component | CAS-No | Weight % |
|---|---|---|
| Water | 7732-18-5 | 62-65 |
| Hydrochloric acid | 7647-01-0 | 35-38 |

## 4. FIRST AID MEASURES

**Eye Contact** Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.

**Skin Contact** Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

**Inhalation** Move to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth resuscitation if victim ingested or inhaled the substance; induce artificial respiration with a respiratory medical device. Immediate medical attention is required.

**Ingestion** Do not induce vomiting. Call a physician or Poison Control Center immediately.

**Notes to Physician** Treat symptomatically.

## 5. FIRE-FIGHTING MEASURES

**Flash Point** No information available.
**Method** No information available.

**Autoignition Temperature** No information available.

**Explosion Limits**
**Upper** No data available
**Lower** No data available

**Suitable Extinguishing Media** Substance is nonflammable; use agent most appropriate to extinguish surrounding fire..

**Unsuitable Extinguishing Media** No information available.

**Hazardous Combustion Products** No information available.

**Sensitivity to mechanical impact** No information available.
**Sensitivity to static discharge** No information available.

**Specific Hazards Arising from the Chemical**
Corrosive Material. Causes burns by all exposure routes. Thermal decomposition can lead to release of irritating gases and vapors.

**Protective Equipment and Precautions for Firefighters**
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

| NFPA | Health 3 | Flammability 0 | Instability 1 | Physical hazards N/A |
|---|---|---|---|---|

## 6. ACCIDENTAL RELEASE MEASURES

**Personal Precautions** Use personal protective equipment. Ensure adequate ventilation. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Do not get in eyes, on skin, or on clothing.

**Environmental Precautions** Should not be released into the environment.

**Methods for Containment and Clean Up** Soak up with inert absorbent material. Keep in suitable and closed containers for disposal.

## 7. HANDLING AND STORAGE

**Handling** Use only under a chemical fume hood. Wear personal protective equipment. Do not breathe vapors or spray mist. Do not get in eyes, on skin, or on clothing. Do not ingest.

**Storage** Keep containers tightly closed in a dry, cool and well-ventilated place. Corrosives area.

## 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

**Engineering Measures** Use only under a chemical fume hood. Ensure that eyewash stations and safety showers are close to the workstation location.

**Exposure Guidelines**

| Component | ACGIH TLV | OSHA PEL | NIOSH IDLH |
|---|---|---|---|
| Hydrochloric acid | Ceiling: 2 ppm | Ceiling: 7 mg/m$^3$<br>Ceiling: 5 ppm<br>(Vacated) Ceiling: 5 ppm<br>(Vacated) Ceiling: 7 mg/m$^3$<br>Ceiling: 7 mg/m$^3$ | IDLH: 50 ppm<br>Ceiling: 5 ppm<br>Ceiling: 7 mg/m$^3$ |

| Component | Quebec | Mexico OEL (TWA) | Ontario TWAEV |
|---|---|---|---|
| Hydrochloric acid | Ceiling: 7.5 mg/m$^3$<br>Ceiling: 5 ppm | Peak: 7 mg/m$^3$<br>Peak: 5 ppm | CEV: 2 ppm |

***NIOSH IDLH:*** *Immediately Dangerous to Life or Health*

**Personal Protective Equipment**

**Eye/face Protection** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166

**Skin and body protection** Wear appropriate protective gloves and clothing to prevent skin exposure

**Respiratory Protection** Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced

## 9. PHYSICAL AND CHEMICAL PROPERTIES

| | |
|---|---|
| **Physical State** | Liquid |
| **Appearance** | Colorless |
| **odor** | pungent |
| **Odor Threshold** | No information available. |
| **pH** | < 1 |
| **Vapor Pressure** | 125 mbar @ 20 °C |
| **Vapor Density** | 1.27 (Air = 1.0) |
| **Viscosity** | 1.8 mPa.s @ 15°C |
| **Boiling Point/Range** | 57°C / 135°F@ 760 mmHg |
| **Melting Point/Range** | -35°C / -31°F |
| **Decomposition temperature** | No information available. |
| **Flash Point** | No information available. |
| **Evaporation Rate** | No information available. |
| **Specific Gravity** | 1.18 |
| **Solubility** | Soluble in water |
| **log Pow** | No data available |
| **Molecular Weight** | 36.46 |
| **Molecular Formula** | HCl.H2O |

## 10. STABILITY AND REACTIVITY

| | |
|---|---|
| **Stability** | Stable under normal conditions. |
| **Conditions to Avoid** | Incompatible products. Excess heat. |
| **Incompatible Materials** | Strong oxidizing agents, Reducing agents, Bases, Metals |
| **Hazardous Decomposition Products** | Carbon monoxide (CO), Carbon dioxide ($CO_2$), Hydrogen chloride gas |
| **Hazardous Polymerization** | Hazardous polymerization does not occur. |
| **Hazardous Reactions .** | None under normal processing.. |

## 11. TOXICOLOGICAL INFORMATION

**Acute Toxicity**

**Component Information**

| Component | LD50 Oral | LD50 Dermal | LC50 Inhalation |
|---|---|---|---|
| Water | 90 mL/kg ( Rat ) | Not listed | Not listed |
| Hydrochloric acid | 700 mg/kg ( Rat ) | 5010 mg/kg ( Rabbit ) | 3124 ppm ( Rat ) 1 h |

| | |
|---|---|
| **Irritation** | Causes burns by all exposure routes |
| **Toxicologically Synergistic Products** | No information available. |

### Chronic Toxicity

**Carcinogenicity** The table below indicates whether each agency has listed any ingredient as a carcinogen.

| Component | ACGIH | IARC | NTP | OSHA | Mexico |
|---|---|---|---|---|---|
| Hydrochloric acid | Not listed | group 3 | Not listed | Not listed | Not listed |

**IARC: (International Agency for Research on Cancer)**
IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans

**Sensitization** No information available.

**Mutagenic Effects** Mutagenic effects have occurred in experimental animals.

**Reproductive Effects** Experiments have shown reproductive toxicity effects on laboratory animals.

**Developmental Effects** Developmental effects have occurred in experimental animals.

**Teratogenicity** Teratogenic effects have occurred in experimental animals..

**Other Adverse Effects** See actual entry in RTECS for complete information.

**Endocrine Disruptor Information** No information available

## 12. ECOLOGICAL INFORMATION

### Ecotoxicity

Do not empty into drains.

| Component | Freshwater Algae | Freshwater Fish | Microtox | Water Flea |
|---|---|---|---|---|
| Hydrochloric acid | Not listed | 282 mg/L LC50 96 h | Not listed | Not listed |

**Persistence and Degradability** No information available

**Bioaccumulation/ Accumulation** No information available

**Mobility**

| Component | log Pow |
|---|---|
| Water | -1.87 |

## 13. DISPOSAL CONSIDERATIONS

**Waste Disposal Methods** Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

## 14. TRANSPORT INFORMATION

**DOT**

| | |
|---|---|
| **UN-No** | UN1789 |
| **Proper Shipping Name** | HYDROCHLORIC ACID |
| **Hazard Class** | 8 |
| **Packing Group** | II |

**TDG**

| | |
|---|---|
| **UN-No** | UN1789 |
| **Proper Shipping Name** | HYDROCHLORIC ACID |
| **Hazard Class** | 8 |
| **Packing Group** | II |

**IATA**

| | |
|---|---|
| **UN-No** | UN1789 |
| **Proper Shipping Name** | Hydrochloric acid |
| **Hazard Class** | 8 |
| **Packing Group** | II |

**IMDG/IMO**

| | |
|---|---|
| **UN-No** | UN1789 |
| **Proper Shipping Name** | Hydrochloric acid |
| **Hazard Class** | 8 |
| **Packing Group** | II |

## 15. REGULATORY INFORMATION

**International Inventories**

| Component | TSCA | DSL | NDSL | EINECS | ELINCS | NLP | PICCS | ENCS | AICS | CHINA | KECL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Water | X | X | - | 231-791-2 | - | | X | - | X | X | X |
| Hydrochloric acid | T | X | - | 231-595-7 | - | | X | X | X | X | KE-20189 X |

**Legend:**
**X - Listed**
**E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.**
**F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.**
**N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.**
**P - Indicates a commenced PMN substance**
**R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.**
**S - Indicates a substance that is identified in a proposed or final Significant New Use Rule**

**T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.**
**XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).**
**Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.**
**Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.**

## U.S. Federal Regulations

**TSCA 12(b)** Not applicable

**SARA 313**

| Component | CAS-No | Weight % | SARA 313 - Threshold Values % |
|---|---|---|---|
| Hydrochloric acid | 7647-01-0 | 35-38 | 1.0 |

**SARA 311/312 Hazardous Categorization**

| | |
|---|---|
| **Acute Health Hazard** | Yes |
| **Chronic Health Hazard** | No |
| **Fire Hazard** | No |
| **Sudden Release of Pressure Hazard** | No |
| **Reactive Hazard** | No |

**Clean Water Act**

| Component | CWA - Hazardous Substances | CWA - Reportable Quantities | CWA - Toxic Pollutants | CWA - Priority Pollutants |
|---|---|---|---|---|
| Hydrochloric acid | X | 5000 lb | - | - |

**Clean Air Act**

| Component | HAPS Data | Class 1 Ozone Depletors | Class 2 Ozone Depletors |
|---|---|---|---|
| Hydrochloric acid | X | | - |

**OSHA**

| Component | Specifically Regulated Chemicals | Highly Hazardous Chemicals |
|---|---|---|
| Hydrochloric acid | - | TQ: 5000 lb |

**CERCLA**
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

| Component | Hazardous Substances RQs | CERCLA EHS RQs |
|---|---|---|
| Hydrochloric acid | 5000 lb | 5000 lb |

**California Proposition 65**
This product does not contain any Proposition 65 chemicals.

**State Right-to-Know**

| Component | Massachusetts | New Jersey | Pennsylvania | Illinois | Rhode Island |
|---|---|---|---|---|---|

| Component | Massachusetts | New Jersey | Pennsylvania | Illinois | Rhode Island |
|---|---|---|---|---|---|
| Hydrochloric acid | X | X | X | X | X |

**U.S. Department of Transportation**

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

**U.S. Department of Homeland Security**

This product contains the following DHS chemicals:

| Component | DHS Chemical Facility Anti-Terrorism Standard |
|---|---|
| Hydrochloric acid | 0 lb STQ (anhydrous); 11250 lb STQ (37% concentration or greater) |

**Other International Regulations**

**Mexico - Grade** No information available

**Canada**

**This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.**

**WHMIS Hazard Class**

D1A Very toxic materials
E Corrosive material

## 16. OTHER INFORMATION

**Prepared By** Regulatory Affairs
Thermo Fisher Scientific
Tel: (412) 490-8929

**Creation Date** 24-Aug-2009

**Print Date** 23-Sep-2009

**Revision Summary** "****", and red text indicates revision

**Disclaimer**

**The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.**

End of MSDS

REVIEWED

DATE: 2012 March 29

# Material Safety Data Sheet

**Creation Date** 03-Feb-2010 **Revision Date** 03-Feb-2010 **Revision Number** 1

## 1. PRODUCT AND COMPANY IDENTIFICATION

**Product Name** **Trichloroethylene**

**Cat No.** **T340-4; T341-4; T341-20; T341-500; T403-4**

**Synonyms** Trichloroethene (Stabilized/Technical/Electronic/Certified ACS)

**Recommended Use** Laboratory chemicals

**Company**
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

**Emergency Telephone Number**
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 703-527-3887

## 2. HAZARDS IDENTIFICATION

**Emergency Overview**

Suspect cancer hazard. May cause cancer. Irritating to eyes and skin. May cause central nervous system effects. Aspiration hazard if swallowed - can enter lungs and cause damage. May cause irritation of respiratory tract. Possible risks of irreversible effects. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

**Appearance** Colorless **Physical State** Liquid **odor** sweet

**Target Organs** Central nervous system (CNS), Eyes, Respiratory system, Kidney, Heart, Liver, Skin, Blood, spleen

**Potential Health Effects**

**Acute Effects**
**Principle Routes of Exposure**

**Eyes** Irritating to eyes.
**Skin** Irritating to skin. May be harmful in contact with skin.
**Inhalation** Inhalation may cause central nervous system effects. May cause irritation of respiratory tract. May be harmful if inhaled.
**Ingestion** Aspiration hazard. May be harmful if swallowed. May cause central nervous system effects. Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea.

**Chronic Effects** May cause cancer. Tumorigenic effects have been reported in experimental animals.. Experiments have shown reproductive toxicity effects on laboratory animals. Possible risks of irreversible effects. May cause adverse liver effects. May cause adverse kidney effects.

See Section 11 for additional Toxicological information.

**Aggravated Medical Conditions** Central nervous system disorders. Cardiovascular. Preexisting eye disorders. Kidney disorders. Liver disorders. Skin disorders.

## 3. COMPOSITION/INFORMATION ON INGREDIENTS

**Haz/Non-haz**

| Component | CAS-No | Weight % |
|---|---|---|
| Trichloroethylene | 79-01-6 | 100 |

## 4. FIRST AID MEASURES

**Eye Contact** Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.

**Skin Contact** Wash off immediately with plenty of water for at least 15 minutes. Obtain medical attention.

**Inhalation** Move to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth resuscitation if victim ingested or inhaled the substance; induce artificial respiration with a respiratory medical device. Get medical attention immediately if symptoms occur.

**Ingestion** Do not induce vomiting. Obtain medical attention.

**Notes to Physician** Treat symptomatically.

## 5. FIRE-FIGHTING MEASURES

**Flash Point** No information available.
**Method** No information available.

**Autoignition Temperature** 410°C / 770°F

**Explosion Limits**
**Upper** 10.5 vol %
**Lower** 8 vol %

**Suitable Extinguishing Media** Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

**Unsuitable Extinguishing Media** No information available.

**Hazardous Combustion Products** No information available.

**Sensitivity to mechanical impact** No information available.
**Sensitivity to static discharge** No information available.

**Specific Hazards Arising from the Chemical**
Thermal decomposition can lead to release of irritating gases and vapors. Containers may explode when heated. Keep product and empty container away from heat and sources of ignition.

**Protective Equipment and Precautions for Firefighters**
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear

**NFPA** **Health** 2 **Flammability** 1 **Instability** 0 **Physical hazards** N/A

## 6. ACCIDENTAL RELEASE MEASURES

**Personal Precautions** Use personal protective equipment. Ensure adequate ventilation. Avoid contact with skin, eyes and clothing.

**Environmental Precautions** Should not be released into the environment.

**Methods for Containment and Clean Up** Soak up with inert absorbent material. Keep in suitable and closed containers for disposal.

## 7. HANDLING AND STORAGE

**Handling** Use only under a chemical fume hood. Wear personal protective equipment. Ensure adequate ventilation. Do not breathe vapors or spray mist. Do not get in eyes, on skin, or on clothing.

**Storage** Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from light.

## 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

**Engineering Measures** Use only under a chemical fume hood. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

**Exposure Guidelines**

| Component | ACGIH TLV | OSHA PEL | NIOSH IDLH |
|---|---|---|---|
| Trichloroethylene | TWA: 10 ppm<br>STEL: 25 ppm | (Vacated) TWA: 50 ppm<br>(Vacated) TWA: 270 mg/m$^3$<br>Ceiling: 200 ppm<br>(Vacated) STEL: 200 ppm<br>(Vacated) STEL: 1080 mg/m$^3$<br>TWA: 100 ppm | IDLH: 1000 ppm |

| Component | Quebec | Mexico OEL (TWA) | Ontario TWAEV |
|---|---|---|---|
| Trichloroethylene | TWA: 269 mg/m$^3$<br>TWA: 50 ppm<br>STEL: 200 ppm<br>STEL: 1070 mg/m$^3$ | TWA: 100 ppm<br>TWA: 535 mg/m$^3$<br>STEL: 1080 mg/m$^3$<br>STEL: 200 ppm | TWA: 10 ppm<br>STEL: 25 ppm |

***NIOSH IDLH:*** *Immediately Dangerous to Life or Health*

**Personal Protective Equipment**

**Eye/face Protection** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166

**Skin and body protection** Wear appropriate protective gloves and clothing to prevent skin exposure

**Respiratory Protection** Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced

## 9. PHYSICAL AND CHEMICAL PROPERTIES

| | |
|---|---|
| **Physical State** | Liquid |
| **Appearance** | Colorless |
| **odor** | sweet |
| **Odor Threshold** | No information available. |
| **pH** | No information available. |
| **Vapor Pressure** | 77.3 mbar @ 20 °C |
| **Vapor Density** | 4.5 (Air = 1.0) |
| **Viscosity** | No information available. |
| **Boiling Point/Range** | 87°C / 188.6°F |
| **Melting Point/Range** | -86°C / -122.8°F |
| **Decomposition temperature °C** | No information available. |
| **Flash Point** | No information available. |
| **Evaporation Rate** | 0.69 (Carbon Tetrachloride = 1.0) |
| **Specific Gravity** | 1.460 |
| **Solubility** | Slightly soluble in water |
| **log Pow** | No data available |
| **Molecular Weight** | 131.39 |
| **Molecular Formula** | C2 H Cl3 |

## 10. STABILITY AND REACTIVITY

| | |
|---|---|
| **Stability** | Light sensitive. Moisture sensitive. |
| **Conditions to Avoid** | Incompatible products. Excess heat. Exposure to light. Exposure to moist air or water. |
| **Incompatible Materials** | Strong oxidizing agents, Strong bases, Metals, Powdered metals |
| **Hazardous Decomposition Products** | Hydrogen chloride gas, Chlorine, Phosgene |
| **Hazardous Polymerization** | Hazardous polymerization does not occur |
| **Hazardous Reactions .** | None under normal processing. |

## 11. TOXICOLOGICAL INFORMATION

**Acute Toxicity**

**Component Information**

| Component | LD50 Oral | LD50 Dermal | LC50 Inhalation |
|---|---|---|---|
| Trichloroethylene | 4290 mg/kg ( Rat ) | 20 g/kg ( Rabbit ) | 8000 ppm ( Rat ) 4 h<br>26300 ppm ( Rat ) 1 h |

| | |
|---|---|
| **Irritation** | Irritating to eyes and skin |
| **Toxicologically Synergistic Products** | No information available. |

### Chronic Toxicity

**Carcinogenicity** The table below indicates whether each agency has listed any ingredient as a carcinogen.

| Component | ACGIH | IARC | NTP | OSHA | Mexico |
|---|---|---|---|---|---|
| Trichloroethylene | A2 | Group 2A | Reasonably Anticipated | X | Not listed |

**ACGIH: (American Conference of Governmental Industrial Hygienists)**
A1 - Known Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Animal Carcinogen
ACGIH: (American Conference of Governmental Industrial Hygienists)
**IARC: (International Agency for Research on Cancer)**
IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans
**NTP: (National Toxicity Program)**
NTP: (National Toxicity Program)
Known - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

**Sensitization** No information available.

**Mutagenic Effects** Mutagenic effects have occurred in humans.

**Reproductive Effects** Experiments have shown reproductive toxicity effects on laboratory animals.

**Developmental Effects** Developmental effects have occurred in experimental animals.

**Teratogenicity** Teratogenic effects have occurred in experimental animals..

**Other Adverse Effects** Tumorigenic effects have been reported in experimental animals.. See actual entry in RTECS for complete information.

**Endocrine Disruptor Information** No information available

## 12. ECOLOGICAL INFORMATION

### Ecotoxicity

. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

| Component | Freshwater Algae | Freshwater Fish | Microtox | Water Flea |
|---|---|---|---|---|
| Trichloroethylene | EC50 96 h 450 mg/L | Not listed | EC50 = 0.81 mg/L 24 h<br>EC50 = 115 mg/L 10 min<br>EC50 = 190 mg/L 15 min<br>EC50 = 235 mg/L 24 h<br>EC50 = 410 mg/L 24 h<br>EC50 = 975 mg/L 5 min | EC50 48 h 2.2 mg/L |

**Persistence and Degradability** No information available

**Bioaccumulation/ Accumulation** No information available

**Mobility** .

| Component | log Pow |
|---|---|

| Component | log Pow |
|---|---|
| Trichloroethylene | 2.29 |

## 13. DISPOSAL CONSIDERATIONS

**Waste Disposal Methods** Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification

| Component | RCRA - U Series Wastes | RCRA - P Series Wastes |
|---|---|---|
| Trichloroethylene - 79-01-6 | U228 | - |

## 14. TRANSPORT INFORMATION

**DOT**

**UN-No** UN1710
**Proper Shipping Name** TRICHLOROETHYLENE
**Hazard Class** 6.1
**Packing Group** III

**TDG**

**UN-No** UN1710
**Proper Shipping Name** TRICHLOROETHYLENE
**Hazard Class** 6.1
**Packing Group** III

**IATA**

**UN-No** UN1710
**Proper Shipping Name** TRICHLOROETHYLENE
**Hazard Class** 6.1
**Packing Group** III

**IMDG/IMO**

**UN-No** UN1710
**Proper Shipping Name** TRICHLOROETHYLENE
**Hazard Class** 6.1
**Packing Group** III

## 15. REGULATORY INFORMATION

**International Inventories**

| Component | TSCA | DSL | NDSL | EINECS | ELINCS | NLP | PICCS | ENCS | AICS | CHINA | KECL |
|---|---|---|---|---|---|---|---|---|---|---|---|

| 15. REGULATORY INFORMATION | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Trichloroethylene | X | X | - | 201-167-4 | - | | X | X | X | X | KE-13680 X |

**Legend:**
**X - Listed**
**E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.**
**F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.**
**N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.**
**P - Indicates a commenced PMN substance**
**R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.**
**S - Indicates a substance that is identified in a proposed or final Significant New Use Rule**
**T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.**
**XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).**
**Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.**
**Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.**

## U.S. Federal Regulations

**TSCA 12(b)** Not applicable

**SARA 313**

| Component | CAS-No | Weight % | SARA 313 - Threshold Values % |
|---|---|---|---|
| Trichloroethylene | 79-01-6 | 100 | 0.1 |

**SARA 311/312 Hazardous Categorization**

| | |
|---|---|
| **Acute Health Hazard** | No |
| **Chronic Health Hazard** | No |
| **Fire Hazard** | No |
| **Sudden Release of Pressure Hazard** | No |
| **Reactive Hazard** | No |

**Clean Water Act**

| Component | CWA - Hazardous Substances | CWA - Reportable Quantities | CWA - Toxic Pollutants | CWA - Priority Pollutants |
|---|---|---|---|---|
| Trichloroethylene | X | 100 lb | X | X |

**Clean Air Act**

| Component | HAPS Data | Class 1 Ozone Depletors | Class 2 Ozone Depletors |
|---|---|---|---|
| Trichloroethylene | X | | - |

**OSHA**
Not applicable

**CERCLA**
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

| Component | Hazardous Substances RQs | CERCLA EHS RQs |
|---|---|---|
| Trichloroethylene | 100 lb | - |

**California Proposition 65**

This product contains the following Proposition 65 chemicals:

| Component | CAS-No | California Prop. 65 | Prop 65 NSRL |
|---|---|---|---|
| Trichloroethylene | 79-01-6 | Carcinogen | 50 µg/day<br>80 µg/day |

**State Right-to-Know**

| Component | Massachusetts | New Jersey | Pennsylvania | Illinois | Rhode Island |
|---|---|---|---|---|---|
| Trichloroethylene | X | X | X | X | X |

### U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

### U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

### Other International Regulations

**Mexico - Grade** No information available

**Canada**

**This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.**

**WHMIS Hazard Class**

D1B Toxic materials
D2A Very toxic materials
D2B Toxic materials

## 16. OTHER INFORMATION

**Prepared By**

Regulatory Affairs
Thermo Fisher Scientific
Tel: (412) 490-8929

| | |
|---|---|
| **Creation Date** | 03-Feb-2010 |
| **Print Date** | 03-Feb-2010 |
| **Revision Summary** | "***", and red text indicates revision |

**Disclaimer**

**The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.**

**End of MSDS**

# Material Safety Data Sheet

**Creation Date** 11-Jun-2009 **Revision Date** 23-Sep-2009 **Revision Number** 1

## 1. PRODUCT AND COMPANY IDENTIFICATION

**Product Name** **Toluene**

**Cat No.** **S80229HPLC; T288-1; T288RS-19; T290-1; T290-1LC; T290-4; T290RS-19; T290RS-28; T290RS-200; T290N2-19; T290SK-1; T290SK-4; T290SS-28; T290SS-50; T290SS-115; T290SS-200; T291-4; T291-4LC; T291RS-200; T291SK-4; T291SS-19; T313-4; T313SK-4; T323-4; T323-20; T324-1; T324-4; T324-20; T324-200; T324-500; T324CU-1300; T324FB-19; T324FB-50; T324FB-115; T324FB-200; T324POP-200; T324POPB-200; T324RB-19; T324RB-115; T324RB-200; T324RS-19; T324RS-28; T324RS-50; T324RS-115; T324RS-200; T324S-4; T324SK-4; T324SS-28; T324SS-50; T324SS-115; T324SS-200; T326F-1GAL; T326P-4; T326S-20; T326S-20LC; T330-4**

**Synonyms** Methylbenzene; Toluol; Phenyl methane (Certified ACS, HPLC, OPTIMA, Laboratory, Histological, Spectranalyzed, Scintanalyzed)

**Recommended Use** Laboratory chemicals

**Company**
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

**Emergency Telephone Number**
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 703-527-3887

## 2. HAZARDS IDENTIFICATION

**DANGER!**

**Emergency Overview**

Flammable liquid and vapor. Causes eye, skin, and respiratory tract irritation. Vapors may cause drowsiness and dizziness. Aspiration hazard if swallowed - can enter lungs and cause damage. Possible risk of harm to the unborn child. May cause adverse kidney effects. May cause adverse liver effects. Danger of serious damage to health by prolonged exposure.

**Appearance** Colorless **Physical State** Liquid **Odor** aromatic

**Target Organs** Eyes, Skin, Respiratory system, Liver, Kidney, Central nervous system (CNS), Blood, spleen

**Potential Health Effects**

**Acute Effects**
**Principle Routes of Exposure**

| | |
|---|---|
| **Eyes** | Irritating to eyes. |
| **Skin** | Irritating to skin. Can be absorbed through skin. May be harmful in contact with skin. |
| **Inhalation** | Irritating to respiratory system. May be harmful if inhaled. May cause drowsiness and dizziness. |
| **Ingestion** | Aspiration hazard if swallowed - can enter lungs and cause damage. May be harmful if swallowed. Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. |

**Chronic Effects** Component substance is listed on California Proposition 65 as a developmental hazard. Experiments have shown reproductive toxicity effects on laboratory animals. May cause adverse liver effects. May cause adverse kidney effects. Danger of serious damage to health by prolonged exposure.

See Section 11 for additional Toxicological information.

**Aggravated Medical Conditions** Central nervous system disorders. Preexisting eye disorders. Kidney disorders. Liver disorders. Skin disorders.

## 3. COMPOSITION/INFORMATION ON INGREDIENTS

**Haz/Non-haz**

| Component | CAS-No | Weight % |
|---|---|---|
| Toluene | 108-88-3 | >95 |

## 4. FIRST AID MEASURES

**Eye Contact** Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.

**Skin Contact** Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

**Inhalation** Move to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth resuscitation if victim ingested or inhaled the substance; induce artificial respiration with a respiratory medical device. Immediate medical attention is required.

**Ingestion** Do not induce vomiting. Call a physician or Poison Control Center immediately.

**Notes to Physician** Treat symptomatically.

## 5. FIRE-FIGHTING MEASURES

| | |
|---|---|
| **Flash Point** | 4°C / 39.2°F |
| **Method** | No information available. |
| **Autoignition Temperature** | 535°C / 995°F |
| **Explosion Limits** | |
| **Upper** | 7.1 vol % |
| **Lower** | 1.1 vol % |

| | |
|---|---|
| **Suitable Extinguishing Media** | Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. Cool closed containers exposed to fire with water spray. |
| **Unsuitable Extinguishing Media** | No information available. |
| **Hazardous Combustion Products** | No information available. |
| **Sensitivity to mechanical impact** | No information available. |
| **Sensitivity to static discharge** | No information available. |

**Specific Hazards Arising from the Chemical**
Flammable. Containers may explode when heated. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back.

**Protective Equipment and Precautions for Firefighters**
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

**NFPA** **Health** 2 **Flammability** 3 **Instability** 0 **Physical hazards** N/A

## 6. ACCIDENTAL RELEASE MEASURES

| | |
|---|---|
| **Personal Precautions** | Use personal protective equipment. Remove all sources of ignition. Take precautionary measures against static discharges. |
| **Environmental Precautions** | Should not be released into the environment. |
| **Methods for Containment and Clean Up** | Soak up with inert absorbent material. Keep in suitable and closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment. |

## 7. HANDLING AND STORAGE

| | |
|---|---|
| **Handling** | Use only under a chemical fume hood. Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation. Keep away from open flames, hot surfaces and sources of ignition. Use only non-sparking tools. Use explosion-proof equipment. Take precautionary measures against static discharges. |
| **Storage** | Keep containers tightly closed in a dry, cool and well-ventilated place. Flammables area. Keep away from heat and sources of ignition. |

## 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

| | |
|---|---|
| **Engineering Measures** | Use only under a chemical fume hood. Ensure that eyewash stations and safety showers are close to the workstation location. Use explosion-proof electrical/ventilating/lighting/equipment. |

**Exposure Guidelines**

| Component | ACGIH TLV | OSHA PEL | NIOSH IDLH |
|---|---|---|---|
| Toluene | TWA: 20 ppm | (Vacated) TWA: 375 mg/m$^3$<br>(Vacated) TWA: 100 ppm<br>Ceiling: 300 ppm<br>(Vacated) STEL: 150 ppm<br>(Vacated) STEL: 560 mg/m$^3$<br>TWA: 200 ppm | IDLH: 500 ppm<br>TWA: 375 mg/m$^3$<br>TWA: 100 ppm<br>STEL: 150 ppm<br>STEL: 560 mg/m$^3$ |

| Component | Quebec | Mexico OEL (TWA) | Ontario TWAEV |
|---|---|---|---|
| Toluene | TWA: 188 mg/m$^3$<br>TWA: 50 ppm<br>Skin | TWA: 188 mg/m$^3$<br>TWA: 50 ppm | TWA: 20 ppm |

***NIOSH IDLH:*** *Immediately Dangerous to Life or Health*

**Personal Protective Equipment**

**Eye/face Protection** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

**Skin and body protection** Wear appropriate protective gloves and clothing to prevent skin exposure.

**Respiratory Protection** Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

## 9. PHYSICAL AND CHEMICAL PROPERTIES

| | |
|---|---|
| **Physical State** | Liquid |
| **Appearance** | Colorless |
| **Odor** | aromatic |
| **Odor Threshold** | No information available. |
| **pH** | Not applicable |
| **Vapor Pressure** | 29 mbar @ 20 °C |
| **Vapor Density** | 3.1 (Air = 1.0) |
| **Viscosity** | 0.6 mPa.s @ 20 °C |
| **Boiling Point/Range** | 111°C / 231.8°F@ 760 mmHg |
| **Melting Point/Range** | -95°C / -139°F |
| **Decomposition temperature °C** | No information available. |
| **Flash Point** | 4°C / 39.2°F |
| **Evaporation Rate** | 2.4 (Butyl Acetate = 1.0) |
| **Specific Gravity** | 0.866 |
| **Solubility** | Insoluble in water |
| **log Pow** | No data available |
| **Molecular Weight** | 92.14 |
| **Molecular Formula** | C7 H8 |

## 10. STABILITY AND REACTIVITY

| | |
|---|---|
| **Stability** | Stable under normal conditions. |
| **Conditions to Avoid** | Incompatible products. Excess heat. |
| **Incompatible Materials** | Strong oxidizing agents, Strong acids |
| **Hazardous Decomposition Products** | Carbon monoxide (CO), Carbon dioxide ($CO_2$) |
| **Hazardous Polymerization** | Hazardous polymerization does not occur. |
| **Hazardous Reactions .** | None under normal processing.. |

## 11. TOXICOLOGICAL INFORMATION

**Acute Toxicity**

**Component Information**

| Component | LD50 Oral | LD50 Dermal | LC50 Inhalation |
|---|---|---|---|
| Toluene | 636 mg/kg ( Rat ) | 12124 mg/kg ( Rat )<br>8390 mg/kg ( Rabbit ) | 26700 ppm ( Rat ) 1 h<br>12.5 mg/L ( Rat ) 4 h |

**Irritation** Irritating to eyes, respiratory system and skin

**Toxicologically Synergistic Products** No information available.

**Chronic Toxicity**

**Carcinogenicity** There are no known carcinogenic chemicals in this product

**Sensitization** No information available.

**Mutagenic Effects** Not mutagenic in AMES Test

**Reproductive Effects** Experiments have shown reproductive toxicity effects on laboratory animals.

**Developmental Effects** Developmental effects have occurred in experimental animals.

**Teratogenicity** Possible risk of harm to the unborn child.

**Other Adverse Effects** See actual entry in RTECS for complete information.

**Endocrine Disruptor Information** No information available

## 12. ECOLOGICAL INFORMATION

**Ecotoxicity**

. Do not empty into drains.

| Component | Freshwater Algae | Freshwater Fish | Microtox | Water Flea |
|---|---|---|---|---|
| Toluene | EC50 96 h >433 mg/L | Not listed | EC50 = 19.7 mg/L 30 min | EC50 48 h 11.3 mg/L<br>EC50 48 h 310 mg/L<br>EC50 48 h 11.3 mg/L |

**Persistence and Degradability** No information available

**Bioaccumulation/ Accumulation** No information available

**Mobility** .

| Component | log Pow |
|---|---|
| Toluene | 2.65 |

## 13. DISPOSAL CONSIDERATIONS

**Waste Disposal Methods** Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

| Component | RCRA - U Series Wastes | RCRA - P Series Wastes |
|---|---|---|
| Toluene - 108-88-3 | U220 | - |

## 14. TRANSPORT INFORMATION

**DOT**

| | |
|---|---|
| **UN-No** | UN1294 |
| **Proper Shipping Name** | Toluene |
| **Hazard Class** | 3 |
| **Packing Group** | II |

**TDG**

| | |
|---|---|
| **UN-No** | UN1294 |
| **Proper Shipping Name** | TOLUENE |
| **Hazard Class** | 3 |
| **Packing Group** | II |

**IATA**

| | |
|---|---|
| **UN-No** | UN1294 |
| **Proper Shipping Name** | Toluene |
| **Hazard Class** | 3 |
| **Packing Group** | II |

**IMDG/IMO**

| | |
|---|---|
| **UN-No** | UN1294 |
| **Proper Shipping Name** | Toluene |
| **Hazard Class** | 3 |
| **Packing Group** | II |

## 15. REGULATORY INFORMATION

**International Inventories**

| Component | TSCA | DSL | NDSL | EINECS | ELINCS | NLP | PICCS | ENCS | AICS | CHINA | KECL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Toluene | X | X | - | 203-625-9 | - | | X | X | X | X | KE-33936 X |

**Legend:**

**X - Listed**
**E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.**
**F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.**
**N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.**
**P - Indicates a commenced PMN substance**
**R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.**
**S - Indicates a substance that is identified in a proposed or final Significant New Use Rule**
**T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.**
**XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).**
**Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.**
**Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.**

## U.S. Federal Regulations

**TSCA 12(b)** Not applicable

**SARA 313**

| Component | CAS-No | Weight % | SARA 313 - Threshold Values % |
|---|---|---|---|
| Toluene | 108-88-3 | >95 | 1.0 |

**SARA 311/312 Hazardous Categorization**

| | |
|---|---|
| **Acute Health Hazard** | No |
| **Chronic Health Hazard** | No |
| **Fire Hazard** | Yes |
| **Sudden Release of Pressure Hazard** | No |
| **Reactive Hazard** | No |

**Clean Water Act**

| Component | CWA - Hazardous Substances | CWA - Reportable Quantities | CWA - Toxic Pollutants | CWA - Priority Pollutants |
|---|---|---|---|---|
| Toluene | X | 1000 lb | X | X |

**Clean Air Act**

| Component | HAPS Data | Class 1 Ozone Depletors | Class 2 Ozone Depletors |
|---|---|---|---|
| Toluene | X | | - |

**OSHA**
Not applicable

**CERCLA**
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

| Component | Hazardous Substances RQs | CERCLA EHS RQs |
|---|---|---|
| Toluene | 1000 lb | - |

**California Proposition 65**
This product contains the following Proposition 65 chemicals:

| Component | CAS-No | California Prop. 65 | Prop 65 NSRL |
|---|---|---|---|
| Toluene | 108-88-3 | Developmental | - |

**State Right-to-Know**

| Component | Massachusetts | New Jersey | Pennsylvania | Illinois | Rhode Island |
|---|---|---|---|---|---|
| Toluene | X | X | X | X | X |

### U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

### U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

### Other International Regulations

**Mexico - Grade** Serious risk, Grade 3

**Canada**

**This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.**

**WHMIS Hazard Class**
B2 Flammable liquid
D2A Very toxic materials
D2B Toxic materials

## 16. OTHER INFORMATION

**Prepared By** Regulatory Affairs
Thermo Fisher Scientific
Tel: (412) 490-8929

**Creation Date** 11-Jun-2009

**Print Date** 23-Sep-2009

**Revision Summary** "***", and red text indicates revision

**Disclaimer**

**The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.**

**End of MSDS**

Material Safety Data Sheet

Poly(vinyl chloride), high molecular weight

MSDS# 76785

## Section 1 - Chemical Product and Company Identification

| | |
|---|---|
| MSDS Name: | Poly(vinyl chloride), high molecular weight |
| Catalog Numbers: | AC183320000, AC183320010, AC183320250, AC183325000 |
| Synonyms: | PVC; Ethylene, chloro-, polymer; Chlorethene homopolymer; Chlorethylene polymer; Vinyl chloride polymer; Poly(chlorethylene) |

| | |
|---|---|
| Company Identification: | Acros Organics BVBA<br>Janssen Pharmaceuticalaan 3a<br>2440 Geel, Belgium |
| Company Identification: (USA) | Acros Organics<br>One Reagent Lane<br>Fair Lawn, NJ 07410 |
| For information in the US, call: | 800-ACROS-01 |
| For information in Europe, call: | +32 14 57 52 11 |
| Emergency Number, Europe: | +32 14 57 52 99 |
| Emergency Number US: | 201-796-7100 |
| CHEMTREC Phone Number, US: | 800-424-9300 |
| CHEMTREC Phone Number, Europe: | 703-527-3887 |

## Section 2 - Composition, Information on Ingredients

---

| | |
|---|---|
| CAS#: | 9002-86-2 |
| Chemical Name: | Poly(vinyl chloride) |
| %: | 100 |
| EINECS#: | 206-625-7 |

---

| | |
|---|---|
| Hazard Symbols: | None listed |
| Risk Phrases: | None listed |

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Caution! Cancer suspect agent. The toxicological properties of this material have not been fully investigated. May cause eye and skin irritation. May cause respiratory and digestive tract irritation. Target Organs: None.

### Potential Health Effects

| | |
|---|---|
| Eye: | May cause eye irritation. |
| Skin: | May cause skin irritation. |
| Ingestion: | May cause irritation of the digestive tract. |
| Inhalation: | May cause respiratory tract irritation. |
| Chronic: | Experimental carcinogen. Chronic inhalation of dust can cause pulmonary damage, blood effects, and abnormal liver function. |

## Section 4 - First Aid Measures

| | |
|---|---|
| Eyes: | Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately. |
| Skin: | Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. |

| | |
|---|---|
| Ingestion: | If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately. |
| Inhalation: | Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid. |
| Notes to Physician: | |

## Section 5 - Fire Fighting Measures

| | |
|---|---|
| General Information: | As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. |
| Extinguishing Media: | Use agent most appropriate to extinguish fire. Use water spray, dry chemical, carbon dioxide, or appropriate foam. |
| Autoignition Temperature: | 435 deg C ( 815.00 deg F) |
| Flash Point: | Not available |
| Explosion Limits: Lower: | Not available |
| Explosion Limits: Upper: | Not available |
| NFPA Rating: | health: 1; flammability: 1; instability: 0; |

## Section 6 - Accidental Release Measures

| | |
|---|---|
| General Information: | Use proper personal protective equipment as indicated in Section 8. |
| Spills/Leaks: | Clean up spills immediately, observing precautions in the Protective Equipment section. Avoid generating dusty conditions. Provide ventilation. Cover with dry earth, dry sand, or other non-combustible material followed with plastic sheet to minimize spreading and contact with water. |

## Section 7 - Handling and Storage

| | |
|---|---|
| Handling: | Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation. |
| Storage: | Keep away from heat and flame. Keep away from sources of ignition. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances. Store protected from light. |

## Section 8 - Exposure Controls, Personal Protection

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| Poly(vinyl chloride) | 1 mg/m3 (respirable fraction) | none listed | none listed |

OSHA Vacated PELs: Poly(vinyl chloride): None listed

Engineering Controls:

Use adequate ventilation to keep airborne concentrations low.

Exposure Limits

Personal Protective Equipment

| | |
|---|---|
| Eyes: | Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166. |
| Skin: | Wear appropriate protective gloves to prevent skin exposure. |
| Clothing: | Wear appropriate protective clothing to prevent skin exposure. |
| Respirators: | A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use. |

## Section 9 - Physical and Chemical Properties

Physical State: Powder

Color: Off - White Powder
Odor: None reported.
pH: Not available
Vapor Pressure: Not available
Vapor Density: Not available
Evaporation Rate: Not available
Viscosity: Not available
Boiling Point: Not available
Freezing/Melting Point: Not available
Decomposition Temperature: Not available
Solubility in water: Not available
Specific Gravity/Density: 1.4000g/cm3
Molecular Formula:
Molecular Weight:

## Section 10 - Stability and Reactivity

| | |
|---|---|
| Chemical Stability: | Reacts violently with F2. Ordinary temperatures cause slow dehalogenation producing hydrogen chloride. |
| Conditions to Avoid: | Incompatible materials, light, dust generation, excess heat, strong oxidants. |
| Incompatibilities with Other Materials | Strong oxidizing agents. |
| Hazardous Decomposition Products | Hydrogen chloride, phosgene, carbon monoxide, carbon dioxide. |
| Hazardous Polymerization | May occur. |

## Section 11 - Toxicological Information

| | |
|---|---|
| RTECS#: | CAS# 9002-86-2: KV0350000 |
| LD50/LC50: | RTECS: Not available. |
| Carcinogenicity: | Poly(vinyl chloride) - IARC: Group 3 (not classifiable) |
| Other: | See actual entry in RTECS for complete information. |

## Section 12 - Ecological Information

Not available

## Section 13 - Disposal Considerations

Dispose of in a manner consistent with federal, state, and local regulations.

## Section 14 - Transport Information

US DOT
Shipping Name: Not regulated as a hazardous material
Hazard Class:
UN Number:
Packing Group:
Canada TDG
Shipping Name: Not available
Hazard Class:
UN Number:
Packing Group:

## Section 15 - Regulatory Information

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:Not available

Risk Phrases:

Safety Phrases:

S 24/25 Avoid contact with skin and eyes.

S 28A After contact with skin, wash immediately with plenty of water.

S 37 Wear suitable gloves.

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

WGK (Water Danger/Protection)

CAS# 9002-86-2: 0

Canada

CAS# 9002-86-2 is listed on Canada's DSL List

Canadian WHMIS Classifications: Not available

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

CAS# 9002-86-2 is not listed on Canada's Ingredient Disclosure List.

US Federal

TSCA

CAS# 9002-86-2 is listed on the TSCA Inventory.

## Section 16 - Other Information

MSDS Creation Date: 12/01/1998

Revision #6 Date 7/20/2009

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantibility or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential, or exemplary damages howsoever arising, even if the company has been advised of the possibility of such damages.

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## Attachment D

## HASP Revision History

**Site Health and Safety Plan**
**Site I OU II – Bethpage**
**Revision History**

| Revision No. | Revision Date | Approved By (Initials) | Changes, Discussion |
|---|---|---|---|
| Rev. 0 | 05/21/2012 | | |
| | | | |
| | | | |
| | | | |
| | | | |

## Attachment E

## Community Air Monitoring Plan

## Community Air Monitoring Plan

The constituents of concern at the Bethpage site are volatile organic compounds (VOCs). VOCs will be monitored using a photo-ionization detector (PID) with a 10.2 eV or 10.6 eV lamp. Particulates will be monitored using a particulate air monitor equipped with a micro-processor to measure real-time measurements of airborne particulate concentrations in micrograms per cubic meter ($\mu g/m^3$).

Real-time air monitoring field logs will be maintained to allow for future interpretation of the logged data. Site conditions, weather conditions, work activities, implemented engineering controls, and periodic real-time VOC and total particulate readings will be recorded on field logs. Copies of all field logs will be available for review on a daily basis.

### VOC Monitoring, Response Levels, and Actions

VOCs will be monitored at the upwind and downwind perimeter of the site on a continuous basis or as otherwise specified. Upwind concentrations will be measured to establish site specific background concentrations. In the event of minimal wind or frequent changes in wind direction, multiple locations will be monitored (i.e., three monitoring locations surrounding the work area).

Monitoring instrumentation will include a real-time PID monitor for VOCs equipped with a 10.2-eV or 10.6 eV lamp, which will be calibrated daily with a 100 parts per million (ppm) isobutylene air standard. Monitoring will be continuously logged by each of the air monitoring instruments during the course of daily operations and each instrument will have an visible light and telemetry/pager system to indicate when an action level has been exceeded. Each air monitoring instrument will be continuously downloaded and saved electronically to a dedicated computer located on-site. Each 15 minute average reading will be recorded during working hours along with the date, time, sampling location, wind direction, and weather conditions.

The Vapor Emission Response Plan describes the action levels for perimeter VOC air monitoring and the associated responses to each level.

**Table E-1**
**VOC Monitoring Response Level Actions**

| Action Level | Response |
|---|---|
| >5 ppm above background for 15-minute average | • Temporarily halt work activities<br>• Continue monitoring<br>• If VOC levels decrease (per instantaneous readings) below 5 ppm over background, work activities can resume |
| Persistent levels >5 ppm over background <25 ppm | • Halt work activities<br>• Identify source of vapors<br>• Corrective action to abate emissions<br>• Continue monitoring<br>• Resume work activities if VOC levels 200 feet downwind of the property boundary or half the distance to the nearest potential receptor is <5 ppm for a 15-minute average |
| If VOC levels are >25 ppm at the perimeter of the work area, activities must be shutdown | |

## Particulate Monitoring, Response Levels, and Actions

Particulate concentrations will be monitored at the upwind and downwind perimeter of the site on a continuous basis or as otherwise specified. Upwind concentrations will be measured to establish site-specific background concentrations. In the event of minimal wind or frequent changes in wind direction, multiple locations will be monitored (i.e., three monitoring locations surrounding the work area).

Particulate monitoring will be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. Each particulate monitor will be calibrated daily with a filtered air sample. Each air monitoring instrument will be continuously downloaded and saved electronically to a dedicated computer located on-site.

The table below describes the action levels for perimeter particulate air monitoring and the associated responses to each level.

**Table E-2**
**Particulate Monitoring Response Level Actions**

| Action Level | Response |
|---|---|
| Downwind particulate concentrations 100 ug/$m^3$ greater than upwind particulate monitor sustained over 15 minute average | Dust suppression techniques are employed |
| Downwind particulate concentrations 150 ug/$m^3$ greater than upwind particulate monitor sustained over 15 minute average | Work halted and dust suppression techniques evaluated. Work continues once dust suppression techniques are proven successful |

## Major Vapor Emission Response Plan

Upon activation, the following activities will be undertaken:

1. The local police authorities will immediately be contacted by the SSO and advised of the situation;

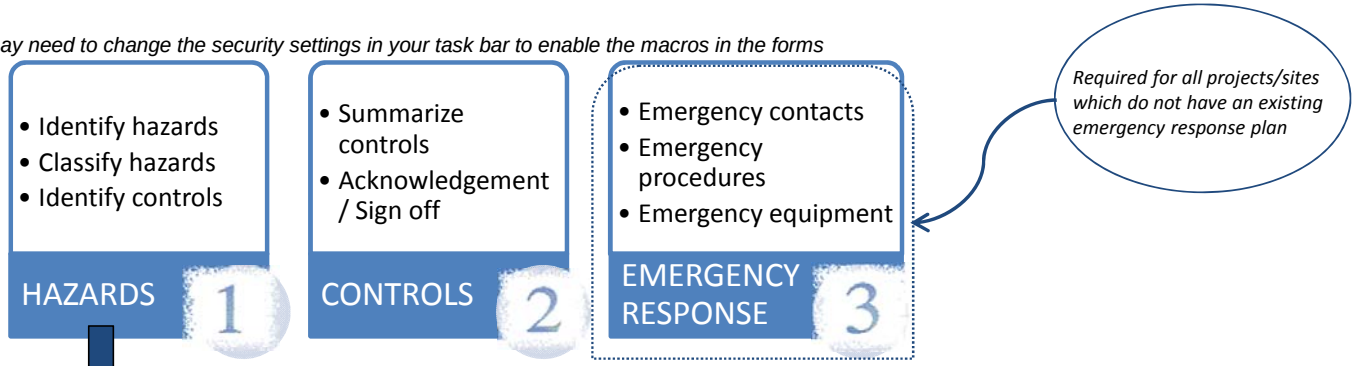
2. Frequent air monitoring will be conducted at 30 minute intervals within the 20 Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the SSO; and

3. All Emergency contacts will go into effect as appropriate.

# S3NA-209-FM TASK HAZARD ANALYSIS

**This THA (worksheets 1 & 2) must be completed for all field work.**

***you may need to change the security settings in your task bar to enable the macros in the forms*




## Hazard Identification

- **Natural (biological)** – bacteria, viruses, insects, plants, birds, and animals
- **Chemical** – exposure to chemical toxins, acute or chronic, by way of inhalation, injection, ingestion or absorption
- **Physical** – slipping/tripping, being struck by moving objects, repetitive movement, strains from lifting
- **Environmental** – extreme heat or cold, noise, vibrations, magnetic fields, pressure extremes and air quality
- **Psychosocial** – stress, violence

## Hazard Classification

- Considers the potential severity of the outcome
- Considers the likelihood of the occurrence
- Used to prioritize and determine extent of required controls

## Controls

- **Elimination (first)** – choose a different process; modify an existing process; substitute with less hazardous substance
- **Engineering Controls (second)** – physically alter the plant or equipment design in order to circumvent possible hazards; place guards on machinery
- **Administrative Controls (third)** – change the job procedure and/or process; limit the amount of time an individual is in a hazardous environment through job rotation
- **Personal Protective Equipment (last option)** – provide employees with direct physical protection while working in a hazardous environment

# S3NA-209-FM TASK HAZARD ANALYSIS

| | | | |
|---|---|---|---|
| RESOLUTION CONSULTANTS | Project Name: NWIRP, Bethpage | Project Number: 0888813596 | Client: Dept of Navy |
| | Supervisor: John Knopf | Project Manager: Brian Caldwell | Location: Bethpage, New York |
| | THA Developed By: J. Parillo | | Date: May 2015 |
| TASK HAZARD ANALYSIS | Task Name: Environment Program Support - Drilling Oversight | Regularity of Task: One-time ☑ | Routine ☐ |

| | Job Event Sequence (List the major steps of the individual task) | Hazards (List primary hazards) | Hazard Classification: Severity | Probability | Risk Level | Hazard Classification | Controls (List controls that Resolution Consultants will implement) |
|---|---|---|---|---|---|---|---|
| 1 | Driving to/from/on Site | Vehicular Incident | 3 | 3 | 6 | Medium | Practice defensive driving. Park vehicle in safe parking locations. |
| | | -Injury | | | | | Slowly exit from parking spaces; Seek eye contact with other drivers or pedestrians. |
| | | -Property Damage | | | | | Before changing lanes, signal well in advance, check mirrors and over shoulder |
| | | -Vehicle Damage | | | | | Maintain safe distances behind vehicles and stay out of other vehicles' blind spots. |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| 2 | Oversight Activities | Slips/Trips/Falls | 2 | 4 | 6 | Medium | Wear proper PPE (Steel Toe Boots), Jobsite housekeeping (Extension cords/hoses). |
| | | Biological Hazards | 4 | 1 | 5 | Low | Inspect area prior to beginning work, wear proper PPE (gloves). |
| | | Sun Burn | 2 | 3 | 5 | Low | Wear proper long clothing and sun screen as necessary |
| | | Bug bites (ticks, mosquitoes) | 3 | 4 | 7 | Medium | Wear proper long clothing and bug repellant as necessary. Perform tick check at the end of e |
| | | Falling Object | 4 | 3 | 7 | Medium | Wear proper PPE (Hard hat, boots, hearing protection, safety glasses) |
| | | Chemical Exposure | 2 | 2 | 4 | Low | Wear proper PPE (Gloves, boots, hard hat, hearing protection, safety glasses) |
| | | Working Alone or Remotely | 2 | 2 | 4 | Low | When possible, work with others, notify supervisor of working hours and location. |
| | | Heavy Equipment | 3 | 3 | 6 | Medium | Use spotters when moving equipment, set up work stations outside of the radius of equipmen |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

## Hazard Classification Guidelines

| Probability: | How likely is it to happen? |
|---|---|
| Very Likely | Likelihood of incident happening often during course of the work activity |
| Likely | Likelihood of incident occurring sometime during the work activity |
| Possibly | Possibility of incident occurring sometime during the work activity |
| Rarely | Incident will rarely occur during the work activity |
| Unlikely | Incident will probably not occur during the work activity |

Hazard Classification:

- HIGH
- MED
- LOW

| Severity | | Probability: Very Likely 5 | Likely 4 | Possibly 3 | Rarely 2 | Unlikely 1 |
|---|---|---|---|---|---|---|
| Catastrophic | 5 | 10 | 9 | 8 | 7 | 6 |
| Major | 4 | 9 | 8 | 7 | 6 | 5 |
| Moderate | 3 | 8 | 7 | 6 | 5 | 4 |
| Minor | 2 | 7 | 6 | 5 | 4 | 3 |
| Insignificant | 1 | 6 | 5 | 4 | 3 | 2 |

# S3NA-209-FM TASK HAZARD ANALYSIS

| | | | |
|---|---|---|---|
| RESOLUTION CONSULTANTS | Project Name: NWIRP, Bethpage | Project Number: 0888813596 | Client: Dept of Navy |
| | Supervisor: John Knopf | Project Manager: Brian Caldwell | Location: Bethpage, New York |
| | THA Developed By: J. Parillo | | Date: May 2015 |

**SUMMARY OF CONTROLS**

Task Name: Environment Program Support - Drilling Oversight

Regularity of Task: One-time ☐ Routine ☑

**Personal Protective Equipment** (*check all that apply*)

- ☑ CSA/ANSI Safety-Toed Boots (Leather or Rubber)
- ☑ CSA/ANSI Safety Glasses or Goggles
- ☑ CSA/ANSI-approved Hard Hat
- ☑ CSA/ANSI Type II/III Reflective Traffic Safety Vest
- ☑ Hearing protection
- ☑ NIOSH half or full face air purifying respirator w./P100, OV cartridges (change out daily if used)
- ☐
- ☐
- ☐
- ☐

**Air Monitoring** (reference HASP monitoring plan)

☐ No air monitoring required ☑ Air monitoring required (*see procedures below*)

| Parameter | Location/Monitoring Interval | Response/Action Levels | Response Activity |
|---|---|---|---|
| VOCs by PID | BZ, continuous | <1 ppm | level d |
| VOCs by PID | BZ, continuous | >1 ppm | Upgrade level C sample 15 min intervals with benzene and vinyl chloride draeger tubes of <1 ppm discontinue respirator use if either is >1.0 ppm - exit work area and contact SSO |
| VOCs by PID | BZ, continuous | >=15 ppm | cease work exit area call SSO |
| | | | |

| Required Training (associated with this THA) | Key SOPs (associated with this THA) | | Client & Other Requirements |
|---|---|---|---|
| 1 OSHA HAZWOPER 40-Hour | 5-001 Safe Work Standards & Rules | 5-313 Protection Against Ticks and Plants | All required site security clearance |
| 2 | 5-208 PPE | 5-314 Working Alone and Remote | |
| 3 | 5-209 Hazard Assessment and Project Planning | 5-406 - Electrical Lines Overhead | |
| 4 | 5-210 Project Safety Meetings | 5-417 - Utilities Underground | |
| 5 | 5-306 Highway and Road Work | 5-405 Drilling Boring and Direct Push | |
| 6 | 5-307 Housekeeping Worksite | | |

**Acknowledgement / Signatures**

Project Manager / Supervisor (signature): Date:

| Name | Signature | Company | Date | Name | Signature | Company | Date |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

# S3NA-209-FM TASK HAZARD ANALYSIS

| | | | |
|---|---|---|---|
| RESOLUTION CONSULTANTS | Project Name: NWIRP, Bethpage | Project Number: 0888813596 | Client: Dept of Navy |
| | Supervisor: John Knopf | Project Manager: Brian Caldwell | Location: Bethpage, New York |
| | THA Developed By: J. Parillo | | Date: May 2015 |
| EMERGENCY RESPONSE PLAN | Task Name: Environment Program Support - Drilling Oversight | Regularity of Task: One-time ☑ | Routine ☐ |

**Check-in Procedures**

| Check-in Times | Check-in Person | Phone Number | Cell Phone Number |
|---|---|---|---|
| | | | |
| Alternate: | | | |

**Emergency Coordinators / Key Personnel**

| Name | Title | Phone Number | Cell Phone Number |
|---|---|---|---|
| | | | |
| Brian Caldwell | CTO Manager | 865-693-3623 | 865-803-6295 |
| John Knopf | LANT CLEAN SH&E Manager | 901-369-0576 | 901-451-1464 |
| Eleanor Vivaudou | Field Lead | 845-425-4980 | 914-227-3942 |
| | | | |
| | Incident Reporting Line (BY THE END OF THE SHIFT) | | |
| Al Taormina | Client Point of Contact (Base) | 516 346 0344 | 516 702 5861 |
| Lora Fly | Client Contact (RPM) | 757-341-2012 | |
| | | | |

**Emergency Agencies / Public Utilities**

| Name | Type | Details | Phone Number |
|---|---|---|---|
| Police | Police | Emergencies | 911 |
| Fire | Fire | Emergencies | 911 |
| Ambulance | Medical | Emergencies | 911 |
| | | | |
| St. Joseph Hospital | Nearest Hospital / Clinic (off-base) | 4295 Hempstead Turnpike, Bethpage, NY | 516-520-2301 |
| | Poison Control Center | | 800-222-1222 |
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**Emergency Equipment & Supplies**

- ☑ First Aid Kit - Type:
- ☐ Blankets / Survival:
- ☐ Fire Extinguishers Type:
- ☑ Communication Device
- ☐ Vehicle Safety Equipment
- ☑ Eye Wash
- ☐ Spill Kit
- ☐ Other:

**Other Emergency Plan Details**