FACILITY INVESTIGATION WORK PLAN
SDG&E SOUTH BAY POWER PLANT
CHULA VISTA, CALIFORNIA

by

Haley & Aldrich, Inc.
San Diego, California

for

San Diego Gas & Electric
San Diego, California

File No. 29197-013
08 June 2005

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08 June 2005
File No. 29197-013

Ms. Violeta Mislang
California Environmental Protection Agency
Department of Toxic Substances Control
State Regulatory Program Division
5796 Corporate Avenue
Cypress, CA 90630

Subject: Facility Investigation Work Plan
South Bay Power Plant
Chula Vista, California

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Dear Ms. Mislang:

Haley & Aldrich, Inc., on behalf of San Diego Gas & Electric (SDG&E), is pleased to provide this Facility Investigation Work Plan (Work Plan) to the Department of Toxic Substances Control (DTSC). This Work Plan has been submitted in response to comments provided by the DTSC to SDG&E in a letter dated 11 February 2003. This Work Plan also contains investigation activities addressed to the current owner/operator (Port of San Diego / Duke Energy) related to specific comments from the DTSC for which they are responsible, regarding their decommissioning and remediation efforts at the North Tank Farm portion of the facility.

Please contact the undersigned at 619.280.9210 or Barbara Montgomery of SDG&E at 858.547.3330 if you have any questions regarding this document.

Sincerely yours,
HALEY & ALDRICH, INC.

Robert L. Manriquez, REA
Sr. Geologist, PG # 7407

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cc: Barbara Montgomery (SDG&E), David Barrett (SDG&E), Bob Howard (Latham & Watkins), Todd Sostek (SDG&E), Bill Hays (Port of San Diego), Kathy Woodard (Duke Energy)

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1. INTRODUCTION

This Facility Investigation (FI) Work Plan has been prepared for San Diego Gas & Electric (SDG&E) by Haley & Aldrich, Inc. (Haley & Aldrich) for the South Bay Power Plant (SBPP) located at 990 Bay Boulevard, Chula Vista, California (see Figure 1).

1.1 Purpose

The scope of this Work Plan includes activities to address solid waste management units (SWMUs) and areas of concern (AOCs) identified by the California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC) in their 16 July 2004 letter and its attachment (A) (see Section 4.1). In addition, the DTSC is currently in negotiations with SDG&E regarding the issuance of a Corrective Action Consent Agreement (CACA). The CACA will formalize the corrective action activities and identify SWMUs/AOCs on the Site that require further investigation.

This FI Work Plan details the investigations deemed necessary to adequately determine the nature and extent of potential releases of hazardous waste or constituents from the SWMUs/AOCs for which insufficient data exist. Furthermore, the FI Work Plan details the gathering of other necessary data for assessing the risk to human health and the environment, and if necessary, for supporting a Corrective Measures Study (CMS), Remedy Selection and Corrective Measures Implementation (CMI).

1.2 Organization of Report

This FI Work Plan is organized in accordance with the DTSC's general guidance documents, as follows:

- Section 1: Introduction
- Section 2: Investigation Objectives
- Section 3: Project Management
- Section 4: Facility Background
- Section 5: Field Investigation
- Section 6: Quality Assurance and Quality Control
- Section 7: Data Management

In addition, references, tables, figures, and appendices are presented at the end of this document to support the various sections.

2. INVESTIGATION OBJECTIVES

2.1 Project Objective

SWMUs/AOCs have been identified by the DTSC to determine the potential risk to human health and the environment. The project objective is to collect data for which there is currently insufficient data on the current nature and extent of potential contamination to allow an assessment of potential impacts.

2.2 Data Quality Objectives

The primary data quality objective is to obtain representative soil and groundwater quality data to allow an assessment of potential chemical impacts at specific SWMUs/AOCs.

A secondary data quality objective is to gather data on the soil stratigraphy, which may be used to assess migration potential and support the design of follow-on investigations.

The specific data quality objectives for each SWMU/AOC are presented in Table I.

3. PROJECT MANAGEMENT

3.1 Project Organization

The project organization is shown on Figure 2. The qualifications of the project team are briefly presented below.

3.1.1 SDG&E

SDG&E's project coordinator will be Ms. Barbara Montgomery.

3.1.2 Haley & Aldrich

Haley & Aldrich has been retained by SDG&E to act as their environmental consultant for the project. Haley & Aldrich's project team are as follows:

Project Manager – Mehdi Miremadi

The Haley & Aldrich project manager will be Mr. Mehdi Miremadi, a principal Hydrologist with Haley & Aldrich. As Project Manager, Mr. Miremadi will be responsible for the overall technical, administrative, and budget control of the project and will assist in performing many of the project tasks. He will be the Haley & Aldrich main point of contact on this project. Mr. Miremadi has a Bachelor's degree in chemical engineering and a Master's degree in hydrology. He has 25 years of environmental consulting, engineering, and project management experience. He has successfully fulfilled technical roles on projects involving environmental assessments, intrusive investigations, risk assessment, and remediation.

Registered Geologist – Robert Manriquez, R.G. REA

Mr. Manriquez will be the project geologist responsible for design and implementation of the field sampling program, data evaluation, and report preparation. He is a California Registered Geologist and Registered Environmental Assessor. He has over 18 years of project experience in the environmental industry and has managed and implemented all aspects of Phase I, II, and III environmental investigations. He has worked with local and state regulatory oversight agencies including the San Diego County Department of Environmental Health (DEH) Site Assessment and Mitigation (SAM) Division, Los Angeles and San Diego Regions of the Regional Water Quality Control Board (RWQCB), and the DTSC.

Field Engineer – Nidal Samara

Mr. Samara has a B.S. degree in environmental engineering and has successfully overseen numerous field investigations including investigations at three Superfund sites and numerous industrial facilities. He is well versed in current best practice with respect to field procedures and sampling quality control and health and safety.

Data Validation – Denis Conley

Mr. Conley will perform the data validation. Mr. Conley has more than 18 years of environmental consulting experience. He has a B.S. degree in applied chemistry and a B.A. degree in biology. Mr. Conley has expertise in the remediation and/or decontamination of structures, surface and subsurface soils, and groundwater impacted with polychlorinated biphenyls (PCBs), dioxins/furans, spent chlorinated solvents, herbicides and pesticides, and hazardous petroleum distillates. Mr. Conley has served as adjunct faculty with the Rochester Institute of Technology's (RIT) Department of Environmental Management in Rochester, New York, conducting lecture and laboratory courses in environmental chemistry and microbiology for undergraduate, graduate, and continuing education students.

Drilling Subcontractor

Haley & Aldrich uses a number of pre-approved drilling contractors who are experienced in environmental soil investigations and with whom we have subcontract agreements and work experience. Haley and Aldrich will obtain competitive bids from these contractors for the scope of work detailed in this Work Plan. Based on cost and availability, an appropriately qualified and experienced drilling subcontractor will be selected.

Analytical Laboratory – American Environmental Testing Laboratory

Laboratory analysis of collected soil and groundwater samples will be performed by American Environmental Testing Laboratory (AETL), a State-certified environmental testing laboratory, or an equally qualified laboratory.

3.2 Project Schedule

The following project schedule is anticipated:

- Mobilize to site within 4 weeks following approval of this Work Plan.
- Complete fieldwork within 4 weeks.
- Complete laboratory analysis and data validation within 4 weeks following completion of the fieldwork.
- Submit the FI Report to DTSC within 8 weeks of data validation.

The total estimated time from receipt of DTSC's approval of the Work Plan to submittal of the FI Report is 20 weeks.

Within 15 calendar days following completion of the FI, an FI Summary Fact Sheet will be submitted to DTSC.

Quarterly Progress Reports will be submitted to DTSC by the 10th day of the first month following the close of each quarter.

3.3 Estimated Budget

The estimated project budget has not been developed at this time. If an estimated project budget is required by DTSC, it will be provided upon request.

4. FACILITY BACKGROUND

4.1 Site Description

The SBPP (the Site) is located at 990 Bay Boulevard, along the eastern shore of San Diego Bay in Chula Vista. The Site occupies approximately 158 acres of land and includes an outdoor plant constructed around generators and boilers (see Figure 3). The facility is comprised of a thermal power plant (728 megawatts), a small gas turbine plant, switchyard, aboveground storage tanks (ASTs) for fuel oil, a cooling water system, and ancillary systems. The gas turbine unit is fueled with jet-A fuel stored in a 100,000-gallon AST. The power plant has four steam-driven generating units fired by natural gas or residual No. 6 fuel oil as backup. Natural gas has been the primary fuel used during the past 14 years. Prior to 1972, the power plant used Bunker C fuel oil. Fuel oil was formerly stored at the North and South Tank Farms. The South Tank Farm included Tanks No. 1, 2, 3, and 7. The North Tank Farm included Tanks 4, 5, and 6. The North Tank Farm has been decommissioned and the tanks have been removed. Portions of the South Tank Farm have gone through decommissioning and Tanks 3 and 7 have been removed. A former wastewater treatment plant (WWTP) is located southeast of the power plant and consisted of six wastewater holding ASTs and six treatment ASTs. The entire WWTP is provided with secondary containment. The former Tiered Permitted WWTP is no longer in use.

On 22 April 1999, SDG&E divested the SBPP, conveying various assets and donating certain property to the San Diego Unified Port District (Port). Concurrently, the Port leased the SBPP to Duke Energy South Bay, LLC (Duke Energy). The process and allocation of environmental obligations at the SBPP are governed by the Port-SDG&E Asset Sale Agreement (ASA) dated 11 December 1998.

In 2001, under the terms of the ASA, SDG&E approached the DEH to oversee the assessment and remediation of five discrete areas of SBPP that SDG&E was obliged under the ASA to resolve in the immediate aftermath of the sale of the operational Port-Duke plant. On 9 July 2001, DTSC advised DEH that DTSC retained jurisdiction of SBPP as a tiered-permitting facility.

Following review of site documents, DTSC issued a letter dated 11 February 2003 providing three separate sets of comments from the State Regulatory Program Division (SRPD), Geological Services Unit, and Human and Ecological Risk Division. In this letter, DTSC identified 27 SWMUs/AOCs and suggested that a work plan be prepared for the additional investigation required for the subject SWMUs/AOCs. SDG&E, in collaboration with the Port and Duke Energy, prepared a document dated 25 February 2004 that presented responses to DTSC's 11 February 2003 letter. In this document, SDG&E provided historical technical data as well as evaluation and justification for SWMUs/AOCs that had either been adequately characterized in the past or were not associated with the SBPP facility. At the center of the discussions were the areas directly beneath the operating power generation units and supporting infrastructure that were currently inaccessible for sampling. SDG&E's recommendation was to defer investigation of the inaccessible areas to a later date such as when the plant will be decommissioned. As indicated, in July 2004, DTSC provided SDG&E a list of SWMUs /AOCs that need to be investigated now as well as a list of SWMUs/AOCs that will be deferred and addressed during facility decommissioning. The subject DTSC SWMUs/AOCs table (DTSC Attachment A, 16 July 2004) is presented as Table II of this Work Plan. This Work Plan addresses only the SWMUs/AOCs that are currently accessible, as listed in Tables III and IV.

The following SWMUs/AOCs have been identified as having insufficient data on the current nature and extent of potential contamination to determine the potential risk to human health and the environment (DTSC 16 July 2004 letter and its attachment A):

- SWMU No. 1: North Tank Farm
- SWMU No. 3: Jet Fuel Area
- SWMU No. 4: UST Area
- SWMU No. 6: Former First Generation Surface Impoundment
- SWMU No. 11: Former Drum Storage Area/Pole Wrap Yard
- SWMU No. 16 / AOCs 1 and 2: East-Central Area, Dissolved VOCs in Groundwater
- SWMU No. 19: Former Off-site Automotive Junkyard Boundary
- SWMU No. 21: East Loop Pipeline
- SWMU No. 25: Former Agricultural Site
- SWMU No. 26: Stormwater Drainage Channel Located on the Southern Edge of Jet Fuel Area
- SWMU No. 28a: Metals, VOCs, Petroleum Hydrocarbon Contamination in Groundwater at the Entire Site
- SWMU No. 28b / AOC 3: Arsenic Hot Spots in Soil Open Area 5
- SWMU No. 28c / AOC 4: Guard House- Mercury in Soil

The locations of these SWMUs/AOCs are shown on Figures 4 through 8. Background information on each of these SWMUs/AOCs is summarized below.

4.2 SWMU No. 1: North Tank Farm

The former North Tank Farm Area (Figure 4) included four ASTs. Three ASTs (4, 5, and 6), each with a capacity of 375,000 barrels (bbl), stored No. 6 fuel oil, one 10,000-bbl AST stored displacement or cutter oil (No. 2 diesel) and the pump pit/deck and aboveground piping connecting the pump pit/deck to each of the tanks. The ASTs and piping were located within a bermed area. Port/Duke Energy decommissioned the ASTs and the ancillary equipment including excavation and removal of approximately 21,000 cubic yards of soil from beneath the ASTs.

4.3 SWMU No. 3: Jet Fuel Area

The Jet Fuel Tank Area (Figure 5) located northwest of the power plant structure included one 1,000-gallon AST located within a bermed area which stores jet fuel (JP-5) for the emergency gas turbine generator.

4.4 SWMU No. 4: Former UST Area

The former UST Area (Figure 6) included two 500-gallon USTs that stored gasoline and diesel fuel. This area was previously investigated and remediated by SDG&E and five monitoring wells were installed in this area. The USTs and pump island were removed, 1,180 cubic yards of soil was excavated, and 19,300 gallons of groundwater was removed from the open excavation and disposed of off-site. Prior to backfilling the excavation in 1999, approximately 1,000 pounds of Oxygen Releasing Compound (ORC) was placed in the bottom of the excavation at and below the groundwater table to enhance degradation of residual petroleum hydrocarbons in soil and groundwater. Follow-up groundwater monitoring indicated a significant decrease of petroleum hydrocarbons.

4.5 SWMU No. 6: Former First Generation Surface Impoundment

The former First Generation Surface Impoundment (Figure 5) located northwest of the power plant structure received untreated wastewater from operations at the plant and acted as a settling basin for removal of solids. The impoundment was 190 by 170 feet in dimension at depths ranging between 8 and 10 feet below ground surface (bgs). The impoundment was decommissioned in 1982 and 920 tons of oily sludge and impacted soil were removed and disposed of off-site. Enecotech conducted follow-up subsurface investigations in 1996 and 1997 to assess the effectiveness of the previous remedial action. Elevated concentrations of metals were detected in soil samples with concentrations decreasing at depths from 12 to 14 feet bgs.

4.6 SWMU No. 11: Former Drum Storage Area / Pole Wrap Yard

A relatively small pentachlorophenol (PCP)-impacted area within the former Drum Storage Area was investigated and remediated in 1993 (Figure 5). The PCP release was limited to a 7-foot by 11-foot area immediately north of the shed. Approximately 4.5 cubic yards of impacted soil was excavated to a depth of 18 inches bgs. PCP was not detected in the soil confirmation samples and follow-up sampling. One soil boring was drilled within the Drum Storage Area in 1998 (SB04-013). Volatile organic compounds (VOCs) and PCBs were not detected in soil samples. Low concentrations of total extractable hydrocarbons (TEH) (18 milligrams per kilogram [mg/kg]) were detected in the surface sample only. Semi-volatile organic compounds (SVOCs) and PCP were below the detection limit of 5 mg/kg.

4.7 SWMU No. 16 / AOCs 1 and 2: East-Central Area, Dissolved VOCs in Groundwater

In 1998, relatively low concentrations of VOCs (up to 53.9 micrograms per liter [μg/L]) of trichloroethylene (TCE) were detected in groundwater (SB5-041A) in the open area east of the switchyard. Following a soil gas survey, nine monitoring wells were installed and samples were collected as well as four Hydropunch groundwater samples (including SB5-094, AOC-1 and SG-06 & -07, AOC-2). VOC concentrations in groundwater were generally low and below 100 μg/L. This area is depicted on Figure 7.

4.8 SWMU No. 19: Former Off-site Automotive Junkyard Boundary

An automobile junkyard was formerly located off-site and east of the Interstate 5 Freeway (I-5) and upgradient of the above-described VOC plume (Figure 7). It is suspected that the VOCs detected in groundwater at the Site directly downgradient of the former junkyard are likely related to releases from the junkyard.

4.9 SWMU No. 21: East Loop Pipeline

Petroleum hydrocarbons above 1,000 mg/kg were detected in soil samples adjacent to a former fuel spill related to the East Loop pipeline in an area near the southeastern corner of the power plant structure (Figure 3). The impacted area reportedly extends to a depth of approximately 6 feet bgs and covers an area of approximately 50 feet by 50 feet.

4.10 SWMU No. 25: Former Agricultural Site

Portions of the Site adjacent to I-5 (Figure 8) may have historically been used for agricultural purposes. The 1998 site-wide investigation included collection of only one soil sample for

analysis of pesticides and herbicides (SB05-032). Pesticides and herbicides were not detected in the one sample analyzed.

4.11 SWMU No. 26: Stormwater Drainage Channel Located on the Southern Edge of Jet Fuel Tank

A 36-inch-diameter storm drain line runs south to north under the Jet Fuel Tank and discharges into an open drainage channel located north of the tank. The channel and its embankments are lined with rocks and boulders. The top of the storm drain is reportedly approximately 5 feet bgs. Figure 5 shows the location and other pertinent information regarding the storm drain line and vicinity.

4.12 SWMU No. 28a: Metals, VOCs, Petroleum Hydrocarbons in Groundwater across the Entire Site

Historical information indicates groundwater below the Site occurs at depths from approximately 10 to 15 feet bgs. The general direction of groundwater flow is to the west toward San Diego Bay. Groundwater hydrology at the Site has previously been characterized using temporary and permanent monitoring wells. The temporary wells were abandoned following the 1998 site-wide investigations. Currently, 20 permanent monitoring wells exist at the Site. Figure 9 shows the location of the existing monitoring wells. In general, the permanent wells are located at the former UST Area, East Open Area with VOC plume, and the Jet Fuel Tank Area. Table V presents the existing permanent groundwater monitoring well construction details.

Extensive site-wide groundwater sampling was conducted during the past investigations as summarized below:

- Forty-eight groundwater samples were analyzed for TEH using United States Environmental Protection Agency (EPA) Method 8015M.
- Thirty-eight groundwater samples were analyzed for VOCs (benzene, toluene, ethylbenzene, xylene [BTEX] and Method 8260 VOCs). Samples from the UST Area were also analyzed for methyl tertiary butyl ether (MTBE).
- Thirty groundwater samples were analyzed for polynuclear aromatic hydrocarbons (PAHs).

4.13 SWMU No. 28b / AOC-3: Arsenic Hot Spots in Soil Open Area 5

Arsenic was detected in two soil borings (SB05-009 and SB05-024) with concentrations above the residential Preliminary Remediation Goal (PRG) of 0.39 mg/kg. In boring SB05-009, arsenic was detected at a concentration of 15 mg/kg in the shallow soil sample (0.5 to 1 foot bgs) and decreased by an order of magnitude to 1.1 mg/kg in the 5-foot sample. Similarly, in boring SB05-024, arsenic was detected in the shallow (0.5 to 1 foot) sample at a concentration of 14 mg/kg which decreased to 1.3 mg/kg in the 5-foot sample. This area is depicted on Figure 7.

4.14 SWMU No. 28c AOC-4: Guard House- Mercury in Soil

Mercury was detected in soil boring SB05-005 in the sample collected from a depth of 4 to 5 feet bgs at a concentration of 2.4 mg/kg. Mercury was not detected in the shallow soil sample from this boring. This area is depicted on Figure 7.

5. FIELD INVESTIGATION

5.1 Task Description

5.1.1 Task 1 – Health & Safety Planning

Haley & Aldrich has prepared a site-specific FI Health and Safety Plan (HASP). The HASP covers the on-site activities during the FI and applies to on-site personnel. The HASP is consistent with the Occupational Safety and Health Administration (OSHA) Regulations, National Institute for Occupational Safety and Health (NIOSH) Occupational Safety and Health Guidance Manuals for Hazardous Waste Sites (1985), and applicable state and local regulations.

The HASP identifies potential physical and chemical hazards and their associated risks, and identifies mitigation and control measures to be implemented during the work, including air monitoring, required levels of personal protection, action levels for the upgrade of personal protective equipment (PPE), and evacuation. Decontamination zones and procedures are also described. The HASP also identifies the site organization and emergency contacts, and on-site and off-site emergency services with maps and routes to the emergency facilities. The HASP activities will be implemented in conjunction with the "Business Plan / Contingency Plan, Facility Emergency Plan, Volume II, for the South Bay Power Plant, DUIK-01, December, 2004 (Facility Contingency Plan). A copy of the Facility Contingency Plan is included as Appendix K.

The HASP has been prepared in accordance with Haley & Aldrich's Standard Operating Procedure (SOP) OP1010 – Health and Safety Plans (see Appendix A), and is presented in this Work Plan as Appendix B. In general, the HASP includes the following:

- Project Information
  - Organization and Responsibilities
  - Training, Initial and Site Specific
- Site Description
  - Site Description
  - Site Background
- Project Task Breakdown
  - Scope of Work
- Hazard Assessment
  - Potential Hazards and Hazard Assessment for Each Task & Operation
- Protective Measures
  - Respiratory Protection
  - Personnel Protective Clothing and Equipment for Each Task
  - Action Levels for Upgrades/Downgrades of PPE
  - Site Control and Decontamination
- Monitoring Plan
  - Ambient Air Monitoring and Personal Monitoring
  - Noise, Heat/Cold, Radiological, etc. Stress Monitoring

- Decontamination
  - Personnel Hygiene and Decontamination Facilities & Procedures
  - Special Protective Measures
- Contingency
  - Site Specific Medical Surveillance Parameters
  - Emergency Response Plan and Contingency Procedures
  - Emergency References
  - Hospital Location Map
  - On-site First Aid and Emergency Equipment
  - Accident Reporting, Investigation, and Recordkeeping

5.1.2 Task 2 – Sampling Activities –Soil and Groundwater

5.1.2.1 Pre-sampling Activities

In accordance with the HASP, prior to performing any intrusive work, Haley & Aldrich will review available site underground utility plans and available construction drawings to avoid underground utilities and structures and identify any conflicts in the work areas. In addition, Haley & Aldrich will contract an independent utility contractor to survey the areas to be investigated. The utility contractor will screen the areas using geophysical survey equipment to identify subsurface features in the work areas or that generate an electronic signal (e.g., power and communications cables, metallic pipes). Dig Alert will also be notified, as required by law, to identify utilities within their jurisdiction around the property at least 48 hours prior to conducting the intrusive activities.

Where necessary to expose the underlying soils and allow advancement of the borings, surfacing (such as asphalt and concrete), where necessary, will be cored using a concrete coring device. The following SOPs for these activities are included as Appendix C: SOP OP3003 – Surficial Soil Sampling, SOP OP2000 – Monitoring Field Explorations, and SOP Sampling According to EPA 5035.

5.1.2.2 Soil Boring and Sampling Activities

Haley & Aldrich proposes to advance the borings using either of two drilling methods as described below (Appendix C).

- Hand auger: A hand-operated stainless steel auger will be used to advance shallow borings (i.e., less than 6 feet bgs) where aboveground access is limited or when in close proximity to underground utilities. Soil cuttings will be inspected and logged by a Haley & Aldrich field geologist or engineer as the boring is advanced. Soil samples for VOC analysis will be obtained by advancing a hand-operated sliding-hammer split sampler lined with previously unused stainless steel tubes ahead of the augered boring. The tubes will then be immediately capped to minimize volatilization of potential VOCs prior to analysis.

- Direct-push: A vehicle-mounted direct-push drilling rig will be used in areas with good aboveground access that are not in close proximity to underground utilities, and for deeper borings. Continuous soil

cores will be collected by hydraulic-percussive driving of a stainless steel sampling probe equipped with dedicated acetate liners. The soil samples collected in liners will be immediately subsampled following inspection and logging by a Haley & Aldrich field geologist or engineer. Soil samples collected for VOC analysis will be subsampled using an EnCore® Sampler to minimize volatilization of potential VOCs prior to analysis.

5.1.2.3 Groundwater Sampling

Groundwater samples will be collected either from direct-push probes or from existing permanent monitoring wells. Prior to the collection of groundwater samples from the permanent monitoring wells, the wells will be inspected and refurbished (if necessary), as described below. The following SOPs for these activities are included as Appendix D: SOP OP3008 – Water Level Measurements, SOP OP3009 – Monitoring Well Development, SOP Groundwater Sampling, and SOP OP3014 – NAPL Detection and Monitoring. Groundwater sampling activities will include some or all of the following.

A. Monitoring Well Redevelopment & Elevation Survey

Since the existing permanent wells have not been sampled for a number of years, prior to collecting groundwater samples from each existing permanent monitoring well, each monitoring well will be visually inspected for condition and then redeveloped. The redevelopment process will be conducted according to the procedures outlined in the SAM Manual and include the use of a drill rig equipped with a surge block. The redevelopment will be conducted to improve communication between the formation and the well casing.

Prior to monitoring, each of the existing permanent groundwater monitoring wells will be surveyed for location and elevation. The elevation measurements will be taken from the top of casing and marked for future reference. The elevation survey will be conducted by a licensed surveyor and referenced to existing known elevation benchmarks. The elevation data will then be used to calculate groundwater elevations as measured from each monitoring well. Existing monitoring well IDs and construction details are presented in Table V.

B. Direct-Push Groundwater Sampling

A vehicle-mounted direct-push drilling rig will be used to advance a groundwater sampling probe to the desired depth. The probe tip will be released and water will be allowed to enter the probe cavity. The collected groundwater will then be pumped from the probe using a peristaltic pump directly into the groundwater sample container(s). Where soil samples are being collected from the same borings as groundwater samples, continuous soil cores will be collected by hydraulic-percussive driving of a stainless steel sampling probe equipped with dedicated acetate liners. The acetate liners will be removed and cut appropriately for soil sampling purposes, in accordance with the soil sampling protocol. The probe will be

advanced to the desired groundwater sampling depth and the groundwater sample will be collected from the probe as outlined in the Groundwater Sampling SOP (Appendix D).

C. Monitoring Well Groundwater Sampling

SOPs for these activities are included as Appendix D, Appendix E, SOP OP3012 – Low Stress/Low Flow Groundwater Sample Collection, and Appendix F, SOP OP3013 – Monitored Natural Attenuation Groundwater Sample Collection.

Groundwater samples will be collected from each monitoring well for two purposes. The groundwater samples will be collected for chemical analysis based on previous site investigation groundwater results and for parameters that will provide data regarding the occurrence of natural attenuation of chemical impacts in groundwater. A brief discussion regarding the monitoring for natural attenuation activities and associated analyses is presented below.

Haley & Aldrich will utilize low-flow micro-purge methodology to monitor and sample the selected groundwater monitoring wells following the procedures outlined in the Haley & Aldrich SOP for *Low-flow Micro-purge sampling of Groundwater*, is included as Appendix E. The activities will be performed in general conformance with the low-flow sampling protocol outlined in the SAM 2003 Manual. The objective of this methodology is to create minimal disturbance to ambient groundwater conditions, and during purging and sampling, collect a more representative sample of groundwater from the groundwater system. This methodology also provides for a closed system measurement of groundwater physical parameters (such as conductivity, dissolved oxygen [DO], pH, etc.), which is more accurate and reliable.

The groundwater monitoring wells will be purged using a precleaned bladder pump with dedicated disposable bladders, and dedicated Teflon-lined tubing, which will be installed specific to each well. Prior to purging and sample collection, the bladder pump will be positioned near the middle of the screened zone interval in each well.

In general, groundwater pumping in each well will be performed such that the discharge flow rate is optimized for each well at a rate below one liter per minute. Groundwater drawdown will be measured continuously in each well to ensure that the drawdown has stabilized during purging to less than one third of a foot of total drawdown in each well. Groundwater field parameters (temperature, pH, specific conductivity, DO, and oxidation reduction potential [ORP]) will be measured continuously through an in-line flow cell, and groundwater purging will continue until three consecutive readings of these parameters stabilize to within criteria established by the SAM Division protocol. Groundwater samples will be collected directly from the dedicated tubing into laboratory-provided containers.

Samples will also be analyzed for the following natural attenuation parameters: nitrate, iron II, methane, total dissolved solids (TDS), and general minerals (hardness, alkalinity, calcium, magnesium, sodium, potassium, chloride, sulfate, iron, and manganese.)

5.1.2.4 Sampling Observations and Monitoring

During advancement of the borings and collection of the soil and groundwater samples, observations of soil conditions encountered and visual/olfactory evidence of contamination will be recorded by the Haley & Aldrich field geologist or engineer. The SOP for this activity, OP2001 – Identification and Description of Soils in the Field using Visual-Manual Methods, is included as Appendix G. Portions of the soil samples collected will be screened for VOCs using a photo-ionization detector (PID). The results of the PID screening and other field observations (i.e., odor, staining, or sheen) will be noted and presented in the final FI Report.

Observations of free-phase product in soil and groundwater will be documented and followed up in general accordance with the following approaches. (1) Free-phase product observed in soil will be delineated with additional step-out borings targeted at sampling depths intended to define the lateral and vertical extent of free-phase product. (2) Free-phase product (light non-aqueous phase liquid ([LNAPL]) on groundwater will be documented. Groundwater samples will not be collected from the boreholes and wells where LNAPL is observed.

5.1.2.5 Sample Handling, Equipment Decontamination, and Post-sampling Activities

Immediately following collection, the soil and groundwater samples will be stored in ice-chilled coolers pending shipment to the analytical testing laboratory. The samples will be transferred to the laboratory following standard Haley & Aldrich chain-of-custody procedures.

To prevent potential cross-contamination between borings and sampling locations, all down-hole and sampling equipment will be thoroughly decontaminated with a powered steam cleaner or by washing with an Alconox® solution in de-ionized water and double rinsing with de-ionized water. All wash water will be contained in clean drums. Soil cuttings generated during the field operations will also be containerized in soil-only drums. The waste drums will be marked as to their contents and source and left on-site at a central location, pending the results of laboratory analyses and determination for appropriate disposal options.

Following sampling, the resultant boreholes will be backfilled with bentonite pellets, hydrated in-place, and capped with concrete or asphalt to match the adjacent site surface. SOPs for these activities are included as Appendix C and Appendix H, SOP OP3001 - Preservation and Shipment of Environmental Samples, Sample Chain-of-Custody Form, and SOP OP1004 – Operation/ Calibration of Photo-ionization Detector.

5.1.3 Task 3 – Analytical Laboratory

Laboratory analyses will be performed by American Environmental Testing Laboratory (AETL), a State-certified environmental testing laboratory under the Environmental Laboratory Accreditation Program (ELAP Certificate No. 1541).

Selected soil and groundwater samples will be analyzed for PCBs, total petroleum hydrocarbons (TPH), VOCs, SVOCs, pesticides, PAHs, herbicides, and metals following the appropriate EPA analytical methods as referenced in Section 5.3.1. In addition, groundwater samples will also be analyzed for natural attenuation parameters including nitrate, iron II, methane, TDS, and general minerals (hardness, alkalinity, calcium, magnesium, sodium, potassium, chloride, sulfate, iron, and manganese). A detailed description of the sampling and analytical program is presented in Tables III and IV.

5.1.4 Task 4 – FI Reporting

Following completion of the fieldwork, an FI report will be prepared for submittal to DTSC that describes the investigative work performed, presents the field and laboratory results, and evaluates these results. The report will also include an evaluation of the completeness of the investigation and identify whether additional work is needed.

The FI report will include:

- A summary of the investigation results including tables that summarize the analytical results
- A description of the investigation, including investigation methods and procedures
- A discussion of key decision points encountered during the investigation and their resolution
- Graphical illustrations showing sampling location and results
- A description of potential or known impacts on human health or the environment
- A discussion of any upset conditions that occurred during the sampling or analysis that may influence the results
- An assessment of the data quality

Within 2 weeks following the FI, an FI Summary Fact Sheet will be completed for submittal to DTSC. The FI Summary Fact Sheet will be a brief one- to two-page summary of key events and findings.

Quarterly progress reports will also be submitted to DTSC in accordance with the schedule and format specified in the CACA.

5.2 Rationale for Sampling

The primary objective of this FI is to obtain representative soil and groundwater quality data to allow an assessment of potential chemical impacts at specific SWMUs/AOCs for which there are currently insufficient data, as outlined in our communications with the DTSC.

Therefore, based on this data need, the soil and groundwater sampling outlined herein will be targeted, as appropriate, at each of the identified SWMUs/AOCs. The proposed sampling locations for the soil borings, direct-push groundwater borings and the groundwater monitoring wells to be sampled for each SWMU/AOC are shown on Figures 4 through 9.

The sampling background, approach, locations, quantities, sample matrix and depth, and analytical methods are presented in Tables III and IV.

Each SWMU/AOC will be addressed according to the information presented in Tables III and IV as appropriate with the stated objectives. The soil and groundwater samples will be collected and analyzed to address the respective SWMU/AOC needs. A brief description of each SWMU/AOC and its related investigation rationale is presented in Tables III and IV and discussed below:

- SWMU No. 1: North Tank Farm (see Figure 4)
  - AST Pipelines. Previous site-wide sampling did not include samples from directly beneath the aboveground pipelines which connected the ASTs to the pump deck. Soil samples will be collected along the alignment of the subject pipelines (see Figure 6).
  - Pump Deck/Pump Pit. Previous site-wide sampling did not include samples from at/beneath the former pump deck. The pump deck has been decommissioned and removed. Confirmation soil samples will be collected in the excavation of the former pump deck.
  - Bermed Pond. Soil samples were not collected from the Bermed Pond location during previous site-wide sampling. Soil samples will be collected within the Bermed Pond.
  - Displacement Oil AST. Groundwater samples were not collected beneath the former AST following its removal. Groundwater samples will be collected to assess groundwater quality at this location.
  - Heat Exchanger. Since the heat exchanger was co-located with the pump deck, proposed pump deck area sampling will also address the heat exchanger.
  - ASTs 4, 5, and 6. ASTs 4, 5, and 6 have been decommissioned and removed. Impacted soil directly beneath the ASTs was excavated and disposed of off-site. Previous confirmation sampling was limited to vertical sampling beneath the ASTs. Lateral confirmation sampling outside of the AST footprints was not conducted. As such, the proposed sampling includes soil and groundwater sampling in specific areas beneath the ASTs requested by DTSC as well as lateral soil sampling outside of the AST footprints adjacent to impacted areas identified beneath the ASTs.
  - Local Staining. A surface stained area of approximately 65 feet by 10 feet had been identified adjacent to the subject AST. The AST has been decommissioned and removed. Confirmation soil samples will be collected at the location of the former AST.
- SWMU No. 3: Jet Fuel Area (see Figure 5)
  - Soil and groundwater sampling will be conducted west and southwest of soil borings JF-9, JF-10, and JF-15 to delineate the lateral and vertical extent of impacts to assess LNAPL.

- LNAPL was detected in previous groundwater sampling at SB-070A. Additional lateral delineation of soil and groundwater impacts in proximity to and downgradient of SB-070A will be conducted.

- SWMU No. 4: Former UST Area (see Figure 6)
  - One round of groundwater sampling of five existing monitoring wells will be performed to evaluate current groundwater quality conditions near the former UST. Groundwater sampling procedures will include low-flow micro-purge and analysis for natural attenuation parameters.

- SWMU No. 6: Former First Generation Surface Impoundment (see Figure 5)
  - Soil and Groundwater – As agreed in the referenced 16 July 2004 DTSC letter, additional confirmation sampling will be conducted later during soil excavation and removal planned for this area. No sampling is proposed at this time.

- SWMU No. 11: Former Drum Storage Area / Pole Wrap Yard (see Figure 5)
  - Additional soil sampling is required for PCP analysis using lower detection limit. Historical investigation used PCP reporting limit of 5 mg/kg, which was above the EPA PRG of 3 mg/kg.

- SWMU No. 16 / AOCs 1 and 2: East-Central Area, Dissolved VOCs in Groundwater (see Figure 7)
  - Soil and groundwater sampling will be conducted near SB5-094 located downgradient of the dissolved VOC plume. Previous sampling at SB05-094 detected low concentrations of VOCs in groundwater.
  - Soil conditions west of previous soil gas sampling points SG-06 and SG-07 will be investigated. Soil samples will be collected west of the soil gas sample locations SG-06 and SG-07 to assess the lateral extent of VOCs in soil in this area.
  - Nine existing monitoring wells will be sampled to assess the viability and potential for natural attenuation of residual VOCs detected in groundwater. Quarterly groundwater monitoring will be conducted for one year (four sampling events). Sampling will be conducted using established EPA natural attenuation protocols.

- SWMU No. 19: Former Offsite Automotive Junkyard Boundary (see Figure 7)
  - Located along the southeastern property boundary, groundwater sampling will be performed along the eastern Site boundary to assess the potential for migration of VOCs from off-site onto the site from the former automotive junkyard. The junkyard is not part of the SBPP.

- SWMU No. 21: East Loop Pipeline (see Figure 3)
  - As agreed to in the referenced 16 July 2004 DTSC letter, identified soil and groundwater residual impacts in this area will be addressed later as part of the planned soil excavation and removal. No sampling is proposed at this time.

- SWMU No. 25: Former Agricultural Site (see Figure 8)
  - Additional soil sampling will be conducted to address the potential for the presence of pesticides and herbicides in the general area along the eastern site boundary.

- SWMU No. 26: Stormwater Drainage Channel Located on the Southern Edge of Jet Fuel Tank (see Figure 5)
  - This area is adjacent to the jet fuel AST and SB-05-070A addressed in SWMU No. 3. Activities to be conducted regarding this drainage channel will coincide with the investigation activities conducted under SWMU No. 3. Sampling will be conducted along and adjacent to the storm drain line that extends beneath the Jet Fuel AST and discharges to the open drainage channel north of the AST to assess potential impacts from the historical impacts in this area on the storm drain system.

- SWMU No. 28a: Site-wide Groundwater Investigation (see Figure 9)
  - Activities to be included with this SWMU are incorporated in SWMUs/AOCs with existing groundwater monitoring wells including the jet fuel AST area (SWMU No. 3), the former UST area (SWMU No. 4), and the southeastern portion of the site (SWMU No. 16). Also included with these activities is monitoring well SB3-017a, located by the administration building, and SB1-0031, located adjacent to AST 1. Activities to be conducted related to this SWMU include:
    - Redeveloping existing groundwater monitoring wells
    - Conducting elevation survey of existing wells
    - Sampling existing groundwater monitoring wells using low-flow micro-purge procedures
    - Assessing natural attenuation processes at the site

- SWMU No. 28b/ AOC 3: Arsenic Hot Spots in Soil Open Area 5 (see Figure 7)
  - Previous results indicated arsenic concentrations at locations SB5-009 and SB5-024 that require further investigation. Soil sampling to further delineate the lateral extent of the observed arsenic in soil will be conducted.

- SWMU No. 28c/ AOC 4: Guard House- Mercury in Soil (see Figure 7)
  - Previous results indicated a mercury concentration of 2.4 mg/kg at boring location SB5-005. This concentration requires further investigation, which will be conducted with soil borings to delineate the lateral extent of mercury.

5.3 Sample Analysis

As mentioned previously, sample analyses will be performed by AETL. Selected samples will be analyzed for selected parameters, according to matrix and methodology, as described below and in Table VI.

5.3.1 Soil and Groundwater Sample Analyses

AETL or an equally qualified laboratory will conduct the laboratory analysis of each of the collected soil and groundwater samples and will use reporting limits for each

analysis, as presented in Appendix I. The analytical methods to be employed are described further below.

- TPH extended range following EPA Method 8015 extended range (Modified). This is a TPH screen for compounds in the carbon range C_4 to C_{40} using Gas Chromatography with Flame Ionization Detection (GC-FID).
- VOCs following EPA Method 8260B using Gas Chromatography/Mass Spectrometry (GC/MS). The laboratory reporting limit for this analysis will vary depending on the specific target analyte.
- SVOCs following EPA Method 8270C by GC/MS. The laboratory reporting limit for this analysis will vary depending on the specific target analyte.
- California Code of Regulations (CCR) Title 22 total metals following EPA Method 6010B and total mercury following EPA Method 7174A using inductive coupled plasma - atomic emission spectrometry. The laboratory reporting limit for this analysis will vary depending on the specific target analyte.
- Pesticides and PCBs following EPA Method 8081/8082.

In general, the analytical reporting limits will be as presented in Appendix J; however, sample matrix interference and elevated sample concentrations can affect the final reporting limits for a particular analysis, resulting in reporting limits greater than those presented.

The above selected analytical suites are based on historical site investigation chemical data and site-related use as discussed in Section 4.

5.4 Field Procedures

The boring and monitoring well locations are shown on Figures 4 through 9 and pertinent sampling information is presented in Tables III and IV. The following section presents the field procedures to be employed during the FI activities.

5.4.1 Sampling Location Selection

The intrusive sampling locations, as shown on Figures 4 through 8, are subject to adjustment, based on the results of the subsurface utility clearance activities. Safety precautions, access constraints, and the presence of utilities and underground structures may require the sampling locations to be modified in the field. Every attempt, within reason, will be made to position the sampling points as close as possible to those shown on Figures 4 through 8, without compromising safety or damaging utilities and/or identified structures.

The sampling locations will be measured in the field using either a global positioning system (GPS), cloth tape, and/or measuring wheel as relative positions to permanent on-site structures (e.g., buildings). The locations will be plotted on a scaled facility drawing.

5.4.2 Sampling Depths

The depths of the samples to be collected are presented in Tables III and IV and are discussed further below.

- The selected depths for soil samples are based on previously collected soil chemical data and will be consistent with the needs of the respective SWMU/AOC as identified for the confirmation and delineation activities described herein.
- The selected depths of the direct-push groundwater samples will be consistent with known groundwater depths previously identified across the site, or at appropriate depths where groundwater is observed during the advancement of direct-push probes from these activities.
- The depths at which groundwater samples will be collected from the existing monitoring well network will be based on the measured depth to groundwater in each monitoring well and the requirements of pump placement for the low-flow micro-purge sampling. Monitoring well construction details as well as the most recent historical depths to groundwater for each permanent monitoring well are presented in Table V. Groundwater samples will generally be collected from the middle of the screened interval.

5.4.3 Sampling Equipment and Procedures

In general, the sampling equipment and procedures to be followed are described in Haley & Aldrich's SOP OP2000 – Monitoring Field Explorations and OP3003 – Surficial Soil Sampling (see Appendix C). The project-specific sampling equipment and procedures detailed below are designed to address the specific requirements of the DTSC.

The following information outlines the soil and groundwater sampling procedures to be followed for each selected drilling method.

- Hand auger: Soil samples for VOC analysis will be obtained by advancing a hand-operated sliding-hammer split-spoon sampler lined with clean stainless steel tubes, which will be advanced ahead of the hand augered boring. The sampling tubes will then be immediately sealed with Teflon squares and capped to minimize volatilization of potential VOCs prior to analysis. Samples for non-volatile analyses, such as SVOCs and metals, may be collected as above, or will be collected from the stainless steel hand-auger bucket and transferred to clean laboratory-supplied sample jar containers using a clean stainless steel trowel.
- Direct-push: soil sampling including continuous soil cores will be collected by hydraulic-percussive by driving a stainless steel sampling probe equipped with dedicated acetate liners. Soil samples collected for VOC analysis will be subsampled using an EnCore® Sampler to minimize volatilization of potential VOCs prior to analysis. Samples for non-volatile analyses will be collected from the liners and transferred to clean laboratory-supplied sample containers by hand (wearing clean nitrile gloves) or using a clean stainless steel trowel.
- Direct-push probe groundwater samples (temporary sampling points) will be collected by advancing the sampling probe approximately one foot below the desired sampling depth, retracting the probe approximately one foot and releasing the temporary disposable tip, and collecting the groundwater sample from either dedicated polyvinyl chloride (PVC) pipe placed in the boring, after removal of the direct-push rod, or by advancing dedicated tubing down the direct-push rod. In both cases, groundwater will be brought to the surface

using a peristaltic pump, at which time the appropriate sample containers will be filled, capped, labeled, and temporarily stored.

- Permanent monitoring well groundwater samples will be collected from established permanent groundwater monitoring wells after performing well development activities, as described below. Prior to the collection of groundwater samples, each monitoring well will be visually inspected for integrity and condition and redeveloped following the surge block procedures outlined in the SAM manual. The surging will be performed to reestablish (increase) the communication between the monitoring well and the geologic formation. The well redevelopment activities will involve the use of a drill rig equipped with a surge block. The surge block will be passed through the well casing for approximately 15 minutes (Appendix D).
- Soil samples for field screening: Aliquots of the collected soil samples will be screened for VOCs using a photo-ionization detector. This will be achieved by placing the soil samples in Ziploc® plastic bags, sealing the bags, manipulating the samples in the bags to encourage volatilization of any contaminants, and leaving the sample bags in a warm location for approximately 15 minutes prior to measuring VOC levels with the PID. The PID will be equipped with a 10.6 eV lamp and appropriate calibration and maintenance will be conducted according to manufacturer requirements. A calibration and maintenance log will be created to record this process (Appendix H).
- Soil samples for off-site laboratory analysis will be immediately capped with Teflon squares and end-caps, labeled, and stored in chilled coolers pending shipment to the testing laboratory. At the end of each day of fieldwork, samples will be dispatched via courier to the testing laboratory under Haley & Aldrich chain-of-custody procedures (Appendix H).
- Following sampling, each borehole will be backfilled with bentonite pellets, hydrated in-place, and capped with concrete or asphalt to match the adjacent site surface (Appendix C).

5.4.4 Equipment Decontamination

To prevent potential cross-contamination between borings and sampling locations, all down-hole and sampling equipment will be thoroughly decontaminated by means of a powered steam cleaner or by washing with an Alconox® and de-ionized water solution, followed by double rinsing with de-ionized water. All wash water will be contained in clean drums. The waste drums will be marked as to their contents and left on-site at the 90-day Hazardous Waste Storage Area pending the results of laboratory analyses to determine appropriate disposal options.

The decontamination procedures followed will be documented in a field logbook dedicated to this project. In addition, a drum log will be completed for the wash water stored at the 90-day Hazardous Waste Storage Area, as copy of which will be provided to appropriate Facility personnel with responsibility for managing the waste stored on-site.

5.4.5 Equipment Calibration and Maintenance

The PID will be calibrated and maintained in accordance with the referenced SOP (Appendix H).

The PID will be calibrated prior to use. The calibration will be checked, at a minimum, at the beginning, middle, and end of each day, and during the day if it is suspected to be giving erroneous readings. The PID will be calibrated with 100 parts per million (ppm) isobutylene. All calibration checks will be recorded in a field logbook dedicated to this project.

5.4.6 Sample Packaging and Shipment

Immediately following collection, the soil and groundwater samples scheduled for analysis will be stored at approximately 4°C in coolers containing frozen ice packs prior to shipment to the testing laboratory. The sample containers will be secondarily sealed in Ziploc® bags. Fragile containers will be "bubble wrapped" to minimize the potential for breakage. At the end of each day of fieldwork, samples will be dispatched via express courier to the testing laboratory under Haley & Aldrich chain-of-custody procedures. Appropriate samples will be preserved and shipped in accordance with the referenced SOP (Appendix H).

5.4.7 Sample Documentation

5.4.7.1 Field Logbook

Dedicated bound field logbook(s) or personal digital assistants (PDAs) will be used for the project. The logbook(s)/PDAs will be used by the field personnel to record daily events which occur during the field program. Entries to the field notebooks will be in permanent ink, and corrections will be lined through and initialed. As a minimum, the following will be recorded on a daily basis:

- Date
- Start time
- Meteorological conditions (weather)
- Field personnel present
- Level of personal protection
- Site identification
- Scheduled activities and location(s)
- Field observations
- Sample identification numbers
- Location and description of sampling points
- Numbers and types of samples collected
- Time of sample collection
- Signature of person making entry

In addition, field maps will be generated either on paper or electronically, documenting the sampling locations and designations. As appropriate, reference will be made to other field documentation (e.g., borehole logs, chain-of-custody forms, waste drum logs).

5.4.7.2 Sample Container Labeling

Containers will be labeled in the field with the following information:

- Haley & Aldrich project number
- Location/sampling designation
- Sample number
- Sample depth
- Time and date of collection
- Analysis to be performed
- Preservation
- Sampler name

The sample labeling convention will include the site, borehole/sample designation, and depth (if appropriate). For example, sample SBPP-RSB03-010 refers to the soil sample taken from the SDG&E South Bay Power Plant, at FI soil boring No. 3, at a depth of 1 foot bgs.

5.4.7.3 Sample Chain of Custody

At least one chain-of-custody form will be used for each cooler. An example sample chain-of-custody form is presented in Appendix H. The following information will be clearly written on each chain-of-custody form:

- Haley & Aldrich project number
- Laboratory name, address, and phone number
- Cooler custody seal number
- Date
- Haley & Aldrich project manager and phone number
- Sample identification
- Sample date and time
- Analysis requested, including EPA method number
- Preservation
- Sampler name and signature
- Other remarks
- Date results requested
- Date delivered to laboratory
- Signature date and time for all subsequent changes in sample control

A copy of the completed chain-of-custody form for each cooler will be sealed in a Ziploc® bag and placed in the cooler. A copy will be retained by field personnel to be placed in the project file. The cooler lid will then be secured with a numbered custody seal.

The analytical laboratory performing the analysis will provide a list of sample containers to be used for sampling with each cooler. The laboratory performing the analysis will be instructed to return a completed copy of the chain of custody with the analytical results.

5.4.7.4 Borehole Logs

The soils encountered during advancement of the boreholes will be logged by Haley & Aldrich field staff in accordance with the referenced Haley & Aldrich SOPs (Appendices C and G).

A standard borehole log form will be completed in the field on which the stratigraphy, PID readings, and soil sampling locations will be recorded. These boring logs may either be hard copy or electronically generated using a PDA.

5.4.7.5 Waste Drum Logs

A drum log will be completed documenting the investigation-derived waste drums generated and stored at a selected Hazardous Waste Storage Area pending disposal/recycling. A copy of each log will be provided to appropriate field or facility personnel with responsibility for managing the waste stored on-site.

5.4.7.6 Photographic Documentation

Pertinent observations during the fieldwork will be recorded using a digital camera. A photograph log will be maintained in the field logbook.

5.4.8 Disposal of Investigation-Derived Waste and Contaminated Materials

The investigation-derived waste will be placed in Department of Transportation (DOT)-certified 55-gallon steel drums suitable for the transportation of hazardous wastes. The drums will be clearly labeled as to their contents and will be temporarily stored at the Facility pending resolution for disposal/recycling. A copy of the drum log completed during the investigation will be provided to appropriate Facility personnel with responsibility for managing waste stored on-site. Upon receipt of the soil laboratory results, SDG&E personnel will make arrangements for the appropriate disposal of the wastes in a manner that is consistent with local, state, and federal regulations.

All wash water, soil cuttings, and potentially contaminated disposable equipment (e.g., Tyvek® suits and nitrile gloves) generated during the field operations will be segregated and containerized in 55-gallon drums. The waste drums will be marked as to their contents and left on-site at a designated area pending the results of laboratory analyses to determine appropriate disposal options. A drum log will be completed for the investigation-derived wastes stored at the storage area and provided to appropriate personnel.

5.4.9 Standard Operating Procedures

Applicable Haley & Aldrich SOPs are listed as appendices in the table of contents of this Work Plan, and are provided at the end of this document. References to their applicability are made in the text of various sections of this Work Plan.

6. QUALITY ASSURANCE AND QUALITY CONTROL

The data quality assurance objectives for the project are presented in Table I. A copy of the analytical laboratory's quality assurance and quality control (QA/QC) plan is presented in Appendix J.

6.1 Field Quality Control Samples

6.1.1 Field Duplicates

Duplicate samples will be collected to check for sampling and analytical precision. Duplicate samples for all parameters will be collected at a frequency of at least 10 percent of all field samples, or one sample per week, whichever is greater.

To the extent practicable, duplicates will be collected from points which are suspected to be contaminated, and will be spread out over the Facility and collected at regular intervals.

The duplicates will be collected, numbered, packaged and sealed in the same manner as other samples. The duplicates will be assigned separate sample numbers and "submitted blind" to the laboratory (i.e., numbered in a way that allows traceability by Haley & Aldrich, but conceals the primary sample identity from the laboratory).

6.1.2 Blank Samples

Blank samples are collected to check for possible cross-contamination during sample collection and shipment, and in the laboratory.

- Trip Blanks: These samples are used to demonstrate that the samples have not been contaminated during transportation or at the laboratory. Two trip blanks (VOC vials containing high-performance liquid chromatography [HPLC]-grade water) will be present in each cooler received from the laboratory. These will be uniquely labeled in the field, recorded on the chain of custody for the cooler in which they are present, and returned to the laboratory for VOC analysis, as necessary.

- Equipment Blanks: As only dedicated soil sampling equipment is being used for the soil sample collection, equipment blanks from decontamination rinse water will not be collected.

- Field Bottle Blank: As only soil samples are being collected, a field bottle blank will not be collected.

6.2 Laboratory Quality Control Samples

Laboratory QC samples for matrix spike and laboratory duplicate analysis will be analyzed at a rate of at least 5 percent of the total samples analyzed (including field blanks and duplicates), or one sample per week, whichever is greater.

As reasonably practicable, the laboratory QC samples will be selected from sampling points that are suspected to be moderately potentially contaminated. Each sample will be labeled "Lab QC Sample." The first laboratory QC sample will be from the first or second day's

sampling effort. Subsequent laboratory QC samples will be spread out over the entire sampling program.

6.3 Performance System Audits by the Respondent

To ensure consistency with the FI Work Plan, the SDG&E project manager will visit the Facility during the field program and audit the field activities.

We understand that a representative from DTSC may also visit the site during the field program and may request duplicate samples for analysis by their laboratory. We understand that DTSC will coordinate their site visit with SDG&E and Haley & Aldrich and inform SDG&E and Haley & Aldrich in advance of the number of duplicates samples they intend to collect and the need for sample containers and coolers.

7. DATA MANAGEMENT

7.1 Investigation Data and Results Evaluation

The quantitative soil sampling data obtained will be compared with available background soil data, published data for background concentrations published by Cal-EPA (Cal-EPA 1991, Cal-EPA 1992), USEPA Region IX Preliminary Remediation Goals (PRGs) (EPA, 2002), and previous soil sampling data from the site (Haley & Aldrich document "Response to Department of Toxic Substances Control Comments, South Bay Power Plant Facility, Chula Vista, California," February 2004) in order to assess whether a chemical impact has been identified at the SWMUs/AOCs being investigated that would require further investigation into the nature and extent of the chemicals of concern identified.

The qualitative results from field observations may be used to assess the migration potential of chemicals of concern that may be identified, and support the design of follow-on investigations, if any.

7.2 Laboratory Data Validation

The soil analytical results will be reviewed by a Haley & Aldrich chemist, independent from the laboratory conducting the analyses. This review will involve checking for completion, sample holding time violations, and the laboratory's QA/QC procedures. The results of this data validation review will be presented in the FI Report.

7.3 Database

The laboratory data will be submitted to Haley & Aldrich electronically (as well as hard copy), avoiding the reentry of data and the resultant risk of data entry error. The chemical data will be provided in electronic format, consistent with Haley & Aldrich standards, which incorporate the use of Microsoft Access and the electronic database structure EQuIS provided by EarthSoft. The electronic chemical data deliverables (EDDs) will be structured to facilitate manipulation into report summary tables and a Geographical Information System (GIS). The GIS will be used to facilitate the presentation of sample data and site features graphically in report figures.

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REFERENCES

1. California Environmental Protection Agency (Cal-EPA), 1991: Background Levels of Trace Elements in Southern California Soils, Draft Annual Report, California Environmental Protection Agency, Contract No. 89-T0081 by University of California, Riverside, California, April 1991 Bradford, G.R., R.J. Arkley, P.F. Pratt, and F.L. Blair. 1967. Total Content of Nine Mineral Elements in Fifty Selected Benchmark Soils Profiles of California. Hilgardia 38:541-556

2. California Environmental Protection Agency (Cal-EPA), 1992: Background Levels of Trace Elements in Southern California Soils, Draft Annual Report, California Environmental Protection Agency, Contract No. 89-T0081 by University of California, Riverside, California, June 1992

3. United States Environmental Protection Agency (EPA), 2002: United States Environmental Protection Agency Region IX, Region 9 PRGs Table 2002 Update, October 1, 2002

4. Haley & Aldrich, Inc., 2004, Response to Department of Toxic Substance Control Comments, South Bay Power Plant Facility, Chula Vista, California, February 2004

TABLES

TABLE I
DATA QUALITY OBJECTIVES
SDG&E SOUTH BAY POWER PLANT
CHULA VISTA, CALIFORNIA

SWMU NO.	AREA	BACKGROUND	PURPOSE	DATA NEEDS	DATA TYPE	ACCURACY LEVEL	PROPOSED INVESTIGATION
1	1a. North Tank Farm	1. AST Pipelines - Hydrocarbon losses from 4 ASTS	Post pipeline removal investigation	Soil data to investigate surface conditions along pipeline route	Soil chemistry analytical data; stratigraphy based on field observations	Soil chemistry - High level of accuracy by applying robust field and laboratory QA/QC procedures; Stratigraphy - Qualitative data based on field observations	Four hand-auger borings (3 feet bgs) along former pipeline route
		2. Pump Deck / Pump Pit Hydrocarbon losses from 4 ASTs	Post remediation confirmation	Soil data to confirm the presence/absence of residual TPH, metal, VOC-impacted soil in bottom of excavation	Soil chemistry analytical data; stratigraphy based on field observations	Soil chemistry - High level of accuracy by applying robust field and laboratory QA/QC procedures; Stratigraphy - Qualitative data based on field observations	Five direct-push soil borings (10 feet bgs) in a grid pattern
		3. Bermed Pond - Potential fuel oil spills	Preliminary characterization	Soil data to confirm the presence/absence of residual TPH, VOC, SVOCs and metal-impacted soil	Soil chemistry analytical data; stratigraphy based on field observations	Soil chemistry - High level of accuracy by applying robust field and laboratory QA/QC procedures; Stratigraphy - Qualitative data based on field observations	Three direct-push soil borings (10 feet bgs) across area
	1b. North Tank Farm	1. Displacement Oil AST - potential impact of displacement oil from spills	Post remediation confirmation	Soil data to confirm the presence/absence of residual TPH, metal, VOC, SVOC-impacted soil in bottom of excavation	Soil chemistry analytical data; stratigraphy based on field observations	Soil chemistry - High level of accuracy by applying robust field and laboratory QA/QC procedures; Stratigraphy - Qualitative data based on field observations	Two direct-push soil borings (10 feet bgs) in area
		2. Heat Exchanger potential impacts from oil spills (Co-located with SWMU 1-1a-2 , refer to SWMU 1-1a-2 for scope)	Post remediation confirmation	Soil data to confirm the presence/absence of residual TPH, metal, VOC-impacted soil in bottom of excavation	Soil chemistry analytical data; stratigraphy based on field observations	Soil chemistry - High level of accuracy by applying robust field and laboratory QA/QC procedures; Stratigraphy - Qualitative data based on field observations	Refer to SWMU 1-1a-2
	1c. North Tank Farm	ASTs 4,5, & 6 - No 2 fuel oil contamination in the fill material beneath former ASTs	Post remediation confirmation	Soil and groundwater data to confirm the presence/absence of residual TPH, metal, VOC-impacted soil and groundwater laterally from former excavation	Soil and grounddwater chemistry analytical data; stratigraphy based on field observations	Soil and groundwater chemistry - High level of accuracy by applying robust field and laboratory QA/QC procedures; Stratigraphy - Qualitative data based on field observations	24 direct-push soil borings and 6 direct-push groundwater probes (10 feet bgs) in former AST 4, ,5, and 6 footprints and lateral areas
	1d. North Tank Farm	Sampling location SB1-060 - temporary groundwater sampling point -	No action necessary based on previous groundwater results site-wide	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	1e. North Tank Farm	Local Staining (identified by SDG&E) (Co-located with SWMU 1-1a-2 , refer to SWMU 1-1a-2 for scope)	Post remediation confirmation	Soil data to confirm the presence/absence of residual TPH, metal, VOC-impacted soil in bottom of excavation	Soil chemistry analytical data; stratigraphy based on field observations	Soil chemistry - High level of accuracy by applying robust field and laboratory QA/QC procedures; Stratigraphy - Qualitative data based on field observations	Refer to SWMU 1-1a-2

TABLE I
DATA QUALITY OBJECTIVES
SDG&E SOUTH BAY POWER PLANT
CHULA VISTA, CALIFORNIA

SWMU NO.	AREA	BACKGROUND	PURPOSE	DATA NEEDS	DATA TYPE	ACCURACY LEVEL	PROPOSED INVESTIGATION
3	3a. Jet Fuel Area - JF-09, JF-10 and JF-15	Fuel hydrocarbons in soil and groundwater	Additional characterization	Soil and groundwater data to confirm the presence/absence of TPH, VOC, SVOC and metal impacts to soil and groundwater	Soil and groundwater chemistry analytical data; stratigraphy based on field observations	Soil and groundwater chemistry - High level of accuracy by applying robust field and laboratory QA/QC procedures; Stratigraphy - Qualitative data based on field observations	Eight direct-push soil and groundwater borings to 10 feet bgs
	3b. Jet Fuel Area -SB01-070A Additional Delineation	Fuel hydrocarbons in soil and groundwater	Additional characterization	Soil and groundwater data to confirm the presence/absence of TPH, VOC, SVOC and metal impacts to soil and groundwater	Soil and groundwater chemistry analytical data; stratigraphy based on field observations	Soil and groundwater chemistry - High level of accuracy by applying robust field and laboratory QA/QC procedures; Stratigraphy - Qualitative data based on field observations	four direct-push soil and groundwater borings to 10 feet bgs. Groundwater monitoring well sampling of three existing monitoring wells in area
4	UST Area	Fuel hydrocarbons remaining in groundwater following UST removal and soil excavation	Post remediation confirmation	Groundwater data to confirm the presence/absence of TPH, VOC, SVOC and metal impacts in groundwater	Groundwater chemistry analytical data and field observations	Groundwater chemistry - High level of accuracy by applying robust field and laboratory QA/QC procedures; Stratigraphy - Qualitative data based on field observations	Monitoring and sampling of existing five permanent groundwater monitoring wells in area
6	Former 1st generation surface impoundment	Remaining fuel hydrocarbon and metal impacts in soil and groundwater following previous soil excavation	Further sampling to be conducted during remediation	Soil data to confirm the presence/absence of potential impacts to soil and groundwater	Not Applicable	Not Applicable	Not Applicable
11 (12)	Former drum storage area (Pole wrap yard) - next to 1st generation impoundment area	Preliminary investigation used elevated detection limit for pentachlorophenol (PCP) analysis.	Post remediation confirmation using lower detection limit for pentachlorophenol (PCP) analysis.	Soil data to confirm the presence/absence of residual PCP in the immediate vicinity of the former drum storage area and pole wrap yard. Reporting limit to be below residential PRGs	Soil chemistry analytical data; stratigraphy based on field observations	Soil chemistry - High level of accuracy by applying robust field and laboratory QA/QC procedures; Stratigraphy - Qualitative data based on field observations	Five direct-push soil borings to 5 feet bgs.
16	16a. **AOC-1** East Central Area	SB5-094 was a temporary well which indicated VOC concentrations. Investigate soil and groundwater in this area	Additional characterization	Soil and groundwater data to further evaluate presence/absence of VOCs in this area.	Soil and groundwater chemistry analytical data; stratigraphy based on field observations	Soil and groundwater chemistry - High level of accuracy by applying robust field and laboratory QA/QC procedures; Stratigraphy - Qualitative data based on field observations	Three direct-push soil and groundwater borings to 10 feet bgs
	16b. **AOC-2** East Central Area	West of previous soil gas probe locations: SG-06 and SG-07	Preliminary characterization	Soil data to confirm the presence/absence of VOC-impacted soil	Soil chemistry analytical data; stratigraphy based on field observations	Soil chemistry - High level of accuracy by applying robust field and laboratory QA/QC procedures; Stratigraphy - Qualitative data based on field observations	Two direct-push soil borings to 10 feet bgs
	16c. East Central Area	Dissolved VOCs in groundwater, East Central Area	Additional characterization and groundwater monitoring	Groundwater data to confirm the presence/absence of potential PCBs, VOCs, SVOCs and metals in groundwater	Groundwater chemistry analytical data; stratigraphy based on field observations	Groundwater chemistry - High level of accuracy by applying robust field and laboratory QA/QC procedures; Stratigraphy - Qualitative data based on field observations	Nine groundwater monitoring wells ranging in depth from 21 to 26 feet bgs

TABLE I
DATA QUALITY OBJECTIVES
SDG&E SOUTH BAY POWER PLANT
CHULA VISTA, CALIFORNIA

SWMU NO.	AREA	BACKGROUND	PURPOSE	DATA NEEDS	DATA TYPE	ACCURACY LEVEL	PROPOSED INVESTIGATION
19	Former Automobile Junkyard Off-site and east of Site	Located along southeastern boundary of site. Potential on-site migration from former junkyard located east of site boundary.	Preliminary characterization	Groundwater data to confirm the presence/absence of potential VOC, SVOCs and TPH	Groundwater chemistry analytical data; stratigraphy based on field observations	Groundwater chemistry - High level of accuracy by applying robust field and laboratory QA/QC procedures; Stratigraphy - Qualitative data based on field observations	Nine direct-push groundwater borings to 10 feet bgs
21	East Loop Pipeline	Located in west central portion of site, near power plant.	Post-remediation confirmation sampling to be conducted during remediation	Soil data to confirm the presence/absence of potential impacts to soil and groundwater	Not Applicable	Not Applicable	Not Applicable
25	Former Agricultural Site Use	South-eastern portion of site, previously used for agricultural purposes, based on aerial photograph review	Preliminary characterization	Soil data to confirm the presence/absence of potential pesticides in soil impacts in this area.	Soil chemistry analytical data; stratigraphy based on field observations	Soil chemistry - High level of accuracy by applying robust field and laboratory QA/QC procedures; Stratigraphy - Qualitative data based on field observations	Four hand-auger or direct-push borings to 3 feet bgs.
26	Storm water Drainage Channel in Jet Fuel Area	Further investigation of fuel hydrocarbons in soil and groundwater adjacent to pipeline and within channel, east of jet fuel AST area	Preliminary characterization	Soil and groundwater data to confirm the presence/absence of potential TPH, VOC, SVOC and metals soil impacts	Soil and groundwater chemistry analytical data; stratigraphy based on field observations	Soil and groundwater chemistry - High level of accuracy by applying robust field and laboratory QA/QC procedures; Stratigraphy - Qualitative data based on field observations	Four direct-push soil and groundwater borings to 10 feet along the storm drain line as well as sediment samples in the drainage channel.
28	28a. Groundwater	Sitewide groundwater investigation Also included with this activity are SWMUs 1,3,4 & 16	Additional groundwater characterization	Groundwater data to confirm the presence/absence of potential VOC, SVOCs and TPH	Groundwater chemistry analytical data; stratigraphy based on field observations	Groundwater chemistry - High level of accuracy by applying robust field and laboratory QA/QC procedures; Stratigraphy - Qualitative data based on field observations	Monitoring and sampling of two groundwater monitoring wells in addition to monitoring wells addressed in SWMUs, 1,3,4& 16, for a total of 20 monitoring wells
	28b. **AOC-3** Open Area 5	Arsenic in previous soil borings SB5 009 and SB5-024	Additional characterization	Soil data to confirm the presence/absence of potential Arsenic-impacted soils	Soil chemistry analytical data; stratigraphy based on field observations	Soil chemistry - High level of accuracy by applying robust field and laboratory QA/QC procedures; Stratigraphy - Qualitative data based on field observations	Six direct-push borings (3 at each location) to five feet .
	28c. **AOC-4** Guard House	Southern portion of Site	Additional characterization	Soil data to confirm the presence/absence of potential mercury-impacted soils	Soil chemistry analytical data; stratigraphy based on field observations	Soil chemistry - High level of accuracy by applying robust field and laboratory QA/QC procedures; Stratigraphy - Qualitative data based on field observations	Four direct-push borings to seven feet

NOTES AND ABBREVIATIONS:
bgs - Below ground surface
SWMU - Solid waste management unit
TPH - Total petroleum hydrocarbons
PCBs - Polychlorinated biphenyls
SVOCs - Semi-volatile organic compounds
VOCs - Volatile organic compounds

TABLE II
AREAS OF CONCERN (AOCS)/SOLID WASTE MANAGEMENT UNITS (SWMUS) *
SDG&E SOUTH BAY POWER PLANT
CHULA VISTA, CALIFORNIA

AOC/ SMWU #	Map Location and Name of AOC/SWMU		Review Results	Recommendations/ Comments	Document to Submit
1	Map Location1a, North Tank Farm				
	a.	1. ASTs Pipelines – Hydrocarbon losses from 4 ASTs	- Soil sampling beneath pipelines was not part of scope of work	- Sampling as part of 1c, Aboveground tanks 4, 5 and 6 needs to be performed to verify cleanup.	Facility Investigation Workplan to confirm metals, VOCs, SVOCS, BTEX
		2. Pump Deck/ Pump Pit – HC losses from 4 ASTs	- No confirmatory sampling was conducted within the footprints of the deck -Nearby sampling location SB01-38A, TPH 4.2 and 38 mg/kg	- A sampling grid and workplan to be submitted to investigate CAM 17 metals, VOCs, SVOCs, TPHd	Facility Investigation Workplan to confirm metals, VOCs, SVOCS, BTEX
		3. Bermed Pond – potential fuel oil spills	- No sampling conducted - Duke/Port proposes to investigate this area.	- DTSC concurs with submittal of a workplan to investigate potential fuel oil spills	Facility Investigation Workplan to confirm metals, VOCs, SVOCS, BTEX
	b.	1. Displacement Oil AST- potential impact of DO spill	Soil contaminated with 4,600 mg/kg TPH was excavated, confirmatory sampling indicates non-detect, however groundwater was reached and not sampled.	- DTSC suggests including this in the required groundwater investigation. Sampling of groundwater could be part of the site-wide groundwater sampling recommended in item #28 of this report if wells are still present, otherwise additional wells may be required.	Groundwater Monitoring Plan to investigate VOCs, BTEX, SVOCs and metals Sampling could be part of the site-wide groundwater sampling
		2. Heat Exchanger potential impact from spills of oil		Additional soil sampling in the immediate area of heat exchanger to confirm petroleum HC contamination need to be conducted	Facility Investigation to confirm presence of petroleum HC. Analysis to include VOCS, BTEX and SVOCs
	c.	Tanks 4,5 & 6 – No 2 fuel oil contamination in the fill material beneath former tanks	- Edge of concrete ring appeared to have provided a conduit for the fuel oil to migrate downward and spread horizontally. After soil excavation, confirmatory samples were only collected from the bottom of tanks, and no sampling conducted to delineate any contamination outside the structural fill. Also, groundwater rose in Tank 5 exploration hole but was not sampled.	- Better clarification of the samples taken and their locations that document final clean up to be provided. A transect of the entire North Tank Farm may need to be performed to verify clean up.	Facility Investigation to confirm presence of petroleum HC. Analysis to include VOCS, BTEX and SVOCs
	d.	Sampling location SB1-060	Lead concentration in groundwater is 20 ug/l (MCL=15 ug/l); Antimony is 34 ug/l (MCL = 6 ug/l) Current status of well unknown	- Additional sampling of well should be considered. Sampling of groundwater could be part of the site-wide groundwater sampling recommended in item #28 of this report if wells are still present, otherwise additional wells may be required.	Groundwater Investigation Workplan to investigate metals, VOCS, SVOCS, and BTEX Sampling could be part of the site-wide groundwater sampling Additional wells may be required if well is not active.
	e.	Local Staining (identified by SDG&E)	Visual fuel oil staining observed. SDG&E is proposing to excavate the surface staining to 2 feet and collecting confirmatory sampling for TPH .	Concurs that remediation is needed. Should be part of the Interim Measures proposed for the site.	Interim Measures Workplan to excavate soil Confirmatory sampling to include BTEX, VOCs and SVOCs.
3	Jet Fuel Area , Map location 1c,		- Existing data: TEH concentrations at JF-8, JF-9, and JF-10 are	- Proposed remediation should be part of the	Facility Investigation Workplan to investigate

	Fuel HC in soil and groundwater	2400, >1000 and 1,400 mg/kg, respectively -SDG&E submitted a Remedial Action Workplan for Fuel Hydrocarbons and Metal Impacted Areas. The Workplan proposes to conduct additional investigation in soil and groundwater for LNPLs, VOCs, metals, SVOCs	interim Measures proposed for the site.	metals, VOCs, SVOCs, BTEX
4	UST Area, Map location 1d (See SWMU #2)	- Soil Excavation conducted. 1000 lbs ORC placed at base of excavation to treat groundwater contamination. Monitoring of MW1 still has benzene conc of <5 to 53 ug/l (MCL =1); MW-3 has 40 ug/l Antimony.	- Additional groundwater sampling of well needed. Sampling could be part of the site-wide groundwater sampling recommended in item #28 of this report.	Groundwater Investigation Workplan Sampling of groundwater should include metals, VOCs, SVOCs, and BTEX
6	Former First Generation Surface Impoundment, Map Location 2b,	- Existing data indicate that trench T4 has chromium at 1,300 mg/kg at 5 feet bgs, and deeper sample has 6.9 mg/kg. - Sampling locations B-24, B-25 and B-27 have metals in groundwater exceeding MCL; - -- Increasing concentration of TEH in sampling FI-11 - SDG&E submitted a Remedial Action Workplan for Fuel Hydrocarbons and Meta l Impacted Areas. The workplan proposes soil excavation and confirmatory sampling Groundwater will be collected and analyzed for PCBs.	- Proposed remediation should be part of Interim Measures.	Interim Measures Workplan to excavate soil. Confirmatory sampling soil and groundwater sampling to analyze metals, VOCs, SVOC, PCBs, and BTEX.
11	Former Drum Storage Area (Pole Wrap Yard) and Laydown Area, Map Location 4a	- Preliminary investigation used high PCP detection limit of <5 mg/kg (Residential PRG=3).	- Additional sampling is required for PCP analysis using lower PCP detection level than residential PRG.	Facility Investigation Workplan. Soil sampling for PCP using lower detection limit.
16	Dissolved VOCs in Groundwater East Central Area, Map location 5a,	- SDG&E submitted the Investigation and Proposed Remediation of Dissolved VOCs in Groundwater workplan to DTSC	Additional sampling in soil and groundwater for VOCs, SVOCs, PCBs, HC and metals is recommended.	Facility Investigation Workplan for soil, and Groundwater Investigation. Analysis should include metals, VOC, SVOCs, PCBs and BTEX. Groundwater sampling could be part of the site-wide groundwater sampling
19	Former Automobile Junkyard	- Located offsite and not part of SBPP, however, SDG&E recommends additional groundwater sampling for VOCs on the property boundary to confirm presence or absence of offsite VOC plume coming from the junkyard.	- Groundwater well sampling should be integrated into site wide groundwater well sampling	Groundwater Investigation Workplan to confirm VOCs, SVOCs, and metals migration. Sampling could be part of the site-wide groundwater sampling
21	East Loop Pipeline - Fuel HC and Metal Impacted Areas	- SDG&E submitted a Remedial Action Workplan for Fuel Hydrocarbons and Metal Impacted Areas. - The workplan proposes soil excavation and confirmatory sampling. - Groundwater sample collected at sampling location SB3-003A detected TEH at 1700 ug/l	- Proposed remediation should be part of Interim Measures - Sampling of groundwater could be part of the site-wide groundwater sampling recommended in item #28 of this report if wells are still present, otherwise additional wells may be required.	a) Interim Measures Workplan, soil excavation and confirmatory sampling for VOCs, SVOCs, BTEX and metals. b) Groundwater Investigation Workplan to investigate metals, BTEX, VOCs, SVOCs in groundwater. Sampling could be part of the site-wide groundwater sampling
25	Former Agricultural Site History	- SDG&E will conduct additional soil sampling in the former Agricultural portion of the site	- A workplan should be submitted to DTSC	Facility Investigation Workplan to analyze for pesticide.

TABLE II
AREAS OF CONCERN (AOCS)/SOLID WASTE MANAGEMENT UNITS (SWMUS)*
SAN DIEGO GAS & ELECTRIC, SOUTH BAY POWER PLANT
CHULA VISTA, CALIFORNIA

26	Storm water Drainage Channel (Southern Edge of Jet Fuel?)	- Should be considered as part of SWMU #3.	- Sampling should be part of SWMU #3.	Facility Investigation Workplan to investigate metals, VOCs, SVOCs, BTEX
28	**Other issues**			
	a. Metals, VOCs, petroleum hydrocarbon contamination in Groundwater at the entire site	- Metals such as Antimony, Lead, Nickel and Thallium; VOCs, TPH detected in groundwater wells	DTSC recommends 1 round of groundwater sampling	Groundwater Investigation workplan for metals, VOCs, SVOCs, and BTEX
	b. Arsenic Hot Spots in soil Open Area 5	- SB5-009 has As contamination of 15 mg/kg; SB5-024 As = 14 mg/kg - Residential PRG of 0.39 was exceeded	- Arsenic hot spots in soil need to be further evaluated in the Risk Assessment.	Interim Measures Workplan to excavate soil. Confirmatory sampling required for Arsenic.
	c. Guard House – Hg in Soil	- Hg = 2.4 mg/kg at boring location SB5-005	Mercury hot spot in soil need to be further evaluated in the Risk Assessment.	Risk Assessment Evaluation
	d. BG groundwater	- Table X identified SB5-075 identified as background well, however Antimony at 35 ug/l (MCL=6) and 15 ug/l Lead were detected. - Also, 140 ug/l Molybdenum was detected in SB5-052.	DTSC suggests evaluating Table X regarding validity of designating background groundwater wells	Groundwater Investigation Workplan to investigate metals,

*** (Source DTSC 16 July 2004, Attachment A)**

TABLE III
SOIL SAMPLING PLAN
SDG&E SOUTH BAY POWER PLANT
CHULA VISTA, CALIFORNIA

								DIRECT-PUSH SOIL PROGRAM									
SWMU	**SWMU ID and Description**		**Background Information**	**Approach**	**Matrix to Investigate**	**Chemicals Targeted**	**RP**	**# of Probes**	**Sample Depth(s) feet**	**Number of Samples**	**Metals**	**VOCs**	**SVOCs**	**Pesticides, Herbicides**	**PCBs**	**TPH**	**PAHs**
1	1a. North Tank Farm	1. AST Pipelines	Sampling beneath Pipelines was not part of previous scope of work	Post pipeline removal investigation - Sampling along pipelines from ASTs 4,5,and 6.	Soil	Metals, VOCs, SVOCs, BTEX, TPH	PORT/ DUKE	4	1,5	8	8	8	8	0	0	8	4
		2. Pump Deck / Pump Pit	No confirmatory sampling was conducted within the footprints of these structures.	Sampling in the center of this area to confirm post remediation conditions	Soil	Metals, VOCs, SVOCs, BTEX, TPHd	SDG&E	5	1,5,10	15	15	15	15	0	0	15	5
		3. Bermed Pond	No previous sampling conducted - Need to investigate this area	Preliminary characterization sampling in this area to evaluate existing conditions	Soil	Metals, VOCs, SVOCs, BTEX, TPHd	SDG&E	3	1,5,10	9	9	9	9	0	0	9	3
	1b North Tank Farm	1. Displacement Oil AST	Soil contaminated with 4,600 mg/kg TPH was excavated, confirmatory sampling indicates non-detect. Groundwater was reached and not analyzed as part of previous remedial activities	Collect groundwater samples	Groundwater	Metals, VOCs, SVOCs, BTEX, TPHd	SDG&E		**(See Groundwater Program Table)**								
		2. Heat Exchanger (Co-located with SWMU 1-1a-2 , refer to SWMU 1-1a-2 for scope)	(Co-located with SWMU 1-1a-2 , refer to SWMU 1-1a-2 for scope)	Post remediation confirmation sampling for soil. Groundwater will not be addressed	Soil	TPHd, VOCs, BTEX, SVOCs	SDG&E		**(See SWMU 1-1a-2 for scope)**								
	1c. North Tank Farm	ASTs 4,5, & 6 - impacted fill material beneath former ASTs	Post AST soil excavation confirmation samples were only collected from bottom of ASTs, no sampling conducted to delineate impacts outside the AST footprint, or groundwater beneath the ASTs.	Post remediation confirmation soil and groundwater sampling to delineate lateral and vertical extents of impacts observed beneath ASTs. Borings to investigate / define vertical and lateral extent will be biased toward locations exhibiting previous impacts under/	Soil and groundwater	TPHd, VOCs, BTEX, SVOCs	PORT/ DUKE & SDG&E	24	3,6,9	72	72	72	72	0	0	72	24
	1.d North Tank Farm	Sampling location SB1-060 - temporary groundwater sampling point - No action necessary based on previous groundwater results site-wide	Lead concentration in groundwater 20 ug/L (MCL = 15 ug/L); Antimony is 34 ug/L (MCL = 6 ug/L)	No action necessary based on previous groundwater results site-wide	Groundwater	N/A	SDG&E		**(See Groundwater Program Table)**								
	1.e North Tank Farm	Local Staining (Co-located with SWMU 1-1a-2 , refer to SWMU 1-1a-2 for scope)	visual fuel oil staining observed. SDG&E proposing to excavate surface staining to 2 feet bgs and collecting confirmation sample during interim measures for site	No action at this time. Sampling will be conducted later during soil remediation	Soil	TPHd, VOCs, BTEX and SVOCs	SDG&E	0	**(Sampling to be conducted later during planned remediation)**								
3	1. Jet Fuel Area - JF-09, JF-10 and JF-15	Fuel hydrocarbons in soil and groundwater	Existing data: TPH concentrations in soil @ JF-9, JF-10 and JF-15 are 5,670, 1,400 and 10,000 mg/kg, respectively.	Additional characterization for soil and groundwater in immediate vicinity and down gradient of observed locations	Soil & Groundwater	Groundwater - metals, VOCs, SVOCs, BTEX, TPHd Soil - TPHd, VOCs, BTEX, SVOCs, Metals	SDG&E	8	3,6,9	24	24	24	24	0	0	24	8

TABLE III
SOIL SAMPLING PLAN
SDG&E SOUTH BAY POWER PLANT
CHULA VISTA, CALIFORNIA

SWMU	SWMU ID and Description		Background Information	Approach	Matrix to Investigate	Chemicals Targeted	RP	DIRECT-PUSH SOIL PROGRAM # of Probes	Sample Depth(s) feet	Number of Samples	Metals	VOCs	SVOCs	Pesticides, Herbicides	PCBs	TPH	PAHs
3 cont.	2.Jet Fuel Area -SB01-070A Additional Delineation	Fuel hydrocarbons in soil and groundwater	Existing data: LNAPL detected in previous groundwater sampling; additional soil and groundwater delineation in proximity and down gradient of SB-070A	If LNAPL is encountered only TPH analysis will be performed	Soil & Groundwater	Groundwater - metals, VOCs, SVOCs, BTEX, TPHd Soil - TPHd, VOCs, BTEX, SVOCs, Metals	SDG&E	4	3,6,9	12	12	12	12	0	0	12	12
4	UST Area (see SWMU # 2)	Fuel hydrocarbons in groundwater	Soil excavation conducted, with 1,000 lbs of ORC placed at bottom of excavation to treat groundwater impacts. MW4A still has benzene concentration of <5 to 53 ug/L (MCL =1 ug/L),	Additional groundwater sampling of monitoring wells to be conducted. No soil sampling is proposed.	Groundwater	metals, VOCs, SVOCs, BTEX, TPHd	SDG&E		**(See Groundwater Program Table)**								
6	Former 1st generation surface impoundment	Remaining residual fuel hydrocarbon and metal impacts in soil & groundwater	Data indicates that trench T4 has chromium at 1,300 mg/kg at 5 feet bgs and deeper sample has 6.9 mg/kg. -Sampling locations B-24, B-25 and B-27 have metals in groundwater exceeding MCLs. There is also increasing concentrations of TPH in samples FI-1.	Confirmation soil and groundwater sampling will be conducted later during planned remediation	Soil & Groundwater	Groundwater - metals (dissolved), VOCs, SVOCs, BTEX, TPHd , PCBs - Soil TPHd, VOCs, BTEX, SVOCs	SDG&E		**(Sampling to be conducted later during planned remediation)**								
11 (12)	Former drum storage area (Pole wrap yard) - next to 1st generation impoundment area	Preliminary investigation detected pentachlorophenol (PCP)	Preliminary investigation used high PCP detection limit of < 5 mg/kg. Residential PRG = 3 mg/kg	Additional sampling is required for PCP analysis using lower detection limit than residential PRG	Soil	PCP with detection limit below 3 mg/kg	SDG&E	5	1,5	10	0	0	10	0	0	0	0
16	1.**AOC-1** - East Central Area	SB5-094 was a temporary well which indicated VOC concentrations. Investigate soil and groundwater in this area	VOCs detected in groundwater from temporrary groundwater sampling point	Collect soil and groundwater samples in this location	Soil & Groundwater	Groundwater - metals (dissolved), VOCs, SVOCs, BTEX, TPHd , PCBs Soil - TPHd, VOCs, BTEX, SVOCs, Metals	SDG&E	3	9	3	3	3	0	0	0	0	0
	2. **AOC-2** -East Central Area	Soil gas locations SG-06 and SG-07	Soil gas VOC concentrations detected in SG-06 and SG-07. lateral extent of impacts not defined	investigate soil to evaluate significance of detected soil gas concentrations and define lateral extent of Vocs	Soil	VOCs	SDG&E	2	3,6,9	6	0	6	0	0	0	0	0
	3. East Central Area	Dissolved VOCs in groundwater, East Central Area	Historical concentrations of VOCs in groundwater in the monitoring wells in this location required further sampling and analysis to establish current conditions. Monitoring has not been recently performed	Sampling of existing groundwater monitoring wells in this area to be performed.	Groundwater	Groundwater - metals (dissolved), VOCs, SVOCs, BTEX, TPHd, PCBs	SDG&E		**(See Groundwater Program Table)**								

TABLE III
SOIL SAMPLING PLAN
SDG&E SOUTH BAY POWER PLANT
CHULA VISTA, CALIFORNIA

								DIRECT-PUSH SOIL PROGRAM									
SWMU	**SWMU ID and Description**		**Background Information**	**Approach**	**Matrix to Investigate**	**Chemicals Targeted**	**RP**	**# of Probes**	**Sample Depth(s) feet**	**Number of Samples**	**Metals**	**VOCs**	**SVOCs**	**Pesticides, Herbicides**	**PCBs**	**TPH**	**PAHs**
19	Former Automobile Junkyard - Off-site and east of Site	Located along southeastern boundary of site. Potential on-site migration from former junkyard located east of site boundary.	Junk Yard is located off-site and not part of SBPP. Investigate potential for off-site groundwater plume migration onto site.	Conduct groundwater sampling along the site eastern boundary to establish current groundwater conditions	Groundwater	Groundwater - metals (dissolved), VOCs, SVOCs, BTEX, TPHd	SDG&E		**(See Groundwater Program Table)**								
21	East Loop Pipeline	Located in west central portion of site, near power plant.	Groundwater sample collected from SB3-003A detected TPH at 1,700 ug/l.	No action at this time. Confirmation soil and groundwater sampling will be conducted later during planned remediation	Soil & Groundwater-	Groundwater - metals (dissolved), VOCs, SVOCs, BTEX, TPHd, Soil - TPHd, VOCs, BTEX, SVOCs, metals	SDG&E		**(Sampling to be conducted later during planned remediation)**								
25	Former Agricultural Site Use	South-eastern portion of site, previously used for agricultural purposes, based on aerial photograph review	Conduct additional soil sampling in the former agricultural portion of the Site for pesticides	Preliminary soil characterization for pesticides in this portion of the Site.	Soil	Pesticides analysis	SDG&E	4	0-1, 2-3	4	0	0	0	4	0	0	0
26	Storm water Drainage Channel in Jet Fuel Area	Further investigation of fuel hydrocarbons in soil and groundwater adjacent to pipeline and within channel, east of jet fuel AST area	Existing data: TPH concentrations in soil @ JF-9, JF-10 and JF-15 are 5,670, 1,400 and 10,000 mg/kg, respectively. LNAPLs reported in SB-01-070A	Delineate soil and groundwater impacts in this areafurther	Soil & Groundwater	Groundwater - metals (dissolved), VOCs, SVOCs, BTEX, TPHd - Soil TPHd, VOCs, BTEX, SVOCs, Metals	SDG&E	4	3,6,9	12	12	12	12	0	0	12	12
28	a. Site-wide Groundwater	Sitewide groundwater investigation Also included with this activity are SWMUs 1,3,4 & 16	Concentrations of metals suchs as antimony, lead, nickel and thallium, VOCs, and TPH detected in groundwater during previous activities	Conduct 1 round of groundwater sampling of all existing site-related monitoring wells	Groundwater	metals, VOCs, SVOCs, BTEX, TPHd	SDG&E		**(See Groundwater Program Table)**								
	b. **AOC - 3** - Open Area 5	Arsenic in previous soil borings SB5-009 and SB5-024	SB5-009 has As contamination of 15 mg/kg; SB5-024 As=14 mg/kg Residential PRG = 0.39 mg/kg	Additional soil characterization to further investigate arsenic in soil hot spots	soil	metals - Arsenic Only analysis	SDG&E	8	0-1, 4-5	16	16*	0	0	0	0	0	0
	AOC - 4 - Guard House	Southern portion of Site	Hg = 2.4 mg/kg at boring location SB5-005	Additional soil characterization to investigateMercury hot spot in soil	Soil	metals, Hg	SDG&E	4	1,4,7	12	12	0	0	0	0	0	0

TABLE IV
GROUNDWATER SAMPLING PLAN
SDG&E SOUTH BAY POWER PLANT
CHULA VISTA, CALIFORNIA

							DIRECT-PUSH GROUNDWATER PROGRAM									GROUNDWATER MONITORING WELL PROGRAM									
SWMU	**SWMU ID and Description**		**Background Information**	**Approach**	**Matrix to Investigate**	**Chemicals Targeted**	**# of Probes**	**Sample Depth(s) feet**	**Number of Samples**	**Metals**	**VOCs**	**SVOCs**	**PCBs**	**TPH**	**PAHs**	**# of Wells**	**Well IDs**	**Depth feet**	**Number of Samples**	**Metals**	**VOCs**	**SVOCs**	**PCBs**	**TPH**	**PAHs**
1	1a. North Tank Farm	1. AST Pipelines	Sampling beneath Pipelines was not part of previous scope of work	Post pipeline removal investigation - Sampling along pipelines from ASTs 4,5,and 6.	Soil	Metals, VOCs, SVOCs, BTEX, TPH	**(No Groundwater Sampling Planned)**									-	-	-	-	-	-	-	-	-	-
		2. Pump Deck / Pump Pit	No confirmatory sampling was conducted within the footprints of these structures.	Sampling in the center of this area to confirm post remediation conditions	Soil	Metals, VOCs, SVOCs, BTEX, TPHd	**(No Groundwater Sampling Planned)**									-	-	-	-	-	-	-	-	-	-
		3. Bermed Pond	No previous sampling conducted - Need to investigate this area	Preliminary characterization sampling in this area to evaluate existing conditions	Soil	metals, VOCs, SVOCs, BTEX, TPHd	**(No Groundwater Sampling Planned)**									-	-	-	-	-	-	-	-	-	-
	1b North Tank Farm	1. Displacement Oil AST	Soil contaminated with 4,600 mg/kg TPH was excavated, confirmatory sampling indicates non-detect. Groundwater was reached and not analyzed as part of previous remedial activities	Collect groundwater samples	Groundwater	Metals, VOCs, SVOCs, BTEX, TPHd	2	10	2	2	-	2	-	2	2	-	-	-	-	-	-	-	-	-	-
		2. Heat Exchanger (Co-located with SWMU 1-1a-2 , refer to SWMU 1-1a-2 for scope)	(Co-located with SWMU 1-1a-2 , refer to SWMU 1-1a-2 for scope)	Post remediation confirmation sampling for soil. Groundwater will not be addressed	Soil	TPHd, VOCs, BTEX, SVOCs	**(No Groundwater Sampling Planned)**									-	-	-	-	-	-	-	-	-	-

							DIRECT-PUSH GROUNDWATER PROGRAM									GROUNDWATER MONITORING WELL PROGRAM									
SWMU	**SWMU ID and Description**		**Background Information**	**Approach**	**Matrix to Investigate**	**Chemicals Targeted**	**# of Probes**	**Sample Depth(s) feet**	**Number of Samples**	**Metals**	**VOCs**	**SVOCs**	**PCBs**	**TPH**	**PAHs**	**# of Wells**	**Well IDs**	**Depth feet**	**Number of Samples**	**Metals**	**VOCs**	**SVOCs**	**PCBs**	**TPH**	**PAHs**
	1c. North Tank Farm	ASTs 4,5, & 6 - impacted fill material beneath former ASTs	Post AST soil excavation confirmation samples were only collected from bottom of ASTs, no soil sampling conducted to delineate impacts outside or within the AST footprints. No groundwater samples collected or analyzed.	Post remediation confirmation soil and groundwater sampling to delineate lateral and vertical extent of impacts observed around and beneath ASTs. Borings to investigate / define soil and groundwater impacts under and around former ASTs.	Soil and Groundwater	TPHd, VOCs, BTEX, SVOCs, Metals	6	10	6	6	6	6	-	6	6	-	-	-	-	-	-	-	-	-	-
	1d. North Tank Farm	Sampling location SB1-060 - temporary groundwater sampling point - No action necessary based on previous groundwater results site-wide	Lead concentration in groundwater 20 ug/L (MCL = 15 ug/L); Antimony is 34 ug/L (MCL = 6 ug/L)	No action necessary based on previous groundwater results site-wide	Groundwater	N/A	**(No Groundwater Sampling Planned)**									-	-	-	-	-	-	-	-	-	-
	1e. North Tank Farm	Local Staining (Co-located with SWMU 1-1a-2 , refer to SWMU 1-1a-2 for scope)	visual fuel oil staining observed. SDG&E proposing to excavate surface staining to 2 feet bgs and collecting confirmation sample during interim measures for site	No action at this time. Sampling will be conducted later during soil remediation	Soil	TPHd, VOCs, BTEX and SVOCs	**(No Groundwater Sampling Planned)**									-	-	-	-	-	-	-	-	-	-

							DIRECT-PUSH GROUNDWATER PROGRAM									GROUNDWATER MONITORING WELL PROGRAM									
SWMU	**SWMU ID and Description**		**Background Information**	**Approach**	**Matrix to Investigate**	**Chemicals Targeted**	**# of Probes**	**Sample Depth(s) feet**	**Number of Samples**	**Metals**	**VOCs**	**SVOCs**	**PCBs**	**TPH**	**PAHs**	**# of Wells**	**Well IDs**	**Depth feet**	**Number of Samples**	**Metals**	**VOCs**	**SVOCs**	**PCBs**	**TPH**	**PAHs**
3	1 . Jet Fuel Area - JF-09, JF-10 and JF-15	Fuel hydrocarbons in soil and groundwater	Existing data: TPH concentrations in soil @ JF-9, JF-10 and JF-15 are 5,670, 1,400 and 10,000 mg/kg, respectively.	Additional characterization for soil and groundwater in immediate vicinity and down gradient of observed locations	Soil & Groundwater	Groundwater - metals, VOCs, SVOCs, BTEX, TPHd Soil - TPHd, VOCs, BTEX, SVOCs, Metals	8	10	8	8	8	8	0	8	8	-	-	-	-	-	-	-	-	-	-
3	2. Jet Fuel Area -SB01-070A Additional Delineation	Fuel hydrocarbons in soil and groundwater	Existing data: LNAPL detected in previous groundwater sampling; additional soil and groundwater delineation in proximity and down gradient of SB-070A	If LNAPL is encountered only TPH analysis will be performed	Soil & Groundwater	Groundwater - metals, VOCs, SVOCs, BTEX, TPHd Soil - TPHd, VOCs, BTEX, SVOCs	4	10	4	4	4	4	0	4	4	3	SB01-070A, SB01-070C, SB01-070D	3	3	3	3	3	0	3	3
4	UST Area (see SWMU # 2)	Fuel hydrocarbons in groundwater	Soil excavation conducted, with 1,000 lbs of ORC placed at bottom of excavation to treat groundwater impacts. MW4A still has benzene concentration of <5 to 53 ug/L (MCL =1 ug/L),	Additional groundwater sampling of monitoring wells to be conducted. No soil sampling is proposed.	Groundwater	metals, VOCs, SVOCs, BTEX, TPHd	-	-	-	-	-	-	-	-	-	5	MW-01 to MW-05	22	5	5	5	5	0	5	0

							DIRECT-PUSH GROUNDWATER PROGRAM									GROUNDWATER MONITORING WELL PROGRAM									
SWMU	**SWMU ID and Description**		**Background Information**	**Approach**	**Matrix to Investigate**	**Chemicals Targeted**	**# of Probes**	**Sample Depth(s) feet**	**Number of Samples**	**Metals**	**VOCs**	**SVOCs**	**PCBs**	**TPH**	**PAHs**	**# of Wells**	**Well IDs**	**Depth feet**	**Number of Samples**	**Metals**	**VOCs**	**SVOCs**	**PCBs**	**TPH**	**PAHs**
6	Former 1st generation surface impoundment	Remaining residual fuel hydrocarbon and metal impacts in soil & groundwater	Data indicates that trench T4 has chromium at 1,300 mg/kg at 5 feet bgs and deeper sample has 6.9 mg/kg. -Sampling locations B-24, B-25 and B-27 have metals in groundwater exceeding MCLs. There is also increasing concentrations of TPH in samples FI-1.	Confirmation soil and groundwater sampling will be conducted later during planned remediation	Soil & Groundwater	Groundwater - metals (dissolved), VOCs, SVOCs, BTEX, TPHd , PCBs - Soil TPHd, VOCs, BTEX, SVOCs, Metals	-	**(Sampling to be conducted later during planned remediation)**								-	-	-	-	-	-	-	-	-	-
11 (12)	Former drum storage area (Pole wrap yard) - next to 1st generation impoundment area	Preliminary investigation detected pentachlorophenol (PCP)	Preliminary investigation used high PCP detection limit of < 5 mg/kg. Residential PRG = 3 mg/kg	Additional sampling is required for PCP analysis using lower detection limit than residential PRG	Soil	PCP with detection limit below 3 mg/kg		**(No Groundwater Sampling Planned)**								-	-	-	-	-	-	-	-	-	-
16	1. **AOC-1** - East Central Area	SB5-094 was a temporary well which indicated VOC concentrations. Investigate soil and groundwater in this area	VOCs detected in groundwater from temporrary groundwater sampling point	Collect soil and groundwater samples in this location	Soil & Groundwater	Groundwater - metals (dissolved), VOCs, SVOCs, BTEX, TPHd , PCBs - Soil TPHd, VOCs, BTEX, SVOCs	3	10	3	0	3	0	0	0	0	-	-	-	-	-	-	-	-	-	-
	2. **AOC-2** - East Central Area	Soil gas locations SG-06 and SG-07	Soil gas VOC concentrations detected in SG-06 and SG-07. lateral extent of impacts not defined	investigate soil to evaluate significance of detected soil gas concentrations and define lateral extent of Vocs	Soil	VOCs		**(No Groundwater Sampling Planned)**								-	-	-	-	-	-	-	-	-	-

							DIRECT-PUSH GROUNDWATER PROGRAM									GROUNDWATER MONITORING WELL PROGRAM									
SWMU	**SWMU ID and Description**		**Background Information**	**Approach**	**Matrix to Investigate**	**Chemicals Targeted**	**# of Probes**	**Sample Depth(s) feet**	**Number of Samples**	**Metals**	**VOCs**	**SVOCs**	**PCBs**	**TPH**	**PAHs**	**# of Wells**	**Well IDs**	**Depth feet**	**Number of Samples**	**Metals**	**VOCs**	**SVOCs**	**PCBs**	**TPH**	**PAHs**
16 cont.	3. East Central Area	Dissolved VOCs in groundwater, East Central Area	Historical concentrations of VOCs in groundwater in the monitoring wells in this location required further sampling and analysis to establish current conditions. Monitoring has not been recently performed	Sampling of existing groundwater monitoring wells in this area to be performed.	Groundwater	Groundwater - metals (dissolved), VOCs, SVOCs, BTEX, TPHd, PCBs	-	-	-	-	-	-	-	-		9	IT-01 TO IT-07, SB05-041A, SB05-043A	21 TO 26	9	9	9	9	9	9	0
19	Former Automobile Junkyard - Off-site and east of Site	Located along southeastern boundary of site. Potential on-site migration from former junkyard located east of site boundary.	Junk Yard is located off-site and not part of SBPP. Investigate potential for off-site groundwater plume migration onto site.	Conduct groundwater sampling along the site eastern boundary to establish current groundwater conditions	Groundwater	Groundwater - metals (dissolved), VOCs, SVOCs, BTEX, TPHd	9	10	9	9	9	9	0	9	0	-	-	-	-	-	-	-	-	-	-
21	East Loop Pipeline	Located in west central portion of site, near power plant.	Groundwater sample collected from SB3-003A detected TPH at 1,700 ug/l.	No action at this time. Confirmation soil and groundwater sampling will be conducted later during planned remediation	Soil & Groundwater-	Groundwater - metals (dissolved), VOCs, SVOCs, BTEX, TPHd, - Soil TPHd, VOCs, BTEX, SVOCs, metals		**(Sampling to be conducted later during planned remediation)**								-	-	-	-	-	-	-	-	-	-

							DIRECT-PUSH GROUNDWATER PROGRAM									GROUNDWATER MONITORING WELL PROGRAM									
SWMU	**SWMU ID and Description**		**Background Information**	**Approach**	**Matrix to Investigate**	**Chemicals Targeted**	**# of Probes**	**Sample Depth(s) feet**	**Number of Samples**	**Metals**	**VOCs**	**SVOCs**	**PCBs**	**TPH**	**PAHs**	**# of Wells**	**Well IDs**	**Depth feet**	**Number of Samples**	**Metals**	**VOCs**	**SVOCs**	**PCBs**	**TPH**	**PAHs**
25	Former Agricultural Site Use	South-eastern portion of site, previously used for agricultural purposes, based on aerial photograph review	Conduct additional soil sampling in the former agricultural portion of the Site for pesticides	Preliminary soil characterization for pesticides in this portion of the Site.	Soil	Pesticides analysis		**(No Groundwater Sampling Planned)**								-	-	-	-	-	-	-	-	-	-
26	Storm water Drainage Channel in Jet Fuel Area	Further investigation of fuel hydrocarbons in soil and groundwater adjacent to pipeline and within channel, east of jet fuel AST area	Existing data: TPH concentrations in soil @ JF-9, JF-10 and JF-15 are 5,670, 1,400 and 10,000 mg/kg, respectively. LNAPLs reported in SB-01-070A	Delineate soil and groundwater impacts in this areafurther	Soil & Groundwater	Groundwater - metals (dissolved), VOCs, SVOCs, BTEX, TPHd - Soil TPHd, VOCs, BTEX, SVOCs	4	10	4	4	4	4	0	4	0	-	-	-	-	-	-	-	-	-	-
28	a. Site-wide Groundwater	Sitewide groundwater investigation Also included with this activity are SWMUs 1,3,4 & 16	Concentrations of metals suchs as antimony, lead, nickel and thallium, VOCs, and TPH detected in groundwater during previous activities	Conduct 1 round of groundwater sampling of all existing site-related monitoring wells	Groundwater	metals, VOCs, SVOCs, BTEX, TPHd	-	-	-	-	-	-	-	-	-	2	SB3-017A, SB1-003A	26	2	2	2	2	0	2	2
	AOC - 3 - Open Area 5	Arsenic in previous soil borings SB5-009 and SB5-024	SB5-009 has As contamination of 15 mg/kg; SB5-024 As=14 mg/kg Residential PRG = 0.39 mg/kg	Additional soil characterization to further investigate arsenic in soil hot spots	soil	metals - Arsenic Only analysis		**(No Groundwater Sampling Planned)**								-	-	-	-	-	-	-	-	-	-
	AOC - 4 - Guard House	Southern portion of Site	Hg = 2.4 mg/kg at boring location SB5-005	Additional soil characterization to investigateMercury hot spot in soil	Soil	metals, Hg		**(No Groundwater Sampling Planned)**								-	-	-	-	-	-	-	-	-	-

TABLE V
EXISTING GROUNDWATER MONITORING WELL CONSTRUCTION DETAILS
SDG&E SOUTH BAY POWER PLANT
CHULA VISTA, CALIFORNIA

				WELL CONSTRUCTION DETAILS							
SWMU	**Description**	**WELL ID**	**Source**	**TOTAL BORING DEPTH [feet]**	**WELL DEPTH [feet]**	**WELL CASING DIAMETER [inches]**	**SCREEN LENGTH [feet]**	**SCREEN INTERVAL [feet]**	**SCREEN SLOT SIZE [inches]**	**ELEVATION - TOP OF CASING [MSL]**	**DEPTH TO GROUNDWATER [bgs] ***
3-2	Jet Fuel AST Area	SB01-070A	#	21	20	2	15	5-20	0.02	-	8.40 / Free product
3-2	Jet Fuel AST Area	SB01-070B	#	26	19.5	2	15	4.5-19.5	0.02	-	8.25
3-2	Jet Fuel AST Area	SB01-070C	#	26	20	2	15	5-20	0.02	-	6.75
3-2	Jet Fuel AST Area	SB01-070D	#	26	19.5	2	15	4.5-19.5	0.02	-	6.7
4	UST Area	MW-01	^	20.5	20	4	15	5-20	0.02	12.97	-
4	UST Area	MW-02	^	20.5	19	4	15	4-19	0.02	12.71	-
4	UST Area	MW-03	^	21	20	4	15	5-20	0.02	12.51	-
4	UST Area	MW-04A	^	20.5	20	4	15	5-20	0.02	12.97	-
4	UST Area	MW-05	^	22	21.5	4	15	6.5-21.5	0.02	15.41	-
16-3	Southeastern Open Area	IT-01	^	23	22	2	15	7-22	0.01	17.1734	11.05
16-3	Southeastern Open Area	IT-02	^	23	22	2	15	7-22	0.01	16.0411	10.01
16-3	Southeastern Open Area	IT-03	^	23	22	2	15	7-22	0.01	15.6367	9.95
16-3	Southeastern Open Area	IT-04	^	23	22	2	15	7-22	0.01	16.1069	10.45
16-3	Southeastern Open Area	IT-05	^	23	22	2	15	7-22	0.01	15.2725	9.43
16-3	Southeastern Open Area	IT-06	^	23	22	2	15	7-22	0.01	16.4951	10.57

TABLE V
EXISTING GROUNDWATER MONITORING WELL CONSTRUCTION DETAILS
SDG&E SOUTH BAY POWER PLANT
CHULA VISTA, CALIFORNIA

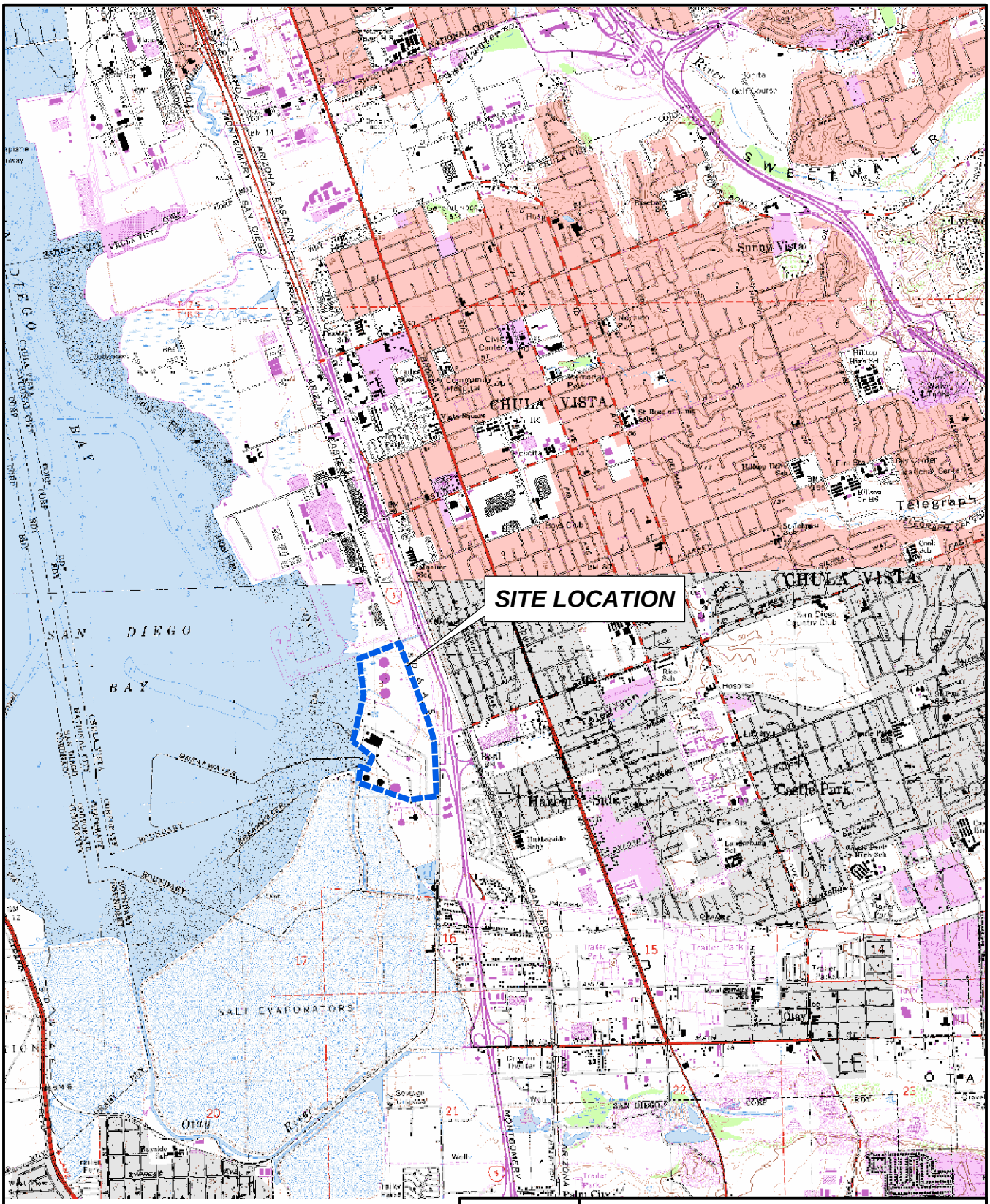
				WELL CONSTRUCTION DETAILS							
16-3	Southeastern Open Area	IT-07	^	23	22	2	15	7-22	0.01	14.2514	9.55
16-3	Southeastern Open Area	SB05-041A	#	26	20	2	10	10-20	0.02	17.2993	11.02
16-3	Southeastern Open Area	SB05-043A	#	21	20	2	10	10-20	0.02	20.2719	13.55
N/A	Administration Building Area	SB03-017A	#	26	20	2	10	10-20	0.02	-	-
N/A	AST 1 Area	SB01-003A	#	26.5	25	2	15	10-25	0.02	-	-

Notes:

Sources
^ = Monitoring well information from IT Corporation (IT) boring logs - February 2001
# = Monitoring well information from Gluor Daniel GTI boring logs - March 1998
* = Data from IT groundwater gauging activities - May 01, 2001

MSL = Mean Sea Level
bgs = below ground surface

FIGURES



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HALEY & ALDRICH

UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

SOUTH BAY POWER PLANT

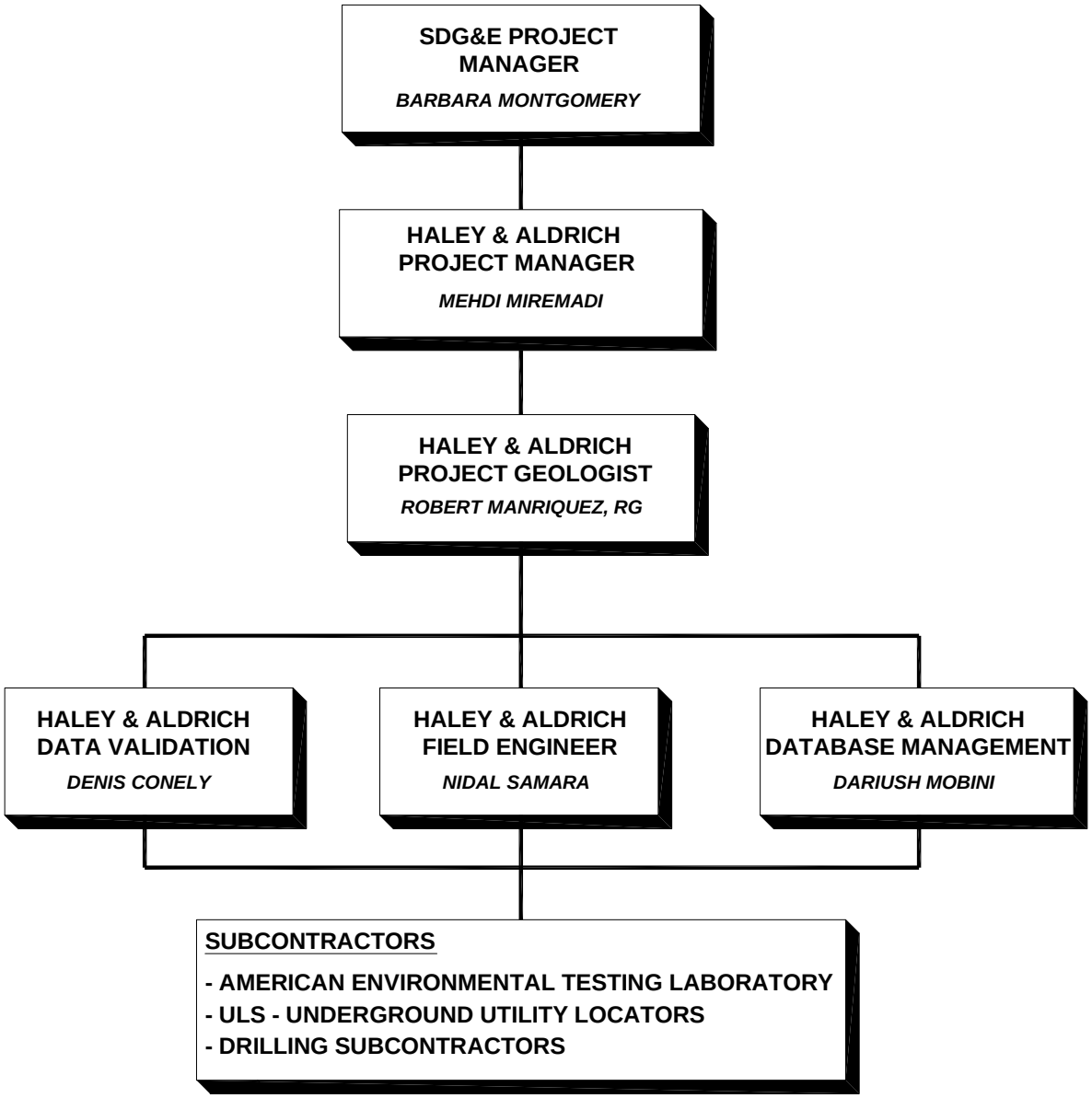
FIGURE 1

SITE LOCATION MAP

NOT TO SCALE

JUNE 2005

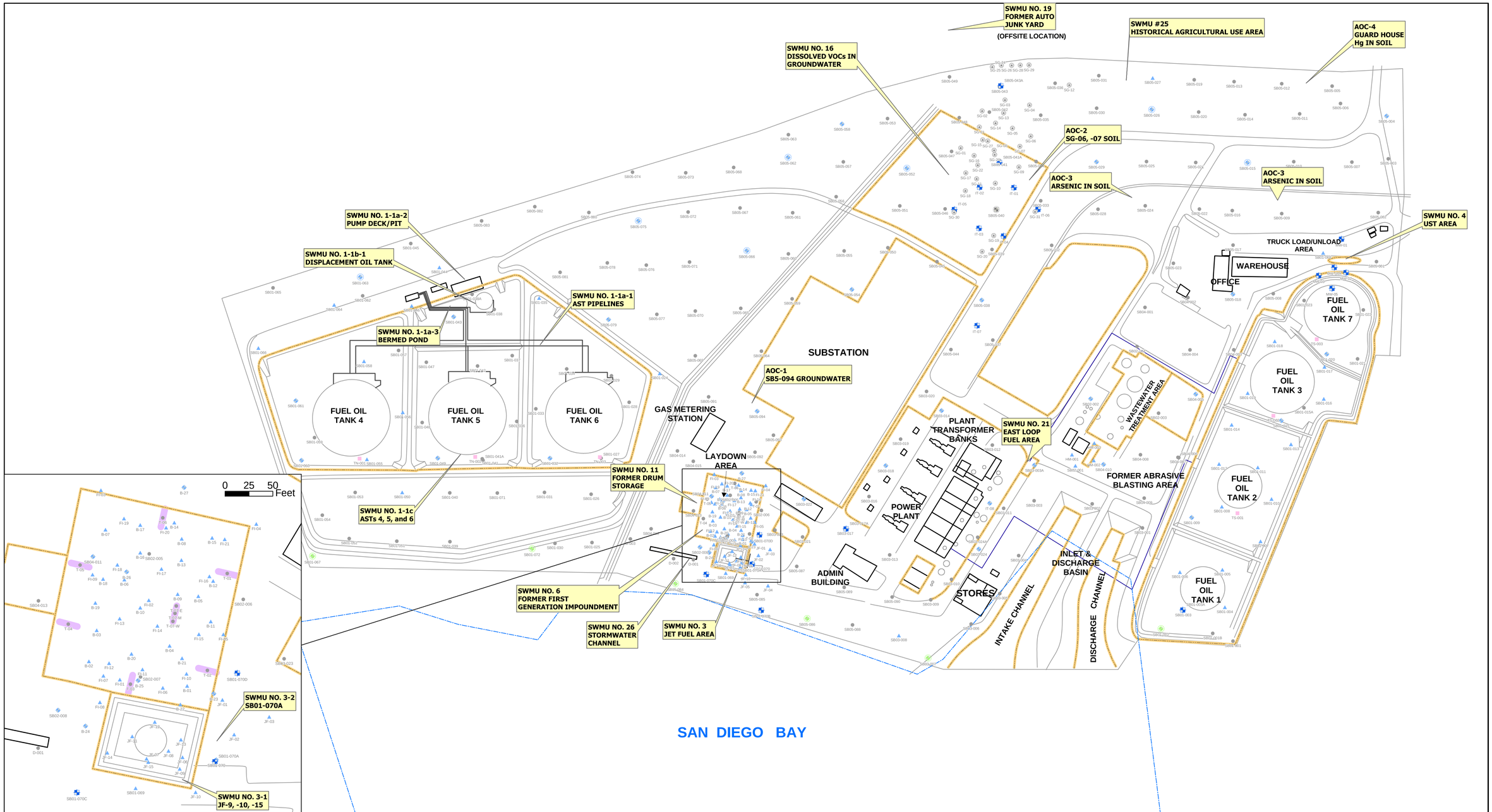
29197-013



PROJECT ORGANIZATION CHART
SOUTH BAY POWER PLANT
FACILITY INVESTIGATION

HALEY & ALDRICH

FIGURE 2



LEGEND

- Soil Boring 0'-5.5'
- Soil Boring 6'-15'
- Soil Boring 1.5'-16'
- Groundwater Sample (Temporary Well - Abandoned)
- Soil Gas Boring
- Background Groundwater Sample (Permanent)
- Background Groundwater sample (Temporary Well - Abandoned)
- Compliance Groundwater Sample (Temporary Well - Abandoned)
- Existing Monitoring Well (Permanent)
- SWMU Boundary
- Exploration Trench Location
- SWMU NO. 3 JET FUEL AREA — SWMU Number and Description

N

All Locations and Dimensions Approximate

0 150 300 600 Feet

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UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

SOUTH BAY POWER PLANT

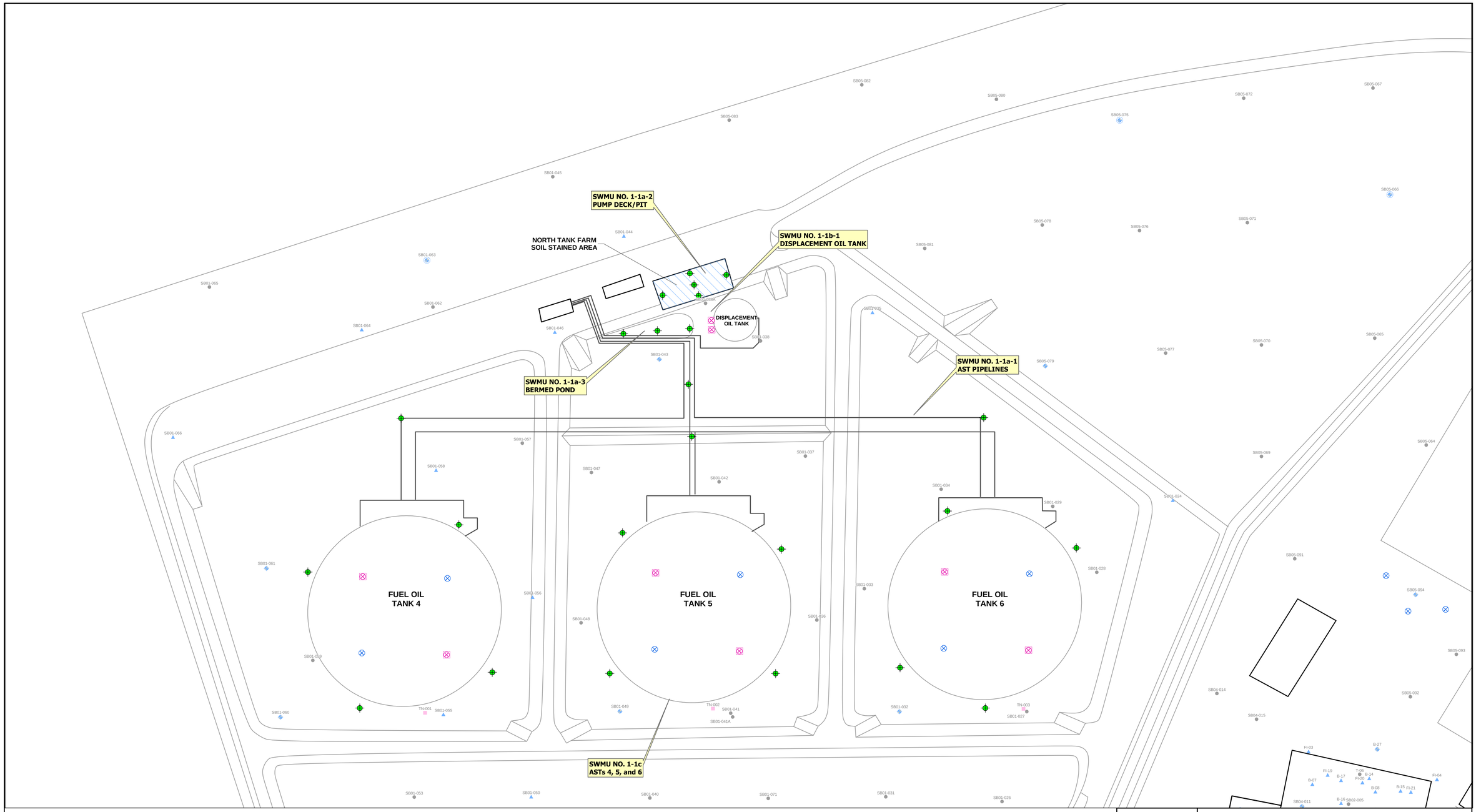
FIGURE 3

SITE PLAN

SCALE AS SHOWN

JUNE 2005

29197-013



LEGEND

HISTORICAL

- Soil Boring 0'-5.5'
- Soil Boring 6'-15'
- Soil Boring 1.5'-16'
- Groundwater Sample (Temporary Well - Abandoned)
- Soil Gas Boring
- Background Groundwater Sample (Existing Well - Permanent)
- Background Groundwater sample (Temporary Well - Abandoned)
- Compliance Groundwater Sample (Temporary Well - Abandoned)
- Existing Monitoring Well (Permanent)

PROPOSED

- Direct-push Groundwater Sample Location
- Direct-push Soil Boring Sample Location
- Hand Auger Soil Boring Sample Location
- Direct-push Soil & Groundwater Sample Location
- Direct-push Soil & Groundwater Sample Location

SWMU NO. 1-1a-3 BERMED POND — SWMU Number and Description

N

All Locations and Dimensions Approximate

0 30 60 120 180 Feet

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UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

SOUTH BAY POWER PLANT

FIGURE 4

SWMU #1
NORTH TANK FARM - SOIL AND GROUNDWATER SAMPLING LOCATIONS

SCALE AS SHOWN

JUNE 2005

29197-013

FORMER LAYDOWN AREA

SWMU NO. 11
FORMER DRUM
STORAGE

SWMU NO. 6
FORMER FIRST
GENERATION
COMPOUNDMENT

GAS TURBINE

SB03-017A

SB01-070D

FORMER FUEL
PIPING MANIFOLD

SWMU NO. 3-2
SB01-070A

STORMWATER CHANNEL

SWMU NO. 26
STORMWATER
CHANNEL

36" STORM DRAIN LINE

36" STORM DRAIN LINE

SB01-070C

SB01-070A

SWMU NO. 3
JET FUEL AREA

SWMU NO. 3-1
JF-9, 10, 15

SB01-070B

LEGEND

HISTORICAL

- Soil Boring 0'-5.5'
- Soil Boring 6'-15'
- Soil Boring 1.5'-16'
- Groundwater Sample (Temporary Well - Abandoned)
- Soil Gas Boring
- Background Groundwater Sample (Permanent)
- Background Groundwater sample (Temporary Well - Abandoned)
- Compliance Groundwater Sample (Temporary Well - Abandoned)
- Existing Monitoring Well (Permanent)

PROPOSED

- Direct-push Groundwater Sample Location
- Direct-push Soil Boring Sample Location
- Hand Auger Soil Boring Sample Location
- Direct-push Soil & Groundwater Sample Location (Associated with JF-9, -10, -15)
- Direct-push Soil & Groundwater Sample Location (Associated with SB01-070A)
- Direct-push Soil and Groundwater Sample Location (Associated with SWMU #26 Stormwater System)
- SWMU NO. 3 JET FUEL AREA — SWMU Number and Description

N

All Locations and Dimensions Approximate

0 15 30 60 90 Feet

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UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

SOUTH BAY POWER PLANT

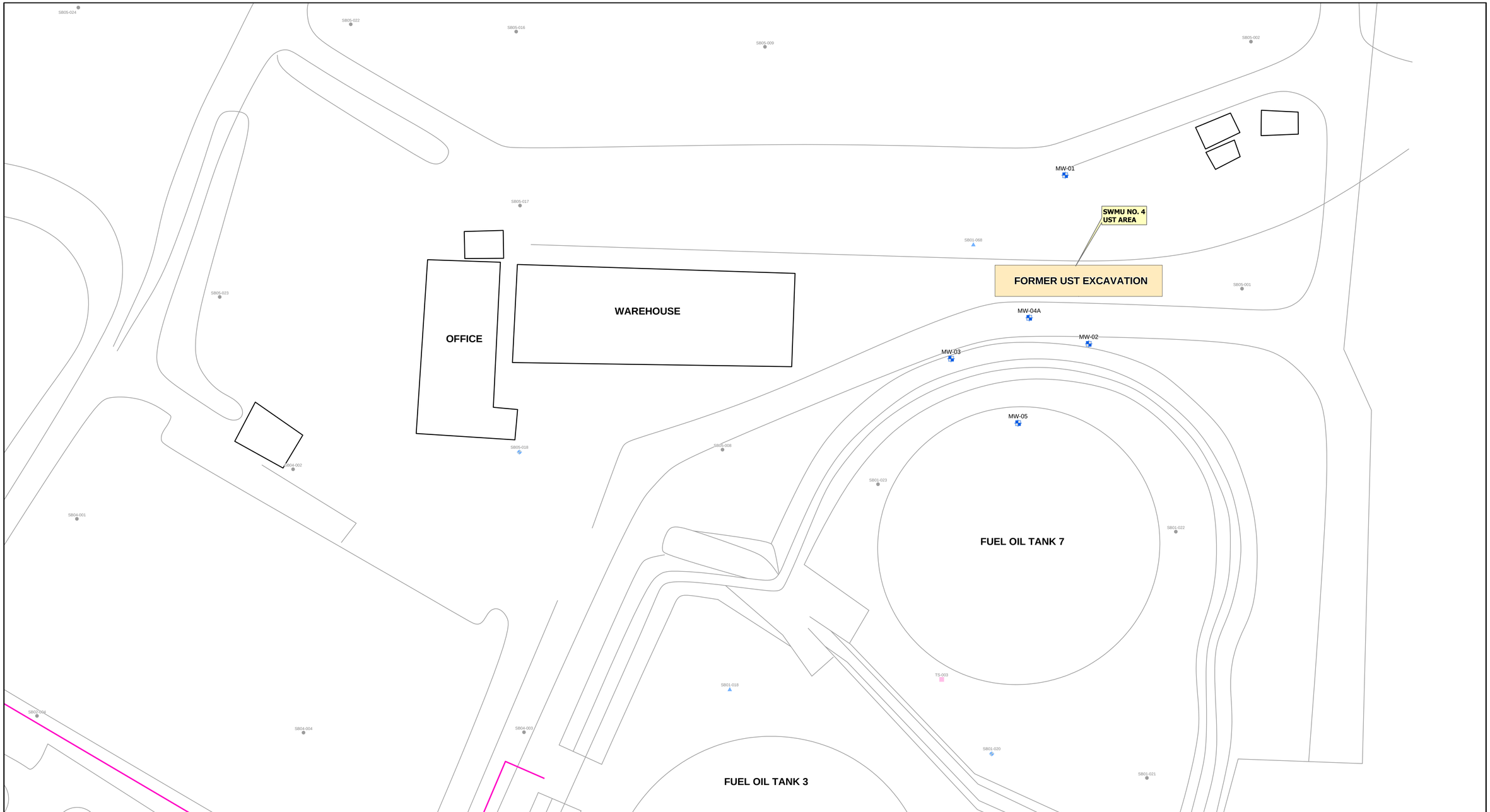
FIGURE 5

SWMUs #3, 6, 11,12, AND 26
SOIL AND GROUNDWATER
SAMPLING LOCATIONS

SCALE AS SHOWN

JUNE 2005

29197-013



LEGEND

HISTORICAL

- Soil Boring 0'-5.5'
- Soil Boring 6'-15'
- Soil Boring 1.5'-16'
- Groundwater Sample (Temporary Well - Abandoned)
- Soil Gas Boring
- Background Groundwater Sample (Permanent)
- Background Groundwater sample (Temporary Well - Abandoned)
- Compliance Groundwater Sample (Temporary Well - Abandoned)
- Existing Monitoring Well (Permanent)

PROPOSED

- Existing Monitoring Well to be Sampled
- SWMU NO. 4 UST AREA — SWMU Number and Description

N

All Locations and Dimensions Approximate

0 15 30 60 90 Feet

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UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

SOUTH BAY POWER PLANT

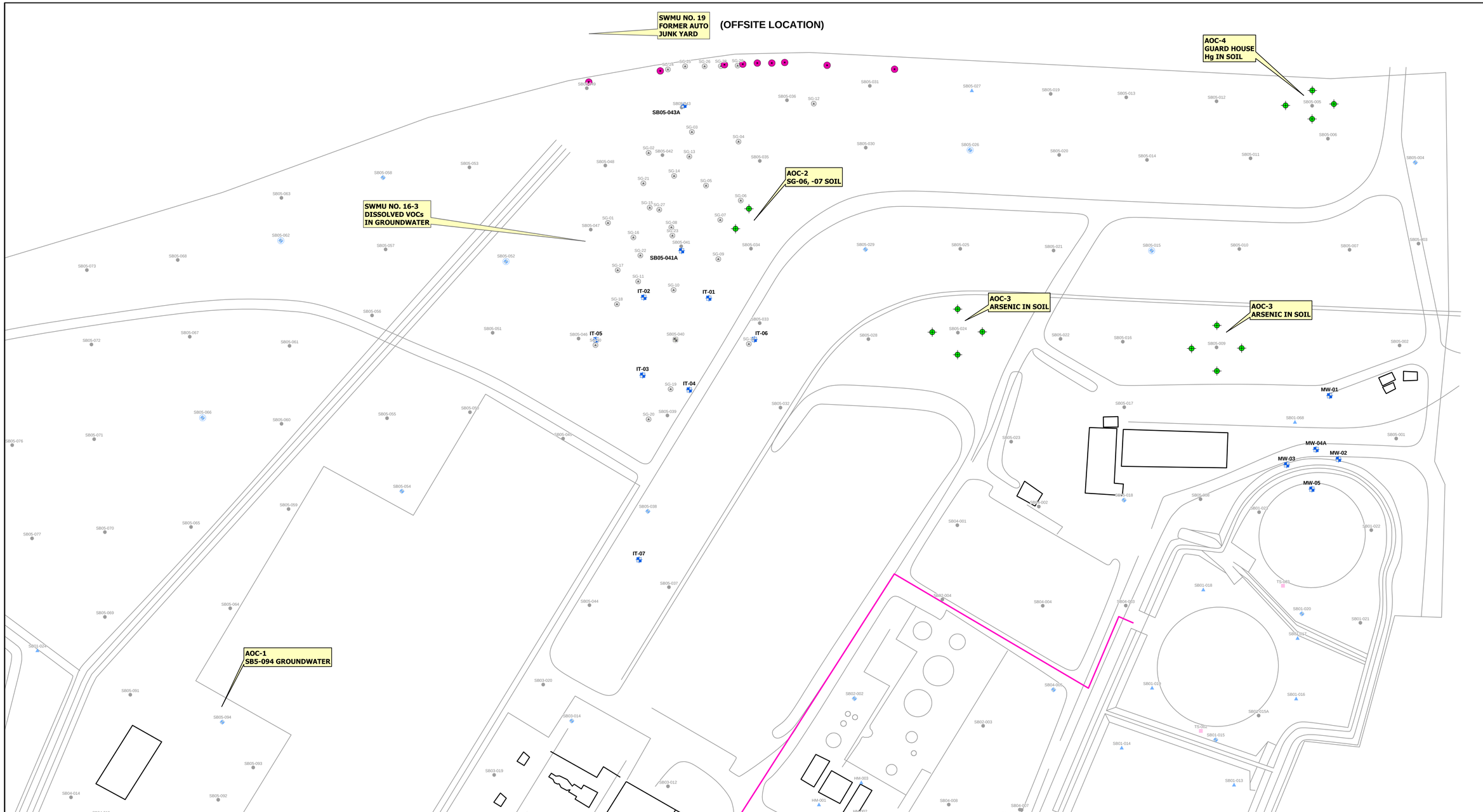
FIGURE 6

SWMU #4 - FORMER UST AREA GROUNDWATER MONITORING WELL LOCATIONS

SCALE AS SHOWN

JUNE 2005

29197-013



LEGEND

HISTORICAL

- Soil Boring 0'-5.5'
- Soil Boring 6'-15'
- Soil Boring 1.5'-16'
- Groundwater Sample (Temporary Well - Abandoned)
- Soil Gas Boring
- Background Groundwater Sample (Existing Well - Permanent)
- Background Groundwater sample (Temporary Well - Abandoned)
- Compliance Groundwater Sample (Temporary Well - Abandoned)
- Existing Monitoring Well (Permanent)

PROPOSED

- Direct-push Groundwater Sample Location
- Hand Auger Soil Boring Location
- Direct-push Soil and Groundwater Sample Location

SWMU NO. 19 FORMER AUTO JUNK YARD — SWMU Number and Description

N

All Locations and Dimensions Approximate

0 40 80 160 240 Feet

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UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

SOUTH BAY POWER PLANT

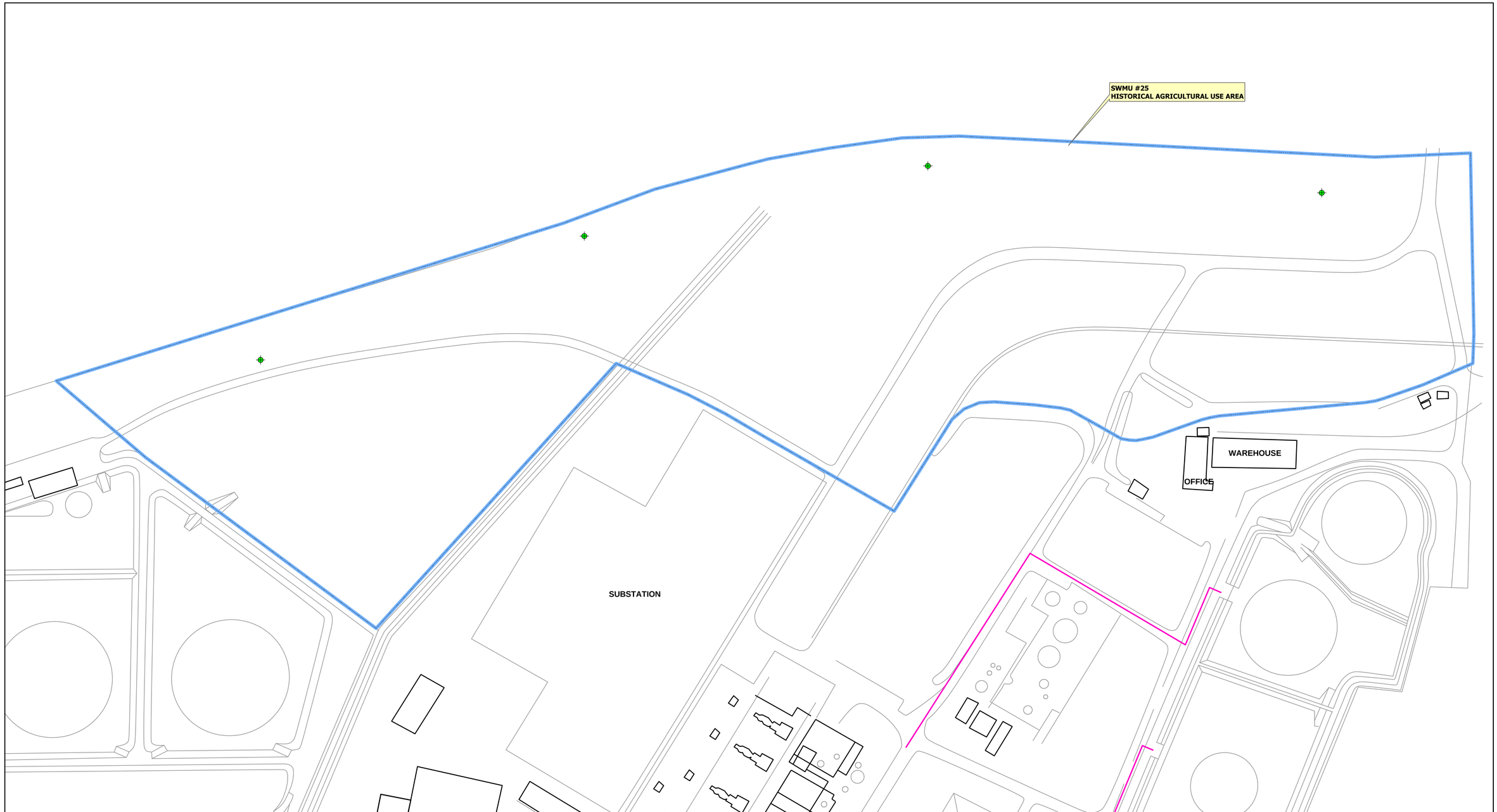
FIGURE 7

SWMU #16, 19, & AOC's (1 to 4)
SOIL AND GROUNDWATER
SAMPLING LOCATIONS

SCALE AS SHOWN

JUNE 2005

29197-013



LEGEND

- Proposed Soil Sample Location
- Historical Use Area
- SWMU Number and Description (SWMU #25 HISTORICAL AGRICULTURAL USE AREA)

N

All Locations and Dimensions Approximate

0 100 200 400 Feet

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UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

SOUTH BAY POWER PLANT

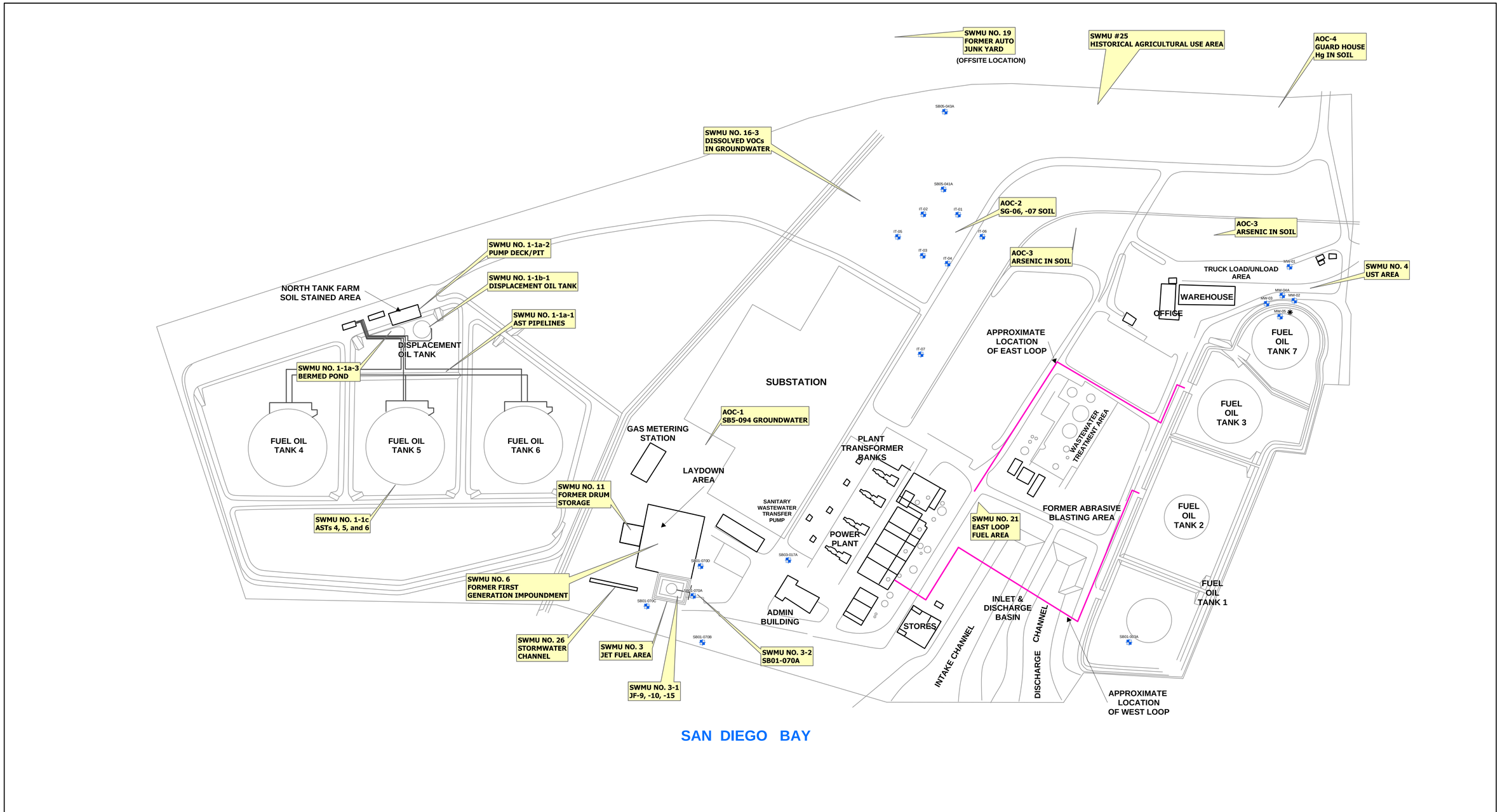
FIGURE 8

SWMU #25 -
HISTORICAL AGRICULTURAL USE AREA - SOIL SAMPLING LOCATIONS

SCALE AS SHOWN

JUNE 2005

29197-013



LEGEND

Existing Permanent Groundwater Well Location

SWMU NO. 3
JET FUEL AREA — SWMU Number and Description

N

All Locations and Dimensions Approximate

0 150 300 600 Feet

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UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

SOUTH BAY POWER PLANT

FIGURE 9

EXISTING PERMANENT MONITORING WELLS

SCALE AS SHOWN

JUNE 2005

29197-013

APPENDIX A

Standard Operating Procedure: OP1010 – Health and Safety Plans

OPERATING PROCEDURE: OP1010

HEALTH AND SAFETY PLANS

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PREPARATION AND APPROVALS

VERSION	AUTHORED/DATE	REVIEWED / DATE	REVIEWED / DATE	REVIEWED / DATE	APPROVED / DATE
Ver. 0.0	CLM/ May 02	ABB / June 02	MDD / Apr. 03		JAK / July 03

Total Pages: 13

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OPERATING PROCEDURE: OP1010

HEALTH AND SAFETY PLANS

1. PURPOSE

To ensure that site-specific health and safety plans (HASP) are developed and implemented for:

- all projects for which HASPs are required by state and federal law; and
- all other projects involving activities which pose the reasonable possibility of exposure to health hazards and/or physical hazards.

1.1 Background

The Occupational Safety and Health Administration standard, "Hazardous Waste Operations and Emergency Response" (29 CFR 1910.120) requires that a site-specific HASP be written for the following operations:

- cleanup operations and initial investigations required by a governmental body (whether Federal, state, local or other) involving hazardous substances that are conducted at uncontrolled hazardous waste sites;
- corrective actions involving cleanup operations at sites covered by the Resource Conservation and Recovery Act; and
- voluntary cleanup operations at sites recognized by Federal, state, local or other governmental bodies as uncontrolled hazardous waste sites.

The nature of Haley & Aldrich's business is such that some field operations and activities, outside of those specified above, may also expose employees to a variety of chemical and/or physical hazards. No single set of rules or protective measures is appropriate for each field operation. Thus, geotechnical and construction projects are subject to the development of HASPs.

Therefore, all projects involving field work must be evaluated by the Project Manager, Local Health and Safety Coordinator, and/or the Corporate Health and Safety Manager for potential hazards to employees. When it is determined that the project activities may result in employee exposure, a site-specific HASP will be required.

1.2 Application

This policy applies to all Haley & Aldrich, Inc. (H&A) and Haley & Aldrich Design and Construction (HADC) projects and activities. The actual determination of whether or not a given project or activity will

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pose the reasonable possibility of exposure to health hazards and/or physical hazards, and therefore, whether or not a HASP will be required, will be made by both the LSHC and PM at the time of project evaluation. Sections 5.2 and 5.3 of this OP list activities for which HASPs are likely to be required.

2. PROCEDURE

2.1 Project Evaluation

Each project manager is responsible to ensure that each of their projects meeting the criteria described in Section 5.2 and 5.3 is evaluated to determine whether or not a HASP will be required for the project. It is the responsibility of the PM to enlist the assistance of the LSHC if the need for a HASP is not immediately clear.

- To assist the PM and the LSHC in performing the project evaluation, a Project Evaluation Checklist is provided in Attachment A.

Another purpose of the review/checklist is to identify those projects whose activities appear to meet the criteria in Sections 5.2 and 5.3 below but which have not yet been evaluated by a representative of the H&S group.

Once the checklist has been completed, it must be signed by the PM and placed in the project file.

2.2 Activities for Which HASPs Are Required

All operations and activities specified below must have a written site-specific HASP prepared prior to the start of field operations if it is related to hazardous waste operations:

- Cleanup operations and initial investigations involving hazardous substances that are required by a governmental authority, whether Federal, state, local, or other, at uncontrolled hazardous waste sites
- Corrective actions involving cleanup operations at sites covered by RCRA
- Voluntary clean-up operations at sites recognized by Federal, state, local, or other governmental bodies as uncontrolled hazardous waste sites
- All other Haley & Aldrich "hazardous waste" related field operations including investigative and remedial activities as defined by OSHA
- Subsurface sampling operations such as drilling, test pitting related to Hazwoper
- Any project that requires the use of an air purifying respirator
- Operations involving confined space entry
- Underground storage tank removals

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- Operations involving buried drums, drum sampling, or drum handling of hazardous chemicals
- Operations involving potential exposure to ionizing radiation
- Operations involving potential exposure to highly toxic substances
- Surface water sampling operations including lagoon sampling and working on barges
- Operations involving working near or over water greater than 3' deep
- Any project in which one must enter an excavation or trench greater than 5' in depth and/or a known hazard (atmospheric, standing water, engulfment, etc.) may be present in the excavation/trench including Construction Monitoring projects that are on Hazwoper sites

2.3 Activities For Which HASPs May Be Required

Other operations that will generally require HASPs, depending upon the degree of hazard involved, include the following activities:

- Groundwater monitoring
- Bulk sampling of potentially hazardous materials (lead, asbestos)
- Process/waste stream sampling at industrial facilities
- Plant decommissioning activities
- Construction, operations, and maintenance of remediation systems
- Air monitoring activities, including stack sampling and fugitive emissions monitoring

2.4 Site Walk-through

When preparing to do an initial job walk-through at a site that has (or may have) chemical contamination, it is usually not necessary to prepare a HASP for the job walk-through activity. However, if the site has surface contamination or other hazards that may pose risks to the individual performing the site walk-through, then evaluation and planning must take place (and be documented) prior to site entry so that steps to avoid hazards will be taken and that the proper PPE will be worn by the H&A employee(s).

2.5 Cost

Cost of developing a project HASP should be a consideration during the proposal development stage. Since the cost of the HASP will be charged to the project, the Project Manager must initiate the project evaluation process at the time of proposal preparation so that these costs can be added to the project budget. Larger projects may require an entire day to develop and this development time must be charged to the project.

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2.6 Preparation

Unless otherwise arranged, all HASPs will be written by PMs and reviewed by the LHSC.

Prior to initiating a new HASP, the PM should consider whether a HASP has already been developed for a current phase of the project. H&A's HASPs are modular in nature and can often be modified from a plan prepared for previous project work at the same location. (This may only applicable if new tasks are being added and all other conditions are the same.)

If a HASP will be required, the PM is responsible for ensuring the HASP is completed and implemented. The PM may personally develop the HASP or defer the responsibility to another person on the project team who is knowledgeable of the project. In some instances, the CHSM should be consulted when complex and hazardous work activities and conditions are anticipated.

An example short form template is posted on the Health and Safety Home Page (H&A Intranet) and can be saved as a MicroSoft ®Word document. The template is designed to be expandable to meet individual project needs. A "user's guide" for the HASP is also available in the same section on the Intranet.

2.7 Format and Content

To maintain consistency throughout the company, a standardized format will be utilized for all HASPs. The amount of detail provided in each HASP will vary with complexity of the project, degree of hazard involved, etc. As a minimum, each HASP must address the following topics, where appropriate:

H&A HASP Section	Content
1.0	**Project Information**
	Organization and Responsibilities
	Training, Initial and Site Specific
2.0	**Site Description**
	Site Description
	Site Background
3.0	**Project Task Breakdown**
	Scope of Work
4.0	**Hazard Assessment**
	Potential Hazards and Hazard Assessment for Each Task & Operation
5.0	**Protective Measures**
	Respiratory Protection
	Personnel Protective Clothing and Equipment for Each Task
	Action Levels for Upgrades/Downgrades of PPE
	Site Control and Decontamination
6.0	**Monitoring Plan**
	Ambient Air Monitoring and Personal Monitoring
	Noise, Heat/Cold, Radiological, etc. Stress Monitoring
7.0	**Decontamination**

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	Personnel Hygiene and Decontamination Facilities & Procedures
	Special Protective Measures
8.0	**Contingency**
	Site Specific Medical Surveillance Parameters
	Emergency Response Plan and Contingency Procedures
	Emergency References
	Hospital Location Map
	On-site First Aid and Emergency Equipment
	Accident Reporting, Investigation, and Recordkeeping

All elements of the HASP must conform to Haley & Aldrich policies and procedures.

2.8 Approvals

In all cases, the HASP must be approved and signed by the LHSC and the PM before it is implemented in the field. Complicated and higher risk projects will require CHSM review and approval prior to use and distribution. A copy of each completed HASP must be maintained on file by the PM. A common electronic file on the local office network will be set up for retention of all final HASPs.

2.9 Issuance and Acceptance

Upon completion and approval of the HASP, the PM must provide a copy of the HASP to all H&A personnel who will be performing activities covered by the HASP. All such personnel, , are required to read the HASP and sign on the "Pre-work and Health and Safety Briefing" page. Copies of all HASP "Signoff" sheets must be maintained in the project file by the PM.

2.10 Modifications

Once field operations begin, it may be necessary to alter HASP content, should it be determined that the hazards have changed, or that personal protective equipment, protective procedures, or emergency information, may not be adequate. In addition, when the scope of work or tasks have been changed, the HASP must be modified to address the health and safety requirements for those new tasks. Should this occur, all proposed modifications to the HASP shall be reviewed and approved by the PM before such changes are implemented. The re-issued HASP will incorporate any changes.

An addendum page may be added to the HASP rather than make changes to the original HASP text. The addendum must be attached to the HASP and must be included with the HASP copies used at the field jobsite.

2.11 Implementation

The responsibility for implementing the requirements of the HASP rests with the Project Manager. The PM must ensure that all personnel who cannot or will not comply with the requirements of the HASP are excluded from activities covered by the HASP. In addition to the HASP requirement determination, the PM, along with assistance from the LHSC, will make other health and safety determinations at the time of initial project

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evaluation. These will include, but not be limited to, the need for on-site health and safety audits during the project, personal air monitoring, and the need for full- or part-time on-site health and safety personnel during the field operations.

2.12 HASP requirements for Subcontractors

Subcontractors and Contractors do not sign H&A's HASP. Health and Safety Plans for our direct subcontractors is a very important issue, especially since OSHA can cite both the subcontractor and the prime contractor at a worksite for an OSHA violation. Under the "multi-employer worksite doctrine", any of three employers can be liable for an OSHA citation:

- the controlling employer,
- the employer who creates the hazard, and
- the employer whose employees are exposed to the hazard.

H&A policy regarding HASPs for subcontractors is outlined in Section 3.04 of Level I H&S Manual. It states that "subcontractors supporting remedial investigations will be expected to submit an appropriate HASP to the PM for review before being permitted to conduct work onsite". H&A does not approve these plans but merely acknowledges that to the best of our knowledge it contains the expected contents for the operations the subcontractor will perform. There should be no exceptions to this requirement whenever a HASP is required under the OSHA standard (1910.120) by the nature of the worksite hazards and activities. We shall not hand our HASP to a subcontractor and allow them to sign our HASP in an understanding that we will "oversee" the safety of their employees.

Each subcontractor that Haley & Aldrich hires must be responsible for their own safety program, site-specific planning, and compliance with all applicable regulations. It's Haley & Aldrich's responsibility to hire only competent and qualified subcontractors and make sure they are fully prepared to do the work we ask of them and are fully compliant while they are on-site.

Project Managers should provide subcontractors with sufficient information prior to the start of work so they can formulate their own plans. Project Managers should review the subcontractor's plan before the start of work to make sure it's acceptable.

2.13 Responsibilities

2.13.1 Staff Members

- Will read, understand, and abide by the requirements of the HASP
- Will sign the "Pre-work Health and Safety Briefing" before the commencement of any work related to the HASP.

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2.13.2 Project Managers

- Will implement the project evaluation process for all projects described in sections 5.2 and 5.3 in this OP by contacting a representative of the H&S department at the time of project proposal;
- Will read and approve the HASP prior to distribution;
- Will distribute a copy of the HASP to the field contact
- Will ensure that all employees working in the field at site that requires a HASP sign the "Pre-work Health and Safety Briefing" before the commencement of any work related to the HASP;
- Will maintain a file of all HASPs developed for their projects;
- Will ensure the implementation of the requirements of the HASP.

2.13.3 Local Health and Safety Coordinator

- Will assist in the project evaluation process to determine the need for a HASP;
- Will provide technical support to PMs in determination of HASP development;
- Will typically work as the Location H&S Liaison and with the CHSM for HASP support

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APPENDIX A
REFERENCES

- The Occupational Safety and Health Administration standard, "Hazardous Waste Operations and Emergency Response" (29 CFR 1910.120)

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APPENDIX B
RELATED HALEY & ALDRICH PROCEDURES

- OP1009 Medical Surveillance Program
- OP1013 Radiation Safety Program
- OP1014 Hazard Communication

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APPENDIX C
FORMS

- See the Health and Safety Home Page (H&A Intranet) for a copy of the HASP.

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APPENDIX D
GLOSSARY

- **Health and Safety Plan (HASP)** - A document written for a particular site or operation which is designed to provide employee protection by describing the nature of the anticipated hazards, the potential effects of exposure to these hazards, the protective measures and equipment to be utilized to minimize exposure, and the appropriate actions to be taken in the event of an emergency.

- **Cleanup Operation** - An activity in which hazardous substances are handled, removed, contained, incinerated, neutralized, stabilized, cleaned-up, or in any other manner processed or handled with the goal of making the site safer for people or the environment

- **Uncontrolled Hazardous Waste Site** - An area in which an accumulation of hazardous waste creates a threat to the health and safety of individuals, or the environment, or both

- **Hazardous Waste** - A waste or combination of wastes as defined in 40 CFR 261.3 or 49 CFR 171.8

- **Hazardous Substance** - Any hazardous waste or any substance listed under section 101(14) of CERCLA, any biological or disease causing agent listed under 101(33) of CERCLA, or any substance listed by the DOT as a hazardous material under 49 CFR 172.101

- **Highly Toxic Substance** - Any substance which has a listed oral (rat) LD_{50} of 50 mg/kg or less; which is listed as a Confirmed Human Carcinogen (i.e., designation A1) by the American Conference of Governmental Industrial Hygienists (ACGIH); or which has an ACGIH Threshold Limit Value, Time-Weighted Average (TLV-TWA) of 1 ppm or less.

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APPENDIX B

Facility Investigation Health & Safety Plan – South Bay Power Plant

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HALEY & ALDRICH, INC.
SITE-SPECIFIC HEALTH & SAFETY PLAN

for

RCRA Facility Investigation at

SDG&E South Bay Power Plant Facility

990 Bay Boulevard, Chula Vista, CA 91911

Project/File No. 29197-013

Prepared by: Colleen Carrick Date: 7 March 2005

Revised by: Rob Manriquez Date: 06 June 2005

APPROVALS: The following signatures constitute approval of this Health & Safety Plan

Beth Breitenbach - Local H&S Coordinator	Date
Rob Manriquez, RG - Field Manager	Date
Anita Broughton, CIH - Corporate H&S Manager	Date

Note: This HASP is developed for Haley & Aldrich purposes only and not for use by subcontractors. Subcontractors may use this HASP as reference only.

PRE-JOB SAFETY CHECKLIST

The following checklist is designed to help Project Managers prepare for the Health & Safety (H&S) requirements needed for their projects.

This form should be used during the planning stage of the project and sufficiently prior to the fieldwork such that the necessary training can be implemented and resources can be mobilized. This form is to be attached to the front off the HASP before it goes to the field.

Please initial in each appropriate box to confirm that the required materials, equipment, training, etc., have been procured before commencement of work at the site.

#	Project H&S Requirements	Approval by PM or LHSC (initial each box or write NA if not applicable)	Date Approved
1.0	HASP and supporting documentation is complete and signed by all H&A field personnel		
2.0	Task Safety Analysis performed and attached to the HASP.		
3.0	All field staff scheduled for project have current 40-hour HAZWOPER training (29CFR1910.20) or 8-hour refresher training.		
4.0	Is a HAZWOPER site supervisor needed, if so, are they trained?		
5.0	Additional Training Requirements met: e.g.- nuclear density gauge, DOT, CSE, Competent Person Training for Excavation, etc		
6.0	We have met the client's additional H&S requirements above and beyond H&A's requirements. Example: facility safety orientations, safety documentation, meetings, personal protective equipment (PPE) requirements		
7.0	H&A subcontractors have met H&A's minimum requirements, including: - Training - Medical surveillance - Written HASP - Insurance - MSDSs		
8.0	All H&A staff involved in project have met their Medical Surveillance examination requirements.		
9.0	Staff that may be required to wear a respirator, medically qualified and fit test card available.		
10.0	MSDSs on-site and available for chemicals on-site.		
11.0	Safety equipment available, such as: flashlights, telephone for communications, ladders, cones, barricade tape, fire extinguisher, first aid kit, PPE, respiratory protection, air instrumentation and calibrated, personal flotation device (PFD), 90' life line with ring, decontamination equipment		

Note: This HASP is developed for Haley & Aldrich purposes only and not for use by subcontractors. Subcontractors may use this HASP as reference only.

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Note: This HASP is developed for Haley & Aldrich purposes only and not for use by subcontractors.
Subcontractors may use this HASP as reference only.

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APPENDICES

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Appendix D Facility Contingency Plan

Note: This HASP is developed for Haley & Aldrich purposes only and not for use by subcontractors.
Subcontractors may use this HASP as reference only.

GENERAL

This Resource Conservation & Recovery Act (RCRA) Facility Investigation (FI) Health & Safety Plan (HASP) has been prepared by Haley & Aldrich, Inc. (H&A). This HASP addresses H&A's on-site activities during the implementation of the scope of work detailed in the FI Workplan for the SDG&E South Bay Power Plant, Chula Vista, California prepared by H&A for SDG&E on April 18, 2005 (FI Workplan).

This HASP provides an overview of current conditions at the Facility and describes the safety procedures to be employed and the rationale for their selection. The HASP has been prepared to ensure proper precautions are taken to protect human health and safety during implementation of the FI Workplan at the Facility. The HASP also describes the health effects and standards for known contaminants and the procedures designed to account for the potential for exposure to unanticipated substances.

During the development of the HASP, consideration was given to current safety standards as defined by the U.S. Environmental Protection Agency (EPA), the Occupational Health and Safety Administration (OSHA), and the National Institute of Occupational Safety and Health (NIOSH). This HASP was prepared in accordance with guidelines set forth in the NIOSH Occupational Safety and Health Guidance Manuals for Hazardous Waste Sites (1985), and Title 8 of the California Code of Regulations, Section 5192 (8 CCR 5192).

Furthermore, this HASP has been coordinated with the Facility's "Business Plan / Contingency Plan, Volume II, Emergency Plan, South Bay Power Plant, Duke Energy North America, California Regional EH&S Department", dated December 2004 (Duke Contingency Plan)

SCOPE AND PURPOSE

The purpose of this HASP is to define the requirements and designate protocols to be followed by the H&A on-site personnel during the FI field activities. Site conditions, potential contamination sources, and previous investigations and cleanup implemented at the Facility are described in the FI Workplan. This HASP is only applicable to H&A on-site personnel during implementation of the FI Workplan at the Facility. This HASP will be used to ensure that adequate site safety practices are employed by H&A in compliance with the Duke Contingency Plan, during implementation of the FI Workplan.

All H&A on-site personnel involved in implementation of the FI Workplan at the Facility must review the HASP and sign an agreement to comply with its requirements and to signify their familiarity with all aspects of the HASP before entering an exclusion zone or a contamination reduction zone. These personnel will also attend a Duke Facility Health & Safety Training session for the Facility conducted by Duke personnel. A copy of the HASP Certification is provided below (see page vii). All H&A on-site personnel working at the Facility will be briefed daily by the H&A Site Safety Officer (SSO) and are required to become familiar with all sections of this HASP, particularly the following sections:

- Directions to Hospital – Section 8.0;
- Safety Rules and Personal Hygiene – Section 4.0, 5.0, and 6.0;
- Field Standard Operating Procedures for Use and Decontamination of Personal Protective Equipment (PPE) – Section 7.0;

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- Heat Stress and Heat Stress Monitoring – Section 4.0.

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Subcontractors may use this HASP for reference only.

ISSUANCE AND COMPLIANCE

- This HASP must be signed by all H&A on-site personnel involved in implementation of the FI Workplan at the Facility.
- This HASP, or a current signed copy, must be retained at the site at all times when H&A staff are present.
- Deviations from this HASP are not permitted without prior approval from the H&A Local Health & Safety Coordinator (LHSC), Project Manager, or Corporate Health & Safety Manager (CHSM). Unauthorized deviations may constitute a violation of H&A company procedures/policies and may result in disciplinary action.
- Revisions to this HASP must be outlined within the contents of the HASP. If immediate or minor changes are necessary, the H&A LHSC and Project Manager may use Appendix A (HASP Amendment Form), presented at the end of this HASP. Any revision to the HASP requires employees to be informed of the changes so that they understand the requirements of the change.
- This HASP will not be relied upon by H&A subcontractors or any other party. H&A subcontractors must have their own HASP. This HASP will be made available for review for "reference only" to H&A's subcontractors and other interested parties (e.g. Facility personnel and regulatory agencies) to ensure that H&A has properly informed our subcontractors and others of the potential hazards associated with the implementation of the FI Workplan to the extent that H&A is aware.
- This site-specific HASP provides only site-specific descriptions and work procedures. General safety and health compliance programs in support of this HASP (e.g., injury reporting, medical surveillance, personal protective equipment (PPE) selection, etc. are described in detail in the H&A Corporate Health and Safety Program Manual and within H&A's Standard Operating Procedures (SOPs). Both the manual and SOPs can be located on the H&A Company Intranet. When appropriate, users of this HASP should always refer to these resources and incorporate to the extent possible. The manual and SOPs are available to clients and regulators upon request.
- Where applicable the Duke Contingency Plan will take precedent in matters related to the Facility.
- All Health & Safety issues and responses, the directly or indirectly affect the facility operations will be communicated immediately to the Facility on-call control room engineer and the responses to such event(s) will be coordinated with the Duke engineer and appropriate facility management, as necessary.

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SITE SAFETY OFFICER

This project has identified the following person listed below as the site safety officer (SSO). **The highest ranking person on-site from this list will be the designated as the SSO. A site safety officer must be on-site at all times.** When none of the following are present on-site, the most senior H&A on-site person for will default to the SSO.

1. Rob Manriquez

2. Nidal Samara

Roles and Responsibilities

The SSO is responsible for implementation of this HASP in the field and enforcement of safety rules and regulations. SSO functions include:

- Act as H&A's liaison for health and safety issues with the client, staff, facility control room engineer, subcontractors, and agencies.
- Verify that utility clearance has been performed by H&A subcontractors.
- Oversee day-to-day implementation of the HASP by H&A employees on-site.
- Interact with subcontractor project personnel on health and safety matters.
- Verify use of required PPE as outlined in the HASP.
- Inspect and maintain H&A safety equipment, including calibration of air monitoring instrumentation used by H&A.
- In consultation with the H&A PM and LHSC, identify necessary changes to HASP and document in Appendix A of the HASP, and notify appropriate persons of changes.
- Investigate and report on-site accidents and incidents involving H&A personnel and H&A subcontractors.
- Verify that site personnel are familiar with site safety requirements (e.g., the hospital route and emergency contact numbers).
- Report accidents, injuries, and near misses to the H&A PM and LHSC as needed.
- Report conditions, accidents and events which may compromise facility operations or safety to the appropriate control room engineer and/or facility management.

The SSO will conduct initial site safety orientations with H&A on-site personnel, H&A subcontractors and other interested parties (e.g. client and regulatory agencies representatives), and conduct toolbox and safety meetings thereafter with H&A on-site personnel and H&A subcontractors at regular intervals and in accordance with H&A policy and contractual obligations. The SSO will track the attendance of all personnel at H&A orientations, toolbox talks, and safety meetings. H&A subcontractors will document their own employee training and provide training rosters to the H&A SSO.

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The SSO will report accidents such as injury, overexposure, or property damage to the H&A LHSC, and PM. The SSO will consult with the client's and facility control room engineer and safety managers and H&A's subcontractors on specific health and safety issues arising over the course of the project, as needed.

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PRE-WORK HEALTH & SAFETY BRIEFING/CERTIFICATION

Note: Only H&A employees sign this page.

I have attended a briefing on this Health & Safety Plan prior to the start of on-site work and declare that I understand and agree to follow the provisions and procedures set forth herein while working on this site.

PRINTED NAME	SIGNATURE	DATE

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1. PROJECT INFORMATION

Name of Project: **RCRA Facility Investigation** **SDG&E South Bay Power Plant Facility**	**H&A File No.: 29197-013**
Location: **990 Bay Boulevard, Chula Vista, CA 91911**	
Respondent (SDG&E) Project Coordinator: **Barbara Montgomery, SDG&E Project Manager** **Ken Rowland**	**Contact Telephone No.:** **Office: 858.547.3330** **Cell: 619.954.9949** **Office: 213.244.5597** **Cell: 213.220.1405**
H&A Field Manager: **Rob Manriquez, RG**	**Contact Telephone No.:** **Office: 619.285.7113** **Cell: 619.851.0955**
Facility Emergency Coordinator: **On-Call Control Room Engineer** **Dave Barnhardt – Plant Manager**	**Contact Telephone No.:** **Office: 24 Hour Phone:: 619.498.5201** **Office: 619.498.5317** **Cell: 619.250.0350**
Alternative Facility Emergency Coordinator:	**Contact Telephone No.:** **Office:** **Pager:** **24 Hour Phone: (619) 725-5100 (SDG&E Trouble Dept.)**
H&A Local Health & Safety Coordinator: **Beth Breitenbach**	**Contact Telephone No.:** **Office: 619.285.7109** **Cell: 619.507.5602**
H&A Corporate Health & Safety Coordinator: **Anita Broughton, CIH**	**Contact Telephone No.:** **Office: 619.285.7104** **Cell: 619.851.5436**

SCOPE OF WORK:

The scope of work for the FI is detailed in the Department of Toxic Substance Control (DTSC)-approved FI Workplan for the Facility. This HASP has been prepared to address the H&A field activities associated with implementation of the FI Workplan. This HASP has been developed to cover a broad range of potential activities that may not be required by the FI Workplan (e.g. hollow-stem auger drilling, and groundwater sampling), such that if the FI Workplan is amended this HASP will remain applicable.

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Subcontractor(s) to be involved in on-site activities:

Subcontractor Firm Name	Work Activity
ULS Services Company	Utility Clearance
Concrete Cutting International	Concrete cutting/coring
To be selected from the following H&A approved suppliers: ■ H&P Mobile Geochemistry ■ Tri-County Drilling, Inc ■ WDC Exploration & Drilling ■ West Hazmat Drilling Corporation ■ Hirsch & Company Surveyors ■ Kehoe Testing and Engineering ■ Other(s)	Concrete cutting/coring, hand-auger boring, direct-push boring, well development rig, surveyor, disposal/recycling,

Projected Start Date: August 2005

Projected Completion Date: October 2005

Estimated Number of Days to Complete Field Work: 6 to 8 weeks

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2. SITE DESCRIPTION

Check one of the following:

Site classification:	☑ Industrial	☐ Commercial	☐ Other

2.1 General Description

The SBPP (the Site) is located at 990 Bay Boulevard, along the eastern shore of San Diego Bay in Chula Vista (see Figure 1). The Site occupies approximately 150 to 160 acres of land and includes an outdoor plant constructed around generators and boilers (see Figure 2). The facility is comprised of a thermal power plant (728 Mega Watts), a small gas turbine plant, switchyard, aboveground storage tanks (ASTs) for fuel oil, a cooling water system, and ancillary systems. The gas turbine unit is fueled with jet-A fuel stored in a 100,000-gallon AST. The power plant has four steam-driven generating units fired by natural gas or residual No. 6 fuel oil as backup. Natural gas has been the primary fuel used during the past 14 years. Prior to 1972, the power plant used Bunker C fuel oil. Fuel oil was formerly stored at the North and South Tank Farms. The South Tank Farm included Tanks No. 1, 2, 3, and 7. The North Tank Farm included Tanks 4, 5, and 6. The North Tank Farm has been decommissioned and the tanks have been removed. The South Tank Farm is going through decommissioning and Tanks 3 and 7 have been removed. A former wastewater treatment plant (WWTP) is located southeast of the power plant and consisted of six wastewater holding ASTs and six treatment ASTs. The entire WWTP is provided with secondary containment. The WWTP is no longer in use.

In 1999, SDG&E divested the SBPP, conveying various assets and donating certain property to the San Diego Unified Port District (Port). Concurrently, the Port leased the SBPP to Duke Energy South Bay, LLC (Duke Energy). The process and allocation of environmental liabilities at the SBPP are governed by the Port-SDG&E "Asset Sale Agreement," dated 11 December 1998 (ASA).

Operations and historical use of chemicals and potential chemicals of concern include the following:

- Petroleum hydrocarbons
- BTEX
- PCBs
- Volatile organic compounds (VOCs)
- Semi-volatile organic compounds (SVOCs)
- Metals
- PCP
- Pesticides
- Arsenic

Site Status Note: Are there current operations at the site? (mark all that apply):

☑ Active	☐ Inactive
☐ Partially active	☐ Other

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Is a **site plan** or sketch available? ☑ Y ☐ N (see attached Figures 1 & 2)

2.2 Work Areas

List/identify each specific work area(s) on the job site and indicate its location(s) on the site plan (see attached Figure 2):

- SWMU No. 1(a – e): North Tank Farm – located at the northern portion of the Facility.
  - a: 1. AST Pipelines
    2. Pump Deck/Pump Pit
    3. Bermed Pond
  - b: 1. Displacement Oil AST
    2. Heat Exchanger area (co-located with SWMU No. 1a-2)
  - c: Former Fuel Tanks #4, #5 and #6
  - d: Groundwater well SB1-060 area (no action necessary)
  - e: Local Soil Staining area (co-located with SWMU No. 1a-2)

- SWMU No. 3: Jet Fuel Area – located northwest of the power plant structure, along the western boundary of the Facility, north of the Administration Building and west of the Gas Metering Station. This area includes an AST located within a bermed area which stores jet fuel. Fuel hydrocarbons in soil and groundwater.
  - a: JF-09, JF-10, and JF-15 – additional characterization
  - b: SB01-070A – additional delineation

- SWMU No. 4: UST Area – located along the central section of the southern boundary, immediately east of the Fuel Tank No. 7, west of the truck load/unload area, and south of the warehouse. Fuel hydrocarbons in soil and groundwater.

- SWMU No. 11: Former Drum Storage Area/Pole Wrap Yard – located north of and adjacent to SWMU No. 6: Former First Generation Impoundment. Preliminary investigation detected pentachlorophenol (PCP).

- SWMU No. 16: East Central Area – located in the east-central portion of the Facility.
  - a: AOC-1: soil and groundwater around SB05-094 (temporary well)
  - b: AOC-2: soil near soil gas borings SG-06 and SG-07
  - c: East Central Area: dissolved VOC's in groundwater

- SWMU No. 19: Former Automobile Junk Yard boundary – located off-site, along the east-central boundary of the Facility.
-
- SWMU No. 25: Former Agricultural Site – located in the south-eastern portion of the site.

- SWMU No. 26: Storm Water Drainage Channel - located on the southern edge of Jet Fuel Area. Fuel hydrocarbons in soil and groundwater adjacent to pipeline and within channel, east of jet fuel AST area.

- SWMU No. 28: Additional Areas of Concern
  - a: Metals, VOCs, petroleum hydrocarbon contamination in groundwater - at the entire site.

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- b: AOC-3: Arsenic Hot Spots in Soil Open Area 5 – located near soil borings SB-009 and SB-024.
- c: AOC-4: Guard House – mercury (Hg) in soil near SB5-005, southern portion of the site.

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3. PROJECT TASK BREAKDOWN

List and describe each distinct work task below:

Task No.	Detailed Task Description	Employee(s)	Work Date(s) or Duration
1	Soil boring and sampling activities utilizing a hand-auger and/or direct–push drilling rig	Nidal Samara Matthew Raithel Colleen Carrick	2-3 weeks
2	Groundwater sampling collected utilizing a direct-push probe or from existing permanent monitoring wells, which will be refurbished if necessary, utilizing low-flow micropurge sampling techniques	Nidal Samara Mathew Raithel Colleen Carrick	2-3 weeks

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4. HAZARD ASSESSMENT

4.1 Chemical Hazards

Material Safety Data Sheets (MSDS) of hazardous materials used during the execution of work shall be available on-site. MSDSs are required for chemicals used to prepare samples, calibration gases, etc.

Note: MSDSs are not required for waste materials.

Does chemical analysis data indicate that the site is potentially contaminated? ☑ Y ☐ N

Potential exposures routes to potential contaminants during field activities include the following:

- Dermal contact with potentially contaminated electrical equipment, gravel, concrete or asphalt surfacing materials, surfacing cutting lubrication water, soil, surface or groundwater, or decontamination wash water.
- Inhalation of potentially contaminated dust or vapors
- Accidental ingestion of potentially contaminated surfacing cutting water, dust, soil, surface or groundwater, or decontamination wash water.

To protect workers from eye and skin contact, skin absorption, inhalation of dust or vapors; and accidental ingestion solids or liquids, PPE will be used as outlined in Section 5.

Potential **physical state** of the hazardous materials at the site (mark all that apply):

☑ Gas/Vapor ☑ Sludge

☑ Liquid ☑ Solid/Particulate

Anticipated/actual **class of compounds** (mark all that apply).

☐ Asbestos ☑ Inorganics

☑ BTEX ☑ Pesticides

☑ Chlorinated Solvents ☑ Petroleum products

☑ Heavy Metals ☑ Other

Polychlorinated biphenyls (PCBs)
Volatile organic compounds (VOCs)
Semi-volatile organic compounds (SVOCs)
Pentachlorophenyl (PCP)

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Impacted environments (indicate the primary media in which contamination is expected):

- ☐ Air
- ☑ Groundwater
- ☑ Soil
- ☐ Sediment
- ☐ Surface water
- ☐ Other

Estimated concentrations/medium of major chemicals that may be encountered by on-site personnel:

Location (refer to Figure 2)	Media	Chemical	Highest Observed Concentration
SWMU No. 1a-1: North Tank Farm AST Pipelines	SO	Metals, VOCs, SVOCs, BTEX, TPH	NA
SWMU No. 1a-2: North Tank Farm Pump Deck/Pump Pit	SO	Metals, VOCs, SVOCs, BTEX, TPHd	Post remediation confirmation sampling*
SWMU No. 1a-3: North Tank Farm Bermed Pond	SO	Metals, VOCs, SVOCs, BTEX, TPHd	NA
SWMU No. 1b-1: North Tank Farm Displacement Oil AST	GW	TPHd, VOCs, BTEX, SVOCs	TPH – 4600 mg/kg* (confirmatory sampling indicates ND)
SWMU No. 1b-2: North Tank Farm Heat Exchanger	SO	TPHd, VOCs, BTEX, SVOCs	Post remediation confirmation sampling*

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Location (refer to Figure 2)	Media	Chemical	Highest Observed Concentration
SWMU No. 1c: North Tank Farm ASTs 4, 5, & 6	SO	TPHd, VOCs, BTEX, SVOCs	Delineation sampling
SWMU No. 3a: Jet Fuel Area JF-09, JF-10, and JF-15	SO & GW	GW: Metals, VOCs, SVOCs, BTEX, TPHd SO: TPHd, VOCs, BTEX, SVOCs	TPH concentration in soil at following locations: JF-9 = 5,670 mg/kg JF-10 = 1,400 mg/kg JF-15 = 10,000 mg/kg
SWMU No. 3b: Jet Fuel Area SB01-070A	SO & GW	GW: Metals, VOCs, SVOCs, BTEX, TPHd SO: TPHd, VOCs, BTEX, SVOCs	LNAPL detected in previous groundwater sampling Additional sampling required for delineation in proximity and down gradient of SB01-070A If LNAPL is encountered, only TPH analysis will be performed
SWMU No. 4: UST Area	GW	Metals, VOCs, SVOCs, BTEX, TPHd	Benzene: 53 ug/L
SWMU No. 11: Former Drum Storage Area/Pole Wrap Yard	SO	PCP (detection limit below 3 mg/kg)	PCP: < 5 mg/kg
SWMU No. 16a: AOC-1 – East Central Area, temporary well SB5-094	SO & GW	GW: Metals (dissolved), VOCs, SVOCs, BTEX, TPHd, PCBs SO: TPHd, VOCs, BTEX, SVOCs	VOCs: detectable concentrations in groundwater
SWMU 16b: AOC-2 – East Central Area, soil gas locations SG-06 and SG-07	SO	VOCs	VOC: detectable concentrations in soil

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Location (refer to Figure 2)	Media	Chemical	Highest Observed Concentration
SWMU 16c: East Central Area	GW	Metals (dissolved), VOCs, SVOCs, BTEX, TPHd, PCBs	VOC: detectable concentrations in groundwater
SWMU 19: Former Automobile Junkyard, off-site and east of site	GW	Metals (dissolved), VOCs, SVOCs, BTEX, TPHd	NA
SWMU 25: Former Agricultural Site Use	SO	Pesticides	Preliminary sampling
SWMU 26: Storm Water Drainage Channel in Jet Fuel Area	SO & GW	GW: Metals (dissolved), VOCs, SVOCs, BTEX, TPHd SO: TPHd, VOCs, SVOCs, BTEX	TPH: JF-9 = 5,670 mg/kg JF-10 = 1,400 mg/kg JF-15 = 10,000 mg/kg LNAPLs reported in SB-01-070A
SWMU 28a: Site-wide Groundwater	GW	Metals, VOCs, SVOCs, BTEX, TPHd	Detectable concentrations of metals such as antimony, lead, nickel, and thallium
SWMU 28b: AOC-3 – Open Area 5	SO	Metals – Arsenic Only analysis	Arsenic (As): SB5-009 = 15 mg/kg SB5-024 = 14 mg/kg Residential PRG = 0.39 mg/kg
SWMU 28c: AOC-4 – Guard House	SO	Metals – Mercury (Hg)	Mercury (Hg): SB5-005 = 2.4 mg/kg

(Media key: A = Air; GW = Groundwater; SW = Surface Water; SO = Soil; SE = Sediment)

Notes and Abbreviations:

* Soil was reportedly removed
ND Not detected above laboratory reporting limit
NA Data not available

Hazardous properties and exposure information including symptoms and effects of exposure for the chemicals identified above, and other common industrial chemicals, are presented in Table 3 (at the end of this HASP).

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Arsenic

The Occupational Safety and Health Administration has set limits of 10 microgram arsenic per cubic meter of workplace air (10 µg/m3) for 8 hour shifts and 40 hour work weeks. Several studies have shown that inorganic arsenic can increase the risk of lung cancer, skin cancer, bladder cancer, liver cancer, kidney cancer, and prostate cancer. The World Health Organization (WHO), the Department of Health and Human Services (DHHS), and the EPA have determined that inorganic arsenic is a human carcinogen.

Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs. Ingesting high levels of inorganic arsenic can result in death. Lower levels of arsenic can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet.

Benzene
Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities

Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death. The major effect of benzene from long-term (365 days or longer) exposure is on the blood. Benzene causes harmful effects on the bone marrow and can cause a decrease in red blood cells leading to anemia. It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection. Some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries. It is not known whether benzene exposure affects the developing fetus in pregnant women or fertility in men. Animal studies have shown low birth weights, delayed bone formation, and bone marrow damage when pregnant animals breathed benzene.

BTEX
BTEX is the common abbreviation for benzene, toluene, ethyl benzene and xylene. OSHA has set permissible exposure limits for all of these contaminants that may be found at this worksite during your work activity. The levels that are set are based on an 8-hour time weighted average. Below are those values-

Benzene	1 ppm / 8 TWA
Toluene	200 ppm / 8 TWA
Ethyl Benzene	100 ppm / 8 TWA
Xylene	100 ppm / 8 TWA

Chromium (Soluble) is a bright, yellowish-red crystalline solid. It is used as an oxidizing agent, an analytical reagent, and in electroplating, explosives, dyeing, and printing.

The legal airborne permissible exposure limit (PEL) for chromic acid is 0.1mg/m^3, **not to be exceeded at any time.** The legal airborne permissible exposure limit (PEL) for chromium (II) and (III) compounds is 0.5mg/m^3

All forms of chromium can be toxic at high levels, but chromium(VI) is more toxic than others.

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Breathing **very high levels** of chromium(VI) in air can damage and irritate your nose, lungs, stomach, and intestines. People who are allergic to chromium may also have asthma attacks after breathing high levels of either chromium(VI) or (III). Long term exposures to **high or moderate levels** of chromium(VI) cause damage to the nose (bleeding, itching, sores) and lungs, and can increase your risk of non-cancer lung diseases. Ingesting very large amounts of chromium can cause stomach upsets and ulcers, convulsions, kidney and liver damage, and even death. It is not known whether chromium harms the fetus or our ability to reproduce. Skin contact with liquids or solids containing chromium(VI) may lead to skin ulcers. Some people have allergic reactions including severe redness and swelling.

It is anticipated that exposure to airborne dust containing chromium will not be a concern during these operations. Dust controls measures such as water sprays must be used, as necessary, to control dust emissions from the drilling operations at all times.

If dust emissions begin to be a problem, cease work immediately and contact the Corporate Health & Safety Manager, or a Certified Industrial Hygienist for assistance. A Respirable Aerosol Monitor (RAM) can be used in this scenario to monitor total dust levels, but it will not give "specific" readings of chromium concentrations. It is mandatory that all workers don "full" level C protection with a half-face air-purifying respirator with HEPA (P-100) filters if any amounts of dust levels are encountered during any of the on-site tasks. The H&A site safety officer will determine this.

As a precaution, personal dust monitoring for chromium, using an industrial hygiene pump and a filter cassette, will be conducted on each day of drilling. One 8-hour, time-weighted average (TWA) sample will be collected from the worker with the greatest potential dust exposure and analyzed by an accredited laboratory.

Polychlorinated Biphenyls (PCBs)

Polychlorinated biphenyls (PCBs) are a group of manufactured organic chemicals that contain 209 individual chlorinated chemicals (known as congeners). PCBs are either oily liquids or solids and are colorless to light yellow in color. They have no known smell or taste. There are no known natural sources of PCBs. Some commercial PCB mixtures are known in the United States by their industrial trade name, Aroclor.

PCBs do not burn easily and are good insulating material. They have been used widely as coolants and lubricants in transformers, capacitors, and other electrical equipment. The manufacture of PCBs stopped in the United States in 1977 because of evidence that they accumulate in the environment and cause harmful effects. Products containing PCBs include electrical transformers and capacitors, electrical appliances containing PCB capacitors, old fluorescent lighting fixtures, old microscope oil, and hydraulic fluids.

For more information on PCBs, refer to the fact sheet in Appendix B.

Lead

The Occupational Safety and Health Administration (OSHA) limits the concentration of lead in workroom air to 50 µg/cubic meter for an 8-hour workday. Lead can affect almost every organ and system in your body. The most sensitive is the central nervous system, particularly in children. Lead also damages kidneys and the immune system. The effects are the same whether it is breathed or swallowed. Exposure to lead is more dangerous for young and unborn children. Unborn children can be exposed to lead through their mothers. Harmful effects include premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and

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reduced growth in young children. These effects are more common after exposure to high levels of lead. In adults, lead may decrease reaction time, cause weakness in fingers, wrists, or ankles, and possibly affect the memory. Lead may cause anemia, a disorder of the blood. It can cause abortion and damage the male reproductive system. The connection between these effects and exposure to low levels of lead is uncertain.

Mercury

Mercury vapor is highly toxic via this route. Causes severe respiratory tract damage. Symptoms include sore throat, coughing, pain, tightness in chest, breathing difficulties, shortness of breath, headache, muscle weakness, anorexia, gastrointestinal disturbance, ringing in the ear, liver changes, fever, bronchitis and pneumonitis. Can be absorbed through inhalation with symptoms similar to ingestion. May cause burning of the mouth and pharynx, abdominal pain, vomiting, corrosive ulceration, bloody diarrhea. May be followed by a rapid and weak pulse, shallow breathing, paleness, exhaustion, tremors and collapse. Delayed death may occur from renal failure. Gastrointestinal uptake of mercury is less than 5% but its ability to penetrate tissues presents some hazard. Initial symptoms may be thirst, possible abdominal discomfort. Causes irritation and burns to skin. Symptoms include redness and pain. May cause skin allergy and sensitization. Can be absorbed through the skin with symptoms to parallel ingestion. Causes irritation and burns to eyes. Symptoms include redness, pain, and blurred vision; may cause serious and permanent eye damage. Chronic exposure through any route can produce central nervous system damage. May cause muscle tremors, personality and behavior changes, memory loss, metallic taste, loosening of the teeth, digestive disorders, skin rashes, brain damage and kidney damage. Can cause skin allergies and accumulate in the body. Repeated skin contact can cause the skin to turn gray in color. A suspected reproductive hazard; may damage the developing fetus and decrease fertility in males and females. Persons with nervous disorders, or impaired kidney or respiratory function, or a history of allergies or a known sensitization to mercury may be more susceptible to the effects of the substance.

The OSHA Acceptable Ceiling Concentration for mercury and mercury compounds: 0.1 mg/m3 (TWA), skin contact is a parameter in determining exposure for mercury.

Toluene

Toluene affects the brain. Low-to-moderate levels from long-term exposure can cause tiredness, confusion, weakness, drunken-type actions, memory loss, nausea and loss of appetite, and hearing loss. Inhaling a high level of toluene in a short time can make you feel light-headed, dizzy, or sleepy. It can cause unconsciousness, and even death. Repeated exposure to high levels can cause permanent brain and speech damage, vision and hearing problems, loss of muscle control, and poor balance. It can also cause memory loss and decreased mental ability. Toluene also affects the kidneys. Several studies have shown that unborn animals were harmed when high levels of toluene were breathed by their mothers. Babies can have neurological problems and retarded growth and development if their mothers breathe a high level of toluene during pregnancy. We do not know if toluene harms the unborn child if the mother is exposed to low levels of toluene during pregnancy.

Xylene

Xylene affects the brain. High levels from exposure for short periods (14 days or less) or long periods (more than 1 year) can cause headaches, lack of muscle coordination, dizziness, confusion, and changes in one's sense of balance. Exposure of people to high levels of xylene for short periods can also cause irritation of the skin, eyes, nose, and throat; difficulty in

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breathing; problems with the lungs; delayed reaction time; memory difficulties; stomach discomfort; and possibly changes in the liver and kidneys. It can cause unconsciousness and even death at very high levels.
Studies of unborn animals indicate that high concentrations of xylene may cause increased numbers of deaths, and delayed growth and development. In many instances, these same concentrations also cause damage to the mothers. We do not know if xylene harms the unborn child if the mother is exposed to low levels of xylene during pregnancy.

4.2 Biological Hazards

4.3 Physical Hazards

Is any site work area(s) to be entered for this project considered a confined space? ☐ Y ☑ N

If yes, indicate which area(s) and why: N/A

ALL CONFINED SPACE ENTRY PROJECTS REQUIRE SPECIAL PROCEDURES, PERMITS AND TRAINING AND MUST BE APPROVED BY THE CORPORATE HEALTH & SAFETY MANAGER.

Physical Hazard Checklist

Indicate all hazards that may be present for each task. If any of these potential hazards are checked, it is the H&A Project Manager's responsibility to determine how to eliminate/minimize the hazard to protect on-site personnel. Note: Task numbers refer to those identified in Section 3.

(copy and paste a checkmark "✓"into appropriate boxes)

Potential Job Hazards	Task 1	Task 2	Task 3	Task 4	Task 5
Underground utilities	✓	✓			
Overhead utilities	✓	✓			
Excavations greater than 4' depth					
Open excavation fall hazards					
Heavy equipment	✓	✓			
Drilling hazards	✓	✓			
Noise (above 85 dBA)	✓	✓			
Traffic concerns	✓	✓			
Extreme weather conditions					
Rough terrain for drilling equipment					
Buried drums					
Heavy lifting (more than 50 lbs)	✓	✓			
High risk fire hazard					
Poisonous insects or plants					
Water hazards					
Use of a boat					
Lockout/Tagout requirements	✓	✓			
Other:	✓	✓			

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Indicate any **unusual features** at the site (e.g., power lines at low heights, variable terrain, excessive insects, etc.) that are **unique to this project** and steps to be taken to minimize risk:

Following is a list of potential activity hazards and controls which should be considered prior to performing work at the site:

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POTENTIAL ACTIVITY HAZARDS

1. Abrasions
2. Access
3. Asphyxiation
4. Bacteria
5. Biological Hazards
6. Blood borne Pathogens
7. Cave ins
8. Chemical/Thermal Burns
9. Chemicals
10. Cold Stress
11. Compressed Gases
12. Confined Spaces
13. Congestion
14. Cuts
15. Defective Equipment
16. Dermatitis
17. Dropping Materials/Tools to Lower Levels
18. Drowning or flowing water
19. Electrical Shock
20. Elevated /Visibility of Overhead Work
21. Energized Equipment
22. Ergonomics
23. Explosions
24. Fatigue
25. Fire
26. Flammability
27. Flying debris
28. Foreign Body in Eye
29. Frost bite/cold
30. Fugitive Dust
31. Generated Wastes
32. Guards removed
33. Hazardous Materials
34. Heat Stress (cramps, exhaustion, stroke)
35. Heavy Equipment Operation (improper use)
36. Heavy Lifting
37. High crime area (violence)
38. High Winds
39. Hoists, Rigging, Slings, Wire, Rope
40. Impact
41. Improper Rigging
42. Inability to Maintain Communication
43. Inclement Weather
44. Inclines
45. Insects/Reptiles
46. Known/Unknown Visitors
47. Mold
48. Moving Equipment, Conveyors or Vehicles
49. Muddy Site Conditions
50. New Personnel
51. New Rental or Change in Equipment Used
52. Noise
53. Odor/VOC Emissions
54. Overhead Utilities
55. Overhead Work
56. Overloaded Equipment (tipping)
57. Oxygen deficiency
58. Pinch Points
59. Poisonous Plants
60. Poor Housekeeping
61. Poor illumination
62. Poor Visibility
63. Pressure
64. Pressurized Lines
65. Radiation
66. Repetitive Motion
67. Sharp Objects
68. Silicosis
69. Slips, Trips, and Falls
70. Sprains and Strains
71. Steam
72. Sunburn
73. Surface Water Run-off
74. Toxicity
75. Traffic
76. Underground utilities
77. Uneven terrain
78. Unsafe Atmosphere
79. Vibration
80. Weight
81. Work at Depth
82. Work at Heights
83. Work over Water
84. Working on Ice

HAZARD CONTROLS

Air Monitoring (PID, MiniRam)
Appropriate Clothing/Monitoring Of Weather
Appropriate Labels/Signage
Barricades/Fencing/Silt Fencing
Buddy System
Confined Space Procedures
Decontamination Procedures
Derived Waste Management Plan
Drinking Water/Fluids
Dust Abatement Measures
Emergency Action Plan
Procedures
Equipment Inspection
Equipment Manuals/Training
Exclusion/Work Zones
Exhaust Ventilation Fall Protection - Type
Fire Extinguisher/Fire Watch
Flotation Devices/Lifelines
Ground Fault Interrupter
Ground Hydraulic Attachments
Grounds on Equipment/Tanks
Hand Signal Communication
Hazardous/Flammable Material Storage
Hearing Protection (Ear plugs)
Hoses, Access to Water
Hot work Procedures
Isolation of Energy Sources(Lockout/Tagout)
Machine/Equipment Guards
Manual Lifting Equipment
Proper Lifting Techniques
Proper Tool for Job
Proper Work Position/Tools
Protective Equipment (Specify)
Radio Communication
Respirator (Half-face)
Safety Harness/Lanyard/Scaffold
Sloping, Shoring, Trench Box
Spill Prevention Measures/Spill Kits
Stormwater Control Procedures/Methods
Vehicle Inspection
Visitor Escort/Orientation/Security
Window Cleaning/Defrost

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Describe any special precautions to be taken with respect to the hazards checked above:

- Utility clearance will be performed to identify underground utilities in the areas of cutting/coring of surfacing, hand augering and drilling.
- Heavy equipment should maintain at least 10 feet distance from overhead utilities.
- Lockout/tagout procedures will be implemented by appropriate SDG&E personnel prior to work around transformers.
- H&A personnel working on-site need to be aware of heavy equipment operations at all times.

4.3.1 Heat Stress

Heat stress on hazardous waste sites or construction sites is usually a result of protective clothing decreasing natural body ventilation, although it may occur at any time when work is being performed at elevated ambient temperatures. Because heat stress is one of the most common and potentially serious illnesses associated with hazardous waste site work, regular monitoring and other preventative measures are vital.

Site workers must learn to recognize and treat the various forms of heat stress.

The best approach is preventative heat stress management. In general:

- Workers should drink 16 ounces of water before beginning work, such as in the morning or after lunch. The water should be maintained at 50 to 60°F. Workers should drink one to two 4-ounce cups of water every 30-60 minutes. A cool area for rest breaks should be designated, preferably air-conditioned. The use of alcohol during non-working hours and the intake of caffeine during working hours can lead to an increase in susceptibility to heat stress. Monitor for signs of heat stress.

- Workers should acclimate to site work conditions by slowly increasing workloads, i.e., do not begin site work activities with extremely demanding activities. This acclimation process may require up to two weeks for completion.

- Cooling devices should be used to aid natural body ventilation. These devices, however, add weight, and their use should be balanced against worker efficiency. An example of a cooling aid is long cotton underwear, which acts as a wick to help absorb moisture and protect the skin from direct contact with heat-absorbing protective clothing.

- Installed mobile showers and/or hose-down facilities should be used to reduce body temperature and cool protective clothing in serious heat stress situations.

- In hot weather, field activities should be conducted in the early morning or evening.

- Adequate shelter should be available to protect personnel from heat, as well as cold, rain, snow, etc., which can decrease physical efficiency and increase the probability of both heat and cold stress. Set up a command post in the shade or erect temporary shade at the workstation, if practical.

- In hot weather, rotate shifts of workers with potential heat stress exposure.

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- Good hygienic standards must be maintained by frequent changes of clothing and showering. Clothing should be permitted to dry during rest periods. Persons who develop skin problems should immediately consult medical personnel.

Effects of Heat Stress

If the body's physiological process fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur ranging from mild (such as fatigue, irritability, anxiety, and decreased concentration, dexterity, or movement) to fatal.

Heat-related problems are:

HEAT STROKE: An acute and dangerous reaction to heat exposure caused by failure of heat regulating mechanisms of the body; the individual's temperature control system that causes sweating stops working correctly. Body temperature rises so high that brain damage and death will result if the person is not cooled quickly.

Symptoms: Red, hot, dry skin, although person may have been sweating earlier; nausea; dizziness; confusion; extremely high body temperature; rapid respiratory and pulse rate; unconsciousness or coma.

Treatment: Cool the victim quickly and obtain immediate medical assistance. If the body temperature is not brought down fast, permanent brain damage or death may result. Soak the victim in cool but not cold water, sponge the body with rubbing alcohol or cool water, or pour water on the body to reduce the temperature to a safe level (102˚F). Observe the victim and obtain medical help. Do not give coffee, tea or alcoholic beverages.

HEAT EXHAUSTION: A state of definite weakness or exhaustion caused by the loss of fluids from the body. This condition is much less dangerous than heat stroke, but it nonetheless must be treated.

Symptoms: Pale, clammy, moist skin, profuse perspiration and extreme weakness. Body temperature is normal, pulse is weak and rapid, and breathing is shallow. The person may have a headache, may vomit, and may be dizzy.

Treatment: Remove the person to a cool place, loosen clothing, and place in a head-low position. Provide bed rest. Consult physician, especially in severe cases. The normal thirst mechanism is not sensitive enough to ensure body fluid replacement. Have patient drink 1 to 2 cups water immediately and every 20 minutes thereafter until symptoms subside. Total water consumption should be 1 to 2 gallons per day.

HEAT CRAMPS: Caused by perspiration that is not balanced by adequate fluid intake. Heat cramps are often the first sign of a condition that can lead to heat stroke.

Symptoms: Acute painful spasms of voluntary muscles (e.g., abdomen and extremities).

Treatment: Remove the victim to a cool area and loosen clothing. Have the patient drink 1 to 2 cups water immediately, and every 20 minutes thereafter until symptoms subside. Total water consumption should be 1 to 2 gallons per day.

HEAT RASH: Caused by continuous exposure to heat and humid air and aggravated by chaffing clothes. Decreases ability to tolerate heat.

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Symptoms: Mild red rash, especially in areas of the body on contract with protective gear.

Treatment: Decrease amount of time in protective gear, and provide powder to help absorb moisture and decrease chaffing.

4.3.2 Illumination

Nighttime work activities are not anticipated; however, if nighttime work becomes necessary, illumination at the site will be supplemented in order to ensure safe working conditions. Supplemental lighting will be provided by mobile generator powered units. Illumination requirements will be in compliance with 8 CCR, §5192.

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5. PROTECTIVE MEASURES

5.1 Personal Protective Equipment Requirements

(copy and paste a checkmark "✓"into appropriate boxes)

Required PPE	Task 1	Task 2	Task 3	Task 4	Task 5
Hard hat	✓	✓	✓		
Safety glasses w/side shields	✓	✓	✓		
Steel-toe footwear	✓	✓	✓		
Hearing protection (plugs, muffs)	✓	✓	✓		
Tyvek ™ coveralls	+	+	+		
PE-coated Tyvek™ coveralls					
Boots, chemical resistant					
Boot covers, disposable	+	+	+		
Leather work gloves					
Inner gloves - nitrile	✓	✓	✓		
Outer gloves – nitrile	+	+	+		
Tape all wrist/ankle interfaces					
Half-face respirator	*	*	*		
Full-face respirator					
Organic vapor cartridges	*	*	*		
Acid gas cartridges					
Other cartridges:					
P-100 (HEPA) filters	*	*	*		
Face shield					
Personal Flotation Device (PFD)					
High-Visibility Safety Vest	✓	✓	✓		
Other:					
Level of protection required [C or D]:	D	D	D		

The PPE checked in any box above must be on-site during the task being performed. Work shall not commence unless the PPE is present.

Notes:

+ If vapor concentrations exceed air monitoring action levels, Tyvek® suits will be worn in place of Level D dedicated clothing by personnel that have potential for contact with contaminated media.
* If vapor concentrations exceed air monitoring action levels, personnel must don half-face respirator equipped with organic vapor cartridges and HEPA filters, and don outer gloves. See Table 2 for conditions requiring respirator use.

Breathing zone photoionization detector (PID) readings will be used to establish the level of PPE required. Sustained PID readings taken in the breathing zone that are greater than those identified in Table 1 and 2 (attached to this HASP) will require an upgrade from Level D to Level C protection. When the workplace atmosphere has been characterized or returns to acceptable levels, this information, along with data on the toxicity of the contaminants present, will be used to determine the appropriate level of PPE required in the work area.

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Field staff shall not perform work requiring Level B personal protection. If it is determined that conditions warrant Level B protection, work will cease until the subcontractor's previous experience in Level B protection is verified. A separate subcontractor may be retained to conduct Level B operations or the current contractors will conduct the supervised operations.

In the event of respirator use, H&A staff that may be required to wear a respirator must be:

- Medically qualified
- Fit tested
- Clean shaven with no facial hair that will interfere with the face-fit seal. This includes one day hair growth or more, beards, excessive long side burns, and goatees.

5.2 Personal Hygiene Safeguards

Describe any additional safeguards other than basic decontamination procedures for personal hygiene. The following safeguards, at a minimum, shall be adhered to:

1. No smoking or use of a tobacco product in the exclusion (hot) zone;
2. No eating or drinking in the exclusion (hot) zone; and
3. It is especially important to wash your hands before eating, smoking, taking medication, chewing gum/tobacco, using the restroom, or applying cosmetics and before you leave the site for the day. It is recommended that personnel present on-site shower or bathe at home at the end of each day of working on the site.

5.3 Site Safety Equipment

Check all items that are required to be on-site:

☑ Fire Extinguisher	☑ First Aid Kit	☐ Flashlight
☐ Air horn/signaling	☑ Cellular Phone	☑ Duct tape
☐ Ladder	☑ Barricade tape	☑ Drum dolly
☐ Two-way radio	☑ Safety cones	☐ Harness/Lanyard
☑ Other Eye wash		

The equipment checked in any box above must be on-site during the task being performed. Work shall not commence unless the equipment is present.

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5.4 Site Security & Work Area Controls

The various work zones may be established at the site before commencing any field activities.

- Exclusion Zone

All workers who enter the contaminated work area will wear the correct level of protection. The number of workers in this zone will be kept at a minimum.

- Contamination Reduction Zone (CRZ)

Decontamination areas for field personnel and heavy equipment will be designated in the CRZ adjacent to the exclusion zone.

- Support Zones

The administrative and break areas shall be located in the support zone outside the CRZ and the overall work zone. The support zone will be located upwind from the overall work zone as permitted by site meteorological conditions. The first aid kit and eye wash station will at this location.

The work areas and site shall be cleared and secured at the end of each workday.

Access to each contaminated work area will be controlled during on-site activities as follows:

- Consider protection of both project and non-project personnel (e.g., Facility personnel, contractors, general public).

- Work areas will be barricaded with traffic cones and barricade tape to prevent access by unauthorized persons. Boreholes will either be completed by the end of each day or traffic covers will be placed over open boreholes during non-working hours.

Can **site access** be controlled by a perimeter fence or similar means? ☑ Y ☐ N

If not, how will the site/work area be controlled during non-work hours to prevent access by unauthorized persons? Not applicable.

5.5 Training Requirements

5.5.1 Health and Safety Training

Personnel will not be permitted to supervise or participate in field activities until they have been trained to a level required by their job function and responsibility, based on either the H&A or Duke Energy Health & Safety protocols. H&A staff members, contractors, subcontractors, and consultants who have the potential to be exposed to contaminated materials or physical hazards must complete the training described in the following sections.

The H&A Project Manager/LHSC will be responsible for maintaining and providing to the client/site manager documentation of H&A staff members' compliance with required training as requested. Records shall be maintained in accordance with OSHA requirements.

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5.5.2 40-Hour Health and Safety Training

The 40-Hour Health and Safety Training course provides instruction on the nature of hazardous waste work, protective measures, proper use of personal protective equipment, recognition of signs and symptoms which might indicate exposure to hazardous substances, and decontamination procedures. It is required for all personnel working on-site, such as equipment operators, general laborers, and supervisors, who may be potentially exposed to hazardous substances, health hazards, or safety hazards consistent with 29 CFR 1910.120.

5.5.3 8-Hour Annual Refresher Training

Personnel who complete the 40-hour health and safety training are subsequently required to attend an annual 8-hour refresher course to remain current in their training. When required, site personnel must be able to show proof of completion (i.e., certification) at an 8-hour refresher training course within the past 12 months.

5.5.4 8-Hour Supervisor Training

On-site managers and supervisors directly responsible for, or who supervise staff members engaged in hazardous waste operations, should have eight additional hours of Supervisor training in accordance with 29 CFR 1910.120. Supervisor Training includes, but is not limited to, accident reporting/investigation, regulatory compliance, work practice observations, auditing, and emergency response procedures.

5.5.5 Additional Training for Specific Projects

H&A personnel will ensure their personnel have received additional training on specific instrumentation, equipment, confined space entry, construction hazards, etc., as necessary to perform their duties. This specialized training will be provided to personnel before engaging in the specific work activities. Any staff member engaging in the following activities will be required to have additional training:

- Client specific training or orientation
- Competent person excavations
- Confined space entry (entrant, supervisor, and attendant)
- Heavy equipment including aerial lifts and forklifts
- First aid/CPR
- Diving
- Use of fall protection
- Commercial Drivers License
- Use of Nuclear Density Gauges
- Asbestos

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6. MONITORING PLAN AND EQUIPMENT

Is **air/exposure monitoring** required at this work site for personal protection? ☑ Y ☐ N

Is **perimeter monitoring** required for community protection? ☐ Y ☑ N

6.1 Monitoring/Screening Equipment

Monitoring/screening equipment required to be on-site:

☑ HNu analyzer (PID) ☑ 10.2eV ☐ 11.7eV

☐ Organic vapor monitor (FID)

☐ Photovac Micro Tip,

☐ Photovac GC

☐ Other

☑ Combustible Gas Indicator (CGI)

☐ Multiple Gas Detector-LEL/O_2/H_2S/CO

☐ Dust Monitors (RAMs)

☐ Colorimetric tubes

A PID with a minimum of a 10.6 electron volt (eV) probe or equivalent will be calibrated according to the manufacturers' instructions using an isobutylene standard. The PID will be used to establish baseline ambient air conditions before operations begin. Readings will be taken twice daily upwind and downwind from the work area to determine background levels of VOCs in the air. The PID will also be used to measure the vapor levels in the breathing zone of on-site personnel every 15 to 30 minutes, or more frequently if elevated VOC concentrations are suspected based on olfactory (odor) or visual observations.

6.2 Standard Action Levels And Required Responses

Action levels for readings obtained with a multiple gas detector or an individual monitoring instrument are listed in Table 2 (at the end of this HASP). Specific ionization potentials and exposure limits are listed in Table 1 (at the end of this HASP).

Description of Monitoring Requirements (include frequency and location by Task):

Monitoring Plan for Task Number(s):	1	Frequency	4	times per	hour

Task 1 - Concrete/asphalt cutting/coring, soil boring using a hand-auger and/or direct-push rig – Measure background, breathing zone, 3 inches from soil cuttings, ambient headspace analyses on soil cuttings, and downwind VOC concentrations using a handheld PID every 15 minutes or as warranted by field conditions.

Monitoring Plan for Task Number(s):	2	Frequency	4	times per	hour

Task 2 - Collect groundwater samples – Measure background, breathing zone, and downwind VOC concentrations using a handheld PID every 15 minutes or as warranted by field conditions.

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Notes:

- Exposure Guidelines for common contaminants are listed in **Table 1** (at the end of this HASP)
- Requirements for PPE upgrades based on monitoring are in **Table 2** (at the end of this HASP)
- Symptoms and effects for the potential contaminants that may be encountered are presented in **Table 3** (at the end of this HASP)
- Record monitoring data and PPE upgrades on **Record of Field Monitoring** form (see Appendix C) and maintain with project files.

6.3 Calibration and Use of Equipment

Calibrate all monitoring equipment in accordance with manufacturers requirements and site specific requirements (e.g., at the beginning and end of each work day). Calibration of equipment shall be documented in the field notes or Daily Field Report (DFR).

The PID will be calibrated at least once at the start of each operating day and if the instrument displays erratic readings during the workday. Possible causes for erratic instrument readings include moisture in the instrument, fouling of the lamp due to high contaminant concentrations or dust, or low battery charge.

Calibration data will be recorded in a bound field notebook or in the field notes. Documentation should include:

- Date/time
- Zero reading before calibration
- Concentration of calibration gas
- Reading obtained with calibration gas before adjusting span
- Final reading obtained with calibration gas after adjusting span

Air monitoring for exposure should be based on the frequency established above (see Section 6.2). Record time, location and results of monitoring and actions taken based upon the readings.

Use the H&A established SOPs for equipment calibration located on the Intranet (also see FI Workplan Appendix D for Standard Operating Procedure: OP1004 – Operation/Calibration of Photo-ionization Detector)

Site activities in the exclusion zone are expected to be performed in Level D PPE with Level C PPE available for use if warranted by site conditions. Field personnel in the exclusion zone, contamination reduction zone, and support zone, as defined in Protective Measures in Section 5.0, will be required to wear steel-toed work boots, a hard hat (if an overhead hazard exists), and safety glasses, and have available Level C PPE in the event that an upgrade in protection is required. Modifications of these levels are permitted and routinely employed during site work activities to maximize efficiency. The level of protection will be selected based on the following:

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- Type and concentration of the chemical substance in the ambient atmosphere and its toxicity;
- The potential for exposure to substances in air, splashes of liquids, or other direct contact with material due to work being done; and
- Knowledge of chemicals on-site along with their properties such as toxicity, route of exposure, and contaminant matrix.

In situations where the type of chemical, concentration, and possibilities of contact are not known, the appropriate level of protection will be selected based on professional experience and judgment until the hazards can be better identified.

Continuous air monitoring with a PID will be used to determine if upgrades in the level of respiratory protection will be necessary. Level C PPE (consisting of chemical-resistant clothing, gloves, overboots, and a full-face negative pressure air respiratory) will be donned in accordance with the action levels presented in Table 2 (at the end of this HASP).

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7. DECONTAMINATION

7.1 Personnel Decontamination

Are **decontamination procedures** required for personnel working on-site? ☑ Y ☐ N
If yes, describe steps:

Step 1 – Equipment Drop

- Deposit equipment used on-site (tools, sampling devices, monitoring equipment, radios, etc.) on plastic drop cloths.
- Decontaminate or dispose of items before removal from the exclusion zone.

Step 2 – Outer Boot/Glove Wash and Rinse

- Scrub outer boots/gloves with decontamination solution.
- Rinse using water.

Step 3 – Outer Boot/Glove Removal

- Remove outer boots/gloves.
- If outer boots/gloves are disposable, deposit in container with plastic liner.
- If outer boots/gloves are non-disposable, store in a clean, dry location.

Step 4 – Respiratory Protection Removal

- Remove hard hat and respirator face piece, and place them on a clean surface.
- Remove any gross contamination by washing and rinsing face piece. Apply isopropyl alcohol or similar to disinfect.
- Wipe off and store face piece in a clean, dry location.

Step 5 – Inner Glove Removal

- Remove inner gloves.
- Deposit in container for disposal.

Step 6 – Field Wash

- Thoroughly wash hands and face with soap and water.
- Shower as soon as possible.

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Location of decontamination station:

A temporary personnel decontamination station will be established on-site at each work area (see Section 2.2), in the Contamination Reduction Zone (see Section 5.4), immediately adjacent to the Exclusion Zone (see Section 5.4).

Disposal of PPE and Decontamination Wash Water:

Potentially contaminated disposable PPE (e.g. Tyvek® suits and nitrile gloves) and decontamination wash water generated during the field operations will be segregated and containerized in clean Department of Transportation (DOT)-approved 55-gallon drums.

The waste drums containing decontamination wash water and potentially contaminated PPE will be marked as to their contents and left on-site at the 90-day Hazardous Waste Storage Area pending the results of laboratory analyses to determine appropriate disposal options. A drum log will be completed for the investigation-derived wastes stored at the 90-day Hazardous Waste Storage Area, a copy of which will be provided to appropriate Facility personnel with responsibility for managing the waste stored on-site.

Disposable PPE that has not come into contact with potentially contaminated media, or that has been thoroughly decontaminated, will be double bagged and disposed of as non-hazardous solid waste via the Facilities non-hazardous waste dumpsters.

7.2 Tools & Equipment Decontamination

All decontamination of tools and equipment will be conducted on-site and not at the H&A office, equipment storage yard or other locations.

Potentially contaminated disposable tools and equipment, and decontamination wash water generated during the field operations will be segregated and containerized in clean DOT-approved 55-gallon drums, as described above.

Disposable tools and equipment that have not come into contact with potentially contaminated media, or that have be thoroughly decontaminated, will be double bagged and disposed of as non-hazardous solid waste via the Facilities non-hazardous waste dumpsters.

Wash water generated during the decontamination of tools and equipment will be segregated and containerized in clean drums, and handled as described above.

Check all **equipment and materials needed for decontamination** of tools and other equipment:

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☐ Acetone	☑ Distilled water	☑ Poly sheeting
☑ Alconox soap	☑ Drums for water	☑ Steam cleaner
☑ Brushes	☐ Hexane	☑ Tap water
☑ Disposal bags	☐ Methanol	☑ Washtubs
☐ Other		

Outline the **equipment decontamination procedures** for this project:

- All drilling equipment (i.e. augers, rods, bits, sampling tubes, etc.) will be steam-cleaned with pressurized steam prior to the onset of drilling activities, between boring locations, and before leaving the site.
- Steam cleaning will be conducted in a designated area on-site, which will be determined by the on-site H&A SSO in consultation with Facility personnel.
- All monitor well materials (casings, screens, caps, plugs, and protective casings) will be cleaned with a low-temperature, pressurized water rinse prior to installation.
- Water generated from cleaning new monitor well materials or from initial steam cleaning of pre-cleaned drilling equipment prior to its first use on the site will not be maintained.
- Sample collection equipment (split-spoon samplers, hand augers, bailers, collection utensils, etc.) will be decontaminated before initial use, between samples, and before leaving the site with a non-phosphate detergent wash and/or high-pressure steam, tap water rinse, and final triplicate deionized water rinse.
- After decontamination, sample collection equipment will not be transported to the sampling location on unclean surfaces (e.g., transport in or on new clean poly sheeting).
- Monitor well development/purge pumps will be decontaminated before and after use in each well with a non-phosphate detergent water wash, tap water rinse, and final deionized water rinse. This wash and rinse sequence will be circulated through the pump system and applied to exterior surfaces that will be or have been in contact with groundwater.
- Subcontractors are responsible for decontamination of their own equipment.

Disposal methods for contaminated decontamination materials (e.g., wash water, rags, brushes, poly sheeting) will consist of:

- Place detergent solutions and rinse water in DOT approved 55-gallon drums, marked as to their contents. Leave on-site at the 90-day Hazardous Waste Storage Area pending the results of laboratory analyses to determine appropriate disposal options. A drum log will be completed for the investigation-derived wastes stored at the 90-day Hazardous Waste Storage Area, a copy of which will be provided to appropriate Facility personnel with responsibility for managing the waste stored on-site.

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- Potentially contaminated disposable decontamination equipment (e.g. rags, poly sheeting) generated during the field operations will be segregated and containerized in clean DOT-approved 55-gallon drums, as described above.

- Disposable decontamination equipment that has not come into contact with potentially contaminated media, or that has be thoroughly decontaminated, will be double bagged and disposed of as non-hazardous solid waste via the Facilities non-hazardous waste dumpsters.

- Cleaning equipment (e.g., brushes, washtubs, and steam cleaner) will be decontaminated for reuse.

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8. CONTINGENCY PLANNING

8.1 Facility Contingency Plan

The Facility's Contingency Plan is presented as Appendix K in the referenced FI Work Plan..

The provisions of the Facility Contingency Plan must be carried out immediately whenever there is a fire, explosion, or release of hazardous waste or hazardous waste constituents which could threaten human health or the environment.

The Facility Contingency Plan describes the actions Facility personnel must take in response to fires, explosions, or any unplanned sudden or non-sudden release of hazardous waste or hazardous waste constituents to air, soil, or surface water at the Facility.

In the event of a release of a hazardous material or waste or any hazardous waste emergency, the on-call control room engineer, who shall be designated the Facility Emergency Coordinator is to be notified immediately. At all times, a Facility Emergency Coordinator will be on call at the Facility. If the designated Emergency Coordinator (on-call control room engineer) is not available, the alternative Emergency contact / Coordinator will be the plant manager, who is to be contacted.

8.2 H&A Response to Emergencies

Typically, H&A does not mitigate emergencies. H&A's response to emergencies is outlined below:

In the event of a release of a hazardous material or waste or any hazardous waste emergency, the Facility Emergency Coordinator is to be notified immediately.

Fire

- Major Fires - Major fires will be mitigated by the local fire departments or by client's on-site fire/emergency response departments.
- Incipient Stage Fires - Incipient stage fires will be extinguished by on-site personnel using fire extinguishers. Only those who have received annual training may use an extinguisher.

Medical

All H&A employee injuries and illnesses will be documented using the Supervisor's Accident/Injury/Near Miss Report (SAIR). This form is available on the Intranet.

- First Aid - First aid will be addressed using the on-site first aid kit. H&A employees are not required or expected to administer first aid/CPR to any H&A, Contractor, or Civilian personnel at any time and it is H&A's position that those who do are doing it on their behalf and not as a function of their job.
- Trauma - Based upon the nature of the injury, the injured party may be transported to the nearest hospital or emergency clinic by on-site personnel or by ambulance. First response to a trauma incident is to call 911 or facility security. H&A staff members are expected to assist in ancillary roles only such as directing ambulances to the scene. It is

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the discretion of the staff member on-site whether an ambulance should be procured in remote locations where ambulance services will not be effective.

Hazardous Materials Spill

- Small incidental spills (e.g. pint of motor oil) caused by H&A employees and/or by H&A's subcontractor will be mitigated by the H&A staff member and/or the H&A subcontractor.
- Large spills (e.g. large leak from heavy equipment fuel tank) caused by H&A's subcontractor will be the responsibility of the subcontractor for cleanup. In the event that it posses a serious human or environmental threat, the local Fire Department and/or client emergency response department will be contacted. Once the emergency has been mitigated typically clean up will be provided by a vendor.

Rescue

H&A employees will not enter any confined spaces for rescue purposes.

Weather Related Emergencies

H&A employees and their subcontractors should be aware of potential health effects and/or physical hazards of working during inclement weather (e.g. heat, lighting). The effects and hazards of heat stress are outlined in Section 4.0.

Emergency Alarming and Communication

In the event of an emergency, on-site H&A personnel and subcontractors shall assemble in a designated area. Role shall be completed by the SSO or senior-most H&A person present. No personnel shall leave the assembly area unless directed to do so by Project Management, the SSO, or recognized emergency response agency (e.g., police, fire department).

Evacuation alarms and/or emergency information will be communicated among personnel on-site by the following means:

- Verbal communication

Emergency services will be summoned:

- Via on-site phone or cellular phone.

The **site evacuation plan** is as follows:

Work zones will be established, the Exclusion Zone will have several emergency exits which will allow safe egress in multiple directions from any point on-site. The exit selection will be based on emergency location, type of emergency, and wind direction. Upon hearing the excavation signal or otherwise being notified of an evacuation, employees will immediately travel to the assembly area located at the decontamination station or other designated area outside of the exclusion zone. Emergency exits, exit routes, and the emergency assembly area will be identified during each daily tailgate meeting.

Employees will follow a route that avoids locations downwind from the emergency. If emergency exits are used, employees within the exclusion zone will proceed to the assembly area by the quickest route possible, staying close to the perimeter of the Exclusion Zone or

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other designated area outside of the Exclusion Zone. When the assembly area is reached, employees will immediately check in with the Haley & Aldrich Field Manager or SSO. The site will remain evacuated until the all clear signal has been given. This will be verbally given by the Haley & Aldrich Field Manager or SSO.

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EMERGENCY RESPONSE RESOURCES

Nearest Hospital: (see attached map) Address: Phone Number:	Bayview Hospital 330 Moss Street, Chula Vista, CA 91911 619.426.6310
Facility Emergency Coordinator: Babara Montgomery	Contact Telephone No.: Office: (858) 547-3330 Cell: (619) 954-9949 24 Hour Phone: (619) 725-5100 (SDG&E Trouble Dept.)
Alternative Facility Emergency Coordinator:	Contact Telephone No.: Office: Pager: 24 Hour Phone: (619) 725-5100 (SDG&E Trouble Dept.)
Ambulance:	911
Fire Department: San Diego Fire Department	911
Police: Chula Vista Police Department	911 or 619.691.5137
Local Emergency Response Teams: San Diego Fire Department or SD County Dept. of Environmental Health or SDG&E Hazardous Incident Response Team (HIRT)	911 619.338.2222 858.549.6519
State Emergency response Teams: California Office of Emergency Services	800.852.7550

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Directions to Bayview Hospital:

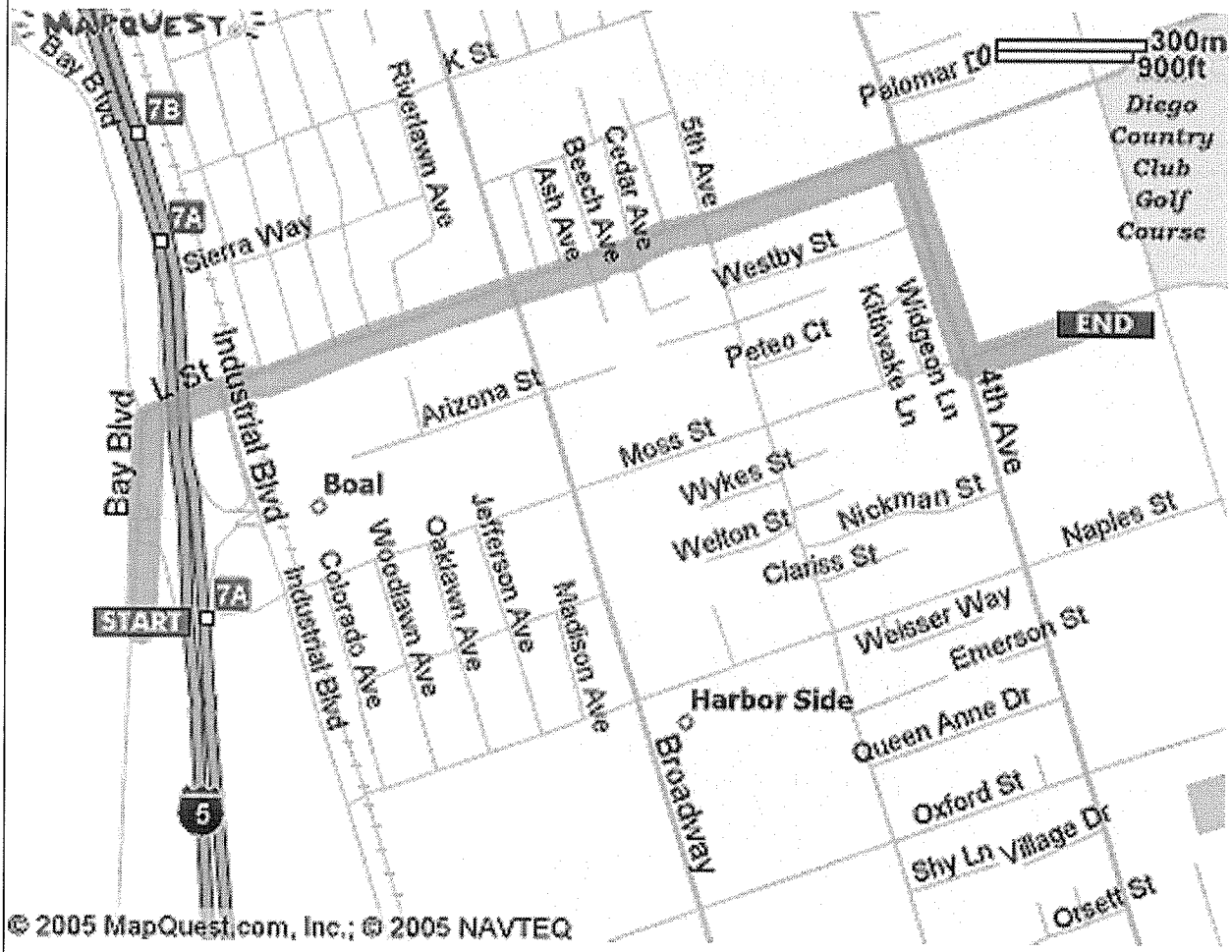
1. Start out going NORTH on BAY BLVD toward L ST. (0.2 miles)

2. Turn RIGHT onto L ST. (0.9 miles)

3. Turn RIGHT onto 4TH AVE. (0.2 miles)

4. Turn LEFT onto MOSS ST. (0.1 miles)

5. END at **Bayview Hospital**, 330 Moss St., Chula Vista, CA, 619-426-6310



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APPENDIX A
HASP Amendment Form

This Appendix is to be used whenever there is an immediate change in the project scope that would require an amendment to the HASP. For project scope changes associated with "add-on" tasks, the changes must be made in the body of the HASP. Before changes can be made, a review of the potential hazards must be initiated by the H&A Project Manager.

Amendment No.	
Site Name:	
Work Assignment No.:	
Date:	
Type of Amendment:	
Reason for Amendment:	
Alternate Safeguard Procedures:	
Required Changes in PPE:	

Project Manager Signature: _____ Date: _____

Local Health and Safety Coordinator: _____ Date: _____

This original form must remain on-site with the original HASP. If additional HASPs are in the field, it is the PM's responsibility to forward a signed copy of this amendment to those who have copies.

APPENDIX C

Standard Operating Procedure: OP3003 – Surficial Soil Sampling
Standard Operating Procedure: OP2000 – Monitoring Field Explorations
Standard Operating Procedure: Sampling According to EPA 5035

OPERATING PROCEDURE: OP3003

SURFICIAL SOIL SAMPLING

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PREPARATION AND APPROVALS

VERSION	AUTHORED/DATE	REVIEWED / DATE	REVIEWED / DATE	REVIEWED / DATE	APPROVED / DATE
Ver. 0.0	JML: June 2003	CSO July 2003			DHS Sept 2003

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OPERATING PROCEDURE: OP3003

SURFICIAL SOIL SAMPLING

1. PURPOSE

The purpose of this Operating Procedure (OP) is to describe the procedures for the collection of representative samples of surficial soil. The procedures are intended specifically to minimize alteration of samples during collection. Surficial soil samples as referenced herein mean soils or soil-like material located less than 6 feet below ground surface which may contain quantities of contaminants.

Refer to OP3000 for General Environmental Field Procedures and Protocol, including procedures for decontamination of sampling equipment and/or containers. Refer to OP3001 for Operating Procedures on Preservation and Shipment of Environmental Samples.

Refer to OP3004 for Operating Procedures on Stream Sediment and Wetlands Soil Sampling. Refer to OP3006 for Operating Procedures on Subsurface Soil Sampling for Chemical Analysis.

Haley & Aldrich (H&A) personnel are to use the techniques in OP3003 to collect surficial soil samples. These operating procedures may be varied or changed as required, dependent upon site conditions, equipment limitations, or limitations imposed by the procedure. In all instances, the actual procedures used should be documented and described in an appropriate site report.

2. EQUIPMENT & SUPPLIES

Required:

1. Site map(s)/plan(s)
2. Safety equipment, as specified in the site-specific Health and Safety Plan
3. Field Log book
4. Stainless steel, plastic, or other appropriate homogenization bucket, bowl or pan
5. Plastic or stainless steel spoons and/or wooden tongue depressors
6. Appropriate size sample containers
7. Plastic zip lock bags
8. Sample Labels
9. Chain of Custody records and custody seals
10. Sampling Record Form (H&A Form 3004)
11. Cooler(s)
12. Ice
13. Decontamination supplies/equipment

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Sampling equipment may include one or more of the following:

1. Stainless steel trowel(s) or scoop(s)
2. Stainless steel spade or shovel
3. Bucket auger
4. Bit auger
5. Continuous flight (screw) auger
6. Post-hole auger
7. Extension/drill rods
8. T-handle
9. Core sampler
10. Sampling trier
11. Thin wall tube sampler
12. Split spoons
13. Vehimeyer soil sampler outfit
14. Tubes
15. Points
16. Drive head
17. Drop hammer
18. Puller jack and grip
19. Backhoe
20. Telescopic mechanical sampling arm (aluminum poles)
21. Stainless steel sampling beaker

Optional:

1. Tape measure
2. Survey equipment or global positioning system (GPS) to locate sampling points
3. Survey stakes or flags
4. Camera and film
5. Plastic sheeting or cover

3. PROCEDURE

3.1 Preparation

- Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies required.

- Obtain necessary sampling and monitoring equipment.

- Decontaminate or pre-clean equipment, and ensure that it is in working order.

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- Prepare schedules and coordinate with staff, client, and regulatory agencies, if appropriate.

- Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.

- Use stakes, flagging, or buoys to identify and mark all sampling locations. Specific site factors, including extent and nature of contaminant, should be considered when selecting sample location. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations should be utility-cleared by the property owner or the On-Scene-Coordinator prior to soil sampling, and utility clearance should always be confirmed before beginning work.

3.2 Presampling Observations, Notes and Required Entries

The information listed below will be recorded in a project Field Log book and a Sampling Record Form. The Sampling Record Form is referenced in Appendix C. The following list of measurements and observations represent a minimum requirement for soil samples:

- Sampling Location Number

- Time

- Date Collected

- Samplers (names of individuals who actually collected samples)

- Sample Destination (Analytical Laboratory) to receive samples

- Description of Sample Location with Sketch or Map

- Sample Depth (i.e., distance in feet from ground surface)

- Photograph Number and Roll Used (if applicable).

- Observable Physical Characteristics
  - Odor
  - Color
  - Density, Consistency, etc.
  - Layering
  - Other

- Evidence of Stressed Vegetation or Wild Life in Area where Sample was taken

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- Ambient Weather Conditions during Sampling
  - Air Temperature
  - Sky Condition
  - Recent Precipitation or Drought

- Samples Collected (enter all sample numbers collected at this location)

3.3 Sampling Procedures

- After entries are completed, label and number required sample bottles. Fill out the label in indelible ink and carefully and clearly address all categories and parameters.

- Sample analyses will be specified by the Project Coordinator and Site Manager. A list of these analyses and required containers and handling procedures is presented in a Site work plan or related document.

- Sampling instructions have been provided for seven sampling devices most often used to collect surficial soil samples. Select the appropriate sampling device.

- Refer to Operation Procedure OP2001 - Identification and Description of Soils in the Field Using Visual-Manual Methods, if observations of surficial soils are to be recorded.

- Decontaminate sampling device and/or container prior to use according to Operation Procedure OP3000 - General Environmental Field Procedures and Protocol.

- Sample containers (glass jars and vials) should be filled to the top. Refer to a Site work plan or related document for sample volume size and appropriate containers for given analyses. Sample containers should contain laboratory-provided preservatives, if necessary. Care should be taken to prevent the presence of air bubbles in VOA vials. All container caps will include an inner teflon septa or lining and must be tightly secured to contain the sample. All samples will be stored and shipped at 4°C. Refer to OP3001 for operating procedures on sample handling and preservatives.

- Check for appropriate liner in cap and secure cap tightly. Store the samples with ice in a cooler, following these sealing and packing procedures:

  - Ice will be placed in plastic zip-lock bags to contain ice water. Sample containers will be adequately layered in bubble wrap to prevent breakage. Samples will be positioned upright in the cooler to prevent breakage, and samples will be stored and shipped at 4°C.

  - All 40-milliliter VOA vials will be sealed in thick or heavy duty plastic zip lock bags.

  - Check to make sure all appropriate information is in Field Log Book or Sampling Record form and Chain-of-Custody form using indelible ink.

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- If samples are to be shipped to a laboratory for analysis, a Chain-of-Custody record, custody seals, fragile markers, and reinforced nylon tape will all be properly affixed to or on the sample cooler. If samples are to be delivered to the laboratory directly by Haley & Aldrich, then only the Chain-of-Custody record is required.

  - Chain-of-Custody Form - enclose in large plastic zip lock bag and tape to inside top of cooler lid.

  - Custody Seals - place custody seal over cooler gasket separating the cooler lid from the cooler bottom at all sides except hinged location.

  - Nylon Tape - tape completely around cooler at two locations. Tape reinforcing will prevent cooler from opening if the lid locking mechanism fails.

  - Fragile Markers - fragile markers and upright stickers will be affixed to each side of the cooler.

3.4 Sampling Device Instructions

The specific procedures and equipment for surficial soil sampling will be defined in a Site work plan or related document. The following presents a description of seven sampling devices commonly used to collect surficial soil samples within 6 feet of ground surface. The split spoon sampler, when used with drilling equipment, can also collect subsurface soil samples to much greater depths. The most appropriate device for a specific sampling program as described in a Site work plan or related document has been selected based on site conditions (accessibility, type of soil, desired depth of samples, etc.) and on climate conditions (e.g. frozen ground in winter).

The selected devices for each sampling task are described in detail in a Site work plan or related document. Any changes to procedures outlined in a Site work plan or related document will be specified by the Site Manager.

3.4.1 Hand Scoops, Trowels, Spades and Shovels

This method is probably the simplest, most expeditious, direct method for making soil samples accessible. Collection of samples from near-surface soil can be accomplished with tools such as spades, shovels, trowels, and scoops. These devices are easy to operate, decontaminate and work well for sampling most surficial soils. Surface material is removed to the required depth and a stainless steel or plastic scoop is then used to collect the sample. This method can be used in most soil types but is limited to sampling at or near the ground surface. Accurate, representative samples can be collected with this procedure depending on the care and precision demonstrated by the sample team member.

Hand scoops and trowels consist of the usual garden type trowel or scoop usually constructed of stainless steel. A stainless steel laboratory scoop is a preferred scoop device due to its non-corrosive nature. Scoops or trowels work well in collecting grab samples of surficial soils or sludges. A flat,

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pointed mason trowel to cut a block of the desired soil is helpful when undisturbed profiles are required. A typical shovel or spade constructed of stainless steel can be used to collect representative soil samples near the surface. Devices plated with chrome or other exterior coatings that may chemically alter the sample should not be used. Plating is particularly common with garden implements such as potting trowels.

Procedures for Use

1. Carefully remove the top layer of soil to the desired sample depth with a cleaned, stainless steel spade, shovel, trowel, or scoop. In the case of sludges exposed to air, it may be desirable to remove the first 1-2 centimeters of material prior to collecting sample.

2. Using a cleaned, stainless steel scoop or trowel, collect the desired quantity of soil.

3. If volatile organic analysis is to be performed, transfer the sample directly into an appropriate, labeled sample container with a stainless steel lab spoon, new wooden tongue depressor or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval or location into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

3.4.2 Bucket and Bit Augers with Thin-Wall Tube Attachment

This system consists of a bucket or bit auger, or a thin-wall tube sampler, a series of extensions/drill rods, and a "T" handle (Figure 1). A cleaned bucket or bit auger is used to bore a hole to the desired sampling depth and then is withdrawn. When using the bucket auger, the soil sample must be removed from the bucket with a cleaned, stainless steel spoon or trowel. The bucket auger can collect a large soil sample (up to 24 ounces) but is limited in penetrating depth to approximately 2 feet under ideal conditions. Bucket augers are useful for direct sample recovery, because they provide a large volume of sample in a short time. The bit auger has greater penetrating depth (up to 6 feet) but collects a small soil sample. The bit auger tip is removed from the auger when the desired sampling depth is reached and replaced with the thin wall tube attachment. The system is then lowered down the cored hole, and driven into the soil to the completion depth. The system is withdrawn and the core is collected from the thin wall tube sampler.

Other types of augers include continuous flight (screw) and post-hole augers. When continuous flight augers are used, the sample can be collected directly from the flights. The continuous flight augers are satisfactory when a composite of the complete soil column is desired. Post-hole augers have limited utility for sample collection as they are designed to cut through fibrous, rooted, swampy soil and cannot be used below a depth of approximately three feet.

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This equipment can be used in a wide variety of soil conditions. The presence of rock layers and collapsing of the borehole usually prohibit sampling at depths greater than 3 to 6 feet. The equipment is inexpensive, easy to operate, and generally works well to sample most soils.

Procedures for Use

1. Attach the cleaned auger bucket or bit to a drill rod extension and further attach the "T" handle to the drill rod.

2. Clear the area to be sampled of any surface debris (twigs, rocks, litter). It may be advisable to remove the first 3 to 6 inches of surface soil for an area approximately 6 inches in radius around the drilling location.

3. Begin augering by rotation of the "T" handle, periodically removing accumulated soils onto a plastic sheet spread near the hole. This prevents accidentally brushing loose material back down the borehole when removing the auger or adding drill rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.

4. After reaching the desired depth, slowly and carefully remove the auger from the hole.

5. If a bucket auger is used, remove the soil sample with a cleaned, stainless steel spoon or trowel.

6. If a bit auger is used, remove the auger tip from the extension rods and replace with a cleaned, thin-wall tube sampler. Install the proper cutting tip.

7. Carefully lower the tube sampler down the borehole. Gradually press the tube sampler into the soil. Take care to avoid scraping the borehole sides. Avoid hammering the drill rods to facilitate coring, as the vibrations may cause the boring walls to collapse.

8. Remove the tube sampler and unscrew the drill rods.

9. Remove the cutting tip, and remove the core from the device.

10. Discard the top of the core (approximately 1 inch), as this possibly represents material collected before penetration of the layer of concern. Place the remaining core into the appropriate labeled sample container. Sample homogenization is not required.

11. If volatile organic analysis is to be performed, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, wooden tongue depressor or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval

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into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

12. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger bit to the drill and assembly, and repeat previous steps, making sure to decontaminate the auger and tube sampler between samples.

13. Abandon the hole according to applicable state regulations. Generally, shallow holes can simply be backfilled with the removed soil material.

3.4.3 Hand Held Corer

The device consists of a "T" handle and cylindrical core tube (Figure 2). The device is equipped with a check valve at the top to prevent washout during retrieval through an overlying water layer, if applicable, and a nosepiece at the bottom to help contain the sample. This device can be used in a wide variety of soil conditions. Hand corers can also be fitted with brass or polycarbonate plastic liners.

Procedures for Use

1. Inspect the corer for proper pre-cleaning.

2. Press the corer in with a smooth continuous motion.

3. Twist the corer, and then withdraw the corer in a single smooth motion.

4. Remove the nosepiece and withdraw the sample into a stainless steel, plastic or other appropriate homogenization container.

5. Transfer the sample into an appropriate sample container with a stainless steel spoon, wooden tongue depressor or equivalent.

3.4.4 Thin Tube Hand Held Sampling Trier

The system consists of a trier, a long hollow cylindrical tube with a slot trending almost its entire vertical length, and a "T" handle (Figure 3). The trier is driven into the soil to be sampled and used to extract a core sample from the appropriate depth. The tip and edges of the tube are sharp to allow the trier to cut a core by rotation of the "T" handle once it is completely pushed-down or manually driven to the depth of collection. Triers range from approximately 20 to 60 inches in length and from approximately 0.5 to 1 inch in diameter.

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Procedures for Use

1. Insert the cleaned trier into the soil or sludge material at a 0 to 45° angle from horizontal. This orientation minimizes the spillage of sample from the sampler. Extraction of samples might require tilting of the containers.

2. Rotate the trier once or twice to cut a core of material.

3. Slowly withdraw the trier, making sure the slot is facing upward.

4. If volatile organic analyses are required, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, wooden tongue depressor or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

3.4.5 Split Spoon Sampler

Split spoon sampling is generally used to collect undisturbed soil cores of 18 or 24 inches in length. A split spoon sampler consists of a cylindrical hollow steel or stainless steel sampler usually 24 inches long and 2 or 3 inches in outside diameter. A series of consecutive cores may be extracted with a split spoon sampler to give a complete soil column profile, or an auger may be used to drill down to the desired depth for sampling. The split spoon is then driven to its sampling depth through the bottom of the augured hole and the core extracted. Split spoon samplers collect in-situ soil samples that permit stratigraphic logging. To remove the split spoon sampler and collect a soil sample, remove the sampler from the driving rods and unscrew the tapered nosepiece and top piece from the sampler. The spoon will then split into two longitudinal sections. It may be necessary to use a pipe wrench to unlock the threaded nosepieces. This sampling device is almost always used in conjunction with a drilling rig and as such is an equipment intensive effort. However, the split spoon may be used with a hand-held drop hammer for collection of shallow soil samples (less than 6 feet below ground surface).

Refer to Operation Procedures OP2005 - Test Borings, Sampling, Standard Penetration Testing and Borehole Abandonment, and OP3006 - Procedures for Subsurface Soil Sampling for Chemical Analysis, which describe the use of this sampler in greater detail.

Review Draft

Procedures for Use

1. Assemble the sampler by aligning both sides of barrel and then screwing the drive shoe on the bottom and the head piece on top.

2. Place the sampler in a position perpendicular to the sample material.

3. Using a well ring, drive the tube. Do not drive past the bottom of the head piece or compression of the sample will result.

4. Record in the Field Log book or test boring log the length of the tube used to penetrate the material being sampled, and the number of blows required to obtain this depth.

5. Withdraw the sampler, and open by unscrewing the bit and head and splitting the barrel. The amount of recovery and soil type should be recorded on the boring log. If a split sample is desired, a cleaned, stainless steel knife should be used to divide the tube contents in half, longitudinally. This sampler is typically available in 2 and 3 1/2 inch diameters. A larger barrel may be necessary to obtain the required sample volume.

6. Without disturbing the core, transfer it to appropriate labeled sample container(s) and seal tightly.

3.4.6 Test Pit/Trench Excavation

A backhoe can be used to remove sections of soil, when detailed examination of soil characteristics are required. This is a relatively expensive sampling method because of the cost of backhoe operation. Refer to Operation Procedure OP2026 - Exploratory Test Pits for more information on test pit excavations.

Procedures for Use

1. Prior to any excavation with a backhoe, it is important to ensure that all sampling locations are clear of overhead and buried utilities.

2. Review the site specific Health & Safety plan and ensure that all safety precautions including appropriate monitoring equipment are installed as required.

3. Using the backhoe, excavate a trench approximately three feet wide and approximately one foot deep below the cleared sampling location, or as specified in a Site work plan or related document. Place excavated soils on plastic sheets. Trenches greater than five feet deep must be sloped or protected by a shoring system, as required by OSHA regulations.

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4. A shovel may be used to remove a one to two inch layer of soil from the vertical face of the pit where sampling is to be done.

5. Record in the Field Log book or test pit log the depth intervals from which the samples are being collected.

6. Samples are taken using a trowel, scoop, or coring device at the desired intervals. Be sure to scrape the vertical face at the point of sampling to remove any soil that may have fallen from above, and to expose fresh soil for sampling. In many instances, samples can be collected directly from the backhoe bucket. A telescopic mechanical arm (see next sampling device) and stainless steel sampling beaker may be used to collect samples.

7. If volatile organic analyses are required, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, wooden tongue depressor or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

8. Abandon the pit or excavation according to applicable state regulations. Generally, shallow excavations can simply be backfilled with the removed soil material. The test pit/excavation should be backfilled in accordance with a Site work plan or related document.

3.4.7 Telescopic Mechanical Sampling Arm

The device consists of an aluminum pole approximately 1 to 2 inches in diameter divided into three, 4-foot sections. Attached to the end of the pole is a stainless steel sampling beaker (usually with an 18-ounce capacity). The pole is capable of telescoping from 4 to 12 feet. This mechanical sampling arm is used to collect soil samples from test pits or other excavations. It allows a sample to be collected from a location that would otherwise be difficult to access.

Procedures for Use

1. Attach the cleaned, stainless steel beaker to the end of the pole either by tightening a clamp or wing nuts.

2. Make sure your feet are safely and securely positioned.

3. Telescope the pole to the required length.

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4. Lower the pole end into the test pit or other excavation.

5. Collect the sample.

6. Remove the sample from the beaker with a cleaned, stainless steel scoop, trowel or new wooden tongue depressor.

3.5 Sample Containers

The samples for each analysis will be collected in the appropriate containers and handled in accordance with the procedures described in a Site work plan or related document.

3.6 Chain-of-Custody Forms

All samples submitted to the contract analytical laboratory for analyses, will be accompanied by a Chain-of-Custody form. Appropriate Chain-of-Custody procedures will be followed at all times during a sampling event and subsequent transport to the contract analytical laboratory. Refer to OP3026 for operation procedures on completing a Chain-of-Custody form and Chain-of-Custody procedures.

3.7 Decontamination

Soil sampling equipment will be cleaned prior to and between each use according to Operation Procedure OP3000 – General Environmental Field Procedures and Protocol. After decontamination, the equipment will be wrapped in aluminum foil and placed on clean racks off the ground until it is used.

3.8 Quality Assurance/Quality Control

There are no specific quality assurance (QA) activities that apply to the implementation of these operating procedures. However, the following QA procedures apply:

- All data must be documented on field data sheets or within site logbooks.
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in a Site work plan or related document. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

3.9 Health and Safety

When working with potentially hazardous materials, follow H&A health and safety procedures, in addition to the procedures specified in the site specific Health & Safety Plan.

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FIGURES

Figure 1. Sampling Augers

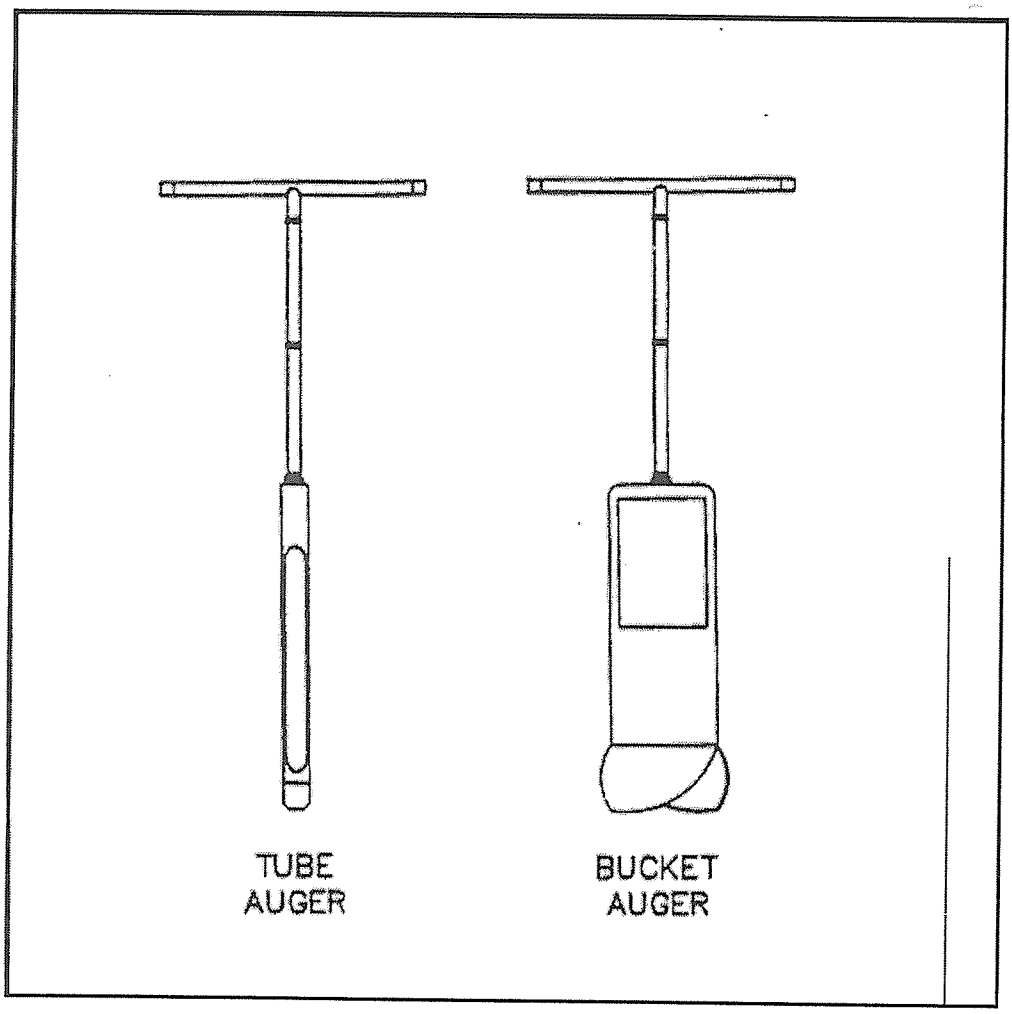


Figure 2. Sample Coring Device

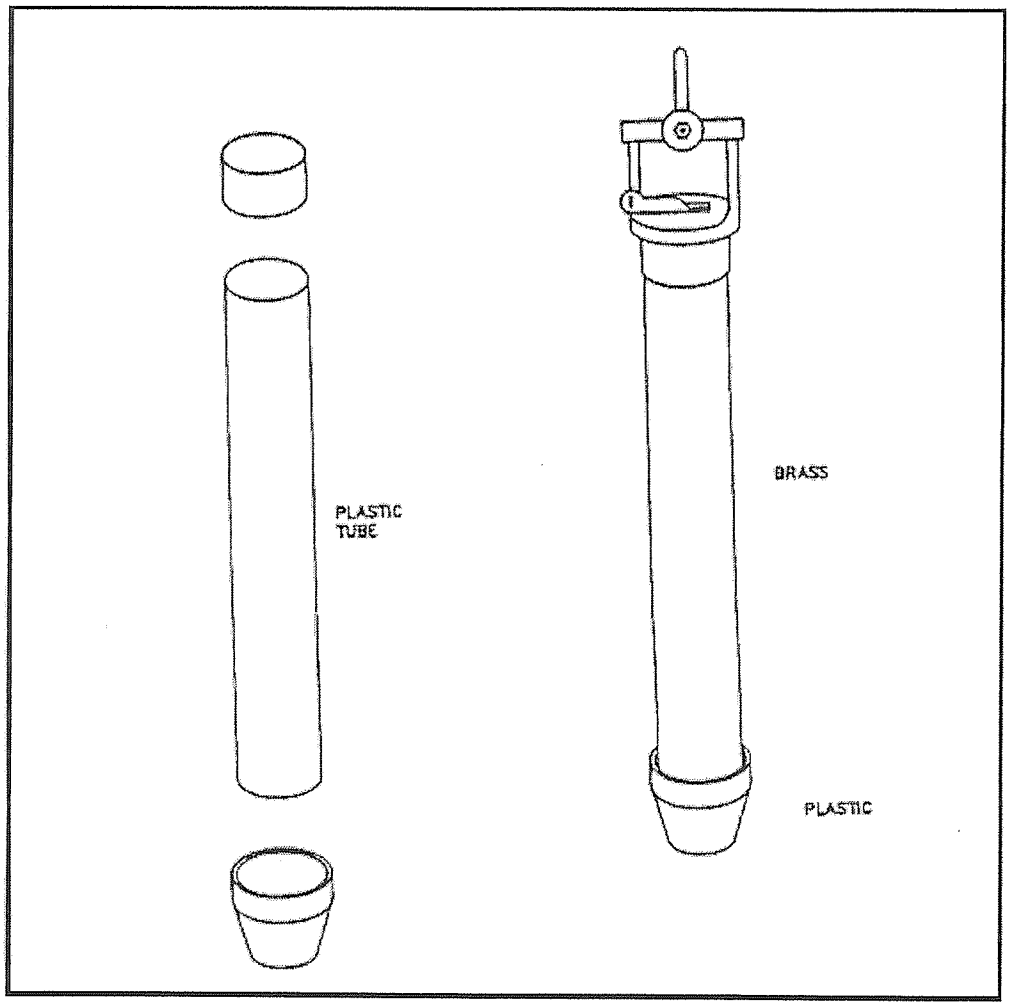
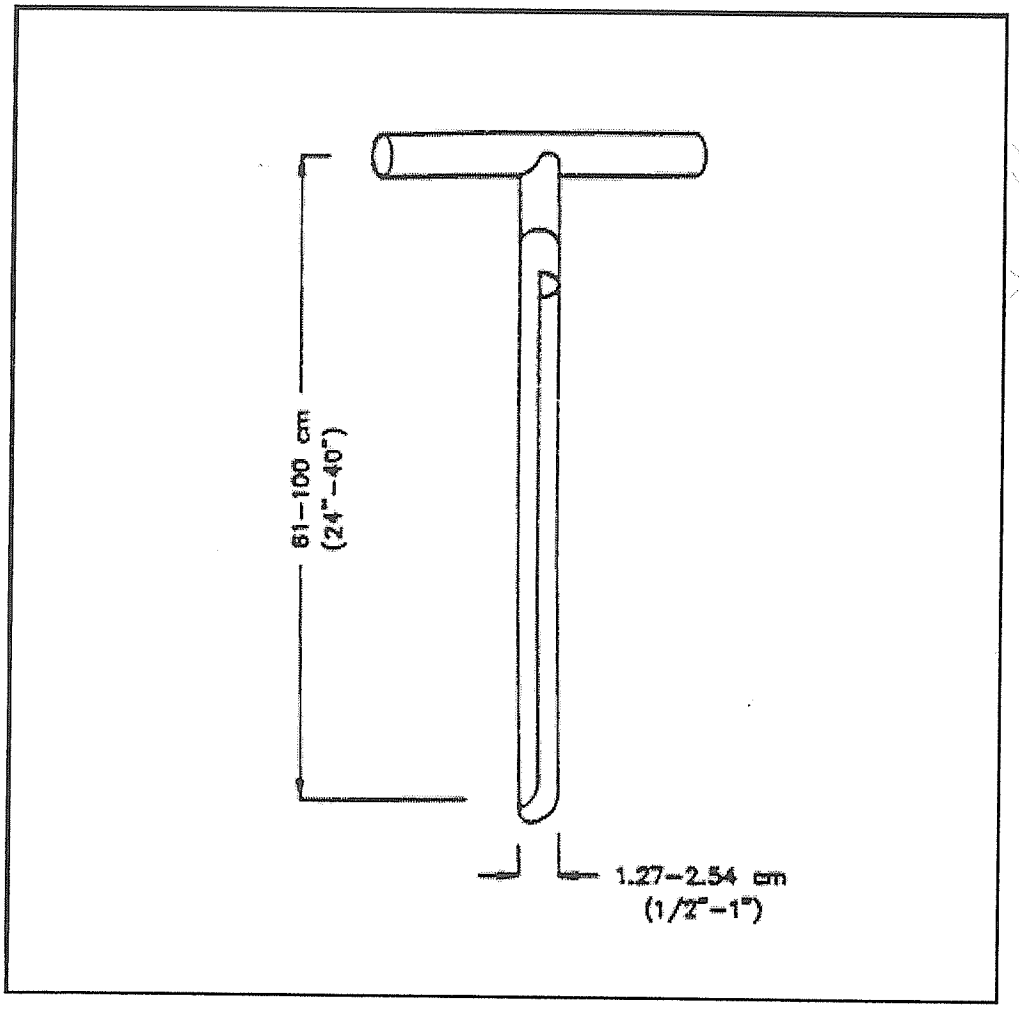


Figure 3. Sampling Trier



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APPENDIX A
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APPENDIX B
RELATED HALEY & ALDRICH PROCEDURES

- OP1009 Medical Surveillance Program
- OP1010 Health and Safety Plans
- OP2001 Identification and Description of Soils in the Field Using Visual-Manual Methods
- OP2005 Test Borings, Sampling, Standard Penetration Testing and Borehole Abandonment
- OP2026 Exploratory Test Pits
- OP3000 General Environmental Field Procedures and Protocol
- OP3001 Preservation and Shipment of Environmental Samples
- OP3004 Stream Sediment and Wetlands Soil Sampling
- OP3006 Procedures for Subsurface Soil Sampling for Chemical Analysis
- OP3026 Chain of Custody

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APPENDIX C
FORMS

- Form 3001 Sampling Labels (Environmental)
- Form 3002 Chain of Custody (Electronic)
- Form 3003 Chain of Custody (Field)
- Form 3004 Sampling Record

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APPENDIX D
GLOSSARY

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OPERATING PROCEDURE: OP2000

MONITORING FIELD EXPLORATIONS

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PREPARATION AND APPROVALS

VERSION	AUTHORED/DATE	REVIEWED / DATE	REVIEWED / DATE	REVIEWED / DATE	APPROVED / DATE
Ver. 0.0	CSO/ 12-02	JAM/ 01-03		STP/6-1-03	SRK/7-1-03

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OPERATING PROCEDURE: OP2000

MONITORING FIELD EXPLORATIONS

1. PURPOSE

Exploratory test borings, probes and test pits represent important sources of subsurface information relating to geologic conditions and site suitability fundamental to environmental site assessment and geotechnical engineering design recommendations. The following procedure is an outline of the field staff responsibilities while monitoring subsurface exploration methods utilized by Haley & Aldrich Inc. (H&A) to obtain the best possible data for geologic characterization, laboratory testing and subsequent engineering evaluations and environmental assessment.

2. EQUIPMENT & MATERIALS

2.1 Standard Required Equipment

Required		Additional as Required	
1.	Proposal (signed by Client)	20.	First Aid Kit
2.	Site Plan	21.	Cellular Phone
3.	Contract with Subcontractor (pay items)	22.	Health & Safety Plan
4.	Exploration Criteria/Specifications	23.	Respirator & Tyvek Suit
5.	Field Book	24.	Laptop Computer
6.	Clipboard	25.	Camera & Film
7.	Logs & Forms	26.	Field Procedures
8.	Office Supplies (pencils & markers)	27.	Maps and References
9.	Engineer's Scale	28.	Sample Bags & Jars with Labels
10.	6 ft. Ruler	29.	Survey Stakes/Paint/Flagging
11.	100 ft. Measuring Tape	30.	Shovel
12.	Hand Lens, magnifying	31.	Geologist's Pick
13.	Pocket Knife	32.	Flashlight
14.	Hard Hat	33.	Roadway Box Key/Socket Wrench
15.	Safety Glasses	34.	Water Level Indicator
16.	Sound Dampeners	35.	Hand Level
17.	Steel Toe Boots	36.	Brunton Compass
18.	Protective Gloves	37.	Pocket Penetrometer
19.	Rain Gear	38.	Torvane

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2.2 Required Environmental Equipment

Most environmental fieldwork will have extensive equipment requirements and supplies specifically related to the project needs. The following list is a representative list of equipment classed as type-specific groups. A comprehensive list of equipment and materials must be developed for each project in coordination with the Project Manager (PM) and Health & Safety (H&S) Coordinator prior to the start of the field program.

1. Personal Protection Equipment (PPE)
   - Air Purifying Respirator & Cartridges (Type GMC-Type H)
   - Latex/Nitrile Inner Gloves/Boot Covers
   - Tyvek/Saranex Coveralls/Sleeves/Apron

2. Decontamination Equipment and Supplies
   - Decontamination Kit
     - 5 gallon bucket
     - 5 gallon water jug
     - alconox detergent
     - brushes & paper towels
     - methanol/hexane/deionized water
   - Decontamination Tub
   - Absorption Pads
   - Polyethylene Sheeting
   - Polyethylene Trash Bags

3. Air Quality/Headspace Monitoring Equipment
   - Photo-Ionization Detector (PID)
   - Flame Ionization Detector (FID)
   - Organic Vapor Analyzer (OVA)
   - Combustible Gas Meter-LEL/O2
   - Dust Monitor
   - Multigas Meter-HCn/Methane/H2S
   - Gas Pointer
   - Draeger Tube Sampling Kit
   - Radiation Survey Meter

4. Soil Sampling Equipment and Supplies
   - Hand Auger
   - Soil Core Sampler
   - Shovel/Trowel/Remote Sampler
   - Stainless Steel Bowl
   - Aluminum Foil
   - Tongue Depressors
   - Sample Bags/Laboratory Glassware & Labels
   - Cooler & Ice Blocks

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5. Water Sampling Equipment and Supplies
   - Water Level Indicator
   - Oil/Water Interface Probe
   - Centrifugal Pump-Volume
   - Submersible Pump-Low Flow
   - Peristaltic Pump & Silicone Tubing
   - Purge Pump & DC Supply
   - Waterra® Tubing/Foot Valves/Filters
   - Stainless Steel/Teflon Bailers & Rope
   - Remote Sampler
   - Water Testing Equipment
     - Flow Cell (pH, temperature, conductivity, DO, turbidity, ORP and salinity)
     - Dissolved Oxygen (DO) Meter
     - Oxidation-Reduction Potential (ORP) Meter
     - Turbidity Meter
     - Downhole Temperature/Resistivity/Conductivity/Salinity Meter
     - pH/ Turbidity/DO/ Temperature/Resistivity/Conductivity/Salinity Meter
   - Laboratory Glassware & Labels
   - Cooler & Ice Blocks

2.3 Additional Equipment, Specialized Instrumentation, Materials & Company Vehicles

Company-wide, Haley & Aldrich maintains an array of equipment, vehicles and specialized instrumentation for a broad variety of uses in addition to the selected equipment listed above. Additional equipment, vehicles and materials may be rented or purchased as needed with the approval of the project manager. Project equipment needs should be addressed proactively so that interoffice allocation can take place. It is recommended that the field staff familiarize themselves with the use, function and availability of all types of equipment standard to the industry. The following list is representative of the additional equipment currently available but is not intended to be a comprehensive list.

1. Survey Instrumentation
   - Theodolite/Transit/ Level & Rod
   - Global Positioning System (GPS)

2. Subsurface Locating Equipment
   - Ground Penetrating Radar (GPR)
   - Metal Detector
   - Magnetometer

3. Air-Soil-Water Quality/Analytical Equipment
   - Gas Chromatograph (GC)
   - TPH Analyzer
   - Infrared Oil Analyzer
   - Radiation Survey Meter
   - Oxidation-Reduction Potential Meter (ORP)

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4. Geotechnical Equipment & Instrumentation
   - Vane Shear Test Equipment
   - Vibrating Wire Piezometer Equipment
   - Pressuremeter Testing Equipment
   - Seismograph Equipment
   - Inclinometer Equipment
   - Nuclear Moisture-Density Gauge
   - Sound Level Meter

5. Hydrogeologic Equipment & Instrumentation
   - Datalogger/Levelogger Hardware & Software
   - Stream Flow Gauge & Equipment

6. Photographic Equipment
   - Video Camera
   - Digital Camera
   - 35mm Camera

7. Communication Equipment
   - Cellular Telephone
   - Satellite Telephone
   - Two-Way Radio

8. Computer Hardware & Software

2.4 Billing Equipment & Materials

Equipment and materials are billed to the project as used on a daily or per item basis. Completion of equipment usage and billing forms and submission of original receipts for items purchased or rented is required in order to charge the project for reimbursement.

3. PROCEDURE

3.1 Preliminary Preparations

3.1.1 Project Briefing

Prior to the beginning of an exploration program all field staff should attend a project briefing with the project manager and office staff involved in the proposed project. At this time a file folder for the field activities should be created for the purpose of containing all relevant project information including: copies of the original proposal, site and utility plans, contract documents and drawings, applicable regulations, exploration and sampling criteria, site contacts, phone numbers of team members, health

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and safety (H&S) plans, log and report forms and any other related documents or references. The field folder should be organized and maintained such that all documents likely to be useful for the completion of field activities by others are readily available in the event of personnel changes.

During the project briefing each team member should become thoroughly familiar with the overall scope of the project in addition to the task items and individual requirements of the work plan. Development of an outline of the specific activities envisioned and a review of the details concerning each task may facilitate the formulation of alternate approaches to field methods as well as the creation of action, materials and equipment lists.

Field staff should review all existing applicable information that relates to site geology and possess detailed familiarity and understanding of the contract specifications in order that knowledgeable field decisions can be made. Field staff should be experienced in all of the various field exploration procedures, instrumentation installation and sampling techniques required for the project. Requests for training, guidance or assistance should be made by the field staff as needed. Haley & Aldrich, Inc. fosters a supportive environment where all staff are encouraged to share knowledge and experiences with each other.

3.1.2 Health & Safety

Safety in the workplace is a prime concern of Haley & Aldrich, Inc. on all projects. It is essential that field personnel understand and comply with all regulations governing worker safety in the field including applicable OSHA guidelines. Certain projects will require the field staff to attend a Health & Safety briefing due to specific occupational safety concerns. The nature of these concerns will be addressed by a site specific Health & Safety Plan. It is the responsibility of the project manager to notify the field staff of the existence of the Health & Safety Plan, however all field staff are encouraged to inquire with the Project Manager and with the Health & Safety Coordinator directly to avoid any possible oversight. Safety awareness and safe work practices are the responsibility of the field staff at all times and on all projects whether or not site or task specific guidelines are in existence. In the event of an accident, exposure or if unexpected contamination is encountered, the Project Manager and the Health & Safety Coordinator must be contacted immediately. Standard H&A safety recommendations for subsurface explorations are provided OP1001 Excavation and Trenching Safety and OP1002 Drilling Safety.

3.2 Duties and Responsibilities

3.2.1 General

The principal reason for providing Haley & Aldrich field representation is to assure that the field data being collected is accurate and of the type necessary to properly evaluate the site geologic conditions for use in the subsequent engineering analyses and environmental assessment.

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3.2.2 Supervision of Subsurface Exploration Programs

Each subsurface exploration program carried out under H&A supervision is designed to accommodate the specific requirements of a given project. Subsurface exploration programs routinely include the excavation of test pits and the drilling of test borings with associated instrumentation installation, special testing and sampling requirements. Modifications to the fieldwork criteria, sampling and testing are often made during the execution of the subsurface exploration program as the accumulated geologic data and test results are interpreted. For this reason it is essential that all records are current and complete and that uncertainties are identified for resolution. Field staff are responsible for maintaining communication with the project manager and logistical coordination of the field effort within the workscope and budgetary limits.

3.2.3 Verification of Subsurface Exploration Techniques and Services

It is the role of H&A field staff to verify that instrumentation installation, subsurface sampling and testing methods are in conformance with applicable approved standards and specifications and to document conditions and results. Performance of sampling and testing is commonly conducted with subcontractor support and equipment. It is the responsibility of the H&A field staff to verify that proper equipment and techniques are employed and to obtain measurements and make observations independently. H&A field staff are responsible for complete field logging of groundwater, soil and bedrock conditions, the maintenance of accurate test records and field exploration location sketches, and ensuring proper instrumentation installation, sample preservation and handling. In addition, payment for services rendered on behalf of the client is commonly handled with H&A providing a daily field report (DFR) including an accurate breakdown of the work activities and itemized costs on a daily basis. Subcontractor pay items and method of payment are defined in their contract.

3.2.4 Right of Access

Prior to site entry, Haley & Aldrich staff members must ensure that permission has been gained from the property owner to access the property.

3.2.5 Layout and Utility Clearance

Prior to the start of any subsurface exploration all proposed locations must have utility clearance from all appropriate agencies and utility owners. Utility owners typically do not enter private properties. If there are particular concerns regarding utilities on private property, arrangements can be made with a private utility locating service. Prior to contacting any utility agency or service all proposed exploration locations must first be clearly marked in the field either with white paint or staked and white flagged. Additional colors can be used to highlight the location if the ground is snow covered. Alternate locations should be laid out in areas of suspected utilities. H&A requires the subsurface exploration subcontractor to obtain the utility clearance within the terms of the contract or services agreement. H&A field staff should verify with the driller/test pit contractor that the utilities have been cleared and obtain the clearance number prior to the start of subsurface explorations. Pre-excavation

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may be necessary in areas of closely spaced utilities either by hand, vacuum, or other means. Additional guidance is provided in OP1003 Utility Clearance.

3.2.6 Site Safety and Subcontractor Briefing

At the start of fieldwork, H&A field staff should coordinate a site briefing to review the schedule and workscope with all subcontractors involved with the project. This briefing should include a review of the equipment and material needs, exploration criteria and priority, testing and sampling specifics, pay items, site conditions, environmental concerns, known or suspected contamination, H&S information, decontamination requirements, site restoration and waste disposal issues, a site walkover and utility check. While it is the subcontractor's responsibility to obtain the utility clearance, the field representative should pay attention to the utility plans as well as surface manifestations of utilities involving manholes or catch basin grates, and gate or roadway boxes. Distance to overhead utilities must be considered as well. Observations of potential conflicts with utilities should be addressed with the subcontractor for their consideration.

3.2.7 Exploration Monitoring

3.2.7.1 General

Haley & Aldrich field staff should become familiar with the technical details and suitability of all exploration equipment and methods. Test borings are the most common method employed by H&A to obtain high quality data on subsurface conditions. Unsampled probes can be used in a limited capacity to document overburden thickness. Specialty equipment is routinely used in sampled probes for environmental sampling. Test pits are preferred for surficial geological mapping and to document fill or overburden thickness. In addition to these typical exploration methods a variety of special testing techniques and instrumentation installations may supplement the subsurface exploration program. Specific H&A procedures must be consulted for details relating to special testing, sampling and instrumentation installation.

3.2.7.2 Exploration Equipment and Use

Exploration equipment selection is based upon a detailed understanding of the capabilities of the equipment with regard to the anticipated site geological conditions. In addition, the particular project needs may necessitate or preclude certain techniques and equipment. During the initial site walkover or layout, equipment access is considered and the type of exploration method is determined. Relatively small drill rigs are routinely used for overburden sampling, bedrock coring and groundwater monitoring well installations on a variety of projects. Larger pneumatic-percussive well rigs are used for drilling aquifer test and production wells. Excavation equipment may be preferred for initial surficial geologic mapping and to provide access prior to drilling. Various probe equipment may be considered for preliminary estimation of overburden thickness. Access to a water supply must be arranged for cased test borings and rock coring. Shallow water conditions and potentially liquefaction-susceptible soils preclude the use of augers. Bedrock monitoring wells must be cored in sufficient diameter to

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allow sand pack and seals. Enclosed areas may necessitate alternate fuels or low overhead equipment. Ecologically sensitive areas may require non-petroleum-based hydraulics or lightweight equipment. Many factors affect the equipment selection resulting in some trade-off in performance, cost and reliability of data.

3.2.7.3 Test Boring Techniques

A. *Cased Borings* - Cased borings are the primary method of obtaining high quality overburden samples and for penetration to bedrock prior to rock coring. The drill casing (pipe) is typically advanced in 5 ft. increments either by driving or spinning and then is washed out with an axially discharging tricone rollerbit pumping water or drill slurry from the recirculation tub. Upon flushing, the rollerbit is removed and a splitspoon sampler is fixed to the drill string (rods), lowered to the bottom of the borehole and driven into the undisturbed soils below the bottom of the casing. The procedure is repeated until the termination depth criterion is reached or bedrock is encountered. Common casing inside diameter (I.D.) ranges from 3 inch to 6 inch depending upon conditions and criteria. Rollerbits are sized to fit inside the casing with approximately 1/16 to 1/8 in. clearance. Typically boreholes are started with 5 or 6 in. I.D. casing fitted with a hard-shoe or drive-shoe in the lead (bottom) section. The casing is driven and splitspoon sampling is conducted at 5 ft. intervals (standard sampling) until an obstruction is encountered or the casing is seated into material such as clay that will maintain itself uncased. In the event of an obstruction the rollerbit or a buttonbit may be used to advance through the obstruction. In some cases the obstruction may break or a boulder-buster may be successfully employed and the casing is advanced. In other cases the next smaller diameter casing will be telescoped down the borehole and advanced through the hole in the obstruction created by the buttonbit. In the event that material such as clay that will maintain itself uncased is encountered, the open hole is extended as deep as possible. The borehole may be maintained by a bentonite or polymer slurry (mud rotary drilling). Casing fitted with a spin-shoe (econoshoe) is advanced by drilling in a similar manner to rollerbit advancement. Slurry or water is pumped down the casing to cool the bit and flush away the drill solids. Prior to splitspoon sampling the rollerbit must be lowered down the borehole and the spun casing must be drilled out in the same fashion as with driven casing. Spun or driven casing must be seated into the top of the bedrock in order to achieve an effective seal prior to rock coring.

B. *Mud Rotary Drilling* - Mud rotary drilling typically is conducted in deeper overburden borings and on projects where there are special concerns for soil sample integrity or particularly soft soils. Various products are used to make drill mud depending upon conditions and project requirements. Some mud is bentonite-silica based (heavy mud), some are compatible with saline conditions for ocean drilling, and some polymers are biodegradable for use in boreholes intended for environmental groundwater monitoring well installation. In all cases, mud drilling requires that a positive head be maintained in the casing at all times to stabilize the borehole. The practice is to fit a bypass line to

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the recirculation circuit that can be easily used to fill the casing as the rollerbit is being withdrawn. Use of a mud balance is required under certain circumstances to ensure sample integrity at the bottom of the borehole. The specific gravity to maintain in the drill mud will be specified on these projects.

C. *Auger Borings* - Hollow stem augers (HSA) are an effective and fast method for drilling shallow borings in softer soils above the water table without introducing water or drill slurry. Hollow stem augers are preferred for environmental studies where continuous soil sampling and minimization of potential cross contamination due to the use of drilling fluids is desired. Hollow stem augers and solid stem augers are also used as shallow probes. Auger flights are typically 5 ft. in length and are commonly 3.5 to 4.25 in. I.D. The lead section is fitted with a cutter head upon which are fixed several hardened, replaceable teeth. Using a center plug fixed to the bottom of the rods, hollow stem augers are typically advanced by drilling to the desired depth whereupon the center plug is replaced by the splitspoon and driven below the bottom of the lead section. Disturbance below the bottom of the augers due to the cutter head is typically substantial and heave is common at the bottom of the borehole due to the piston like effect of the center plug during removal. As such, augers are not favored for test borings on many geotechnical projects where high quality samples and penetration resistance data are required.

D. *Splitspoon Sampling and the Standard Penetration Test (SPT)* - The typical method for obtaining representative samples and a measure of the penetrative resistance of soils in test borings is by means of the Standard Penetration Test (SPT). This is accomplished utilizing a hollow tube splitspoon sampler assembly attached to the drill rods and driven into the soils at the bottom of the borehole at regular intervals. Splitspoon samplers are manufactured in various sizes with the most commonly used being 1 3/8 in. I.D. (2 in. O.D.) and having an interior sample chamber length of 24 in. (approximately 36 in. overall length). Once lowered to the sampling depth, the sampler is typically driven 24 in. into the soils with a 140 lb. hammer freely-falling over a 30 in. drop and the number of blows (SPT blowcount) required for each 6 in. of penetration is recorded. The penetrative resistance in blows per foot obtained from the summation of the blowcounts from 6 in. to 18 in. is referred to as the "N-value". Terminology for density of granular soils and consistency of cohesive soils has been correlated to N-values. When performed properly the SPT provides useful data for determination of the geotechnical behavior of soils and engineering design in addition to representative remolded soil samples for geological interpretation.

E. *Bedrock Coring* - Bedrock coring is conducted in cased borings to obtain accurate detail of the bedrock properties and high quality samples for laboratory testing. A wide variety of rock core equipment is available and rock coring techniques vary greatly depending upon the driller, rock type, equipment and many other factors. Observations related to drilling activities are a primary focus during rock coring including bit weight, feed restriction, head speed, engine speed and gear, pump volume, water loss

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and fluid return, core rate, drilling halts, jamming, rapid advances, equipment defects, bit type, bit wear, core barrel type, core barrel adjustment. For all projects it is essential that accurate measurements be made when determining the depth of the bedrock surface from drill action or SPT and that detailed observations are recorded concerning the effects noted and the procedures executed upon encountering bedrock. Coring should begin at the minimum depth below the bedrock surface required to seat the casing in order to document the bedrock condition in the uppermost zone where typically fracturing and weathering transitions are greatest. Core hole depth must be verified following each run to account for lost core. When necessary, logging should be broken down into a two step process beginning with sample preservation, labeling and recording of a simple description including recovery and RQD measurements followed by detailed logging of individual features and properties as time and conditions permit.

F. *Observation Well Installation* - Groundwater observation or monitoring wells are commonly installed in completed test borings as a means obtaining accurate stabilized groundwater readings essential to engineering design, and hydrogeologic modeling. In addition, permanent observation or monitoring well installations provide for continual long-term sampling for environmental analyses. A wide variety of material types and sizes are employed depending upon the intended use. Typical observation or monitoring wells installations consist of 2 in. I.D. PVC pipe with a machine slotted screen section backfilled with filter sand and sealed with bentonite within the desired stratum or zone. Solid riser sections above the sealed zone may be grouted or backfilled with a variety of materials depending upon the project needs and finished at the ground surface with either a flush-mount roadway box or with a protective casing such as a guard pipe and padlock for undeveloped sites. Careful attention to the placement of screens, backfill and seals is required and accurate depth measurements must be recorded during installation. Initial well development may occur immediately upon completion in order set the sand pack and remove the effects of drill fluids from the formation waters.

3.2.7.4 Probes

A. *Unsampled Probes* - The term probe has historically referred to the advancement of a solid drill bit or rod by various means without sampling in order to estimate potential soft sediment thickness and refusal or obstruction depths. Small diameter rods advanced by hand have been useful in determining minimum peat and organic thickness in wetlands. Mechanical advancement of solid stem augers with conventional drilling equipment and pneumatic-percussive air track drilling are routinely used to supplement or replace test borings in areas of known shallow bedrock. Direct-push methods include simple rod assemblies to sophisticated electro-piezocone mechanisms. The principle advantage to conducting probes is that a great deal of data points can be rapidly obtained to create detailed contours of the desired surface or stratum. Implicit in the conduct of non-instrumented unsampled probes is that variations in drill action

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or rod advance is used to estimate strata changes. Acoustic listening devices placed within a saturated bedrock well near an air track rig will enhance the listener's ability to hear the pneumatic-percussive bit encounter bedrock. Primary among the disadvantages to conducting probes is the uncertainty resulting from relying strictly upon drill action without a hard data sample. Close proximity probes in zones of shallow refusal and repeated probes adjacent to those terminated on suspected obstructions help boost confidence and define aberrations. Secondary among the disadvantages to conducting probes is the inaccuracy inherent in the measurement of an often rapidly moving reference point as the drill advances through obstructions or variable zones into progressively more competent bedrock. Solid stem augers with conventional drilling equipment are slow to progress through dense soils and may be defeated by boulders but can be advanced below the water table without problems. Pneumatic-percussive air track drilling will rapidly advance through dense soils, boulders and bedrock but is inhibited below the groundwater table by borehole collapse and particularly when the air evacuation is suspended as rods are added to the drill string. Depending upon site conditions and termination depth, dozens of probes may be conducted in a single day. As such, horizontal and vertical control should be established at each probe location separate from the probe effort in order to obtain the most use from the rig time and to maximize the accuracy of the data.

B. *Sampled Probes* - Small diameter hand augers, soil plugs and manual soil cores are routinely used for surface soil sampling for rudimentary site reconnaissance, environmental sampling and hydric soils mapping. Direct-push and percussive or vibration driven soil core equipment preferred for shallow environmental sampling ranges in size from small diameter hand held units to vehicle mounted machinery capable of obtaining soil cores within polycarbonate liners 3.6 in. I.D. by 8 ft. length. As with any uncased borehole, additional soil cores may be obtained until the termination depth criterion is reached or sample integrity is compromised due to borehole collapse. Care must be exercised in establishing collapsed or resampled zones when documenting direct-push samples or soil cores.

3.2.7.5 Test Pits

Test pits are an extremely economical and effective way to rapidly characterize shallow subsurface conditions. Test pits are particularly useful for surficial geologic mapping, determining fill thickness and content, contouring shallow bedrock conditions and in determining oversized (cobble and boulder) percentages. Small backhoes with an approximately ¼ cubic yard bucket capacity are capable of excavating test pits up to 12 ft. depth in most materials and can be used with minimal site damage. Larger excavators with an approximately ¾ cubic yard bucket capacity are capable of excavating test pits up to 16 to 20 ft. depth and can be used to construct access for drill rigs on difficult sites. Given sufficient area, excavators can safely enter the excavation and extend the test pit indefinitely. During test pit excavation careful consideration must be given to potential bearing surface disturbance within proposed structures. In addition, care must be taken to minimize other site impacts

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requiring costly restoration including damage to trees, pavement, curbing, landscaping and utilities.

3.2.7.6 Environmental Sampling & Monitoring

Environmental sampling combined with discrete field screening of soil and groundwater for contaminants is routinely conducted during the performance of subsurface explorations. In addition, continuous monitoring of air quality within the work zone or at the project site may be required to address H&S concerns. Potential contaminants and sources may be identified in the initial stage of project planning and prior arrangements made for PPE, monitoring, sampling and laboratory analysis.

To minimize the risk of cross-contamination typical environmental sampling programs work from known or suspected clean areas toward areas of known or suspected contamination. Contamination encountered unexpectedly may present serious exposure risks to field personnel without proper PPE and monitoring instrumentation, particularly if the contamination is gross or unidentified. In the event unexpected contamination is encountered, all fieldwork should be suspended and the area evacuated immediately until the Project Manager and the Health & Safety Coordinator can be contacted so that H&S and sampling guidelines can be developed.

A. *Decontamination Procedures & Waste Management* - Standard equipment decontamination practices may include the establishment of a decontamination area such that decontamination fluids are collected and properly stored for disposal. Typically a location within the site is chosen away from sensitive or occupied zones and a decontamination pad is created within a bermed area using polyethylene sheeting. A high-pressure steam cleaner is used to wash all equipment prior to each exploration and wastewater is pumped into adjacent drums. Splitspoons and hand sampling tools are scrubbed between samples at the exploration location using a detergent (water and alconox) solution rinsed with control (tap) water followed by a solvent (methanol) rinse, wiped with a paper towel and rinsed with deionized water before being allowed to air dry. Hexane may be needed for removal of heavy petroleum, grease and coal tar. Decontamination waste, sample residue and drill cuttings are typically drummed, labeled and staged onsite for proper disposal.

B. *Environmental Soil Sampling* - Environmental soil samples obtained for chemical analyses are collected in surface samples and by using many of the techniques employed in typical subsurface explorations with special attention given to decontamination procedures. Preservation, handling and glassware for environmental soil samples varies considerably depending upon several factors including the type and degree of contamination, the analytical method to be conducted, the analytical laboratory being used and the governing regulations. In addition, the depth and location of samples may be strictly controlled under agency guidelines. Documentation of volatile organic compounds (VOC) in the soil through headspace screening is required in order to provide real-time guidance in the field to direct the sampling.

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Clean 8 oz. jars are partially filled with newly obtained soils and covered with aluminum foil and allowed to stabilized prior to screening with a photoionization detector (PID). The presence of metals in soils is not associated with odors, while coal tar, fuels and solvents are often easily distinguished. Particular attention is given to discoloration or odors noted, however it is company policy to avoid fumes and odors at all times. Soils collected from a discrete zone should be homogenized and a representative portion placed into laboratory glassware and labeled. Analytical samples are kept in a cooler with ice blocks and a Chain of Custody form is maintained until transfer to the analytical laboratory.

C. *Environmental Water Sampling* - Groundwater monitoring (observation) wells must undergo an initial well development following installation and prior to sampling. This is intended optimize well function and to produce formation-derived groundwater samples and valid analytical testing results. Groundwater sampling from existing monitoring wells for chemical analyses involves initially gauging the static groundwater level and the well depth in order to determine the well volume. Waterra® footvalves and tubing, bailers, submersible pumps or peristaltic pumps may be used to purge a minimum of three well volumes in order to minimize well effects. Turbidity, conductivity, resistivity, salinity, dissolved oxygen, oxidation-reduction potential, temperature and pH are recorded periodically after purging and groundwater parameters must be stable prior to sampling. Low-flow groundwater sampling is required for certain analyses to be valid. In such cases, variable speed submersible pumps are used at extremely slow rates to minimize drawdown and turbidity. Sampling of surface waters or open-body water at depth may be done with remote or variable depth, bottle-type samplers. Preservation, handling and glassware for environmental water samples varies considerably depending upon several factors including the type and degree of contamination, the analytical method to be conducted, the analytical laboratory being used and the governing regulations.

4.2.7.7 Special Testing, Sampling and Instrumentation

H&A utilizes a wide variety of well established and state-of-the-art soil, rock and groundwater testing procedures and instrumentation to supplement many subsurface exploration programs. Among the methods and techniques routinely used are fixed-piston tube sampling, vane shear testing, pressuremeter testing, permeability testing, water pressure (packer) testing in rock, inclinometer installation, multiposition borehole extensometers (MPBX) installation and aquifer (pump) testing. Prior to attempting an unfamiliar technique H&A field staff must review all related procedures and consult experienced personnel. Outside support or training that may be necessary to perform new procedures shall be sought with project manager approval. Notes and references obtained should be retained for potential development into new operating procedure.

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APPENDIX A
REFERENCES

A.1 References

- American Society for Testing and Materials, current edition, "Annual Book of ASTM Standards," Vol.04.08, D420-98, "Standard Guide to Site Characterization for Engineering Design and Construction Purposes."
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- American Society for Testing and Materials, current edition, "Annual Book of ASTM Standards," Vol.04.08, D5730-98, "Standard Guide for Site Characteristics for Environmental Purposes with Emphasis on Soil, Rock, the Vadose Zone and Ground Water."

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- American Society for Testing and Materials, current edition, "Annual Book of ASTM Standards," Vol.04.09, D6169-98, "Standard Guide for Selection of Soil and Rock Sampling Devices for Environmental Investigations."

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APPENDIX B
RELATED HALEY & ALDRICH PROCEDURES

- OP1001 Excavation and Trenching Safety
- OP1002 Drilling Safety
- OP1003 Utility Clearance
- OP2001 Identification & Description of Soils in the Field Using Visual-Manual Methods
- OP2002 Identification & Description of Rock in the Field Using Visual-Manual Methods
- OP2003 Surficial Geologic Mapping
- OP2005 Test Borings, Sampling, Standard Penetration Testing (STP) and Borehole Abandonment
- OP2017 Rock Coring
- OP2020 Groundwater Monitoring (Observation) Well Installation, Development and Abandonment
- OP2026 Exploratory Test Pits
- OP2028 Exploratory Probes
- OP2030 Direct Push Borings (Percussion-Vibration Driven Probes)

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APPENDIX C
FORMS AND EXAMPLES

C.1 Forms

All Haley & Aldrich field forms are maintained on the server at K:\techproc\sop\Forms. The following is a list of selected current forms available for use in routine field exploration programs:

Site Investigations

- Form 2024 Site Investigation Form

Test Borings

- Form 2004 Subcontractor Quantities For Test Borings
- Form 2029 Sampling Labels - Geotechnical
- Form 2003 Test Boring Daily Field Report
- Form 2001 Test Boring Reports
- Form 2002 Core Boring Reports
- Form 2028 Geotechnical Sample Receiving Form

Observation (Monitoring) Wells

- Form 2007 Observation Well Installation Form
- Form 2013 Well Decommissioning Report
- Form 3006 Monitoring Well Development Report
- Form 2021 Groundwater Monitoring Report

Test Pits

- Form 2006 Test Pit Logs
- Form 2028 Geotechnical Sample Receiving Form

Test Probes

- Form 2022 Test Probe Report
- Form 2023 Test Probe Summary
- Form 2025 Vibracore Report

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Environmental Sampling

- Form 1010 Headspace Screening Report
- Form 3001 Sampling Labels – Environmental
- Form 3002 Chain of Custody Electronic
- Form 3003 Chain of Custody Field
- Form 3004 Sampling Record
- Form 3005 Groundwater Sampling Record

C.2 Examples

The following examples of selected completed forms are intended to provide guidance in the standard documentation conventions practiced by H&A.

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SITE INVESTIGATION FORM

PROJECT _____ H&A FILE NO. _____
LOCATION _____ PROJECT MGR. _____
CLIENT _____ FIELD REP _____
CONTRACTOR _____ DATE _____

SITE ACCESS
☐ Paved ☐ Gravel ☐ Trails ☐ None ☐ Water ☐ Inside ☐ Other _____

ENTRANCE
☐ Enclosed ☐ Gate/Keys Comments: _____

EXPLORATION EQUIPMENT
☐ Truck Rig ☐ ATV Rig ☐ Skid Rig ☐ Tripod ☐ Geoprobe ☐ Other _____
☐ Backhoe ☐ Bobcat ☐ Excavator ☐ Sm Excavator ☐ Barge ☐ Other _____
☐ Chainsaw ☐ Haybales ☐ Plywood ☐ 4WD Vehicle ☐ Other _____

WATER SUPPLY AVAILABLE
☐ Hydrant ☐ Tap ☐ River/Lake ☐ None

ELECTRIC AVAILABLE:
☐ Yes ☐ No

TOPOGRAPHY
☐ Low Lying ☐ Level ☐ Sloping ☐ Cliffs ☐ Mountains ☐ Other _____

PHYSIOGRAPHY
☐ Bedrock ☐ Till Upland ☐ Valley Floor ☐ Flood Plain ☐ Coastal Plain ☐ Other _____
☐ Wetlands ☐ Tidal Marsh ☐ Estuarine ☐ Lakes/Ponds ☐ Outwash Plain ☐ Other _____
☐ Developed ☐ Filled Land ☐ Paved ☐ Landscaped ☐ Other _____

DRAINAGE
☐ Rivers ☐ Streams ☐ Rills ☐ Canals ☐ Ditches ☐ Culverts ☐ Other _____

ESTIMATED GROUNDSURFACE ELEVATION: _____ ft

ESTIMATED GROUNDWATER DEPTH/ELEVATION: _____ ft

WOODED
☐ Heavily ☐ Partially ☐ Sparsely ☐ Comments: _____

VEGETATION
☐ Brush ☐ Grass ☐ None ☐ Comments: _____

BEDROCK OUTCROPS
LOCATION: _____
TYPE: _____

SOIL EXPOSURES
LOCATION: _____
TYPE: _____

EXISTING STRUCTURES
☐ Buildings ☐ Warehouse ☐ Slabs ☐ Bridges ☐ Foundations ☐ Other _____

UNDERGROUND STORAGE TANKS
☐ Yes ☐ No

VISIBLE EVIDENCE OF CONTAMINATION
☐ Drums ☐ Staining ☐ Site history ☐ Unauthorized dumping ☐ Other _____

OVERHEAD UTILITIES
LOCATION: _____
TYPE: _____

UNDERGROUND UTILITIES
LOCATION: _____
TYPE: _____

COMMENTS: _____

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SITE INVESTIGATION FORM

PROJECT		H&A FILE NO.	
LOCATION		PROJECT MGR.	
CLIENT		FIELD REP	
CONTRACTOR		DATE	

SITE SKETCH

North Arrow

OVERALL DESCRIPTION AND REMARKS:	LEGEND
	Scale: 0

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SUBCONTRACTOR QUANTITIES FOR TEST BORINGS

Form #2005

Project	File No.
Location	Date
Contractor	Project Manager

No.	Description	Unit	Quantity
I	**MOBILIZATION/DEMOBILIZATION**		
1	Mob/Demob of Truck rig w/ OSHA-trained crew within 100 miles of contractor yard*	ea	
2	Mob/Demob of Skid rig with OSHA-trained crew within 100 miles of contractor yard*	ea	
3	Mob/Demob of Bomb/ATV rig with OSHA-trained crew within 100 miles of contractor yard*	ea	
4	Mob/Demob of Geoprobe rig w/ OSHA-trained crew within 100 miles of contractor yard*	ea	
II	**DRILLING - FOOTAGE RATE**		
5	3-in. dia. cased overburden drilling (0-100 ft.) with no sampling	lf	
6	cased overburden drilling (0-100 ft.) with standard 5-ft. interval sampling	lf	
7	cased overburden drilling (0-100 ft.) continuous sampling	lf	
8	4-in. dia. cased overburden drilling (0-100 ft.) with no sampling	lf	
9	cased overburden drilling (0-100 ft.) with standard 5-ft. interval sampling	lf	
10	cased overburden drilling (0-100 ft.) continuous sampling	lf	
11	4-¼ in. dia. hollow stem auger overburden drilling (0-100 ft.) with no sampling	lf	
12	hollow stem auger overburden drilling (0-100 ft.) w/ standard 5-ft. interval sampling	lf	
13	hollow stem auger overburden drilling (0-100 ft.) continuous sampling	lf	
14	NX rock core via double-tube core barrel (includes bit wear)	lf	
15	HX rock core via double-tube core barrel (includes bit wear)	lf	
16	Extra split spoon samples (for footage rates only)	ea	
17	3-in. undisturbed tube samples	ea	
18	Standby Time for rig and crew/Decon of equipment	hr	
III	**DRILLING - DAY RATE**		
19	Truck mounted drill rig with OSHA-trained crew	day	
20	Truck mounted drill rig with OSHA-trained crew (overtime rate)	hr	
21	Skid rig with OSHA-trained crew	day	
22	Skid rig with OSHA-trained crew (overtime rate)	hr	
23	Bomb/ATV drill rig with OSHA-trained crew	day	
24	Bomb/ATV drill rig with OSHA-trained crew (overtime rate)	hr	
25	Geoprobe rig with OSHA-trained crew	day	
26	Geoprobe rig with OSHA-trained crew (overtime rate)	hr	
27	NX rock core via double-tube core barrel (includes bit wear for day rates)	lf	
28	HX rock core via double-tube core barrel (includes bit wear for day rates)	lf	
29	Geoprobe push samples liners (4' section)	ea	
IV	**OBSERVATION WELL INSTALLATION**		
30	1-in. dia. piezometer (Sch 40 PVC) installed	lf	
31	2-in. dia. well (Sch 40 PVC) installed (slotted and screened)	lf	
32	4-in. dia. well (Sch 40 PVC) installed (slotted and screened)	lf	
33	Standard 4-in. dia. roadway box	ea	
34	Standard 8-in. dia. roadway box	ea	
35	5 ft. protective guard pipe with padlock (4-in. diameter)	ea	
V	**ADDITIONAL ITEMS**		
36	Utility Clearance	ea	
37	Permits - Determined on a job to job basis	ls	
38	State Police Detail	hr	
39	Laborer	hr	
40	Chain Saw	day	
41	Steam Cleaner with Generator	day	
42	Upgrade Crew Personnel Protection to Level "C"	hr	
43	55 gal. soil/water drum	ea	
44	Borehole Grouting (4-in. diameter)	lf	
45	Sand	bag	
46	Concrete	bag	
47	Cold Patch	bag	
48			
49			
VI	COMMENTS		

Driller Signature _____ **Date** _____

Geologist Signature _____ **Date** _____

WHITE - FIELD SERVICE MANAGER CANARY - CONTRACTOR PINK - PROJECT MANAGER

Form 2004

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Haley & Aldrich, Inc.
465 Medford St., Suite 2200
Boston, MA 02129
Tel: 617-886-7400

Boring ID:	File Number:
Sample Interval:	Project:
Depth:	PM:
Recovery:	Blow Counts:
Collected By:	/ / /
Comments:	

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Haley & Aldrich, Inc.
465 Medford St., Suite 2200
Boston, MA 02129
Tel: 617-886-7400

Boring ID:	File Number:
Sample Interval:	Project:
Depth:	PM:
Recovery:	Blow Counts:
Collected By:	/ / /
Comments:	

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Boston, MA 02129
Tel: 617-886-7400

Boring ID:	File Number:
Sample Interval:	Project:
Depth:	PM:
Recovery:	Blow Counts:
Collected By:	/ / /
Comments:	

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Boston, MA 02129
Tel: 617-886-7400

Boring ID:	File Number:
Sample Interval:	Project:
Depth:	PM:
Recovery:	Blow Counts:
Collected By:	/ / /
Comments:	

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Boring ID:	File Number:
Sample Interval:	Project:
Depth:	PM:
Recovery:	Blow Counts:
Collected By:	/ / /
Comments:	

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Boston, MA 02129
Tel: 617-886-7400

Boring ID:	File Number:
Sample Interval:	Project:
Depth:	PM:
Recovery:	Blow Counts:
Collected By:	/ / /
Comments:	

HALEY & ALDRICH

Haley & Aldrich, Inc.
465 Medford St., Suite 2200
Boston, MA 02129
Tel: 617-886-7400

Boring ID:	File Number:
Sample Interval:	Project:
Depth:	PM:
Recovery:	Blow Counts:
Collected By:	/ / /
Comments:	

HALEY & ALDRICH

Haley & Aldrich, Inc.
465 Medford St., Suite 2200
Boston, MA 02129
Tel: 617-886-7400

Boring ID:	File Number:
Sample Interval:	Project:
Depth:	PM:
Recovery:	Blow Counts:
Collected By:	/ / /
Comments:	

HALEY & ALDRICH

Haley & Aldrich, Inc.
465 Medford St., Suite 2200
Boston, MA 02129
Tel: 617-886-7400

Boring ID:	File Number:
Sample Interval:	Project:
Depth:	PM:
Recovery:	Blow Counts:
Collected By:	/ / /
Comments:	

HALEY & ALDRICH

Haley & Aldrich, Inc.
465 Medford St., Suite 2200
Boston, MA 02129
Tel: 617-886-7400

Boring ID:	File Number:
Sample Interval:	Project:
Depth:	PM:
Recovery:	Blow Counts:
Collected By:	/ / /
Comments:	

Form 2029

HALEY & ALDRICH

TEST BORING DAILY REPORT

PROJECT		H&A FILE NO.	
LOCATION		PROJECT MANAGER	
CLIENT		FIELD REPRESENTATIVE	
CONTRACTOR		DATE	
DRILLER		DFR NUMBER	
TYPE OF RIG(S)		NUMBER OF RIGS	

SUBCONTRACTOR'S TIME ON SITE

Rig Type	Arrived	Left Site	Lunch/Other	Downtime	Standby Time	Total Billable Hours

HALEY & ALDRICH'S TIME ON SITE

Field Representive(s)	Arrived	Left Site	Lunch/Other	Paperwork	Travel Time	Total Billable Hours

WORK PRODUCTION TO DATE

Boring No.	Type of Drilling	Over Burden (lf)	Rock Core (lf)	Obstr. Drilling	Total Footage (lf)	Tubes Samples	Extra Split Spoons*	Misc. (Wells etc.)	Materials Encountered (Type and Depth Range)

STATUS OF TOTAL PRODUCTION

Unsampled	Continuos	Standard	Inside Dia.	Boring Footages: Item	Today	Total to Date	Estimate	% Complete	Additional pay Items	Today	Total to Date
									Observation Wells I.D. (ft)		
									Roadway Boxes (ea)		
				H.S.A.					Guard Pipes (ea)		
				Casing					Steamer and Generator (day)		
				Casing					Grout (lf)		
				Casing					Undisturbed Tube Samples (ea)		
				Uncased					Extra Split Spoons (ea)*		
				Rock Core					55 Gallon Drums (ea)		
				Geoprobe					Police Details (hr)		
									Stand by Time (hr)		

No. of Borings Completed	Remaining	Rig-Days to Date	Remaining

SYMBOLS

B 2-1/2 inch Standard	A 4 inch Hollow Stem Auger	Z Probes of Soundings	T 2 inch Shelby Tube	Y Pressure Test
N 3 inch Standard	W Water Borings	C Rock Core	V Vane Shear Test	S Observation Well
H 4 inch Standard	X Continuous Sampling	U 3 inch Piston Tube	P Permeability Test	

* Extra split spoon samples are for footage contracts only.

HALEY & ALDRICH

TEST BORING DAILY REPORT

REMARKS

HALEY & ALDRICH

TEST BORING REPORT

BORING NO.

Page 1 of

PROJECT		H&A FILE NO.	
LOCATION		PROJECT MGR.	
CLIENT		FIELD REP.	
CONTRACTOR		DATE STARTED	
DRILLER		DATE FINISHED	

Elevation	ft.	Datum	Boring Location

Item	Casing	Sampler	Core Barrel
Type			
Inside Diameter (in.)			
Hammer Weight (lb.)			
Hammer Fall (in.)			

Rig Make & Model: ☐ Truck ☐ ATV ☐ Track ☐ Skid ☐ Tripod ☐ Geoprobe ☐ Air Track ☐ Cat-Head ☐ Winch ☐ Roller Bit ☐ Cutting Head

Hammer Type: ☐ Safety ☐ Doughnut ☐ Automatic

Drilling Mud: ☐ Bentonite ☐ Polymer ☐ None

Casing Advance: Type Method Depth

Drilling Notes:

Depth (ft.)	Sampler Blows per 6 in.	Sample No. & Recovery (in.)	Sample Depth (ft.)	Well Diagram	Stratum Change (ft.)	USCS Symbol	Visual-Manual Identification & Description (density/consistency, color, GROUP NAME & SYMBOL, maximum particle size*, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0																	

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth in feet to: Bottom of Casing	Bottom of Hole	Water

Sample ID	
O	Open End Rod
T	Thin Wall Tube
U	Undisturbed Sample
S	Split Spoon Sample
G	Geoprobe

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

Summary

Overburden (Linear ft.)
Rock Cored (Linear ft.)
Number of Samples

BORING NO.

Field Tests — Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Meduim H - High V - Very High

*NOTE: Maximum Particle Size is determined by direct observation within the limitations of sampler size.

NOTE: Soil Identifications based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

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HALEY & ALDRICH

TEST BORING REPORT

BORING NO.

Page of

Depth (ft.)	Sampler Blows per 6 in.	Sample No. & Recovery (in.)	Sample Depth (ft.)	Well Diagram	Stratum Change (ft.)	USCS Symbol	Visual-Manual Identification & Description (density/consistency, color, GROUP NAME & SYMBOL, maximum particle size*, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel		Sand			Fines	Field Test			
								% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength

NOTES:

FILE NO.

BORING NO.

*NOTE: Maximum Particle Size is determined by direct observation within the limitations of sampler size.

NOTE: Soil identifications based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

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HALEY & ALDRICH

CORE BORING REPORT

BORING NO.

Page 1 of

PROJECT		H&A FILE NO.	
LOCATION		PROJECT MGR.	
CLIENT		FIELD REP.	
CONTRACTOR		DATE STARTED	
DRILLER		DATE FINISHED	

Elevation ft Datum Boring Location

Item	Casing	Sampler	Core Barrel
Type			
Inside Diameter (in			
Hammer Weight (lb			
Hammer Fall (in)			

Rig Make & Model

- ☐ Truck
- ☐ ATV
- ☐ Track
- ☐ Skid
- ☐ Tripod
- ☐ Geoprobe
- ☐ Air Track
- ☐ _____
- ☐ Cat-Head
- ☐ Winch
- ☐ Roller Bit
- ☐ Cutting Head

Hammer Type

- ☐ Safety
- ☐ Doughnut

Casing ☐ Driven ☐ Spun

Drill Mud

- ☐ Bentonite
- ☐ Polymer
- ☐ None

Depth (ft)	Drilling Rate (min/ft)	Core No. Depth (ft)	Recovery RQD (in)	Recovery RQD (%)	Weath-ering	Well Diagram	Stratum Change (ft)	Visual Classification and Remarks

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth in feet to: Bottom of Casing	Bottom of Hole	Water

Sample ID

- O Open End Rod
- T Thin Wall Tube
- U Undisturbed Sample
- S Split Spoon Sample
- G Geoprobe

Well Diagram

- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (Linear ft.)	
Rock Cored (Linear ft.)	
Number of Samples	

BORING NO.

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HALEY & ALDRICH

CORE BORING REPORT

BORING NO.

Page of

Depth (ft)	Drilling Rate (min/ft)	Core No. Depth (ft)	Recovery RQD (in)	Recovery RQD (%)	Weath-ering	Well Diagram	Stratum Change (ft)	Visual Classification and Remarks

FILE NO.

BORING NO.

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HALEY & ALDRICH

GEOTECHNICAL SAMPLE RECEIVING REPORT

Page of

PROJECT _____ H&A FILE NO. _____
LOCATION _____ PROJECT MGR. _____
CLIENT _____ PROJECT ENGR. _____
DELIVERED BY _____ DATE _____

TYPE OF SAMPLE

SOIL:
Jar Samples _____ box(es)
Undisturbed Tube Samples:
Outside Diameter: ☐ 3-in. ☐ 2-in. _____ tube(s)
*** Bag Samples _____ bag(s)
*** 5-gal. Bucket Samples _____ bucket(s)

ROCK CORE:
Boxes: _____ box(es)
Other: _____ sample(s)

OTHER: _____

HAZARDOUS MATERIALS? ☐ Yes ☐ No
CONTAMINANTS (please list major contaminants)

If geology/pre-construction project, fill out Section A - If Con-Mon project, fill out Section B.

A:

Box No.	Exploration No.	Sample No.(s) From - To	Depth From - To	Remarks {if multiple types of samples, list type, (e.g., jars, tube, bag, rock)}

B:

Explor. No.	Sample No.	Depth Range (ft)	Sample Description (USCS or geologic unit)	Sample Source (on-site, Contractor Pit, etc.)	Proposed Use (see below)

For "Proposed Use" try to use the term from the specifications (e.g., structural fill, common fill, dense graded, State Highway Spec. No., etc.)

Notes: _____

*** ANY BAG/BUCKET SAMPLE WHICH HAS NOT HAD TESTING ASSIGNED AFTER 3 WEEKS OF RECEIVING WILL BE AUTOMATICALLY DISPOSED OF UNLESS THE LABORATORY MANAGER IS GIVEN PRIOR WRITTEN NOTIFICATION OF THE NEED TO RETAIN THE SAMPLE.

To be completed by lab personnel:

Sample received by: _____ Boxes Labeled? ☐ Yes ☐ No

STORAGE LOCATION:

☐ Geotechnical Laboratory ☐ Storage Room / Shelf Location: _____
☐ Humid Room ☐ Other: _____

Form 2028

HALEY & ALDRICH

GEOTECHNICAL SAMPLE RECEIVING REPORT

PROJECT	MAXIM OFFICE PARK	H&A FILE NO.	11111-030
LOCATION	BOSTON, MASSACHUSETTS	PROJECT MGR.	S. KRAEMER
CLIENT	BOSTON ARCHITECTS, INC.	PROJECT ENGR.	M. LALLY
DELIVERED BY	JOE SAND	DATE	03/14/02

TYPE OF SAMPLE

SOIL:

Jar Samples 2 box(es)

Undisturbed Tube Samples:
Outside Diameter: ☐ 3-in. ☐ 2-in. 2 tube(s)

*** Bag Samples 3 bag(s)

*** 5-gal. Bucket Samples ____ bucket(s)

ROCK CORE:

Boxes: 2 box(es)

Other: ____ sample(s)

OTHER: ____

HAZARDOUS MATERIALS? ☐ Yes ☑ No

CONTAMINANTS (please list major contaminants)

If geology/pre-construction project, fill out Section A - If Con-Mon project, fill out Section B.

A:

Box No.	Exploration No.	Sample No.(s) From - To	Depth From - To	Remarks (if multiple types of samples, list type, (e.g., jars, tube, bag, rock))
1	B-01	S01 - S19	-	jars
1	B-02	S01 - S04	-	jars
2	B-02	S05 - S14	-	jars
-	B-01	U1	58.0 - 60.0	tube R=24
-	B-02	U1	68.0 - 70.	tube R=22
1	B-01	C01 - C03	-	rock core
-	TP-01	B01	5.0 - 9.0	ziplock bag

B:

Explor. No.	Sample No.	Depth Range (ft)	Sample Description (USCS or geologic unit)	Sample Source (on-site, Contractor Pit, etc.)	Proposed Use (see below)
TP-04	B01	8.5 - 10.7	Glacial Till	on-site	Common Fill
-	S12	n/a	Brown silty sand	Joe's Borrow Pit, Stoughton, MA	Structural Fill

For "Proposed Use" try to use the term from the specifications (e.g., structural fill, common fill, dense graded, State Highway Spec. No., etc.)

Notes: ____

*** ANY BAG/BUCKET SAMPLE WHICH HAS NOT HAD TESTING ASSIGNED AFTER 3 WEEKS OF RECEIVING WILL BE AUTOMATICALLY DISPOSED OF UNLESS THE LABORATORY MANAGER IS GIVEN PRIOR WRITTEN NOTIFICATION OF THE NEED TO RETAIN THE SAMPLE.

To be completed by lab personnel:

Sample received by: ____ Boxes Labeled? ☐ Yes ☐ No

STORAGE LOCATION:

☐ Geotechnical Laboratory ☐ Storage Room / Shelf Location: ____

☐ Humid Room ☐ Other: ____

HALEY & ALDRICH

OBSERVATION WELL INSTALLATION REPORT

Well No.

Boring No.

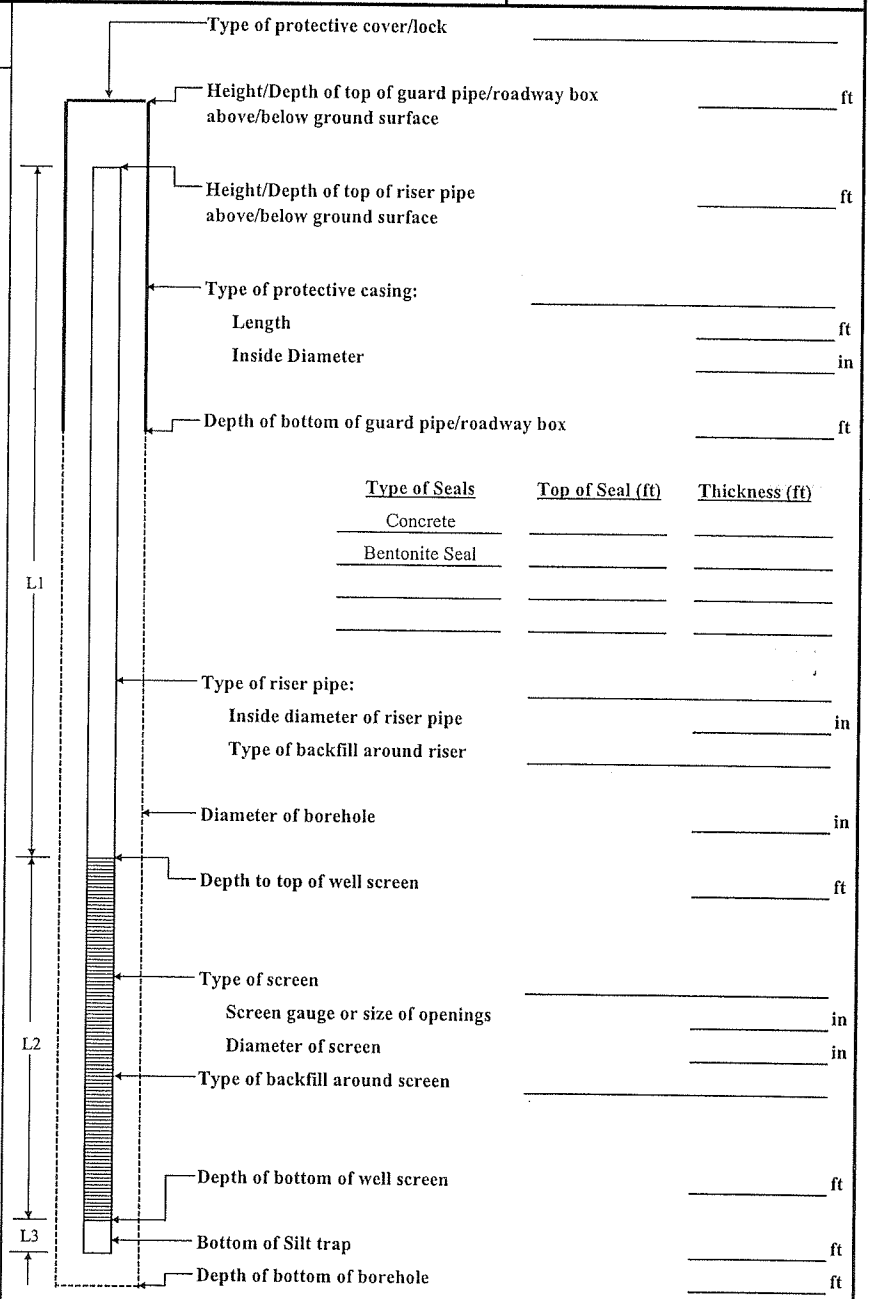
PROJECT		H&A FILE NO.	
LOCATION		PROJECT MGR.	
CLIENT		FIELD REP.	
CONTRACTOR		DATE INSTALLED	
DRILLER		WATER LEVEL	

Ground El. _____ ft
El. Datum _____

Location _____

☐ Guard Pipe
☐ Roadway Box

SOIL/ROCK CONDITIONS	BOREHOLE BACKFILL



Type of protective cover/lock _____

Height/Depth of top of guard pipe/roadway box above/below ground surface _____ ft

Height/Depth of top of riser pipe above/below ground surface _____ ft

Type of protective casing: _____
Length _____ ft
Inside Diameter _____ in

Depth of bottom of guard pipe/roadway box _____ ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Concrete		
Bentonite Seal		

Type of riser pipe: _____
Inside diameter of riser pipe _____ in
Type of backfill around riser _____

Diameter of borehole _____ in

Depth to top of well screen _____ ft

Type of screen _____
Screen gauge or size of openings _____ in
Diameter of screen _____ in
Type of backfill around screen _____

Depth of bottom of well screen _____ ft

Bottom of Silt trap _____ ft

Depth of bottom of borehole _____ ft

(Bottom of Exploration)
(Numbers refer to depth from ground surface in feet)

(Not to Scale)

_____ ft + _____ ft + _____ ft = _____ ft
Riser Pay Length (L1) | Length of screen (L2) | Length of silt trap (L3) | Pay length

COMMENTS: _____

Form 2007

HALEY & ALDRICH

MONITORING WELL DEVELOPMENT REPORT

Well No.

PROJECT		H&A FILE NO.	
LOCATION		PROJECT MGR.	
CLIENT		FIELD REP.	
CONTRACTOR		DATE	
ELEVATION SUBTRAHEND			

Estimated Volume of Water Lost During Drilling: _____ gallons

Comments: _____

Depth to Water Before Development: _____ feet

Comments: _____

Depth to Well Bottom Before Development: _____ feet

Comments: _____

Turubitiy of Water Before Development: _____ NTU

Comments: _____

Volume of Water Removed: _____ gallons

Comments: _____

Method of Removal (bailing, pumping): _____

Comments: _____

Depth to Well Bottom After Development: _____ feet

Comments: _____

Depth to Water After Development: _____ feet

Comments: _____

Turubitiy of Water After Development: _____ NTU

Comments: _____

HALEY & ALDRICH

GROUNDWATER MONITORING REPORT

OW/PZ NUMBER

Page of

PROJECT

LOCATION

CLIENT

CONTRACTOR

ELEVATION SUBTRAHEND

H&A FILE NO.

PROJECT MGR.

FIELD REP.

DATE

Date	Time	Elapsed Time (days)	Depth of Water from Ground Surface	Elevation of Water	Remarks	Read By

Form 2021

HALEY & ALDRICH

TEST PIT LOG

Test Pit No.

Page 1 of

PROJECT		H&A FILE NO.	
LOCATION		PROJECT MGR.	
CLIENT		FIELD REP	
CONTRACTOR		DATE	
EQUIPMENT		WEATHER	

Ground El. _____ ft.
El. Datum _____

Location _____

Groundwater depths/entry rates (in./min.):

Depth (ft.)	Sample ID	Stratum Change Depth (ft.)	USCS Symbol	Visual Identification (Color, GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength

Obstructions:

Remarks:

Field Tests

Dilatancy:	R - Rapid S - Slow N- None
Toughness:	L - Low M - Medium H - High
Plasticity:	N - Nonplastic L - Low M - Medium H - High
Dry Strength:	N - None L - Low M - Medium H - High V - Very High

Standing water in completed pit:
at depth _____ ft.
measured after _____ hrs. elapsed

Boulders:

Diameter (in.)	Number		Approx. vol. (cu. ft.)
12 to 24		=	
over 24		=	

Test Pit Dimensions (ft.):
Pit Depth _____
Pit Length X Width _____

NOTE: Soil identifications based on visual/manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

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Form 2006 USCS Geo.

HALEY & ALDRICH

ENVIRONMENTAL TEST PIT LOG

Test Pit No.

Page of

PROJECT
LOCATION
CLIENT
CONTRACTOR
EQUIPMENT

H&A FILE NO.
PROJECT MGR.
FIELD REP
DATE
WEATHER

Ground El. ft.
El. Datum

Location

Groundwater depths/entry rates (in./min.):

Depth (ft.)	Sample ID	PID Reading (ppm.)	Stratum Change Depth (ft.)	USCS Symbol	Visual Identification (Color, GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength

Obstructions:

Remarks:

Bucket Decontamination Method:

Field Tests

Dilatancy: R - Rapid S - Slow N- None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

Standing water in completed pit:

at depth ft.
measured after hrs. elapsed

Boulders:

Diameter (in.)	Number		Approx. vol. (cu. ft.)
12 to 24		=	
over 24		=	

Test Pit Dimensions (ft.):

Pit Depth
Pit Length X Width

NOTE: Soil Identifications based on visual/manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

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Form 2006 USCS Env.

HALEY & ALDRICH

TEST PROBE REPORT

PROBE NO.

PROJECT		H&A FILE NO.	
LOCATION		PROJECT MGR.	
CLIENT		FIELD REP	
CONTRACTOR		DATE	
EQUIPMENT		DRILLER	

Rig Type:	TOP OF ROCK BASED ON:		Datum
Diameter of Hole:	☐ Rate of Penetration	☐ Acoustic Device	Ground El.
Drill Bit type:	☐ Driller's Opinion	☐ Other	Water El.
Drill Bit O.D.:	DEPTH TO TOP OF SOUND ROCK		Location:

Scale In Feet	Cutting Description and Remarks

Form 2022

HALEY & ALDRICH

TEST PROBE SUMMARY

Page of

PROJECT
LOCATION
CLIENT
CONTRACTOR
EQUIPMENT

H&A FILE NO.
PROJECT MGR.
FIELD REP
DATE
DRILLER

Probe Type

Probe No.	Location	Ground Surface Elevation	Depth to Water (ft)	Depth Probed		Soil Strata Description	Remarks
				From (ft)	To (ft)		

Form 2023

HALEY & ALDRICH

VIBRACORE REPORT

Probe No.

PROJECT		H&A FILE NO.	
LOCATION		PROJECT MGR.	
CLIENT		GEOLOGIST	
CONTRACTOR		DATE	
EQUIPMENT		CHECKED BY	

Depth (ft)	Sketch	Visual Description
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Recovery

Section	Tube Length	Sample Length	Total Weight

Top:

Bottom:

Notes:

Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

Remarks:

HALEY & ALDRICH

HEADSPACE SCREENING REPORT

PROJECT _____ H&A FILE NO. _____
LOCATION _____ PROJECT MGR. _____
CLIENT _____ FIELD REP _____
INSTRUMENT _____ DATE SAMPLED _____
DATE CALIBRATED (1) _____ LAMP (eV) _____ DATE SCREENED _____
AMBIENT TEMPERATURE _____ CALIBRATED BY _____ SCREENING LOC. _____

Exploration	Sample Number	Depth (ft)	Sample Description	Sample Reading (ppm)(2)	Back-Ground Reading (ppm)(2)	Remarks	GC(3)	Containers			
								Drill Jar			

1. Instrument calibrated to the manufacturer standard.
2. ppm represents concentration of detectable volatile gaseous compounds in parts per million of air.
3. Sample assigned for gas chromatograph screening.

Sampled and relinquished by:	Received by:	Relinquished by:	Received by:
Sign:	Sign:	Sign:	Sign:
Print:	Print:	Print:	Print:
Firm:	Firm:	Firm:	Firm:
Date: Time:	Date: Time:	Date: Time:	Date: Time:

HALEY & ALDRICH

Haley & Aldrich, Inc.
465 Medford St., Suite 2200
Boston, MA 02129
Tel: 617-886-7400

Sample ID:	File Number:
Depth:	Project:
Date:	Analysis:
Time:	Preservative:
Collected By:	Laboratory:
Comments:	

HALEY & ALDRICH

Haley & Aldrich, Inc.
465 Medford St., Suite 2200
Boston, MA 02129
Tel: 617-886-7400

Sample ID:	File Number:
Depth:	Project:
Date:	Analysis:
Time:	Preservative:
Collected By:	Laboratory:
Comments:	

HALEY & ALDRICH

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465 Medford St., Suite 2200
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Depth:	Project:
Date:	Analysis:
Time:	Preservative:
Collected By:	Laboratory:
Comments:	

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Date:	Analysis:
Time:	Preservative:
Collected By:	Laboratory:
Comments:	

HALEY & ALDRICH

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Depth:	Project:
Date:	Analysis:
Time:	Preservative:
Collected By:	Laboratory:
Comments:	

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465 Medford St., Suite 2200
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Depth:	Project:
Date:	Analysis:
Time:	Preservative:
Collected By:	Laboratory:
Comments:	

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465 Medford St., Suite 2200
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Tel: 617-886-7400

Sample ID:	File Number:
Depth:	Project:
Date:	Analysis:
Time:	Preservative:
Collected By:	Laboratory:
Comments:	

HALEY & ALDRICH

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465 Medford St., Suite 2200
Boston, MA 02129
Tel: 617-886-7400

Sample ID:	File Number:
Depth:	Project:
Date:	Analysis:
Time:	Preservative:
Collected By:	Laboratory:
Comments:	

HALEY & ALDRICH

Haley & Aldrich, Inc.
465 Medford St., Suite 2200
Boston, MA 02129
Tel: 617-886-7400

Sample ID:	File Number:
Depth:	Project:
Date:	Analysis:
Time:	Preservative:
Collected By:	Laboratory:
Comments:	

HALEY & ALDRICH

Haley & Aldrich, Inc.
465 Medford St., Suite 2200
Boston, MA 02129
Tel: 617-886-7400

Sample ID:	File Number:
Depth:	Project:
Date:	Analysis:
Time:	Preservative:
Collected By:	Laboratory:
Comments:	

Form 3001

HALEY & ALDRICH
Haley & Aldrich, Inc.
465 Medford St.,
Suite 2200,
Boston, MA 02129-1400

CHAIN OF CUSTODY RECORD

Phone (617) 886-7400
Fax (617) 886-7700

Page of

H&A FILE NO.
PROJECT NAME
H&A CONTACT

LABORATORY
ADDRESS
PROJECT MANAGER

DELIVERY DATE
TURNAROUND TIMI
DELIVERY DATE

Sample No.	Date	Time	Depth	Type	Container Size	No. of Containers	Analysis Requested	Preservatives	Comments - (special instructions, precautions, additional method numbers, etc.)

Sampled and Relinquished by	Received by
Sign	Sign
Print	Print
Firm	Firm
Date Time	Date Time
Relinquished by	**Received by**
Sign	Sign
Print	Print
Firm	Firm
Date Time	Date Time
Relinquished by	**Received by**
Sign	Sign
Print	Print
Firm	Firm
Date Time	Date Time

PRESERVATION KEY	Sampling Comments
A Sample chilled	
B Sample filtered	
C NaOH	
D HNO_3	
E H_2SO_4	
F HCL	
G Methanol	
H Sodium Bisulfate	
I	

Evidence samples were tamperd with? YES NO

If YES, please explain in section below.

WHITE - Laboratory CANARY - Project Manager PINK - Haley & Aldrich Laboratory GOLDENROD - Haley & Aldrich Contact

Form 3002

HALEY & ALDRICH

Haley & Aldrich, Inc.
465 Medford St., Suite 2200
Boston, MA 02129
Tel: 617-886-7400

Sample ID:	File Number:
Depth:	Project:
Date:	Analysis:
Time:	Preservative:
Collected By:	Laboratory:
Comments:	

HALEY & ALDRICH

Haley & Aldrich, Inc.
465 Medford St., Suite 2200
Boston, MA 02129
Tel: 617-886-7400

Sample ID:	File Number:
Depth:	Project:
Date:	Analysis:
Time:	Preservative:
Collected By:	Laboratory:
Comments:	

HALEY & ALDRICH

Haley & Aldrich, Inc.
465 Medford St., Suite 2200
Boston, MA 02129
Tel: 617-886-7400

Sample ID:	File Number:
Depth:	Project:
Date:	Analysis:
Time:	Preservative:
Collected By:	Laboratory:
Comments:	

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Time:	Preservative:
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Comments:	

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Sample ID:	File Number:
Depth:	Project:
Date:	Analysis:
Time:	Preservative:
Collected By:	Laboratory:
Comments:	

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Sample ID:	File Number:
Depth:	Project:
Date:	Analysis:
Time:	Preservative:
Collected By:	Laboratory:
Comments:	

Form 3002

HALEY & ALDRICH
Haley & Aldrich, Inc.
465 Medford St.,
Suite 2200,
Boston, MA 02129-1400

CHAIN OF CUSTODY RECORD

Phone (617) 886-7400
Fax (617) 886-7600

Page of

H&A FILE NO. _____
PROJECT NAME _____
H&A CONTACT _____

LABORATORY _____
ADDRESS _____
CONTACT _____

DELIVERY DATE _____
TURNAROUND TIME _____
PROJECT MANAGER _____

Sample No.	Date	Time	Depth	Type	VOA	ABNs PAH only	Metals RCRA (8) PP(13)	Pesticides PCBs	VPH Full Suite C-ranges only	EPH Full Suite C-ranges only	TPH (specify)	TCLP (specify)	Reactivity Ignitability Corrosivity				Number of Containers	Comments (special instructions, precautions, additional method numbers, etc.)

Analysis Requested

Sampled and Relinquished by	Received by
Sign	Sign
Print	Print
Firm	Firm
Date Time	Date Time
Relinquished by	**Received by**
Sign	Sign
Print	Print
Firm	Firm
Date Time	Date Time
Relinquished by	**Received by**
Sign	Sign
Print	Print
Firm	Firm
Date Time	Date Time

LIQUID													
													VOA Vial
													Amber Glass
													Plastic Bottle
													Preservative
													Volume

SOLID													
													VOA Vial
													Amber Glass
													Clear Glass
													Preservative
													Volume

PRESERVATION KEY

A Sample chilled	C NaOH	E H_2SO_4	G Methanol
B Sample filtered	D HNO_3	F HCL	H Sodium Bisulfate

Sampling Comments

Evidence samples were tampered with? YES NO
If YES, please explain in section below.

WHITE - Laboratory CANARY - Project Manager PINK - Haley & Aldrich Laboratory GOLDENROD - Haley & Aldrich Contact

Form 3003

WATER AND WASTEWATER METHODS

Analysis Description	Method No.	Preservative	Solid Sample Volume/Container	Liquid Sample Volume/Container	Holding Time
Alkalinity	310	Cool 4° C	N/A	250 mL HDPE	14 days
Amenable Cyanide	Std. Mth. 412 F.	pH>12 NaOH, Cool 4° C	N/A	1 L HDPE	14 days
Ammonia	350	pH<2 H2SO4, Cool 4° C	N/A	1 L HDPE	28 days
Base/Neutral & Acid Extractables	625	Cool 4° C	N/A	1 L Amber	7 days Ext/40 days Analyze
Biochemical Oxygen Demand (BOD)	405.1	Cool 4° C	N/A	2 L HDPE	48 hours
Chemical Oxygen Demand (COD)	410	pH<2 H2SO4, Cool 4° C	N/A	125 mL HDPE	28 days
Chloride	300.0, 325	None Required	N/A	125 mL HDPE	28 days
Chromium, Hexavalent	3500D, 218.4/5	None Required	N/A	1 L HDPE	24 hours
Fluoride	300.0, 340	None Required	N/A	500 mL HDPE	28 days
Hardness, Total (as CaCO3)	130	pH<2 H2SO4, Cool 4° C	N/A	250 mL HDPE	6 Months
Nitrate	300.0, 352.1	Cool 4° C	N/A	250 mL HDPE	48 Hours
Nitrite	300.0, 354.1	Cool 4° C	N/A	125 mL HDPE	48 Hours
Orthophosphate	300.0, 365	Filter, Cool 4° C	N/A	125 mL HDPE	48 Hours
PCBs	608	Cool 4° C	N/A	1 L Amber	7 days Ext/40 days Analyze
Pesticides	608	Cool 4° C	N/A	1 L Amber	7 days Ext/40 days Analyze
Physiologically Available Cyanid	MADEP draft	pH>12 NaOH, 4° C	N/A	1 L HDPE	14 days
Priority Pollutant Metals (13 Metals	200.7/AA, 200 Series	pH<2 HNO3, 4° C	N/A	1 L HDPE	28 days (Hg), 6 mos. (others)
Purgeable Halocarbons & Aromatics	601/602	pH 2 HCl, Cool 4° C	N/A	40 mL Glass Vial	14 days
RCRA Metals (8 Metals)	200.7/AA, 200 Series	pH<2 HNO3, 4° C	N/A	1 L HDPE	28 days (Hg), 6 mos. (others)
Sulfate	300.0, 375	Cool 4° C	N/A	250 mL HDPE	28 days
Sulfide	376	pH>9 NaOH, Zn Acetate, Cool 4° C	N/A	1 L HDPE	7 days
Sulfite	377.1	None Required	N/A	125 mL HDPE	Analyze Immediately
Total Cyanide	335	pH>12 NaOH, Cool 4° C	N/A	1 L HDPE	14 days
Total Dissolved Solids (TDS)	209	Cool 4° C	N/A	250 mL HDPE	7 days
Total Organic Carbon (TOC)	415	pH<2 HCl or H2SO4, Cool 4° C, Dark	N/A	40 mL Amber	28 days
Total Organic Halogen (TOX)	506	pH<2 HNO3, 4° C	N/A	1 L Amber	check with lab
Total Phenolics	420.1	pH<2 H2SO4, Cool 4° C	N/A	1 L Amber	28 days
Total Phosphorus	365	pH<2 H2SO4, Cool 4oC	N/A	125 mL HDPE	28 days
Total Solids (TS)	160.3	Cool 4° C	N/A	250 mL HDPE	7 days
Total Suspended Solids (TSS)	160.2	Cool 4° C	N/A	250 mL HDPE	7 days
Volatile Organics	624	pH 2 HCl, Cool 4° C	N/A	40 mL Glass Vial	14 days
Weak and Dissociable Cyanide	Std. Mth. 412 H.	pH>12 NaOH, Cool 4° C	N/A	1 L HDPE	14 days
DRINKING WATER ANALYSIS					
Volatile Organics	502.2 or 524.2	pH 2 HCl, Cool 4° C	N/A	40 mL Glass Vial	14 days
MICROBIOLOGY					
Fecal Coliform	STDMTH	Cool 4o C	N/A	sterile, 125 mL	6 hours
Standard Plate Count	STDMTH	Cool 4o C	N/A	sterile, 125 mL	6 hours
Total Coliform	STDMTH	Cool 4o C	N/A	sterile, 125 mL	6 hours
Yeast and Mold	STDMTH	Cool 4o C	N/A	sterile, 125 mL	6 hours

SOIL/SEDIMENTS/WATER

Analysis Description	Method No.	Solids (S) / Liquids (L) Preservative	Solid Sample Volume/Container	Liquid Sample Volume/Container	Holding Time
Acid Extractables/Base/Neutral Extractables	8270	S/L: Cool 4° C	8 oz. CWM	1 L Amber	7 days Ext/40 days Analyze
Amenable Cyanide	-	S: 4° C / L: pH>12 NaOH, 4° C	4 oz. CWM	1 L HDPE	14 days
Chromium, Hexavalent	3060A/7196	S/L: Cool 4° C	8 oz. CWM	1 L HDPE	24 hours
Extractable Hydrocarbons	8015B	S: Cool 4° C / L: pH<2 HCl, 4° C	8 oz. CWM	1 L Amber	7 days Ext/40 days Analyze
Herbicides	8150	S/L: Cool 4° C	8 oz. CWM	1 L Amber	7 days Ext/40 days Analyze
Non-Halogenated Organics	8015B	S: Cool 4° C / L: pH<2 HCl, 4° C	4 oz. CWM	40 mL Glass Vial	14 days
PAH (low level)	8310 or GC/MS SIM	S/L: Cool 4° C	8 oz. AWM	1 L Amber	7 days Ext/40 days Analyze
Paint Filter Liquids Test	9095	S: Cool 4° C	8 oz. CWM	1 L Amber	Analyze ASAP
PCBs	8082	S/L: Cool 4° C	8 oz. CWM	1 L Amber	7 days Ext/40 days Analyze
Pesticides	8081	S/L: Cool 4° C	8 oz. CWM	1 L Amber	7 days Ext/40 days Analyze
Physiologically Available Cyanid	MADEP draft	S: 4° C / L: pH>12 NaOH, 4° C	4 oz. CWM	1 L HDPE	14 days
Priority Pollutant Metals(13 Metals)	6010&7000	S: 4° C / L: pH<2 HNO3, 4° C	8 oz. CWM	1 L Amber	28 days (Hg), 6 mos. (others)
RCRA Metals (8 Metals)	6010&7000	S: 4° C / L: pH<2 HNO3, 4° C	8 oz. CWM	1 L Amber	28 days (Hg), 6 mos. (others)
Total Cyanide	9010	S: 4° C / L: pH>12 NaOH, 4° C	4 oz. CWM	1 L HDPE	14 days
Volatile Hydrocarbons	8015B	S: Cool 4° C / L: pH<2 HCl, 4° C	4 oz. CWM	40 mL Glass Vial	14 days
Volatile Organics	8260B, 8021	S: methanol/$NaHSO_4$, 4° C / L: pH<2 HCl, 4° C	4 oz. CWM	40 mL Glass Vial	14 days
RCRA HAZARDOUS WASTE CHARACTERIZATION					
Corrosivity (pH only)	SW846-7.2	S: Cool 4° C	4 oz. CWM	check with lab	Analyze ASAP
Ignitability/Flashpoin	SW846-7.1	S: Cool 4° C	4 oz. CWM	check with lab	Analyze ASAP
Reactivity (CN-/S2-)	SW846-7.3	S: Cool 4° C	4 oz. CWM	check with lab	Analyze ASAP
TCLP (RCRA 8) Metals (check for mercury)	1311	S: Cool 4° C	16 oz. CWM	check with lab	6 mos. Ext/6 mos. Analyze
TCLP Pesticides/Herbicides	1311	S: Cool 4° C	16 oz. CWM	check with lab	14 days Ext/40 days Analyze
TCLP Semivolatiles	1311	S: Cool 4° C	16 oz. CWM	check with lab	14 days Ext/40 days Analyze
TCLP Volatiles	1311	S: Cool 4° C	8 oz. CWM	check with lab	14 days Ext/14 days Analyze
HYDROCARBON OIL & GREASE ANALYSIS					
MADEP EPH Method	MADEP REV. 0	S: Cool 4° C / L: pH<2 HCl, 4° C	4 oz. Amber	1 L Amber	S:7 days Ext / L:14 days Ext
MADEP EPH Method (C-Ranges only)	MADEP REV. 0	S: Cool 4° C / L: pH<2 HCl, 4° C	4 oz. Amber	1 L Amber	S:7 days Ext / L:14 days Ext
MADEP VPH Method	MADEP REV. 0	S: methanol, 4° C / L: pH<2 HCl, 4° C	40 mL+2 oz. CWM.	40 mL Glass Vial	S: 28 days / L: 14 days
MADEP VPH Method (C-Ranges only)	MADEP REV. 0	S: methanol, 4° C / L: pH<2 HCl, 4° C	40 mL+2 oz. CWM.	40 mL Glass Vial	S: 28 days / L: 14 days
MADEP EPH Method - with selected PAHs (including acenaphthene, naphthalene, 2-methylnaphthalene, and phenanthrene	MADEP REV. 0	S: Cool 4° C / L: pH<2 HCl, 4° C	4 oz. Amber	1 L Amber	S:7 days Ext / L:14 days Ext
Petroleum Identification	ASTM D3328				
Quantitative (include Chromatograms		S: Cool 4° C / L: pH<2 H_2SO_4, 4° C	4 oz. CWM	1 L Amber	S: 7 days / L: 28 days
Total Petroleum Hydrocarbons (Infrared	418.1	S: Cool 4° C / L: pH<2 H_2SO_4, 4° C	4 oz. CWM	1 L Amber	S: 7 days / L: 28 days

AIR METHODS

Analysis Description	Method No.	Preservative	Sample Volume/Container		Holding Time
Volatile Organic Compounds	EPA T01/T02	tubes: 4° C; Tedlar Bags: dark	N/A	N/A	tube: 14 days; bag: 72 hours
Volatile Organic Compounds	EPA T014	check with lab	N/A	N/A	can: 14 days; bag: 72 hours
VPH in air	EPA T01/T02	tubes: 4° C; Tedlar Bags: dark	N/A	N/A	tube: 14 days; bag: 72 hours
VPH in air	EPA T014	check with lab	N/A	N/A	can: 14 days; bag: 72 hours

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SAMPLING RECORD

Page of

PROJECT
LOCATION
CLIENT
CONTRACTOR

H&A FILE NO.
PROJECT MGR.
FIELD REP
DATE

Weather
Temperature
Ground surface Conditions ☐ Dry ☐ Wet ☐ Damp ☐ Standing Water ☐ Snow (____in) ☐ Other_____
Comments

SOIL SAMPLING AND SURFACE WATER SAMPLING INFORMATION

Sample No.	Location	Depth (ft)	Time	Sample Description	Sampling Device	Cleaning Prodedure	Container Type

General Comments: (ie: field filtrations, persons communicated with at site, etc.)

Form 3004

HALEY & ALDRICH

GROUNDWATER SAMPLING RECORD

Page of

PROJECT		H&A FILE NO.	
LOCATION		PROJECT MGR.	
CLIENT		FIELD REP	
CONTRACTOR		DATE	

GROUNDWATER SAMPLING INFORMATION

Well No.							
Water Depth (ft)							
Time							
Product							
Depth Of Well (ft)							
Inside Diameter (in)							
Standing Water Depth (ft) (1)							
Volume Of Water In Well (gal)							
Purging Device							
Volume of Bailer/Pump Capacity							
Cleaning Procedure							
Bails Removed/ Volume Removed							
Time Purging Started							
Time Purging Stopped							
Sampling Device							
Cleaning Procedure							
TIME SAMPLES TAKEN	VOA						
	ABN						
	Metals						
PARAMETERS	Color						
	Odor						
	pH						
	Conductivity						
	Turbidity						
	Dissolved Oxygen						
	Temp, ^{0} C						
	Salinity						

Remarks: (ie: field filtrations, persons communicated with at site, etc.)

1. Standing Water Depth = Depth of Well - Water Depth

Form 3005

HALEY & ALDRICH

TEST BORING REPORT

BORING NO. B 7 (OW)

PROJECT	Greenspace Development	H&A FILE NO.	27921-000
LOCATION	18 Riverside Road, Boston Massachusetts	PROJECT MGR.	S.R. Kraemer
CLIENT	Ecologic Investments	FIELD REP.	C.S. Osgood
CONTRACTOR	Guild Drilling Co., Inc.	DATE STARTED	13-Feb-01
DRILLER	Charlie O'Donnel	DATE FINISHED	14-Feb-01

Elevation 23.3 ft | Datum Boston City | Boring Location See sketch on reverse of form.

Item	Casing	Sampler	Core Barrel
Type	NW	S	NV2
Inside Diameter (in.)	3	1.385	2
Hammer Weight (lb.)	300	140	
Hammer Fall (in.)	24	30	

Rig Make & Model: CME 75
- ☑ Truck ☐ Tripod ☑ Cat-Head
- ☐ ATV ☐ Geoprobe ☐ Winch
- ☐ Track ☐ Air Track ☑ Roller Bit
- ☐ Skid ☐ ☐ Cutting Head

Hammer Type: ☑ Safety ☐ Doughnut ☐ Automatic

Drilling Mud: ☑ Bentonite ☐ Polymer ☐ None

Casing Advance: Type Method Depth — NW Driven 29.0 ft.

Drilling Notes: Flushed slurry prior to coring.

Depth (ft.)	Sampler Blows per 6 in.	Sample No. & Recovery (in.)	Sample Depth (ft.)	Stratum Change (ft.)	USCS Symbol	Visual-Manual Identification & Description (density/consistency, color, GROUP NAME & SYMBOL, maximum particle size*, structure, odor, moisture, optional descriptions, geologic interpretation)	% Coarse Gravel	% Fine Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Fines	Dilatancy	Toughness	Plasticity	Strength
0	10		0.0		SP-SM	Medium dense brown poorly graded SAND with silt (SP-SM),				20	70	10				
	12	S1				mps 2 mm, distinctly stratified, fines partially organic, no odor, dry.										
	15	21"														
	20		2.0	2.0		-ALLUVIUM-										
	11		2.0		SP	Dense brown poorly graded SAND (SP), mps 25 mm, no odor, dry.	5	5	20	30	35	5				
	15	S2														
	16	10"														
	17		4.0	4.5		-ALLUVIUM-										
5	WOR		5.0			Very soft, dark brown ORGANIC SOILS with sand (OL/OH), trace					25	75	S	M	H	VH
	WOR	S3			OL/OH	seashell fragments and particles, soil mps 0.5 mm, strong										
	WOH	24"				organic odor, moist.										
	WOH		7.0			-ORGANIC DEPOSIT-										
				8.0		Note: Drilling fluid returning medium to fine sand from 8.0 ft. to 10.0 ft. Drilling fluid color change to yellow red at 8.5 ft.										
				10.0		-PROBABLE MARINE DEPOSIT-										
10	3		10.0		CH	Stiff yellow brown fat CLAY (CH), trace fine sand, mps 0.5 mm,						100	N	M	H	
	6	S4				apparently laminated with frequent fine sand partings and										
	6	22"				possible organic fibers, no odor, moist.										
	6		12.0	13.5		-MARINE DEPOSIT-										
						Note: Drill action indicates gravel below 13.5 ft.										
15	12		15.0		CL	Very stiff yellow brown to gray sandy lean CLAY with gravel (CL),	5	10	10	10	15	50	S	M	M	
	14	S5				mps 35 mm, distinct disrupted laminae in discrete zones, coarse										
	15	17"				fraction consists of well rounded igneous and igneous and										
	19		17.0			metamorphic lithologies, no odor, moist.										
				18.0		-GLACIOMARINE DEPOSIT-										
				19.0		Note: Drill action and total loss of drilling fluid indicates gravel and cobbles from 18.0 ft. to 19.0 ft.										
20						Very dense gray silty SAND (SM), mps 15 mm, very well bonded,										
	21	S6	20.0		SM	coarse fraction consists partly of platy argillite fragments, no odor, moist.		10	15	20	30	25	R			
	25	10"	21.0	21.0		-GLACIAL TILL-										
	33	S6A	21.0		ML	Very dense gray SILT (ML), mps <0.1 mm, no structure, no odor,						100	R		N	
	34	7"	22.0			dry.										
						-RESIDUAL SOIL-										
						Note: Drilling advanced smoothly from 21.0 ft. to 25.0 ft.										
25				25.0		PROBABLE TOP OF DECOMPOSED BEDROCK 25.0 FT.										
	53		25.0			Very dense gray highly to completely weathered ARGILLITE.										
	28	S7				Possible extremely thin relect bedding subparallel to strong										
	39	5"				low angle foliation. Sample is generally well bonded and consists										
	35		27.0			of very soft angular fragments and particles which are easily										
						crushed with finger pressure.										
						-DECOMPOSED BEDROCK-										
						Note: Drill action indicates stratum change at 28.5 ft.										
				28.5		TOP OF "SOUND" BEDROCK 28.5 FT.										
						SEE SHEET 2 FOR CORE BORING REPORT										
30																

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth in feet to: Bottom of Casing	Bottom of Hole	Water
13-Feb-01	15:30	0	29.0	29.0	2.0
14-Feb-01	7:00	15.5	29.0	29.0	6.2
14-Feb-01	15:00	1.0	39.5	39.5	10.4

Sample ID
- O Open End Rod
- T Thin Wall Tube
- U Undisturbed Sample
- S Split Spoon Sample
- G Geoprobe

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (Linear ft.)	29.5
Rock Cored (Linear ft.)	10.0
Number of Samples	S7 C2
BORING NO.	B 7 (OW)

Field Tests Dilatancy: R - Rapid S - Slow N - None Toughness: L - Low M - Medium H - High Plasticity: N - Nonplastic L - Low M - Medium H - High Dry Strength: N - None L - Low M - Meduim H - High V - Very High

*NOTE: Maximum Particle Size is determined by direct observation within the limitations of sampler size.

NOTE: Soil Identifications based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

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CORE BORING REPORT

BORING NO. B 7 (OW)

Depth (ft)	Drilling Rate (min/ft)	Core No. Depth (ft)	Recovery (in)	Recovery (%)	RQD	Weathering	Well Diagram	Stratum Change (ft)	Visual Classification and Remarks
									SEE SHEET 1 TEST BORING REPORT FOR OVERBURDEN DETAILS.
								21.0	TOP OF RESIDUAL SOIL 21.0 FT.
									Note: Advanced borehole with rollerbit and splitspoon and drove NW casing through residual soil from 21.0 ft. to 25.0 ft.
						Residual Soil			-RESIDUAL SOIL-
25								25.0	TOP OF DECOMPOSED BEDROCK 25.0 FT.
						High to Complete			Note: Advanced borehole with rollerbit and splitspoon and drove NW casing through decomposed bedrock from 25.0 ft. to 28.5 ft.
									-DECOMPOSED BEDROCK-
								28.5	TOP OF "SOUND" BEDROCK 28.5 FT.
									Note: Seated NW casing at 29.0 ft. Advanced borehole with rollerbit to 29.5 ft. without sampling prior to coring.
30		29.5	56"			Slight			C1: Moderately hard, slightly weathered, gray, aphanitic ARGILLITE. Bedding extremely thin to very thin, generally low angle (30-35 degrees). Foliation low angle, commonly subparallel to bedding. Cleavage well developed along bedding/foliation planes where coincident.
	6								
						Mod.			Cleavage joints very close to close 29.5 -31.0 ft. and close below 32.5 ft. smooth-planar, slightly oxidized, occasionally calcite-infilled, tight. High angle to vertical joints moderately close, rough-undulatory, pyritized or highly oxidized and decomposed with silt infilling, open.
	3	C1				High			
						Mod.			
	5								Soft, moderately to highly weathered zone 31.0-32.5 ft. associated with extremely close, moderately dipping, slickensided-planar shears intersecting bedding plane and high angle features.
						Slight			
	6								Note: Partial water loss below 31.0 ft.
		34.5	24"	40%					Note: Lost core assumed 31.7-32.0 ft.
35	6	34.5	60"	100%					C2: Similar to bottom of run C1 except cleavage joints close to moderately close. High angle to vertical joints absent. Occasional thin zone of extremely close, extremely thin, moderately dipping to high angle (50-60 degrees) calcite stringers. Occasional calcite-healed low angle joint.
	7								
	6	C2				Slight			-CAMBRIDGE FORMATION-
	6							38.0	
	8								Lithology change at 38.0 ft. to hard, slightly weathered, dark gray to black, fine grained to aphanitic DIABASE. Single high angle joint at 38.7 ft. rough-stepped, slightly oxidized, tight.
		39.5	54"	90%					
40	8								BOTTOM OF EXPLORATION 39.5 FT.

HALEY & ALDRICH

TEST PIT LOG

Test Pit No. **TP-1**

Page 1 of 1

PROJECT	New England Hospital	H&A FILE NO.	10715-205
LOCATION	Boston, Massachusetts	PROJECT MGR.	M.X. Haley
CLIENT	PFT Associates	FIELD REP	C. S. Osgood
CONTRACTOR	J. Marchese & Sons Const.	DATE	07-Jan-02
EQUIPMENT	CAT 416 Rubber Tire Extendahoe 0.24 cu.yd. bucket capacity	WEATHER	Mostly Clear 20s

Ground El. 36.3 ft.
El. Datum NGVD

Location: West of Pedestrian Tunnel

Groundwater depths/entry rates (in./min.):
7.8 ft. Steadily

Depth (ft.)	Sample ID	Stratum Change Depth (ft.)	USCS Symbol	Visual Identification (density/consistency, color, GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
				Dark brown silty SAND (SM), mps 5 mm, organic odor, moist.		5	5	10	45	40	R			
	0.5		SM	Fines largely organic.										
				-LOAM FILL-										
		1.3												
2	S3			Yellow brown to olive brown sandy fat CLAY (CH), trace roots, clinker fragments,	5	5	5	10	15	60	N	M	H	
			CH	cinder particles and fragments, clay pipe fragments, metal wire, asphalt fragments.										
				10% cobbles, <5% boulders, mps 30 in., no odor, moist.										
				-FILL-										
4	4.0			Note: Poured concrete foundation wall on east side of test pit from 0.0 -4.4 ft.										
	4.0													
				Note: Poured concrete foooting 4.4-5.4 ft.										
6	S2													
8	8.0	8.0												
	8.0			Yellow brown fat CLAY (CH), trace fine sand. mps 0.5 mm, no odor, dry.					5	95	N	M	H	
	S1		CH	Appartantly laminated with frequent fine sand partings and possible organic fibers.										
	9.0			-MARINE DEPOSIT-										
10														
		11.0												
				Yellow brown to gray sandy lean CLAY (CL) with gravel. mps 35 mm,	5	10	10	10	15	50	S	M	L	
			CL	Distinct disrupted laminae in discrete zones. Coarse fraction consists of well-rounded										
				igneous and metemorphic lithologies.										
12	12.0	12.0		-GLACIOMARINE DEPOSIT-										
				Note: Possible stratum change to gray lean CLAY with sand (CL) below 12.0 ft.										
				Coarse fraction apparantly less abundent.										
				-MARINE DEPOSIT-										
				BOTTOM OF EXPLORATION 13.5 FT.										
14														

Obstructions:

Remarks:
Note: Bag samples S1-S3 obtained for potential mechanical analysis from depths indicated.

Field Tests

Dilatancy:	R - Rapid S - Slow N- None
Toughness:	L - Low M - Medium H - High
Plasticity:	N - Nonplastic L - Low M - Medium H - High
Dry Strength:	N - None L - Low M - Medium H - High V - Very High

Standing water in completed pit:
at depth 13.2 ft.
measured after 0.1 hrs. elapsed

Boulders:

Diameter (in.)	Number		Approx. vol. (cu. ft.)
12 to 24	1	=	1.8
over 24	1	=	8.2

Test Pit Dimensions (ft.):
Pit Depth 13.5
Pit Length X Width 9.0 x 6.0

NOTE: Soil identifications based on visual/manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

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ENVIRONMENTAL TEST PIT LOG

Test Pit No. **TP 214**

PROJECT	Mirror Lake Watershed Study	H&A FILE NO.	28675-309
LOCATION	Essex, Massachusetts	PROJECT MGR.	D.H. Gevalt
CLIENT	Citizens Advisory Partnership	FIELD REP	C.S. Osgood
CONTRACTOR	Stanley Lynde Const. Co., Inc.	DATE	19-Jul-02
EQUIPMENT	Case 580 rubber tire backhoe - 1/4 cu. yd. bucket	WEATHER	Thunderstorms 90's

Ground El.	74.5 ft.	Location	N 2,089,041.101	Groundwater depths/entry rates (in./min.):
El. Datum	NGVD		E 801,444.238	None

Depth (ft.)	Sample ID	PID Reading (ppm.)	Stratum Change Depth (ft.)	USCS Symbol	Visual Identification (density/consistency, color, GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions,	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
					Note: Ground surface strewn with boulders. Numerous depressions indicating										
					subsurface voids noted.										
	1.5				15% coarse to fine sand, 15% cinder fragments and particles, 10% unidentifiable, white										
					ash-like material, 10% fines (largely organic), 10% coarse to fine gravel, 10% wood										
2					(manufactured and treated), 5% glass fragments, 5% metal strips and wire, 5% charcoa										
	S2	15.9			5% plastic sheeting (possibly polyethelene bags), 5% brick particles, 5% clay pipe										
					fragments. Matrix generally dark brown to gray in color with pockets of white and red										
					15% boulders, 15 % cobbles. Maximum particle size 36 inches.										
	2.5				Distinct decomposed gasoline odor, possible faint napthalene odor. Visible irridescent										
					sheen on moist solids 4.6 to 5.2 ft.										
4					-FILL-										
	4.6														
	S1	140			Note: Bedrock surface smooth and flat, consisting of very hard to hard, slightly										
	5.2		5.2		weathered, light gray to pink, coarse to fine grained granite. Single high angle joint noted										
					REFUSAL ON BEDROCK 5.2 FT.										
6															
8															

Obstructions:

Remarks:

Note: Sample S1 submitted for laboratory chemical analysis.

Note: Field monitoring of breathing zone and headspace screening conducted using an hNU 11.7 ev. PID.

Bucket Decontamination Method: Steam cleaned

Field Tests

Dilatancy:	R - Rapid S - Slow N- None
Toughness:	L - Low M - Medium H - High
Plasticity:	N - Nonplastic L - Low M - Medium H - High
Dry Strength:	N - None L - Low M - Medium H - High V - Very High

Standing water in completed pit:

at depth NE ft.

measured after 0.75 hrs. elapsed

Boulders:

Diameter (in.)	Number		Approx. vol. (cu. ft.)
12 to 24	6.0	=	18.0
over 24	1.0	=	33.0

Test Pit Dimensions (ft.):

Pit Depth	5.2
Pit Length X Width	10.5 x 4.3

NOTE: Soil identifications based on visual/manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

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Form #3008

APPENDIX D
CHECKLISTS

D.1 Field Monitoring Checklist

D.1.1 Preliminary Preparation

A. Project Briefing
B. Field Project File and Document Assembly
- Proposal
- Contract Documents
- Locus, Site & Utility Plans
- Exploration Criteria
- Subcontractor Agreement
- Site and Project Contacts
- Forms
  - DFR
  - Subcontractor Quantities
  - Test Boring Report
  - Core Boring Report
  - Observation Well Installation Form
  - Test Pit Log
  - Special Testing / Instrumentation Forms
  - COC
  - Equipment Usage and Billing Form
  - Sample Receiving Form

C. H&S Briefing
- H&S Plan

D. Equipment Request and Assembly

D.1.2 Onsite Duties

A. Site Walkover and Subcontractor Utility and Safety Briefing
B. Exploration Program Review
- Exploration Layout
- Site Conditions Sketch
- Preliminary Surficial Geologic Map
- Exploration Monitoring
  - Equipment Inventory
  - Exploration Layout & Utility Check
  - Field Logging Soil & Rock
  - Water Level Measurements
  - Production and Budget Quantities
  - Sample Handling & Transport
  - Instrumentation & Testing Records
  - As-Built Sketches & Exploration Locations

Haley & Aldrich

D.1.3 Follow Up & Summary

- Proof Logs and Test Reports
- Finalize DFR and Subcontractor Quantities
- Sample Receiving and Disposition
- Equipment Return and Billing
- Exploration Program Summary
- Final Site & Geological Conditions Summary
- Geologic Profiles

Haley & Aldrich

1.0 INTRODUCTION AND PURPOSE

This SOP specifically applies to the collection and storage of soil for volatile organic compound (VOC) analysis using the current promulgated EPA methodology identified as SW-846 Method 5035A.

This SOP is intended to complement the RFI Workplan.

2.0 SCOPE

This SOP shall be followed by Haley & Aldrich's employees collecting soil samples in a closed-system purge-and-trap process for the analysis of VOCs in soil using Method 5035A.

3.0 RESPONSIBILITIES

The Haley & Aldrich Project Manager will be responsible for ensuring that field personnel implement this SOP, and rectifying instances of noncompliance with this SOP.

4.0 PROCEDURES

Information from the United States Environmental Protection Agency (USEPA) guidance document tiled, *Method 5035A, Closed-System Purge-and-Trap and Extraction for Volatiles Organics in Soil and Waste Samples*, Draft Revision 1, (USEPA, 2002) and from En Novative Technologies, Inc. (2003) was reviewed. The following sections describe typical preparation and sample collecting activities for soil sampling using Method 5035A.

4.1 Equipment Inspection

The soil sampling equipment (i.e., drill rig, hand auger, etc.) should be inspected prior to use to ensure that it is well maintained and clean.

4.2 Sample Site Preparation

After a fresh surface of the soil has been exposed to the atmosphere, the subsample collection process should be completed in the least amount of time in order to minimize the loss of VOCs due to volatilization. Removing a subsample from a material should be done with the least amount of disruption as possible. If it appears that the soil may have already lost VOCs (exposed for more than a couple of minutes) or if it may be contaminated by other waste, different soil strata, or vegetation, trimming of the surface layers of the sample may be done.

4.3 Sample Collection

Currently, there are three acceptable collection options using EPA Method 5035A (En Novative

Technologies, 2003) as follows. Table 1 also summarizes the sampling methods available for use.

- **EnCore® Sampler Preservation** – Collect three cores and a dry weight for each sample point and ship to laboratory within 40 hours of collection.

- **Field Preservation (Methanol)** – Requires coring and weighing 5-gram samples and placing in 40-milliliter (ml) vials preserved with methanol. This method does involve the use of hazardous substances and weighing samples in the field. Unused methanol and sample must be disposed of as hazardous waste with the accompanying transportation restrictions.

- **Field Preservation (Acid)** – Requires coring and weighing 5-gram samples and placing in 40-ml vials preserved with an acid solution (formed from sodium bisulfate). This method overcomes the methanol issues and eliminates subsampling in the laboratory; however, different limitations exist:

  - Acid may be insufficient for preservation in soils with high buffering capacity;
  - Alkaline soils may react vigorously with acid resulting in out-gassing and the vials may explode;
  - Acid may change the state of the contaminants resulting in the precipitation or dissolution of the chemical, depending on organic carbon content of the soil; and
  - A high level analysis may be needed in addition to the low level analysis. Soil samples containing high level VOCs (greater than 200 micrograms per kilogram [µg/kg]) are prepared by the laboratory for purging using Method 5030.

The soil sampling methods likely to be employed at the Facility are EnCore® sampler preservation and field preservation (with acid and methanol) as described below:

A. EnCore® Sampler Preservation

The EnCore® sampler is a single use device and cannot be cleaned and /or reused. It is designed to store soil and should not be used to store solvent or free product. The EnCore® sampler must be used with EnCore® T-Handle and/or EnCore® Extrusion Tool exclusively (sold separately). EnCore® sampler can be used to collect 5 grams of soil or 25 grams of soil depending on the device used (either the 5-gram sampler or the 25-gram sampler).

A detailed description of EnCore® sampling procedures, including diagrams, is included in Appendix A and summarized below.

Before collecting the sample:

- Hold the coring body and push the plunger rod down until the small o-ring rests against

tabs.

- Depress the locking lever on the EnCore® T-Handle.
- Place the coring body, plunger end first, into the open end of the T-handle, aligning the slots on the coring body with the locking pins in the T-handle.
- Twist the coring body clockwise to lock the pins into the slots.
- Check to ensure that the sampler is locked in place. The sampler is ready to use.

Collecting the sample:

- Turn the T-handle with the T-up and the coring body down. This positions the plunger bottom flush with the bottom of the coring body.
- Using the T-handle, push the sampler into the soil until the coring body is completely full. When full, the small o-ring will be centered in the T-handle viewing hole.
- Remove the sampler from the soil. Wipe the excess soil from the coring body exterior.
- Cap the coring body while it is still on the T-handle. Push the cap over the flat area of the ridge and twist to lock the cap in place. The cap must be seated to seal the sampler (see diagram in Appendix A).

Prepare the sampler for shipment:

- Remove the capped sampler by depressing the locking lever on the T-handle while twisting and pulling the sampler from the T-handle.
- Lock the plunger by rotating the extended plunger rod fully counterclockwise until the wings rest firmly against the tabs (see diagram in Appendix A).
- Attach the completed tear-off label (from EnCore® sampler bag) to the cap on the coring body. The sample shall be labeled according to RFI Workplan.
- Return the full EnCore® sampler to the zipper bag.
- Immediately place the bag on ice in a cooler for delivery to the laboratory.

Three EnCore® samples per interval are required to be collected. The holding time for samples collected using EnCore® sampling device is 48 hours.

B. Field Preservation (Acid and Methanol)

The En Novative Field Preservation Kit (including the Terra Core™ sampler) is designed to assist field personnel with the collection of soil samples using the chemical preservation procedures described in SW-846 Method 5035A (USEPA, 2002 and En Novative Technologies, 2003).

Each field preservation kit includes two vials for low level samples (sodium bisulfate), one vial for high level sample (methanol), one jar for a dry weight sample, and one Terra Core™ sampler.

Note: Soil samples that contain carbonates will effervesce when preserved with sodium bisulfate solution. Effervescence could result in explosion of the VOA vial. Always wear appropriate

protective clothing and goggles when using this kit. SW-846 Method 5035A specifies that samples which effervesce must be collected in 40-ml VOA vial that contains 5-ml of organic free water and a stir bar. These vials are sold separately by En Novative Technologies.

The Terra Core™ sampler is a one-time use tool that collects the appropriate amount of soil to be placed in each of the vials (approximately 5 grams of soil). A detailed description of Terra Core™ sampling procedures, including diagrams, is included in Appendix B and summarized below.

Before collecting the sample:

- Label vials and dry weight jar and/or zipper bag with the appropriate sample identification. The sample shall then be labeled according to RFI Workplan.
- Have ready a 40-ml glass VOA vial, containing the appropriate preservative.

Collecting the sample:

- Wipe all soil or debris from the outside of the Terra Core™ sampler. The soil plunge should be flush with the mouth of the sampler. Remove any excess soil that extends beyond the mouth of the sampler.
- Rotate the plunger that was seated in the handle top 90 degrees until it is aligned with the slots in the body.
- With the plunger seated in the handle, push the Terra Core™ into freshly exposed soil until the sample chamber is filled (approximately 5 grams of soil).
- Place the mouth of the sampler into the 40-ml VOA vial containing the appropriate preservative and extrude the sample by pushing the plunger down. Transfer one 5-gram soil plug from the sample point to each of the three 40-ml VOA vials containing sodium bisulfate or methanol by repeating the above steps three times.
- Quickly place the lid back on each of the 40-ml VOA vials. When capping the 40-ml VOA vials, be sure to remove any soil or debris from the threads of the vial.
- If effervescence occurs, use the same Terra Core™ sampler to transfer approximately 5 grams of soil plug from the same sample point to two VOA vials, each containing 5-ml of organic free water (sold separately by En Novative Technologies, Inc.). The vials containing only soil and water will be the samples submitted to the laboratory.
- Fill the dry weight jar half full with soil. Replace and tighten the jar lid.

Prepare the Terra Core™ sampler for shipment:

- Place all the containers back in the foam holder and close the zipper bag.
- Immediately place the bag on ice in a cooler for delivery to the laboratory.

There is a 14-day holding time for soil samples using the Terra Core™ sampler.

Table 1

METHOD 5035A SAMPLING TECHNIQUES:

Collection Method	Description	Comments
EnCore® Sampler	Use sampling tool designated to collect the appropriate amount of soil. Three samplers required by laboratories per interval in which a sample is collected.	Easy to collect samples. Little additional field time and no additional field personnel required. 48-hour holding time. Costs – For each interval collected, three samplers have to be used at approximately $10 per sampler ($30 dollars per sample collected).
Terra Core™ Sampler	Use sampling tool designated to collect approximately 5 grams of soil. Samples collected in 40-mL vials pre-weighed with magnetic stirring strip and appropriate preservatives.	Relatively inexpensive filed supplies. Easy to collect samples. Little additional field time and no additional field personnel required. 14-day holding time for samples. In high pH samples, sample can effervesce from reaction with the preservative resulting in inability to utilize this technique. Would have to use encore sampler or vials with reagent water rather than preservative, which affects holding time. Cost - $12 per kit containing three 40-ml vials, one jar, and Terra Core™ sampler

6.0 RECORDS

Records shall be maintained as described in the RFI Workplan

7.0 HEALTH AND SAFETY

The soil investigation activities at the Facility shall be conducted in accordance with the Site-Specific Health and Safety Plan.

8.0 REFERENCES

En Novative Technologies, Inc., 2003. Field Preservation Kit Directions, 2003.

USEPA, 2002. "Method 5035A, Closed-System Purge-and-Trap and Extraction for Volatiles Organics in Soil and Waste Samples," Draft Revision 1, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA Publication SW-846*, Third Edition, as amended by Updates I, II, IIA, IIB, III, IIIA, Revision 5, April 1998.

9.0 APPENDICES

1. **Appendix A: En Core® Sampler**
2. **Appendix B: Field Preservation Kit and Terra Core™ Sampler**

8.0 REFERENCES

En Novative Technologies, Inc., 2003. Field Preservation Kit Directions, 2003.

USEPA, 2002. "Method 5035A, Closed-System Purge-and-Trap and Extraction for Volatiles Organics in Soil and Waste Samples," Draft Revision 1, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA Publication SW-846*, Third Edition, as amended by Updates I, II, IIA, IIB, III, IIIA, Revision 5, April 1998.

9.0 APPENDICES

1. **Appendix A: En Core® Sampler**
2. **Appendix B: Field Preservation Kit and Terra Core™ Sampler**

APPENDIX A

EnCore® Sampler

Disposable En Core® Sampler

En Novative Technologies, Inc.
1241 Bellevue Street
Green Bay, WI 54302
Phone: 920-465-3960 • Fax: 920-465-3963
Toll Free: 888-411-0757
www.ennovativetech.com

Sampling Procedures

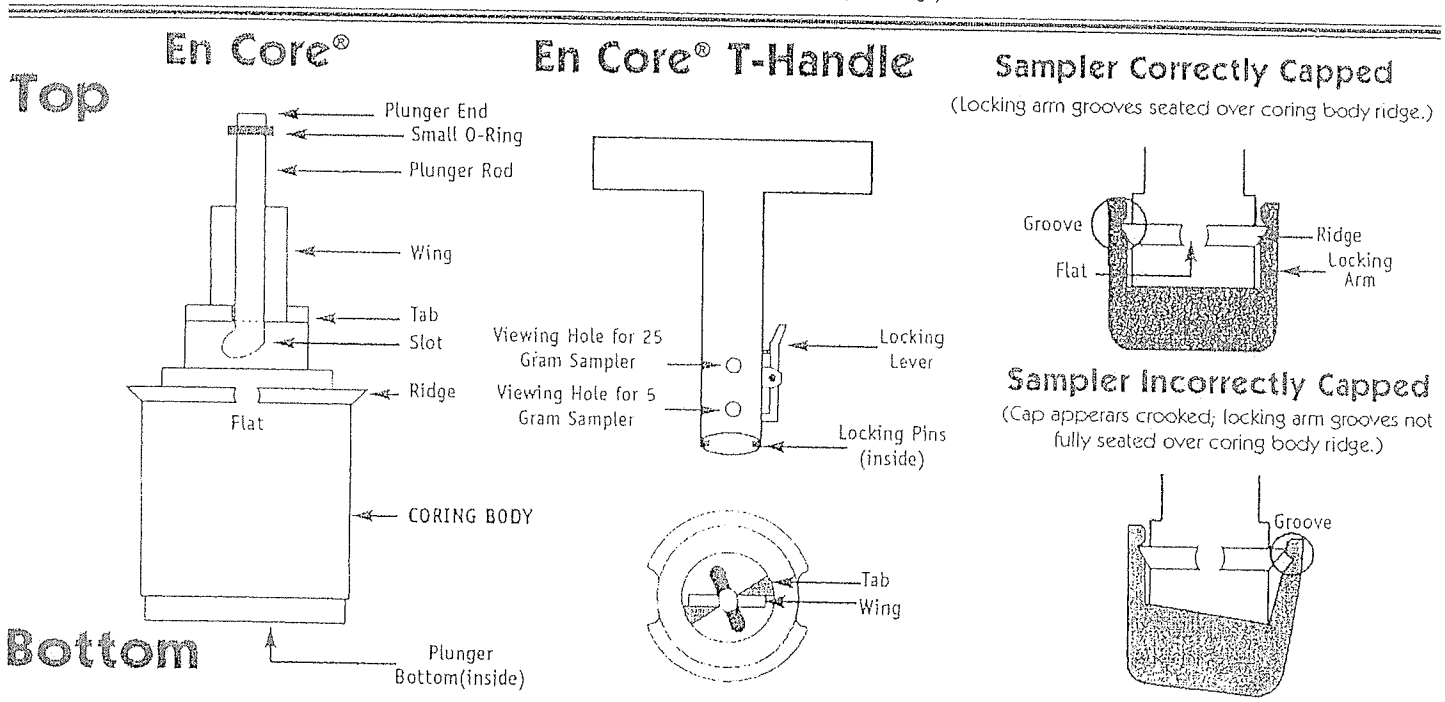
NOTE:

1. En Core® Sampler is a SINGLE USE device. It cannot be cleaned and/or reused.

2. En Core® Sampler is designed to store soil. Do not use En Core Sampler to store solvent or free product!

3. En Core® Sampler must be used with En Core® T-Handle and/or En Core® Extrusion Tool exclusively. (These items are sold separately.)

Using The En Core® T-Handle



BEFORE TAKING SAMPLE:

1. Hold coring body and push plunger rod down until small o-ring rests against tabs. This will assure that plunger moves freely.

2. Depress locking lever on En Core T-Handle. Place coring body, plunger end first, into open end of T-Handle, *aligning the (2) slots on the coring body with the (2) locking pins in the T-Handle.* Twist coring body clockwise to lock pins in slots. Check to ensure Sampler is locked in place. Sampler is ready for use.

TAKING SAMPLE:

3. Turn T-Handle with T-up and coring body down. This positions plunger bottom flush with bottom of coring body (ensure that plunger bottom is in position). Using T-Handle, push Sampler into soil until coring body is completely full. When full, small o-ring will be centered in T-Handle **viewing hole**. Remove Sampler from soil. Wipe excess soil from coring body exterior.

4. Cap coring body while it is still on T-handle. *Push* cap over **flat** area of **ridge** *and twist* to lock **cap** in place. **CAP MUST BE SEATED TO SEAL SAMPLER (see diagram).**

PREPARING SAMPLER FOR SHIPMENT:

5. Remove the capped Sampler by depressing locking lever on T-Handle while twisting and pulling Sampler from T-Handle.

6. Lock plunger by rotating extended plunger rod fully counter-clockwise until **wings** rest firmly against tabs (see plunger diagram).

7. Attach completed tear-off label (from En Core Sampler bag) to cap on coring body.

8. Return full En Core Sampler to zipper bag. Seal bag and put on ice.

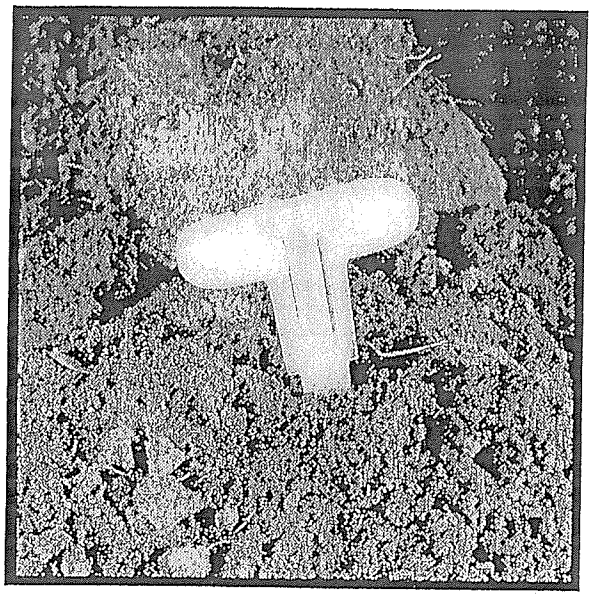
APPENDIX B

FIELD PRESERVATION KIT & TERRA CORE™ SAMPLER

En Novative Technologies, Inc.

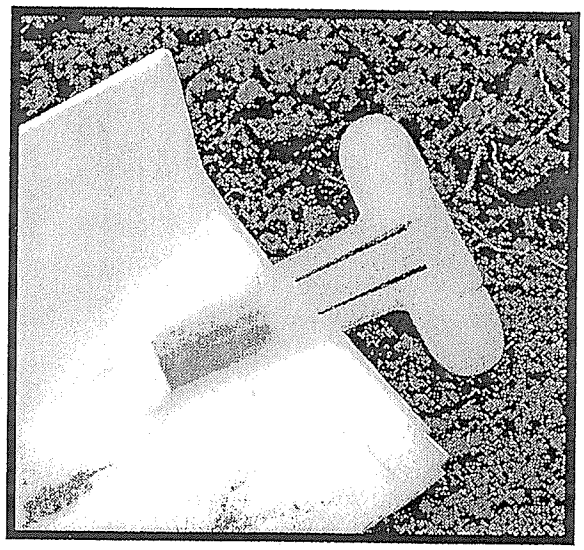
Recommended Use Of the Terra Core®

NOTE: The Terra Core® Sampler is a single use device. It cannot be cleaned and/or reused.



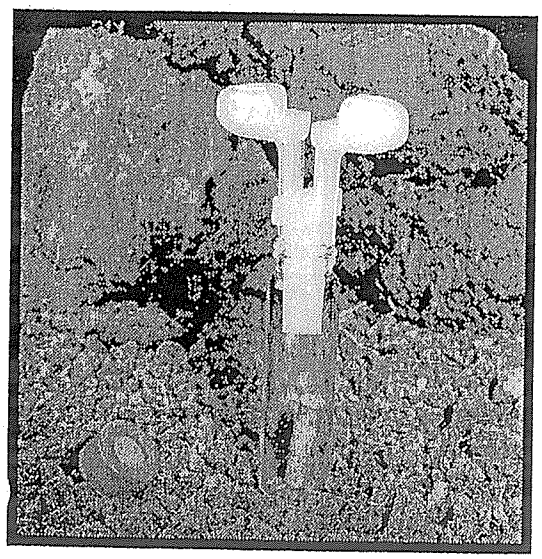
Step 1

Have ready a 40ml glass VOA vial containing the appropriate preservative.
With the plunger seated in the handle, push the Terra Core into freshly exposed soil until the sample chamber is filled.
A filled chamber will deliver approximately 5 grams of soil.



Step 2

Wipe all soil or debris from the outside of the Terra Core® sampler. The soil plug should be flush with the mouth of the sampler. Remove any excess soil that extends beyond the mouth of the sampler.



Step 3

Rotate the plunger that was seated in the handle top 90° until it is aligned with the slots in the body. Place the mouth of the sampler into the 40ml VOA vial containing the appropriate preservative and extrude the sample by pushing the plunger down. Quickly place the lid back on the 40ml VOA vial.
Note: When capping the 40ml VOA vial, be sure to remove any soil or debris from the threads of the vial.

En Novative Technologies, Inc. • 1241 Bellevue Street • Green Bay, WI 54302 • www.ennovativetech.com
Phone: 920-465-3960 • Toll Free: 888-411-0757 • Fax: 920-465-3963

En Novative Technologies, Inc.

Field Preservation Kit Directions

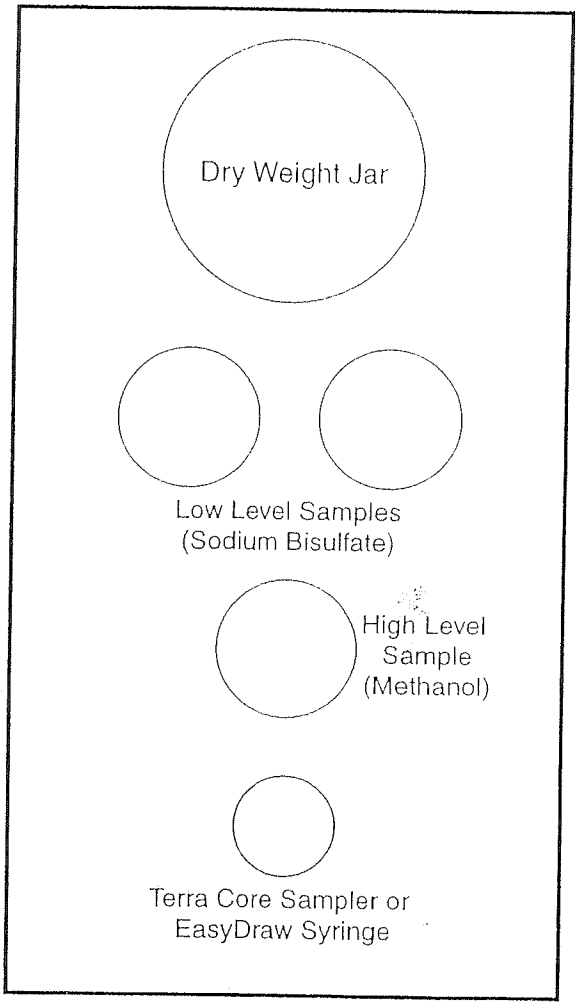
Jsing the En Novative Field Preservation Kit for High and Low Level Soil Sampling as Referenced in USEPA, SW-846 Update III, Method 5035

The En Novative Field Preservation Kit is designed to assist field personnel with collection of soil samples for volatiles analyses using the chemical preservation procedures described in SW-846 Method 5035. *NOTE: When following the field preservation option of SW-846 Method 5035, the method directs that chemical preservation should be done immediately.*

Each kit contains two vials for LOW LEVEL SAMPLES (SODIUM BISULFATE), one vial for a HIGH LEVEL SAMPLE (METHANOL), one jar for a DRY WEIGHT SAMPLE, and one Terra Core® Sampler or EasyDraw Syringe®.

WARNING! Soil samples which contain carbonates will effervesce when preserved with Sodium Bisulfate solution. Effervescence could result in explosion of the VOA vial. Always wear appropriate protective clothing and goggles when using this kit.

SW-846 Method 5035 specifies that samples which effervesce must be collected in 40 ml VOA vials which contain 5mls of organic free water and a stir bar. These vials can be purchased separately from En Novative Technologies, Inc.



Step 1: Label vials and dry weight jar and/or zipper bag with the appropriate sample identification.

Step 2: Following the appropriate enclosed directions, use the Terra Core® Sampler or EasyDraw Syringe® to transfer one ~ 5 gram soil plug from the sample point to each of the two 40 ml VOA vials containing sodium bisulfate for LOW LEVEL SAMPLES. Quickly replace and tighten the lids. If effervescence occurs, using the same Terra Core® Sampler or EasyDraw Syringe®, transfer an ~5 gram soil plug from the same sample point to two VOA vials, each containing 5 mls of organic free water. (These vials can be purchased separately from En Novative Technologies, Inc.) These vials containing only soil and water will now be the samples submitted for analyses.

Step 3: Using the same Terra Core® Sampler or EasyDraw Syringe®, transfer one ~5 gram soil plug from the same sample point to the remaining 40 ml VOA vial containing Methanol for the HIGH LEVEL SAMPLE. Quickly replace and tighten the lid.

Step 4: Fill the dry weight jar half full with soil. Replace and tighten the jar lid. Place all containers back in foam holder and close zipper bag.

Step 5: Carefully place bag on ice for delivery to the laboratory.

En Novative Field Preservation Kit for High and Low Level Sampling Includes:

- 1 - Disposable Terra Core Sampler or EasyDraw Syringe
- 1 - Dry weight jar with lid
- 2 - 40ml VOA vials with stir bar, 5mls of Sodium Bisulfate solution and tare weight
- 1 - 40ml VOA vial with 5mls of Methanol and tare weight

En Novative Technologies, Inc. • 1241 Bellevue Street • Green Bay, WI 54302 • www.ennovativetech.com
Phone: 920-465-3960 • Toll Free: 888-411-0757 • Fax: 920-465-3963

APPENDIX D

Standard Operating Procedure: OP3008 - Water Level Measurements
Standard Operating Procedure: OP3009 – Monitoring Well Development
Standard Operating Procedure Groundwater Sampling
Standard Operating Procedure: OP3014 – NAPL Detection and Monitoring

OPERATING PROCEDURE: OP3008

MANUAL WATER LEVEL MEASUREMENT PROCEDURE

Haley & Aldrich

PREPARATION AND APPROVALS

VERSION	AUTHORED/DATE	REVIEWED / DATE	REVIEWED / DATE	REVIEWED / DATE	APPROVED / DATE
Ver. 0.0	NVD/ 03-03	GJM/ 7-03	EBK/ 9-04		

Total Pages: 11

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Haley & Aldrich

OPERATING PROCEDURE: OP3008

MANUAL WATER LEVEL MEASUREMENT

1. INTRODUCTION

This procedure describes the measurement of water levels in groundwater monitoring and extraction wells, piezometers and boreholes. This procedure does not cover automated measurement of water levels with a transducer/datalogger and does not cover measurement of phase-separated liquids.

This procedure discusses collection of water levels using either an electric water level indicator or a chalked, graduated steel tape. Water levels will be acquired in a manner that provides accurate and precise data. These data may then be used to calculate groundwater elevations, determine hydraulic gradients and construct groundwater elevation contour maps. Accuracy and precision in obtaining the measurements are critical to insure the usability of the data.

1.1 Background

Water level measurements should be made from a fixed reference point marked on the well. The fixed reference mark will usually be located on the top of the well casing or on the top of the water level access point into the well, depending on the completion of the well at the surface. Following well installation, a survey mark is placed on the top of the well casing (typically PVC) as a reference point for groundwater level measurements. If such a survey mark is not present, the reference point is typically established and marked on the north side of the well casing.

If possible, avoid using steel protective casings or flush-mounted road boxes as a measurement reference point due to the greater potential for damage. All field personnel must be made aware of the measurement reference point being used in order to ensure the collection of comparable data. The well reference point elevation is surveyed to the nearest 0.01 ft. for later use in calculating groundwater elevation.

Before measurements are made, water levels in monitoring wells and piezometers should be allowed to stabilize for a minimum of 24 hours after well construction and development. In low-yield situations, recovery of water levels to equilibrium may take longer. All measurements should be made to an accuracy of 0.01 feet. All water level measuring equipment must be decontaminated prior to entering the Site. Water level measurements should, if possible, proceed progressively from the least-contaminated to the most-contaminated well, if applicable to the project.

In order to provide reliable data, water levels at a given site should be collected within a 24-hour period or the shortest time practical. However, certain situations may produce rapidly changing groundwater levels that require taking measurements as close in time as possible. Large changes in water levels within wells may be indicative of such conditions. Rapid groundwater level changes may occur due to:

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- Barometric pressure changes
- Tidal fluctuations
- Navigation controls on rivers
- Rainfall events
- Groundwater pumping

Due to possible changes during the groundwater level collection period, it is imperative that the time of data collection at each station be accurately recorded. In addition, personnel collecting water level data must record if any of the above conditions are known or suspected to be occurring during the groundwater level collection period.

In conjunction with groundwater level measurements, surface water (e.g. ponds, lakes, rivers, and lagoons) may be monitored as well. This information is useful (and can be critical) in understanding the hydrogeologic setting of the site and how contaminants may move beneath the site.

2. EQUIPMENT & SUPPLIES

Main field equipment includes:

- Battery-operated, non-stretch, electric water level probe with permanent markings at 0.01 ft. increments.
- Surveyor's steel tape with permanent markings at 0.01 ft. increments.
- Well key, screw driver and socket set.
- Decon Kit.

The electric water level indicator and the chalked steel tape are two devices commonly used to measure water levels. Both have an accuracy of 0.01 feet. The calibrated cable on the depth indicator will be checked against a surveyor's steel tape periodically. The time period between calibrations will be established based on the site-specific project conditions and the equipment usage. Calibration on a minimum quarter year basis is recommended. A new cable will be installed if the cable has changed by more than 0.1% (0.1 feet for a 100 foot cable) or becomes faded or difficult to read.

Other field equipment may include:

- Air monitoring instrumentation (Photo ionization detector (PID) or Flame ionization detector (FID))
- Survey tape or other well depth measurement device
- Chalk
- Ruler
- Site field book or project-/site-specific forms

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- Paper towels and trash bags
- Decontamination supplies, if applicable to the project
- Site-specific water level data forms

3. PROCEDURE

3.1 Preparation

1. Review the site-specific Sampling and Analysis Plan and Health and Safety Plan to determine project requirements. Determine and obtain the equipment and supplies needed. Obtain previous water level monitoring data, if available.

2. Obtain site access, and any necessary well keys or well wrenches.

3. Decontaminate or pre-clean equipment, and ensure that it is in working order.

4. Identify water level monitoring locations on site plan prior to going into the field.

3.2 Procedure

Procedures for determining water levels are as follows:

1. If possible, and when applicable, start at wells that are the least contaminated and progressively proceed to wells that are the most contaminated.

2. Clean/decontaminate all the equipment prior to entering the Site and between well locations, if required by Site protocol.

3. Remove any exterior lock and steel protective cover. Bail or remove any precipitation or surface water that may have accumulated in the well vault or the annulus between any steel protective cover and the casing, to prevent the water from draining into the well.

4. Remove any interior lock and cap or plug. Record the well ID, time of day (military format) and any other pertinent information.

5. If required by site-specific protocol, monitor the headspace of the well with a photoionization detector (PID) or flame ionization detector (FID) to determine the presence of volatile organic compounds. Record the results in the field book or on the site-specific forms. If necessary, initiate personal protective measures indicated by the site-specific health and safety plan.

6. Turn on the electric water level indicator and adjust the sensitivity. Chalk a 1- to 5-foot section of the steel tape. Lower the water level measuring device into the well. Electrical devices are lowered until

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the audible or visual signals indicate that the probe has contacted the water surface. Chalked steel tapes are lowered a foot or more below the water surface as determined by review of previous measurements at the well. Several repeat measurement attempts may be required with a chalked steel tape to determine this depth.

7. Measure and record the depth to water from the marked reference point and also record a description of the reference point used for the measurement (e.g. Top of four-inch PVC casing).

   For electrical indicators record the distance from the water surface (as determined by the audio signal, visual signal or meter) to the reference measuring point.

   For chalked tapes, an even-foot mark is held at the reference point, once the chalked section of the tape is below the water level. Both the water level indicated by wet chalk on the tape and the foot mark held at the reference point are recorded. The depth to the water is the difference between the two readings.

   Two water levels should be collected from each well and the results compared. If results do not agree to within 0.02 feet, a third measurement should be taken and the readings averaged. Consistent failure of consecutive readings to agree suggest that water levels are changing; that there is water cascading in the well; that the electric indicator is giving a false signal (such as the probe contacting moisture in the casing or an obstruction); or that some other anomalous condition with the well or equipment is precluding a correct measurement.

8. Remove all downhole equipment; replace well caps, plugs, locks and protective steel cover.

9. Decontaminate all downhole equipment that has contacted groundwater, if required by Site protocol, and store for transport to the next well.

10. Record any physical changes, such as evidence of tampering with the well or cover, vandalism, erosion or cracks in protective concrete pad, or variation in total depth of well. See the example format of water level data collection below.

Example Format of Water Level Data Collection

Date	Well ID	Depth to Water (from Top of PVC)	Time of Day	Comments/Notes
10/10/2001	MW-1	8.72'/8.72'	13:05	Surface water in manhole, cement pad cracked
10/10/2001	MW-2	9.51'/9.51'	13:07	Petroleum odor, sheen noted on probe

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3.3 Calculations

To calculate groundwater elevation above mean sea level, use the following equation:

$$E_W = E - D$$

Where:

E_W	=	Elevation of water above mean sea level (feet) or local datum
E	=	Elevation above sea level or local datum at point of measurement (feet)
D	=	Depth to water (feet)

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APPENDIX A
REFERENCES

- ASTM 4750 Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)
- ASTM D6000 Guide for Presentation of Water-Level Information from Ground-Water Sites
- Driscoll, F.G. 1986. Groundwater and Wells. Second Edition. Chapter 16. *Collection and Analysis of Pumping Test Data.* pp 534-579. Johnson Filtration Systems Inc. St. Paul, Minnesota.
- U.S. Environmental Protection Agency, 1986. RCRA Groundwater Monitoring Technical Enforcement Guidance Document, pp. 207.
- U.S. Environmental Protection Agency, 1987. A Compendium of Superfund Field Operations Methods. EPA/540/p-87/001 Office of Emergency and Remedial Response Washington, D.C. 20460.
- U.S. EPA Environmental Response Team, Standard Operating Procedures, Manual Water Level Measurements. Dated 02/11/2000, SOP 2043.

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APPENDIX B
RELATED HALEY & ALDRICH PROCEDURES

- OP1004 Operation/Calibration of PID Photoionization Detector
- OP1007 Field Monitoring for Volatile Organics (breathing space-work zone)
- OP1009 Medical Surveillance Program
- OP1010 Health and Safety Plans
- OP1022 Health and Safety Manual
- OP3000 General Environmental Field Procedures and Protocols
- OP3001 Preservation and Shipment of Environmental Samples
- OP3006 Procedures for Subsurface Soil Sampling and Chemical Analysis
- OP3008 Manual Water Level Measurement Procedure
- OP3009 Monitoring Well Development Procedure
- OP3012 Low Stress/Low Flow Groundwater Sample Collection Procedure
- OP3027 Decontamination Procedure

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APPENDIX C
FORMS

- Form 2021 Groundwater Monitoring Report

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APPENDIX D
GLOSSARY (To Be Updated As Appropriate)

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OPERATING PROCEDURE: OP3009

MONITORING WELL DEVELOPMENT PROCEDURE

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PREPARATION AND APPROVALS

VERSION	AUTHORED/DATE	REVIEWED / DATE	REVIEWED / DATE	REVIEWED / DATE	APPROVED / DATE
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OPERATING PROCEDURE: OP3009

MONITORING WELL DEVELOPMENT PROCEDURE

1. PURPOSE

This procedure provides guidance on methods and techniques for groundwater monitoring well development typically performed after well installation, but prior to groundwater quality sampling, specifically for instrumentation installed in overburden or bedrock for environmental monitoring and geotechnical purposes. Groundwater well development increases the yield of the well by removing fine sediments and particles from within the well and the well filter pack, enhances the hydraulic communication between the well and the screened formation, decreases turbidity, increases precision of hydrologic measurements, and increases representativeness of groundwater quality data. Well development is an integral component of a groundwater sampling program, with the objective of obtaining high quality, reproducible groundwater quality data.

The selected method and duration of groundwater well development will be dependent on a number of factors, including: well construction method and materials, depth to groundwater, anticipated groundwater testing parameters and data quality objectives, presence of contamination (i.e., degree of contamination and presence of free-phase non-aqueous phase liquids), method of borehole advancement, and site physical setting/access.

IMPORTANT NOTES:

It is not necessary to follow all of the methods in this procedure for every monitoring well development performed. The procedures may be adapted to conform to specific local practice, site-specific geologic conditions, or to support local, municipal or state regulatory requirements.

The term "groundwater monitoring well" or "well" in the procedure is used to denote groundwater monitoring wells, groundwater observation wells, piezometers, gas monitoring wells, lysimeters or other devices constructed in similar manner to a well. Certain well constructions (i.e., large-diameter pumping test wells, injection/extraction wells, commercial, residential or industrial water supply wells) may be developed using the information contained in the procedure, but are typically installed using specialized drilling equipment and are typically developed using that equipment by specific methods that are beyond the scope and intent of this field procedure.

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2. EQUIPMENT & SUPPLIES

Required

1. Water Level Indicator, Sinco or equivalent
2. Oil/Water Interface Probe
3. Thermometer
4. pH meter and buffering/calibration solutions
5. Conductivity meter and probe
   Dissolved oxygen meter and probe
7. Turbidity meter and probe
8. Oxidation/Reduction Potential meter and probe
9. Salinity meter
10. Pump (Grundfos, peristaltic, whale etc.)
11. Pump accessories (Cables, fittings, tools)
12. ½ in. or 5/8 in. HDPE or Teflon discharge tubing; also silicon tubing for peristaltic pump
13. Power source for pump (generator with fuel; automotive battery, rechargeable battery)
14. Graduated plastic bucket (5-gallon) or flow meter
15. Stopwatch
16. Standard decontamination equipment (water jug, buckets or washtubs, brushes, Alconox, distilled water, tap water, methanol, squeeze bottles)
17. Ruler, engineer's 6 ft. folding
18. Scale, engineer's
19. Graduated tape, 100 ft. length, weighted end
20. Field Logs & Forms/Field Book 6.
21. Site Plan, Maps, Boring and Well Installation Logs
22. Personal protective equipment
23. Calculator
24. Keys to well padlocks/covers
25. Paper towels
26. Trash bags

Optional:

1. Horiba MultiMeter (measures pH, temperature, conductivity, DO, turbidity, and salinity)
2. Horiba U-22 Flow Cell (measures pH, temperature, conductivity, DO, turbidity, ORP and salinity)
3. Inertial Pump Materials: Waterra Foot Valves, HDPE Tubing
4. Bailers; rope, knife

3. PROCEDURE

3.1 Summary of Procedure Purpose and Intent

The primary purpose of developing groundwater quality monitoring wells at sites containing, or potentially containing, solid or hazardous materials or their byproducts, is to create an effective filter pack around the well screen, rectify impact to the formation caused by drilling and the associated drilling fluid, remove fine

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particles from the formation near the borehole and assist in restoring the natural water quality of the aquifer in the vicinity of the well. The properly developed well ensures the reliable collection of representative ground water samples, of acceptably low turbidity.

Well development induces movement of water in two directions across the well screen and filter pack. This movement removes fines or other foreign materials from within the well, the filter pack, and the surrounding natural formation, creating a stable graded filter yielding water of relatively low turbidity.

3.2 Role of Environmental Professional or Engineer

Groundwater monitoring well development requires evaluation and consideration of a variety of site-specific characteristics, which precludes the use of one single development practice or procedure. The procedure is provided as a guide to aid the environmental professional, geologist or engineer in selecting the technical approach and methodology to effectively complete a well development program.

At the initiation of project planning, the Project Manager, Project Engineer or Scientist, and field personnel, determine any project-specific requirements for groundwater well development. Municipal, state or federal regulations, local practice, client requirements or project requirements may dictate the use of a different or modified well development method.

3.3 General Methods of Monitoring Well Development

There are three general types of well development methods typically employed on small diameter monitoring wells (equal to or less than 4 in. I.D.) installed for environmental purposes:

- Pumping and overpumping
- Bailing
- Surging with a Surge Block

Well development methods that potentially alter the chemical composition of the groundwater are not acceptable. Therefore, methods that introduce fluids (including water pumped from the well) or air, to accomplish development are generally considered unsuitable. This eliminates several methods commonly used to develop large-diameter water supply wells. These methods include backwashing, jetting, airlift pumping or air surging.

The majority of well development for environmental purposes is conducted by mechanical pumping and overpumping, use of inertial lift pumps, inertial lift pumps with surge blocks, bailers, or a combination of these methods.

3.4 Preliminary Procedures

In preparation for well development activities (and subsequent groundwater quality sampling event), the Project Manager and groundwater developer/sampler reviews project-specific requirements and considerations of the well development and groundwater sampling program.

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The information reviewed may include site map or plans, drilling methods and records, well construction records, depth to groundwater data, previous groundwater quality data, data trends, earlier sampling records and field procedures used, and preferred well sampling sequence or sampling order. Identify project documentation needs and records of well development execution.

Other information to be reviewed are specific laboratory analyses to be performed on samples to be obtained from each well, sampling glassware, need for field filtration and container preservatives. Related aspects of the procedure include site health & safety plan review, evaluation of the site physical setting, availability of electrical power, property access permission and constraints, and purge water disposal.

Design the well development program to support the data quality objectives of the chemical analyses of the groundwater samples to be obtained. Based on the types of data to be collected in the field, identify the appropriate types of mechanical purging required (by pumps or other specialized equipment), likelihood of the presence of non-aqueous phase liquid (NAPL) and accommodations for measuring NAPL. Generally, a series of wells are developed starting with the least contaminated well working towards the well exhibiting the most significant contamination, if known.

Other considerations are identifying protocol for personnel protective equipment (PPE) use and specialized handling of purged water and decontamination wastewater, as generated. Recently installed monitoring wells should not be developed before well sealant materials (bentonite annular seal, cement/bentonite grout) have set or cured, typically assumed to be approximately one week.

In some cases, groundwater obtained from wells installed and sealed with a column of cement grout has exhibited artificially high pH, due to migration and influence of the calcium carbonate from the cement. The Project Manager and field representative are cautioned of this possibility, manifested during the well development procedure by inconsistent, unstable or high pH readings.

Table I presents common well development equipment, and lists advantages/disadvantages of the equipment.

3.5 Calculate Volume of Standing Water in Well

Calculate the estimated volume of standing water in the well. Some useful formulae for calculating well volumes are provided below:

- $V = L\, r^2 (0.163)$

  Where:

  V = volume of standing water in well, in gallons
  r = internal radius of well, in inches
  L = length of standing water column, in feet
  0.163 = derived constant converting well radius in inches to feet, and cubic feet to gallons

Other useful formulae:

- Gallons per 100 ft. = 4.08 * (D)2

  Where D = Inside well or borehole diameter, in inches

- Cubic feet of water per 100 ft. = 0.55 * (D)2

  Where D = Inside well or borehole diameter, in inches

- 7.48 gallons = 1 cubic foot

- 0.134 cubic feet = 1 gallon

3.6 Field Procedures

3.6.1 Locate Well

Locate the subject well in the field, using site plans, sketches, fixed references or other available documentation. Metal detectors may be useful in locating buried metal well casings; however, non-ferrous (i.e., aluminum or PVC) or missing well casings will not respond to metal detector signals.

Verify well designation, particularly individual wells located in closely spaced well clusters or well nests. If necessary, verify and document the location of the well to be decommissioned, referenced by taped distance to three fixed features, or acquire coordinates using global positioning system (GPS) methods or by instrument survey.

3.6.2 Evaluate Well Integrity and Construction

Evaluate and document condition of protective well casing and surface seal (padlock missing/broken, well cap missing, staining on well riser observed, concrete surface seal cracked, surface runoff entering well etc.). Record well construction material (stainless steel, PVC, fiberglass, galvanized steel, black carbon steel etc.).

Establish/verify monitoring well reference point (i.e., PVC rim, roadway box rim, protective guard pipe casing rim, ground surface).

3.7 Well Development Procedure – Mechanical Pump Method

Mechanical pumps include electrically powered submersible pumps (Grundfos and Whale brands), or suction lift surficial pumps, such as centrifugal or peristaltic types. Pumps may have variable speed controls to regulate discharge rate. Other types of suction lift surface pumps may be driven by internal combustion gasoline engines (not discussed in this procedure).

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1. Follow Preliminary Procedures above, including evaluation of well integrity and documentation of well construction details.

2. Don appropriate personnel protective equipment (PPE) as identified in project health & safety plan. Pay particular attention to splash hazards.

3. Decontaminate all downhole development equipment prior to placement within wells, between uses in either the same well, or in other wells. Clean and prepare equipment using an Alconox soapy wash, tap water rinse, methanol rinse, and distilled/deionized water rinse. Containerize decontamination rinseate, if required.

4. If warranted, measure for possible presence of non-aqueous phase liquids (NAPL), using oil/water interface probe. Modify well development program based on findings and discussion with Project Manager, including postponing/canceling well development.

5. Measure well diameter, depth to water (static water level), depth to bottom of well using water level indicator or weighted graduated tape. Calculate standing water volume (see above).

6. Verify information on the respective well record, if available, and note any discrepancies. If well logs are not available, determine screen length and depth, if possible, to determine whether the well construction will provide useful data.

7. Evaluate obstructions present within the well or material accumulated in bottom of well. The presence of substantial quantity of accumulated materials (i.e., silt > 0.5 ft.) in bottom of well may warrant modifying the well development method to remove the sediment (i.e., use of peristaltic pump or hand bailer to remove sediment).

8. Remove any unsuitable dedicated groundwater sampling devices, if present (i.e., Waterra-type inertial pumps and discharge tubing, bailers, SoakEase absorbent material). Retain and discard as solid waste.

9. Groundwater purged from the borehole may or may not require containment or may be discharged on the ground in vicinity of well head, depending on groundwater quality, site setting, regulatory considerations and project requirements. Resolve with Project Manager prior to entering field.

10. Cut a clean piece of discharge tubing for selected pump (typically ½ in. or 5/8 in. high density polyethylene (HDPE) or Teflon tubing) of sufficient length to fully penetrate the well to its screened depth and to accommodate measuring purge volumes and inorganic parameters at ground surface. Cut tubing should not fall or drop into the well.

11. For submersible pumps, attached tubing and lower pump intake into well, suspending pump intake at the approximate midpoint of the saturated zone for water table wells, or at the screen midpoint for deeper wells. Connect power cables and controller box, and operate the pump according to manufacturer's instructions.

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12. Initially operate pump at a discharge rate approximately equal to well recharge rate, using graduated bucket or flow meter and stopwatch to estimate flow, and adjust until drawdown of approximately 0.3 ft. is obtained. At the start of purging, obtain inorganic field parameters of the discharge, in the following order: pH, temperature, specific conductance (conductivity), oxidation-reduction potential (ORP), dissolved oxygen (DO) and turbidity, and record on field forms or in logbook.

13. Well development continues until representative groundwater, free from drilling fluids, drill cuttings, accumulated sediment or other materials introduced during the well construction is obtained.

    Unless determined by project specific requirements, remove approximately 3 to 5 well volumes, measuring and recording inorganic field parameters for each well volume removed. If, during removal of 3 to 5 well volumes, field parameters have stabilized within 10% for two successive readings, and turbidity has been reduced to 5 nephelometric turbidity units (NTU) or less, then well development is considered complete. Based on discussion with the Project Manager or environmental professional, consider the applicability of Step 14 below, and complete if warranted.

    In certain circumstances and based on project objectives, well development may consist of removing a fixed volume of water from the well that is predicated on the drilling method used for well installation. For wells installed without the introduction of drilling fluids (i.e., hollow stem augers, driven well points), three (3) well volumes are removed. For wells where drilling fluids were introduced (i.e., cased borings, rock coring, mud rotary methods), ten (10) well volumes are removed. In these cases, inorganic field parameter readings may be obtained for informational purposes.

14. A parallel objective of well development may be to remove drilling fluid lost to the formation(s) that was introduced during the drilling process. This aspect of development is complete when the identified volume of fluid is removed, and stabilized inorganic parameters are achieved.

15. If field parameters have not stabilized after Step 13, increase pumping rate to dislodge fine-grained materials from the filter pack, or remove sediment in suspension. It may be necessary to lower pump intake to accommodate drawdown. Avoid pulling coarse sediment into well intake to prevent pump impeller damage.

16. If slow recharge rate does not allow for continuous operation, shut off pump, allow well to recharge, and resume pumping at slower rate and well evacuation until discharge water clears. Resume measuring field parameters (Step 13) until stabilized.

17. Complete documentation as appropriate.

3.8 Well Development Procedure – Inertial Pump Methods

Inertial pumps use a dedicated pre-cleaned single ball check valve ("foot valve") and HDPE discharge tubing to manually remove water from the well.

1. Follow Preliminary Procedures above, including evaluation of well integrity and documentation of well construction details, and Section 5.7, Steps 1 through 10.

2. Attach foot valve (i.e. Waterra type) to bottom end of HDPE tubing and lower into well. Allow approximately 2 to 4 ft. extra tubing above well casing for controlling discharge of purge water.

3. To remove groundwater from the well, manually lift and lower the HDPE tubing within the well bore by hand, approximately once every three to five seconds, timing the motion to optimize purge water volume removed with each stroke. Clean foot valve if it becomes clogged or obstructed by sediment by carefully removing tubing from well, unthreading the foot valve, and rinsing with distilled water.

4. Monitor inorganic field parameters as in Steps 12 to 14, above.

5. If slow recharge rate does not allow for continuous purging, allow well to recharge, and resume purging and well evacuation until discharge water clears. Resume measuring field parameters until stabilized. HDPE tubing and foot valves are typically dedicated and left in groundwater well following sampling.

6. Complete documentation as appropriate.

3.9 Well Development Procedure - Surge Blocks

Surge blocks can be used in conjunction with pre-cleaned, dedicated inertial pumps (single ball check valve or "foot valve") and HDPE discharge tubing.

1. Follow Preliminary Procedures above, including evaluation of well integrity and documentation of well construction details, and Section 5.7, Steps 1 through 10.

2. Press fit the surge block device securely onto foot valve (i.e. Waterra type), attach foot valve to bottom end of HDPE tubing and lower into well. Allow approximately 2 to 4 ft. extra tubing above well casing for controlling discharge of purge water.

3. To surge the groundwater, lower the surge block into the water column and use as a "plunger" by manually lifting and lowering the HDPE tubing by hand, forcing water to flow into and out of the screened portion of the aquifer. Surge each well for a minimum of 30 minutes to remove the finer material from the aquifer surrounding the borehole, providing a developed zone of uniformly graded sand of higher porosity and higher permeability surrounding the well screen, allowing the water to flow more freely into the well, and reducing potential turbidity.

4. Following the surging portion of the well development, remove the surge block from the foot valve, and purge a minimum of one well volume from the well by removing the fine particles brought into the well during surging.

5. Monitor inorganic field parameters as in Steps 12 to 14, above.

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6. If slow recharge rate does not allow for continuous purging, allow well to recharge, and resume purging and well evacuation until discharge water clears. Resume measuring field parameters until stabilized. HDPE tubing and foot valves are typically dedicated and left in well following sampling.

7. Complete documentation as appropriate.

3.10 Well Development Procedure - Bailers

Hollow, cylindrical bailers are a type of grab sampling device, and may be constructed of stainless steel, Teflon, or PTFE, typically with a single ball check valve fixed on the bottom. They are manually lowered into the well using a rope tether, allowed to collect well water, then lifted from the well. The collected water is discharged to a graduated bucket, and the process repeated until the well is deemed adequately developed. Stainless steel bailers are generally simple to decontaminate. Teflon or PTFE bailers are considered dedicated or disposable after one-time use.

In general, the use of bailers are not a preferred well development method, due to the time required to remove potentially large volumes of development water, especially in deep wells. Their use, however, creates agitation and mixing within the water column, which suspends sediment and fines, incrementally aiding in clearing the well and filter pack, thereby reducing turbidity.

PTFE ("clear") bailers are often used to collect NAPL for thickness measurements or product analysis. Although not discussed in this procedure, bailers are generally not recommended for groundwater sampling overall, and not acceptable for low-flow groundwater sampling in particular, especially sampling for volatile organic compounds (VOCs), volatile petroleum hydrocarbons (VPH), dissolved metals or other analytes requiring field filtration.

3.11 Restoration and Cleanup

The area around the well head and ground surface shall be completely cleaned up of any development materials (plastic sheeting, tubing, paper towels, litter, etc.), and the well secured.

3.12 Documentation

A complete record of the well development procedure should be documented and incorporated into the project file. Complete portions of the Groundwater Sampling Record form, recording the following information:

- Project information, date and personnel present
- Well location and designation
- Well condition inventory
- Presence of NAPL

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- Diameter, depth of well, screened interval (if known), depth to static groundwater, volume of standing water column in well
- Detailed description of well development equipment and procedure used
- Time(s) development started and ended
- Incremental and total volume of purge water removed
- Inorganic field parameter measurements
- Comments on discharge water quality
- Modifications to procedures
- Decontamination method, and discharge water management method
- Drum count of accumulated discharge water, if applicable

Appendix C contains a blank Sampling Report (Form #3004), Groundwater Sampling Record (Form #3005), Monitoring Well Development Report (Form #3006) and Low Flow Field Sampling Form (Form #3010) for reference.

3.13 Precision and Bias

This procedure provides qualitative information only; therefore, a precision and bias statement is not applicable.

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TABLE 1
Common Well Development Equipment

Material	Type	Power Requirement	Positive Attributes	Negative Attributes
Mechanical Pumps:				
Grundfos Pump	Submersible pump (variable speed)	120V A.C. current	-Lift height only constrained by cable length (+/- 150 ft.) -Controllable, variable flow rate from 0.01 to ≈35 L/minute -Stainless steel disassembles for simple decontamination See note 1	-Requires generator if no power source available -Risk of cross contamination of sample glassware or tubing from generator fuel -Heavy/cumbersome -Sediment may clog pump impellers -2.0 in. minimum well diameter See note 2
GeoDurham	Submersible Pump (variable speed)	12V D.C. current (Automotive battery)	-Portable power supply -Lift height only constrained by cable length (+/- 75 ft) -Controllable, variable flow rate -Stainless steel for simple decontamination See note 1	-Limit on lowest pump speed/discharge -Sediment may clog pump impellers -Power supply limits duration of pump use -2.0 in. minimum well diameter See note 2
Whale Pumps	Submersible pump (variable speed)	12V D.C. current (Automotive battery)	-Portable power supply -Lift height only constrained by cable length (+/- 30 ft.) -Disassembles for simple decontamination -1.5 in. minimum well diameter	-Power supply limits duration of pump use See note 2
Peristaltic Pumps	Suction lift surface pump (single speed)	12V D.C. current (Automotive Battery)	-Good for purging sediment from silt trap during development -Dedicated tubing -Easy to operate -0.5 in. minimum well diameter	-Not appropriate for sampling VOCs (agitation) -Lift limited to ≈25 ft. BGS -Pump rate 0.01 L/min.
Manual Methods:				
Inertial Pump	Submersible foot valve with discharge tubing	Manually operated	-Dedicated tubing -Inexpensive -Simple to operate -0.5 in. minimum well diameter	-Depth limited by manual capability to lift tubing (typically 70 to 80 ft.) -Tiring for large volumes of development water -Sediment may clog foot valve
Stainless Steel Bailer	Grab sample device with single check valve	Manually operated	-Disassembles for simple decontamination -Simple to operate	-Not appropriate for groundwater sampling (agitation) -Tiring for large volumes of development water -Splash hazard
Teflon Bailer	Grab sample device with single check valve	Manually operated	-Dedicated -Simple to operate -Inexpensive	-Not appropriate for groundwater sampling (agitation) -Tiring for large volumes of development water -Splash hazard
Clear Bailer	Grab sample device with single check valve	Manually operated	-Dedicated -Simple to operate -Inexpensive -Can collect NAPL for evaluation	-Not appropriate for groundwater sampling (agitation) -Tiring for large volumes of development water -Splash hazard

Notes and References:
1. Appropriate for low flow/low stress groundwater sampling.
2. Not appropriate if DNAPL/LNAPL present in monitoring well.

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APPENDIX A
REFERENCES

A.1 Reference Procedures

- American Society for Testing and Materials, current edition, "Annual Book of ASTM Standards," Vol.04.08, D5521-94, "Standard Guide for Development of Groundwater Monitoring Wells in Granular Aquifers."

- Puls, R.W., Barcelona, M.J., 1996. "Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures," US EPA Ground Water Issue, US Environmental Protection Agency. Office of Solid Waste, EPA/540/S-95/504, pp. 1 to 12.

- US Environmental Protection Agency, Region I, (30 July 1996). "Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells," SOP # GW 0001, Revision 2.

A.2 Other References

- US Environmental Protection Agency, 1992. Office of Solid Waste," RCRA Groundwater Monitoring: Draft Technical Guidance," EPA/530/R-93/001, NTIS PB 93-139350, November 1992, pp. 6-46 to 6-50.

- American Society for Testing and Materials, current edition, "Annual Book of ASTM Standards," Vol.04.08, D6634-01, "Standard Guide for the Selection of Purging and Sampling Devices for Groundwater Monitoring Wells."

- American Society for Testing and Materials, current edition, "Annual Book of ASTM Standards," Vol.04.08, D5903-96 (Reapproved 2001), "Standard Guide for Planning and Preparing for a Groundwater Sampling Event."

- Massachusetts Department of Environmental Protection, "Standard References For Monitoring Wells," January 1991, document WSC-310-91, Section 4.5 Well Development.

A.3 COMMENTS ON REFERENCE PROCEDURES

The procedures and equipment listed in EFP No. 01a and used by Haley & Aldrich are generally as specified in the ASTM and US EPA Reference Procedures. Deviations of EFP No. 01a from the Reference Procedures are not provided. The procedure described in Section 5 has been developed to assist Haley & Aldrich personnel in performing well development, and in some cases simplifies the Reference Procedures.

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APPENDIX B
RELATED HALEY & ALDRICH PROCEDURES

- OP2020 Groundwater Monitoring (Observation) Well Abandonment
- OP2031 Groundwater Monitoring (Observation) Well Installation
- OP3000 General Environmental Field Procedures and Protocols
- OP3007 Procedures for Surface Water Sampling
- OP3008 Manual Water Level Measurement Procedure
- OP3010 Groundwater Quality Sampling Procedure
- OP3012 Low Stress/Low Flow Groundwater Sample Collection Procedure
- OP3014 NAPL Monitoring and Sampling
- OP3015 Aquifer Parameter Testing Procedure

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APPENDIX C
FORMS

- 3004 Sampling Report
- 3005 Groundwater Sampling Record
- 3006 Monitoring Well Development Report
- 3010 Low Flow Field Sampling Form

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SAMPLING RECORD

Page of

PROJECT		H&A FILE NO.	
LOCATION		PROJECT MGR.	
CLIENT		FIELD REP	
CONTRACTOR		DATE	

Weather _____ Temperature _____

Ground surface Conditions ☐ Dry ☐ Wet ☐ Damp ☐ Standing Water ☐ Snow (____in) ☐ Other_____

Comments _____

SOIL SAMPLING AND SURFACE WATER SAMPLING INFORMATION

Sample No.	Location	Depth (ft)	Time	Sample Description	Sampling Device	Cleaning Prodedure	Container Type

General Comments: (ie: field filtrations, persons communicated with at site, etc.)

Form 3004

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GROUNDWATER SAMPLING RECORD

Page of

PROJECT		H&A FILE NO.	
LOCATION		PROJECT MGR.	
CLIENT		FIELD REP	
CONTRACTOR		DATE	

GROUNDWATER SAMPLING INFORMATION

Well No.							
Water Depth (ft)							
Time							
Product							
Depth Of Well (ft)							
Inside Diameter (in)							
Standing Water Depth (ft) (1)							
Volume Of Water In Well (gal)							
Purging Device							
Volume of Bailer/Pump Capacity							
Cleaning Procedure							
Bails Removed/ Volume Removed							
Time Purging Started							
Time Purging Stopped							
Sampling Device							
Cleaning Procedure							
TIME SAMPLES TAKEN	VOA						
	ABN						
	Metals						
PARAMETERS	Color						
	Odor						
	pH						
	Conductivity						
	Turbidity						
	Dissolved Oxygen						
	Temp, ^{0} C						
	Salinity						

Remarks: (ie: field filtrations, persons communicated with at site, etc.)

1. Standing Water Depth = Depth of Well - Water Depth

Form 3005

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MONITORING WELL DEVELOPMENT REPORT

Well No.

PROJECT		H&A FILE NO.	
LOCATION		PROJECT MGR.	
CLIENT		FIELD REP.	
CONTRACTOR		DATE	
ELEVATION SUBTRAHEND			

Estimated Volume of Water Lost During Drilling: _____ gallons

Comments: _____

Depth to Water Before Development: _____ feet

Comments: _____

Depth to Well Bottom Before Development: _____ feet

Comments: _____

Turubitiy of Water Before Development: _____ NTU

Comments: _____

Volume of Water Removed: _____ gallons

Comments: _____

Method of Removal (bailing, pumping): _____

Comments: _____

Depth to Well Bottom After Development: _____ feet

Comments: _____

Depth to Water After Development: _____ feet

Comments: _____

Turubitiy of Water After Development: _____ NTU

Comments: _____

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LOW FLOW/MNA FIELD SAMPLING FORM

Page of

PROJECT _____ H&A FILE NO. _____

LOCATION _____ PROJECT MGR. _____

CLIENT _____ FIELD REP _____

CONTRACTOR _____ DATE _____

Sampling Data:

Well ID: _____ Well Depth: _____ ft Initial Depth To Water: _____ ft Purging Device: _____

Start time: _____ Depth To Top Of Screen: _____ ft Depth Of Pump Intake: _____ ft Tubing Present In Well: ☐ Yes ☐ No

Finish Time: _____ Depth To Bottom Of Screen _____ ft Tubing Type: _____

Elapsed Time (24 hour)	Depth To Water From Casing (ft)	Pump Setting (ml/min) or (gal/min)	Purge Rate (ml/min) or (gal/min)	Cumulative Purge Vol. (liters) or (gal)	Temp-erature (°F) or (°C)	pH	Conduct-ivity (us/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	ORP/eH (mv)	Comments

Form 3010

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FMG 6.4-02 SAMPLE COLLECTION DATA SHEET

FMG 6.4-03 MONITORING WELL RECORD FOR LOW-FLOW PURGING

GROUNDWATER

INTRODUCTION

This procedure is for the collection of groundwater samples for laboratory analysis.

PROCEDURES REFERENCED

- FMG 5.1 - Water Level Measurements.
- FMG 9.0 - Equipment Decontamination.

PROCEDURAL GUIDELINES

The following describes two techniques for groundwater sampling: "Low Stress/Low Flow Methods" and "Typical Sample Methods."

"Low Stress/Low Flow" methods will be employed when it is critical to collect groundwater samples truly representative of the groundwater present, not impacted by sediment/colloid presence. Analysis typically sensitive to turbidity/sediment issues are polychlorinated biphenyls (PCBs), semivolatile compounds (SVOCs), and metals.

The "Typical Sample Methods" will be employed where the collection of parameters less sensitive to turbidity/sediment issues are being collected (VOCs and general chemistry).

Note: If non-aqueous phase liquids (NAPL) (light or dense) are detected in a monitoring well, groundwater sample collection will not be conducted and the Project Manager must be contacted to determine a course of action.

Preparatory Requirements

- Verify well identification and location using borehole log details and location layout figures. Note the condition of the well and inform the Project Manager of any necessary repair work required.
- Prior to opening the well cap, measure the breathing space above the well casing with a PID to establish baseline levels. Repeat this measurement once the well cap is opened. If either

of these measurements exceeds the air quality criteria in the health and safety plan, field personnel should adjust their PPE accordingly.

- Prior to commencing the groundwater purging/sampling tasks, a water level must be obtained to determine the well volume for hydraulic purposes. Refer to FMG 5.1 - Water Level Measurements for details. In some settings it maybe necessary to allow the water level time to equilibrate. This condition exists if a water tight seal exists at the well cap and the water level has fluctuated above the top of screen; creating a vacuum or pressurized area in this air space. Three water level checks will verify static water level conditions or changing conditions.
- Calculate the water volume in the well. Typically overburden well volumes consider only the quantity of water standing in the well screen and riser; bedrock well volumes are calculated on the quantity of water within the open corehole and within the overburden casing.
- Estimate natural groundwater flow rate into well to determine the approximate pumping rate for purging/sampling activities.

Well Purging and Stabilization Monitoring (Low Stress/Low Flow Method)

- The GM method of preference for groundwater sampling will be the low stress/low flow method described below.
- Bladder pumps/submersible variable rate pumps (i.e., Grundfos™ Rediflo or equivalent) are typically employed.
- Slowly lower the pump, safety cable, tubing and electrical lines into the well to the depth specified by the project requirements. The pump should be placed in the well approximately 24 hours prior to purging. The pump intake must be at the mid-point of the well to prevent disturbance and resuspension of any sediment in the screen base.
- Before starting the pump, measure the water level again with the pump in the well leaving the water level measuring device in the well when completed.
- Purge the well at 100 to a maximum of 500 milliliters per minute (mL/min). During purging, the water level should be monitored approximately every 5 minutes, or as appropriate. A steady flow rate should be maintained that results in drawdown of 0.3 feet or less. The rate of pumping should not exceed the natural flow rate conditions of the well being sampled. Care should be taken to maintain pump suction and to avoid entrainment of air in the tubing. Record adjustments made to the pumping rates and water levels immediately after each adjustment.
- During the purging of the well, monitor and record the field indicator parameters (pH, temperature, conductivity, oxidation-reduction (redox) reaction potential (ORP), dissolved oxygen (DO), and turbidity) approximately every 5 minutes. Stabilization is considered to be achieved when the final groundwater flow rate is achieved, and three consecutive readings for each parameters are within the following limits:
  - pH ±0.1 pH units of the average value of the three readings;
  - temperature ±3 percent of the average value of the three readings;

- conductivity ±0.005 milliSiemen per centimeter (mS/cm) of the average value of the three readings for conductivity <1 mS/cm and ±0.01 mS/cm of the average value of the three readings for conductivity >1 mS/cm;
- ORP ±10 millivolts (mV) of the average value of the three readings;
- DO ±10 percent of the average value of the three readings; and
- turbidity ±10 percent of the average value of the three readings, or a final value of less than 5 nephelometric turbidity units (NTU).

- Should stabilization not be achieved for all field parameters, purging is continued until a maximum of 20 well screen volumes have been purged from the well. Since low-flow purging (LFP) likely will not draw groundwater from a significant distance above or below the pump intake, the screen volume is based upon a 5-foot (1.4 m) screen length. After purging 20 well screen volumes, purging is continued if the purge water remains visually turbid and appears to be clearing, or if stabilization parameters are varying slightly outside of the stabilization criteria listed above and appear to be approaching stabilization.
- If low-turbidity samples are critical to the project goals, purging will be extended until turbidity has been reduced to 5 NTU or less.
- The pump must not be removed from the well between purging and sampling.

Well Purging and Stabilization Monitoring (Typical Method)

- Typically peristaltic pumps or bladder pumps or submersible pumps are preferred. In most cases bailer use is not desirable.
- Pump placement is typically performed at the mid-point of the screen.
- Purge the well until three consecutive well volume measurements of temperature and specific conductivity are approximately plus or minus 10 percent and if the pH values are within 1 pH unit of the last three value averages, and the groundwater turbidity values are less than 5 NTU. If stabilization has not occurred within the first five well volumes removed, continue purging and monitoring until eight well volumes have been pumped.
- Groundwater turbidity may be evaluated by a visual examination for sediment/silt presence or use of a nephlometer. Work Plan-specific goals may exist for turbidity values which may require extending the purging, or require an alternate pumping system.
- Monitoring well purging is accomplished by using in-place pumps or by either a peristaltic, bladder or other appropriate pump, depending on the well depth. The pump/hose assembly or bailer used for purging should be lowered into the top of the standing water column and not deep into the column. Typically pump placement at the mid-point of the screen is adequate.

Sampling Techniques

- If an alternate pump is utilized, the first pump discharge volumes should be discarded to allow the equipment a period of acclimation to the groundwater.
- Samples are typically collected directly from the pump with the groundwater being discharged directly into the appropriate sample container. Avoid handling the interior of the bottle or bottle cap and don new gloves for each well sampled to avoid contamination of the sample.
- Order of sample collection:
  - Volatile organic compounds;
  - Semi-volatile organic compounds;
  - Total organic carbon (TOC);
  - Total organic halogens (TOX);
  - Extractable organics;
  - Total metals;
  - Dissolved metals;
  - Phenols;
  - Cyanide;
  - Sulfate and chloride;
  - Nitrate and ammonia; and
  - Radionuclides.
- For low stress/low flow sampling, samples should be collected at a flow rate between 100 and 250 mL/min and such that drawdown of the water level within the well does not exceed the maximum allowable drawdown of 0.3 feet.
- The pumping rate used to collect a sample for VOCs should not exceed 100 mL/min. Samples should be transferred directly to the final container 40 mL glass vials completely full and topped with a teflon cap. Once capped the vial must be inverted and tapped to check for headspace/air presence (bubbles). If air is present the sample vial will be discarded, and re-collected until free of air.
- Field filtration will be performed if dictated by the project Work Plan.
- Sample labels/sample identification
- All samples must be labeled with:
  - A unique sample number;
  - Date and time;
  - Parameters to be analyzed;
  - Project Reference ID; and
  - Sampler's initials.
- Labels should be secured to the bottle and should be written in indelible inks.

EQUIPMENT/MATERIALS

- pH meter, conductivity meter, dissolved oxygen (DO) meter, oxidation-reduction (redox) reaction potential (ORP) meter, nephlometer, temperature gauge.
- Field filtration units (if required).
- Purging/sampling equipment:
  - Peristaltic pump (not suitable for VOCs[1]/SVOCs or depths >25 feet);
  - Suction pumps (not suitable for LFP, VOCs/SVOCs, or depths >25 feet);
  - Submersible pumps (suitable for VOCs/SVOCs only at low flow rates);
  - Air lift pumps (not suitable for VOCs/SVOCs);
  - Bladder pumps (suitable for LFR and VOCs/SVOCs);
  - Inertia pumps (gaining acceptability for VOCs/SVOCs generally not suited for GM programs); and
  - Bailers (not suitable for LFP generally not suited for GM programs).
- Water level probe.
- Sampling materials (containers, log book/forms, coolers, chain-of-custody).
- Work Plan.
- Health and Safety Plan.

Note[1]: Peristaltic pump use for VOC collection is not acceptable on EPA/RCRA sites; this technique has gained acceptance in select areas where it is permissible to collect VOCs using a peristaltic pump at a low flow rate (ex. Michigan).

Field Notes

Field notes must document all the events, equipment used, and measurements collected during the sampling activities. FMG 1.4 - Data Recording - Field Books/Digital Recording describes the data/recording procedure for field activities. The log book should document the following for each well sampled:

- Identification of well.
- Well depth.
- Static water level depth and measurement technique.
- Sounded well depth.
- Presence of immiscible layers and detection/collection method.
- Well yield – high or low.
- Purge volume and pumping rate.

- Time well purged.
- Measured field parameters.
- Purge/sampling device used.
- Well sampling sequence.
- Sampling appearance.
- Sample odors.
- Sample volume.
- Types of sample containers and sample identification.
- Preservative(s) used.
- Parameters requested for analysis.
- Field analysis data and method(s).
- Sample distribution and transporter.
- Laboratory shipped to.
- Chain-of-custody number for shipment to laboratory.
- Field observations on sampling event.
- Name collector(s).
- Climatic conditions including air temperature.
- Problems encountered and any deviations made from the established sampling protocol.

A standard log form for documentation and reporting groundwater purging and sampling events are to be used.

Groundwater/Decon Fluid Disposal

Groundwater disposal methods will vary on a case-by-case basis but may range from:

- Off-site treatment at private treatment/disposal facilities or public owned treatment facilities.
- On-site treatment at Facility operated facilities.
- Direct discharge to the surrounding ground surface, allowing groundwater infiltration to the underlying subsurface regime.
- Direct discharge to impervious pavement surfaces, allowing evaporation to occur.

Decon fluids should be segregated and collected separately from wash waters/groundwater containers. Often small volumes of solvents used during the day can be allowed to evaporate if left in an open pail. In the event evaporation is not possible or practical, off-site disposal arrangements must be made.

REFERENCES

ASTM D5474 - Guide for Selection of Data Elements for Groundwater Investigations.

ASTM D4696 - Guide for Pore-Liquid Sampling from the Vadose Zone.

ASTM D5979 - Guide for Conceptualization and Characterization of Groundwater Systems.

ASTM D5903 - Guide for Planning and Preparing for a Groundwater Sampling Event.

ASTM D4448 - Standard Guide For Sampling Groundwater Wells.

ASTM D6001 - Standard Guide For Direct Push Water Sampling For Geo-Environmental Investigations.

USEPA. Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures (EPA/540/S-95/504).

USEPA. RCRA Groundwater Monitoring: Draft Technical Guidance (EPA/530-R-93-001).

OPERATING PROCEDURE: OP3014

NAPL DETECTION AND MONITORING

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PREPARATION AND APPROVALS

VERSION	AUTHORED/DATE	REVIEWED / DATE	REVIEWED / DATE	REVIEWED / DATE	APPROVED / DATE
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OPERATING PROCEDURE OP3014

NON-AQUEOUS PHASE LIQUID (NAPL) DETECTION AND MONITORING

1. PURPOSE

This procedure details the methodology for detection and monitoring for the presence of dense and light non-aqueous phase liquids (DNAPL and LNAPL), and the collection of NAPL samples for laboratory analysis in monitoring, observation, and extraction wells. The presence of NAPL may be indicated by a sheen on the water surface and/or a sheen/staining on a water level indicator device. If NAPL is suspected, the well shall be checked for the presence of NAPL after water level measurements have been taken and prior to groundwater sampling activities. It should be noted that groundwater sampling and analysis may not be appropriate at locations where NAPL has been identified.

The potential presence of NAPL (particularly DNAPL) may also be indicated by elevated dissolved-phase concentrations in water. A common "rule of thumb" is that dissolved-phase concentrations greater than 1% of the theoretical solubility limit of a compound may indicate potential NAPL presence.

2. EQUIPMENT & SUPPLIES

- Interface probe.
- Bottom-loading bailer.
- Double check valve bailer.
- Peristaltic pump.
- Inertial pump.
- Work Plan.
- Health and Safety Plan.

3. PROCEDURE

Conduct well identification, inspection, and opening in accordance with FMG 5.1 - Water Level Measurements.

- NAPL level measurements are best conducted using a dual phase interface probe. The interface probe uses an optical liquid sensor, in conjunction with an electric circuit to detect the top of a phase-separated liquid and the interface between the phase layer and water (water level). The procedure for use of this probe is:

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3.1 For LNAPL

1. Lower the probe tip into the center of the well until discontinuous beeping is heard (this indicates the top of the LNAPL has been detected and may vary depending upon the instrument - please refer to the operating manuals). Grasp the calibrated tape at the reference point and record reading. Confirm the reading by slowly raising and lowering the probe to the level of the phase layer. Note caution should be used in the measurement of the LNAPL, because more viscous forms of LNAPL may adhere to the measurement tape and result in thicker than actual NAPL measurements.

2. Once the top of the phase layer is confirmed, slowly lower the probe until a continuous sound is heard (may vary depending upon the instrument - please refer to the operating manuals). This indicates that the water level has been encountered. Grasp the tape at the reference point and record the reading. Again note that caution should be used because a more viscous LNAPL may adhere to the tape and result in thicker than actual NAPL measurements. Confirm this water level measurement by raising the interface probe until NAPL is indicated. Repeat the above steps as the interface probe is removed from the well.

3. Decontaminate the submerged end of the tape and probe prior to the next use in accordance with procedures appropriate for site-specific contaminants.

3.2 For DNAPL

1. After the water/LNAPL measurement is taken, slowly lower the probe tip in the center of the well to the bottom of the well, a discontinuous beeping will be heard if DNAPL is present. Grasp the calibrated tape at the reference point and note reading.

2. Once the bottom of the well is confirmed, slowly raise the probe until a continuous sound is heard. This indicates that the water level has been encountered and represents the top of the DNAPL layer. Grasp the tape at the reference point and note the reading. Confirm this water level measurement.

3. Decontaminate the submerged end of the tape and probe prior to the next use.

Alternative NAPL measurement methods exist in the event an interface probe is unavailable or not functioning properly. These methods tend to be less accurate than the interface probe but may be used to establish an estimated NAPL measurement. Note that LNAPL should be checked/measured first.

- Clear Bailer – A clear bottom-loading bailer may be used to estimate NAPL thickness. The bailer should be carefully lowered to the location of suspected NAPL presence (top of water column/base of water column) and slowly removed and examined for NAPL. If present, the column of NAPL within the clear bailer can be measured to estimate the NAPL thickness within the well. Note that the bailer material must be compatible with the products measured (some bailer check balls may float in DNAPL)

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- Weighted Cord or Telltale Rods – Primarily used for DNAPL measurements, a weighted "cotton" string, cord, or telltale rods may be lowered to the base of the well and inspected upon retrieval. Typically, the lower DNAPL layer will "coat" the string/rod indicating the approximate thickness of this layer. However, some DNAPLs may be colorless.

3.3 Well NAPL Sampling

1. Prior to sampling, the level of NAPL in the well should be measured as identified above.

2. Various sampling devices can be employed to acquire fluid samples from the top and bottom of the well, including the following:

   - Bottom-loading bailer;
   - Double check value bailer (produces most reliable results);
   - Peristaltic pump for shallow wells (<25 feet in depth); or
   - Inertial pump for deeper wells and larger thickness of product (up to 300 feet in depth).

3. Transfer NAPL to sample containers for shipment to laboratory. NAPL can be sampled to evaluate the physical properties of the fluid or to evaluate chemical composition.

4. Decontaminate equipment prior to next use.

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APPENDIX A
REFERENCES

- Cohen, Robert M., Mercer, James W. (GeoTrans, Inc.), Robert S. Kerr Environmental Research Laboratory "DNAPL Site Evaluation" Office Research and Development. U.S. Environmental Protection Agency

- Cohen, R.M., Brayda, A.P., Shaw, S.T., and Spaulding, C.P.; Fall 1992 "Evaluation of Visual Methods to Detect NAPL in Soil and Water", Groundwater Monitoring Review, Vol. 12 No. 4, pp. 132-141.

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APPENDIX B
RELATED HALEY & ALDRICH PROCEDURES

- OP1004 Operation/Calibration of PID Photoionization Detector
- OP1007 Field Monitoring for Volatile Organics (breathing space-work zone)
- OP1009 Medical Surveillance Program
- OP1010 Health and Safety Plans
- OP1022 Health and Safety Manual
- OP3000 General Environmental Field Procedures and Protocols
- OP3001 Preservation and Shipment of Environmental Samples
- OP3006 Procedures for Subsurface Soil Sampling and Chemical Analysis
- OP3008 Manual Water Level Measurement Procedure
- OP3009 Monitoring Well Development Procedure
- OP3010 Groundwater Quality Sampling Procedure
- OP3012 Low Stress/Low Flow Groundwater Sample Collection Procedure
- OP3014 NAPL Monitoring and Sampling
- OP3015 Aquifer Parameter Testing Procedure
- OP3026 Chain of Custody

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APPENDIX C
FORMS

Form 3001	Sampling Labels (Environmental)
Form 3003	Chain of Custody Record (Field)
Form 3005	Groundwater Sampling Record
Form 3006	Monitoring Well Devel Rpt
Form 3010	Low Flow Field Sampling Form

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APPENDIX D
GLOSSARY

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APPENDIX E

Standard Operating Procedure: OP3012 - Low Stress/Low Flow Groundwater Sample Collection

OPERATING PROCEDURE: OP3012

LOW STRESS/LOW FLOW GROUNDWATER SAMPLE COLLECTION PROCEDURE

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PREPARATION AND APPROVALS

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OPERATING PROCEDURE: OP3012

LOW STRESS/LOW FLOW GROUNDWATER SAMPLE COLLECTION PROCEDURE

1. PURPOSE

This document describes procedures for collection of groundwater samples for laboratory analysis utilizing the "Low Stress/Low Flow Method". This method should be employed when it is critical to collect groundwater samples not impacted by over-purging, aeration, and sediment/colloid presence. Although the procedures described in this document are generally appropriate for obtaining groundwater samples as part of Monitored Natural Attenuation (MNA) programs, a more complete procedure for MNA programs is described in a separate document (Monitored Natural Attenuation Sample Collection Procedure).

The method described herein is most appropriate for wells that can accept a submersible pump and have a screened interval of ten feet or less. However, the procedure is flexible and can be modified for a variety of well construction and groundwater yield situations. The low-flow purging and sampling method is not appropriate for use in all hydrogeologic regimes, and certain groundwater monitoring well designs may make the method unsuitable (e.g. open hole and long screen monitoring wells in bedrock and stratified sand and clay where the water bearing zones have not been characterized).
This procedure does not address wells that contain Non-Aqueous Phase Liquids (NAPLs).

Note: The methods described in this document are provided for training use and general information. Depending upon regulatory agency and other project specific requirements, appropriate field procedures may differ from those described herein. These procedures should be confirmed with the Haley & Aldrich Project Manager prior to implementation.

1.1 BACKGROUND

Research conducted by Puls et al. (1992), Puls and Powell (1992), and Powell and Puls (1993) has shown that high-volume purging and sampling cause significant turbidity and suspended particulate artifacts that can result in an overestimation of certain analytes of interest (e.g., metals or hydrophobic organic compounds). Additionally, standard purging procedures can cause pressure changes and bailing can cause aeration that can strip volatile organic compounds from groundwater samples (Pennino, 1988) and provide misrepresentative data on aquifer conditions (such as dissolved oxygen and redox). Overpurging of a well can cause water to cascade down the well screen, causing undesirable aeration and volatilization.

The use of low-flow pumping devices for purging and sampling minimizes both the disturbance of water in well casing and the potential for mobilization of colloidal material (Barcelona et al., 1994). Low-flow purging with maintenance of water level in the well and stabilization of indicator parameters (especially turbidity) allows collection of groundwater samples that are more representative of conditions without filtering (U.S. EPA, 1993; Backhus et al., 1993). In many cases, use of a low-flow pump to purge and sample monitoring

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wells decreases sampling time, reduces the need to handle large volumes of purge water and lowers the cost associated with its disposal, and may allow collection of samples for without filtering.

Low-flow refers to the velocity with which water enters the pump intake and that is imparted to the formation pore water in the immediate vicinity of the well screen. It does not necessarily refer to the flow rate of water discharged at the surface that can be affected by flow regulators or restriction. Water level drawdown provides the best indication of the stress imparted by a given flow-rate for a given hydrological situation. The objective is to pump in a manner that minimizes stress (drawdown) to the system to the extent practicable taking into account established site sampling objectives (USEPA, Puls and Barcelona, April 1996).

2. EQUIPMENT & SUPPLIES

1. Adjustable rate, positive displacement pumps (e.g. low flow-rate submersible centrifugal or bladder pumps constructed of stainless steel or Teflon). The pump should be easily adjustable and capable of operating reliably at lower flow rates. An example is QED MicroPurge bladder pump (available for purchase or rental at US Environmental 781-899-6969, among others).

   Under most regulatory programs, peristaltic pumps may be used for collection of inorganic samples only – they are NOT appropriate for collection of VOCs. Bailers are inappropriate for use in this procedure. Waterra tubing purging and sampling is also not recommended for low-flow sampling by the USEPA.

2. Tubing: Tubing used in purging and sampling each well must be dedicated to the individual well. Once properly located, moving the pump in the well should be avoided. Consequently, the same tubing should be used for purging and sampling. The tubing wall thickness should be maximized (3/8 to ½ inch) and the tubing length should be minimized (i.e. do not have excess tubing outside of the well)

   - **Organic analysis**: Teflon or Teflon-lined polyethylene tubing must be used to collect samples.
   - **Inorganic analysis**: Teflon or Teflon lined polyethylene, PVC, Tygon or polyethylene tubing may be used to collect samples.

3. Polyethylene sheeting and sampling gloves.

4. Water level measuring device, 0.01 feet accuracy, (electronic preferred for tracking water level drawdown during all pumping operations).

5. Flow measurement supplies (e.g. graduated cylinder and stopwatch).

6. Interface probe, if needed.

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7. Power source (e.g. generator, located downwind; nitrogen tank, etc). The generator should not be oversized for the pump.

8. In-line flow-through cell containing purge criteria parameter monitoring instruments for pH, turbidity, specific conductance, temperature, Eh and dissolved oxygen (DO). The in-line device should be bypassed or disconnected during sample collection. An example is the Horiba U-22 which is a flow-through cell that comes with probes capable of measuring pH, dissolved oxygen, conductivity, salinity, TDS, temperature, turbidity and oxidation-reduction potential. Available from Ashtead Technologies, 800.242.3910, www.ashtead-technology.com or Pine Environmental, 800-301-9663, www.pine-environmental.com, among others.

9. Photoionization detector (PID), or flame ionization detector (FID) or equivalent.

10. Nylon stay-ties

11. Decontamination supplies

12. Field book or well sampling form

13. Sample Bottles. It is recommended that preservatives be added to sample bottles prior to field activities to reduce potential error or introduction of contaminants.

14. Sample preservation supplies (as required by the analytical method; see previous item)

15. Sample tags or labels, and chain of custody.

16. Well construction data, location map, field data from last sampling event.

17. Sampling Plan or Work Plan

18. Health & Safety Plan

19. pH meter

20. Conductivity meter

21. Dissolved Oxygen (DO) meter

22. Oxidation -reduction (REDOX) reaction potential (ORP) meter

23. Nephlometer (turbidity)

24. Temperature gauge

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25. Field test kits (such as Hach kits for measurement of dissolved iron (Fe^{+2}), carbon dioxide, and alkalinity). See the document "Monitored Natural Attenuation Groundwater Sample Collection Procedure" for specifications and ordering information for these types of kits.

26. Field filtration units (if required)

3. PROCEDURE

3.1 Sampling Preparatory Activities

Prior to entering the field there are several activities that should be conducted. The activities are as follows:

- Obtain and review a copy of the Sampling or Work Plan and Health & Safety Plan.
- Obtain and review previous groundwater sampling data (if available), previous water level measurements and well construction details (total depth and length of well screen).
- Locate a site map denoting the wells to be sampled.
- Obtain well wrenches, well keys and any other equipment needed to access the wells.
- Coordinate site access.
- Coordinate with laboratory to obtain sample bottles and necessary quality assurance samples.
- Perform an inventory of necessary purging, sampling, and field measurement equipment. Certain equipment may need to be purchased or rented for the sampling event. Check field measurement probes for proper calibration and ensure that the probes and kits are complete (i.e., contain calibration and analytical solutions) for the entire sampling event.

3.2 Preliminary Site Activities

Once on site the following activities should be conducted prior to beginning sampling.

- Verify well identification and location using borehole log details and location site map. Check the condition of the well and record any evidence of damage or need for repair in the field book or field sampling form. Following field activities inform the Project Manager of any necessary repair work required.
- Lay out sheet of clean polyethylene around the well for monitoring and sampling equipment.

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- Prior to opening the well cap, measure the breathing space above the well casing with a PID or FID to establish baseline levels. Repeat this measurement once the well cap is opened. If either of these measurements exceeds the air quality criteria in the health and safety plan, field personnel should adjust their PPE accordingly.

- If the well does not have a water level reference point (usually a V-cut or indelible mark in the well casing), make one. Describe its location and record the date of the mark in the field book or sampling form.

- Collect a round of synoptic water level measurements and well depth (in the shortest possible time) before any purging or sampling activities begin. Water levels and well depths should be measured and reported to 0.01 ft. The water levels should be obtained from the denoted reference point on the well.

- Water level and total depth measurements must be obtained to determine the well volume for hydraulic purposes. In some settings it maybe necessary to allow the water level time to equilibrate. This condition exists if a watertight seal exists at the well cap and the water level has fluctuated above the top of screen thereby creating a vacuum or pressurized area in this air space. Three water level checks will verify static water level conditions or changing conditions.

- Check newly constructed wells for the presence of light or dense aqueous phase liquids before sampling.

3.3 Sampling Procedure

It is preferable to sample the wells in order of increasing chemical concentrations (known or anticipated). The following describes the procedure for the low-flow purging and sampling method. Equipment calibration, logbook documentation, sample bottle filling and preservation, and shipping will be conducted in accordance with the site-specific Quality Assurance Project Plan (QAPjP). Personal protective equipment will be donned in accordance with the requirements of the site-specific Health and Safety Plan.

1. Attach and secure the polyethylene tubing to the low-flow pump. See the equipment and materials section for recommended pump types. As the pump is slowly lowered into the well, secure the safety drop cable, tubing, and electrical lines to each other using nylon stay-ties. It is recommended that the pump be placed in the well 12 to (preferably) 48 hours prior to purging/sampling to minimize the effects of turbidity and mixing in the well from introducing the pump.

2. Pump, safety cable, tubing and electrical lines should be lowered slowly into the well to a depth corresponding to the center of the saturated screen section of the well, or at a location determined to either be a preferential flow path or zone where contamination is present. The pump intake should be kept above the bottom of the well to prevent mobilization of any sediment present in the bottom of the well.

3. Before starting the pump, measure the water level again with the pump in the well. Start pumping water from the well at a rate of **100 to 500 milliliters per minute (mL/min) which correlates to 0.03**

to 0.13 gallons per minute. Avoid surging. Observe air bubbles displaced from discharge tube to assess progress of steady pumping until water arrives at the surface. The pumping rate should cause little or no water level drawdown in the well (less than 0.2 ft) and the water level should stabilize.

Water level measurements should be made every three to five minutes. Precautions should be taken to avoid pump suction loss or air entrainment. Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to avoid pumping the well dry and ensure stabilization of indicator parameters. If the recharge rate of the well is very low, purging should be interrupted so as not to cause the drawdown within the well to advance below the pump intake but the operator should attempt to maintain a steady flow rate with the pump to the extent practicable. Record adjustments made to the pumping rates and water levels immediately after each adjustment.

In low-yielding wells, where 100 mL/min exceeds the entrance rate of groundwater into the well, it is important to avoid dewatering the well screen interval and purging the well dry should be avoided to the extent possible. In these cases, the pump should remain in place and the water level should be allowed to recover repeatedly until there is sufficient volume in the well to permit collection of samples. Under these low-yield conditions, it may become difficult to maintain an adequate water volume in the flow-through cell described in the next step. An alternative means of sample collection may be necessary under these conditions and should be discussed with the Project Manager.

4. While purging the well, measurements of water quality indicator parameters utilizing an in-line flow-through cell (or similar equipment) should be collected every three to five minutes until all of the parameters have stabilized. See the Equipment and Materials section for recommendations. Stabilization is achieved when three successive readings are within the following tolerances noted in the table below.

Parameter	Stabilization Level (3 successive readings within)
Turbidity	+10% and final value between 5 and 10 NTU
Specific conductance	+3%
pH	±0.1
Dissolved oxygen (DO)	±10%
Redox potential (Eh)	±10mv

In general, the order of stabilization is pH, temperature and specific conductance, followed by redox potential, dissolved oxygen, and turbidity (USEPA, 1996). A minimum subset of these parameters that can be used to determine stabilization during purging in this procedure are pH, specific conductivity and turbidity or DO. Turbidity and DO are typically the last parameters to stabilize. If the parameters have stabilized, but the turbidity is not in the range of 10 NTU, then follow step 6. For informational purposes, the following table provides typical ranges of the various field parameters. Field data collected during purging and sampling should be compared against these values and, if substantial differences exist, the accuracy of the meter should be verified to rule out potential operational problems with the equipment.

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Parameter	Typical Range of Values
Turbidity	10 – 500 NTU
Specific conductance	50 – 500 mS
pH	6 - 9
Dissolved oxygen (DO)	ND – 9 mg/L
Redox potential (Eh)	-250 - +400 mV

5. Once stabilization has been documented, go to step 8.

6. Should stabilization not be achieved for all field parameters (or turbidity only as described in Step 4), purging is continued until a maximum of 20 well screen volumes have been purged from the well. Since low-flow purging (LFP) likely will not draw groundwater from a significant distance above or below the pump intake, the screen volume is based upon a 5-foot (1.4 m) screen length. After purging 20 well screen volumes, purging is continued if the purge water remains visually turbid and appears to be clearing, or if stabilization parameters are varying slightly outside of the stabilization criteria listed above and appear to be approaching stabilization.

   - If low-turbidity samples are critical to the project goals, purging will be extended until turbidity has been reduced to 5 NTU or less.

   - The pump must not be removed from the well between purging and sampling.

7. If the turbidity measurements do not approach the range of that of natural groundwater (10 NTU), both filtered and unfiltered samples should be collected for analysis of compounds such as metals or hydrophobic compounds[1]. Filtered metal samples are to be collected with an in-line filter. A high capacity, in-line 0.45 micron particulate filter must be pre-rinsed according to the manufacturers recommendations, or with approximately 1 liter of groundwater following purging and prior to sampling. After the sample is filtered it must be preserved immediately.

8. Collect groundwater samples. All sample containers should be filled by allowing the pump discharge to gently flow down inside the container with minimal turbulence. The flow-through cell, or similar equipment, should be bypassed during sampling. As each sample bottle is collected, the bottle should be labeled with the following information then place into a cooler with the proper temperature control.

   - Sample number/ID
   - Date and time
   - Parameters to be analyzed
   - Project Reference ID
   - Samplers initials

[1] Filtering of samples for analysis is a project-specific requirement and should be confirmed with the Project Manager prior to filtration.

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After collection of the samples, the tubing from the pump should be properly discarded or dedicated to the well for re-sampling (by hanging the tubing inside the well). Avoid handling the interior of the bottle or bottle cap and don new gloves for each well sampled to avoid contamination of the sample.

VOC and gas sensitive (e.g. Fe^{+2}, CH_4, H_2S/HS) parameter samples should be collected first. Refer the project sampling and analysis plan to determine which analytes will be measured in the field (wellhead) and which will be submitted to a fixed-base laboratory. The order of sample collection is as follows:

1. Volatile organic compounds
2. Gas sensitive parameters (e.g. Fe^{+2}, CH_4, H_2S/HS)
3. Semi-volatile organic compounds
4. Total organic carbon (TOC)
5. Total organic halogens (TOX)
6. Extractable organics
7. Total metals
8. Dissolved metals
9. Phenols
10. Cyanide
11. Sulfate and chloride
12. Nitrate and ammonia
13. Radionuclides

*Note: **The pumping rate used to collect a sample for VOCs should not exceed 100 mL/min.** Samples should be transferred directly to the final container 40 mL glass vials completely full and topped with a Teflon cap. Once capped the vial must be inverted and tapped to check for headspace/air presence (bubbles). If air is present the sample vial will be discarded, and re-collected until free of air. Field filtration will be performed if dictated by the project Work Plan.*

9. Measure and record final water level and well depth.

10. Secure the well (close and lock).

3.4 Decontamination

Decontaminate sampling equipment prior to use in the first well and following sampling of each subsequent well. Pumps will not be removed from well between purging and sampling operations. The pump and tubing (including support cable and electrical wires that are in contact with the well) will be decontaminated by one of the procedures listed below.

3.4.1 Procedure 1

Decontamination solutions can be pumped from buckets through the pump, or the pump can be disassembled and flushed with the decontamination solutions. It is recommended that the detergent

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and isopropyl alcohol be used sparingly in the decontamination process and that water-flushing steps be extended to ensure that any sediment trapped in the pump is removed. The pump exterior and electrical wires must be rinsed with the decontaminating solutions, as well. The procedure is as follows:

1. Flush the equipment/pump with potable water.

2. Flush with non-phosphate detergent solution. If the solution is recycled, the solution must be changed periodically.

3. Flush with potable or distilled/deionized water to remove all of the detergent solution. If the water is recycled, the water must be changed periodically.

4. Flush with isopropyl alcohol (pesticide grade). If equipment blank data from the previous sampling event shows that the level of contamination is low, then this step may be skipped.

5. Flush with distilled/deionized water. The final water rinse must not be recycled.

6. Decontaminate the in-line flow-through cell and other sampling equipment with similar procedures, as appropriate.

3.4.2 Procedure 2

1. Steam clean the outside of the submersible pump.

2. Pump hot potable water from the steam cleaner through the outside of the pump. This can be accomplished by placing the pump inside a three or four inch diameter PVC pipe with cap. Hot water from the steam cleaner jet will be directed inside the PVC pipe and the pump exterior will be cleaned. The hot water from the steam cleaner will then be pumped from the PVC pipe through the pump and collected into another container. Note: additives or solutions should not be added to the steam cleaner.

3. Pump non-phosphate detergent solution through the inside of the pump. If the solution is recycled, the solution must be changed periodically.

4. Pump potable water through the inside of the pump to remove all of the detergent solution. If the solution is recycled, the solution must be changed periodically.
5. Pump distilled/deionized water through the pump. The final water rinse must not be recycled.

6. Decontaminate the in-line flow-through cell and other sampling equipment with appropriate procedures.

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3.5 Field Documentation

Field notes must document all the events, equipment used, and measurements collected during the sampling activities. The logbook or sampling form (see Appendix C Forms) should document the following for each well sampled:

- Identification of well
- Well depth
- Static water level depth and measurement technique
- Sounded well depth
- Presence of immiscible layers and detection/collection method
- Well yield - high or low
- Purge volume and pumping rate
- Time well purged
- Measured field parameters - record measurements obtained every 3-5 minutes to monitor for stabilization, see attached example record log.
- Purge/sampling device used
- Well sampling sequence
- Sampling appearance
- Sample odors
- Sample volume
- Types of sample containers and sample identification
- Preservative(s) used
- Parameters requested for analysis
- Field analysis data and method(s)
- Sample distribution and transporter

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- Laboratory shipped to
- Chain of custody number for shipment to laboratory
- Field observations on sampling event
- Name collector(s)
- Climatic conditions including air temperature
- Problems encountered and any deviations made from the established sampling protocol.

3.6 Groundwater/Decontamination Fluid Disposal

Groundwater disposal methods will vary on a case-by-case basis and field personnel should consult the Project Manager for site-specific requirements. Disposal options may include:

- Off-site treatment at private treatment/disposal facilities or public owned treatment facilities.
- On-site treatment at Facility operated facilities.
- Direct discharge to the surrounding ground surface, allowing groundwater infiltration to the underlying subsurface regime.
- Direct discharge to impervious pavement surfaces, allowing evaporation to occur
- Decontamination fluids should be segregated and collected separately from wash waters/groundwater containers. Often small volumes of solvents used during the day can be allowed to evaporate if left in an open pail. In the event evaporation is not possible or practical, off-site disposal arrangements must be made.

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APPENDIX A
REFERENCES

- USEPA Low-flow (minimal drawdown) groundwater sampling procedures (EPA/540/S-95/504), April 1996.
- USEPA Ground-Water Sampling-A Workshop Summary, Dallas, Texas, November 30 - December 2, 1993. EPA/600/R-94/205.
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- Barcelona, M.J., H.A. Wehrmann, and M.D. Varljen. 1994. Reproducible Well Purging Procedures and VOC Stabilization Criteria for Ground-Water Sampling. Ground Water. V. 32, pp. 12-22.
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- Puls, R.W. and R.M. Powell. 1992. Acquisition of Representative Ground Water Quality Samples for Metals. Ground Water Monitoring Review. V. 12, pp. 167-176.
- Puls, R.W., D.A. Clark, B. Bledsoe, R.M. Powell, and C.J. Paul. 1992. Metals in Ground Water: Sampling Artifacts and Reproducibility. Hazardous Waste and Hazardous Materials. V. 9, pp. 149-162.
- USEPA Region 3. 1997. Recommended Procedure for Low-Flow Purging and Sampling of Groundwater Monitoring Wells. Waste and Chemicals Management Division - Low Flow Sampling. Bulletin No. QAD023.
- USEPA Region 1. 1996. Low Stress (Low Flow) Purging and Sampling for the Collection of Groundwater Samples from Monitoring Wells. SOP #: GW 001. Revision 2. pp.13.
- USEPA Region 2. 1998. Ground Water Sampling Procedure, Low Stress (Low Flow) Purging and Sampling. GW Sampling SOP, Final.

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APPENDIX B
RELATED HALEY & ALDRICH PROCEDURES

- OP3000 General Environmental Field Procedures and Protocol
- OP3001 Preservation and Shipment of Environmental Samples
- OP3008 Manual Water Level Measurement Procedure
- OP3009 Monitoring Well Development Procedure
- OP3010 Groundwater Quality Sampling Procedure
- OP3013 Monitored Natural Attenuation Groundwater Sample Collection Procedure
- OP3014 NAPL Monitoring and Sampling Procedure

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APPENDIX C
FORMS

- Form 3001 Sampling Labels (Environmental)
- Form 3003 Chain of Custody
- Form 3004 Sampling Record
- Form 3005 Groundwater Sampling Record
- Form 3006 Monitoring Well Development Report

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Sample ID:	File Number:
Depth:	Project:
Date:	Analysis:
Time:	Preservative:
Collected By:	Laboratory:
Comments:	

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Collected By:	Laboratory:
Comments:	

Form 3001

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CHAIN OF CUSTODY RECORD

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Page of

H&A FILE NO.		LABORATORY		DELIVERY DATE	
PROJECT NAME		ADDRESS		TURNAROUND TIME	
H&A CONTACT		CONTACT		PROJECT MANAGER	

Sample No.	Date	Time	Depth	Type	VOA	ABNs PAH only	Metals RCRA (8) PP(13)	Pesticides PCBs	VPH Full Suite C-ranges only	EPH Full Suite C-ranges only	TPH (specify)	TCLP (specify)	Reactivity Ignitability Corrosivity				Number of Containers	Comments (special instructions, precautions, additional method numbers, etc.)

Analysis Requested

Sampled and Relinquished by	Received by
Sign	Sign
Print	Print
Firm	Firm
Date Time	Date Time
Relinquished by	**Received by**
Sign	Sign
Print	Print
Firm	Firm
Date Time	Date Time
Relinquished by	**Received by**
Sign	Sign
Print	Print
Firm	Firm
Date Time	Date Time

LIQUID													
													VOA Vial
													Amber Glass
													Plastic Bottle
													Preservative
													Volume
SOLID													
													VOA Vial
													Amber Glass
													Clear Glass
													Preservative
													Volume

Sampling Comments

Evidence samples were tampered with? YES NO

If YES, please explain in section below.

PRESERVATION KEY

A Sample chilled	**C** NaOH	**E** H_2SO_4	**G** Methanol
B Sample filtered	**D** HNO_3	**F** HCL	**H** Sodium Bisulfate

WHITE - Laboratory **CANARY** - Project Manager **PINK** - Haley & Aldrich Laboratory **GOLDENROD** - Haley & Aldrich Contact

Form 3003

WATER AND WASTEWATER METHODS

Analysis Description	Method No.	Preservative	Solid Sample Volume/Container	Liquid Sample Volume/Container	Holding Time
Alkalinity	310	Cool 4° C	N/A	250 mL HDPE	14 days
Amenable Cyanide	Std. Mth. 412 F.	pH>12 NaOH, Cool 4° C	N/A	1 L HDPE	14 days
Ammonia	350	pH<2 H2SO4, Cool 4° C	N/A	1 L HDPE	28 days
Base/Neutral & Acid Extractables	625	Cool 4° C	N/A	1 L Amber	7 days Ext/40 days Analyze
Biochemical Oxygen Demand (BOD)	405.1	Cool 4° C	N/A	2 L HDPE	48 hours
Chemical Oxygen Demand (COD)	410	pH<2 H2SO4, Cool 4° C	N/A	125 mL HDPE	28 days
Chloride	300.0, 325	None Required	N/A	125 mL HDPE	28 days
Chromium, Hexavalent	3500D, 218.4/5	None Required	N/A	1 L HDPE	24 hours
Fluoride	300.0, 340	None Required	N/A	500 mL HDPE	28 days
Hardness, Total (as CaCO3)	130	pH<2 H2SO4, Cool 4° C	N/A	250 mL HDPE	6 Months
Nitrate	300.0, 352.1	Cool 4° C	N/A	250 mL HDPE	48 Hours
Nitrite	300.0, 354.1	Cool 4° C	N/A	125 mL HDPE	48 Hours
Orthophosphate	300.0, 365	Filter, Cool 4° C	N/A	125 mL HDPE	48 Hours
PCBs	608	Cool 4° C	N/A	1 L Amber	7 days Ext/40 days Analyze
Pesticides	608	Cool 4° C	N/A	1 L Amber	7 days Ext/40 days Analyze
Physiologically Available Cyanid	MADEP draft	pH>12 NaOH, 4° C	N/A	1 L HDPE	14 days
Priority Pollutant Metals (13 Metals	200.7/AA, 200 Series	pH<2 HNO3, 4° C	N/A	1 L HDPE	28 days (Hg), 6 mos. (others)
Purgeable Halocarbons & Aromatics	601/602	pH 2 HCl, Cool 4° C	N/A	40 mL Glass Vial	14 days
RCRA Metals (8 Metals)	200.7/AA, 200 Series	pH<2 HNO3, 4° C	N/A	1 L HDPE	28 days (Hg), 6 mos. (others)
Sulfate	300.0, 375	Cool 4° C	N/A	250 mL HDPE	28 days
Sulfide	376	pH>9 NaOH, Zn Acetate, Cool 4° C	N/A	1 L HDPE	7 days
Sulfite	377.1	None Required	N/A	125 mL HDPE	Analyze Immediately
Total Cyanide	335	pH>12 NaOH, Cool 4° C	N/A	1 L HDPE	14 days
Total Dissolved Solids (TDS)	209	Cool 4° C	N/A	250 mL HDPE	7 days
Total Organic Carbon (TOC)	415	pH<2 HCl or H2SO4, Cool 4° C, Dark	N/A	40 mL Amber	28 days
Total Organic Halogen (TOX)	506	pH<2 HNO3, 4° C	N/A	1 L Amber	check with lab
Total Phenolics	420.1	pH<2 H2SO4, Cool 4° C	N/A	1 L Amber	28 days
Total Phosphorus	365	pH<2 H2SO4, Cool 4oC	N/A	125 mL HDPE	28 days
Total Solids (TS)	160.3	Cool 4° C	N/A	250 mL HDPE	7 days
Total Suspended Solids (TSS)	160.2	Cool 4° C	N/A	250 mL HDPE	7 days
Volatile Organics	624	pH 2 HCl, Cool 4° C	N/A	40 mL Glass Vial	14 days
Weak and Dissociable Cyanide	Std. Mth. 412 H.	pH>12 NaOH, Cool 4° C	N/A	1 L HDPE	14 days
DRINKING WATER ANALYSIS					
Volatile Organics	502.2 or 524.2	pH 2 HCl, Cool 4° C	N/A	40 mL Glass Vial	14 days
MICROBIOLOGY					
Fecal Coliform	STDMTH	Cool 4o C	N/A	sterile, 125 mL	6 hours
Standard Plate Count	STDMTH	Cool 4o C	N/A	sterile, 125 mL	6 hours
Total Coliform	STDMTH	Cool 4o C	N/A	sterile, 125 mL	6 hours
Yeast and Mold	STDMTH	Cool 4o C	N/A	sterile, 125 mL	6 hours

SOIL/SEDIMENTS/WATER

Analysis Description	Method No.	Solids (S) / Liquids (L) Preservative	Solid Sample Volume/Container	Liquid Sample Volume/Container	Holding Time
Acid Extractables/Base/Neutral Extractables	8270	S/L: Cool 4° C	8 oz. CWM	1 L Amber	7 days Ext/40 days Analyze
Amenable Cyanide	-	S: 4° C / L: pH>12 NaOH, 4° C	4 oz. CWM	1 L HDPE	14 days
Chromium, Hexavalent	3060A/7196	S/L: Cool 4° C	8 oz. CWM	1 L HDPE	24 hours
Extractable Hydrocarbons	8015B	S: Cool 4° C / L: pH<2 HCl, 4° C	8 oz. CWM	1 L Amber	7 days Ext/40 days Analyze
Herbicides	8150	S/L: Cool 4° C	8 oz. CWM	1 L Amber	7 days Ext/40 days Analyze
Non-Halogenated Organics	8015B	S: Cool 4° C / L: pH<2 HCl, 4° C	4 oz. CWM	40 mL Glass Vial	14 days
PAH (low level)	8310 or GC/MS SIM	S/L: Cool 4° C	8 oz. AWM	1 L Amber	7 days Ext/40 days Analyze
Paint Filter Liquids Test	9095	S: Cool 4° C	8 oz. CWM	1 L Amber	Analyze ASAP
PCBs	8082	S/L: Cool 4° C	8 oz. CWM	1 L Amber	7 days Ext/40 days Analyze
Pesticides	8081	S/L: Cool 4° C	8 oz. CWM	1 L Amber	7 days Ext/40 days Analyze
Physiologically Available Cyanid	MADEP draft	S: 4° C / L: pH>12 NaOH, 4° C	4 oz. CWM	1 L HDPE	14 days
Priority Pollutant Metals(13 Metals)	6010&7000	S: 4° C / L: pH<2 HNO3, 4° C	8 oz. CWM	1 L Amber	28 days (Hg), 6 mos. (others)
RCRA Metals (8 Metals)	6010&7000	S: 4° C / L: pH<2 HNO3, 4° C	8 oz. CWM	1 L Amber	28 days (Hg), 6 mos. (others)
Total Cyanide	9010	S: 4° C / L: pH>12 NaOH, 4° C	4 oz. CWM	1 L HDPE	14 days
Volatile Hydrocarbons	8015B	S: Cool 4° C / L: pH<2 HCl, 4° C	4 oz. CWM	40 mL Glass Vial	14 days
Volatile Organics	8260B, 8021	S: methanol/$NaHSO_4$, 4° C / L: pH<2 HCl, 4° C	4 oz. CWM	40 mL Glass Vial	14 days
RCRA HAZARDOUS WASTE CHARACTERIZATION					
Corrosivity (pH only)	SW846-7.2	S: Cool 4° C	4 oz. CWM	check with lab	Analyze ASAP
Ignitability/Flashpoin	SW846-7.1	S: Cool 4° C	4 oz. CWM	check with lab	Analyze ASAP
Reactivity (CN-/S2-)	SW846-7.3	S: Cool 4° C	4 oz. CWM	check with lab	Analyze ASAP
TCLP (RCRA 8) Metals (check for mercury)	1311	S: Cool 4° C	16 oz. CWM	check with lab	6 mos. Ext/6 mos. Analyze
TCLP Pesticides/Herbicides	1311	S: Cool 4° C	16 oz. CWM	check with lab	14 days Ext/40 days Analyze
TCLP Semivolatiles	1311	S: Cool 4° C	16 oz. CWM	check with lab	14 days Ext/40 days Analyze
TCLP Volatiles	1311	S: Cool 4° C	8 oz. CWM	check with lab	14 days Ext/14 days Analyze
HYDROCARBON OIL & GREASE ANALYSIS					
MADEP EPH Method	MADEP REV. 0	S: Cool 4° C / L: pH<2 HCl, 4° C	4 oz. Amber	1 L Amber	S:7 days Ext / L:14 days Ext
MADEP EPH Method (C-Ranges only)	MADEP REV. 0	S: Cool 4° C / L: pH<2 HCl, 4° C	4 oz. Amber	1 L Amber	S:7 days Ext / L:14 days Ext
MADEP VPH Method	MADEP REV. 0	S: methanol, 4° C / L: pH<2 HCl, 4° C	40 mL+2 oz. CWM.	40 mL Glass Vial	S: 28 days / L: 14 days
MADEP VPH Method (C-Ranges only)	MADEP REV. 0	S: methanol, 4° C / L: pH<2 HCl, 4° C	40 mL+2 oz. CWM.	40 mL Glass Vial	S: 28 days / L: 14 days
MADEP EPH Method - with selected PAHs (including acenaphthene, naphthalene, 2-methylnaphthalene, and phenanthrene	MADEP REV. 0	S: Cool 4° C / L: pH<2 HCl, 4° C	4 oz. Amber	1 L Amber	S:7 days Ext / L:14 days Ext
Petroleum Identification	ASTM D3328				
Quantitative (include Chromatograms		S: Cool 4° C / L: pH<2 H_2SO_4, 4° C	4 oz. CWM	1 L Amber	S: 7 days / L: 28 days
Total Petroleum Hydrocarbons (Infrared	418.1	S: Cool 4° C / L: pH<2 H_2SO_4, 4° C	4 oz. CWM	1 L Amber	S: 7 days / L: 28 days

AIR METHODS

Analysis Description	Method No.	Preservative	Sample Volume/Container		Holding Time
Volatile Organic Compounds	EPA T01/T02	tubes: 4° C; Tedlar Bags: dark	N/A	N/A	tube: 14 days; bag: 72 hours
Volatile Organic Compounds	EPA T014	check with lab	N/A	N/A	can: 14 days; bag: 72 hours
VPH in air	EPA T01/T02	tubes: 4° C; Tedlar Bags: dark	N/A	N/A	tube: 14 days; bag: 72 hours
VPH in air	EPA T014	check with lab	N/A	N/A	can: 14 days; bag: 72 hours

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SAMPLING RECORD

Page of

PROJECT _____ H&A FILE NO. _____
LOCATION _____ PROJECT MGR. _____
CLIENT _____ FIELD REP _____
CONTRACTOR _____ DATE _____

Weather _____ Temperature _____
Ground surface Conditions ☐ Dry ☐ Wet ☐ Damp ☐ Standing Water ☐ Snow (____in) ☐ Other_____
Comments _____

SOIL SAMPLING AND SURFACE WATER SAMPLING INFORMATION

Sample No.	Location	Depth (ft)	Time	Sample Description	Sampling Device	Cleaning Prodedure	Container Type

General Comments: (ie: field filtrations, persons communicated with at site, etc.)

Form 3004

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GROUNDWATER SAMPLING RECORD

Page of

PROJECT		H&A FILE NO.	
LOCATION		PROJECT MGR.	
CLIENT		FIELD REP	
CONTRACTOR		DATE	

GROUNDWATER SAMPLING INFORMATION

Well No.							
Water Depth (ft)							
Time							
Product							
Depth Of Well (ft)							
Inside Diameter (in)							
Standing Water Depth (ft) (1)							
Volume Of Water In Well (gal)							
Purging Device							
Volume of Bailer/Pump Capacity							
Cleaning Procedure							
Bails Removed/ Volume Removed							
Time Purging Started							
Time Purging Stopped							
Sampling Device							
Cleaning Procedure							
TIME SAMPLES TAKEN	VOA						
	ABN						
	Metals						
PARAMETERS	Color						
	Odor						
	pH						
	Conductivity						
	Turbidity						
	Dissolved Oxygen						
	Temp, ^{0} C						
	Salinity						

Remarks: (ie: field filtrations, persons communicated with at site, etc.)

1. Standing Water Depth = Depth of Well - Water Depth

Form 3005

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MONITORING WELL DEVELOPMENT REPORT

Well No.

PROJECT		H&A FILE NO.	
LOCATION		PROJECT MGR.	
CLIENT		FIELD REP.	
CONTRACTOR		DATE	
ELEVATION SUBTRAHEND			

Estimated Volume of Water Lost During Drilling: _____ gallons

Comments: _____

Depth to Water Before Development: _____ feet

Comments: _____

Depth to Well Bottom Before Development: _____ feet

Comments: _____

Turubitiy of Water Before Development: _____ NTU

Comments: _____

Volume of Water Removed: _____ gallons

Comments: _____

Method of Removal (bailing, pumping): _____

Comments: _____

Depth to Well Bottom After Development: _____ feet

Comments: _____

Depth to Water After Development: _____ feet

Comments: _____

Turubitiy of Water After Development: _____ NTU

Comments: _____

APPENDIX F

Standard Operating Procedure OP3013 - Monitored Natural Attenuation Groundwater Sample Collection

OPERATING PROCEDURE: OP3013

MONITORED NATURAL ATTENUATION GROUNDWATER SAMPLE COLLECTION PROCEDURE

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PREPARATION AND APPROVALS

VERSION	AUTHORED/DATE	REVIEWED / DATE	REVIEWED / DATE	REVIEWED / DATE	APPROVED / DATE
Ver. 0.0	SLB/GMW / 05-01	NVD/ 05-01	GJM/ 06-03		JAK/ 06-03

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OPERATING PROCEDURE: OP3013

MONITORED NATURAL ATTENUATION GROUNDWATER SAMPLE COLLECTION PROCEDURE

1. PURPOSE

This document describes procedures for collection of groundwater samples as part of Monitored Natural Attenuation (MNA) programs. In general, the procedures described in this document are similar to those described in the "Low Stress/Low Flow Groundwater Sample Procedure" document. While this document will focus on collection of samples for MNA programs, low flow sampling is often utilized for collection of samples where entrained particulates or turbidity could negatively effect the samples. This approach is also appropriate for sites where bioremediation is either being implemented or planned.

With MNA and bioremediation programs, it is very important to obtain groundwater samples that are indicative of actual aquifer conditions, particularly with respect to assessing aquifer redox conditions. Standard purging and sampling procedures can cause aeration of groundwater and cause volatilization of organic compounds. Low-flow groundwater purging and sampling procedures should be employed to avoid aquifer stress, oxygenation of the water in the monitoring well, and contaminant loss from volatilization. In-line flow-through monitoring equipment should be used to monitor aquifer stabilization during purging and for collection of many field groundwater analytical parameters. Many parameters should be obtained immediately at the wellhead (rather than at a fixed-base laboratory) to limit geochemical changes during sample transport.

A summary of natural attenuation groundwater sampling parameters is attached to this document as Table 1.

Note: The methods described in this document are provided for training use and general information. Depending upon regulatory agency and other project specific requirements, appropriate field procedures may differ from those described herein. These procedures should be confirmed with the Haley & Aldrich Project Manager prior to implementation.

1.1 Background

As defined by USEPA, Monitored Natural Attenuation (MNA) is a combination of physical, chemical and biological processes including biodegradation, sorption, dilution, diffusion, dispersion, volatilization, and chemical transformation that act to reduce measurable contaminant concentrations in the subsurface environment. Some of the processes, namely biodegradation and chemical transformation, are destructive and act to reduce contaminant mass.

These MNA processes cause geochemical shifts, or "footprints" to occur in an aquifer. MNA programs are designed to evaluate these footprints to assess how processes are acting to reduce and stabilize contaminant concentrations. MNA programs are applicable to many classes of contaminants, but this procedure is limited to assessing MNA at sites impacted by chlorinated solvents, petroleum compounds, and metals.

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To assess the extent to which the above processes are active in an aquifer, it is important to obtain groundwater samples that are representative of aquifer conditions. Research has shown that standard purging and sampling procedures (high flow rate, removal of 3-5 well volumes, sample collection with bailers) can cause pressure changes and aeration that can strip volatile organic compounds from groundwater samples (Pennino, 1988). These methods can also provide misrepresentative data on aquifer conditions particularly important in MNA evaluations, such as dissolved oxygen and redox. This document describes appropriate purging and sampling procedures, summarizes the recommended list of groundwater analytical parameters, and provides recommendations for appropriate analytical procedures including analysis of some parameters at the wellhead immediately after purging. A sampling form is included with this procedure and should be used to record water level and field parameter measurements to monitor for stabilization of groundwater conditions during purging.

Although the procedures in this document highly recommend the use of submersible pumps capable of low flow rates and in-line flow through monitoring equipment, certain project restrictions or well construction may inhibit the use of this equipment. Alternate procedures for groundwater sampling using conventional sampling equipment such as bailers are provided, but should not be used unless absolutely necessary.

2. EQUIPMENT & SUPPLIES

1. Adjustable rate, positive displacement pumps (e.g. low flow-rate submersible centrifugal or bladder pumps constructed of stainless steel or Teflon). The pump should be easily adjustable and capable of operating reliably at lower flow rates. An example is QED MicroPurge bladder pump (available for purchase or rental at US Environmental 781-899-6969, among others).

   Under some regulatory programs, peristaltic pumps may be used for collection of inorganic samples only – they are NOT viewed as appropriate for collection of VOCs (NYSDEC holds this view). Bailers are inappropriate for collection of groundwater samples for MNA programs, and should not be used unless absolutely necessary. Purging and sampling with Waterra tubing purging is also not recommended for low-flow/MNA sampling by the USEPA. Contact Sue Boyle (585-321-4222) if Waterra sampling is necessary.

2. Tubing: Tubing used in purging and sampling each well must be dedicated to the individual well. Once properly located, moving the pump in the well should be avoided. Consequently, the same tubing should be used for purging and sampling. The tubing wall thickness should be maximized (3/8 to ½ inch) and the tubing length should be minimized (i.e. do not have excess tubing outside of the well)

   - **Organic analysis**: Teflon or Teflon-lined polyethylene tubing must be used to collect samples.
   - **Inorganic analysis**: Teflon or Teflon lined polyethylene, PVC, Tygon or polyethylene tubing may be used to collect samples.

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3. Polyethylene sheeting and sampling gloves.

4. Water level measuring device, 0.01 feet accuracy, (electronic preferred for tracking water level drawdown during all pumping operations).

5. Flow measurement supplies (e.g. graduated cylinder and stopwatch).

6. Interface probe, if needed.

7. Power source (e.g. generator, located downwind; nitrogen tank, etc). The generator should not be oversized for the pump.

8. In-line flow-through cell containing purge criteria parameter monitoring instruments for pH, turbidity, specific conductance, temperature, Eh and dissolved oxygen (DO). The in-line device should be bypassed or disconnected during sample collection. An example is the Horiba U-22 which is a flow-through cell that comes with probes capable of measuring pH, dissolved oxygen, conductivity, salinity, TDS, temperature, turbidity and oxidation-reduction potential. Available from Ashtead Technologies, 800.242.3910, www.ashtead-technology.com or Pine Environmental, 800-301-9663, www.pine-environmental.com, among others.

9. Photoionization detector (PID), or equivalent.

10. Nylon stay-ties.

11. Decontamination supplies.

12. Field book or well sampling form.

13. Sample Bottles. It is recommended that preservatives be added to sample bottles prior to field activities to reduce potential error or introduction of contaminants.

14. Sample preservation supplies (as required by the analytical method; see previous item).

15. Sample tags or labels, and chain of custody.

16. Well construction data, location map, field data from last sampling event.

17. Sampling Plan or Work Plan

18. Health & Safety Plan

19. pH meter

20. Conductivity meter

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21. Dissolved Oxygen (DO) meter

22. Oxidation -reduction (REDOX) reaction potential (ORP) meter

23. Nephlometer (turbidity)

24. Temperature gauge

25. Field test kits (such as Hach kits – www.hach.com- for measurement of dissolved iron (Fe^{+2}), carbon dioxide, and alkalinity.

26. Field filtration units (if required)

3. PROCEDURE

3.1 Sampling Preparatory Activities

Prior to entering the field there are several activities that should be conducted. The activities are as follows:

1. Obtain and review a copy of the Sampling or Work Plan and Health & Safety Plan.

2. Obtain and review previous groundwater sampling data (if available), previous water level measurements and well construction details (total depth and length of well screen).

3. Obtain and review the "MNA Sampling Form".

4. Locate a site map denoting the wells to be sampled.

5. Obtain well wrenches, well keys and any other equipment needed to access the wells.

6. Coordinate site access.

7. Coordinate with laboratory to obtain sample bottles and necessary quality assurance samples.

8. Perform an inventory of necessary purging, sampling, and field measurement equipment. Certain equipment may need to be purchased or rented for the sampling event. Check field measurement probes for proper calibration and ensure that the probes and kits are complete (i.e., contain calibration and analytical solutions) for the entire sampling event.

3.2 Preliminary Site Activities

Once on-site, the following activities should be conducted prior to beginning sampling:

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- Verify well identification and location using borehole log details and location site map. Check the condition of the well and record any evidence of damage or need for repair in the field book or field sampling form. Following field activities inform the Project Manager of any necessary repair work required.

- Lay out sheet of clean polyethylene around the well for monitoring and sampling equipment.

- Prior to opening the well cap, measure the breathing space above the well casing with a PID or FID to establish baseline levels. Repeat this measurement once the well cap is opened. If either of these measurements exceeds the air quality criteria in the health and safety plan, field personnel should adjust their PPE accordingly.

- If the well does not have a water level reference point (usually a V-cut or indelible mark in the well casing), make one. Describe its location and record the date of the mark in the field book or sampling form.

- Obtain a round of synoptic water level measurements and well depth (in the shortest possible time) before any purging or sampling activities begin. Water levels and well depths should be measured and reported to 0.01 ft.

  Water level and total depth measurements must be obtained to determine the well volume for hydraulic purposes. In some settings it maybe necessary to allow the water level time to equilibrate. This condition exists if a watertight seal exists at the well cap and the water level has fluctuated above the top of screen thereby creating a vacuum or pressurized area in this air space. Three water level checks will verify static water level conditions or changing conditions.

- Check newly constructed wells for the presence of light or dense aqueous phase liquids before sampling.

3.3 Sampling Procedure

It is preferable to sample the wells in order of increasing chemical concentrations (known or anticipated). Equipment calibration, logbook documentation, sample bottle filling and preservation, and shipping will be conducted in accordance with the site-specific Quality Assurance Project Plan (QAPjP). Personal protective equipment will be donned in accordance with the requirements of the site-specific Health and Safety Plan.

1. Follow the procedures described in the Preliminary Site Activities section above.

2. Attach and secure the polyethylene tubing to the low-flow pump. See the equipment and materials section for recommended pump types. As the pump is slowly lowered into the well, secure the safety drop cable, tubing, and electrical lines to each other using nylon stay-ties. It is recommended that the pump be placed in the well 12 to (preferably) 48 hours prior to purging/sampling to minimize the effects of turbidity and mixing in the well from introducing the pump. This may not be feasible for many project applications.

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3. Pump, safety cable, tubing and electrical lines should be lowered slowly into the well to a depth corresponding to the center of the saturated screen section of the well, or at a location determined to either be a preferential flow path or zone where contamination is present. The pump intake should be kept above the bottom of the well to prevent mobilization of any sediment present in the bottom of the well.

4. Before starting the pump, measure and record the water level again with the pump in the well. Start pumping water from the well at a rate of **100 to 500 milliliters per minute (mL/min) which correlates to 0.03 to 0.13 gallons per minute**. Avoid surging. Observe air bubbles displaced from discharge tube to assess progress of steady pumping until water arrives at the surface. The pumping rate should cause little or no water level drawdown in the well (less than 0.2 ft) and the water level should stabilize.

   Water level measurements should be obtained and recorded every three to five minutes. Precautions should be taken to avoid pump suction loss or air entrainment. Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to avoid pumping the well dry and ensure stabilization of indicator parameters. If the recharge rate of the well is very low, purging should be interrupted so as not to cause the drawdown within the well to advance below the pump intake but the operator should attempt to maintain a steady flow rate with the pump to the extent practicable. Record adjustments made to the pumping rates and water levels immediately after each adjustment.

   In low-yielding wells, where 100 mL/min exceeds the entrance rate of groundwater into the well, it is important to avoid dewatering the well screen interval. In these cases, the pump should remain in place and the water level should be allowed to recover repeatedly until there is sufficient volume in the well to permit collection of samples. Under these low-yield conditions, it may become difficult to maintain an adequate water volume in the flow-through cell described in the next step. Often, a well recharges too slowly to adhere to these procedures, but efforts should be made to obtain a sample that is representative of aquifer conditions. An alternative means of sample collection may be necessary under these conditions and should be discussed with the Project Manager, or field oversight staff.

5. While purging the well, measurements of water quality indicator parameters utilizing an in-line flow-through cell (or similar equipment) should be collected every three to five minutes until all of the parameters have stabilized. See the Equipment and Materials section for recommendations. Stabilization is achieved when three successive readings are within the following tolerances noted in the table below.

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Table 1
Parameter Stabilization Levels

Parameter	Stabilization Level (3 successive readings within)
Turbidity	+10% and final value between 5 and 10 NTU
Specific conductance	+3%
pH	±0.1
Dissolved oxygen (DO)	±10%
Redox potential (Eh)	±10mv

In general, the order of stabilization is pH, temperature and specific conductance, followed by redox potential, dissolved oxygen, and turbidity (USEPA, 1996). A minimum subset of these parameters that can be used to determine stabilization during purging in this procedure are pH, specific conductivity and turbidity or DO. Turbidity and DO are typically the last parameters to stabilize. If the parameters have stabilized, but the turbidity is not in the range of 5-10 NTU, then follow step 6.

For informational purposes, the following table provides typical ranges of the various field parameters. Field data collected during purging and sampling should be compared against these values and, if substantial differences exist, the accuracy of the meter should be verified to rule out potential operational problems with the equipment. As a field check for accuracy of the data, compare the dissolved oxygen and redox measurements, they should correlate. For example a depressed dissolved oxygen reading (approximately <0.5 mg/L) should correlate with depressed redox reading (approximately <0 mV).

Table 2
Parameter Ranges

Parameter	Typical Range of Values
Turbidity	10 – 500 NTU
Specific conductance	50 – 500 mS
pH	6 - 9
Dissolved oxygen (DO)	ND – 9 mg/L
Redox potential (Eh)	-250 - +400 mV

6. Once stabilization has been documented, go to step 8.

7. Should stabilization not be achieved for all field parameters purging is continued until a maximum of 20 well screen volumes have been purged from the well. [Note: Because purging of this volume groundwater could negatively impact project costs, the project manager should be contacted if difficulties in attaining stabilization occur]. Since low-flow purging (LFP) likely will not draw groundwater from a significant distance above or below the pump intake, the screen volume is based

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upon a 5-foot (1.4 m) screen length. After purging 20 well screen volumes, purging is continued if the purge water remains visually turbid and appears to be clearing, or if stabilization parameters are varying slightly outside of the stabilization criteria listed above and appear to be approaching stabilization.

- If low-turbidity samples are critical to the project goals, purging will be extended until turbidity has been reduced to 5 NTU or less.
- The pump must not be removed from the well between purging and sampling.

8. If the turbidity measurements do not approach the range of that of natural groundwater (10 NTU), both filtered and unfiltered samples should be collected for analysis of compounds such as metals or hydrophobic compounds[1]. If appropriate, filtered metal samples are to be collected with an in-line filter. A high capacity, in-line 0.45 micron particulate filter must be pre-rinsed according to the manufacturers recommendations, or with approximately 1 liter of groundwater following purging and prior to sampling. After the sample is filtered it must be preserved immediately.

9. Collect groundwater samples. All sample containers should be filled by allowing the pump discharge to gently flow down inside the container with minimal turbulence. The flow-through cell, or similar equipment, should be bypassed during sampling. As each sample bottle is collected, the bottle should be labeled with the following information then place into a cooler with the proper temperature control.

   - Sample number/ID
   - Date and time
   - Parameters to be analyzed
   - Project Reference ID
   - Samplers initials

   After collection of the samples, the tubing from the pump should be properly discarded or dedicated to the well for re-sampling (by hanging the tubing inside the well). Avoid handling the interior of the bottle or bottle cap and don new gloves for each well sampled to avoid contamination of the sample.

   VOC and gas sensitive (e.g. Fe^{+2}, ethene, ethane, methane) parameter samples should be collected first. Refer to the Summary of Natural Attenuation Parameters (Table 1) attached to this document (or the project sampling and analysis plan) to determine which analytes will be measured in the field (wellhead) and which will be submitted to a fixed-base laboratory. Not all parameters will be obtained on each site, during each sampling event. The actual parameters collected will be based on the project requirements. The recommended order of sample collection is as follows:

   1. Volatile organic compounds

[1] Filtering of samples for analysis is a project-specific requirement and should be confirmed with the Project Manager prior to filtration.

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2. Gas sensitive parameters (e.g. Fe+2, ethene, ethane, methane) and other wellhead parameters. Note that for MNA programs, the method of collection of Fe+2 is at the wellhead with a colorimetric kit (i.e. Hach, www.Hach.com). Other wellhead parameters such as alkalinity and carbon dioxide should also be obtained at this time, with appropriate colorimetric kit.

3. Semi-volatile organic compounds

4. Dissolved organic carbon

5. Extractable organics

6. Total metals

7. Dissolved metals (see number 2 above)

8. Phenols

9. Cyanide

10. Sulfate, nitrate, nitrogen/ammonia, and chloride

11. Radionuclides

Note: ***The pumping rate used to collect a sample for VOCs should not exceed 100 mL/min.*** *Samples should be transferred directly to the final container 40 mL glass vials completely full and topped with a Teflon cap. Once capped the vial must be inverted and tapped to check for headspace/air presence (bubbles). If air is present the sample vial will be discarded, and re-collected until free of air. Field filtration will be performed only if dictated by the project Work Plan.*

10. Measure and record final water level and well depth.

11. Secure the well (close and lock).

3.4 Alternate Sampling Procedure

It is understood that project restrictions or well construction may not allow the use of a submersible pump for groundwater purging and sampling. This alternate procedure describes groundwater sampling with conventional equipment such as bailers. Because the use of bailers, or similar equipment, can cause collection of samples that are misrepresentative of aquifer conditions, this alternate procedure should not be used unless absolutely necessary.

1. Follow the Preliminary Site Procedures above.

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2. Attach an appropriate length of new polyethylene rope to the end of bailer. Measure and mark on the rope the depth that corresponds to the bottom of the bailer located at the middle of the well screen interval.

3. Check for light or dense non-aqueous phase liquids.

4. Slowly lower the bailer into the water column so that the intake at bottom of the bailer is located at the midpoint of the well screen. Purge 3 to 5 well volumes of groundwater, or as indicated by the project requirements. Care should be taken to perform the purging slowly and carefully, to avoid agitation and oxygenation of the groundwater in the monitoring well.

5. Once purging is completed, groundwater samples should be obtained with the bailer. The groundwater should be poured slowly into the sample collection vials, to limit oxygenation and volatilization. The order of sample collection described in the Sample Procedure section above should be followed.

6. Because in-line flow-through equipment cannot be used, collection of field parameters that are representative of aquifer conditions will require extra care. After collection of the groundwater samples is complete, groundwater should be poured slowly into a clean, small beaker/container for measurement with the various field probes.

3.5 Decontamination

Decontaminate sampling equipment prior to use in the first well and following sampling of each subsequent well. Pumps will not be removed from well between purging and sampling operations. The pump and tubing (including support cable and electrical wires that are in contact with the well) will be decontaminated by one of the procedures listed below.

3.5.1 Procedure 1

Decontamination solutions can be pumped from buckets through the pump, or the pump can be disassembled and flushed with the decontamination solutions. It is recommended that the detergent and isopropyl alcohol be used sparingly in the decontamination process and that water-flushing steps be extended to ensure that any sediment trapped in the pump is removed. The pump exterior and electrical wires must be rinsed with the decontaminating solutions, as well. The procedure is as follows:

1. Flush the equipment/pump with potable water.

2. Flush with non-phosphate detergent solution. If the solution is recycled, the solution must be changed periodically.

3. Flush with potable or distilled/deionized water to remove all of the detergent solution. If the water is recycled, the water must be changed periodically

Review Draft

4. Flush with isopropyl alcohol (pesticide grade). If equipment blank data from the previous sampling event shows that the level of contamination is low, then this step may be skipped.

5. Flush with distilled/deionized water. The final water rinse must not be recycled.
6. Decontaminate the in-line flow-through cell and other sampling equipment with similar procedures, as appropriate.

3.5.2 Procedure 2

1. Steam-clean the outside of the submersible pump.

2. Pump hot potable water from the steam cleaner through the outside of the pump. This can be accomplished by placing the pump inside a three or four inch diameter PVC pipe with cap. Hot water from the steam cleaner jet will be directed inside the PVC pipe and the pump exterior will be cleaned. The hot water from the steam cleaner will then be pumped from the PVC pipe through the pump and collected into another container. Note: additives or solutions should not be added to the steam cleaner.

3. Pump non-phosphate detergent solution through the inside of the pump. If the solution is recycled, the solution must be changed periodically.

4. Pump potable water through the inside of the pump to remove all of the detergent solution. If the solution is recycled, the solution must be changed periodically.

5. Pump distilled/deionized water through the pump. The final water rinse must not be recycled.

6. Decontaminate the in-line flow-through cell and other sampling equipment with appropriate procedures.

3.6 Field Documentation

Field notes must document all the events, equipment used, and measurements collected during the sampling activities. In addition to the information recorded on Table 2 – MNA Field Sampling Form, the logbook should document the following for each well sampled:

1. Identification of well

2. Well depth

3. Static water level depth and measurement technique

4. Sounded well depth

5. Presence of immiscible layers and detection/collection method

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6. Well yield - high or low
7. Purge volume and pumping rate
8. Time well purged
9. Measured field parameters - record measurements obtained every 3-5 minutes to monitor for stabilization, see attached example record log.
10. Purge/sampling device used
11. Well sampling sequence
12. Sampling appearance
13. Sample odors
14. Sample volume
15. Types of sample containers and sample identification
16. Preservative(s) used
17. Parameters requested for analysis
18. Field analysis data and method(s)
19. Sample distribution and transporter
20. Laboratory shipped to
21. Chain of custody number for shipment to laboratory
22. Field observations on sampling event
23. Name collector(s)
24. Climatic conditions including air temperature
25. Problems encountered and any deviations made from the established sampling protocol.

3.7 Groundwater/Decon Fluid Disposal

Groundwater disposal methods will vary on a case-by-case basis (consult the Project Manager) but may range from:

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Off-site treatment at private treatment/disposal facilities or public owned treatment facilities

On-site treatment at Facility operated facilities

Direct discharge to the surrounding ground surface, allowing groundwater infiltration to the underlying subsurface regime

Direct discharge to impervious pavement surfaces, allowing evaporation to occur

Decontamination fluids should be segregated and collected separately from wash waters/groundwater containers. Often small volumes of solvents used during the day can be allowed to evaporate if left in an open pail. In the event evaporation is not possible or practical, off-site disposal arrangements must be made.

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APPENDIX A
REFERENCES

- USEPA Low-flow (minimal drawdown) groundwater sampling procedures (EPA/540/S-95/504), April 1996.
- USEPA: Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater, EPA/600/R-98/128 September 1998.
- National Research Council, 2000. Natural Attenuation for Groundwater Remediation, pp. 176-77.
- Barcelona, M.J., H.A. Wehrmann, and M.D. Varljen. 1994. Reproducible Well Purging Procedures and VOC Stabilization Criteria for Ground-Water Sampling. Ground Water. V. 32, pp. 12-22.
- Pennino, J.D. 1988. There is No Such Thing as a Representative Ground Water Sample. Ground Water Monitoring Review. V 8, pp. 4-9.
- Puls, R.W. and R.M. Powell. 1992. Acquisition of Representative Ground Water Quality Samples for Metals. Ground Water Monitoring Review. V. 12, pp. 167-176.
- USEPA Region 3. 1997. Recommended Procedure for Low-Flow Purging and Sampling of Groundwater Monitoring Wells. Waste and Chemicals Management Division - Low Flow Sampling. Bulletin No. QAD023.
- USEPA Region 1. 1996. Low Stress (Low Flow) Purging and Sampling for the Collection of Groundwater Samples from Monitoring Wells. SOP #: GW 001. Revision 2. pp. 13.
- USEPA Region 2. 1998. Ground Water Sampling Procedure, Low Stress (Low Flow) Purging and Sampling. GW Sampling SOP, Final.

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Table 3 Summary of Natural Attenuation Groundwater Sampling Parameters

FIELD PARAMETERS

Analysis	Method/Reference	Minimum Level of Quantification	Comments	Data Use	Recommended Frequency of Analysis	Sample Volume, Sample Container, Sample Preservation	Field or Fixed~Base Laboratory
Alkalinity	Hach Alkalinity test kit model AL AP MG-L	50 mg/L	Phenolphthalein method	General water quality parameter used (1) as a marker to verify that all site samples are obtained from the same ground-water system and (2) to measure the buffering capacity of ground water. (3) indicator of biodegradation	Each sampling round	Collect 100 mL of water in glass container.	Field
Carbon Dioxide	Hach Carbon Dioxide Kit	10 mg/L	Field	Indicator of ongoing aerobic biodegradation, should correlate with alkalinity	Each sampling round	Collect 100 mL of water in glass or plastic container and analyze as soon as possible	Field
Iron (II) (Fe+2)	Colorimetric Hach Method #8146	0.5 mg/L	Filter if turbid.	May indicate an anaerobic degradation process due to depletion of oxygen, nitrate, and manganese.	Each sampling round	Collect 100 mL and analyze as soon as possible.	Field
pH	Field probe with direct reading meter calibrated in the field according to the supplier's specifications.	0.1 standard units	Field	Aerobic and anaerobic biological processes are pH-sensitive. Lower pH can be indication of biodegradation.	Each sampling round	Measure immediately after purging is complete site using a flow-through cell or over-flow cell.	Field
Conductivity	E120.I/SW9050,	50 µS/cm	direct reading meter	General water quality parameter used as a marker to verify that site samples are obtained from the same ground-water system.	Each sampling round	Collect 100 to 250 mL of water in a glass or plastic container.	Field
Temperature	Field probe with direct reading meter.	0 degrees Celsius	Field only	To determine if a well is adequately purged for sampling.	Each sampling round	Read from oxygen meter,	Field
Oxidation-reduction potential (ORP) or Redox	Field probe with direct reading meter.	-300 mV to 300 mV (necessary range)	Field only, care should be taken to not aerate the sample during sampling.	To determine the redox conditions in groundwater for assessing biodegradation potential.	Each sampling round	Measure immediately after purging is complete site using a flow-through cell or over-flow cell.	Field
Dissolved Oxygen	Field probe with direct reading meter.	0.1 mg/L	Field only, care should be taken to not aerate the sample during sampling.	To determine the level of dissolved oxygen in groundwater (assessing biodegradation potential.)	Each sampling round	Measure dissolved oxygen on site using a flow-through cell or over-flow cell.	Field

Table 3 Summary of Natural Attenuation Groundwater Sampling Parameters

FIXED LABORATORY

Analysis	Method/Reference	Minimum Level of Quantification	Comments	Data Use	Recommended Frequency of Analysis	Sample Volume, Sample Container, Sample Preservation	Field or Fixed-Base Laboratory
Chloride	EPA 325.1	1 mg/L	Mercuric nitrate titration (Ion chromatography (IC) method E300 or method SW9050 may also be used)	General water quality parameter used as a marker to verify that site samples are obtained from the same ground-water system. Final product of chlorinated solvent reduction.	Each sampling round	Collect 250 mL of water in a glass container. **cool to 4°C**	Fixed-base
Nitrate	EPA 353.2	0.1 mg/L	If using E300, do not preserve with H_2SO4	Substrate for microbial respiration if oxygen is depleted.	Each sampling round	Collect to 250 mL of water in a glass or plastic container; **add H_2SO_4 to pH less than 2, cool to 4°C.**	Fixed-base
Nitrite	EPA 353.2	0.1 mg/L	E300 acceptable alternate	Substrate for microbial respiration if oxygen is depleted.	Each sampling round	Collect to 250 mL of water in a glass or plastic container, **cool to 4°C.**	Fixed-base
Nitrogen, Kjeldahl, TKN	EPA 351.2	0.1 mg/L		Determination of ammonia plus organic nitrogen for calculation of bio-available organic nitrogen	Each sampling round	Collect to 250 mL of water in a glass or plastic container **add H_2SO_4 to pH less than 2, cool to 4°C, .**	Fixed-base
Nitrogen, Ammonia	EPA 350.2	0.1 mg/L		See above	Each sampling round	Collect to 250 mL of water in a glass or plastic, **add H_2SO_4 to pH less than 2, cool to 4°C.**	Fixed-base
Sulfate (SO_4^{2-})	EPA 375.4	5 mg/L	(Ion chromatography (IC) method E300 or method SW9050 may also be used)	Substrate for anaerobic microbial respiration.	Each sampling round	Collect to 250 mL of water in a glass or plastic container; **cool to 4°C**	Fixed-base
Phosphorous	EPA 365.1	0.05 mg/L		Determination of nutrient concentration.	Each sampling round	Collect to 250 mL of water in a glass or plastic, **add H_2SO_4 to pH less than 2, cool to 4°C.**	Fixed-base

Table 3 Summary of Natural Attenuation Groundwater Sampling Parameters

FIXED LABORATORY, CONT'D

Analysis	Method/Reference	Minimum Level of Quantification	Comments	Data Use	Recommended Frequency of Analysis	Sample Volume, Sample Container, Sample Preservation	Field or Fixed-Base Laboratory
Total Iron and Dissolved and Total Manganese	SW6010	1 mg/L	ICP Atomic Emission Spectroscopy	To determine if anaerobic biological activity is solubilizing manganese from the aquifer matrix material. To determine the total amount of iron present in groundwater.	One round of sampling	Collect 100 ml in a glass or plastic container that is rinsed in the field with the ground water to be sampled. **Field filter dissolved Mn sample and adjust pH to 2 with nitric acid.** Do not insert pH paper or an electrode into the sample.	Fixed-base
Aromatic and chlorinated hydrocarbons (BTEX, trimethylbenzene isomers, chlorinated compounds)	SW8260A	MCLs	Analysis may be extended to higher molecular weight alkyl benzenes	Method of analysis for BTEX and chlorinated solvents/byproducts, which are the primary target analytes for monitoring natural attenuation; method can be extended to higher molecular weight alkyl benzenes; trimethyl-benzenes are used to monitor plume dilution if degradation is primarily anaerobic.	Each sampling round	Collect water samples in a 40 mL VGA vial; **cool to 4°C**	Fixed-base
Methane, ethane, and ethene	Kampbell eral., 1989 and 1998 or SW3810 Modified	1 ug/L methane 5 ug/L ethane 5 ug/L ethene	Method published by researchers at the U.S. Environmental Protection Agency.	The presence of CH_4 suggests BTEX degradation via methanogenesis. Ethane and ethene data are used where chlorinated solvents are suspected of undergoing biological transformation.	Each sampling round	Collect water samples in 50 mL glass serum bottles with gray butyl /Teflon-faced septa and crimp caps. **cool to 4°C.**	Fixed-base
Dissolved Organic Carbon (DOC)	EPA 415.1	0.1 mg/L	UV/Persulfate Oxidation – Dohrmann Analyzer or equivalent	Used to classify plume and to assess the amount of carbon present to drive reductive dechlorination.	Each sampling round	Collect to two 40 mL vials, field filter and **add H_2SO_4 to pH less than 2, cool to 4°C.**	Fixed-base

NOTES:

1. "Hach" refers to the Hach Company catalog, 1990.
2. "SW" refers to *Standard Methods for the Examination of Water and Wastewater,* 1 8th edition, 1992.
3. "EPA" refers to *Methods for Chemical Analysis of Water and Wastes,* U.S. EPA, 1983.
4. "SW" refers to the *Test Methods for Evaluating Solid Waste, Physical, and Chemical Methods,* SW-846, U.S. EPA, 3rd edition, 1986.

APPENDIX B
Related Haley & Aldrich Procedures

- OP3000 General Environmental Field Procedures and Protocol
- OP3001 Preservation and Shipment of Environmental Samples
- OP3008 Manual Water Level Measurement Procedure
- OP3009 Monitoring Well Development Procedure
- OP3010 Groundwater Quality Sampling Procedure
- OP3012 Low Stress/Low Flow Groundwater Sampling Procedure
- OP3014 NAPL Monitoring and Sampling Procedure

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APPENDIX C
FORMS

- Form 3001 Sampling Labels (Environmental)
- Form 3003 Chain of Custody
- Form 3004 Sampling Record
- Form 3005 Groundwater Sampling Record
- Form 3006 Monitoring Well Development Report

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Haley & Aldrich, Inc.
465 Medford St., Suite 2200
Boston, MA 02129
Tel: 617-886-7400

Sample ID:	File Number:
Depth:	Project:
Date:	Analysis:
Time:	Preservative:
Collected By:	Laboratory:
Comments:	

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Tel: 617-886-7400

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Depth:	Project:
Date:	Analysis:
Time:	Preservative:
Collected By:	Laboratory:
Comments:	

Form 3001

HALEY & ALDRICH
Haley & Aldrich, Inc.
465 Medford St.,
Suite 2200,
Boston, MA 02129-1400

CHAIN OF CUSTODY RECORD

Phone (617) 886-7400
Fax (617) 886-7600

Page of

H&A FILE NO.		LABORATORY		DELIVERY DATE	
PROJECT NAME		ADDRESS		TURNAROUND TIME	
H&A CONTACT		CONTACT		PROJECT MANAGER	

Sample No.	Date	Time	Depth	Type	Analysis Requested: VOA	ABNs PAH only	Metals RCRA (8) PP(13)	Pesticides PCBs	VPH Full Suite C-ranges only	EPH Full Suite C-ranges only	TPH (specify)	TCLP (specify)	Reactivity Ignitability Corrosivity				Number of Containers	Comments (special instructions, precautions, additional method numbers, etc.)

Sampled and Relinquished by	Received by
Sign	Sign
Print	Print
Firm	Firm
Date Time	Date Time
Relinquished by	**Received by**
Sign	Sign
Print	Print
Firm	Firm
Date Time	Date Time
Relinquished by	**Received by**
Sign	Sign
Print	Print
Firm	Firm
Date Time	Date Time

LIQUID													
													VOA Vial
													Amber Glass
													Plastic Bottle
													Preservative
													Volume
SOLID													
													VOA Vial
													Amber Glass
													Clear Glass
													Preservative
													Volume

PRESERVATION KEY

A Sample chilled	**C** NaOH	**E** H_2SO_4	**G** Methanol
B Sample filtered	**D** HNO_3	**F** HCL	**H** Sodium Bisulfate

Sampling Comments

Evidence samples were tampered with? YES NO

If YES, please explain in section below.

WHITE - Laboratory **CANARY** - Project Manager **PINK** - Haley & Aldrich Laboratory **GOLDENROD** - Haley & Aldrich Contact

Form 3003

WATER AND WASTEWATER METHODS

Analysis Description	Method No.	Preservative	Solid Sample Volume/Container	Liquid Sample Volume/Container	Holding Time
Alkalinity	310	Cool 4° C	N/A	250 mL HDPE	14 days
Amenable Cyanide	Std. Mth. 412 F.	pH>12 NaOH, Cool 4° C	N/A	1 L HDPE	14 days
Ammonia	350	pH<2 H2SO4, Cool 4° C	N/A	1 L HDPE	28 days
Base/Neutral & Acid Extractables	625	Cool 4° C	N/A	1 L Amber	7 days Ext/40 days Analyze
Biochemical Oxygen Demand (BOD)	405.1	Cool 4° C	N/A	2 L HDPE	48 hours
Chemical Oxygen Demand (COD)	410	pH<2 H2SO4, Cool 4° C	N/A	125 mL HDPE	28 days
Chloride	300.0, 325	None Required	N/A	125 mL HDPE	28 days
Chromium, Hexavalent	3500D, 218.4/5	None Required	N/A	1 L HDPE	24 hours
Fluoride	300.0, 340	None Required	N/A	500 mL HDPE	28 days
Hardness, Total (as CaCO3)	130	pH<2 H2SO4, Cool 4° C	N/A	250 mL HDPE	6 Months
Nitrate	300.0, 352.1	Cool 4° C	N/A	250 mL HDPE	48 Hours
Nitrite	300.0, 354.1	Cool 4° C	N/A	125 mL HDPE	48 Hours
Orthophosphate	300.0, 365	Filter, Cool 4° C	N/A	125 mL HDPE	48 Hours
PCBs	608	Cool 4° C	N/A	1 L Amber	7 days Ext/40 days Analyze
Pesticides	608	Cool 4° C	N/A	1 L Amber	7 days Ext/40 days Analyze
Physiologically Available Cyanid	MADEP draft	pH>12 NaOH, 4° C	N/A	1 L HDPE	14 days
Priority Pollutant Metals (13 Metals	200.7/AA, 200 Series	pH<2 HNO3, 4° C	N/A	1 L HDPE	28 days (Hg), 6 mos. (others)
Purgeable Halocarbons & Aromatics	601/602	pH 2 HCl, Cool 4° C	N/A	40 mL Glass Vial	14 days
RCRA Metals (8 Metals)	200.7/AA, 200 Series	pH<2 HNO3, 4° C	N/A	1 L HDPE	28 days (Hg), 6 mos. (others)
Sulfate	300.0, 375	Cool 4° C	N/A	250 mL HDPE	28 days
Sulfide	376	pH>9 NaOH, Zn Acetate, Cool 4° C	N/A	1 L HDPE	7 days
Sulfite	377.1	None Required	N/A	125 mL HDPE	Analyze Immediately
Total Cyanide	335	pH>12 NaOH, Cool 4° C	N/A	1 L HDPE	14 days
Total Dissolved Solids (TDS)	209	Cool 4° C	N/A	250 mL HDPE	7 days
Total Organic Carbon (TOC)	415	pH<2 HCl or H2SO4, Cool 4° C, Dark	N/A	40 mL Amber	28 days
Total Organic Halogen (TOX)	506	pH<2 HNO3, 4° C	N/A	1 L Amber	check with lab
Total Phenolics	420.1	pH<2 H2SO4, Cool 4° C	N/A	1 L Amber	28 days
Total Phosphorus	365	pH<2 H2SO4, Cool 4oC	N/A	125 mL HDPE	28 days
Total Solids (TS)	160.3	Cool 4° C	N/A	250 mL HDPE	7 days
Total Suspended Solids (TSS)	160.2	Cool 4° C	N/A	250 mL HDPE	7 days
Volatile Organics	624	pH 2 HCl, Cool 4° C	N/A	40 mL Glass Vial	14 days
Weak and Dissociable Cyanide	Std. Mth. 412 H.	pH>12 NaOH, Cool 4° C	N/A	1 L HDPE	14 days
DRINKING WATER ANALYSIS					
Volatile Organics	502.2 or 524.2	pH 2 HCl, Cool 4° C	N/A	40 mL Glass Vial	14 days
MICROBIOLOGY					
Fecal Coliform	STDMTH	Cool 4o C	N/A	sterile, 125 mL	6 hours
Standard Plate Count	STDMTH	Cool 4o C	N/A	sterile, 125 mL	6 hours
Total Coliform	STDMTH	Cool 4o C	N/A	sterile, 125 mL	6 hours
Yeast and Mold	STDMTH	Cool 4o C	N/A	sterile, 125 mL	6 hours

SOIL/SEDIMENTS/WATER

Analysis Description	Method No.	Solids (S) / Liquids (L) Preservative	Solid Sample Volume/Container	Liquid Sample Volume/Container	Holding Time
Acid Extractables/Base/Neutral Extractables	8270	S/L: Cool 4° C	8 oz. CWM	1 L Amber	7 days Ext/40 days Analyze
Amenable Cyanide	-	S: 4° C / L: pH>12 NaOH, 4° C	4 oz. CWM	1 L HDPE	14 days
Chromium, Hexavalent	3060A/7196	S/L: Cool 4° C	8 oz. CWM	1 L HDPE	24 hours
Extractable Hydrocarbons	8015B	S: Cool 4° C / L: pH<2 HCl, 4° C	8 oz. CWM	1 L Amber	7 days Ext/40 days Analyze
Herbicides	8150	S/L: Cool 4° C	8 oz. CWM	1 L Amber	7 days Ext/40 days Analyze
Non-Halogenated Organics	8015B	S: Cool 4° C / L: pH<2 HCl, 4° C	4 oz. CWM	40 mL Glass Vial	14 days
PAH (low level)	8310 or GC/MS SIM	S/L: Cool 4° C	8 oz. AWM	1 L Amber	7 days Ext/40 days Analyze
Paint Filter Liquids Test	9095	S: Cool 4° C	8 oz. CWM	1 L Amber	Analyze ASAP
PCBs	8082	S/L: Cool 4° C	8 oz. CWM	1 L Amber	7 days Ext/40 days Analyze
Pesticides	8081	S/L: Cool 4° C	8 oz. CWM	1 L Amber	7 days Ext/40 days Analyze
Physiologically Available Cyanid	MADEP draft	S: 4° C / L: pH>12 NaOH, 4° C	4 oz. CWM	1 L HDPE	14 days
Priority Pollutant Metals(13 Metals)	6010&7000	S: 4° C / L: pH<2 HNO3, 4° C	8 oz. CWM	1 L Amber	28 days (Hg), 6 mos. (others)
RCRA Metals (8 Metals)	6010&7000	S: 4° C / L: pH<2 HNO3, 4° C	8 oz. CWM	1 L Amber	28 days (Hg), 6 mos. (others)
Total Cyanide	9010	S: 4° C / L: pH>12 NaOH, 4° C	4 oz. CWM	1 L HDPE	14 days
Volatile Hydrocarbons	8015B	S: Cool 4° C / L: pH<2 HCl, 4° C	4 oz. CWM	40 mL Glass Vial	14 days
Volatile Organics	8260B, 8021	S: methanol/$NaHSO_4$, 4° C / L: pH<2 HCl, 4° C	4 oz. CWM	40 mL Glass Vial	14 days
RCRA HAZARDOUS WASTE CHARACTERIZATION					
Corrosivity (pH only)	SW846-7.2	S: Cool 4° C	4 oz. CWM	check with lab	Analyze ASAP
Ignitability/Flashpoin	SW846-7.1	S: Cool 4° C	4 oz. CWM	check with lab	Analyze ASAP
Reactivity (CN-/S2-)	SW846-7.3	S: Cool 4° C	4 oz. CWM	check with lab	Analyze ASAP
TCLP (RCRA 8) Metals (check for mercury)	1311	S: Cool 4° C	16 oz. CWM	check with lab	6 mos. Ext/6 mos. Analyze
TCLP Pesticides/Herbicides	1311	S: Cool 4° C	16 oz. CWM	check with lab	14 days Ext/40 days Analyze
TCLP Semivolatiles	1311	S: Cool 4° C	16 oz. CWM	check with lab	14 days Ext/40 days Analyze
TCLP Volatiles	1311	S: Cool 4° C	8 oz. CWM	check with lab	14 days Ext/14 days Analyze
HYDROCARBON OIL & GREASE ANALYSIS					
MADEP EPH Method	MADEP REV. 0	S: Cool 4° C / L: pH<2 HCl, 4° C	4 oz. Amber	1 L Amber	S:7 days Ext / L:14 days Ext
MADEP EPH Method (C-Ranges only)	MADEP REV. 0	S: Cool 4° C / L: pH<2 HCl, 4° C	4 oz. Amber	1 L Amber	S:7 days Ext / L:14 days Ext
MADEP VPH Method	MADEP REV. 0	S: methanol, 4° C / L: pH<2 HCl, 4° C	40 mL+2 oz. CWM.	40 mL Glass Vial	S: 28 days / L: 14 days
MADEP VPH Method (C-Ranges only)	MADEP REV. 0	S: methanol, 4° C / L: pH<2 HCl, 4° C	40 mL+2 oz. CWM.	40 mL Glass Vial	S: 28 days / L: 14 days
MADEP EPH Method - with selected PAHs (including acenaphthene, naphthalene, 2-methylnaphthalene, and phenanthrene	MADEP REV. 0	S: Cool 4° C / L: pH<2 HCl, 4° C	4 oz. Amber	1 L Amber	S:7 days Ext / L:14 days Ext
Petroleum Identification	ASTM D3328				
Quantitative (include Chromatograms		S: Cool 4° C / L: pH<2 H_2SO_4, 4° C	4 oz. CWM	1 L Amber	S: 7 days / L: 28 days
Total Petroleum Hydrocarbons (Infrared	418.1	S: Cool 4° C / L: pH<2 H_2SO_4, 4° C	4 oz. CWM	1 L Amber	S: 7 days / L: 28 days

AIR METHODS

Analysis Description	Method No.	Preservative	Sample Volume/Container		Holding Time
Volatile Organic Compounds	EPA T01/T02	tubes: 4° C; Tedlar Bags: dark	N/A	N/A	tube: 14 days; bag: 72 hours
Volatile Organic Compounds	EPA T014	check with lab	N/A	N/A	can: 14 days; bag: 72 hours
VPH in air	EPA T01/T02	tubes: 4° C; Tedlar Bags: dark	N/A	N/A	tube: 14 days; bag: 72 hours
VPH in air	EPA T014	check with lab	N/A	N/A	can: 14 days; bag: 72 hours

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SAMPLING RECORD

Page of

PROJECT		H&A FILE NO.	
LOCATION		PROJECT MGR.	
CLIENT		FIELD REP	
CONTRACTOR		DATE	

Weather _____ Temperature _____

Ground surface Conditions ☐ Dry ☐ Wet ☐ Damp ☐ Standing Water ☐ Snow (____in) ☐ Other_____

Comments _____

SOIL SAMPLING AND SURFACE WATER SAMPLING INFORMATION

Sample No.	Location	Depth (ft)	Time	Sample Description	Sampling Device	Cleaning Prodedure	Container Type

General Comments: (ie: field filtrations, persons communicated with at site, etc.)

Form 3004

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GROUNDWATER SAMPLING RECORD

Page of

PROJECT		H&A FILE NO.	
LOCATION		PROJECT MGR.	
CLIENT		FIELD REP	
CONTRACTOR		DATE	

GROUNDWATER SAMPLING INFORMATION

Well No.							
Water Depth (ft)							
Time							
Product							
Depth Of Well (ft)							
Inside Diameter (in)							
Standing Water Depth (ft) (1)							
Volume Of Water In Well (gal)							
Purging Device							
Volume of Bailer/Pump Capacity							
Cleaning Procedure							
Bails Removed/ Volume Removed							
Time Purging Started							
Time Purging Stopped							
Sampling Device							
Cleaning Procedure							
TIME SAMPLES TAKEN	VOA						
	ABN						
	Metals						
PARAMETERS	Color						
	Odor						
	pH						
	Conductivity						
	Turbidity						
	Dissolved Oxygen						
	Temp, ^{0} C						
	Salinity						

Remarks: (ie: field filtrations, persons communicated with at site, etc.)

1. Standing Water Depth = Depth of Well - Water Depth

Form 3005

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MONITORING WELL DEVELOPMENT REPORT

Well No.

PROJECT		H&A FILE NO.	
LOCATION		PROJECT MGR.	
CLIENT		FIELD REP.	
CONTRACTOR		DATE	
ELEVATION SUBTRAHEND			

Estimated Volume of Water Lost During Drilling: _____ gallons

Comments: _____

Depth to Water Before Development: _____ feet

Comments: _____

Depth to Well Bottom Before Development: _____ feet

Comments: _____

Turubitiy of Water Before Development: _____ NTU

Comments: _____

Volume of Water Removed: _____ gallons

Comments: _____

Method of Removal (bailing, pumping): _____

Comments: _____

Depth to Well Bottom After Development: _____ feet

Comments: _____

Depth to Water After Development: _____ feet

Comments: _____

Turubitiy of Water After Development: _____ NTU

Comments: _____

APPENDIX G

Standard Operating Procedure: OP2001 – Identification and Description of Soils in the Field Using Visual-Manual Methods

OPERATING PROCEDURE: OP2001

IDENTIFICATION AND DESCRIPTION OF SOILS IN THE FIELD USING VISUAL-MANUAL METHODS

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PREPARATION AND APPROVALS

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OPERATING PROCEDURE: OP2001

IDENTIFICATION AND DESCRIPTION OF SOILS IN THE FIELD USING VISUAL-MANUAL METHODS

1. PURPOSE

This procedure provides methods of identifying soils in a field or office setting using visual examination and simple manual tests. Soil identification produces a Group Symbol and a Group Name for each soil identified. The Group Names and Group Symbols are based on the Unified Soil Classification System (USCS) described in ASTM Standard D2487. It is important to note that this method produces a **SOIL IDENTIFICATION** based on simple observations and does not produce a SOIL CLASSIFICATION. Soil classifications are determined using ASTM D2487 and require laboratory test results which may not be available for every project.

Additional descriptive information is also determined for each soil reviewed. The description includes soil properties such as color, consistency, odor, etc.

Haley & Aldrich (H&A) personnel are to use the techniques in OP2001 to identify and describe all soil samples from any source. The nature of this soil identification procedure makes it adaptable to various types of geologic terrain and provides a high degree of reproducibility and understanding among geoscience professionals everywhere.

IMPORTANT NOTE: It is not necessary to follow all of the methods in this procedure for every sample. Soils which appear similar can be grouped together based on one or two samples completely identified and described. Similar samples can be identified as the same soil based on performing only a few of the identification and descriptive procedures.

2. EQUIPMENT & SUPPLIES

Required		Optional	
1.	Knife, pocket	7.	Penetrometer, pocket
2.	Ruler, engineer's 6 ft. folding	8.	Torvane, pocket
3.	Scale, engineer's	9.	Color chart, Munsell's
4.	Marker, indelible, black	10.	Sieves
5.	Logs & Forms	11.	Test tube
6.	Lens, hand, magnifying	12.	Camera & film
		13.	Jars, sample with labels
		14	HCl (one part 10N HCl to three parts water

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3. PROCEDURE

3.1 Introduction to Soil Identification and Description

The Haley & Aldrich soil identification and description procedures follow the visual-manual procedure outlined in ASTM D2488. Two distinct tasks are required. First the soil is identified based on percentage of grain-size constituents. This process produces a Group Name and Group Symbol for the soil. Secondly, the soil is described. The additional descriptive information includes properties such as color, density or consistency, odor, structure, and geologic origin.

The Group Names and Group Symbols used to identify soils are determined using the flow charts shown in Figures 1 and 2. The Group Names and Group Symbols generated by this procedure are based on the Unified Soil Classification System. It is important to point out again that the soil Group names and Group Symbols determined using OP2001 and ASTM D2488 do not constitute a soil classification. When precise classification of soils is required for engineering purposes, the laboratory procedures outlined in ASTM D2487 must be used.

Soil identification is divided into three broad categories: **coarse grained** soils, for which the proportion and gradation of the components are most significant; **fine grained** soils, for which the degree of plasticity and dry strength are the controlling factor; and **organic** soils. Frequently, coarse grained and fine grained soils will occur in combination.

Soil identification is limited to soil particles smaller than 3 inches in size.

At the initiation of project planning, the Project Manager, Project Engineer or Scientist, and field personnel determine any project-specific requirements for soil identification and description. Project requirements may dictate the use of a different identification system. Different identification methods are permitted if our client requires them. Although identification systems vary to some degree, the procedural aspects of making the underlying observations and describing the soils encountered generally remain the same.

3.2 Definition of Soil Components

Soil Component	Size Range and Sieve Size	
OVERSIZED PARTICLES:		
Boulders	> 12 in.	>305 mm
Cobbles	3 in. to 12 in.	75.0 mm to 305 mm
COARSE GRAINED PARTICLES:		
Gravel:		
coarse Gravel	3 in. to 3/4 in.	75.0 mm to 19.0 mm
fine Gravel	3/4 in. to No. 4 (3/16")	19.0 mm to 4.75 mm
Sand:		
coarse Sand	No. 4 (3/16") to No.10 (1/13")	4.75 mm to 2.00 mm
medium Sand	No. 10 (1/13") to No. 40 (1/60")	2.00 mm to 0.42 mm
fine Sand	No. 40 (1/60") to No. 200	0.42 mm to 0.075 mm
FINE GRAINED PARTICLES:		
Silt:	< No. 200	< 0.075 mm
Nonplastic to very slightly plastic Little or no dry strength		
Clay:	< No. 200	< 0.075 mm
Plastic Considerable dry strength		

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Two other terms are frequently used to broadly describe and define soil behavior:

- Cohesive Soil

  A soil that when unconfined has considerable dry strength when air-dried and that has considerable cohesion when submerged.

- Noncohesive or Cohesionless Soil

  A soil that when unconfined has little or no strength when air-dried and that has little or no cohesion when submerged.

3.3 Sampling

The sample used for soil identification should be representative of the stratum from which it was obtained. All samples should be carefully identified by File No., Exploration No., Sample No., recovery, depth, source, etc.

Soil identification procedures are generally based on a very small quantity of the stratum sampled. Larger particle sizes included in a sample may misrepresent the true proportion of such sizes in a given stratum due to their greater individual weight. Furthermore, in test borings where a split-spoon sampler is utilized, size limitations (2 in. O.D. by 1-3/8 in. I.D.) preclude the ability to recover representative samples in soil strata with significant percentages of gravel and larger size components. Care must be exercised in the field when identifying and describing soils. Care is also required when selecting a representative sample for preservation and possible laboratory testing.

ASTM D2488 defines the minimum amount of soil required for identification and description. The minimum amount required is based on the maximum particle size observed in the soil. However, in many cases it is not possible to obtain the required amount of soil. Therefore, the following table should be used as a guide. Wherever possible, an employee should base his or her soil identification and description on an amount of soil equal to or greater than the minimum amount of soil required in the following table. As a general rule it should be assumed that all split-spoon samples of soils containing coarse gravel do not meet the required sample size. In addition, all jar samples of soil containing particles larger than coarse sand may not meet the required sample size.

Maximum Particle Size		Minimum Specimen Size (estimated in dry weight)
No. 4 (5 mm)	coarse sand	100 g (0.25 lb)
3/8 in. (10 mm)	fine gravel	200 g (0.5 lb)
¾ in. (19 mm)	fine gravel	1.0 kg (2.2 lb)
1.5 in. (38 mm)	coarse gravel	8.0 kg (18 lb)
3 in. (75 mm)	coarse gravel	60.0 kg (132 lb)

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3.4 Soil Identification

Detailed methods used to identify soil are presented below.

3.4.1 Preliminary Identification

The first step in the soil identification process is the preliminary identification of the soil. At this step, it will be determined if the soil will be considered a fine grained soil or a coarse grained soil. To do this, the percentage of each soil component must be estimated.

3.4.1.1 Fine Grained Soil:

If it is estimated that the soil consists of 50 percent or more fines (particles that are finer than a No. 200 sieve), the soil will be identified as either a SILT or a CLAY using Figure 1.

3.4.1.2 Coarse Grained Soil:

If it is estimated that the soil contains less than 50 percent fines (particles that are finer than a No. 200 sieve), the soil will be identified as either a GRAVEL or a SAND using Figure 2.

3.4.1.3 Organic Soils:

If it is estimated that the soil consists of enough organic particles to influence the soil properties, see Section 3.4.5 and Figure 1.

3.4.2 Methods for Identifying Soil

The following items must be determined to identify a soil:

3.4.2.1 Percent of Gravel, Sand, and Fines

Estimate and note the percentage of gravel, sand, and fines. Estimate percentages to the nearest 5 percent. The percentages of gravel, sand, and fines should equal 100 percent.

3.4.2.2 Percent of Oversized Particles

Estimate and note the percentage, if any, of boulders and cobbles. Estimate percentages, relative to the total volume observed, to the nearest 5 percent.

Methods of estimating the percentages of various soil components are found in APPENDIXD.

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3.4.3 Identification of Coarse Grained Soils

If the soil to be identified contains more than 50 percent coarse grained material it will be identified as a SAND or a GRAVEL. If a coarse grained soil contains no more than 5 percent fines, it is not necessary to determine the characteristics of the fines. Proceed to Section 3.5 and 3.6.

If the sample contains more than 5 percent fines, proceed to Section 3.4.4 below, Identification of Fine Grained Soil Fractions.

3.4.4 Identification of Fine Grained Soil Fractions

The identification of fine grained soil is determined using a combination of four manual tests: dilatancy, toughness, plasticity, and dry strength. It may not be necessary to perform all four tests to determine the identity of a soil. Figure 3a, Sample Identification Procedure Chart, and 3b, Summary of Test Characteristics, are used as guides for identifying fines.

Select a representative sample of the material for examination. Remove particles larger than the No. 40 sieve (medium sand and larger) until a specimen equivalent to about a handful of material is available. Use this specimen for performing the dilatancy, toughness, plasticity, and dry strength tests.

To identify the fine grained fraction of a soil, ASTM D2488 requires that particles larger than the No. 40 be removed from the sample. However, with some soils it may be impractical to remove medium and coarse sand from a sample in the field. In such a case, it should be noted on the log and a best estimate made.

Contaminated soils may also pose a problem for fine grained soil identification. Gloves should be worn whenever contaminated fine grained soils are identified in the field. In some cases, contaminants present in the soil (such as coal tar or gasoline) make manual testing impractical, unreliable or unsafe. In such a case, it should be noted on the log and a best estimate made.
Additional comments on contaminated soil are found in Section 3.8.

3.4.4.1 Tests for Fine Grained Soil

A. *Dilatancy* - Dilatancy is the expansion of soil when subjected to a shearing deformation or, more simply, describes the soil's reaction to hand shaking.

From the specimen, select enough material to mold into a ball about 1/2 in. (13 mm) in diameter. Mold the material, adding water if necessary, until it has a soft, but not sticky, consistency. 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 listed below. The appearance of water on the surface of the specimen

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resembles a glossy, "liver-like" consistency. When then squeezed, the water and gloss disappears from the surface. The reaction is the speed with which water appears while shaking, and disappears while squeezing.

Criteria for Describing Dilatancy

Description	Criteria
None	No visible change in the 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

B. *Toughness* - Toughness is the consistency of the soil near its plastic limit.

On the basis of observations made during the plasticity test, describe the toughness of the material as low, medium, or high in accordance with the criteria below.

Criteria for Describing Toughness

Description	Criteria
Low	Only slight pressure is required to roll a 1/8 in. (3 mm) thread near the plastic limit. The thread and the lump are weak and soft.
Medium	Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness.
High	Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness

C. *Plasticity* - Plasticity is the property of soil which allows it to be deformed beyond the point of recovery without cracking or appreciable volume change. The plasticity of soil is determined manually by observing how it behaves when it is rolled into a thread, the degree of cohesiveness at the plastic limit, and the general range of moisture contents over which the soil remains in a plastic state.

The test specimen is shaped into an elongated pat and rolled by hand on a smooth surface or between the palms. Attempt to roll the soil into a thread about 1/8 in. (3 mm) in diameter. If the sample is too wet to roll easily, it should be spread into a thin layer and allowed to lose some water by evaporation. If the sample is too dry, add water.

Fold the sample threads and reroll repeatedly until the thread crumbles at a diameter of about 1/8 in. (3 mm). The thread will crumble at a diameter of 1/8 in. (3 mm) when the water content in the soil is near the plastic limit. Note the pressure required to roll

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the thread near the plastic limit. Also, note the strength of the thread. After the thread crumbles, the pieces should be lumped together and kneaded until the lump crumbles.

Note the plasticity of the soil as nonplastic, low, medium, or high in accordance with the criteria listed below.

Criteria for Describing Plasticity

Description	Criteria
Nonplastic	A 1/8 in. (3 mm) thread cannot be rolled at any water content
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit

D. *Dry Strength* - Dry strength describes the crushing characteristics of a dry soil crumb under finger pressure.

Select enough material to mold into a ball about 1 in. (25 mm) in diameter. Mold the material until it has the consistency of putty, adding water if necessary. From the molded material, make at least three test specimens. A test specimen shall be a ball of material about 1/2 in. (13 mm) in diameter. Allow the test specimens to dry in air or sun, or by artificial means as long as the temperature does not exceed 140° F (60°C). If the test specimen contains natural dry lumps, those that are about 1/2 in. (13 mm) in diameter may be used in place of the molded balls. (The process of molding and drying usually produces higher strengths than are found in natural dry lumps of soil.)

Test the strength of the dry balls or lumps by crushing between the fingers. The dry strength increases with increasing plasticity. Note the strength as none, low, medium, high, or very high in accordance with the criteria listed below.

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Criteria for Describing Dry Strength

Description	Criteria
None	The dry specimen crumbles into powder with mere pressure of handling
Low	The dry specimen crumbles into powder with some finger pressure
Medium	The dry specimen breaks into pieces or crumbles with considerable finger pressure
High	The dry specimen cannot be broken with finger pressure. Specimen will break into pieces between thumb and a hard surface
Very high	The dry specimen cannot be broken between the thumb and a hard surface

If natural dry lumps are used, do not use the results of any of the lumps that are found to contain particles of coarse sand. The presence of high-strength water-soluble cementing materials, such as calcium carbonate, may cause exceptionally high dry strengths. The presence of calcium carbonate can usually be detected from the intensity of the reaction with dilute hydrochloric acid (HCl) (see Appendix G).

3.4.4.2 Identifying the Fine Grained Fraction

Decide whether the fine grained soil fraction is an *inorganic* or an *organic* fine grained soil (see 3.4.5). If inorganic, follow the steps listed below using Table 1 as a guide.

Identify the fine grained soil fraction as a *silt*, ML, if the soil has slow to rapid dilatancy, low toughness, no to low plasticity, and no to low dry strength.

Identify the fine grained soil fraction as an *elastic silt*, MH, if the soil has no to slow dilatancy, low to medium toughness and plasticity, and low to medium dry strength. These properties are similar to those for a lean clay. However, the silt will dry quickly on the hand and have a smooth, silky feel when dry. Some soils that would classify as MH in accordance with the criteria in Test Method D 2487 are visually difficult to distinguish from lean clays, CL. It may be necessary to perform laboratory testing for proper identification.

Identify the fine grained soil fraction as a *lean clay*, CL, if the soil has no or slow dilatancy, medium toughness and plasticity, and medium to high dry strength.

Identify the fine-grained soil fraction as a *fat clay*, CH, if the soil has no dilatancy, high toughness and plasticity, and high to very high dry strength.

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TABLE 1 - Identification of Inorganic Fine Grained Soils from Manual Tests

Soil Symbol	Dilatancy	Toughness	Plasticity Designation	Dry Strength
ML	Slow to rapid	Low or thread cannot be formed	Non-plastic	None to low
MH	None to slow	Low to medium	Low	Low to medium
CL	None to slow	Medium	Medium	Medium to high
CH	None	High	Highly	High to very high

3.4.5 Organic Soils

Organic soils are those soils that contain sufficient organic matter to significantly affect the engineering properties or usage of the soil. Topsoil, peat and organic silt are typical examples. Peaty diatomaceous earth is a common organic soil found at the lower stratum of peat bogs. Fibrous peats may be found in both fresh-water (bogs) and marine settings. Organic clays are common in some sections of the country. Certain types of anthropogenic fills contain significant percentages of organic matter.

- Identification of Organic Fine Grained Soils - Identify the soil as an *organic soil*, OL/OH, if the soil contains enough organic particles to influence the soil properties (see Figure 1). Organic soils usually have a gray, dark gray brown to black color and may have an "earthy" or hydrogen sulfide odor. Often, organic soils will change color, for example, black to brown, when exposed to the air. Some organic soils will lighten in color significantly when air-dried. Organic soils frequently contain carbonate shell fragments, silica tests (diatoms) or woody, fibrous matter, although the presence of these materials is not an exclusive indicator of organic soils. Organic soils normally will not have a high toughness or plasticity. The thread for the toughness test will be spongy or elastic. In some cases, through practice and experience, it may be possible to further identify the organic soils as organic silts or organic clays, OL or OH. Correlations between the dilatancy, dry strength, toughness tests, and laboratory tests can be made to identify organic soils in certain deposits of similar materials of known geologic origin.

- Identification of Peat - A sample composed primarily of vegetable tissue in various stages of decomposition that has a fibrous to amorphous texture, usually a dark brown to black color, and an organic odor, shall be designated as a highly organic soil and shall be identified as peat, PT.

Because organic soils can exhibit some of the characteristics of inorganic clay soils, they may be differentiated by the following criteria:

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- Inorganic Clay Soils - Any color may be expected. For more plastic clays, appreciable effort is required to pull the material apart. The broken pieces show the structure standing on end from the pulling. For high plasticities, the smear has a shiny, waxy appearance.

- Organic Soils – Gray, dark gray, black and various shades of brown are characteristic colors. Fresh organic soils, particularly marine peats and silts, commonly have a strong odor of hydrogen sulfide and heating the sample will intensify the odor. Less effort is required to pull fine grained non-fibrous organic soils apart than in the case of inorganic fine grained soil, and a clean break is generally formed. The smear, although smooth, is very dull and appears silty. Fibrous structure is, of course, an obvious identifying property. Organic silts respond positively to the dilatancy test. Organic soils customarily have very low shear strength in their natural state. Organic clays may be very difficult to identify visually without supplemental laboratory testing.

3.4.6 Identifying Soil

Proceed to section 3.5 and 3.6 to determine a Group Symbol and Group Name.

3.5 Determining the Group Symbol

Based on the properties of the soil, determine the Group Symbol using Figure 1 for fine grained soil and for organic soil, or Figure 2 for coarse grained soil.

If a soil has properties that do not distinctly place it into a specific group, Borderline Symbols may be used. A Borderline Symbol is two symbols separated by a slash, for example, CL/CH, GM/SM, CL/ML. **Borderline Symbols** should not be confused with **Dual Symbols** such as GP-GM (well graded GRAVEL with silt) or SW-SC (well graded SAND with clay). A Dual Symbol is two symbols separated by a dash and represents a standard identification group.

3.6 Determining the Group Name

Based on additional observations, determine a Group Name using Figure 1 for fine grained soil and for organic soil, or Figure 2 for coarse grained soil.

3.6.1 Fine Grained Soil

If the fine grained soil is estimated to have 15 to 25 percent sand or gravel, or both, the words "with sand" or "with gravel" (whichever is more predominant) shall be added to the Group Name. For example: "lean CLAY with sand, CL" or "SILT with gravel, ML" (see Fig. 1. If the percentage of sand is equal to the percentage of gravel, use "with sand." If the soil is estimated to have 30 percent or more sand or gravel, or both, the adjectives "sandy" or "gravelly" shall be added to the Group Name. Add the word "sandy" if there appears to be more sand than gravel. Add the word "gravelly" if there appears to be more gravel than sand. For example: "sandy lean CLAY, CL", "gravelly fat CLAY, CH", or "sandy SILT, ML" (see Fig. 1). If the percentage of sand is equal to the percent of gravel, use "sandy."

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3.6.2 Coarse Grained Soil

1. The soil is a *GRAVEL* if the percentage of gravel is estimated to be more than the percentage of sand. The soil is a *SAND* if the percentage of gravel is estimated to be equal to or less than the percentage of sand.

2. The soil is a *clean GRAVEL* or *clean SAND* if the percentage of fines is estimated to be 5 percent or less.

3. Identify the soil as a *well graded GRAVEL*, GW, or as a *well graded SAND*, SW, if it has a wide range of particle sizes and substantial amounts of the intermediate particle sizes.

4. Identify the soil as a *poorly graded GRAVEL*, GP, or as a *poorly graded SAND*, SP, if it consists predominantly of one size (uniformly graded), or it has a wide range of sizes with some intermediate sizes obviously missing (gap or skip graded).

5. Identify the soil as a *clayey GRAVEL*, GC, or a *clayey SAND*, SC, if the percentage of fines is estimated to be 15 percent or greater, and the fines are clayey as determined by the procedures in Section 3.4.4.

6. Identify the soil as a *silty GRAVEL*, GM, or a *silty SAND*, SM, if the percentage of fines is estimated to be 15 percent or greater, and the fines are silty as determined by the procedures in Section 3.4.4.

7. If the soil is estimated to contain 10 percent fines, give the soil a dual identification using two Group Symbols. The first Group Symbol corresponds to a clean gravel or sand (GW, GP, SW, SP) and the second Group Symbol corresponds to a gravel or sand with fines (GC, GM, SC, SM). The Group Name corresponds to the first Group Symbol plus the words "with clay" or "with silt" to indicate the plasticity characteristics of the fines. For example: "well graded GRAVEL with clay, GW-GC" or "poorly graded SAND with silt, SP-SM" (see Fig. 2). If the specimen is predominantly sand or gravel but contains an estimated 15 percent or more of the other coarse grained constituent, the words "with gravel" or "with sand" are added to the Group Name. For example: "poorly graded GRAVEL with sand, GP" or "clayey SAND with gravel, SC" (see Fig. 2).

3.7 Soil Description

Appropriate descriptive information is also recorded. The twelve categories of descriptive information are listed below.

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3.7.1 Required Descriptive Information

3.7.1.1 Density

The density of cohesionless or granular soils is determined by the Standard Penetration Test. The density of a soil based on the Standard Penetration Test is obtained from the following table:

Standard Penetration Test (SPT) N-Value (Blows per foot)	Density
0 - 4	Very loose
5 - 10	Loose
11 - 30	Medium dense
31 - 50	Dense
Over 50	Very dense

3.7.1.2 Consistency

The consistency of cohesive soils is determined in one of two ways. The preferred method of determining consistency in the field is based upon undrained strength as determined by a Torvane, pocket penetrometer or Field Vane shear test. In general, however, consistency is determined by the Standard Penetration Test (SPT), ASTM Designation D 1586, performed in test borings. The SPT consists of counting the number of blows of a 140 pound hammer freely falling 30 inches while driving a 2 inch O.D. split spoon sampler 18 inches into the soil. The number of blows is recorded for each 6 inches of penetration for an 18 inch drive. The first 6 inches of penetration are discounted and the number of hammer blows required to drive the sample over the 6 to 18 inch range of sampler penetration is termed the standard penetration resistance (N). Cable or wire-winch attached weights are unacceptable for determining STP.

The scale used for the consistency of a soil is presented in the following table:

Approximate Undrained Shear Strength (tsf)	Standard Penetration Test N-Value (Blows/foot)	Consistency
Below 0.13	0 - 2	Very soft
0.13 to 0.25	3 - 4	Soft
0.25 to 0.5	5 - 8	Medium stiff
0.5 to 1.0	9 - 15	Stiff
1.0 to 2.0	16 - 30	Very stiff
Over 2	Over 30	Hard

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If required, the ASTM procedure for determining consistency can be used, which is based on indentation of the soil with the thumb and is presented in Appendix E. If the ASTM procedure is used, it should be noted on the logs.

3.7.1.3 Color

Color may be useful in identifying materials of similar geologic origin. Color is an important property in identifying organic soils.

Moist soil samples should be used to describe soil color. Color description is generally confined to a few basic terms such as brown, black, gray and yellow. These terms are often combined in pairs. Examples of combined color descriptors are gray green, yellow brown or yellow gray. In listing two colors, the second color listed is the predominant of the two colors. The ending "ish" is never added to a color description. If dictated by specific project requirements, more accurate color descriptions based on hue and chroma may be obtained by use of the "Munsell Soil Color Charts."

If the soil color is not homogeneous due to layering, describe the color of all layers. If the soil is not layered, use the term mottled, if appropriate, to describe the colors. (Example: mottled brown and gray.)

3.7.1.4 Group Name and Group Symbol

The primary constituent is typed in all uppercase in the Group Name and the Group Symbol is uppercase and set in parentheses.

3.7.1.5 Percent Oversized

When the sample contains cobbles or boulders or both, estimate the percent relative to the total volume observed to the nearest 5 percent.

3.7.1.6 Maximum Particle Size

Describe the maximum particle size found in the sample. The maximum particle size is used to determine the sample size required for field identification and various laboratory tests.

3.7.1.7 Structure

Several terms have been found useful in simplifying the description of some special characteristic of a soil or to add additional information. A list of a few of the more common terms is given in Appendix F, Descriptive Terminology for Soil Structure.

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3.7.1.8 Odor

Describe the odor if organic or unusual. Soils containing a significant amount of organic material usually have a distinctive odor of decaying vegetation. Unusual odors may indicate soil contamination and should be avoided. This should be called to the attention of the project manager unless contamination was expected in the soil.

3.7.1.9 Moisture Condition

The moisture condition of a soil should be described as dry, moist or wet according to the criteria listed below.

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

3.7.1.10 Geologic Interpretation

A geologic interpretation of the soil is very helpful and should be added; e.g., Glaciofluvial Deposits. Note however that if you are uncertain about an interpretation, it is your responsibility to review it with a senior H&A geologist.

3.7.2 Additional Descriptive Information

The following additional information should be included as a part of a soil description. Methods for describing these soil properties are listed in Appendix G.

a. Hardness of the Plus No. 10 Fraction
b. Angularity of the Plus No. 10 Fraction
c. Particle Shape of the Plus No. 4 Fraction
d. Reaction with Hydrochloric Acid
e. Cementation of Intact Samples
f. Torvane and Pocket Penetrometer Readings
g. Additional Comments

3.8 Contaminated Soils

Contamination of soil can occur from an extremely wide range of hazardous and non-hazardous anthropogenic pollutants being released into the environment from a variety of disposal methods. Naturally deposited undisturbed soils may be stained from liquids passing through them. "Clean" undisturbed soils can absorb and retain strong odors from adjacent vapor sources. The actual soil constituents may be partially or completely comprised of anthropogenic materials: ash, cinders, clinker, slag, glass, brick, concrete, etc. If so, the sample should be described with respect to these constituents.

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Contaminated soil may be any color, may have some odor level, and may retain the actual product. Indicators of potential contamination include, but are not limited to, soil with an unusual color or distinct odor such as gasoline, diesel fuel, solvents, moth balls, etc. However, the soil may not show any of the above indicators and still be contaminated. If unexpected soil contamination is encountered and there is no site-specific Health & Safety plan, or appropriate Health & Safety equipment is not available, immediately cease exploration operations, clear personnel from work area, and contact the H&A Project Manager and Health and Safety Representative for instructions.

3.8.1 Description of Fills

For methods used to describe fills, see Appendix H.

3.9 Presentation of Soil Identification and Descriptive Information

The soil identification should consist of the Group Name, the Group Symbol, and all required descriptive information. **If using this procedure to identify soil, it must be distinctly and clearly stated in all logs, summary tables, and reports that the Group Names and Group Symbols are based on visual-manual procedures.**

As a rule, descriptive information should be listed in the following order:

1. **Percent of Gravel, Sand, and Fines**
2. **Dilatancy**
3. **Toughness**
4. **Plasticity**
5. **Dry Strength**
6. **Density/Consistency***
7. **Color**
8. **Group Name and Group Symbol**
9. **Percent Oversized (boulders and cobbles)**
10. **Maximum Particle Size**
11. **Structure***
12. **Odor**
13. **Moisture**
14. Optional Descriptions
15. **Geologic Interpretation**

Descriptors in **BOLD** should always be included with descriptions. Descriptors followed with an asterisk (*) apply only to intact samples such as split-spoon samples.

Examples:

Several examples of soil identifications and descriptions based on this procedure are presented below. Note not only the order of descriptive terms, but also the use of commas, hyphens, slashes, parentheses, and upper case letters. Abbreviations should not be utilized in writing soil identifications and descriptions.

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Example 1

The example below is a standard identification and description of 50 lb. grab sample from a test pit:

10% fine gravel, 30% coarse sand, 30% medium sand, 30% fine sand, no fines

Brown, poorly graded SAND (SP)
10% boulders, 15% cobbles, maximum particle size 18" (450 mm).
Stratified with coarse to medium grained layers 3" to 6" thick (75-150 mm) alternating with fine grained layers 6" to 12" thick (150-300 mm).
No odor, dry.
GLACIOFLUVIAL DEPOSIT

If the soil above was described from an 8 oz. driller's jar, the following statement should be added to the description:

(Note: Sample size smaller than recommended.)

Example 2

The example below is a standard identification and description of a split-spoon sample:

10% fine gravel, 5% coarse sand, 5% medium sand, 10% fine sand,
70% fines: no dilatancy, medium toughness, medium plasticity, medium dry strength

Stiff, gray green, sandy lean CLAY (CL).
Maximum particle size 13 mm. Laminated. Frequent fine sand partings, occasional medium to fine sand seams. Fine gravel and coarse sand present as dropstones.
No odor. Moist.
MARINE DEPOSIT

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Example 3

The example below is a standard identification and description of split-spoon sample:

5% coarse gravel, 10% fine gravel, 5% coarse sand, 10% medium sand, 40% fine sand, 30% fines: rapid dilatancy, low toughness, low plasticity, low dry strength.

Very dense, brown, silty SAND with gravel (SM)
Maximum particle size 1 in. (25 mm).
Foliated and well bonded, no odor, moist, uncemented.
Coarse fraction generally hard and rounded igneous and metamorphic lithologies, imbedded.
Minor soft and angular, flat to elongated sedimentary lithologies (argillite).
Weak reaction with HCl on minor white 0.5-0.1 mm grains (possible seashell particles).
Note: Drill action indicates occasional cobbles. Possible sand lenses indicated by wash water return.
GLACIAL TILL DEPOSIT

Example 3 (abbreviated):

5% c GVL, 10% f GVL, 5% c SA, 10% m SA, 40% f SA
30% fines: D=R, T=L, P=L, DS=L

Very dense, brown, silty SAND with gravel (SM)
mps 25 mm. Foliated and well bonded, no odor, moist.
Cobbles indicated by drill action.
GLACIAL TILL DEPOSIT

In general, final identification of soil samples for typed boring logs and reports requires a careful review, taking into consideration the laboratory identification tests that were not available at time of sampling.

3.10 Precision and Bias

This procedure provides qualitative information only; therefore, a precision and bias statement is not applicable.

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Figure 1:
Flow Chart for Identifying Fine-Grained Soils (50% or more fines)

Group Symbol				Group Name
ML (SILT)	<30% plus No. 200	<15% plus No. 200		SILT
		15-25% plus No. 200	% sand ≥% of gravel	SILT with sand
			% sand <% of gravel	SILT with gravel
	≥30% plus No. 200	% sand ≥% of gravel	<15% gravel	sandy SILT
			≥15% gravel	sandy SILT with gravel
		% sand <% of gravel	<15% sand	gravelly SILT
			≥15% sand	gravelly SILT with sand
MH (ELASTIC SILT)	<30% plus No. 200	<15% plus No. 200		elastic SILT
		15-25% plus No. 200	% sand ≥% of gravel	elastic SILT with sand
			% sand <% of gravel	elastic SILT with gravel
	≥30% plus No. 200	% sand ≥% of gravel	<15% gravel	sandy elastic SILT
			≥15% gravel	sandy elastic SILT with gravel
		% sand <% of gravel	<15% sand	gravelly elastic SILT
			≥15% sand	gravelly elastic SILT with sand
CL (LEAN CLAY)	<30% plus No. 200	<15% plus No. 200		lean CLAY
		15-25% plus No. 200	% sand ≥% of gravel	lean CLAY with sand
			% sand <% of gravel	lean CLAY with gravel
	≥30% plus No. 200	% sand ≥% of gravel	<15% gravel	sandy lean CLAY
			≥15% gravel	sandy lean CLAY with gravel
		% sand <% of gravel	<15% sand	gravelly lean CLAY
			≥15% sand	gravelly lean CLAY with sand
CH (FAT CLAY)	<30% plus No. 200	<15% plus No. 200		fat CLAY
		15-25% plus No. 200	% sand ≥% of gravel	fat CLAY with sand
			% sand <% of gravel	fat CLAY with gravel
	≥30% plus No. 200	% sand ≥% of gravel	<15% gravel	sandy fat CLAY
			≥15% gravel	sandy fat CLAY with gravel
		% sand <% of gravel	<15% sand	gravelly fat CLAY
			≥15% sand	gravelly fat CLAY with sand
OL/OH (ORGANIC SOILS)	<30% plus No. 200	<15% plus No. 200		ORGANIC SOIL
		15-25% plus No. 200	% sand ≥% of gravel	ORGANIC SOIL with sand
			% sand <% of gravel	ORGANIC SOIL with gravel
	≥30% plus No. 200	% sand ≥% of gravel	<15% gravel	sandy ORGANIC SOIL
			≥15% gravel	sandy ORGANIC SOIL with gravel
		% sand <% of gravel	<15% sand	gravelly ORGANIC SOIL
			≥15% sand	gravelly ORGANIC SOIL with sand

Note: Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5%

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Figure 2:
Flow Chart for Identifying Coarse-Grained Soils (less than 50% fines)

				Group Symbol		Group Name
GRAVEL % gravel > % sand	≤5% fines	Well-graded		GW	<15% sand	well-graded GRAVEL
					≥15% sand	well-graded GRAVEL with sand
		Poorly-graded		GP	<15% sand	poorly-graded GRAVEL
					≥15% sand	poorly-graded GRAVEL with sand
	10% fines	Well-graded	fines = ML or MH	GW-GM	<15% sand	well-graded GRAVEL with silt
					≥15% sand	well-graded GRAVEL with silt and sand
			fines = CL or CH	GW-GC	<15% sand	well-graded GRAVEL with clay
					≥15% sand	well-graded GRAVEL with clay and sand
		Poorly-graded	fines = ML or MH	GP-GM	<15% sand	poorly-graded GRAVEL with silt
					≥15% sand	poorly-graded GRAVEL with silt and sand
			fines = CL or CH	GP-GC	<15% sand	poorly-graded GRAVEL with clay
					≥15% sand	poorly-graded GRAVEL with clay and sand
	≥15% fines		fines = ML or MH	GM	<15% sand	silty GRAVEL
					≥15% sand	silty GRAVEL with sand
			fines = CL or CH	GC	<15% sand	clayey GRAVEL
					≥15% sand	clayey GRAVEL with sand
SAND % sand ≥ % gravel	≤5% fines	Well-graded		SW	<15% gravel	well-graded SAND
					≥15% gravel	well-graded SAND with gravel
		Poorly-graded		SP	<15% gravel	poorly-graded SAND
					≥15% gravel	poorly-graded SAND with gravel
	10% fines	Well-graded	fines = ML or MH	SW-SM	<15% gravel	well-graded SAND with silt
					≥15% gravel	well-graded SAND with silt and gravel
			fines = CL or CH	SW-SC	<15% gravel	well-graded SAND with clay
					≥15% gravel	well-graded SAND with clay and gravel
		Poorly-graded	fines = ML or MH	SP-SM	<15% gravel	poorly-graded SAND with silt
					≥15% gravel	poorly-graded SAND with silt and gravel
			fines = CL or CH	SP-SC	<15% gravel	poorly-graded SAND with clay
					≥15% gravel	poorly-graded SAND with clay and gravel
	≥15% fines		fines = ML or MH	SM	<15% gravel	silty SAND
					≥15% gravel	silty SAND with gravel
			fines = CL or CH	SC	<15% gravel	clayey SAND
					≥15% gravel	clayey SAND with gravel

Note: Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5%

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FIGURE 3a. SAMPLE IDENTIFICATION PROCEDURE CHART

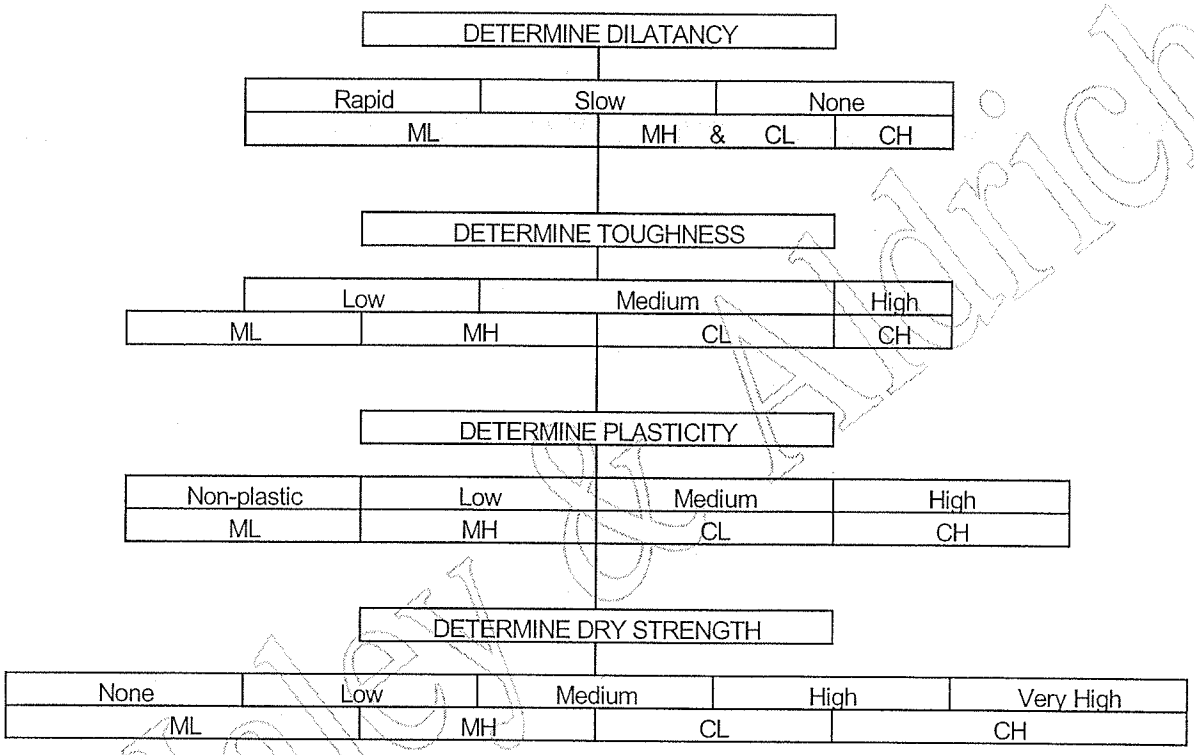

FIGURE 3b. SUMMARY OF TEST CHARACTERISTICS

	Dilatancy	Toughness	Plasticity	Dry Strength
ML	slow - rapid	low	none - low	none - low
MH	none - slow	low - medium	low - medium	low - medium
CL	none - slow	medium	medium	medium - high
CH	none	high	high	high - very high

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APPENDIX A
REFERENCES

A.1 Reference Procedure

- American Society for Testing and Materials, current edition, "Annual Book of ASTM Standards," Vol.04.08, D2488-93, "Description and Identification of Soils (Visual-Manual Procedure)."

A.2 Other References

- American Society for Testing and Materials, current edition, "Annual Book of ASTM Standards," Vol.04.08, D2487-98, "Classification of Soils for Engineering Purposes (Unified Soil Classification System)."

- American Society for Testing and Materials, current edition, "Annual Book of ASTM Standards," Vol.04.08, D1586-99, "Penetration Test and Split-Barrel Sampling of Soils."

- American Society for Testing and Materials, current edition, "Annual Book of ASTM Standards," Vol.04.09, D5434-97, "Field Logging of Subsurface Explorations of Soil and Rock."

A.3 COMMENTS ON REFERENCE PROCEDURE

The procedures and equipment listed in OP2001 and used by H&A are generally as specified in the Reference Procedure. Deviations of OP2001 from the Reference Procedure are listed below. The procedure described in Section 3 has been developed to assist H&A personnel in identifying and describing soil, and in some cases simplifies the Reference Procedure.

OP2001 deviates from the ASTM Reference Procedure in the following:

- ASTM D2488-93 defines the minimum amount of soil required for identification and description. The minimum amount required is based on the maximum particle size observed in the soil. However, in many cases it is not possible to obtain the required amount of soil due to the limitations of the sampling techniques used. As a general rule it should be assumed that all split-spoon samples of soils containing coarse gravel do not meet the required sample size. In addition, all jar samples of soil containing particles larger than coarse sand may not meet the required sample size.

- ASTM D2488-93 requires the percentage of cobbles and boulders to be estimated on the basis of volume percentage. The gravel, sand, and fines percentages are to be determined based on an estimate of dry weight. However, in almost all cases this method overly complicates estimating the percentage of different soil components. Haley & Aldrich considers that estimates of percentage based on particle volume and particle weight (either wet or dry) are equivalent for practical purposes. Average specific gravities of soil range between 2.65 and 2.75. Percentages of particle fractions based on volume should, in general, vary by no more than 5 percent from percentages based on weight—well within the error limits of the procedure.

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- To identify the fine grained fraction of a soil, ASTM D2488 requires that particles larger than No. 40 be removed from the sample. With some soils it may be impractical to remove medium and coarse sand from a sample in the field.

- Consistency of cohesive soil is based upon undrained strength as determined by a Torvane or Field Vane shear test. The Standard Penetration Test (SPT) is used in cases where no other data are available.

- The density of granular soils is determined by the Standard Penetration Test, ASTM Designation D1586, performed in test borings.

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APPENDIX B
RELATED HALEY & ALDRICH PROCEDURES

- OP2000 Monitoring Field Explorations
- OP2005 Test Borings, Sampling, Standard Penetration Testing and Borehole Abandonment
- OP2026 Exploratory Test Pits

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APPENDIX C
FORMS AND EXAMPLES

C.1 Forms

All Haley & Aldrich field forms are maintained on the server at K:\techproc\op\Forms. The following is a list of forms currently available specifically for the logging of soils using the USCS as practiced by H&A.

C.1.1 Test Boring Logging

- Form 2001 Test Boring Report
- Form 2002 Core Boring Report

C.1.2 Test Pit Logging

- Form 2006 Test Pit Log

C.2 Examples

The following examples of completed forms are intended to provide guidance in field logging. These examples are not intended to show all of the variations of USCS use, rather they are presented as a general reference of the standard logging conventions practiced by H&A.

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TEST BORING REPORT

BORING NO.

Page 1 of

PROJECT		H&A FILE NO.	
LOCATION		PROJECT MGR.	
CLIENT		FIELD REP.	
CONTRACTOR		DATE STARTED	
DRILLER		DATE FINISHED	

Elevation	ft.	Datum	Boring Location

Item	Casing	Sampler	Core Barrel	Rig Make & Model				Hammer Type	Drilling Mud	Casing Advance
Type				☐ Truck	☐ Tripod	☐ Cat-Head		☐ Safety	☐ Bentonite	Type Method Depth
Inside Diameter (in.)				☐ ATV	☐ Geoprobe	☐ Winch		☐ Doughnut	☐ Polymer	
Hammer Weight (lb.)				☐ Track	☐ Air Track	☐ Roller Bit		☐ Automatic	☐ None	
Hammer Fall (in.)				☐ Skid	☐ _____	☐ Cutting Head		Drilling Notes:		

Depth (ft.)	Sampler Blows per 6 in.	Sample No. & Recovery (in.)	Sample Depth (ft.)	Well Diagram	Stratum Change (ft.)	USCS Symbol	Visual-Manual Identification & Description (density/consistency, color, GROUP NAME & SYMBOL, maximum particle size*, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0																	

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth in feet to: Bottom of Casing	Bottom of Hole	Water

Sample ID	
O	Open End Rod
T	Thin Wall Tube
U	Undisturbed Sample
S	Split Spoon Sample
G	Geoprobe

Well Diagram	
	Riser Pipe
	Screen
	Filter Sand
	Cuttings
	Grout
	Concrete
	Bentonite Seal

Summary	
Overburden (Linear ft.)	
Rock Cored (Linear ft.)	
Number of Samples	
BORING NO.	

Field Tests Dilatancy: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Meduim H - High V - Very High

*NOTE: Maximum Particle Size is determined by direct observation within the limitations of sampler size.

NOTE: Soil identifications based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

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TEST BORING REPORT

BORING NO.

Page of

Depth (ft.)	Sampler Blows per 6 in.	Sample No. & Recovery (in.)	Sample Depth (ft.)	Well Diagram	Stratum Change (ft.)	USCS Symbol	Visual-Manual Identification & Description (density/consistency, color, GROUP NAME & SYMBOL, maximum particle size*, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel		Sand			Field Test			
								% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength

NOTES:

FILE NO.

BORING NO.

*NOTE: Maximum Particle Size is determined by direct observation within the limitations of sampler size.

NOTE: Soil Identifications based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

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CORE BORING REPORT

BORING NO.

Page 1 of

PROJECT		H&A FILE NO.	
LOCATION		PROJECT MGR.	
CLIENT		FIELD REP.	
CONTRACTOR		DATE STARTED	
DRILLER		DATE FINISHED	

Elevation ft	Datum	Boring Location

Item	Casing	Sampler	Core Barrel
Type			
Inside Diameter (in)			
Hammer Weight (lb)			
Hammer Fall (in)			

Rig Make & Model

- ☐ Truck
- ☐ ATV
- ☐ Track
- ☐ Skid
- ☐ Tripod
- ☐ Geoprobe
- ☐ Air Track
- ☐ _____
- ☐ Cat-Head
- ☐ Winch
- ☐ Roller Bit
- ☐ Cutting Head

Hammer Type: ☐ Safety ☐ Doughnut

Casing: ☐ Driven ☐ Spun

Drill Mud: ☐ Bentonite ☐ Polymer ☐ None

Depth (ft)	Drilling Rate (min/ft)	Core No. Depth (ft)	Recovery RQD (in)	Recovery RQD (%)	Weath-ering	Well Diagram	Stratum Change (ft)	Visual Classification and Remarks

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth in feet to: Bottom of Casing	Bottom of Hole	Water

Sample ID	
O	Open End Rod
T	Thin Wall Tube
U	Undisturbed Sample
S	Split Spoon Sample
G	Geoprobe

Well Diagram	
	Riser Pipe
	Screen
	Filter Sand
	Cuttings
	Grout
	Concrete
	Bentonite Seal

Summary	
Overburden (Linear ft.)	
Rock Cored (Linear ft.)	
Number of Samples	

BORING NO.

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CORE BORING REPORT

BORING NO.

Page of

Depth (ft)	Drilling Rate (min/ft)	Core No. Depth (ft)	Recovery RQD (in)	Recovery RQD (%)	Weath-ering	Well Diagram	Stratum Change (ft)	Visual Classification and Remarks

FILE NO.

BORING NO.

I:\Forms\Field\Form 3302

TEST BORING REPORT

BORING NO. B 7 (OW)

PROJECT	Greenspace Development	H&A FILE NO.	27921-000
LOCATION	18 Riverside Road, Boston Massachusetts	PROJECT MGR.	S.R. Kraemer
CLIENT	Ecologic Investments	FIELD REP.	C.S. Osgood
CONTRACTOR	Guild Drilling Co., Inc.	DATE STARTED	13-Feb-01
DRILLER	Charlie O'Donnel	DATE FINISHED	14-Feb-01

Elevation 23.3 ft. Datum Boston City Boring Location See sketch on reverse of form.

Item	Casing	Sampler	Core Barrel
Type	NW	S	NV2
Inside Diameter (in.)	3	1.385	2
Hammer Weight (lb.)	300	140	
Hammer Fall (in.)	24	30	

Rig Make & Model: CME 75
- [x] Truck
- [ ] ATV
- [ ] Track
- [ ] Skid
- [ ] Tripod
- [ ] Geoprobe
- [ ] Air Track
- [ ]
- [x] Cat-Head
- [ ] Winch
- [x] Roller Bit
- [ ] Cutting Head

Hammer Type: [x] Safety [ ] Doughnut [ ] Automatic

Drilling Mud: [x] Bentonite [ ] Polymer [ ] None

Casing Advance: Type Method Depth — NW Driven 29.0 ft.

Drilling Notes: Flushed slurry prior to coring.

Depth (ft.)	Sampler Blows per 6 in.	Sample No. & Recovery (in.)	Sample Depth (ft.)	Stratum Change (ft.)	USCS Symbol	Visual-Manual Identification & Description (density/consistency, color, GROUP NAME & SYMBOL, maximum particle size*, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0																
	10		0.0		SP-SM	Medium dense brown poorly graded SAND with silt (SP-SM),				20	70	10				
	12	S1				mps 2 mm, distinctly stratified, fines partially organic, no odor, dry.										
	15	21"														
	20		2.0	2.0		-ALLUVIUM-										
	11		2.0		SP	Dense brown poorly graded SAND (SP), mps 25 mm, no odor, dry.	5	5	20	30	35	5				
	15	S2														
	16	10"														
	17		4.0			-ALLUVIUM-										
				4.5												
5																
	WOR		5.0			Very soft, dark brown ORGANIC SOILS with sand (OL/OH), trace					25	75	S	M	H	VH
	WOR	S3			OL/OH	seashell fragments and particles, soil mps 0.5 mm, strong										
	WOH	24"				organic odor, moist.										
	WOH		7.0			-ORGANIC DEPOSIT-										
				8.0												
						Note: Drilling fluid returning medium to fine sand from 8.0 ft. to 10.0 ft. Drilling fluid color change to yellow red at 8.5 ft.										
						-PROBABLE MARINE DEPOSIT-										
				10.0												
10																
	3		10.0		CH	Stiff yellow brown fat CLAY (CH), trace fine sand, mps 0.5 mm,						100	N	M	H	
	6	S4				apparently laminated with frequent fine sand partings and										
	6	22"				possible organic fibers, no odor, moist.										
	6		12.0			-MARINE DEPOSIT-										
				13.5												
						Note: Drill action indicates gravel below 13.5 ft.										
15																
	12		15.0		CL	Very stiff yellow brown to gray sandy lean CLAY with gravel (CL),	5	10	10	10	15	50	S	M	M	
	14	S5				mps 35 mm, distinct disrupted laminae in discrete zones, coarse										
	15	17"				fraction consists of well rounded igneous and igneous and										
	19		17.0			metamorphic lithologies, no odor, moist.										
						-GLACIOMARINE DEPOSIT-										
				18.0												
						Note: Drill action and total loss of drilling fluid indicates gravel										
				19.0		and cobbles from 18.0 ft. to 19.0 ft.										
20																
	21	S6	20.0			Very dense gray silty SAND (SM), mps 15 mm, very well bonded,										
	25	10"	21.0		SM	coarse fraction consists partly of platy argillite fragments, no odor, moist.		10	15	20	30	25	R			
	33	S6A	21.0	21.0		-GLACIAL TILL-										
	34	7"	22.0		ML	Very dense gray SILT (ML), mps <0.1 mm, no structure, no odor,						100	R		N	
						dry.										
						-RESIDUAL SOIL-										
						Note: Drilling advanced smoothly from 21.0 ft. to 25.0 ft.										
				25.0		PROBABLE TOP OF DECOMPOSED BEDROCK 25.0 FT.										
25																
	53		25.0			Very dense gray highly to completely weathered ARGILLITE.										
	28	S7				Possible extremely thin relect bedding subparallel to strong										
	39	5"				low angle foliation. Sample is generally well bonded and consists										
	35		27.0			of very soft angular fragments and particles which are easily										
						crushed with finger pressure.										
						-DECOMPOSED BEDROCK-										
						Note: Drill action indicates stratum change at 28.5 ft.										
				28.5		TOP OF "SOUND" BEDROCK 28.5 FT.										
						SEE SHEET 2 FOR CORE BORING REPORT										
30																

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth in feet to: Bottom of Casing	Bottom of Hole	Water
13-Feb-01	15:30	0	29.0	29.0	2.0
14-Feb-01	7:00	15.5	29.0	29.0	6.2
14-Feb-01	15:00	1.0	39.5	39.5	10.4

Sample ID
- O Open End Rod
- T Thin Wall Tube
- U Undisturbed Sample
- S Split Spoon Sample
- G Geoprobe

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (Linear ft.)	29.5
Rock Cored (Linear ft.)	10.0
Number of Samples	S7 C2

BORING NO. B 7 (OW)

Field Tests Dilatancy: R - Rapid S - Slow N - None Plasticity: N - Nonplastic L - Low M - Medium H - High
Toughness: L - Low M - Medium H - High Dry Strength: N - None L - Low M - Meduim H - High V - Very High

*NOTE: Maximum Particle Size is determined by direct observation within the limitations of sampler size.

NOTE: Soil Identifications based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

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CORE BORING REPORT

BORING NO. B 7 (OW)

Depth (ft)	Drilling Rate (min/ft)	Core No. Depth (ft)	Recovery (in)	RQD (%)	Weathering	Well Diagram	Stratum Change (ft)	Visual Classification and Remarks
								SEE SHEET 1 TEST BORING REPORT FOR OVERBURDEN DETAILS.
							21.0	TOP OF RESIDUAL SOIL 21.0 FT.
								Note: Advanced borehole with rollerbit and splitspoon and drove NW casing through residual soil from 21.0 ft. to 25.0 ft.
					Residual Soil			-RESIDUAL SOIL-
25							25.0	TOP OF DECOMPOSED BEDROCK 25.0 FT.
					High to Complete			Note: Advanced borehole with rollerbit and splitspoon and drove NW casing through decomposed bedrock from 25.0 ft. to 28.5 ft.
								-DECOMPOSED BEDROCK-
							28.5	TOP OF "SOUND" BEDROCK 28.5 FT.
								Note: Seated NW casing at 29.0 ft. Advanced borehole with rollerbit to 29.5 ft. without sampling prior to coring.
30		29.5	56"		Slight			C1: Moderately hard, slightly weathered, gray, aphanitic ARGILLITE. Bedding extremely thin to very thin, generally low angle (30-35 degrees). Foliation low angle, commonly subparallel to bedding. Cleavage well developed along bedding/foliation planes where coincident.
	6							
					Mod.			Cleavage joints very close to close 29.5 -31.0 ft. and close below 32.5 ft. smooth-planar, slightly oxidized, occasionally calcite-infilled, tight. High angle to vertical joints moderately close, rough-undulatory, pyritized or highly oxidized and decomposed with silt infilling, open.
	3	C1			High			
					Mod.			
	5							Soft, moderately to highly weathered zone 31.0-32.5 ft. associated with extremely close, moderately dipping, slickensided-planar shears intersecting bedding plane and high angle features.
					Slight			
	6							Note: Partial water loss below 31.0 ft.
		34.5	24"	40%				Note: Lost core assumed 31.7-32.0 ft.
35	6	34.5	60"	100%				C2: Similar to bottom of run C1 except cleavage joints close to moderately close. High angle to vertical joints absent. Occasional thin zone of extremely close, extremely thin, moderately dipping to high angle (50-60 degrees) calcite stringers. Occasional calcite-healed low angle joint.
	7							
	6	C2			Slight			-CAMBRIDGE FORMATION-
	6						38.0	
	8							Lithology change at 38.0 ft. to hard, slightly weathered, dark gray to black, fine grained to aphanitic DIABASE. Single high angle joint at 38.7 ft. rough-stepped, slightly oxidized, tight.
		39.5	54"	90%				
40	8							BOTTOM OF EXPLORATION 39.5 FT.

FILE NO. 27921-000 BORING NO. B 7 (OW)

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TEST PIT LOG

Test Pit No.

Page 1 of

PROJECT		H&A FILE NO.	
LOCATION		PROJECT MGR.	
CLIENT		FIELD REP	
CONTRACTOR		DATE	
EQUIPMENT		WEATHER	

Ground El. _____ ft. Location _____ Groundwater depths/entry rates (in./min.):
El. Datum _____

Depth (ft.)	Sample ID	Stratum Change Depth (ft.)	USCS Symbol	Visual Identification (Color, GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength

Obstructions:

Remarks:

Field Tests

Dilatancy:	R - Rapid S - Slow N- None
Toughness:	L - Low M - Medium H - High
Plasticity:	N - Nonplastic L - Low M - Medium H - High
Dry Strength:	N - None L - Low M - Medium H - High V - Very High

Standing water in completed pit:
at depth _____ ft.
measured after _____ hrs. elapsed

Boulders:

Diameter (in.)	Number		Approx. vol. (cu. ft.)
12 to 24		=	
over 24		=	

Test Pit Dimensions (ft.):
Pit Depth _____
Pit Length X Width _____

NOTE: Soil identifications based on visual/manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

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ENVIRONMENTAL TEST PIT LOG

Test Pit No.

Page of

PROJECT		H&A FILE NO.	
LOCATION		PROJECT MGR.	
CLIENT		FIELD REP	
CONTRACTOR		DATE	
EQUIPMENT		WEATHER	

Ground El. ft.
El. Datum

Location

Groundwater depths/entry rates (in./min.):

Depth (ft.)	Sample ID	PID Reading (ppm.)	Stratum Change Depth (ft.)	USCS Symbol	Visual Identification (Color, GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength

Obstructions:

Remarks:

Bucket Decontamination Method:

Field Tests

Dilatancy:	R - Rapid S - Slow N- None
Toughness:	L - Low M - Medium H - High
Plasticity:	N - Nonplastic L - Low M - Medium H - High
Dry Strength:	N - None L - Low M - Medium H - High V - Very High

Standing water in completed pit:

at depth ft.
measured after hrs. elapsed

Boulders:

Diameter (in.)	Number	Approx. vol. (cu. ft.)
12 to 24		
over 24		

Test Pit Dimensions (ft.):

Pit Depth
Pit Length X Width

NOTE: Soil identifications based on visual/manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

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SAMPLE

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ENVIRONMENTAL TEST PIT LOG

Test Pit No. **TP 214**

Page 1 of 1

PROJECT	Mirror Lake Watershed Study	H&A FILE NO.	28675-309
LOCATION	Essex, Massachusetts	PROJECT MGR.	D.H. Gevalt
CLIENT	Citizens Advisory Partnership	FIELD REP	C.S. Osgood
CONTRACTOR	Stanley Lynde Const. Co., Inc.	DATE	19-Jul-02
EQUIPMENT	Case 580 rubber tire backhoe - 1/4 cu. yd. bucket	WEATHER	Thunderstorms 90's

Ground El. 74.5 ft.
El. Datum NGVD

Location N 2,089,041.101
E 801,444.238

Groundwater depths/entry rates (in./min.):
None

Depth (ft.)	Sample ID	PID Reading (ppm.)	Stratum Change Depth (ft.)	USCS Symbol	Visual Identification (density/consistency, color, GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions,	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
					Note: Ground surface strewn with boulders. Numerous depressions indicating subsurface voids noted.										
	1.5				15% coarse to fine sand, 15% cinder fragments and particles, 10% unidentifiable, white ash-like material, 10% fines (largely organic), 10% coarse to fine gravel, 10% wood (manufactured and treated), 5% glass fragments, 5% metal strips and wire, 5% charcoa										
2	S2	15.9			5% plastic sheeting (possibly polyethelene bags), 5% brick particles, 5% clay pipe fragments. Matrix generally dark brown to gray in color with pockets of white and red. 15% boulders, 15 % cobbles. Maximum particle size 36 inches.										
	2.5				Distinct decomposed gasoline odor, possible faint napthalene odor. Visible irridescent sheen on moist solids 4.6 to 5.2 ft.										
4					-FILL-										
	4.6														
	S1	140			Note: Bedrock surface smooth and flat, consisting of very hard to hard, slightly										
	5.2		5.2		weathered, light gray to pink, coarse to fine grained granite. Single high angle joint noted										
					REFUSAL ON BEDROCK 5.2 FT.										
6															
8															

Obstructions:

Remarks:
Note: Sample S1 submitted for laboratory chemical analysis.
Note: Field monitoring of breathing zone and headspace screening conducted using an hNU 11.7 ev. PID.
Bucket Decontamination Method: Steam cleaned

Field Tests

Dilatancy:	R - Rapid S - Slow N- None
Toughness:	L - Low M - Medium H - High
Plasticity:	N - Nonplastic L - Low M - Medium H - High
Dry Strength:	N - None L - Low M - Medium H - High V - Very High

Standing water in completed pit:
at depth NE ft.
measured after 0.75 hrs. elapsed

Boulders:

Diameter (in.)	Number		Approx. vol. (cu. ft.)
12 to 24	6.0	=	18.0
over 24	1.0	=	33.0

Test Pit Dimensions (ft.):
Pit Depth 5.2
Pit Length X Width 10.5 x 4.3

NOTE: Soil identifications based on visual/manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

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HALEY & ALDRICH, INC.
SAMPLE

TEST PIT LOG

Test Pit No. **TP-1**

Page 1 of 1

PROJECT	New England Hospital	H&A FILE NO.	10715-205
LOCATION	Boston, Massachusetts	PROJECT MGR.	M.X. Haley
CLIENT	PFT Associates	FIELD REP	C. S. Osgood
CONTRACTOR	J. Marchese & Sons Const.	DATE	07-Jan-02
EQUIPMENT	CAT 416 Rubber Tire Extendahoe	WEATHER	Mostly Clear 20s

Ground El. 36.3 ft. | El. Datum NGVD | Location: West of Pedestrian Tunnel | Groundwater depths/entry rates (in./min.): 7.8 ft. Steadily

Depth (ft.)	Sample ID	Stratum Change Depth (ft.)	USCS Symbol	Visual Identification (density/consistency, color, GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
				Dark brown silty SAND (SM), mps 5 mm, organic odor, moist.		5	5	10	45	40	R			
	0.5		SM	Fines largely organic.										
				-LOAM FILL-										
		1.3												
2	S3			Yellow brown to olive brown sandy fat CLAY (CH), trace roots, clinker fragments,	5	5	5	10	15	60	N	M	H	
			CH	cinder particles and fragments, clay pipe fragments, metal wire, asphalt fragments										
				mps 24 in., no odor, moist.										
				-FILL-										
4	4.0			Note: Poured concrete foundation wall on east side of test pit from 0.0 -4.4 ft										
	4.0													
6	S2													
8	8.0	8.0												
	8.0			Yellow brown fat CLAY (CH), trace fine sand. mps 0.5 mm, no odor, dry.					5	95	N	M	H	
	S1		CH	Appartantly laminated with frequent fine sand partings and possible organic fibers.										
	9.0			-MARINE DEPOSIT-										
10														
		11.0												
				Yellow brown to gray sandy lean CLAY (CL) with gravel. mps 35 mm.	5	10	10	10	15	50	S	M	L	
			CL	Distinct disrupted laminae in discrete zones. Coarse fraction consists of well-rounded										
				igneous and metemorphic lithologies.										
12	12.0	12.0		-GLACIOMARINE DEPOSIT-										
				Note: Possible stratum change to gray lean CLAY with sand (CL) below 12.0 ft										
				Coarse fraction apparantly less abundent.										
				-MARINE DEPOSIT-										
				BOTTOM OF EXPLORATION 13.5 FT.										
14														

Obstructions:

Remarks:
Note: Bag samples S1-S3 obtained for potential mechanical analysis from depths indicated.

Field Tests

Dilatancy:	R - Rapid S - Slow N- None
Toughness:	L - Low M - Medium H - High
Plasticity:	N - Nonplastic L - Low M - Medium H - High
Dry Strength:	N - None L - Low M - Medium H - High V - Very High

Standing water in completed pit:
at depth 13.2 ft.
measured after 0.1 hrs. elapsed

Boulders:

Diameter (in.)	Number		Approx. vol. (cu. ft.)
12 to 24	1	=	1.8
over 24	1	=	8.2

Test Pit Dimensions (ft.):
Pit Depth 13.5
Pit Length X Width 9.0 x 6.0

NOTE: Soil identifications based on visual/manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

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APPENDIX D
CRIBSHEETS

D.1 Cribsheets

The following cribsheets are provided as a quick reference to the major soil properties defined by the USCS as practiced by H&A. These abbreviated summary tables are not a comprehensive reference, rather they are intended to be used as a field aid during identification and description of soils by staff thoroughly familiar with OP2001.

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COLOR EXAMPLES

- GRAY
- GRAY-BROWN
- OLIVE-BROWN
- OLIVE
- OLIVE-GRAY
- DARK BROWN
- RED-GRAY
- RED-BROWN
- BROWN
- RED
- LIGHT BROWN
- TAN
- YELLOW-BROWN
- RED-YELLOW
- YELLOW

GRAIN SIZE

Clear Square Sieve Openings: 12" 3" 3/4"

U.S. Standard Series Sieve: 4 10 40 200

SOILS	Boulders	Cobbles	Gravel		Sand			Silts and Clays
			Coarse	Fine	Coarse	Medium	Fine	
FILLS	Blocks	Pieces	Fragments		Particles			Specks

300mm 75mm 19mm 4.75mm 2.0mm 0.42mm 0.075mm

APPARENT/RELATIVE DENSITY NON-COHESIVE SOIL

APPARENT DENSITY	SPT (# blows/ft)	MODIFIED CA. SAMPLER (# blows/ft)	CALIFORNIA SAMPLER (# blows/ft)	RELATIVE DENSITY (%)
Very loose	0-4	0-4	0-5	0 -15
Loose	5-10	5-12	6-15	15-35
Medium dense	11-30	13-35	16-40	35-65
Dense	31-50	36-60	41-70	65-85
Very dense	> 50	>60	>70	85-100

CONSISTENCY COHESIVE SOIL

		TORVANE	POCKET PENETROMETER
CONSISTENCY	SPT (# blows/ft)	UNDRAINED SHEAR STRENGTH (tsf)	UNCONFINED COMPRESSIVE STRENGTH (tsf)
Very soft	0 - 2	<0.13	<0.25
Soft	3 - 4	0.13 - 0.25	0.25 - 0.5
Medium Stiff	5 - 8	0.25 - 0.5	0.5 - 1.0
Stiff	9 - 15	0.5 - 1.0	1.0 - 2.0
Very Stiff	16 - 30	1.0 - 2.0	2.0 - 4.0
Hard	>30	>2.0	>4.0

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

SOIL IDENTIFICATION SHOULD INCLUDE:

1. Percent of gravel, sand & fines
2. Dilatancy, toughness, plasticity, dry strength
3. Density/Consistency
4. Color
5. Group name/Group symbol
6. Percent oversized
7. Maximum particle size
8. Structure
9. Odor
10. Moisture
11. Optional descriptions
12. Geologic interpretation

Criteria for Describing Soil Structure

Description	Criteria
Bed	A sedimentary layer bounded by depositional surfaces.
Blocky	A characteristic in which cohesive soil can be broken down into small angular lumps which resist further breakdown.
Bonded	Attached or adhering.
Fissured	Broken along definite planes of fracture.
Foliated	Planar arrangement of textural or structural features.
Frequent	More than one per foot of thickness.
Homogeneous	Same color and appearance throughout.
Interbedded	Alternating soil layers of different composition.
Laminae	A very thin cohesive layer.
Layer	A general term for material lying essentially parallel to the surfaces against which it was formed.
Lens	A lenticular deposit, larger than a pocket.
Occasional	One or less per foot of thickness.
Parting	A very thin granular layer.
Pocket	Small erratic deposits less than 12 in. in thickness.
Seam	A thin layer separating two distinctive layers of different composition or greater magnitude.
Stratified	Alternating layers of varying material or color.
Stratum	A stratigraphic unit.
Varve	A cyclic sedimentary couplet consisting of a coarser and a finer layer representing the variation in depositional energy resulting from the annual freeze-thaw cycle typically found in glaciolacustrine environments.

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Criteria for Describing Dilatancy

Description	Criteria
None	No visible change in the 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.

Criteria for Describing Toughness

Description	Criteria
Low	Only slight pressure is required to roll a 1/8 in. (3 mm) thread near the plastic limit. The thread and the lump are weak and soft.
Medium	Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness.
High	Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness.

Criteria for Describing Plasticity

Description	Criteria
Nonplastic	A 1/8 in. (3 mm) thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

Criteria for Describing Dry Strength

Description	Criteria
None	The dry specimen crumbles into powder with mere pressure of handling.
Low	The dry specimen crumbles into powder with some finger pressure.
Medium	The dry specimen breaks into pieces or crumbles with considerable finger
High	pressure. The dry specimen cannot be broken with finger pressure. Specimen will break into pieces between thumb and a hard surface.
Very High	The dry specimen cannot be broken between the thumb and a hard surface.

SUMMARY OF TEST RESULTS

	Dilatancy	Toughness	Plasticity	Dry Strength
ML	slow - rapid	low	none - low	none - low
MH	none - slow	low - medium	low - medium	low - medium
CL	none - slow	medium	medium	medium - high
CH	none	high	high	high - very high

Laminate 1B

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APPENDIX E
ESTIMATING SOIL COMPONENT PERCENTAGES

E.1 Estimating Percentages by Weight or Volume

ASTM D2488 goes to great lengths to differentiate between soil component percentages determined by estimates of particle volume, particle weight, and particle dry weight. The dry weight of soil is calculated by dividing the weight of the moist soil by (1 + soil water content percentage expressed as a decimal). ASTM D2488 requires the percentage of cobbles and boulders to be estimated on the basis of volume percentage. Of the fraction of the soil smaller than 3 in., the gravel, sand, and fines percentages are to be determined based on an estimate of dry weight.

However, in almost all cases, this method overly complicates estimating the percentage of different soil components. Haley & Aldrich considers that estimates of percentage based on particle volume and particle weight (either wet or dry) are equivalent. Averages of specific gravity of soil range between 2.65 and 2.75. Percentages of particle fractions based on volume should, in general, vary by no more than 5 percent from percentages based on weight, well within the error limits of the procedure.

There are two cases where weight and volume measurements will not agree.

The first case is for organic soils. The organic portions of the soil will have a low specific gravity ($\leq$ 1.0) and even large quantities will weigh little, while the mineral portions will have a much higher specific gravity and higher weights for smaller volumes. Care and experience are needed to estimate percentages in an organic soil.

The other case where weight and volume measurements will not agree is in areas were soils contain an unusual amount of particles made up of minerals with a very low or very high specific gravity, such as mica and vermiculite, or pyrite and magnetite. Again, care and experience are required to accurately estimate soil fraction percentages.

Listed below are methods for estimating particle size fractions suggested by ASTM D2488. A review of these ASTM methods will show that the recommended methods are based not on dry weight of soil but on volume estimates.

E.2 Preparation for Identification

- The soil identification portion of this procedure is based on the portion of the soil sample that will pass a 3 in. (75 mm) sieve. The larger than 3 in. (75 mm) particles must be removed—manually for a loose sample, or mentally for an intact sample—before classifying the soil.

- Estimate and note the percentage of cobbles and the percentage of boulders.

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E.3 Estimating Soil Component Percentages

Of the fraction of the soil smaller than 3 in. (75 mm), estimate and note the percentage of the gravel, sand, and fines. Considerable experience is required to estimate the percentages of particle-size components. Frequent comparisons with laboratory particle-size analyses should be made. The percentages shall be estimated to the closest 5 percent. The percentages of gravel, sand, and fines must add up to 100 percent. If one of the components is present but not in sufficient quantity to be considered 5 percent of the smaller than 3 in. (75 mm) portion, indicate its presence by the term *trace*, for example, trace of fines. A trace is not to be considered in the total of 100 percent for the components.

E.4 Suggested Procedures for Estimating the Percentages of Gravel, Sand, and Fines in a Soil Sample (ASTM D2488-93)

E.4.1 Jar Method

The relative percentage of coarse and fine grained material may be estimated by thoroughly shaking a mixture of soil and water in a test tube or jar, and then allowing the mixture to settle. The coarse particles will fall to the bottom and successively finer particles will be deposited with increasing time; the sand sizes will fall out of suspension in 20 to 30 seconds. The relative proportions can be estimated from the relative volume of each size separate. This method should be correlated to particle-size laboratory determinations.

E.4.2 Visual Method

Mentally visualize the gravel size particles placed in a sack (or other container) or sacks. Then do the same with the sand size particles and the fines. Then mentally compare the number of sacks to estimate the percentage of plus No. 4 sieve size and minus No. 4 sieve size present. The percentages of sand and fines in the minus sieve size No. 4 material can then be estimated from the wash test (A.4.3).

E.4.3 Wash Test (for relative percentages of sand and fines)

Select and moisten enough minus No. 4 sieve size material to form a 1 in. (25 mm) cube of soil. Cut the cube in half, set one-half to the side, and place the other half in a small dish. Wash and decant the fines out of the material in the dish until the wash water is clear and then compare the two samples and estimate the percentage of sand and fines. Remember that the percentage is based on weight, not volume. However, the volume comparison will provide a reasonable indication of grain size percentages.

E.4.4 Other

While washing, it may be necessary to break down lumps of fines with the finger to get the correct percentages.

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APPENDIX F
ASTM D2488 CONSISTENCY TEST

ASTM D2488 determines consistency using a scale based on a thumb penetration test. This scale is presented here in the event that a client on a project requires it, but it is not used in H&A's general practice. If this scale is used, it should be noted on the exploration log.

For intact fine grained soil, describe the consistency as very soft, soft, firm, hard, or very hard, in accordance with the criteria listed below. This observation is inappropriate for soils with significant amounts of gravel.

ASTM Criteria for Describing Consistency

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

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APPENDIX G
DESCRIPTIVE TERMINOLOGY FOR SOIL STRUCTURE

Describe the structure of intact soils in accordance with the criteria in listed below.

Criteria for Describing Soil Structure

Description	Criteria
Bed	A sedimentary layer bounded by depositional surfaces.
Blocky	A characteristic in which cohesive soil can be broken down into small angular lumps which resist further breakdown.
Bonded	Attached or adhering.
Fissured	Broken along definite planes of fracture.
Foliated	Planar arrangement of textural or structural features.
Frequent	More than one per foot of thickness.
Homogeneous	Same color and appearance throughout.
Interbedded	Alternating soil layers of different composition.
Laminae	A very thin cohesive layer.
Layer	A general term for material lying essentially parallel to the surfaces against which it was formed.
Lens	A lenticular deposit, larger than a pocket.
Occasional	One or less per foot of thickness.
Parting	A very thin granular layer.
Pocket	Small erratic deposits less than 12 in. in thickness.
Seam	A thin layer separating two distinctive layers of different composition or greater magnitude.
Stratified	Alternating layers of varying material or color.
Stratum	A stratigraphic unit.
Varve	A cyclic sedimentary couplet consisting of a coarser and a finer layer representing the variation in depositional energy resulting from the annual freeze-thaw cycle typically found in glaciolacustrine environments.

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APPENDIX H
ADDITIONAL DESCRIPTIVE INFORMATION

The following additional descriptive information should be included as a part of a soil description.

H.1. Angularity of the Plus No. 10 Fraction

If requested by the Project Manager, the angularity of the plus No. 10 fraction (gravel and coarse sand) can be described as angular, subangular, subrounded, or rounded in accordance with the criteria in listed below and Fig. H-1. A range of angularity may be stated, such as: subrounded to rounded.

Criteria for Describing Angularity of Coarse Grained Particles (see Fig. H-1)

Description	Criteria
Angular	Particles have sharp edges and relatively planar sides with unpolished surfaces
Subangular	Particles are similar to angular description but have rounded edges
Subrounded	Particles have nearly planar sides but have well rounded corners and edges
Rounded	Particles have smoothly curved sides and no edges

H.2. Particle Shape of the Plus No. 4 Fraction

Describe the shape of the Plus No. 4 fraction (gravel, cobbles and boulders) as flat, elongated, or flat and elongated if they meet the criteria listed below using the dimensions shown in Figure G-2. Otherwise, do not mention the shape. Indicate the fraction of the particles that have the shape, such as: one-third of the gravel particles are flat.

Criteria for Describing Particle Shape (see Fig. G-2)

The particle shape shall be described as follows where length, width, and thickness refer to the greatest, intermediate, and least dimensions of a particle, respectively.

Flat	Particles with width/thickness ratio > 3
Elongated	Particles with length/width ratio > 3
Flat and elongated	Particles meet criteria for both flat and elongated

H.3. Hardness of the Plus No. 10 Fraction

Describe the hardness of coarse sand and larger particles as hard, or state what happens when the particles are hit by a hammer; for example, gravel size particles fracture with considerable hammer blow, some gravel size particles crumble with hammer blow. "Hard" means particles do not crack, fracture, or crumble under a hammer blow.

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H.4 Reaction with Hydrochloric Acid

Describe the reaction with HCl as none, weak, or strong, in accordance with the criteria listed below. Since calcium carbonate is a common cementing agent, a report of its presence on the basis of the reaction with dilute hydrochloric acid is important.

Criteria for Describing the Reaction with HCl

Description	Criteria
None	No visible reaction
Weak	Some reaction, with bubbles forming slowly
Strong	Violent reaction, with bubbles forming immediately

H.5. Additional Comments

Additional comments shall be noted. These may include:

In-situ bonding, particularly of glacial till soils: poor, moderate, well bonded.
Presence of obstructions: specifically for man-made features (not boulders).
"Running" or "Flowing" sands: typically below the water table, these are a good liquefaction indicator.
Validity of apparent density: Blow counts increased by gravel content.
Water loss: Very important in coring bedrock, but appropriate for soils.
Presence of roots or root holes.
Caving of trench or hole.

H.6. Additional Descriptive Information for Intact Samples - Cementation

Describe the cementation of intact coarse grained soils as weak, moderate, or strong as follows:

Criteria for Describing Cementation

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure

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FIGURE H-1 Typical Angularity of Grains

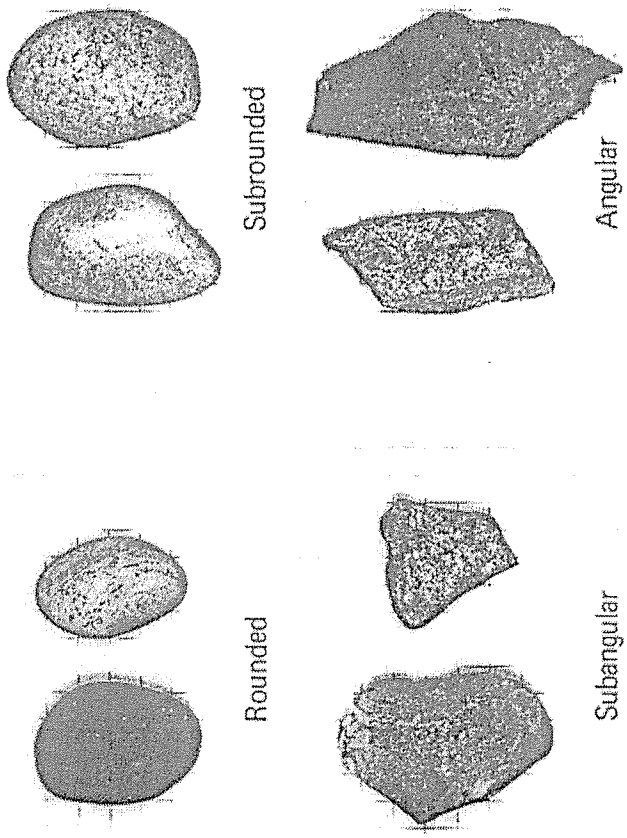
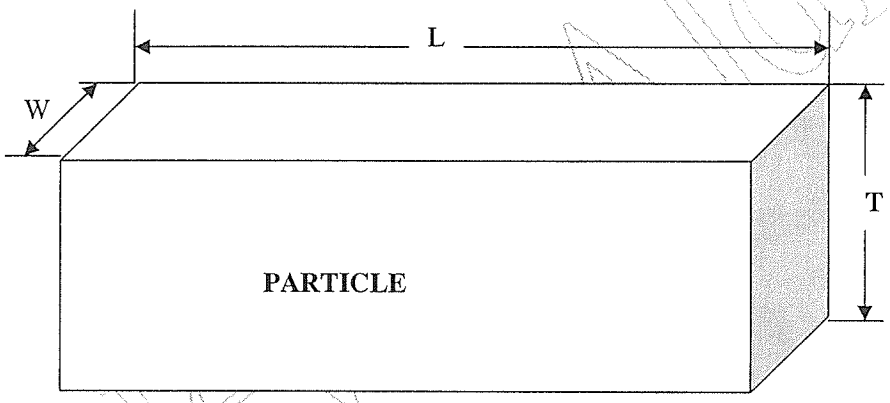


FIGURE H-2 Criteria for Particle Shape

Particle Shape

W = Width
T = Thickness
L = Length



FLAT: W/T >3

ELONGATED: L/W >3

FLAT and ELONGATED:
meets both criteria

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APPENDIX I
FILLS

I.1 Fill Description

Fills can be separated into two distinct categories:

Fills consisting largely of natural components can usually be described in a similar manner to natural soils including a particle breakdown and designation of a USCS Group Symbol and Group Name.

Fills containing man-made or deleterious materials that constitute a significant percentage of the total volume cannot be described in the typical fashion, nor can a USCS Group Symbol and Group Name be designated. In fills with substantial quantities of man-made or deleterious materials the typical particle breakdown is not conducted and constituent estimates are simply listed in order of abundance.

The distinction between the two categories of fills defined above will in some cases be unclear. Determination of which method to use to describe fills is a field decision based on the character of the fills observed and the method which best conveys an accurate representation of the materials present.

Many artificial and deleterious materials have very low densities but may constitute a significant percentage of the total fill volume. In such cases constituent estimates may be based upon volume, not weight, and noted in the description.

Since artificial materials will commonly occur across a wide range of sizes it may be impractical to distinguish them separately from the total as oversize components. To do so may necessitate including them twice within a single description. In such cases the descriptive terms for size ranges may be included with the constituent estimates or noted in the description.

The presence of certain materials in extremely small quantities can be of critical importance in fills. Constituents comprising less than 5% of the total are qualified and preceded by the term "trace" and included in the particle breakdown, constituent estimates, or noted in the description.

I.2 Fill Types

Characterizing fill types based upon similarities can aid in estimating quantities for reuse, treatment or disposal. Caution must be exercised that any characterization of fill type is an accurate reflection of site conditions and that field assumptions do not conflict with the site history or project objectives. Consultation with the Project Manager to develop criteria upon which to base fill types is required. The following terminology is used by Haley & Aldrich to denote size ranges of artificial materials within fills:

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Descriptive Fill Term	Size Range	Size Range Metric	Comparative Soil Term
Specks	<No. 200 Sieve	<0.075 mm	Silt
Particles	No. 200 to 3/16 in.	0.075 mm to 5 mm	Sand
Fragment	3/16 in. to 3 in.	5 mm to 75 mm	Gravel
Pieces	3 in. to 12 in.	75 mm to 305 mm	Cobbles
Blocks	>12 in.	>305 mm	Boulders

Definitions of Common Fill Constituents and Terminology

Term	Definition
Anthropogenic	Impacted by man.
Artificial	Man-made.
Ash	Inorganic residue of combusted matter.
Ceramic	Nonmetallic mineral products manufactured by firing.
Charcoal	Carbonaceous residue of incompletely combusted organic material.
Cinder	General term for ash, charcoal, clinkers or slag.
Clinker	Solid waste formed in furnaces consisting of fused stony matter.
Concrete	Solid mass of cemented aggregate.
Deleterious	Having a harmful or obscure affect.
Loam	Soil containing roughly equal proportions of sand, silt and clay. Usually organic matter is present in varying amounts.
Slag	Clinker or solid waste from iron blast furnaces.
Tar	Viscous, dark, bituminous liquid.

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Examples of Fills consisting largely of natural materials:

Example1 (Test Boring Description)

10% medium sand, 25% fine sand, 15% roots
50% fines: slow dilatancy, low toughness, nonplastic, low dry strength

Very loose, dark brown sandy ORGANIC SOIL (OL/OH)
15% roots estimated by volume, trace brick particles.
mps 2.0 mm.
No structure, musty odor, dry.
LOAM FILL

Example 2 (Stockpile Description)

100% coarse gravel

Purple, poorly graded GRAVEL (GP)
No oversize, mps 2.5 in.
Consists entirely of very hard angular processed rhyolite.
No odor, dry.
CRUSHED STONE

Example 3 (Test Pit Description)

15% coarse gravel, 10% fine gravel, 15% coarse sand, 15% medium sand, 25% fine sand
5% brick fragments to particles, 5% concrete or mortar, 10% fines: rapid dilatancy

Brown to dark brown, well graded SAND with silt and gravel (SW-SM)
10% cobbles, 5% boulders, mps 18 in.

Concrete present generally as moderately hard fragments with several elongated blocks observed measuring less than 30 in. maximum dimension. Minor decomposed concrete or mortar observed on brick fragments. Possible asbestos observed in trace quantities as friable white fibers in occasional extremely small pockets. Slight decomposed gasoline odor associated with observed water. Wet at 8.5 ft.
FILL

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Examples of Fills consisting of significant percentages of artificial or deleterious matter:

Example 1 (Test Pit Description)

55% concrete, 20% brick, 10% medium to fine sand, 5% coarse to fine gravel
5% fines, 5% cobbles, mps 6 in., trace metal strips and wire, wood fragments, plastic pieces, glass shards, cinder particles to specks, unidentified apparent precipitate present as blue specks.

Soil components light brown. Consists entirely of apparent demolition debris. Concrete present primarily as hard flat or irregular blocks measuring 18 in. to 36 in. maximum dimension with most containing #6 to #8 rebar. Brick present generally as fragments. No odor, moist.
RUBBLE FILL

Example 2 (Test Pit Description)

20% ash, 20% charcoal particles, 15% clinker fragments to particles, 15% fines, 10% sand
5% paper, 5% glass pieces to fragments, 5% ceramic fragments, 5% wood blocks to fragments, trace metal pieces to fragments, asphalt pieces to fragments.

Color variable changing to dark gray below 4.0 ft. Fines not identified. Consists primarily of partially burned and decomposed household refuse by identifiable remains of newspaper, bottles and cans. Distinct fuel odor and oil saturation below observed water at 4.5 ft. Free product noted 5 mm thick on water surface after a 15 minute stabilization period.
REFUSE FILL

Example 3 (Test Pit Description)

50% cinder fragments to particles, 20% fines, 15% fly ash, 10% gravel, 5% sand, trace possible ceramic particles, glass shards.

Dark gray to black discoloration. Fines not identified. Heavily contaminated with coal tar in discrete zones or pockets of apparently higher permeability ranging in thickness from 6 in. to 24 in. at depths of 2.0 ft. to 7.5 ft. Strong naphthalene odor. Moist below 9.0 ft.
MGP WASTE

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Example 4 (Test Boring Description)

15% coarse sand, 15% clinker fragments to particles, 15% fine gravel, 15% ash, 10% ceramic particles, 10% unidentified fines, 10% wood, 5% fine sand, 5% glass particles, trace brick particles.

Medium dense. Soil components brown to dark brown with dark gray discoloration. Coarse sand and gravel generally hard and angular. Possible organics present partly as fines. Wood present as lumber fragments and possible roots. Strong septic odor and faint possible solvent odor detected. Sample moisture probably due to drilling fluid.
FILL

Suggested Nomenclature

Suggested nomenclature for possible fill types are included below.

Primarily Natural Components	Significant Percentage Artificial or Deleterious
Loam Fill	Bark Mulch
Cohesive Fill	Stump Fill
Hydraulic Fill	Rubble Fill
Granular Fill	Refuse Fill
Structural Fill	Urban Fill
Till Fill	Medical Waste
Crushed Stone	Tannery Waste
Ballast	MGP Waste
Mine Tailings	Cinder Fill
Rock Fill	Miscellaneous Fill
Rip Rap	Grits and Screenings

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APPENDIX H

Standard Operating Procedure: OP3001 Preservation and Shipment of Environmental Samples Sample Chain-of-Custody Form
Standard Operating Procedure OP1004 - Operation/Calibration of Photo-ionization Detector

OPERATING PROCEDURE: OP3001

PRESERVATION AND SHIPMENT OF ENVIRONMENTAL SAMPLES

PREPARATION AND APPROVALS

VERSION	AUTHORED/DATE	REVIEWED / DATE	REVIEWED / DATE	REVIEWED / DATE	APPROVED / DATE
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OPERATING PROCEDURE: OP3001

PRESERVATION AND SHIPMENT OF ENVIRONMENTAL SAMPLES

1. PURPOSE

This operating procedure (OP) has been established to maintain consistency in preservation and shipment of environmental samples to protect the integrity of the samples prior to analysis. This OP may be modified to suit the needs of an individual site and to comply with specific regulatory programs (i.e. state, CERCLA, RCRA).

The objectives of this OP are to maintain the physical form and chemical composition of the sample and to prevent changes in contaminant concentration. To meet these objectives, there must be a measure of control over all sample handling procedures beginning with sample container cleaning procedures and ending with laboratory analysis. This OP deals with the first half of the control process: the procedures leading up to and ending with sample packaging and transport to the laboratory. The information provided herein will make it possible to choose the minimum number of sample handling and preservation practices necessary to ensure the integrity of a sample designated for analysis.

Refer to OP3000 for General Environmental Field Procedures and Protocol, including procedures for decontamination of sampling equipment and/or containers. Refer to OP3026 for Operating Procedures on completing a Chain of Custody.

2. EQUIPMENT & SUPPLIES

- Prepackaged or decontaminated sampling device
- Laboratory supplied sample containers
- Preservatives, as applicable
- Disposable gloves
- Litmus/pH paper, as applicable
- Labels
- Permanent/indelible marker
- Cooler
- Ice
- Bubble wrap
- Packing tape
- Chain of Custody

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3. PROCEDURE

There are four basic steps necessary to obtain meaningful analytical data: preparation of the sample container, sampling, sample preservation, and analysis. The amount of sample to be collected, and the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix being sampled and the parameter(s) of interest. In order to obtain meaningful analytical data, sample preservation techniques must be effective from the time of sample collection to the time of analysis.

3.1 Selection of Sampling Parameters

The selection of sampling parameters is dependent on the specific work objectives for a Site. When choosing preservatives for your sampling and analysis program, verify that the preservatives or lab techniques used do not contain chemicals that are also constituents of concern at the Site.

In addition, it is important to recognize acetone, as a high purity solvent rinse in sampling equipment decontamination procedures, is included as an analyte on the Target Compound List (TCL) and SW-846, but not on the Priority Pollutant List (PPL).

3.2 Sampling Equipment and Container Selection

Proper selection of sampling equipment and containers for sample collection is an important means of protecting the integrity of the sample. When selecting sampling equipment and containers, verify that the materials that come into direct contact with the sample are compatible with the chemical or physical properties of the contaminant(s) of concern. The type of sample containers to be used in a sampling event should be determined during sampling event planning and documented in the sampling and analysis plan.

As a general rule when obtaining soil samples using core barrel samplers, samples obtained for semivolatile organic compound (SVOC) analysis can be obtained within a core barrel or core barrel liner that is composed of stainless steel, steel, or brass. When only inorganic constituents are of concern, a plastic core barrel liner would be more appropriate. All of these materials are suitable for volatile organic compounds (VOCs) as long as the contact time is minimized. Often all of the above samples (SVOCs, inorganic, and VOCs) are obtained from a single soil core. In this situation, soils should be taken from the interior of the soil core to avoid potential interferences between the contaminants of concern and the surface of the core barrel that is in direct contact with the sample.

For sediment sampling, the analytical sediment sample is arbitrarily defined as that which passes a 10-mesh (approximately 2-mm openings) sieve. The purpose of this is to provide a basis for discrimination of sediment and foreign objects or materials. Stainless steel or nylon sieves may be used when inorganic constituents are to be determined. (For inorganic analyses, stainless steel sieves are acceptable provided the mesh is not soldered or welded to the frame.) Stainless steel or brass sieves are suitable for use when organic substances are to be determined. (For organic analyses, organic materials such as rubber or plastics should not be used in the storage or handling of samples.)

For water sampling, specifications on container design, including shape, volume, gas tightness, materials of construction, and use of cap liners, are defined for specific parameters or suites of parameters (for example,

amber glass containers protect photosensitive analytes, such as polychlorinated biphenyls (PCBs) from chemical alteration). Specifications for sample container selection are documented in parameter-specific analytical methods (for example, ASTM, U.S. EPA SW846, AWWA Standard Methods) as well as in Federal (40 CFR Part 136), state, and local regulatory guidelines on groundwater sample collection and preservation. Table 1 provides examples of common container materials, colors and volumes.

3.2.1 Reactivity of Container Material with Sample

Choosing the proper composition of sample containers will help to ensure that the chemical and physical integrity of the sample is maintained. For potentially hazardous material, glass is the recommended container type because it is chemically inert to most substances. Plastic containers are not recommended for most hazardous wastes because the potential exists for contaminants to adsorb to the surface of the plastic or for the plasticizers to leach into the sample.

In some instances, the sample characteristics or analytes of interest may dictate that plastic containers be used instead of glass. Because some metals species will adhere to the sides of glass containers in an aqueous matrix, plastic bottles must be used for samples collected for metals analysis. In the case of a strong alkali waste or hydrofluoric solution, plastic containers may be more suitable because glass containers may be etched by these compound creating adsorptive sites on the container surface.

3.2.2 Volume of the Container

The volume of sample to be collected will be dictated by the analytical method and the sample matrix. The laboratory must supply bottles of sufficient volume to perform the required analysis. Table 1 indicates the container volumes required for the various parameters. In most cases, the methodology dictates the volume of sample material required to complete the analysis. However, individual labs may provide larger volume containers for various analytes to ensure sufficient quantities for replicates or other quality control checks.

3.2.3 Color of Container

Whenever possible, amber glass containers should be used to prevent photodegeneration of the sample, except when samples are being collected for metals analysis. If amber containers are not available, containers holding samples should be protected from light. However, 40-milliliter (ml) clear glass vials are often provided by laboratories for aqueous VOC analysis and are acceptable for use.

3.2.4 Container Closures

Container closures should form a leak-proof seal (i.e., screw caps or ground glass stoppers). Closures must be constructed of a material which is inert with respect to the sampled material, such as Polytetrafluoroethylene (PTFE) (e.g., Teflon®). Alternately, the closure may be separated from the sample by a closure liner that is inert to the sample material such as PTFE liner or septum.

3.2.5 Decontamination of Sample Containers

Sample containers must be laboratory cleaned, preferably by the laboratory performing the analysis. The cleaning procedure is dictated by the specific analysis to be performed on the sample.

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When sampling for organic compounds, if your sample containers are not provided by the analytical laboratory, care should be taken to ensure that the containers are properly cleaned and prepared. Refer to ASTM Standard D3694-96 *Standard Practices for Preparation of Sample Containers and for Preservation of Organic Constituents* for guidance.

After the sample containers are cleaned, they can be pre-preserved or preserved in the field. Information on sample preservation is given in Section 3.4. Sample containers provided by a commercial analytical laboratory are cleaned and in many cases pre-preserved by the laboratory. The sample bottles should be prepared for shipment accompanied by a chain-of-custody and the cooler containing them should be sealed. The chain-of-custody must also accompany the bottles during transportation to the field, sample collection, transportation back to the lab, during analysis and final disposal of the sample container.

3.3 Sample Labels

Sample labels may be in the form of adhesive labels or tags, or both. Tags have the advantage of being removable to become part of the record keeping process, although their inadvertent loss or inappropriate removal may leave the sample without documentation. Labels should be made of waterproof paper and indelible ink should be used to make entries. Alternatively, sample information may be written directly on the sample container, as long as the writing can be done indelibly. Containers should be free from other labels and other writing to prevent any confusion. If both tags and labels are used, care should be taken to ensure that the information on both is identical.

Labels or tags should be filled out just before or immediately after sample collection. Labels should contain spaces for the following information:

- Project identification code.
- Sample identifying name
- Sampling location ID, sampling point ID.
- Sampling date and time.
- Analyses desired.
- Company name.

3.4 Sample Presevation

The need for sample preservation for specific analytes should be defined prior to the sampling event and documented in the site-specific sampling and analysis plan. Certain analytical methodologies for specific analytes require chemical additives in order to stabilize and maintain sample integrity. Unless the analysis is accomplished within 2 hours after sampling, preservation is preferred and usually required.

Preservatives are generally added to the sampling bottles by the laboratory prior to shipment into the field. If the sample bottles are not pre-preserved by the laboratory, preservatives may be added in the field immediately after the samples are collected. Many laboratories provide pre-preserved bottles as a matter of convenience and to help ensure that samples will be preserved immediately upon collection. A problem associated with this method arises if not enough sample is collected, resulting in too much preservative in the sample. More

commonly encountered problems with this method include the possibility of insufficient preservative provided to achieve the desired pH level or the need for additional preservation due to chemical reactions caused by the addition of sample liquids to pre-preserved bottles.

3.4.1 Soil

3.4.1.1 Composite Samples

When composite samples are collected, the appropriate preservation reagents must be added to the compositing vessel prior to collection. If the preservation requirements call for refrigeration, the sample must be refrigerated during the collection. The collection time for a single composite sample should not exceed 24 hours. If longer sampling periods are necessary, a series of composite sample should be collected.

3.4.1.2 Grab Samples

In the absence of specific instructions, storage at a temperature of 4°C or lower for a period of time not to exceed 1 week is recommended.

3.4.1.3 Sediment Samples

Sediment samples intended for both organic and inorganic compound analysis may undergo changes in composition during storage. The analytical method should specify the conditions necessary to assure requisite stability. In the absence of specific instructions, storage at a temperature of 4°C or lower for a period of time not to exceed 1 week is recommended, although it is known that microbiological activity does not cease under these conditions.

3.4.2 Water

3.4.2.1 Groundwater Samples

Groundwater samples are subject to chemical, physical, and biological change at the ground surface relative to in-situ conditions as a result of exposure to ambient conditions during sample collection.

Groundwater sample preservation procedures are grouped into two general categories: (1) physical preservation and (2) chemical preservation. Groundwater samples should be preserved in the field at the time of sample collection using physical means to prevent sample container breakage or temperature increases, and chemical means to minimize changes in groundwater sample chemistry prior to laboratory analysis.

Physical groundwater sample preservation methods include: *(1)* use of appropriate sample collection containers for each parameter being analyzed, *(2)* use of appropriate sample collection procedures (i.e. making sure there are no air bubbles in VOA vials) *(3)* use of appropriate packing of sample containers for shipment to prevent sample container breakage and potential cross-contamination of samples during shipment, and *(4)* temperature control.

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Samples are cooled to reduce biological activity on the organic chemicals. Cool the sample to 4°C immediately after sampling using a wet ice water bath. During storage or shipment, or both, maintain the sample at 4°C. A temperature blank should be used with each shipping container of samples to determine actual sample temperatures at the time the sample shipment is received by the laboratory.

Chemical preservation of groundwater samples involves the addition of one or more chemicals (reagent-grade or better) on a parameter-specific basis to protect sample integrity. Table 1 provides examples of common analyte-specific chemical preservation methods. Chemical preservation is specified in numerous analytical methods as well as in various regulatory guidance documents such as 40 CFR Part 136.3. Chemicals can be used to adjust sample pH or inhibit microbial activity to prevent chemical alteration of samples. In most cases the samples containers will be pre-preserved by the analytical laboratory. In the case that the sample containers are not pre-preserved, refer to *ASTM D 6517-00 Standard Guide for Field Preservation of Ground-Water Samples* for guidance.

After the sample container is filled and preserved, it should be securely capped and gently inverted to ensure uniform distribution of the preservative throughout the sample.

Preservation must take place immediately upon sample collection except when samples are to be filtered. Samples requiring filtration must be processed immediately after collection. Filtered samples are then preserved immediately following the filtration process.

Samples must be placed into a cooler and maintained at 4°C immediately upon collection and preservation.

When collecting samples in pre-preserved containers, care must be taken not to pre-rinse the container with the sample and to avoid overfilling the container to prevent loss of chemical preservative. It may be necessary to establish site-specific protocol to address acceptable periods for storage and storage conditions for pre-preserved sample containers due to the potential for chemical reactions to occur between the chemical preservative and the empty sample container

Records should be kept for all forms of sample preservation used for groundwater samples. The following should be reported:

- Type of sample container(s) used for each parameter being analyzed (volume, materials of construction, type of cap, etc.);
- Packaging method(s) used to prevent sample bottle breakage during sample storage and shipment;
- How groundwater samples were cooled to 4°C, if required for physical preservation;
- Chemical preservative(s) used on a parameter-specific basis;

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- Description of appearance of unpreserved and preserved samples, specifically noting any chemical reactions which may occur upon addition of chemical preservative (for example, effervescence, formation of precipitates, change in color).

3.5 Chain-Of-Custody

The purpose of a chain-of-custody is to provide accountability for and documentation of sample integrity from the time the samples are collected until sample disposal. A chain-of-custody is intended to be a legal form documenting sample possession during collection, shipment, storage and the process of analysis. Chain-of-custody procedures are necessary in a program to assure the ability to support data and conclusions adequately in a legal or regulatory situation. Refer to OP3026 for Operating Procedures on completing a Chain of Custody.

A single field sampling person should be assigned responsibility for custody of samples. An alternate custodian should also be assigned to cover the prime custodian's absence. As few people as possible should handle samples. The assigned field sampler should be personally responsible for the care and custody of the samples collected until they are properly transferred. While samples are in their custody, field personnel should be able to testify that no one was able to tamper with the samples without their knowledge.

A standard chain-of-custody form included in Appendix A has been designed for recording custody information related to field sample handling. The following information should be on the form:

- Sample identifying name.
- Sampling location ID, sampling point ID.
- Sampling date and time.
- Sampling interval.
- Signatures of sampling personnel and signatures of all personnel handling and receiving the samples.
- Project identification code.
- Preservation (to alert lab personnel): amount and type.
- Number of containers. Indicate number of replicates if there are multiple containers of the same type.
- Field notes.
- Analyses desired.
- Sample type: grab, composite, etc.

When transferring the possession of samples, the individuals relinquishing and the individuals receiving the samples should sign, date, and note the time on the custody record. Provisions should be made for receipt of samples at nonstandard hours, such as nights and weekends by non-laboratory personnel. Shipping documents, with noted time of receipt and receipt by whom, should be made part of the custody record.

3.6 Sample Sealing

Sample custody seals of waterproof adhesive paper may be used to detect unauthorized tampering with samples prior to receipt by the lab. When seals are used, they should be applied so that it is necessary to break them in order to open the sample cooler. It is helpful to cover the custody seal with clear packing tape to ensure the security of the cooler.

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3.7 Holding Times

Table 1 lists maximum holding times cited in the U.S. EPA "Guidelines Establishing Test Procedures for the Analysis of Pollutants under the Clean Water Act". Sample containers should be shipped and received by the laboratory and as soon as possible to allow sufficient time for the laboratory to perform the requested analyses within the holding time defined by the applicable laboratory analytical method for each parameter.

3.8 Sample Storage and Transport

Field personnel should package and ship samples in compliance with all applicable regulations including the Department of Transportation (for example, Title 49 Code of Federal Regulations, Part 172) and the International Air Transportation Association (IATA). Samples should be placed in a cooler to be maintained at 4°C. Special care should be taken when packaging glass (i.e., using bubble wrap). Sample containers should be shipped in a manner that will ensure the samples are received intact by the laboratory, at the appropriate temperature, and as soon as possible to allow sufficient time for the laboratory to perform the requested analyses within the holding time. Samples should be shipped well before the holding time is up and ideally should be shipped within 24 hours of sample collection.

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TABLE 1 - Required Containers, Preservation Techniques, and Holding Times

Using USEPA-Contract Lab Program Methodologies for Aqueous and Nonaqueous Samples

Parameter	Sample Container (1)	Container Volume	Preservation	Maximum Holding Time
Volatile Organics	Aqueous-G, black phenolic plastic screw cap, teflon-lined septum	Aqueous 40 ml	Cool, 4 deg C, dark, 0.08% $Na_2S_2O_3$ if residual Cl_2	10 days
	Nonaqueous-G, polypropylene cap, white teflon liner	Nonaqueous 120 ml		10 days
Total Organic Carbon	G - Preferred, P - If determined that there is no contributing organic contamination	100 ml	Cool, 4 deg C, dark, HCl or H_2SO_4 to pH<2 if analysis can't be done within 2 hrs	2 Hrs - unpreserved 28 days - preserved
Base Neutral/Acid Extractable (Semivolatile) Organics	Amber Glass, Teflon lined cap	1 liter	Cool, 4 deg C, dark	Extraction Aqueous continuous liquid-liquid extraction must be started within 5 days Non-aqueous - 10 days Analysis 40 days from validated time of sample receipt at the lab.
Total Petroleum Hydrocarbons	G	1 liter	Cool, 4 deg C	Aqueous 7 days
		4 oz		Non-Aqueous 28 days Gasoline in soil 7 days
Pesticide/PCBs	Amber G, Teflon lined cap	1 liter	Cool, 4 deg C, dark	Extraction Aqueous continuous liquid-liquid extraction must be started within 5 days Non-aqueous - 10 days Analysis 40 days from validated time of sample receipt at the lab.
Metals except Mercury	Aqueous-P bottle, P cap, P liner	Aqueous - 1000 ml	Aqueous - HNO_3 to pH<2	180 days
	Nonaqueous-Flint G bottle, black phenolic cap, polyethylene liner	Nonaqueous 4, 8, 16, or 32 oz	Nonaqueous - 4 deg C until analysis	
Hexavalent Chromium	P, G	400 ml	Cool, 4 deg C	24 hrs
Mercury	Aqueous-P bottle, P cap, P liner	Aqueous - 1000 ml	Aqueous - HNO_3 to pH<2	26 days
	Nonaqueous-Flint G bottle, black phenolic cap, polyethylene liner	Nonaqueous 4, 8, 16, or 32 oz	Nonaqueous - 4 deg C until analysis	
Phenols	G Only	1 liter	Cool, 4 deg C, H_2SO_4 to pH<2	28 days

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TABLE 1 - Required Containers, Preservation Techniques, and Holding Times (CONTINUED)

Parameter	Sample Container (1)	Container Volume	Preservation	Maximum Holding Time
Cyanide	Aqueous-P bottle, P cap, P liner	Aqueous - 1000 ml	Aqueous - 0.6g ascorbic acid if residual Cl_2, NaOH to pH>12, cool, 4 deg C until analyzed $CaCO_3$ in presence of sulfide	12 days
	Nonaqueous-Flint Glass bottle, black phenolic cap, polyethylene liner	Nonaqueous 4, 8, 16, or 32 oz	Nonaqueous Cool, 4 deg C until analyzed	
Sulfates	P, G	100 ml	Cool, 4 deg C	28 days
Sulfides	P, G	1 liter	Cool, 4 deg C, add 4 drops zinc acetate per 100 ml sample, NaOH to pH>9	7 days
Chloride	P, G	1 liter	Cool, 4 deg C	28 days
Total Nitrogen	Aqeous - P bottle, P cap, P liner	Aqueous - 1000 ml	H_2SO_4 to pH<2	12 days
Nitrate	P, G	1 liter	Cool, 4 deg C,	24 hrs - Unpreserved
			H_2SO_4 to pH<2, (2 ml/L)	28 days - preserved
Fluoride	Aqeous - P bottle, P cap, P liner	Aqueous - 1000 ml	4 deg C until analysis	26 days

Excerpt from Appendix 2-1 (NJDEP Field Sampling Procedures Manual, May 1992) which is based on 40 CFR part 136.3

P - Plastic, hard or soft

G - Glass

$Na_2S_2O_3$ - Sodium thiosulfate

HCl - Hydrochloric acid

Cl_2 - Chlorine

H_2SO_4 - Sulfuric acid

HNO_3 - Nitric Acid

NaOH - Sodium hydroxide

$CaCO_3$ - Calcium carbonates

APPENDIX A
REFERENCES

A.1 Reference Procedure

- American Society for Testing and Materials International, Standard Guide for Field Preservation of Groundwater Samples, ASTM D 6517-00, April 2000.
- American Society for Testing and Materials International, Standard Guide for Sample Chain-of-Custody Procedures, ASTM D 4840-99, January 2000.
- American Society for Testing and Materials International, Standard Practice for Collection and Handling of Soils Obtained in Core Barrel Samplers for Environmental Investigations, ASTM D 6640-01, April 2001.
- American Society for Testing and Materials International, Standard Practice for Estimation of Holding Time for Water Samples Containing Organic and Inorganic Constituents, ASTM D 4841-88, October 1985.
- American Society for Testing and Materials International, Standard Practice for Preparation of Sediment Samples for Chemical Analysis, ASTM D 3 976-92, December 1992.
- American Society for Testing and Materials International, Standard Practices for Preparation of Sample Containers and for Preservation of Organic Constituents, ASTM D 3694-96, March 1997.

A.2 Other References

- New Jersey Department of Environmental Protection, Field Sampling Procedures Manual, May 1992.
- United States Environmental Protection Agency Environmental Response Team, Groundwater Well Sampling SOP #: 2007, 26 January 1995.

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APPENDIX B
RELATED HALEY & ALDRICH PROCEDURES

- OP1004 Operation/Calibration of PID Photoionization Detector
- OP1007 Field Monitoring for Volatile Organics (breathing space-work zone)
- OP1009 Medical Surveillance Program
- OP1010 Health and Safety Plans
- OP1022 Health and Safety Manual
- OP3000 General Environmental Field Procedures and Protocols
- OP3006 Procedures for Subsurface Soil Sampling and Chemical Analysis
- OP3008 Manual Water Level Measurement Procedure
- OP3009 Monitoring Well Development Procedure
- OP3010 Groundwater Quality Sampling Procedure
- OP3012 Low Stress/Low Flow Groundwater Sample Collection Procedure
- OP3014 NAPL Monitoring and Sampling
- OP3026 Chain of Custody

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APPENDIX C
FORMS

Form 3001	Sampling Labels (Environmental)
Form 3003	Chain of Custody Record (Field)
Form 3005	Groundwater Sampling Record
Form 3006	Monitoring Well Devel Rpt
Form 3010	Low Flow Field Sampling Form

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APPENDIX D
GLOSSARY

Chemical preservation - the addition of acidic, alkaline or biologically toxic compounds, or combination thereof, to a groundwater sample to prevent changes in chemical properties of the sample that may occur after collection.

Custody - physical possession or control. A sample is under custody if it is in possession or under control so as to prevent tampering or alteration of its characteristics.

Holding time - the maximum amount of time that may transpire from the moment a sample container is filled to the time the sample is extracted or analyzed. Holding times are parameter-specific, variable in length, and defined by laboratory analytical methods.

Physical preservation - methods that are implemented to protect the physical integrity of a groundwater sample from the time the sample is collected until the sample is analyzed.

Temperature blank - a laboratory quality control sample that is transported with samples and is used by the laboratory performing sample analyses to verify that temperature-sensitive samples have been adequately cooled to 4°C for shipment to and arrival at the laboratory.

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APPENDIX E
CHAIN OF CUSTODY RECORD

See three-piece form in Forms cabinet.

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HALEY & ALDRICH
Haley & Aldrich, Inc.
465 Medford St.,
Suite 2200,
Boston, MA 02129-1400

CHAIN OF CUSTODY RECORD

Phone (617) 886-7400
Fax (617) 886-7600

Page of

H&A FILE NO.
PROJECT NAME
H&A CONTACT

LABORATORY
ADDRESS
CONTACT

DELIVERY DATE
TURNAROUND TIME
PROJECT MANAGER

Sample No.	Date	Time	Depth	Type	VOA	ABNs PAH only	Metals RCRA (8) PP(13)	Pesticides PCBs	VPH Full Suite C-ranges only	EPH Full Suite C-ranges only	TPH (specify)	TCLP (specify)	Reactivity Ignitability Corrosivity				Number of Containers	Comments (special instructions, precautions, additional method numbers, etc.)

Analysis Requested

Sampled and Relinquished by	Received by
Sign	Sign
Print	Print
Firm	Firm
Date Time	Date Time
Relinquished by	**Received by**
Sign	Sign
Print	Print
Firm	Firm
Date Time	Date Time
Relinquished by	**Received by**
Sign	Sign
Print	Print
Firm	Firm
Date Time	Date Time

LIQUID													
													VOA Vial
													Amber Glass
													Plastic Bottle
													Preservative
													Volume

SOLID													
													VOA Vial
													Amber Glass
													Clear Glass
													Preservative
													Volume

PRESERVATION KEY

A Sample chilled	C NaOH	E H_2SO_4	G Methanol
B Sample filtered	D HNO_3	F HCL	H Sodium Bisulfate

Sampling Comments

Evidence samples were tampered with? YES NO
If YES, please explain in section below.

WHITE - Laboratory CANARY - Project Manager PINK - Haley & Aldrich Laboratory GOLDENROD - Haley & Aldrich Contact

Form 3003

OPERATING PROCEDURE: OP1004

OPERATION/CALIBRATION OF PID PHOTOIONIZATION DETECTOR

Haley & Aldrich

PREPARATION AND APPROVALS

VERSION	AUTHORED/DATE	REVIEWED / DATE	REVIEWED / DATE	REVIEWED / DATE	APPROVED / DATE
Ver. 0.0	JWL / Dec. 02	CLM / Oct. 02	GJM / June 03		JAK / Aug. 03

Total Pages: 6

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OPERATING PROCEDURE: OP1004

OPERATION/CALIBRATION OF PID PHOTOIONIZATION DETECTOR

1. PURPOSE

This procedure describes the operation and calibration techniques for the Model PI 101 Photoionization Detector, manufactured by HNU Systems, Inc. The instrument will measure organic vapor levels. There are three direct reading ranges: 0-20 ppm, 0-200 ppm and 0-2,000 ppm at a minimum gain (all specifications are benzene referred). The detection limit is 0.1 ppm. The linear range is 0.1-600 ppm. The response time is less than 3 seconds to 90% of full scale. The instrument will have an 11.7 eV UV lamp.

2. EQUIPMENT & SUPPLIES

2.1 Supporting Materials

- HNU PI 101 instrument with 10.2 or 11.7 eV UV lamp
- Span gas cylinders: 100 ppm isobutylene in air
- Calibration "Tee" with rotometer

3. PROCEDURE

3.1 Responsibilities

The Site Technician will be responsible for the calibration, operation and maintenance of the photoionization detector (PID).

The Safety Officer will be responsible for insuring that the work is performed and that the required data is collected.

3.2 Operation

The location and extent of use of the PID will be determined by the Safety Officer.

The following procedures will be performed daily, prior to initiation of air monitoring activities and after an instrument warm-up period. The following are general operating instructions for the instrument; more detailed instructions are provided in the manufacturer's operation manual.

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1. Instrument zero: Turn the function switch to the stand-by position. If the meter does not read zero, rotate the zero potentiometer until a zero reading is obtained. Wait 15-20 seconds to ensure that the reading is stable. If not, readjust andre-check.

2. Calibration: Turn the function switch to the measurement range to be used for sampling. Attach the 8" probe extension to the calibration "Tee", then attach the calibration gas cylinder and rotometer to the remaining connections on the "Tee". Open the cylinder until a slight flow is detected on the rotometer. The HNU unit draws the volume of sample for detection and the excess is indicated on the rotometer. Adjust the span potentiometer so that the instrument reading is the exact value of the calibration gas. Close and remove the span gas. If the instrument span setting is changed, the instrument zero step will be repeated.

3. All calibration checks will be documented in the Site Log Book.

4. Operation: Verify that the function switch is at the measurement range in use during normal sampling. Note the instrument readings during the site visit.

3.3 Repair and Maintenance

If the instrument fails to function as per manufacturer's specifications, it will be replaced with a spare. The defective unit should be sent to the manufacturer for diagnostic treatment and correction.

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APPENDIX A
RELATED HALEY & ALDRICH PROCEDURES

- OP1005 Operation/Calibration of FID Flame Ionization Detector
- OP1006 Operation of Draeger Gas Detector Pump
- OP1007 Field Monitoring for Volatile Organics (breathing space-work zone)
- OP1009 Medical Surveillance Program
- OP1010 Health and Safety Plans

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APPENDIX B
GLOSSARY

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APPENDIX I

Analytical Laboratory Reporting Limits

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *AQUEOUS SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Total Petroleum Hydrocarbons by Modified EPA 8015B						
Container: *Amber Glass, Teflon Lined Cap*			***Amount Required:*** *1 Liter*			
Preservation: *Cool, 4°C*			***Holding Time:*** *Extraction: 7 days* *Analysis: 40 days*			
TPH as Diesel (C_{13} to C_{22})	0.1	0.5	mg/L	75	125	20
TPH as Heavy Hydrocarbons (C_{23} to C_{40})	0.1	0.5	mg/L			
Total TPH as Diesel and Heavy Hydrocarbon (C_{13} to C_{40})	0.1	0.5	mg/L			
8015B surrogates						
Chlorobenzene				*75*	*125*	

RPD = RELATIVE PERCENT DIFFERENCE

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Total Petroleum Hydrocarbons by Modified EPA 8015B						
Container: *40 ml Glass vial, Teflon Lined Septum*			***Amount Required:*** *40 ml X 2*			
Preservation: *HCL to pH <2, Cool, 4°C, No Head space*			***Holding Time:*** *14 days*			
TPH as Gasoline and Light Hydrocarbons (C_4 to C_{12})	0.005	0.010	mg/L	75	125	20
8015B surrogates						
4-Bromofluorobenzene				*75*	*125*	

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *AQUEOUS SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Polynuclear Aromatic Hydrocarbons by EPA 8310						
Container: *Amber Glass, Teflon Lined Cap*			***Amount Required:*** *1 Liter*			
Preservation: *Cool, 4°C, Dark*			***Holding Time:*** *Extraction: 7 days*			
			Analysis: 40 days			
Acenaphthene	0.10	0.20	µg/L	75	125	
Acenaphthylene	0.10	0.20	µg/L	75	125	
Anthracene	0.10	0.20	µg/L	75	125	
Benzo (a) anthracene	0.10	0.20	µg/L	75	125	20
Benzo (a) pyrene	0.10	0.20	µg/L	75	125	20
Benzo (b) fluoranthene	0.10	0.20	µg/L	75	125	
Benzo (g,h,i) perylene	0.10	0.20	µg/L	75	125	
Benzo (k) fluoranthene	0.10	0.20	µg/L	75	125	
Chrysene	0.10	0.20	µg/L	75	125	
Dibenzo (a, h) anthracene	0.10	0.20	µg/L	75	125	
Fluoranthene	0.10	0.20	µg/L	75	125	
Fluorene	0.10	0.20	µg/L	75	125	
Indeno (1,2,3-cd) pyrene	0.10	0.20	µg/L	75	125	
Naphthalene	0.10	0.20	µg/L	70	120	20
Phenanthrene	0.10	0.20	µg/L	75	125	
Pyrene	0.10	0.20	µg/L	60	110	
8310 surrogates						
p-terphenyl-d14			µg/L	*75*	*125*	

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *AQUEOUS SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Volatile Organic Compounds by EPA 8260B						
Container: *40 ml Glass vial, Teflon Lined Septum*			***Amount Required:*** *40 ml X 2*			
Preservation: *HCL to pH<2, Cool, 4°C, No Head space*			***Holding Time:*** *14 days*			
1,1,1,2-Tetrachloroethane	0.5	1.0	µg/L			
1,1,1-Trichloroethane	0.5	1.0	µg/L	75	125	
1,1,2,2-Tetrachloroethane	0.5	1.0	µg/L			
1,1,2-Trichloroethane	0.5	1.0	µg/L			
1,1-Dichloroethane	0.5	1.0	µg/L			
1,1-Dichloroethene	0.5	1.0	µg/L	75	125	20
1,1-Dichloropropene	0.5	1.0	µg/L			
1,2,3-Trichlorobenzene	0.5	1.0	µg/L			
1,2,3-Trichloropropane	0.5	1.0	µg/L			
1,2,4-Trichlorobenzene	0.5	1.0	µg/L			
1,2,4-Trimethylbenzene	0.5	1.0	µg/L			
1,2-Dibromo-3-Chloropropane	2.5	5.0	µg/L			
1,2-Dibromoethane	0.5	1.0	µg/L			
1,2-Dichlorobenzene	0.5	1.0	µg/L			
1,2-Dichloroethane	0.5	1.0	µg/L			
1,2-Dichloropropane	0.5	1.0	µg/L			
1,3,5-Trimethylbenzene	0.5	1.0	µg/L			
1,3-Dichlorobenzene	0.5	1.0	µg/L			
1,3-Dichloropropane	0.5	1.0	µg/L			
1,4-Dichlorobenzene	0.5	1.0	µg/L			
2,2-Dichloropropane	0.5	1.0	µg/L			
2-Butanone (Methylethyl kethone [MEK])	5.0	5.0	µg/L			
2-Chloroethyl Vinylether	2.5	5.0	µg/L			
2-Chlorotoluene	0.5	1.0	µg/L			
2-Hexanone	2.5	5.0	µg/L			
4-Chlorotoluene	0.5	1.0	µg/L			
4-Methyl-2-Pentanone	2.5	5.0	µg/L			
Acetone	10	10	µg/L			
Benzene	0.5	1.0	µg/L	75	125	20
Bromobenzene	0.5	1.0	µg/L			
Bromochloromethane	0.5	1.0	µg/L			
Bromodichloromethane	0.5	1.0	µg/L			
Bromoform	2.5	5.0	µg/L			
Bromomethane	1.5	3.0	µg/L			
Carbon Disulfide	0.5	1.0	µg/L			
Carbon Tetrachloride	0.5	1.0	µg/L			
Chlorobenzene	0.5	1.0	µg/L	75	125	20
Chloroethane	1.5	3.0	µg/L			

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *AQUEOUS SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Volatile Organic Compounds by EPA 8260B						
Container: *40 ml Glass vial, Teflon Lined Septum*			***Amount Required:*** *40 ml X 2*			
Preservation: *HCL to pH<2, Cool, 4°C, No Head space*			***Holding Time:*** *14 days*			
Chloroform	0.5	1.0	µg/L	75	125	
Chloromethane	1.5	3.0	µg/L			
cis-1,2-Dichloroethene	0.5	1.0	µg/L			
cis-1,3-Dichloropropene	0.5	1.0	µg/L			
Dibromochloromethane	0.5	1.0	µg/L			
Dibromomethane	0.5	1.0	µg/L			
Dichlorodifluoromethane	1.5	3.0	µg/L			
Ethylbenzene	0.5	1.0	µg/L	75	125	
Hexachlorobutadiene	1.5	3.0	µg/L			
Isopropylbenzene	0.5	1.0	µg/L			
Methylene Chloride	2.0	4.0	µg/L			
MTBE	0.5	1.0	µg/L			
n-Butylbenzene	0.5	1.0	µg/L			
n- Propylbenzene	0.5	1.0	µg/L			
Naphthalene	0.5	1.0	µg/L			
p- Isopropyltoluene	0.5	1.0	µg/L			
sec-Butylbenzene	0.5	1.0	µg/L			
Styrene	0.5	1.0	µg/L			
tert-Butylbenzene	0.5	1.0	µg/L			
Tetrachloroethene	0.5	1.0	µg/L			
Toluene	0.5	1.0	µg/L	75	125	20
trans-1,2-Dichloroethene	0.5	1.0	µg/L			
trans-1,3-Dichloropropene	0.5	1.0	µg/L			
Trichloroethene	0.5	1.0	µg/L	75	125	20
Trichlorofluoromethane	0.5	1.0	µg/L			
Vinyl Acetate	0.5	5.0	µg/L			
Vinyl Chloride	0.5	3.0	µg/L			
o-xylene	0.5	1.0	µg/L	75	125	
m,p-xylene	1.0	2.0	µg/L	75	125	
8260B surrogates						
Toluene-d8			µg/L	*75*	*125*	
4-Bromofluorobenzene			µg/L	*75*	*125*	
Dibromofluoromethane			µg/L	*75*	*125*	

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *AQUEOUS SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
TTLC Metals by Method 6010B/7471A						
Container: *Plastic or Glass*			***Amount Required:*** *500 ml*			
Preservation: *HNO_3 to pH<2, Cool, 4°C*			***Holding Time:*** *6 months, 28 days for Hg*			
Antimony	0.05	0.10	mg/L	80	120	15
Arsenic	0.05	0.10	mg/L	80	120	15
Barium	0.03	0.05	mg/L	80	120	15
Beryllium	0.01	0.05	mg/L	80	120	15
Cadmium	0.01	0.05	mg/L	80	120	15
Chromium	0.01	0.05	mg/L	80	120	15
Cobalt	0.01	0.05	mg/L	80	120	15
Copper	0.01	0.05	mg/L	80	120	15
Lead	0.05	0.10	mg/L	80	120	15
Mercury by 7470A	0.001	0.002	mg/L	80	120	15
Molybdenum	0.01	0.05	mg/L	80	120	15
Nickel	0.01	0.05	mg/L	80	120	15
Selenium	0.05	0.10	mg/L	80	120	15
Silver	0.01	0.05	mg/L	80	120	15
Thallium	0.05	0.10	mg/L	80	120	15
Vanadium	0.03	0.05	mg/L	80	120	15
Zinc	0.01	0.05	mg/L	80	120	15

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *AQUEOUS SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Method SM 4500-CN-E						
Container: *Plastic or Glass*			***Amount Required:*** *1 Liter*			
Preservation: *NaOH to pH>12, Cool, 4°C*			***Holding Time:*** *14 days (24 hours if sulfide is present)*			
Total Cyanide	0.01	0.05	mg/L	80	120	15

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *AQUEOUS SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Method EPA 7199A						
Container: *Plastic or Glass*			***Amount Required:*** *250 ml*			
Preservation: *Cool, 4°C*			***Holding Time:*** *24 Hours*			
Chromium, Hexavalent	2.0	2.0	µg/L	80	120	20

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *AQUEOUS SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Semi-Volatile Organic Compounds by EPA 8270C						
Container: *Amber Glass, Teflon Lined Cap*			***Amount Required:*** *1 Liter*			
Preservation: *Cool, 4°C*			***Holding Time:*** *Extraction: 7 days*			
			Analysis: 40 days			
1,2,4-Trichlorobenzene	5	10	µg/L	39	98	20
1,2-Dichlorobenzene	5	10	µg/L			
1,3-Dichlorobenzene	5	10	µg/L			
1,4-Dichlorobenzene	5	10	µg/L	36	97	20
2,4,5-Trichlorophenol	5	10	µg/L			
2,4,6-Trichlorophenol	5	10	µg/L			
2,4-Dichlorophenol	5	10	µg/L			
2,4-Dimethylphenol	5	10	µg/L			
2,4-Dinitrophenol	5	10	µg/L			
2,4-Dinitrotoluene	5	10	µg/L	24	96	20
2,6-Dinitrotoluene	5	10	µg/L			
2-Chloronaphthalene	5	10	µg/L			
2-Chlorophenol	5	10	µg/L	27	123	20
2-Methylnaphthalene	5	10	µg/L			
2-Methylphenol	5	10	µg/L			
2-Nitroaniline	5	10	µg/L			
2-Nitrophenol	5	10	µg/L			
3,3-Dichlorobenzidine	5	10	µg/L			
3-Methylphenol	5	10	µg/L			
3-Nitroaniline	5	10	µg/L			
4,6-Dinitro-2-methylphenol	5	10	µg/L			
4-Bromophenyl Phenyl Ether	5	10	µg/L			
4-Chloro-3-methylphenol	5	10	µg/L	39	98	20
4-Chloroanoline	5	10	µg/L			
4-Chlorophenyl Phenyl Ether	5	10	µg/L			
4-Methylphenol	5	10	µg/L			
4-Nitroaniline	5	10	µg/L			
4-Nitrophenol	5	10	µg/L	10	80	20
Acenaphthene	5	10	µg/L	46	118	20
Acenaphthylene	5	10	µg/L			
Anthracene	5	10	µg/L			
Benzo (a) anthracene	5	10	µg/L			
Benzo (a) pyrene	5	10	µg/L			
Benzo (b) fluoranthene	5	10	µg/L			
Benzo (g,h,I) perylene	5	10	µg/L			
Benzo (k) fluoranthene	5	10	µg/L			
Benzoic Acid	5	10	µg/L			
Benzyl Alcohol	5	10	µg/L			

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *AQUEOUS SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Semi-Volatile Organic Compounds by EPA 8270C						
Container: *Amber Glass, Teflon Lined Cap*			***Amount Required:*** *1 Liter*			
Preservation: *Cool, 4°C*			***Holding Time:*** *Extraction: 7 days*			
			Analysis: 40 days			
Bis-(2-chloroethoxy)methane	5	10	µg/L			
Bis-(2-chloroethyl)ether	5	10	µg/L			
Bis-(2-chloroisopropyl)ether	5	10	µg/L			
Bis-(2-ethylhexyl) Phthalate	5	10	µg/L			
Butyl Benzyl Phthalate	5	10	µg/L			
Chrysene	5	10	µg/L			
Dibenzo (a,h) anthracene	5	10	µg/L			
Dibenzofuran	5	10	µg/L			
Diethyl Phthalate	5	10	µg/L			
Dimethyl Phthalate	5	10	µg/L			
Di-n-butyl Phthalate	5	10	µg/L			
Di-n-octyl Phthalate	5	10	µg/L			
Fluoranthene	5	10	µg/L			
Fluorene	5	10	µg/L			
Hexachlorobenzene	5	10	µg/L			
Hexachlorobutadiene	5	10	µg/L			
Hexachlorocyclopentadiene	5	10	µg/L			
Hexachloroethane	5	10	µg/L			
Indeno-(1,2,3-cd) pyrene	5	10	µg/L			
Isophorone	5	10	µg/L			
Naphthalene	5	10	µg/L			
Nitrobenzene	5	10	µg/L			
N-Nitrosodi-n-propylamine	5	10	µg/L	41	116	20
N-Nitrosodiphenylamine	5	10	µg/L			
Pentachlorophenol	5	10	µg/L	40	125	20
Phenanthrene	5	10	µg/L			
Phenol	5	10	µg/L	12	98	20
Pyrene	5	10	µg/L	26	127	20
8270C surrogates						
2-Fluorobiphenyl			µg/L	*30*	*115*	
2-Fluorophenol			µg/L	*25*	*121*	
Nitrobenzene-d5			µg/L	*23*	*120*	
Phenol-d5			µg/L	*24*	*113*	
Terphenyl-d14			µg/L	*18*	*137*	
2,4,6-Tribromophenol			µg/L	*19*	*122*	

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR NPDES *AQUEOUS SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Organochlorine Pesticide Compounds by EPA 8081A						
Container: *Amber Glass ,Teflon Lined Cap*			***Amount Required:*** *1 Liter*			
Preservation: *Cool, 4°C*			***Holding Time:*** *Extraction: 7 days* *Analysis: 40 days*			
4,4'-DDD (DDD)	0.10	0.20	µg/L			
4,4'-DDE (DDE)	0.10	0.20	µg/L			
4,4'-DDT (DDT)	0.10	0.20	µg/L	40	140	40
Aldrin	0.05	0.10	µg/L	40	140	40
Chlordane	0.05	0.10	µg/L			
Dieldrin	0.10	0.20	µg/L	40	140	40
Endosulfan 1	0.05	0.10	µg/L			
Endosulfan 11	0.10	0.20	µg/L			
Endosulfan sulfate	0.10	0.20	µg/L			
Endrin	0.10	0.20	µg/L	40	140	40
Endrin aldehyde	0.10	0.20	µg/L			
Endrin ketone	0.10	0.20	µg/L			
Gamma-Chlordane	0.05	0.10	µg/L			
Heptachlor	0.05	0.10	µg/L	40	140	40
Heptachlor epoxide	0.05	0.10	µg/L			
Methoxychlor	0.05	1.0	µg/L			
Texaphene	5.00	10.0	µg/L			
alpha-Chlordane	0.05	0.10	µg/L			
alpha-Hexachlorocyclohexane (Alpha-BHC)	0.05	0.10	µg/L			
Beta- Hexachlorocyclohexane (Betta-BHC)	0.05	0.10	µg/L			
delta- Hexachlorocyclohexane (Delta-BHC)	0.05	0.10	µg/L			
gamma- Hexachlorocyclohexane (Gamma-BHC, Lindane)	0.05	0.10	µg/L	40	140	40
8081A surrogates						
Tetrachloro-m-xylene			µg/L	*30*	*150*	
Decachlorobiphenyl			µg/L	*30*	*150*	

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *AQUEOUS SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
PCB Compounds by EPA 8082 ***Container:*** *Amber Glass, Teflon Lined Cap* ***Preservation:*** *Cool, 4°C*			***Amount Required:*** *1 Liter* ***Holding Time:*** *Extraction: 7 days* *Analysis: 40 days*			
Aroclor-1016 (PCB-1016)	1.0	2.0	µg/L			
Aroclor-1221 (PCB-1221)	2.0	4.0	µg/L			
Aroclor-1232 (PCB-1232)	1.0	2.0	µg/L			
Aroclor-1242 (PCB-1242)	1.0	2.0	µg/L			
Aroclor-1248 (PCB-1248)	1.0	2.0	µg/L			
Aroclor-1254 (PCB-1254)	1.0	2.0	µg/L			
Aroclor-1260 (PCB-1260)	1.0	2.0	µg/L	75	125	20
Aroclor-1262 (PCB-1262)	1.0	2.0	µg/L			
Aroclor-1268 (PCB-1268)	1.0	2.0	µg/L			
8082 surrogates						
Tetrachloro-m-xylene			µg/L	*75*	*125*	

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR NPDES *AQUEOUS SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Organophosphorus Compounds by EPA 8141A						
Container: *Amber Glass, Teflon Lined Cap*			***Amount Required:*** *1 Liter*			
Preservation: *Cool, 4°C*			***Holding Time:*** *Extraction: 7 days*			
			Analysis: 40 days			
Azinophos, Methyl (Guthion)	2.0	2.0	µg/L			
Bolstar (Sulprofos)	1.0	1.0	µg/L	50	124	50
Chlorpyrifos (Dursban)	1.0	1.0	µg/L			
Coumaphos	2.0	2.0	µg/L			
Demeton	1.0	1.0	µg/L			
Diazinon	1.0	1.0	µg/L			
Dichlorvos	1.0	1.0	µg/L			
Disulfoton (Disyston)	1.0	1.0	µg/L			
Ethoprop	1.0	1.0	µg/L	51	127	50
Fensulfothion	1.0	1.0	µg/L			
Fenthion	1.0	1.0	µg/L			
Merphos	1.0	1.0	µg/L			
Methyl Parathion	1.0	1.0	µg/L			
Mevinphos (Phosdrin)	2.0	2.0	µg/L			
Naled (Dibrom)	2.0	2.0	µg/L			
Phorate (Thimet)	1.0	1.0	µg/L	50	125	50
Ronnel	1.0	1.0	µg/L	53	127	50
Stirophos (Tetrachlorvinphos)	1.0	1.0	µg/L			
Tokuthion (Prothiofos)	1.0	1.0	µg/L			
Trichloronate	1.0	1.0	µg/L			
8141A surrogates						
Tributylphosphate			µg/L	*50*	*129*	

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *AQUEOUS SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Chlorinated Herbicides by EPA 8151A						
Container: *Amber Glass, Teflon Lined Cap*			***Amount Required:*** *1 Liter*			
Preservation: *Cool, 4°C*			***Holding Time:*** *Extraction: 7 days*			
			Analysis: 40 days			
Acifluorfen	1.0	1.0	µg/L			
Bentazon	0.5	0.5	µg/L			
Chloramben	0.5	0.5	µg/L			
2,4-D	0.5	0.5	µg/L	36	152	21
Dalapon	1.0	1.0	µg/L			
2,4-DB	0.5	0.5	µg/L			
Dicamba	0.5	0.5	µg/L			
3,5-Dichlorobenzoic Acid	0.5	0.5	µg/L			
Dichloroprop	0.5	0.5	µg/L			
Dinoseb	0.5	0.5	µg/L			
MCPA	100	100	µg/L			
MCPP	100	100	µg/L			
4-Nitrophenol	0.5	0.5	µg/L			
Pentachlorophenol (PCP)	0.5	0.5	µg/L			
Picloram	0.5	0.5	µg/L			
2,4,5-T (2,4,5-Trichlorophenoxyacetic Acid)	0.5	0.5	µg/L	44	141	35
2,4,5-TP (Silvex)	0.5	0.5	µg/L	31	148	36
8151A surrogates						
N/A						

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *AQUEOUS SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Dioxin and Furan Compounds by EPA 8290						
Container: *Amber Glass, Teflon Lined Cap*			***Amount Required:*** *1 Liter X 2*			
Preservation: *Cool, 4°C, Dark*			***Holding Time:*** *Extraction: 30 days*			
			Analysis: 45 days			
2,3,7,8-Tetrachlorodibenzo-ρ-dioxin (TCDD)	1.5	1.5	pg/L	40	130	40
1,2,3,7,8-Pentachlorodibenzo-ρ-dioxin (PeCDD)	1.5	1.5	pg/L			
1,2,3,4,7,8-Hexachlorodibenzo-ρ-dioxin (HxCDD)	1.5	1.5	pg/L			
1,2,3,6,7,8-Hexachlorodibenzo-ρ-dioxin (HxCDD)	1.5	1.5	pg/L			
1,2,3,7,8,9-Hexachlorodibenzo-ρ-dioxin (HxCDD)	1.5	1.5	pg/L			
1,2,3,4,6,7,8-Heptachlorodibenzo-ρ-dioxin (HpCDD)	1.5	1.5	pg/L			
1,2,3,4,5,6,7,8-Octachlorodibenzo-ρ-dioxin (OCDD)	1.5	1.5	pg/L			
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	1.5	1.5	pg/L	40	130	40
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	1.5	1.5	pg/L			
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	1.5	1.5	pg/L			
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	1.5	1.5	pg/L			
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	1.5	1.5	pg/L			
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	1.5	1.5	pg/L			
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	1.5	1.5	pg/L			
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	1.5	1.5	pg/L			
1,2,3,4,5,6,7,8-Octachlorodibenzofuran (OCDF)	1.5	1.5	pg/L			
Total Tetrachlorodibenzo-ρ-dioxin (TCDD)	1.5	1.5	pg/L			
Total Pentachlorodibenzo-ρ-dioxin (PeCDD)	1.5	1.5	pg/L			
Total Hexachlorodibenzo-ρ-dioxin (HxCDD)	1.5	1.5	pg/L			
Total Heptachlorodibenzo-ρ-dioxin (HpCDD)	1.5	1.5	pg/L			
Total Tetrachlorodibenzofuran (TCDF)	1.5	1.5	pg/L			
Total Pentachlorodibenzofuran (PeCDF)	1.5	1.5	pg/L			
Total Hexachlorodibenzofuran (HxCDF)	1.5	1.5	pg/L			
Total Heptachlorodibenzofuran (HpCDF)	1.5	1.5	pg/L			
8290 surrogates						
Cl_{14}-2,3,7,8-TCDD			pg/L	*40*	*130*	

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *AQUEOUS SAMPLES*

ANALYTE	Method	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
General Minerals							
Container: *Plastic, Teflon Lined Cap*				***Amount Required:*** *1 Liter X 3*			
Preservation: *Cool, 4°C*				***Holding Time:*** *Various*			
Bicarbonate Alk. as $CaCO_3$	SM2320B	1	2	mg/L	80	120	15
Carbonate Alk. as $CaCO_3$	SM2320B	1	2	mg/L	80	120	15
Hydroxide Alk. as $CaCO_3$	SM2320B	1	2	mg/L	80	120	15
Alkalinity Total as $CaCO_3$	310.1	1	2	mg/L	80	120	15
Anions Total	Calc.	0.01	0.01	meq/L			
Cations Total	Calc.	0.01	0.01	meq/L			
Ion Balance	Calc.	0.01	0.01	%	80	120	
Chloride	325.3	0.5	1.0	mg/L	80	120	15
Specific Conductance	120.1	5	10	umhos/cm	80	120	
Fluoride	340.2	0.1	0.2	mg/L	80	120	15
Hardness Total as $CaCO_3$	130.2	1	2	mg/L	80	120	15
Nitrate as Nitrogen	352.1	0.05	0.10	mg/L	80	120	15
Nitrite as Nitrogen	354.1	0.01	0.02	mg/L	80	120	15
pH	150.1	0.01	0.01	std. unit	80	120	
Sulfate	375.4	5	10	mg/L	80	120	15
Surfactants(MBAS)	425.1	0.03	0.05	mg/L	80	120	15
Total Dissolved Solids	160.1	5	10	mg/L	80	120	
Aluminum	200.7	0.05	0.10	mg/L	80	120	15
Calcium	200.7	0.25	0.50	mg/L	80	120	15
Copper	200.7	0.01	0.02	mg/L	80	120	15
Iron	200.7	0.02	0.05	mg/L	80	120	15
Magnesium	200.7	0.25	0.50	mg/L	80	120	15
Manganese	200.7	0.005	0.010	mg/L	80	120	15
Potassium	200.7	0.5	1.0	mg/L	80	120	15
Sodium	200.7	0.25	0.50	mg/L	80	120	15
Zinc	200.7	0.015	0.030	mg/L	80	120	15

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *SOIL SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Total Petroleum Hydrocarbons by Modified EPA 8015B ***Container:*** *Clear Wide Mouth Glass, Teflon Lined Cap* ***Amount Required:*** *120 gr* ***Preservation:*** *Cool, 4°C* ***Holding Time:*** *Extraction: 14 days* *Analysis: 40 days*						
TPH as Diesel (C_{13} to C_{22})	5.0	10.0	mg/Kg	75	125	20
TPH as Heavy Hydrocarbons (C_{23} to C_{40})	5.0	10.0	mg/Kg			
Total TPH as Diesel and Heavy Hydrocarbons (C_{13} to C_{40})	5.0	10.0	mg/Kg			
8015B surrogates						
Chlorobenzene				*75*	*125*	

RPD = RELATIVE PERCENT DIFFERENCE

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Total Petroleum Hydrocarbons by Modified EPA 8015B ***Container:*** *Clear Wide Mouth Glass, Teflon Lined Cap,* ***Amount Required:*** *120 gr, or 5 gr X 4* *Encor, pre-preserved 40ml vials X 4, SS Sleeve, or other.* ***Preservation:*** *Cool, 4°C* ***Holding Time:*** *14 days*						
TPH as Gasoline and Light Hydrocarbons (C_4 to C_{12})	0.50	1.00	mg/Kg	75	125	20
8015B surrogates						
4-Bromofluorobenzene				*75*	*125*	

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *SOIL SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Polynuclear Aromatic Hydrocarbons by EPA 8310						
Container: *Clear Wide Mouth Glass, Teflon Lined Cap*			***Amount Required:*** *120 gr*			
Preservation: *Cool, 4°C, Dark*			***Holding Time:*** *Extraction: 14 days*			
				Analysis: 40 days		
Acenaphthene	0.01	0.02	mg/Kg	75	125	
Acenaphthylene	0.01	0.02	mg/Kg	75	125	
Anthracene	0.01	0.02	mg/Kg	75	125	
Benzo (a) anthracene	0.01	0.02	mg/Kg	75	125	20
Benzo (a) pyrene	0.01	0.02	mg/Kg	75	125	20
Benzo (b) fluoranthene	0.01	0.02	mg/Kg	75	125	
Benzo (g,h,i) perylene	0.01	0.02	mg/Kg	75	125	
Benzo (k) fluoranthene	0.01	0.02	mg/Kg	75	125	
Chrysene	0.01	0.02	mg/Kg	75	125	
Dibenzo (a, h) anthracene	0.01	0.02	mg/Kg	75	125	
Fluoranthene	0.01	0.02	mg/Kg	75	125	
Fluorene	0.01	0.02	mg/Kg	75	125	
Indeno (1,2,3-cd) pyrene	0.01	0.02	mg/Kg	75	125	
Naphthalene	0.01	0.02	mg/Kg	75	125	20
Phenanthrene	0.01	0.02	mg/Kg	75	125	
Pyrene	0.01	0.02	mg/Kg	75	125	
8310 surrogates						
p-terphenyl-d14			mg/Kg	*75*	*125*	

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *SOIL SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Volatile Organic Compounds by EPA 8260B						
Container: *Clear Wide Mouth Glass, Teflon Lined Cap, Encor, pre-preserved 40ml vials X 4, SS Sleeve, or other.*			***Amount Required:*** *120 gr, or 5 gr X 4*			
Preservation: *Cool, 4°C*			***Holding Time:*** *14 days*			
1,1,1,2-Tetrachloroethane	5.0	10	µg/Kg			
1,1,1-Trichloroethane	5.0	10	µg/Kg	75	125	
1,1,2,2-Tetrachloroethane	5.0	10	µg/Kg			
1,1,2-Trichloroethane	5.0	10	µg/Kg			
1,1-Dichloroethane	5.0	10	µg/Kg			
1,1-Dichloroethene	5.0	10	µg/Kg	75	125	20
1,1-Dichloropropene	5.0	10	µg/Kg			
1,2,3-Trichlorobenzene	5.0	10	µg/Kg			
1,2,3-Trichloropropane	5.0	10	µg/Kg			
1,2,4-Trichlorobenzene	5.0	10	µg/Kg			
1,2,4-Trimethylbenzene	5.0	10	µg/Kg			
1,2-Dibromo-3-Chloropropane	25	50	µg/Kg			
1,2-Dibromoethane	5.0	10	µg/Kg			
1,2-Dichlorobenzene	5.0	10	µg/Kg			
1,2-Dichloroethane	5.0	10	µg/Kg			
1,2-Dichloropropane	5.0	10	µg/Kg			
1,3,5-Trimethylbenzene	5.0	10	µg/Kg			
1,3-Dichlorobenzene	5.0	10	µg/Kg			
1,3-Dichloropropane	5.0	10	µg/Kg			
1,4-Dichlorobenzene	5.0	10	µg/Kg			
2,2-Dichloropropane	5.0	10	µg/Kg			
2-Butanone (Methylethyl kethone [MEK])	25	50	µg/Kg			
2-Chloroethyl Vinylether	50	50	µg/Kg			
2-Chlorotoluene	5.0	10	µg/Kg			
2-Hexanone	25	50	µg/Kg			
4-Chlorotoluene	5.0	10	µg/Kg			
4-Methyl-2-Pentanone	25	50	µg/Kg			
Acetone	25	50	µg/Kg			
Benzene	2.0	10	µg/Kg	75	125	20
Bromobenzene	5.0	10	µg/Kg			
Bromochloromethane	5.0	10	µg/Kg			
Bromodichloromethane	5.0	10	µg/Kg			
Bromoform	25	50	µg/Kg			
Bromomethane	15	30	µg/Kg			
Carbon Disulfide	25	50	µg/Kg			
Carbon Tetrachloride	5.0	10	µg/Kg			

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *SOIL SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Volatile Organic Compounds by EPA 8260B						
Container: *Clear Wide Mouth Glass, Teflon Lined Cap, Encor, pre-preserved 40ml vials X 4, SS Sleeve, or other.*			***Amount Required:*** *120 gr, or 5 gr X 4*			
Preservation: *Cool, 4°C*			***Holding Time:*** *14 days*			
Chlorobenzene	5.0	10	µg/Kg	75	125	20
Chloroethane	15	30	µg/Kg			
Chloroform	5.0	10	µg/Kg	75	125	
Chloromethane	15	30	µg/Kg			
cis-1,2-Dichloroethene	5.0	10	µg/Kg			
cis-1,3-Dichloropropene	5.0	10	µg/Kg			
Dibromochloromethane	5.0	10	µg/Kg			
Dibromomethane	5.0	10	µg/Kg			
Dichlorodifluoromethane	15	30	µg/Kg			
Ethylbenzene	2.0	10	µg/Kg	75	125	
Hexachlorobutadiene	5.0	10	µg/Kg			
Isopropylbenzene	5.0	10	µg/Kg			
Methylene Chloride	25	50	µg/Kg			
MTBE	5.0	10	µg/Kg			
n-Butylbenzene	5.0	10	µg/Kg			
n- Propylbenzene	5.0	10	µg/Kg			
Naphthalene	5.0	10	µg/Kg			
p- Isopropyltoluene	5.0	10	µg/Kg			
sec-Butylbenzene	5.0	10	µg/Kg			
Styrene	5.0	10	µg/Kg			
tert-Butylbenzene	5.0	10	µg/Kg			
Tetrachloroethene	5.0	10	µg/Kg			
Toluene	2.0	10	µg/Kg	75	125	20
trans-1,2-Dichloroethene	5.0	10	µg/Kg			
trans-1,3-Dichloropropene	5.0	10	µg/Kg			
Trichloroethene	5.0	10	µg/Kg	75	125	20
Trichlorofluoromethane	5.0	10	µg/Kg			
Vinyl Acetate	25	50	µg/Kg			
Vinyl Chloride	15	30	µg/Kg			
o-xylene	2.0	10	µg/Kg	75	125	
m,p-xylenes	2.0	20	µg/Kg	75	125	
8260B surrogates						
Toluene-d8			µg/Kg	*75*	*125*	
4-Bromofluorobenzene			µg/Kg	*75*	*125*	
Dibromofluoromethane			µg/Kg	*75*	*125*	

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *SOIL SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
TTLC Metals by Method 6010B/7471A						
Container: *Clear Wide Mouth Glass, Teflon Lined Cap*			***Amount Required:*** *120 gr*			
Preservation: *Cool, 4°C*			***Holding Time:*** *6 months, 28 days for Hg*			
Antimony	1.0	5.0	mg/Kg	80	120	15
Arsenic	1.0	5.0	mg/Kg	80	120	15
Barium	2.5	5.0	mg/Kg	80	120	15
Beryllium	1.3	2.5	mg/Kg	80	120	15
Cadmium	1.3	2.5	mg/Kg	80	120	15
Chromium	2.5	5.0	mg/Kg	80	120	15
Cobalt	2.5	5.0	mg/Kg	80	120	15
Copper	2.5	5.0	mg/Kg	80	120	15
Lead	2.5	5.0	mg/Kg	80	120	15
Mercury by 7471A	0.1	0.2	mg/Kg	80	120	15
Molybdenum	2.5	5.0	mg/Kg	80	120	15
Nickel	2.5	5.0	mg/Kg	80	120	15
Selenium	1.0	5.0	mg/Kg	80	120	15
Silver	2.5	5.0	mg/Kg	80	120	15
Thallium	1.0	5.0	mg/Kg	80	120	15
Vanadium	2.5	5.0	mg/Kg	80	120	15
Zinc	2.5	5.0	mg/Kg	80	120	15

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *SOIL SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Method EPA 9010B ***Container:*** *Clear Wide Mouth Glass, Teflon Lined Cap* ***Amount Required:*** *120 gr* ***Preservation:*** *Cool, 4°C* ***Holding Time:*** *14 days*						
Total Cyanide	0.5	0.5	mg/Kg	80	120	20

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *SOIL SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Method EPA 7199A ***Container:*** *Clear Wide Mouth Glass, Teflon Lined Cap* ***Amount Required:*** *120 gr* ***Preservation:*** *Cool, 4°C* ***Holding Time:*** *Extraction: 1 month* *Analysis: 70 Hours*						
Chromium, Hexavalent	0.20	0.20	mg/Kg	65	110	20

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *SOIL SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Semi-Volatile Organic Compounds by EPA 8270C						
Container: *Clear Wide Mouth Glass, Teflon Lined Cap*			***Amount Required:*** *120 gr*			
Preservation: *Cool, 4°C*			***Holding Time:*** *Extraction: 14 days*			
			Analysis: 40 days			
1,2,4-Trichlorobenzene	0.25	0.50	mg/Kg	38	107	20
1,2-Dichlorobenzene	0.25	0.50	mg/Kg			
1,3-Dichlorobenzene	0.25	0.50	mg/Kg			
1,4-Dichlorobenzene	0.25	0.50	mg/Kg	28	104	20
2,4,5-Trichlorophenol	0.25	0.50	mg/Kg			
2,4,6-Trichlorophenol	0.25	0.50	mg/Kg			
2,4-Dichlorophenol	0.25	0.50	mg/Kg			
2,4-Dimethylphenol	0.25	0.50	mg/Kg			
2,4-Dinitrophenol	0.25	0.50	mg/Kg			
2,4-Dinitrotoluene	0.25	0.50	mg/Kg	28	89	20
2,6-Dinitrotoluene	0.25	0.50	mg/Kg			
2-Chloronaphthalene	0.25	0.50	mg/Kg			
2-Chlorophenol	0.25	0.50	mg/Kg	25	102	20
2-Methylnaphthalene	0.25	0.50	mg/Kg			
2-Methylphenol	0.25	0.50	mg/Kg			
2-Nitroaniline	0.25	0.50	mg/Kg			
2-Nitrophenol	0.25	0.50	mg/Kg			
3,3-Dichlorobenzidine	0.25	0.50	mg/Kg			
3-Methylphenol	0.25	0.50	mg/Kg			
3-Nitroaniline	0.25	0.50	mg/Kg			
4,6-Dinitro-2-methylphenol	0.25	0.50	mg/Kg			
4-Bromophenyl Phenyl Ether	0.25	0.50	mg/Kg			
4-Chloro-3-methylphenol	0.25	0.50	mg/Kg	40	99	20
4-Chloroaniline	0.25	0.50	mg/Kg			
4-Chlorophenyl Phenyl Ether	0.25	0.50	mg/Kg			
4-Methylphenol	0.25	0.50	mg/Kg			
4-Nitroaniline	0.25	0.50	mg/Kg			
4-Nitrophenol	0.25	0.50	mg/Kg	11	114	20
Acenaphthene	0.25	0.50	mg/Kg	31	137	20
Acenaphthylene	0.25	0.50	mg/Kg			
Anthracene	0.25	0.50	mg/Kg			
Benzo (a) anthracene	0.25	0.50	mg/Kg			
Benzo (a) pyrene	0.25	0.50	mg/Kg			
Benzo (b) fluoranthene	0.25	0.50	mg/Kg			
Benzo (g,h,i) perylene	0.25	0.50	mg/Kg			
Benzo (k) fluoranthene	0.25	0.50	mg/Kg			
Benzoic Acid	0.25	0.50	mg/Kg			
Benzyl Alcohol	0.25	0.50	mg/Kg			

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *SOIL SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Semi-Volatile Organic Compounds by EPA 8270C						
Container: *Clear Wide Mouth Glass, Teflon Lined Cap* ***Amount Required:*** *120 gr*						
Preservation: *Cool, 4°C* ***Holding Time:*** *Extraction: 14 days* *Analysis: 40 days*						
Bis-(2-chloroethoxy)methane	0.25	0.50	mg/Kg			
Bis-(2-chloroethyl)ether	0.25	0.50	mg/Kg			
Bis-(2-chloroisopropyl)ether	0.25	0.50	mg/Kg			
Bis-(2-ethylhexyl) Phthalate	0.25	0.50	mg/Kg			
Butyl Benzyl Phthalate	0.25	0.50	mg/Kg			
Chrysene	0.25	0.50	mg/Kg			
Dibenzo (a,h) anthracene	0.25	0.50	mg/Kg			
Dibenzofuran	0.25	0.50	mg/Kg			
Diethyl Phthalate	0.25	0.50	mg/Kg			
Dimethyl Phthalate	0.25	0.50	mg/Kg			
Di-n-butyl Phthalate	0.25	0.50	mg/Kg			
Di-n-octyl Phthalate	0.25	0.50	mg/Kg			
Fluoranthene	0.25	0.50	mg/Kg			
Fluorene	0.25	0.50	mg/Kg			
Hexachlorobenzene	0.25	0.50	mg/Kg			
Hexachlorobutadiene	0.25	0.50	mg/Kg			
Hexachlorocyclopentadiene	0.25	0.50	mg/Kg			
Hexachloroethane	0.25	0.50	mg/Kg			
Indeno-(1,2,3-cd) pyrene	0.25	0.50	mg/Kg			
Isophorone	0.25	0.50	mg/Kg			
Naphthalene	0.25	0.50	mg/Kg			
Nitrobenzene	0.25	0.50	mg/Kg			
N-Nitrosodi-n-propylamine	0.25	0.50	mg/Kg	41	126	20
N-Nitrosodiphenylamine	0.25	0.50	mg/Kg			
Pentachlorophenol	0.25	0.50	mg/Kg	13	125	20
Phenanthrene	0.25	0.50	mg/Kg			
Phenol	0.25	0.50	mg/Kg	26	90	20
Pyrene	0.25	0.50	mg/Kg	35	142	20
8270C surrogates						
2-Fluorobiphenyl			mg/Kg	*30*	*115*	
2-Fluorophenol			mg/Kg	*25*	*121*	
Nitrobenzene-d5			mg/Kg	*23*	*120*	
Phenol-d5			mg/Kg	*21*	*113*	
Terphenyl-d14			mg/Kg	*18*	*137*	
2,4,6-Tribromophenol			mg/Kg	*19*	*122*	

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *SOIL SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Organochlorine Pesticide Compounds by EPA 8081A						
Container: *Clear Wide Mouth Glass, Teflon Lined Cap*			***Amount Required:*** *120 gr*			
Preservation: *Cool, 4°C*			***Holding Time:*** *Extraction: 14 days*			
				Analysis: 40 days		
Aldrin	0.01	0.05	mg/Kg	40	140	40
Chlordane	0.04	0.20	mg/Kg			
alpha-Chlordane	0.01	0.05	mg/Kg			
4,4'-DDD (DDD)	0.01	0.05	mg/Kg			
4,4'-DDE (DDE)	0.01	0.05	mg/Kg			
4,4'-DDT (DDT)	0.01	0.05	mg/Kg	40	140	40
Dieldrin	0.01	0.05	mg/Kg	40	140	40
Endosulfan 1	0.01	0.05	mg/Kg			
Endosulfan 11	0.01	0.05	mg/Kg			
Endosulfan sulfate	0.01	0.05	mg/Kg			
Endrin	0.01	0.05	mg/Kg	40	140	40
Endrin aldehyde	0.01	0.05	mg/Kg			
Endrin ketone	0.01	0.05	mg/Kg			
Gamma-Chlordane	0.01	0.05	mg/Kg			
Heptachlor	0.01	0.05	mg/Kg	40	140	40
Heptachlor epoxide	0.01	0.05	mg/Kg			
alpha-Hexachlorocyclohexane (Alpha-BHC)	0.01	0.05	mg/Kg			
Beta- Hexachlorocyclohexane (Betta-BHC)	0.01	0.05	mg/Kg			
delta- Hexachlorocyclohexane (Delta-BHC)	0.01	0.05	mg/Kg			
gamma- Hexachlorocyclohexane (Gamma-BHC, Lindane)	0.01	0.05	mg/Kg	40	140	40
Methoxychlor	0.01	0.05	mg/Kg			
Texaphene	0.04	0.20	mg/Kg			
8081A surrogates						
Tetrachloro-m-xylene			mg/Kg	*30*	*150*	
Decachlorobiphenyl			mg/Kg	*30*	*150*	

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *SOIL SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
PCB Compounds by EPA 8082						
Container: *Clear Wide Mouth Glass, Teflon Lined Cap*			***Amount Required:*** *120 gr*			
Preservation: *Cool, 4°C*			***Holding Time:*** *Extraction: 14 days* *Analysis: 40 days*			
Aroclor-1016 (PCB-1016)	35	35	µg/Kg			
Aroclor-1221 (PCB-1221)	70	70	µg/Kg			
Aroclor-1232 (PCB-1232)	35	35	µg/Kg			
Aroclor-1242 (PCB-1242)	35	35	µg/Kg			
Aroclor-1248 (PCB-1248)	35	35	µg/Kg			
Aroclor-1254 (PCB-1254)	35	35	µg/Kg			
Aroclor-1260 (PCB-1260)	35	35	µg/Kg	50	150	20
Aroclor-1262 (PCB-1262)	35	35	µg/Kg			
Aroclor-1268 (PCB-1268)	35	35	µg/Kg			
8082 surrogates						
Tetrachloro-m-xylene			µg/Kg	*50*	*150*	

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *SOIL SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Organophosphorus Compounds by EPA 8141A						
Container: *Clear Wide Mouth Glass, Teflon Lined Cap*			***Amount Required:*** *120 gr*			
Preservation: *Cool, 4°C*			***Holding Time:*** *Extraction: 14 days*			
			Analysis: 40 days			
Azinophos, Methyl (Guthion)	100	100	µg/Kg			
Bolstar (Sulprofos)	50	50	µg/Kg	64	115	43
Chlorpyrifos (Dursban)	50	50	µg/Kg			
Coumaphos	100	100	µg/Kg			
Demeton	50	50	µg/Kg			
Diazinon	50	50	µg/Kg			
Dichlorvos	50	50	µg/Kg			
Disulfoton (Disyston)	50	50	µg/Kg			
Ethoprop	50	50	µg/Kg	54	129	43
Fensulfothion	50	50	µg/Kg			
Fenthion	50	50	µg/Kg			
Merphos	50	50	µg/Kg			
Methyl Parathion	50	50	µg/Kg			
Mevinphos (Phosdrin)	100	100	µg/Kg			
Naled (Dibrom)	100	100	µg/Kg			
Phorate (Thimet)	50	50	µg/Kg	50	126	47
Ronnel	50	50	µg/Kg	60	121	24
Stirophos (Tetrachlorvinphos)	50	50	µg/Kg			
Tokuthion (Prothiofos)	50	50	µg/Kg			
Trichloronate	50	50	µg/Kg			
8141A surrogates						
Tributylphosphate			µg/Kg	*52*	*129*	

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *SOIL SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Chlorinated Herbicides by EPA 8151A						
Container: *Clear Wide Mouth Glass, Teflon Lined Cap*			***Amount Required:*** *120 gr*			
Preservation: *Cool, 4°C*			***Holding Time:*** *Extraction: 14 days*			
			Analysis: 40 days			
Acifluorfen	20	20	µg/Kg			
Bentazon	10	10	µg/Kg			
Chloramben	10	10	µg/Kg			
2,4-D	10	10	µg/Kg	36	157	55
Dalapon	20	20	µg/Kg			
2,4-DB	10	10	µg/Kg			
Dicamba	10	10	µg/Kg			
3,5-Dichlorobenzoic Acid	10	10	µg/Kg			
Dichloroprop	10	10	µg/Kg			
Dinoseb (DNBP, 2-sec-Butyl-4,6-dinitrophenol)	20	20	µg/Kg			
MCPA	2000	2000	µg/Kg			
MCPP	2000	2000	µg/Kg			
4-Nitrophenol	10	10	µg/Kg			
Pentachlorophenol (PCP)	10	10	µg/Kg			
Picloram	10	10	µg/Kg			
2,4,5-T (2,4,5-Trichlorophenoxyacetic Acid)	10	10	µg/Kg	69	140	35
2,4,5-TP (Silvex)	10	10	µg/Kg	32	149	36
8151A surrogates						
N/A						

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *SOIL SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Dioxin and Furan Compounds by EPA 8290						
Container: *Clear Wide Mouth Glass, Teflon Lined Cap*		***Amount Required:*** *120 gr*				
Preservation: *Cool, 4°C*		***Holding Time:*** *Extraction: 30 days*				
			Analysis: 45 days			
2,3,7,8-Tetrachlorodibenzo-ρ-dioxin (TCDD)	1.5	1.5	ng/Kg	40	130	40
1,2,3,7,8-Pentachlorodibenzo-ρ-dioxin (PeCDD)	1.5	1.5	ng/Kg			
1,2,3,4,7,8-Hexachlorodibenzo-ρ-dioxin (HxCDD)	1.5	1.5	ng/Kg			
1,2,3,6,7,8-Hexachlorodibenzo-ρ-dioxin (HxCDD)	1.5	1.5	ng/Kg			
1,2,3,7,8,9-Hexachlorodibenzo-ρ-dioxin (HxCDD)	1.5	1.5	ng/Kg			
1,2,3,4,6,7,8-Heptachlorodibenzo-ρ-dioxin (HpCDD)	1.5	1.5	ng/Kg			
1,2,3,4,5,6,7,8-Octachlorodibenzo-ρ-dioxin (OCDD)	1.5	1.5	ng/Kg			
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	1.5	1.5	ng/Kg	40	130	40
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	1.5	1.5	ng/Kg			
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	1.5	1.5	ng/Kg			
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	1.5	1.5	ng/Kg			
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	1.5	1.5	ng/Kg			
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	1.5	1.5	ng/Kg			
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	1.5	1.5	ng/Kg			
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	1.5	1.5	ng/Kg			
1,2,3,4,5,6,7,8-Octachlorodibenzofuran (OCDF)	1.5	1.5	ng/Kg			
Total Tetrachlorodibenzo-ρ-dioxin (TCDD)	1.5	1.5	ng/Kg			
Total Pentachlorodibenzo-ρ-dioxin (PeCDD)	1.5	1.5	ng/Kg			
Total Hexachlorodibenzo-ρ-dioxin (HxCDD)	1.5	1.5	ng/Kg			
Total Heptachlorodibenzo-ρ-dioxin (HpCDD)	1.5	1.5	ng/Kg			
Total Tetrachlorodibenzofuran (TCDF)	1.5	1.5	ng/Kg			
Total Pentachlorodibenzofuran (PeCDF)	1.5	1.5	ng/Kg			
Total Hexachlorodibenzofuran (HxCDF)	1.5	1.5	ng/Kg			
Total Heptachlorodibenzofuran (HpCDF)	1.5	1.5	ng/Kg			
8290 surrogates						
Cl_{14}-2,3,7,8-TCDD			ng/Kg	*40*	*130*	

RPD = RELATIVE PERCENT DIFFERENCE

TABLE 1 AETL'S SUMMARY OF ANALYTES AND QAPP OBJECTIVES FOR *SOIL SAMPLES*

ANALYTE	MDL	PQL	UNITS	LOWER CONTROL LIMIT %	UPPER CONTROL LIMIT %	RPD LIMIT
Volatile Aromatic (BTEX) Compounds by EPA 8021B						
Container: *Clear Wide Mouth Glass, Teflon Lined Cap, Encor, pre-preserved 40ml vials X 4, SS Sleeve, or other.* ***Amount Required:*** *120 gr, or 5 gr X 4*						
Preservation: *Cool, 4°C* ***Holding Time:*** *14 days*						
Benzene	2.0	5.0	µg/Kg	75	125	20
Ethylbenzene	2.0	5.0	µg/Kg	75	125	20
Toluene	2.0	5.0	µg/Kg	75	125	20
o-xylene	2.0	5.0	µg/Kg	75	125	20
m,p-xylenes	2.0	5.0	µg/Kg	75	125	20
8021B surrogates						
α,α,α-Trifluorotoluene			µg/Kg	*75*	*125*	

RPD = RELATIVE PERCENT DIFFERENCE

APPENDIX J

Analytical Laboratory Quality Assurance and Quality Control Plan

American Environmental Testing Laboratory

Quality Assurance/Quality Control

Manual

American Environmental Testing Laboratory

Quality Assurance/Quality Control

Manual

Reviewed and Approved by:

C. Razmara

Cyrus Razmara Ph.D. - Laboratory Director

05-05-05
Date

Gary Morelli - QA/QC Manager

05-05-05
Date

American Environmental Testing Laboratory

Quality Assurance/Quality Control

Manual

AETL Control # 1/1

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Quality Control/Quality Assurance Manual

PURPOSE

The purpose of this manual is to formally document the principles and procedures by which the laboratory produces its data. The objective of this QA/QC program is to provide a system of checks and controls which enables the laboratory to reliably and consistently provide data that is performed according to established EPA methodologies, of known precision and accuracy, and defensible in court, if necessary.

To meet this commitment, a comprehensive QA/QC program has been established. American Environmental Testing Laboratory (hereinafter called AETL) adheres to the principles and procedures outlined in this manual.

SCOPE

This manual presents an overview of the Quality Assurance/Quality Control (QA/QC) program that governs all data which is produced by AETL. The essential components of AETL's QA/QC program are outlined in the following sections. Detailed information regarding specific methods/procedures should be directed to documented Standard Operating Procedures (SOPs) or to laboratory management.

AETL has modeled its program after guidelines as outlined in "Interim Guidelines and Specifications for Preparing Quality Assurance Program Plans," QAMS-004/80, December 29, 1980 and "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans," QAMS_005/80, February, 1983, both of which have been issued by the Office of Monitoring Systems and Quality Assurance, Office of Research and Development, USEPA. All routine QA/QC practices follow EPA "Minimum Guidelines for the Evaluation of Laboratory DATA" as reporting in the Thursday, February 8, 1990 (page 4440) issue of the Federal Register.

INTRODUCTION

American Environmental Testing Laboratory is an analytical laboratory offering specialized environmental testing services. The laboratory has expertise in the analysis of organic and inorganic compounds in support of various

environmental activities including investigations, remediations, monitoring services, underground tank (UST) programs and other related events.

The laboratory routinely analyses in full compliance with the following agencies:

- US Environmental Protection Agency (USEPA)
- California Department of Health Services (CA DHS)
- American Society of Materials and Testing (ASTM)
- Arizona Department of Health Services (ADHS)
- Nevada Department of Health Services (UST work only)

Outside laboratories are audited for Quality Control procedures for all analyses not performed by AETL. An objective list of standard features is used for each outside laboratory with each laboratory listed in the order in which they are graded.

DEFINITIONS

Analytical Batch- is the basic unit for analytical quality control. The analytical batch is a group of samples which are analyzed together with the same method sequence and same lots of reagents and with manipulations common to each sample within the same time period or in continuous sequential time periods. Samples in each batch should be similar in composition (matrix) and must be analyzed within the same 24 hour time frame as a unit.
An analytical batch at AETL is composed of 15 or less samples. Every analytical batch has a corresponding QC batch number which is the extraction date for extractable organic compounds and the analysis date for non-extractable organic compounds. The QC batch number for wet chemistry and analysis of metals is the corresponding preparation date of each analytical method.

Method Detection Limit (MDL)- is a statistically derived number specific to each instrument, each instrument detector and in some instances, each different analyte, the amount of which is distinctively detectable, and is above zero concentration (99% sure).

Practical Quantitation Limit (PQL)- is a mathematical multiple of the MDL. The value of the multiple which can range from 1 to 10 is dependent upon factors such as the method of analysis and the actual practice that is followed by individual chemists in the laboratory.

Environmental Sample (or field sample)- is a representative portion of any material collected from any source for which determination of composition or portions thereof is requested.

Initiate Analysis- is the point in time that the sample, extract or digestate is introduced into an instrument or process for analysis of the parameter of interest.

Method Blank- is an analysis involving all of the reagents or chemical solutions common to a given analysis using reagent grade water (see below) as the matrix.

QA/QC Program- is the complete plan of policies and procedures incorporated by the laboratory in order to produce acceptable data.

Reagent Grade- is a reagent which conforms to the current specifications of the Committee on Analytical Reagents of the American Chemical Society. The burden of verification of this is generally left to the chemical manufacturer.

Replicate Sample- is a sample prepared by dividing a sample into two or more separate aliquots. Duplicate samples are considered to be two replicates.

Standard Curve- is a plot of instrument response to an analyte versus the known concentration of a standard analyte.

Reagent Water- is an analyte-free or laboratory pure water which is either distilled and/or de-ionized and is free of contaminants that may interfere with the analytical test in question.

LABORATORY STRUCTURE

The current management structure of AETL consists of a Laboratory Director, Project Managers, Laboratory Supervisors, and Chemists. The laboratory is structured into two main branches, the Organic Branch that includes the analysis of all organic compounds by GC/FID/PID/HALL, GC/MS, HPLC and IR, and the Inorganic Branch that includes the analysis of all inorganic compounds such as metals by ICP, FLAA, GFAA, anions, and cations by wet chemistry methods.

QA/QC OBJECTIVES FOR DATA MEASUREMENT

The Quality Assurance/Quality Control program is an essential part of the analytical protocol. It has been integrated into all facets of the laboratory operation. Its purpose is to detect and correct problems in the measurement process, to ensure that all data is valid, of known precision and accuracy and legally defensible. It is designed to monitor and control the quality of data

generated by the laboratory. The conscientious execution of the QA/QC procedures described herein ensures that the results will meet or exceed the minimum requirements of data acceptability as established by the EPA and California DHS. It assures the proper sample collection, preservation, labeling and storage procedures are applied to maintain sample integrity and identification. The specific procedures implemented to obtain valid data are described in the following sections.

The QA/QC program objectives include:

- Demonstration of the ability of the laboratory to perform analyses accurately, reproducibly and reliably.
- Reduction of measurement errors to acceptable minimum levels.
- Evaluation and control of data generation.
- Documentation of the laboratory's performance on a daily basis.

An essential part of the formally documented QA/QC program is the sound judgment of the technical staff. It is the technical staff that interprets events that may have caused an out-of-control condition. A function of the QA/QC program is to alert the staff that a nonconformity may exist. This ensures that corrective action can be administered without delay. Samples analyzed under conditions that are found to be out-of-control are reanalyzed utilizing a properly operating system.

SAMPLING PROCEDURES

In an attempt to minimize sample preservation effects, samples should be analyzed as soon as possible after receipt into the laboratory. Since it is not always possible to perform analyses immediately, sample must be maintained in an unaltered state. Samples are always preserved with consideration for desired analyte(s).

Sample collection technique preservation conditions and storage conditions may have a significant impact on chemical/physical analysis. AETL has a policy of providing certified pre-cleaned sampling containers to clients so that container integrity is not an issue. The use of proper sampling containers, protocols and performance of analyses within the established holding time limit are criteria for data acceptance that are not compromised at AETL. The following items demand attention to ensure sample integrity:

- Samples must be collected and stored in contaminant-free containers.
- Samples must consist of an adequate volume and /or weight.

- Samples must be clearly and completely labeled corresponding to the client chain of custody record.
- Samples must be properly preserved immediately after collection.

A listing of sampling and preservation requirements for analyses performed by AETL is presented in Appendix 1.

When sample containers and labels are provided to clients, AETL adheres to the EPA's established guidelines for sample preservation, storage, and holding times. For the analyses of water and waste water, the laboratory follows the guidelines found in Table 1060: I, page 1-22 in "Standard Methods for the Examination of Water and Waste Water," 1995, 19th edition, APHA, AWWA, WEF and Table 2-16 in SW-846, September 1986, 3rd edition, Volume 1A, pages 31-32.

SAMPLE CUSTODY

The chain of custody procedure employed by AETL follows procedures established by the EPA and is applied to all samples whether they are analyzed immediately, in the field, by the laboratory or sent to an outside laboratory by courier. The objective of the chain of custody procedure is to establish legal documentation describing the transfer of samples. The procedure records the custody of the samples from the sampling event, through shipment and receipt by the laboratory. The samples may be considered legal evidence and it is the intention of AETL to treat them accordingly.

The chain of custody procedure is outlined below:

1. When samples are received in the laboratory, they are checked against the chain of custody to make sure that samples and chain of custody match. If any discrepancies such as missing samples, miss-matching of numbers or quantity of sample are observed the information is conveyed to the pre-assigned project manager, who in turn will inform the sampler or client for explanation or new instructions.
   After matching of samples and the chain of custody, up to three pages of chains of custody are grouped together and assigned an AETL job number. This is done in order to avoid generation of large document files in AETL Laboratory Information Management System (LIMS). All documents in relation to all the samples in an AETL job are filed in the specific folder for that AETL job number. These documents could be specific instructions for the analysis of the samples or AETL generated chains of custody for subcontract work, etc. If a group of samples are subdivided into many AETL jobs, then all instructions for that group of samples are filed in every corresponding AETL job.

2. All samples that are received by the laboratory, and which have been grouped in an AETL job, are individually assigned an unambiguous, laboratory identification number at the time of receipt in the laboratory. Samples that are to be archived, are not assigned a laboratory identification number. These samples are stored in the pre-determined area in a refrigerator. Archived samples will be held until an analysis is assigned to them. At that time, they will be assigned a laboratory identification number and processed.

3. The sample containers are fully identified with this laboratory identification number. Sample labels are completed and are permanently fixed to the sample container. The time and date of the sampling event, the identity of the sampler and the preservative, if any, are documented on the chain of custody record.

4. Each sample on the chain of custody is marked with the assigned laboratory identification number and the record is compared with the labeling of the sample container. Information noted on the chain of custody record includes: client name, project name and location, sampler's signature, sample identification, analysis requested, turn around time requirements, number of containers per sample, description of sample matrix, date and time of the sampling event, laboratory's name and the laboratory sample number.

5. Each transfer of sample custody is recorded on the form. The relinquishing party and the receiving party accepting the samples must sign the chain of custody record and document the time and date of the transfer.

6. All information with regards to sample identity and requested analysis is transferred to the laboratory logbook. The chain of custody which now contains an AETL job number and individual laboratory identification numbers are forwarded to data entry. At the data entry all samples with the requested analysis are logged in to the Laboratory Information Management System (LIMS). After entry into the LIMS, a work order is generated. Project manager then checks the work order for corrections and completeness. The project manager will make sure that all the information with regards to a project, samples, and requested analysis have been transcribed correctly and completely into the LIMS.

7. After the samples have been logged in and tagged with their individual laboratory identification number, they will be transferred to the corresponding refrigerator for soil, water and air samples. Samples will be grouped by AETL job number and placed in pre-assigned locations

according to their laboratory identification number. Range of laboratory identification numbers are posted outside individual refrigerators so that samples can be located by the analysts for analysis.

8. There is usually a time laps between receipt of samples and the issuance of a work order. In order to avoid any delays in the analysis of the samples, after logging in of the samples in the laboratory log book, every analyst that has to perform any analysis will receive a copy of the chain of custody with the requested analysis hi-lighted for that analyst. Each of the pertinent analysts are also informed of incoming samples with the required turn around times by the project managers as soon as the information is available. If laboratory is at capacity, then alternative arrangements will be made.

9. When the analyst is ready for the analysis of samples, he or she will remove the samples from their corresponding storage space and will return the samples to the same place after completion of his or her work.

10. If a sample has to be shared by more than one analyst, then the analysts are informed by the project manager of the requirement so that the sample will be analyzed in accordance with the proper order of analytical priorities. The order of analytical priorities at AETL is as such: VOC, Organics, Wet Chem, Metals.

11. Samples are kept in cold storage for up to 3 months. After this period they are kept in ambient storage for up to 6 months. Unless the client requests that sample be held longer, all samples will be disposed by certified waste disposal companies. All samples are documented by their laboratory identification number prior to their disposal. All wastes that are disposed, are manifested and the manifest documents filed and kept for six years.

A copy of the AETL chain of custody record is presented in Appendix 2.

CALIBRATION PROCEDURES AND FREQUENCY

The accuracy of calibration is dependent on the purity of the standard solutions and reagents used in the analytical operation. AETL continually monitors the quality of its reagents and standard solutions. When possible, standards acquired have traceability to the USEPA or the National Institute of Standards and Technology (NIST). Permanent records are maintained to document standard traceability. This information is recorded in a Standards Log Book. An example form is given in Appendix 3.

The generation of valid data is dependent on the accurate and reliable calibration of the instrument. Although calibration and standardization procedures vary depending on the type of system and analytical method employed, the principles of calibration are universal. Proper calibration ensures that the analytical system is operating correctly and functioning at the proper sensitivity to meet established method detection limits. Before a system is used for analyses, the calibration range is defined, detection limits are determined and potential interferences are identified and eliminated where possible. The calibration status is checked periodically to ensure that the system is functioning properly. Each instrument is calibrated with standards appropriate to the type of analysis and the calibration range established for the method employed. The calibration program at AETL is instrument/method specific. The calibration procedure for selected instruments are given in the following sections.

Gas Chromatography/Mass Spectroscopy (GC/MS) Analysis

Commercially available standards or standards prepared from neat compounds, validated by comparison to EPA or NIST reference materials when possible, are used to determine the detectability and adjust the selectivity of the chromatographic system for all compounds or multi-response mixtures being measured.

The calibration procedure is initiated after the system has been reviewed to ensure proper operation. A blank is analyzed immediately prior to the analysis of calibration standards to indicate the absence of interferences. Calibration is completed by analyzing standard solutions at a minimum of five concentration levels according to the standard operating procedure for the method under consideration. The standard of lowest concentration is at or slightly above the established limit of quantification for each analyte. Analyzing a standard with a concentration in the midpoint level completes the calibration process. The source of this standard is independent of the calibration standards. It is also verified at least once for every 15 measurements and at the beginning and end of a batch.

The criteria of retention time stability and sensitivity of instrumentation for every method are met prior to the start of any analysis of samples.

Bromofluorobenzene (BFB) Tuning criteria and calibration verification (SPCC and CCC) criteria must be met before analyzing samples and checked every 12 hours during sample analyses. When the response for all parameters is within the limits set for acceptance, the analysis of environmental samples may continue. When an individual response falls outside this range, the system must be recalibrated for that parameter after checking the original response.

Internal Standard Calibration

All GC/MS procedures at AETL use the internal standard calibration procedure concentrations.

Gas Chromatography (GC) Analysis

Commercially available standards or standards prepared from neat compounds, validated by comparison to EPA or NIST reference materials when possible, are used to determine the detectibility and adjust the selectivity of the chromatographic system for all compounds or multi-response mixtures being measured.

The calibration procedure is initiated after the system has been reviewed to ensure proper operation. A blank is analyzed immediately prior to the analysis of calibration standards to indicate the absence of interferences. Calibration is completed by analyzing standard solutions at a minimum of five concentration levels according to the standard operating procedure for the method under consideration. The standard of lowest concentration is at or slightly above the established limit of quantification for each analyte. The other standards should be limited by the working range of the detector(s) in use. The calibration process is completed by analyzing a standard, usually a midpoint level concentration, that originates from a source independent of the calibration standards. It is also verified at least once for every 15 measurements and at the beginning and end of a batch.

When the response for all parameters is within the limits set for acceptance (usually ± 15%), the analysis of environmental samples may continue. When an individual response falls outside this range, the system must be recalibrated for that parameter after checking the original response. In addition, the samples analyzed under the failed check standard must be reanalyzed for the parameter that failed.

High Performance Liquid Chromatography (HPLC)

Commercially available standards or standards prepared from neat compounds, validated by comparison to EPA or NIST reference materials when possible, are used to determine the detectibility and adjust the selectivity of the chromatographic system for all compounds or multi-response mixtures being measured.

The calibration procedure is initiated after the system has been reviewed to ensure proper operation. A blank is analyzed immediately prior to the analysis

of calibration standards to indicate the absence of interferences. Calibration is completed by analyzing standard solutions at a minimum of five concentration levels according to the standard operating procedure for the method under consideration. The standard of lowest concentration is at or slightly above the established limit of quantification for each analyte. The other standards should be limited by the working range of the detector(s) in use. The calibration process is completed by analyzing a standard, usually a midpoint level concentration, that originates from a source independent of the calibration standards. It is also verified at least once for every 15 measurements and at the beginning and end of a batch.

When the response for all parameters is within the limits set for acceptance (usually ± 15%), the analysis of environmental samples may continue. When an individual response falls outside this range, the system must be recalibrated for that parameter after checking the original response. In addition, the samples analyzed under the failed check standard must be reanalyzed for the parameter that failed.

External Standard Calibration

All Chromatographic procedures at AETL use the external standard calibration procedure. A calibration curve is constructed with peak height or area versus concentration for the analyte of interest. An R squared value of 98% or greater for the external five point calibration curves are forced through the origin to account for background noise. The calibration factor can then be used to determine analyte concentrations.

Metals Analyses

Commercially available standards or standards prepared from neat compounds, validated by comparison to EPA or NIST reference materials when possible, are used to determine the concentrations of each metal analyzed.

For Flame Atomic Absorption (FLAA) or Graphite Furnace Atomic Absorption (GFAA), a three-point calibration curve is initiated by analyzing a minimum of three different concentrations and a calibration curve is initiated by analyzing a minimum of three different concentrations and a calibration blank. For Inductively Coupled Plasma (ICP) a calibration blank and a high concentration standard for each of the elements of interest are analyzed. Concentrations of each level are specified by the manufacturer or are in the EPA methods. This is to ensure proper operation and calibration of the system before commencing the analysis scheme. A blank is analyzed immediately prior to the

analysis of calibration standards to indicate the absence of interferences and a clean system. In addition, a method blank is always run after a high or off-scale analysis has been run. The calibration process is completed by analyzing a standard, usually at midpoint level concentration, that originates from a source independent of the calibration standards.

After every 10 samples the working standard curve is verified by measuring a midpoint standard. For ICP analyses, this check standard value must be within 10% of the true value or the previous 10 samples need to be reanalyzed. For FLAA analyses, this check standard value must be within 15% of the true value or the previous 10 samples need to be reanalyzed. For GFAA, this check standard value must be within 20% of the true value or the previous 10 samples need to be reanalyzed.

For ICP analyses the interelement and background correction factors must be verified at the beginning and end of each analytical run or twice every 8-hour work shift, which ever is more frequent. Results must be within 20% of the true value or analyses cannot continue.

All EDL or hollow cathode lamps for FLAA or GFAA are checked each time they are used to determine if they are within manufacturer's specified energy levels.

Conventional Wet Chemistry Analyses

Conventional wet analyses utilize various instrumentation, which are applied to specific analytical methodologies. Each instrument is calibrated or checked prior to sample analysis. A method blank and a minimum of three standards are prepared when appropriate. Calibration is deemed acceptable when a linear response is obtained or when the calibration response is within method guidelines. Reagent grade standards are used for calibration purposes. Check standards are obtained from an independent source.

IR analyses for EPA 418.1 and 413.2 use at least a five-point calibration and preferably a seven-point calibration. Since it is unlikely that the calibration will ever fail unless there is an instrument malfunction, a single midpoint calibration check should be sufficient for each batch of IR analyses. After every 10 samples the working standard curve is verified by measuring a midpoint standard. This sample value must be within 20% of the true value or the previous 10 samples need to be reanalyzed.

ANALYSTS TRAINING

All analysts who are hired by AETL are screened rigorously for their professional backgrounds and formal education. After hiring, every analyst is assigned a supervisor and a peer member who will work with the new analyst. The new analyst is then issued a Good Laboratory Practice Standards Manual and the Standard Operating Procedure (SOP) of the assigned analytical method. The analyst will then work with the peer member under the supervision of an assigned supervisor. When the analyst feels confident enough that he or she can perform the method, he or she is asked to proceed with an Initial Demonstration of Proficiency (IDP). When the analyst can show an IDP of 90% or better he or she will be given a blind internal QC sample. After passing of the QC sample and achievement of a 90% or better result on the IDP, the analysts will be allowed to work independently. All analysts constantly work under the supervision of their section supervisor at all times.

ANALYTICAL PROCEDURES

The laboratory routinely provides analyses of organic and inorganic parameters in conformity with US EPA and CA DHS methodologies. Appropriate analytical techniques are incorporated into methods and procedures as prescribed by the EPA and ASTM. The origination of these procedures and techniques is presented in Appendix 4.

Each analytical method employed is documented in the form of a Standard Operating Procedure (SOP). The purpose of establishing these procedures is to standardize the methods so that all samples are analyzed consistently, correctly and without bias. In addition, the SOPs provide a good starting point for the training of new analysts. The SOP is constructed so that it contains detailed instructions describing the use and performance of the method. All pertinent QA/QC program procedures are integrated into the SOP.

Before an analytical method is used to generate data, the method is validated. Method validation includes definition of detection limits, the determination of the calibration range, and precision and accuracy. A list of recommended methods for the analysis of specific parameters to be used in this laboratory and in outside laboratories is presented in Appendix 1.

DATA MANAGEMENT

All data generated at AETL is extensively checked to ensure that it is valid, of known precision and accuracy and defensible. The data validation

process consists of data generation, reduction, and review. After this process has been completed to the satisfaction of the QA/QC project plan, the laboratory report is generated and reviewed.

Data Reduction

Data reduction is the process by which raw data is transformed into final results. The analyst who generated the analytical data has the primary responsibility for its quality. All data is generated and reduced following procedures specified by the laboratory SOPs. Each analyst reviews the quality of his/her work based on these established QA/QA procedures, his/her technical knowledge, and experience. The analysts reviews the data package to ensure that:

- Raw data generated from the analysis is correct and complete
- Appropriate SOPs have been followed
- Analytical results are correct and defensible
- Method blank test results are within control limits
- Matrix spike/spike duplicate results are within control limits
- Laboratory control sample results are within established limits
- Documentation is complete

Data Validation

After the data reduction package is reviewed, initialed, and dated by the analyst, it is then forwarded to the laboratory manager for review. This review also includes verification of calculations and raw data to provide a complete independent audit of the data package. When no errors are found, the reviewed data are then approved for release and the final report is prepared.

Report Documentation

The purpose of the Laboratory Report is to provide a concise and complete description of the analytical results generated for a specific set of samples. The Laboratory Report consists of three parts: general client and lab information, laboratory results and the Quality Assurance/Quality Control summary.

General information issued in the laboratory report consists of the client identification and address, project identification and address, date of the report, laboratory job number and client job number, the date the sample(s) was

collected, the date it was received by the laboratory, the date it was analyzed and the physical state of the sample.

The QA/QC summary issued in the laboratory report consists of a description of the parameter investigated, the method used, the QC type (Matrix Spike/Spike Duplicate or Laboratory Control Sample), the recovery, the acceptable range for recovery, the reproducibility and the acceptable range for reproducibility.

The laboratory results section of the laboratory report identifies the test performed, the sample on which the test was performed, the parameters investigated, the level determined for each parameter investigated with the appropriate units and the method detection limit for each parameter.

Additional information issued in the laboratory report includes a statement as to the condition of the sample(s) on receipt. In addition, any qualifications about the sample analysis such as fuel type, method alterations, etc. will be places in the laboratory report summaries on footnotes.

INTERNAL QUALITY CONTROL CHECKS

Data quality is monitored with internal QC checks. The checks are used to determine whether the laboratory is operating within acceptable limits. Sample matrix effects are also evaluated by the use of QC checks.

Method Blanks

Method blanks are analyzed to assess the level of background interference or contamination in the analytical system. A method blank is analyzed each time a batch is processed. When compounds are found in the blank, their values are evaluated to determine their effect on the analysis of environmental samples. Three possibilities exist:

1. There are no compounds found in the blank.
   No action is required.

2. Compound(s) is (are) found in the blank, but are not found in the sample.
   No action is required.

3. Compound(s) is (are) found in the blank and are found in the sample. The results are not corrected by subtracting any blank value from the sample. No positive sample result is reported unless the concentration of the

compound in the sample exceeds five times the amount of the compound in question found in the blank or if it exceeds 10 times the amount in any blank for the common contaminants listed below:

a. methylene chloride
b. acetone
c. toluene
d. 2-butanone
e. phthalate esters

Certain other compounds such as Freon 113, hexane, and pentane may be present in blanks if they are being used in the vicinity of analyses. The presence of these compounds in the blank and sample should be dealt with using the five times rule listed above.

Calibration Check Standards

Calibration check standards are analyzed to confirm that measurements were performed in an in-control mode of operation. The calibration check standard concentration is established near the midpoint of the calibration range. Instrument calibration is checked with every analytical batch. It is also verified once for at least every 15 measurements or at the end of a batch, whichever is more frequent. Calibration checks must be within 15% for all analytes of interest before proceeding with the analysis of samples.

Laboratory Control Samples

Laboratory Control Samples (LCS) are prepared/obtained from sources independent of the calibration standards. The LCS concentration is established near the midpoint calibration range. An LCS must be prepared and analyzed once per batch of samples.

Matrix Spikes

A matrix spike is an environmental sample into which known concentrations of analyte(s) have been added. The matrix spike sample is analyzed with environmental samples of the same matrix type in each batch and the results are used to evaluate sample matrix effects on method accuracy. For each method at least two compounds or 10 percent of the analytes of interest must be spiked.

Matrix Spike Duplicates

A matrix spike duplicate is one of two QC checks of an environmental sample. It is spiked with the same concentration of an analyte(s) as the matrix spike. The matrix spike duplicate sample is analyzed with environmental samples of the same matrix type in each batch. The results evaluate sample matrix effects on method accuracy. Values obtained from the matrix spike and matrix spike duplicate analyses are compared to evaluate sample matrix effects on method precision. Statistics are kept for each analyte recovery for each matrix type.

Surrogates

Surrogates are organic compounds, which are similar to the analytes of interest, but are not normally found in environmental samples. Surrogates must be spiked into blanks, standards, spikes, and samples for organic analyses to monitor sample specific effects on method accuracy. They should not interfere with target analytes.

Field / Trip Blanks

Field blanks are used to monitor contamination origination from the collection and transportation of environmental samples. They are prepared and sealed in the laboratory using reagent grade water (preferably Type II) and are released to the sample collector prior to the collection event. These blanks are analyzed immediately in order to eliminate interferences from storage effects.

There are two types of field blanks; field blanks which are opened in the field during the time that a sample is being collected and equipment blanks, which are the rinsate from sample collection.

A trip blank remains sealed the entire from the laboratory to sample collection to the laboratory again. It measures any effects due to the sample container, transportation effects, and sample environment to and from the laboratory.

INTRALABORATORY AUDITS

Audits are an integral part of the QA/QC program. Audits conducted at AETL are of two types: system audits, which quantitatively evaluate the operational details of the QA/QC program, and performance audits which quantitatively evaluate the accuracy of analytical data generated. It is the responsibility of the laboratory manager or an outside auditing entity such as CA DHS personnel to conduct these audits.

System Audits

System audits consist of checks of critical operations in randomly selected test record that are reviewed to assure that all required documentation are retrievable. Data is examined in detail to determine the quality as well as the completeness of the information. This detailed examination also ensures that all steps of the QA/QC program are performed. The frequency of system audits depends on the critical nature of the data output, the importance of different certifications/recertifications, and the number of system changes.

Performance Audits

Performance audits evaluate test methods. The laboratory manager conducts these audits by introducing reference samples into the analysis stream without the knowledge of the analyst when possible. The audit is completed upon evaluation of the analytical results of reference samples by the laboratory manager.

PREVENTIVE MAINTENANCE

A preventive maintenance schedule exists for each instrument, which enables consistent generation of quality data. Routine instrument maintenance is conducted by designated laboratory personnel in accordance with the manufacturer's specification and/or the experience of the operator. Instrument repairs are performed by trained staff of instrument manufacturer representatives. AETL maintains logbooks documenting the preventive maintenance and repairs performed on each instrument.

DATA ASSESSMENT

The effectiveness of a QA/QC program is measured by the quality of data generated by the laboratory. Data generated by the laboratory is assessed in terms of the measure of its precision, accuracy, representativeness,

completeness, and comparability. The quantification procedure for each of these terms is detailed in the following sections.

Precision

Precision is the degree to which a measurement can be reproduced without assumption of any prior knowledge as to the true result. Precision is assessed by the means of duplicate/replicate sample analyses. The acceptability of replicate analyses at AETL is the evaluation of the relative percent difference (RPD) of control sample values. The RPD is calculated in all cases where matrix spike and matrix spike duplicate determination are made. Its definition is given below:

$$RPD = \{(X_1 - X_2) \div [(X_1 + X_2) \div 2]\} \times 100$$

Where X_1 and X_2 are measurements of the same parameter of duplicate/replicate sample analyses.

Accuracy

Accuracy is the determination of how close a measurement is to the actual value. It can be assessed by means of laboratory control samples (LCS), standard reference materials or spiked samples and their corresponding percent recoveries. The calculation of accuracy is terms of percent recovery is as follows:

$$\text{Percent Recovery} = [(\text{Observed Value} - \text{Sample Value}) \div \text{Known Value}] \times 100$$

The determination of the accuracy of a measurement requires knowledge of the known value for the parameter being measured.

Representativeness

Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a given set of samples or data sets to that of the site from which the samples were collected. The use of appropriate methods and sound judgment in the field will ensure that samples are representative of the site and that their collection was performed in accordance with the appropriate project sampling and analysis plan (SAP). To maximize representatieness of results, sampling procedures should follow established protocols and sample locations should be chosen based on sound judgment and knowledge of the particular site. Laboratory personnel will be able to advise the client on these matters. Some samples may require analysis of multiple phases to obtain representative results. The client is always consulted as to which phase of a multi-phase sample is to be analyzed.

Completeness

Completeness is defined as the ratio of usable (i.e. non-rejected) laboratory measurements to the total number of planned measurements for an investigation.

Percent completeness=(NUR ÷TNPR) x 100

NUR = Number of Usable Results i.e. Non-rejected Results
TNPR = Total Number of Possible Results

AETL goal is to achieve Percent Completeness of 90% or better.

Comparability

Comparability is an evaluation of the relative consistency of the laboratory measurement data. Since comparability cannot be measured quantitatively, therefore professional judgment is relied upon. Internal comparability will be achieved for samples by adhering to consistent sample collection procedures and analyses methods throughout each investigation.

Control Charts / QA Statistics

Statistics are maintained by the laboratory to determine laboratory specific Quality Control limits. Matrix Spike/Matrix Spike Duplicate data are tabulated on a Semi-Annually basis for each parameter for each matrix type. Control charts are established using this data to monitor trends and shifts in data generation. Check standards and matrix spike/matrix spike duplicates sets or laboratory control sample spikes are used in conjunction with laboratory control charts to monitor the daily performance of analytical methods. Precision and accuracy are evaluated for each QC sample and compared to established laboratory acceptance criteria. If laboratory criterion has not been established, or the laboratory has produced an insufficient number of data points, then the EPA method should be consulted for control limits.

The control chart is a graph of the mean value line with upper and lower control limits. There are two types of control limits that evaluate data acceptability: the warning limit and the out-of-control limit. The warning limit is set at ± 2 standard deviations of the mean and the out-of-control limit at ± 3 standard deviations of the mean. QC results in the 2-3 standard deviation range alert the analyst to a potential out of range event. Data lying beyond the third standard deviation requires that the test be repeated for all samples affected. For the

purpose of control chart interpretation, an out of range event is defined as any QC data point or set of points that meet the following conditions:

- A single data point outside of 3 standard deviations.
- Two points which are consecutively outside of 2 standard deviations (warning limit).

The following criteria define a trend or shift, respectively:

- The steady increase or decrease in value of seven consecutive measurements.
- A series of seven or more consecutive points above or below the mean.

When any of the above conditions exists, all analyses pertaining to the method which is out-of-control must cease, corrective action must be initiated, and all samples analyzed under the out-of-control situation must be reanalyzed. The instrument or procedure should be examined for possible causes.

CORRECTIVE ACTION

Regardless of the cause, any activity in the laboratory which adversely affects the quality of the data is considered a nonconformance. Non-conformances are defined as errors, deficiencies or out-of-control situations. These situations can arise due to method procedural problems, equipment malfunctions, improper data reduction or nonsystematic errors. The QA/QC program provides systematic procedures called corrective actions to resolve these non-conformances and restore the system to its proper condition. The analyst, who performs the initial review of the situation and the initial diagnosis of the nonconformance, often handles corrective action procedures. If the problem persists or cannot be identified, the matter is referred to laboratory management for further investigation. Once a nonconformance has been confirmed, analysis must be stopped and the integrity of the results determined. When the analyses are adversely affected, the samples in question must be reanalyzed utilizing a system that is functioning properly. Once resolved, full documentation of the corrective action procedure is filed with management, placed into the maintenance logbook, and all reanalyzed samples noted in the instrument logbook. An example of a non-conformance report is presented in Appendix 5.

QUALITY ASSURANCE REPORTS

Once per month or more often if necessary, management discusses QA/QC issues that have relevance to the previous month's performance. The

purpose of this discussion is to provide a monthly monitoring and review of the data produced by the laboratory. A continual effort is made through SOPs and QA/QC documents to upgrade the quality of data being produced by the laboratory.

Document Control

In relation to every project two types of document are generated. The first type is any document that is generated outside the laboratory by the client and the sampler. The second type is any document that is generated by the laboratory. All documents that are generated outside the laboratory and which are forwarded to the laboratory are filed in the corresponding AETL Job folder and returned to the client with the original results of analysis.
A copy of these documents with a copy of the analytical results are kept in the AETL job folder and eventually filed in storage in accordance with AETL job number.
All new data that are generated by the laboratory are also filed in the corresponding daily folder for each method and kept in storage in accordance with dates and AETL job numbers. All documents that are stored at AETL are kept for at least 6 years.

SECURITY

The laboratory maintains two levels of security to limit access to samples or associated data. Facility security is maintained through controlled access to the laboratory by keeping the doors locked with limited access for cleared laboratory employees. The door of the sample storage room, which is kept locked at all times, is only accessible by the sample custodian. Access to clients' old data and files, which are kept in locked files in the laboratory's main office, is only possible through the laboratory secretary with the approval of the laboratory director. Clients' new data is kept in computer network, which can be accessed through a password by the laboratory secretary with the approval of the laboratory director.

In addition all employees of AETL sign a confidentiality agreement when they become employed at AETL. Unless authorized by the laboratory director, none of AETL employees are allowed to discuss any of the results with any client. Only project manager and the laboratory director are authorized to discuss data with the clients. Data of no client is discussed with any third party unless, the client authorizes AETL in writing.

Data generated by AETL is transcribed into AETL LIMS by data entry staffs that are assigned a personal security pass codes. Once a data has been entered into

the LIMS, it can no longer be changed, deleted or added to unless, it is authorized by the corresponding project manager or laboratory director.
All information on AETL LIMS is stored on tape on a weekly basis. A copy of the tape is always kept by the laboratory director in storage outside the laboratory premises for safety.

APPENDIX 1

SAMPLING AND PRESERVATION REQUIREMENTS

AMERICAN ENVIRONMENTAL TESTING LABORATORY

INORGANIC TESTS

Determination	Method No.	Matrix	Preservative	Sample Required	Container	Holding Time
Acidity	305.1	Water	Cool, 4°C	100 mL	P / G	14 days
Alkalinity	310.1	Water	Cool, 4°C	100 mL	P / G	14 days
Ammonia	350.1 auto 350.2 manual 350.3 electrode	Water	Cool, 4°C; H_2SO_4 to pH <2	500 mL	P / G	28 days
BOD	405.1	Water	Cool, 4°C	1000 mL	P / G	48 hours
Boron	200.7 212.3	Water	None Required	600 mL	P	28 days
Bromide	320.1 300	Water	None Required	100 mL	P / G	28 days
Calcium	215.2 200.7	Water	Cool, 4°C; H_2SO_4 to pH <2	600 mL	P / G	6 months
Chloride	325.3 300	Water	None Required	100 mL	P / G	28 days

AMERICAN ENVIRONMENTAL TESTING LABORATORY

Determination	Method No.	Matrix	Preservative	Sample Required	Container	Holding Time
Chlorine, residual	330.4	Water	None Required	100 mL	P / G	Analyze Immediately
COD	410.4	Water	Cool, 4°C; H_2SO_4 to pH <2	100 mL	P / G	28 days
Color	110.2	Water	Cool, 4°C	100 mL	P / G	48 hours
Cyanide, Total	335.2 9010	Water Soil	Cool, 4°C; NaOH to pH>12 0.6 gm Ascorbic acid Cool, 4°C	500 mL 20 gm	P / G	14 days, 24h if sulfide is present
Cyanide, Amenable to Chlorination	335.1 9012	Water Soil	Cool, 4°C; NaOH to pH>12 0.6 gm Ascorbic acid Cool, 4°C	500 mL 20 gm	P / G	14 days, 24h if sulfide is present
Fluoride	340.2 300	Water	None Required	100 mL	P	28 days
Hardness	130.2 200.7	Water	HNO_3 to pH <2	100 mL	P / G	6 months
Iodide	345.1	Water	Cool, 4°C	100 mL	P	Analyze Immediately

Polyethylene (P), Glass (G)

AMERICAN ENVIRONMENTAL TESTING LABORATORY

Determination	Method No.	Matrix	Preservative	Sample Required	Container	Holding Time
Metals, except Cr(VI) & Mercury	200 Series / 6010/7000Series	Water* / Soil/Sludge	HNO_3 to pH <2 / None Required	600 mL / 200 gm	P / G	6 months
Cr (VI)	7196 / 99	Water* / Soil/Sludge	Cool, 4°C	400 mL / 100 gm	P / G	(W) 24 hours, (S) 30days to digestion, 168 h. to analysis.
Mercury	245.1 / 7471	Water* / Soil/Sludge	HNO_3 to pH <2 / None Required	400 mL / 200 gm	P / G	28 days
Nitrate	352.1 / 300	Water	Cool, 4°C	100 mL	P / G	48 hours
Nitrate & Nitrite	353.3 / 300	Water	Cool, 4°C; H_2SO_4 to pH <2	100 mL	P / G	28 days
Nitrite	354.1 / 300	Water	Cool, 4°C	100 mL	P / G	48 hours
Nitrogen, Total Kjeldahl	351.3	Water	Cool, 4°C; H_2SO_4 to pH <2	100 mL	P / G	28 days
Odor	140.1	Water	Cool, 4°C	500 mL	G	Analyze Immediately

* For dissolved metals, filter on site, and then add preservative. Polyethylene (P), Glass (G).

AMERICAN ENVIRONMENTAL TESTING LABORATORY

Determination	Method No.	Matrix	Preservative	Sample Required	Container	Holding Time
Oil and Grease	413.1 / 1664 9070	Water Soil/Sludge	Cool, 4°C; H_2SO_4 to pH <2	4000 mL 200 gm	G	28 days
Orthophosphate	365.1	Water	Filter Immediately; Cool, 4°C	100 mL	P / G	48 hours
Oxygen, Dissolve	360.1	Water	None Required	100 mL	G bottle and top	Analyze Immediately
pH	150.1 9040 / 9045	Water Soil/Sludge	None Required	100 mL 20 gm	P / G	Analyze Immediately
Phenolics	420.1 / 9065	Water	Cool, 4°C; H_2SO_4 to pH <2	500 mL	G	28 days
Phosphorus, Total	365.2	Water	Cool, 4°C; H_2SO_4 to pH <2	100 mL	P / G	28 days
Residue, Filterable (TDS)	160.1	Water	Cool, 4°C	200 mL	P / G	7 days
Residue, Nonfilterable (TSS)	160.2	Water	Cool, 4°C	200 mL	P / G	7 days

Polyethylene (P), Glass (G).

AMERICAN ENVIRONMENTAL TESTING LABORATORY

Determination	Method No.	Matrix	Preservative	Sample Required	Container	Holding Time
Residue, Settleable (SS)	160.5	Water	Cool, 4°C	1000 mL	P / G	48 hours
Residue, Total (TS)	160.3	Water	Cool, 4°C	200 mL	P / G	7 days
Residue, Volatile (TVS)	160.4	Water	Cool, 4°C	200 mL	P / G	7 days
Silica	370.1 200.7	Water	Cool, 4°C	100 mL	P	28 days
Specific Conductance	120.1 / 9050	Water	Cool, 4°C	100 mL	P / G	28 days
Sulfate	375.4 9038	Water	Cool, 4°C	100 mL	P / G	28 days
Sulfide	376.2 9030	Water	Cool, 4°C; 2 mL zinc acetate plus NaOH to pH > 9	500 mL	P / G	7 days
Sulfite	377.1	Water	None Required	100 mL	P / G	Analyze Immediately

AMERICAN ENVIRONMENTAL TESTING LABORATORY

Determination	Method No.	Matrix	Preservative	Sample Required	Container	Holding Time
Surfactants (MBAS)	425.1	Water	Cool, 4°C	100 mL	P / G	48 hours
Temperature	170.1	Water	None Required	100 mL	P / G	Analyze Immediately
Total Organic Carbon (TOC)	415.1 / 9060	Water	Cool, 4°C; HCl or H_2SO_4 to pH <2	100 mL	P / G	28 days
Total Organic Halogen (TOX)	9020	Water	Cool, 4°C; H_2SO_4 to pH <2	100 mL	G	28 days
Total Organic Lead	CA DHS	Soil/Sludge	Cool, 4°C	50 gm	P / G	14 days
Total Recoverable Petroleum Hydrocarbons(TRPH)	418.1	Water / Soil	Cool, 4°C; H_2SO_4 to pH <2 / Cool, 4°C	4000 mL / 200 gm	G	14 days
Turbidity	180.1	Water	Cool, 4°C	100 mL	P / G	48 hours

AMERICAN ENVIRONMENTAL TESTING LABORATORY
ORGANIC TESTS

Determination	Method No.	Matrix	Preservative	Sample Required	Container	Holding Time
Purgeable Halocarbons	601 / 8010	Water / Soil	Cool, 4°C; 0.008% sodium thiosulfate**	2 x 40 mL / 50 gm	G, Teflon lined septum	14 days
Purgeable Aromatic Hydrocarbon	602 / 8020/8021B	Water / Soil	HCl to pH 2, Cool, 4°C; 0.008% sodium thiosulfate** Cool, 4°C	2 x 40 mL / 50 gm	G, Teflon lined septum	14 days
Acrolein, Acrylonitrile	603 / 8030	Water / Soil	Cool, 4°C; 0.008% sodium thiosulfate**adjust pH to 4-5 Cool, 4°C	2 x 40 mL / 50 gm	G, Teflon lined septum	14 days
Phenols	604 / 8040	Water / Soil	Cool, 4°C; 0.008% sodium thiosulfate** Cool, 4°C	4000 mL / 200 gm	G, Teflon lined septum	(W), 7 days until extraction (S), 14 days until extraction 40 days after extraction
Phthalate Esters	606 / 8060	Water / Soil	Cool, 4°C; 0.008% sodium thiosulfate** Cool, 4°C	4000 mL / 200 gm	G, Teflon lined cap	(W), 7 days until extraction (S), 14 days until extraction 40 days after extraction
Organochlorine Pesticides / PCBs	608 / 8080	Water / Soil	Cool, 4°C	4000 mL / 200 gm	G, Teflon lined cap	(W), 7 days until extraction (S), 14 days until extraction 40 days after extraction
Organochlorine Pesticides	8081	Water / Soil	Cool, 4°C	4000 mL / 200 gm	G, Teflon lined cap	(W), 7 days until extraction (S), 14 days until extraction 40 days after extraction
PCBs	8082	Water / Soil	Cool, 4°C	4000 mL / 200 gm	G, Teflon lined cap	(W), 7 days until extraction (S), 14 days until extraction 40 days after extraction
Polynuclear Aromatic Hydrocarbons	610 / 8100 / 8310	Water / Soil	Cool, 4°C; 0.008% sodium thiosulfate** Store in dark	4000 mL / 200 gm	G, Teflon lined cap	(W), 7 days until extraction (S), 14 days until extraction 40 days after extraction

**Added if residual Chlorine present, Glass (G), Soil (S), Water (W)

AMERICAN ENVIRONMENTAL TESTING LABORATORY

Determination	Method No.	Matrix	Preservative	Sample Required	Container	Holding Time
Chlorinated Hydrocarbon	612 / 8120	Water Soil	Cool, 4°C	4000 mL 200 gm	G, Teflon lined cap	(W), 7 days until extraction (S), 14 days until extraction 40 days after extraction
Organo phosphorous compounds	8141	Water Soil	Cool, 4°C	4000 mL 200 gm	G, Teflon lined cap	(W), 7 days until extraction (S), 14 days until extraction 40 days after extraction
Organochlorine Herbicides	615 / 8151A	Water Soil	Cool, 4°C	4000 mL 200 gm	G, Teflon lined cap	(W), 7 days until extraction (S), 14 days until extraction 40 days after extraction
Volatile Organic compounds	624 / 8240/8260B	Water Soil	Cool, 4°C; 0.008% sodium thiosulfate* Cool, 4°C	2×40 mL 50 gm	G, Teflon lined cap	14 days for water, and 5030, 48 hours for soil by 5035
Semi - Volatile Organic compounds	625 / 8270C	Water Soil	Cool, 4°C; 0.008% sodium thiosulfate* Cool, 4°C	4000 mL 200 gm	G, Teflon lined cap	(W), 7 days until extraction (S), 14 days until extraction 40 days after extraction
Total Petroleum Hydrocarbon as Gasoline	P & T / Extractable LUFT Manual	Water Soil	Cool, 4°C; 0.008% sodium thiosulfate* HCl to pH <2 Cool, 4°C	2×40 mL 50 gm	G, Teflon lined septum	14 days
Total Petroleum Hydrocarbon as Diesel	Extractable	Water Soil	Cool, 4°C	4000 mL 200 gm	G	(W), 7 days until extraction (S), 14 days until extraction 40 days after extraction
PCDB-Dioxins and PCDB-Furans	8280/8290	Water Soil	Cool, 4°C	4000 mL 200 gm	G	(W), 7 days until extraction (S), 14 days until extraction 40 days after extraction
Dissolved gasses in water	RSK-175SOP	Water	Cool, 4°C	2 x 40 mL VOA	G	14 days

Polyethylene (P) Glass (G) *added if residual Chlorine present

APPENDIX 2

CHAIN-OF-CUSTODY RECORD

APPENDIX 3

STANDARDS LOG FORM

APPENDIX 4

LIST OF TECHNICAL REFERENCES

LIST OF TECHNICAL REFERENCES

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Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 2nd Edition, USEPA, revised April 1985 and 3rd edition, September, 1986.

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Methods for the Determination of Organic Compounds in Drinking Water, EPA-600/4-88/039, December, 1988.

Methods for Organic Analysis of Municipal and Industrial Wastewater, EPA-600/4-82-057, July, 1982.

Official Methods and Recommended Practices of the American Oil Chemist's Society, American Oil Chemist's Society, 1988.

Federal Register, Vol. 56, No. 5, pp. 636-643, January 8, 1991.

Criteria for Identification of Hazardous and Extremely Hazardous Wastes, California Code of Regulations, (CCR) Title 22.

"Direct Current Plasma (DCP) Optical Spectrometric Method for Trace Elemental Analysis of Water and Wastes, Method AES0029", 1986, Revised 1991, Applied Research Laboratories, Inc., 24911 Avenue Stanford, Valencia, CA 91355.

APPENDIX 5

QC NONCONFORMANCE REPORT

QC NONCONFORMANCE REPORT

JOB # _____ **SAMPLES AFFECTED** _____

DATE _____

ANALYSIS OUT OF CONTROL_____

_____

_____

_____

_____

HOW THE PROBLEM WAS RESOLVED_____

_____

_____

_____

_____

COMMENTS_____

_____

_____

_____

_____

Attach control charts and other data associated with the nonconformance.

ANALYST_____

Corrective action verified by:_____

LABORATORY QA/QC

APPENDIX 6

DOHS CERTIFICATION

APPENDIX K

Business Plan / Contingency Plan (Volume II), Facility Emergency Plan,
South Bay Power Plant, Duke Energy North America,
California Regional EH&S Department

BUSINESS PLAN / CONTINGENCY PLAN

VOLUME II:

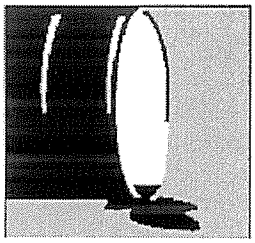
FACILITY EMERGENCY PLAN

SOUTH BAY POWER PLANT

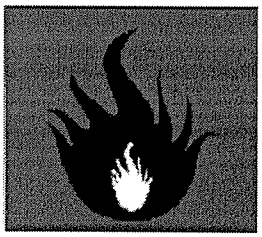
PREPARED BY

DUKE ENERGY NORTH AMERICA
CALIFORNIA REGIONAL EH&S DEPARTMENT

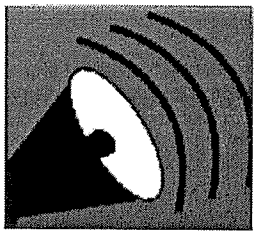
Duke-01
December 2004



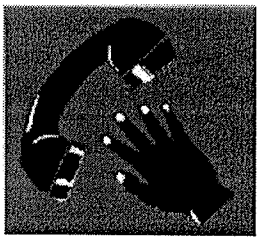
SPILL OR RELEASE



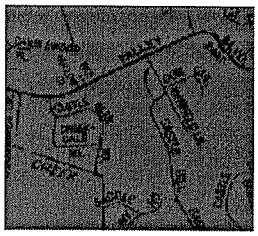
FIRE / FLOOD EARTHQUAKE/ BOMB THREAT



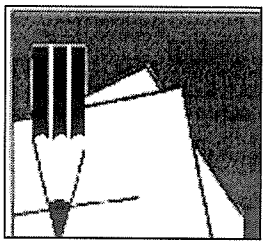
EMERGENCY RESPONSE/ICS/ MEDICAL/ EVACUATION



TEAMS & CONTACTS



MAPS & DIAGRAMS



PLAN ADMINISTRATION

Duke Energy highly values the health and safety of our employees, customers and communities, and the protection of the environment. Business planning increases the likelihood that desired conditions will be maintained as we generate electric power to serve the needs of California customers. Planning begins with anticipating environmental, health and safety hazards. This Facility Emergency Plan has been prepared for Duke Energy South Bay, LLC, South Bay Power Plant (SBPP) to ensure that in the event of an emergency, roles, responsibilities, and actions are defined and summarized for employee and team effectiveness. This Facility Emergency Plan satisfies emergency planning regulatory requirements (AB 2185 and 19 CCR, Division 2, Chapter 4) by outlining and describing steps to be taken to "stop, prevent, abate, or mitigate a release or threatened release thereby ensuring the elimination of a condition of substantial probability of harm to human health and safety, property, or the environment."

This plan has been developed as Volume II to the SBPP Business Plan/Contingency Plan (BP/CP). It works in conjunction with the BP/CP, and provides specific procedures and notification processes to be performed in response to various emergency situations.

The Plant Manager is the Emergency Coordinator for this facility. The Alternate Emergency Coordinators are the Assistant Plant Manager and the Production Team Leaders (PTLs). These personnel collectively provide 24-hour, seven day a week, emergency response coordination.

The SBPP is owned by the San Diego Unified Port District. Duke Energy North America (DENA) is the operator of SBPP, and has a 10-year lease with the Port District to operate the SBPP. The SBPP is located in Chula Vista, San Diego County, California. It operates four steam-driven turbine generator units that produce a total of approximately 700 megawatts (MW) of electrical energy. Boilers used to produce steam are fired primarily by natural gas transferred in by pipeline. Fuel oil #6 is used as a backup fuel supply and is rarely burned. Also onsite is a 14-MW gas turbine fueled by Jet A fuel, started with natural gas. This unit is used for "black starts" (should the plant lose power and need to restart itself independently from the outside electrical system) and to produce additional power during peak season.

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SPILL OR RELEASE OF HAZARDOUS MATERIALS (YELLOW)

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SPILL OR RELEASE OF HAZARDOUS MATERIALS (YELLOW) – CON'T

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- Acetylene Gas FG-16
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Oil-Based Liquids
- Light Oils OBL-1
- Solvents OBL-7
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Other Chemicals
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- Calcium Nitrate OC-6
- Nalco 356 Corrosion Inhibitor OC-10
- Diethylene Glycol Monobutyl Ether OC-15
- Aer-O-Foam XL OC-20

FIRE, EARTHQUAKE, BOMB THREAT, FLOODS (RED)

Fire (General Procedures) F-1

Fire with Hazardous Chemicals
- Follow general procedures, and see fire information under specific substance at yellow tab section

Earthquake EQ-1

Bomb Threat BT-1

Flash Flood / Flood / Extremely High Tide FD-1

GENERAL EMERGENCY RESPONSE, INCIDENT COMMAND SYSTEM, MEDICAL EMERGENCIES, EVACUATION (ORANGE)

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- Plans/Forms IC-4
- ICS Functions (Roles) IC-5
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- Supplementary Information IC-14
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TEAMS AND CONTACTS (BLUE) TN-1

MAPS & DIAGRAMS (GREEN) M-1

1.0. INTRODUCTION

The California Regional Environmental Health and Safety Department has prepared this Facility Emergency Plan on behalf of Duke Energy South Bay, LLC operating staff to ensure that in the event of an emergency, roles, responsibilities, and actions are defined for employee and team effectiveness. The power plant is located in Chula Vista, San Diego County, California. The plant produces electrical energy using four steam turbine generation units fired primarily by pipeline natural gas. Fuel Oil #6 is used as a back-up fuel supply and is rarely burned. The normal gross output of the four units is about 700,000 kilowatts.

This Facility Emergency Plan satisfies facility needs as well as emergency planning regulatory requirements as outlined in AB 2185 and 19 CCR, Division 2, Chapter 4. This is accomplished by outlining and describing procedures to stop, prevent, abate, or mitigate a chemical release or threatened release, fire, explosion, or other emergency, thereby ensuring the elimination of a condition of substantial probability of harm to human health and safety, property, or the environment.

1.1. PURPOSE

The Facility Emergency Plan (FEP) is designed to minimize hazards to human health or the environment from fires, explosions, natural disasters, bomb threats, or any unplanned sudden or non-sudden release of hazardous chemicals/hazardous waste or hazardous waste constituents or used oil to air, soil or surface water. The provisions of the plan must be carried out immediately whenever there is an injury/illness, fire, bomb threat, earthquake, explosion or release of hazardous materials and/or wastes, which could threaten human health or the environment. This plan is applicable only to Duke Energy's South Bay Power Plant (SBPP).

1.2. EMERGENCY PLAN REVIEW AND UPDATE

The Facility Emergency Plan is reviewed and updated at least every three years in accordance with AB 2185, or more frequently if necessary. The Plan will be reviewed/revised when appropriate under any one or more of the following conditions:

1. The applicable regulations are revised.
2. The plan is deemed inadequate or fails in an emergency.
3. Facility changes occur in design, construction, operation or maintenance that results in change(s) to the response necessary in an emergency.
4. The list of Incident Commanders changes.
5. The available emergency equipment changes.
6. The notification lists/procedures change.

1.3 MANAGEMENT APPROVAL

The management of SBPP is committed to providing the manpower, equipment, facilities, and materials required to establish precautionary measures and to expeditiously control and remove material discharged because of a spill or release at the SBPP. The Plant Manager has a responsibility to provide a safe and healthful work place for all employees. Specific responsibilities related to Emergency Planning include:

- Ensuring the development, implementation, and maintenance of the FEP;
- Communicating emergency planning expectations to employees; and
- Providing adequate resources, including proper equipment and training, to address foreseeable emergencies.

By signature, I certify that I have reviewed and approved the SBPP FEP, Volume II of the Business Plan/Contingency Plan, South Bay Power Plant.

This Plan is implemented as herein described:

Signature: Signature on File Date:

Name: David Barnhardt
Title: Plant Manager

2.0 CURRENT REVISION DATE

The current revision date and the revision number are listed on the cover page. Revisions are summarized and tracked on the Revision Log (Table 1). The FEP is a controlled document. Each copy is assigned a control number and is issued to a Controlled Copy Holder as listed in Table 2. Additional copies must be numbered sequentially and can only be issued by the California Regional Environmental, Health and Safety Department. Table 2 must be revised to reflect issuance of additional controlled copies. Any revisions must be coordinated and implemented through the California Regional Environmental, Health and Safety Department.

2.1 REVISION LOG

The revision history of this FEP is summarized and tracked on the Revision Log (Table 1). Information recorded in the revision log includes the revision number, revision date, the person inserting the revised sections, the sections affected and reason for the change.

TABLE 1. REVISION LOG

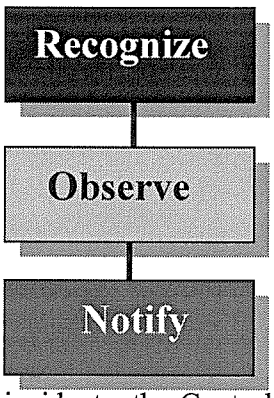
REVISION NUMBER	REVISION DATE	INSERTED BY	SECTION AFFECTED	REASON FOR CHANGE
Duke-00	July 2002	Kathy Woodard	All	---
Duke-01	December 2004	Kathy Woodard		Changes in the management organization; general improvements

TABLE 2. CONTROLLED COPY HOLDER

BOOK NUMBER	BOOK LOCATION	ISSUED TO
1	San Diego County Department of Environmental Health	Hazardous Materials Management Division
2	Chula Vista Police Department	Chief of Police
3	Chula Vista Fire Department	Fire Inspector
4	Scripps Memorial Hospital	Director, Facility Support Services
5	Sharp Chula Vista Medical Center	Facilities Manager
6	South Bay Power Plant	Environmental Office
7	South Bay Power Plant	Operations PTLs Office
8	South Bay Power Plant	Plant Manager
9	South Bay Power Plant	Security – Gate Guard
10	South Bay Power Plant	Assistant Plant Manager
11	South Bay Power Plant	Control Room #1
12	South Bay Power Plant	Control Room #2
13	DENA, CA Regional Office	Regional Environmental Health & Safety Manager

3.0 INCIDENT DISCOVERY

In any spill, release, or emergency incident, the first act is ***discovery***. The following information should be learned through proper training, because the discovery process (described here in three steps) critically depends on the person's resident knowledge, alertness, and training. All employees should receive facility-specific training in hazard recognition. This includes familiarity with the forms, uses and behaviors of all of the chemicals utilized at the facility, signs of abnormal operations of the facility components, and clues or evidence of releases. Many of these topics are covered in detail in other training (e.g., operator training, hazardous materials training) provided to SBPP employees, so only a summary is provided here.



The discovery stage in incident management involves **three steps**. A potential problem is **first** ***recognized*** by an employee. Alternatively, recognition may result from an automated sensor or alarm system. **Secondly**, once a potential hazard has been recognized, the employee makes a reasonable attempt to ***observe*** the possible problem from a safe vantage point. The employee should note the source, location, material type, nature and extent, and possible or known impacts, including possible injuries. **Thirdly**, once the employee has determined that a significant or reportable incident is occurring, or that conditions appear abnormal and potentially dangerous, the employee immediately ***notifies*** the Control Room Operator using the internal communications systems. In all incidents, the Control Room Operator is required to notify the Production Team Leader. The Production Team Leader serves as the acting Incident Commander. This notification is to include key observations and information needed by the Incident Commander to be able to assess the situation and decide on a tactical, first-response action.

While in the workplace, an employee may ***recognize*** a problem or potential hazard. Part of recognition is to know the properties and behavior of equipment and chemicals at the facility (e.g., visible appearance, sound, odor, vibration, temperature). Some common classes of recognized hazards or emergencies and an approximate risk hierarchy, from highest hazard to lowest, are as follow:

- **Flammable Gas Release without Ignition** (e.g., hydrogen) – Can be evident by visible damage to equipment, sound, condensation or frost on surfaces. High hazard of ignition and explosion, so immediately clear the area to a safe distance.

- **Fire** – Can be evident because of visible flame and/or smoke, heat, charring of surfaces. If a compressed gas is the cause, or if there is a risk of the fire being extinguished while there is a continuing gas release, there may be a high hazard of explosion or rapid spread of the fire. Immediately clear the area to a safe distance, unless the fire is incipient and controllable and one is trained in fire fighting;

- **Gasoline or Other Highly Ignitable Fluid Release** – Can be evident by visible liquid, damage to equipment, and characteristic smell of gasoline vapors. Dense vapors stay near the ground and can easily be explosively ignited. Clear the area if the release is large, is uncontrolled, and/or there is a potential ignition source.

- **Non-Flammable Gas Release** – Can be evident by visible damage to equipment, sound, condensation or frost on surfaces. Risk of asphyxiation due to oxygen displacement. Clear the area if release appears large and uncontrolled, especially if in a building or confined space.

- **Toxic Gas or Vapor Release** (e.g., acids or caustics) – Can be evident due to equipment damage, visible vapor cloud, odor, or acute pain in breathing, the eyes, and the skin. Clear the area to a safe distance.

- **Injury / Illness** (including confined space) – First aid training received by all SBPP employees will have prepared them to recognize common injuries and illnesses. If a person is down or injured, the risk to others may be limited, provided that the cause does not remain. **Do not enter a confined space** to attempt to help a person. Without proper precautions, equipment and training, a rescuer may become the next victim.

- **Life Endangering Equipment Failure** (e.g., high-pressure steam; mechanical failure) – High-pressure steam may be detectable as a high-pitched sound, and it can be invisible. Stand clear of any failed equipment to observe the situation.

- **Oil or Other Organic Liquids Spill or Release** – Visible as clear to dark colored fluids, some that flow freely and others that are viscous, can have a noticeable odor. Can be hazardous, but less severe acute risks are usually associated with these materials. Observe from closer, but safe range.

Observe

Quickly, and ***only from a safe place***, observe the situation, making note of the following:

- **Location** of the problem and its source;
- **Identity** of the known or likely material involved if it is a release;
- **Extent** of the problem (Incidental or Uncontrolled);
- **Fire or explosion risk;**
- **Injuries** to personnel and their severity; and
- **Risks** to personnel or responders (e.g., damaged equipment, mechanical hazards, gases or vapors).

Notify

First, immediately notify personnel in the area who may be in danger or who may be trained to assist. **ATTEMPT TO DO THIS WITHOUT SLOWING NOTIFICATION OF THE CONTROL ROOM OPERATOR.**

Second, immediately notify the Control Room Operator via plant phone, 450 MHz radio, or cell phone providing the following information:

- **Your name;**
- **Your observations** of the situation (**Location, Identity, Extent, Fire/Explosion, Injuries, Risks**).

Upon notification of the incident by the Incident Discoverer, the Control Room Operator will notify the Production Team Leader, who will assume the role and responsibilities of the Incident Commander. The Incident Commander will draw upon his/her knowledge of plant operations, specific training courses (i.e., operator training, hazardous materials training), and this manual to respond to a particular emergency.

Third, prepare to act as the first responder if properly trained and instructed to do so by the Incident Commander.

Fourth, if not properly trained to respond, ***prepare to remain*** at the scene at a safe distance to meet emergency responders to direct them to the emergency, but ***only if instructed*** to do so by the Incident Commander.

3.1 INITIAL RESPONSE

Specific incident that could pose a hazard to human health or the environment have been identified for the SBPP. Response guidelines have been developed for each specific incident and are located in the following sections. Information on the Incident Command System, medical emergencies and evacuation plans is grouped together under the orange tabs; incidents not related to a spill or release including fire, earthquake, flood, and bomb threat are grouped together under the red tabs; incidents related to a chemical spill or release are grouped together under the yellow tables; teams and contact and contact information is grouped together under the blue tabs; and facility maps and diagrams are grouped together under the green tabs.

3.2 PROCEDURES FOR INTERNAL AND EXTERNAL NOTIFICATIONS

Procedures for internal and external notifications are described in detail in Section 3.0, Incident Discovery, and in each of the incident-specific response guidelines. Internal notification procedures begin with notification of the Control Room Operator upon discovery of an incident. The Control Room Operator will then notify the Production Team Leader, who assumes the role of the Incident Commander. The incident commander is responsible for managing all emergency response actions. Detailed descriptions of the duties and responsibilities of the Incident Commander are summarized in ICS ⇒ *ORANGE TAB*.

Depending on the nature of the incident, the Incident Commander or First Responder may initiate additional internal notifications including activation of alarms. The alarm system at the SBPP consists of a STATION ALERT (high/low siren) and a VOICE MESSAGE system.

External notifications, as appropriate for each incident, are detailed in each incident-specific response guideline. External notifications include entities such as the National Response Center, Chula Vista Fire Department, San Diego County Health Department, California Office of Emergency Services, Regional Water Quality Control Board, possibly emergency response contractors, etc. Instructions are also included in these steps with regard to the type of critical information that the caller should be prepared to give to the emergency contact.

Especially in the event of external notification, facility employees serving in key responder roles should don the use of identification during the emergency, such as a title on a vest. This will assist external responders in identifying key contact individuals during an emergency. In the event that one individual serves more that one response role, the title associated with the higher command position should be donned. The specific roles assumed during an incident are outlined in ICS ⇒ *ORANGE TAB.*

A complete list of all internal and external contacts is provided in Teams and Contacts ⇒ ***BLUE TAB***. The notification process is summarized below.

GENERAL NOTIFICATION PROCESS

FIRST RESPONDER
contact the Control Room Operator:
x5201 **or** 619-420-7383

CONTROL OPERATOR notifies:

Production Team Leader or Plant Manager
and
Initiate additional notifications as directed by PM/PTL

PLANT MANAGER / PRODUCTION TEAM LEADER

Initiate Incident Command System (ICS)

- ❑ Ensure IC is designated and communicated
- ❑ IC to designate other ICS positions, as needed
- ❑ Ensure any additional notifications are conducted, particularly 911

Additional Notifications based on type of incident:

FIRE, BOMB THREAT OR MEDICAL EMERGENCY, notify:

Chula Vista Fire Department/Police Department..... **911**

ACTUAL OR THREATENED CHEMICAL SPILL OR RELEASE that could significantly impact human health, safety or the environment, notify:

Chula Vista Fire Department/Police Department	911
San Diego County Health Department	619-338-2222
California Office of Emergency Services	800-852-7550

❑ See Spill or Release section (Yellow Tab) for additional contact requirements and reportable quantity information

DOCUMENT ALL NOTIFICATIONS

SPILL or RELEASE of...

Asbestos	Asbestos-containing Materials (ASB-1)
Acids/Bases	Ammonium Hydroxide (AB-1) Sulfuric Acid (AB-6) Sodium Hydroxide Solid (AB-11) Sodium Hypochlorite (AB-16)
Flammable Gases	Hydrogen Gas (FG-1) Natural Gas (FG-6) Propane Gas (FG-11) Acetylene (FG-16) Nitric Oxide Gas (FG-21)
Non-Flammable Gases	Non-Flammable Gas (NFG-1)
Oil-Base Liquids	Light Oils (OBL-1) Solvents (O-7) Fuel Oils (O-15)
Other Chemicals	Mercury (OC-1) Calcium Nitrate (AXXO-L01) (OC-6) Nalco 356 Corrosion Inhibitor (OC-10) Diethylene Glycol Monobutyl Ether (OC-15) AER-O-Foam XL (OC-20)

RESPONSE FOR AN

ASBESTOS FIBER RELEASE

HEALTH HAZARDS
Chronic exposure to airborne asbestos fibers can result in cancer and asbestosis.
Avoid exposure to all asbestos fibers.

FIBER RELEASE EPISODE:

An unscheduled (unplanned) disturbance of friable Asbestos Containing Materials (ACM), or suspect ACM, shall be considered a FIBER RELEASE EPISODE (i.e., spill) and needs to be responded to and managed according to the standards in this document and the Business Unit's asbestos procedure. **Refer to Duke's Operations & Maintenance Procedures, Volume 7 Health and Safety, Procedure No. 7-41, for Asbestos Management Procedures.**

DEFINITIONS:

- **CLASS I ASBESTOS WORK:** Activities involving the removal of known/presumed Thermal System Insulation (TSI) and surfacing material.
- **CLASS III ASBESTOS WORK:** Repair and maintenance operations where known/presumed ACM, including TSI or surfacing material, is likely to be disturbed. The amount of disturbed materials cannot exceed that which can be contained in one standard glove bag or waste bag, which shall not exceed 60 inches in length and width. If this quantity is exceeded, the removal is Class I or II.
- **COMPETENT PERSON:** a designated person who has received specialized training and is capable of:
  - Identifying existing asbestos hazards,
  - Selecting the appropriate control strategy, and authorizing prompt corrective measures.
- **MAJOR FIBER RELEASE EPISODE:** is defined as an event where greater than three (3) square feet or three (3) linear feet of material is disturbed.
  - A **Major Fiber Release** typically involves Class 1 cleanup/repair activities and has expanded internal reporting requirements.
- **MINOR FIBER RELEASE**: any disturbance of less than three (3) linear feet of material.
  - A **Minor Fiber Release** only involves Class 3 cleanup/repair activities
- **QUALIFIED PERSONNEL:** are Duke employee's or contract personnel specially trained and certified to perform cleanup or abatement of asbestos.

RESPONSE FOR A

ASBESTOS FIBER RELEASE

(CONTINUED)

FIRST RESPONDERS ACTIONS:

If there is a suspect or confirmed release of ACM, then the personnel recognizing the response should conduct the following actions:

CHECK BOX	ACTION
	ASSESS surrounding conditions and potential hazards. Act immediately to manage imminent danger situations (i.e., flammable gas release, fire). You do not have to be an asbestos competent person to address imminent danger situations.
	EVACUATE all personnel from the immediate area.
	NOTIFY the Control Room Operator (x **5201**) and Area Supervisor **Note:** If the release impacts a large area or is associated with another emergency condition (i.e., explosion), then the shift PTL should **expand the INCIDENT COMMAND STRUCTURE**, as necessary (details at ⇒ *ORANGE TAB)*.
	BARRICADE & DENY ENTRY to the area from a safe distance using red **"Danger-Do Not Enter"** or **"Asbestos Hazard"** Tape. **Note:** The initial goal is to remove occupants from areas that may be affected by asbestos fibers. When possible, isolate access to any affected areas by closing doors and/or erecting temporary barriers to restrict airflow. Shut-down, modify, and/or seal off any HVAC systems that could be affected by the fiber release. Also, be aware that airborne asbestos fibers may be transported vertically by up-drafting within structures.
	CONTACT THE PLANT'S COMPETENT PERSON(S). The Area Supervisor should contact the plant competent person. The competent person needs to determine if the material disturbed was ACM or suspect ACM and what further response and clean-up actions are required.
	WAIT for direction from the competent person and the arrival of properly trained cleanup personnel.
	PROVIDE SUPPORT as necessary to personnel or contractor conducting cleanup.
	REPORTING REQUIREMENTS: The Area Supervisor is responsible for informing site management, completing an Incident Investigation Report (IIR), and initiating all required internal and external notifications as deemed necessary by the requirements listed in the "EXTERNAL NOTIFICATION" section below.

RESPONSE FOR A

ASBESTOS FIBER RELEASE

(CONTINUED)

RESPONSE PERSONNEL CLEAN-UP ACTIONS:

When the Plant Competent Person(s) arrive at the incident location, the following steps should be taken to insure a complete response.

CHECK BOX	ACTION
	ASSESS existing conditions in and around the spill area to determine hazards and what controls are needed to stabilize the source.
	ENSURE AREA IS SECURE – Signs should be posted as necessary immediately outside the fiber release site to prevent persons not involved in the cleanup from inadvertently entering the area. **Establish a "Regulated Area"** if worker exposure is reasonably expected to exceed the OSHA PEL of 0.1 fiber/cc. • Post signs / Control access. (Ensure those entering the regulated area are properly trained and wearing required PPE.)
	DEVELOP WORK PLAN – The Competent/Qualified Person will categorize the release as MAJOR or MINOR and develop a work plan for clean-up of the spilled material using OMP 7-41 as a guide. In addition to the OMP requirements, a **Major Fiber Release Episode** must always include: • Bulk sample analysis; • Perimeter/area/barrier air monitoring; and, • Careful visual inspection and final clearance air monitoring to verify satisfactory cleanup. **Note**: Bulk sample collection and clearance monitoring shall only be done by an appropriately trained and accredited Duke employee or third party CAC/SST who is not associated with the abatement company.
	CONDUCT PRE-JOB BRIEFING with workers to discuss PPE requirements, work practices, control methods, monitoring strategy, etc...
	IMPLEMENT WORK PLAN under the direction of a Competent Person. Operations personnel who have to perform critical plant operational activities may enter into asbestos work areas where ACM is being disturbed and/or damaged ACM is present as long as they have 2- hours of asbestos awareness training and are qualified to wear a respirator. The following (minimum) PPE requirements apply: disposable coveralls (i.e., tyvek suits), shoe covering, hood, half-mask respiratory (and/or PAPR) with P-100 filter, safety glasses, and gloves. Personal decontamination is necessary every time the worker leaves the regulated area.

RESPONSE FOR A

ASBESTOS FIBER RELEASE

(CONTINUED)

	Note: Those individuals are not allowed to conduct asbestos related tasks, and time in the area should be minimized. In addition, the entrant should get verbal approval from an asbestos Competent Person prior to entry, and provisions should be made to have them escorted by a Class I/II worker when in a Class I regulated area.
	RE-OPEN REGULATED AREA upon completion of work, inspection of work area, and/or verification that air sampling results are below re-occupancy limits. **Note**: Asbestos Consultants should be used to oversee work practices and perform sampling for large spills with high public visibility.

EXTERNAL NOTIFICATIONS:

- Any release, or threatened release, of asbestos that has the potential for off-site impact, and/or could significantly impact human health or the environment, must be reported immediately upon discovery to:
  - Chula Vista Fire Department 911
  - San Diego County Health Department .....(619) 338-2222
  - California Office of Emergency Services .....(800) 852-7550
  - San Diego Air Pollution Control District.....(858) 650-4700
  - DOSH Local District Office (Cal DOSH)..... .....(619) 767-2280

- **IF** quantity released off-site is <u>equal to or greater than</u> the REPORTABLE QUANTITY (RQ), notify:

  <u>RQ = 1 POUND (airborne, friable asbestos)</u>
  CERCLA listed hazardous.....YES
  SARA TITLE III listed hazardous material.....NO

  - National Response Center .....(800) 424-8802

- **IF** the quantity released onsite is greater than or equal to 160 square feet, 260 linear feet, or 35 cubic feet, emergency abatement may proceed under the supervision of a competent person; however written notification must be provided to the APCD within 24 hours of the commencement of emergency work. The letter must describe the time and nature of the event and identify how the event meets the definition of an "emergency renovation" under 40CFR61.141.

RESPONSE FOR A

ASBESTOS FIBER RELEASE

(CONTINUED)

- Unanticipated disturbances of less than 160 square feet, 260 linear feet, or 35 cubic feet, should not be reported to the APCD. Instead, record the quantity of disturbed material and add to the amount tracked under the annual notification (see Environmental Scientist for assistance).

INTERNAL NOTIFICATIONS:

- **IF** the event is categorized as a "Major Fiber Release" then the release requires Internal Notification. Follow the internal notification requirements outlined in OMP 7-43. The incident type would be "Asbestos Fiber Release."

- In addition, Corporate Risk Management needs to be informed as soon as practical.
  - Corporate Risk Management (Mr. Keith Bone) .....(704) 382-4932 ..... Pager (877) 380-1796

SPECIFIC FIRST-AID:

Inhalation. Remove to fresh air. If breathing is irregular or has stopped, begin CPR (First-Aid trained personnel only). Seek medical attention for treatment, observation, and support as needed.

Eye Contact. Flush with water until debris is removed. If irritation continues, consult with your Supervisor and/or responding medical providers to determine if additional medical care is necessary.

Skin Contact. Wash skin thoroughly with water and soap. Remove and bag contaminated clothing.

ADDITIONAL INFORMATION:

Description:	Asbestos is a naturally occurring, hydrated mineral silicate, separable into filaments.
Code Numbers:	CAS 1332-21-4UN 2212 (Blue) UN 2590 (White)
DOT Designation:	ORM-E
Synonyms:	None.
Incompatibilities:	None.
Permissible Exposure	

RESPONSE FOR A

ASBESTOS FIBER RELEASE

(CONTINUED)

Limits in Air:	OSHA's PEL is 0.1 fibers/cubic centimeter (cc) over an 8-hour time-weighted average. OSHA's Excursion limit is 1 fiber/cc over a 30 minute period. NO ACTION LEVEL
Determination in Air:	Per NIOSH publication USPHS/NIOSH.
Flash Point:	Not Applicable. Non-flammable.
Melting Point:	N/A
Vapor Pressure:	N/A

* US Dept. of Health and Human Services. June 1997. NIOSH Pocket Guide to Chemical Hazards.

Per the requirements of the EPA's Model Accreditation Plan (40 CFR 763 Subpart E, App. C), this plan was developed and approved by the following accredited AHERA Project Designer.

Project Designer's (Name): Tom Bauman
State of California, Project Designer Certificate Number: 2957
State of California, Certified Asbestos Consultant Number: 92-0507

(Signature): Thomas J. Bauman (Date): January 15, 2004

Minor modifications that are categorically clerical were completed in December 2004 as part of an overall review of the FEP. None of the changes impacted the process and response actions certified as appropriate by the Certified Asbestos Contractor, Tom Bauman on January 15, 2004. Therefore, the original certification was maintained.

(end of **ASBESTOS** section)

AMMONIUM HYDROXIDE

AMMONIUM HYDROXIDE

LOCATION: Ammonia Tanks
VOLUME: Two 22,000 gallon tanks
USES: NO_X Control on Boiler SCR's for Units 1,2,3 and 4

CONCENTRATION: 28 – 30% Ammonia in water.

APPEARANCE: Clear, colorless liquid with strong, pungent, ammonia odor. The odor is detectable at 5 ppm and irritating at 25-50 ppm, so it provides a warning of hazardous concentrations in air.

For in-line boiler chemical cleaning, solid sodium bromate and ammonium carbonate are dissolved into the liquid ammonium hydroxide to form the "Ammonia-Bromate" solution. Response procedures for the solution are the same as for ammonium hydroxide, described below.

HEALTH HAZARDS

Irritating and corrosive to body tissues. Above 50°F, the ammonia vapor from this material can be a serious hazard in a spill situation. Excessive inhalation of vapors is irritating to the mucous membranes of the respiratory tract and can result in headache, coughing, severe lung congestion (edema and difficulty in breathing). Skin contact with liquid can irritate, redden and cause burns. Liquid contact with the eye can be severely damaging and can result in loss of vision. Ingestion is corrosive to the digestive tract.

FIRE AND EXPLOSION HAZARDS

Aqua ammonia is not flammable. However, ammonia vapor is flammable in the range of 16% to 25% in air. When heated, ammonium hydroxide will rapidly emit ammonia (NH_3) vapors. Ammonia necessitates respiratory protection and eye protection for fire fighters.

ATTENTION

Determination of an incidental release versus an uncontrolled release will be at the discretion of a **PROPERLY TRAINED PERSONNEL*** only, based on his/her training and knowledge of response capabilities.

(*) **PROPERLY TRAINED PERSONNEL** include those employees that have successfully completed training in respiratory protection, hazard communication, Emergency Action Plan, use of personal protective equipment and decontamination procedures.

AMMONIUM HYDROXIDE

INCIDENTAL RELEASE:

When there is a **MINIMAL SAFETY OR HEALTH HAZARD**, a release may be controlled by properly trained personnel following standard procedures such as:

- **DRESS IN LEVEL D** Personal Protective Equipment (full-face shield, neoprene, viton, butyl rubber, nitril rubber, chlorinated polyethylene, and/or polyvinyl chloride gloves, boots, aprons, and gauntlets to prevent skin contact)
- **ATMOSPHERE** conditions are monitored by an atmospheric monitor that alarms at 50 ppm.
- **NEUTRALIZING** with water.
- **ABSORB** with earth, sand, vermiculite, or other absorbent, noncombustible material.
- **PLACE** material in suitable container for later disposal.

UNCONTROLLED RELEASE:

If the release cannot be controlled by properly trained personnel (see above) or there is an immediate health threat due to fire, exposure or release of this substance, initiate emergency response support actions outlined below. If the spill reaches water, notify agencies immediately (see details under "Agency Notifications").

FIRST RESPONDER ACTION:

NOTIFY by dialing **5201** (day) or **(619) 420-7383** (24hr).
DO NOT walk into or touch any spilled material, or enter a space where a strong odor is apparent and where continuing release is occurring.
ATTEND to injured personnel if safe to do so.
APPROACH from upwind direction, only close enough to evacuate.
EVACUATE immediate area.
BARRICADE area from safe distance and **DENY ENTRY** (minimum 330-foot radius).
VERIFY that pad drains are routed to surface impoundments.
INITIATE SECONDARY CONTAINMENT:

- Shut off valves to stop or control flow.
- Dike area with absorbent material or sand.
- Cover storm drains in area and divert flow.
- If solution is in storm drains, send crew to a down stream catch basin to stop flow with absorbent, sand, or pipe plug device. (see storm drain diagram in ⇒ *GREEN TAB)*
- Ensure the atmosphere in catch basins is safe to enter via use of an air monitor.
- Ensure the main storm drain valve is closed.

WAIT for the arrival of properly trained personnel.

AMMONIUM HYDROXIDE

EMERGENCY RESPONSE SUPPORT:

CONTROL OPERATOR - dial **911** to notify Chula Vista Fire Department
AMBULANCE: If 911 is called for an ambulance for personnel who have been chemically contaminated, **PROVIDE** the ambulance dispatcher the name of the chemical involved.
CONDUCT NOTIFICATIONS (details follow).
IMPLEMENT INCIDENT COMMAND STRUCTURE; integrate CVFD as lead in hazardous material response (details ⇒ ***ORANGE TAB)***.

- **ESCORT** CVFD to spill location
- **BRIEF** CVFD personnel as follows:
  - cause of the incident
  - amount released if known
  - is spill contained
  - whether rescue of personnel is necessary.
- **REMAIN** present until emergency no longer exists

CONTACT the Environmental Specialist, when the emergency situation is controlled, for assistance in obtaining cleanup contractors.

FIRE FIGHTING:

Follow procedures in fire fighting section ⇒ ***RED TAB*** plus the specific information below:

Use extinguishing media appropriate to surrounding fire conditions. Use cold water spray to control vapors and cool fire-exposed containers.

NOTIFY CVFD of any fires including those that have been extinguished.

SPECIFIC FIRST-AID:

Inhalation: Remove to fresh air. If not breathing, give artificial respiration.

Eye contact: DO NOT allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes while forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissue. Get medical attention. Contact lenses should **NOT** be worn when handling ammonium hydroxide.

Skin contact: TREAT FOR INHALATION EXPOSURE FIRST. Quickly remove and isolate contaminated clothing. Flush exposed skin areas with plenty of water for at least 15 minutes. Wash exposed area with soap and water. If irritation is present after washing get medical attention. Keep the victim quiet and maintain normal body temperature.

AMMONIUM HYDROXIDE

Ingestion: **NEVER** give anything by mouth to an unconscious or convulsing person. Give large quantities of water to dilute, immediately followed by lavage with water, lemon juice milk, or emulcents; delay may cause perforation of the esophagus or stomach. **DO NOT** induce vomiting. Get medical attention.

AGENCY NOTIFICATIONS:

NOTE: A release confined to a permanent secondary containment structure is not a release to the environment and does not trigger these reporting requirements, unless there is a specific threat to health or safety.

- IF Any release or threatened release of ammonium hydroxide which could significantly impact human health, safety, or the environment must be reported immediately upon discovery to:
  - California Office of Emergency Services 1-800-852-7550
  - Chula Vista Fire Department 911
  - San Diego County Health Department .....(619) 338-2222
- IF quantity released is equal to or greater than the REPORTABLE QUANTITY (RQ), and extends outside the facility boundaries, notify:

  RQ = 1000 POUNDS (≈ 130 GALLONS); OR 100lbs ammonia vapor.
  CERCLA listed hazardous material..... YES
  SARA TITLE III listed hazardous material.....NO

  - National Response Center 1-800-424-8802
- IF a substantial release to the ground or to an open storm drain occurs, notify:
  - Regional Water Quality Control Board .....(858) 467-2952
- IF spill reaches the bay or affects wildlife, notify:
  - Department of Fish and Game .....(916) 445-0045
    Office of Spill Prevention and Response

AMMONIUM HYDROXIDE

- At the discretion of the Environmental Specialist, the following agencies may be notified as a courtesy:

  - U.S. Coast Guard ..... (Day) (619) 683-6495 or (Night) (619) 683-6470
  - California Coastal Commission .....(415) 904-5200
  - State Land Commission .....(562) 499-6312

OTHER NOTIFICATIONS: DEGS Media Rep (Incl. tips on media inquiries) ..... see ⇒ ***BLUE TAB***
Duke Energy Western Region ..... see ⇒ ***BLUE TAB***

ADDITIONAL INFORMATION:

Description:	A clear, colorless, corrosive alkaline liquid.
Code Numbers:	CAS 1336-21-6 UN 2672
DOT Designation:	Corrosive liquid.
Synonyms:	Spirit of Hartshorn, ammonia water (strong), ammonium hydrate, aqua ammonia, NH_40H.
Incompatibilities:	Acids, copper, tin, zinc, aluminum and their alloys, and with galvanized surfaces. Explosive materials can result from reaction with iodine.
Determination in Air:	Ammonia detector tube (2 – 30 ppm) and an air pump
IDLH:	300 ppm*
Permissible Exposure Limits (PEL) in Air:	35 ppm (NH_3)*
Threshold Limit Value (TLV):	25 ppm (NH_3)*
Flash Point:	Not available.
Autoignition Temperature:	1204°F as NH_3
Boiling Point:	82.4°F (28°C) @ 760 mm Hg
Vapor Pressure:	115 mm Hg @ 68°F
Vapor Density:	1.2 (Air = 1)
Specific Gravity:	0.9 (water = 1)
Solubility:	Soluble
pH:	13.6 @ 77°F (25°C)

*Mallinckrodt Inc. April 1989. Material Safety Data Sheet for Ammonium Hydroxide.

(end of **AMMONIUM HYDROXIDE** section)

SULFURIC ACID

SULFURIC ACID (BATTERIES)

LOCATION: Battery Room Various
QUANTITY: ≈ 1 gallon in each battery
USES: Back Up Power Battery

APPEARANCE: Colorless to dark brown, odorless, dense, oily liquid. Pure compound is a solid below 51°F (11°C).

HEALTH HAZARDS

Concentrated solution is a severe respiratory tract, skin, and eye irritant. Exposure can result in severe burns, tissue damage, scarring, functional inhibition, and blindness if splashed in the eye. Although ingestion is unlikely, it may cause severe injury and death. Avoid vapors with pungent odor by staying upwind and out of low areas.

FIRE AND EXPLOSION HAZARDS

Non-combustible material. Water applied directly to sulfuric acid results in violent heat liberation and splattering of material. For surrounding fire use extinguishing material appropriate to burning material, use water with great caution and only if absolutely necessary. Sulfuric acid can react with organic materials and may produce sufficient heat to ignite combustible materials. Reaction with metals may produce hydrogen gas which is extremely flammable. Thermal decomposition of sulfuric acid can produce sulfur oxides. Fire fighters should wear a self-contained breathing apparatus with a full face piece operated the positive-pressure mode.

ATTENTION

Determination of an incidental release versus an uncontrolled release will be at the discretion of a **PROPERLY TRAINED PERSONNEL*** only, based on his/her training and knowledge of response capabilities.

(*) **PROPERLY TRAINED PERSONNEL** include those employees that have successfully completed training in respiratory protection, hazard communication, Emergency Action Plan, use of personal protective equipment and decontamination procedures.

SULFURIC ACID

INCIDENTAL RELEASE:

When there is minimal safety or health hazard, a release may be controlled by properly trained personnel following standard procedures such as:

- **DRESS IN LEVEL D** Personal Protective Equipment (chemical safety goggles, gloves, boots, aprons, and gauntlets to prevent skin contact)
- **NEUTRALIZING** with sodium bicarbonate or a mixture of soda ash/slaked lime.
- **DO NOT** use water or organic material.
- **DILUTE** acid (as an alternative to neutralizing) with water **ONLY** if soaked into ground or small quantity in storm drain.
- **DO NOT** allow water inside acid container and **DO NOT** get solid stream of water on pools or large flows of acid, as violent boiling and spattering may occur.

UNCONTROLLED RELEASE:

If the release cannot be controlled by properly trained personnel (see above) or there is an immediate health threat due to fire, exposure or release of this substance, initiate emergency response support actions outlined below.

If a spill reaches water, notify agencies immediately (see "Agency Notification" details below).

FIRST RESPONDER ACTION:

NOTIFY by dialing **5201** (day) or **(619) 420-7383** (24hr)
DO NOT walk into or touch any spilled material.
ATTEND to personnel in adequately ventilated areas.
EVACUATE immediate area.
BARRICADE area from safe distance and **DENY ENTRY** of unauthorized personnel.
INITIATE SECONDARY CONTAINMENT:

- **Dike** area with absorbent material or sand.
- Cover storm drains in area and divert flow.
- If solution is in storm drains, send crew to downline catch basin to stop flow with absorbent, sand, or pipe plug device. (See storm drain diagram in ⇒ *GREEN TAB)*
- Ensure the atmosphere in catch basins is safe to enter via use of an air monitor.
- Ensure main storm drain valve is closed.

WAIT for arrival of properly trained personnel.

SULFURIC ACID

EMERGENCY RESPONSE SUPPORT:

CONTROL ROOM - dial **911** to notify Chula Vista Fire Department
AMBULANCE: If 911 is called for an ambulance for personnel who have been chemically contaminated, **PROVIDE** the ambulance dispatcher the name of the chemical involved.
CONDUCT NOTIFICATIONS (details follow).
IMPLEMENT INCIDENT COMMAND STRUCTURE; integrate CVFD as lead in hazardous material response (details ⇒ ***ORANGE TAB)***.
PRIMARY LIAISON SHOULD -

- **ESCORT** CVFD to spill location
- **BRIEF** CVFD personnel as follows:
  - cause of the incident
  - amount released if known
  - is spill contained
  - whether rescue of personnel is necessary.
- **REMAIN** present until emergency no longer exists

CONTACT the Environmental Specialist, when the emergency situation is controlled, for assistance in obtaining cleanup contractors.

FIRE FIGHTING:

Follow fire-fighting procedures in ⇒ ***RED TAB*** plus the specific information below:

- For small fires use dry chemical, carbon dioxide, or halon. Use water on combustibles burning in vicinity of acid.
- For large fires, increase **EVACUATION** perimeter and bring in **CVFD.** Do not get solid streams of water on material. Notify the fire department of all fires, including those that have been extinguished.

SPECIFIC FIRST-AID:

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. Keep warm and at rest. Get medical attention as soon as possible.

Eye contact: DO NOT allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes while forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissue. Get medical attention. Contact lenses should **NOT** be worn when handling sulfuric acid.

Skin contact: TREAT FOR INHALATION EXPOSURE FIRST. Quickly remove and isolate contaminated clothing. Flush exposed skin areas with plenty of water for at least 15 minutes. Use a 2% sodium bicarbonate solution to further neutralize any H_2SO_4 on the skin. Wash

SULFURIC ACID

exposed area with soap and water. If irritation is present after washing get medical attention.

Ingestion: **NEVER** give anything by mouth to an unconscious or convulsing person. Give large quantities (1 to 2 glasses) of water or milk to dilute. **DO NOT** induce vomiting. **DO NOT** attempt to neutralize the acid with sodium bicarbonate. Get medical attention.

AGENCY NOTIFICATIONS:

NOTE: A release confined to a permanent secondary containment structure is not a release to the environment and does not trigger these reporting requirements, unless there is a specific threat to health or safety.

- IF Any release or threatened release of sulfuric acid which could significantly impact human health, safety, or the environment must be reported immediately upon discovery to:
  - California Office of Emergency Services 1-800-852-7550
  - Chula Vista Fire Department 911
  - San Diego County Health Department .....(619) 338-2222
- IF quantity released is equal to or greater than the REPORTABLE QUANTITY (RQ), and extends outside the facility boundaries, notify:

  RQ = 1000 POUNDS (≈ 65 GALLONS)
  CERCLA listed hazardous material.....YES
  SARA TITLE III extremely hazardous material .....NO

  - National Response Center 1-800-424-8802
- IF a substantial release to the ground or to an open storm drain occurs, notify:
  - Regional Water Quality Control Board .....(858) 467-2952
- IF spill reaches the bay or affects wildlife, notify:
  - Department of Fish and Game .....(916) 445-0045
    Office of Spill Prevention and Response

SULFURIC ACID

- At the discretion of the Environmental Specialist, the following agencies may be notified as a courtesy:

  - U.S. Coast Guard ..... (Day) (619) 683-6495 or (Night) (619) 683-6470
  - California Coastal Commission .....(415) 904-5200
  - State Land Commission .....(562) 499-6312

OTHER NOTIFICATIONS:

DEGS Media Rep (Incl. tips on media inquiries) ..... see ⇒ ***BLUE TAB***
Duke Energy Western Region ..... see ⇒ ***BLUE TAB***

ADDITIONAL INFORMATION:

Description:	Colorless to dark brown, odorless, dense, oily liquid.
Code Numbers:	CAS 7664-93-9 UN 1830
DOT Designation:	Corrosive material.
Synonyms:	Battery acid, BOV, dipping acid, hydrogen sulfate.
Incompatibilities:	Water, bases, organic materials, halogens, metal acetylides, oxides and hydrides, and strong oxidizing and reducing agents.
Determination in Air:	Sulfur dioxide detector tube (0.05 – 10 ppm) and an air sampling pump.
IDLH:	15 mg/m^3*
Permissible Exposure Limits (PEL) in Air:	1 mg/m^3*
Threshold Limit Value (TLV):	1 mg/m^3*
Flash Point:	Not Applicable. Non flammable.
Melting Point:	50.65°F (10.36°C)
Boiling Point:	554°F (290°C)
Vapor Pressure:	<0.001 mm Hg @ 20°F
Vapor Density:	1.2 kg/m^3, 0.075 lbs/ft^3 (Air=1)
Specific Gravity:	1.841
Solubility:	Soluble

* US Dept. of Health and Human Services. June 1997. NIOSH Pocket Guide to Chemical Hazards.

(end of **SULFURIC ACID** section)

SODIUM HYDROXIDE SOLID

SODIUM HYDROXIDE BEADS

LOCATION: Chemical Mixing Rooms
VOLUME: 5 pound plastic jars
USES: pH Control Boilers

APPEARANCE: White, odorless, deliquescent pellets, flakes or granules.

HEALTH HAZARDS

Extremely alkaline. Very corrosive to body tissues. May cause burning to the eyes, skin, respiratory and gastrointestinal tract. Vapor can cause nasal and lung damage. Stay upwind and out of low areas.

FIRE HAZARDS

Not flammable. Containers of sodium hydroxide may explode when heated. Sodium hydroxide will generate large amounts of heat when in contact with water.

ATTENTION

Determination of an incidental release versus an uncontrolled release will be at the discretion of a **PROPERLY TRAINED PERSONNEL*** only, based on his/her training and knowledge of response capabilities.

(*) **PROPERLY TRAINED PERSONNEL** include those employees that have successfully completed training in respiratory protection, hazard communication, Emergency Action Plan, use of personal protective equipment and decontamination procedures.

INCIDENTAL RELEASE: When there is a **MINIMAL SAFETY OR HEALTH HAZARD**, a release may be controlled by properly trained personnel following standard procedures such as:

- **DRESS IN LEVEL D** Personal Protection Equipment (impervious gloves, boots, aprons, and gauntlets to prevent skin contact and protective eyeglasses or chemical safety goggles)

SODIUM HYDROXIDE SOLID

- **CLEAN UP** spills promptly as moisture absorption from the air may make cleanup difficult. Shovel or vacuum (with appropriate filter) into suitable container (above 60°C sodium hydroxide corrodes steel) for reclamation if possible. **AVOID** dust generation.
- **FLUSH** area with water, but **DO NOT DISCHARGE** directly into storm drains.
- If necessary, **NEUTRALIZE** flush water with dilute acid

UNCONTROLLED RELEASE:

If the release cannot be controlled by properly trained personnel (see above) or there is an immediate health threat due to fire, exposure or release of this substance, initiate emergency response support actions outlined below.

If a spill reaches water, notify agencies immediately (see "Agency Notification" details below).

FIRST RESPONDER ACTION:

NOTIFY by dialing **5201** (day) or **(619) 420-7383** (24hr)
DO NOT walk into or touch any spilled material.
ATTEND to personnel in adequately ventilated areas; beware of odorless vapor.
EVACUATE immediate area.
BARRICADE area from safe distance and **DENY ENTRY** of unauthorized personnel.
INITIATE SECONDARY CONTAINMENT:

- Shut off valves to stop or control flow.
- Dike area with absorbent material or sand.
- Cover storm drains in area and divert flow.
- If solution is in storm drains, send crew to downline catch basin to stop flow with absorbent, sand, or pipe plug device. (See storm drain diagram in ⇒ *GREEN TAB)*
- Ensure the atmosphere in catch basins is safe to enter via use of an air monitor.
- Ensure main storm drain valve is closed.

WAIT for arrival of properly trained contract personnel.

SODIUM HYDROXIDE SOLID

EMERGENCY RESPONSE SUPPORT:

CONTROL ROOM - dial **911** to notify Chula Vista Fire Department
AMBULANCE: If 911 is called for an ambulance for personnel who have been chemically contaminated, **PROVIDE** the ambulance dispatcher the name of the chemical involved.
CONDUCT NOTIFICATIONS (details follow).
IMPLEMENT INCIDENT COMMAND STRUCTURE; integrate CVFD as lead in hazardous material response (details ⇒ ***ORANGE TAB***).
PRIMARY LIAISON SHOULD -

- **ESCORT** CVFD to spill location
- **BRIEF** CVFD personnel as follows:
  - cause of the incident
  - amount released if known
  - is spill contained
  - whether rescue of personnel is necessary.
- **REMAIN** present until emergency no longer exists

CONTACT the Environmental Specialist, when the emergency situation is controlled, for assistance in obtaining cleanup contractors.

FIRE FIGHTING:

Follow procedures in fire fighting section ⇒ ***RED TAB*** and consider the following:

- Sodium hydroxide is not flammable. However, containers of sodium hydroxide may explode when heated. Sodium hydroxide will generate large amounts of heat when in contact with water.

NOTIFY CVFD of all fires, including those that have been extinguished.

SPECIFIC FIRST-AID:

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. Keep warm and at rest. Get medical attention as soon as possible.

Eye contact: DO NOT allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of cold water for at least 15 minutes while forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissue. **WARNING!** Although splashed directly in only one eye, sodium hydroxide may affect the other eye's sight if prompt medical attention is not received. Get medical attention. Contact lenses should **NOT** be worn while handling caustic soda.

SODIUM HYDROXIDE SOLID

Skin contact: TREAT FOR INHALATION EXPOSURE FIRST. Quickly remove and isolate contaminated clothing. Flush exposed skin areas with plenty of water for at least 15 minutes. **BE AWARE** that this substance can become very hot when in contact with water. Wash affected area with soap and water. If irritation is present after washing get medical attention.
Ingestion: NEVER give anything by mouth to an unconscious or convulsing person. Give large quantities (1 to 2 glasses) of water, followed by vinegar or fruit juice to neutralize the poison. **DO NOT** induce vomiting. Get medical attention.

AGENCY NOTIFICATIONS:

NOTE: A release confined to a permanent secondary containment structure is not a release to the environment and does not trigger these reporting requirements, unless there is a specific threat to health or safety.

- IF Any release or threatened release of sodium hydroxide which could significantly impact human health, safety, or the environment must be reported immediately upon discovery to:
  - California Office of Emergency Services 1-800-852-7550
  - Chula Vista Fire Department 911
  - San Diego County Health Department .....(619) 338-2222
- IF quantity released is <u>equal to or greater than</u> the REPORTABLE QUANTITY (RQ), and extends outside the facility boundaries, notify:

  <u>RQ = 1000 POUNDS</u>
  CERCLA listed hazardous material.....YES
  SARA TITLE III listed hazardous material.....NO

  - National Response Center 1-800-424-8802
- IF a substantial release to the ground or to an open storm drain occurs, notify:
  - Regional Water Quality Control Board .....(858) 467-2952
- IF spill reaches the bay or affects wildlife, notify:
  - Department of Fish and Game .....(916) 445-0045
    Office of Spill Prevention and Response

SODIUM HYDROXIDE SOLID

- At the discretion of the Environmental Specialist, the following agencies may be notified as a courtesy:

  - U.S. Coast Guard ..... (Day) (619) 683-6495 or (Night) (619) 683-6470
  - California Coastal Commission .....(415) 904-5200
  - State Land Commission .....(562) 499-6312

ADDITIONAL INFORMATION:

Description:	White or off-white solid, flake, or powder.
Code Numbers:	CAS 1310-73-2 UN 1823
DOT Designation:	Corrosive material.
Synonyms:	Caustic soda, caustic alkali, caustic flake, sodium hydrate, soda lye, white caustic.
Incompatibilities:	Water, acids, flammable liquids, organic halogens, metals (aluminum, tin, zinc), nitromethane and nitro compounds.
IDLH:	10 mg/m^3*
Permissible Exposure Limits (PEL) in Air:	2 mg/m^3 (ceiling)*
Threshold Limit Value (TLV):	2 mg/m^3 (ceiling)*
Flash Point:	Not Applicable. Non flammable.
Melting Point:	605°F (318°C)
Boiling Point:	2,534°F (1,390°C)
Vapor Pressure:	1 mm Hg @ 1,362°F (739°C)
Solubility:	1g/0.9 ml water
Specific Gravity, Solid:	2.13 @ 68°F
pH (0.5% solution):	13

* US Dept. of Health and Human Services. June 1997. NIOSH Pocket Guide to Chemical Hazards.

(end of **SODIUM HYDROXIDE SOLIDS** section)

SODIUM HYPOCHLORITE

SODIUM HYPOCHLORITE

LOCATION: CW Deck
VOLUME: 6,500 Gallon tank
USES: CW Tunnels to keep clear

APPEARANCE: Sodium hypochlorite has a straw yellow color with characteristic odor of bleach.

HEALTH HAZARDS

Vapor generated above 230°F, 2.5 times heavier than air, settles in low areas. Vapors can be very irritating to mucous membranes when inhaled. Contact may severely irritant, redden, or damage skin and eyes. Not flammable, but may ignite combustibles such as wood, oil, etc. (Strong oxidizer). Toxic to fish.

FIRE AND EXPLOSION HAZARDS

Will not burn, but most combustible materials will burn in vapors from Sodium Hypochlorite at temperatures above 230°F as they do in oxygen; flammable gases will form explosive mixtures with sodium hypochlorite vapors. May ignite other combustible materials (wood, paper, oil, etc.). Mixture with fuels may cause explosion. Containers may explode in heat of fire. Almost any form of energy (heat, sunlight, sparks, etc.) explodes hydrogen and sodium hypochlorite vapor mixtures (5-95%). May combine with water or steam to produce toxic and corrosive fumes of hydrochloric acid. Emits highly toxic fumes when heated above 230°F. Avoid vapor contact with powdered metals. May degrade plastic and rubber.

ATTENTION

Determination of an incidental release versus an uncontrolled release will be at the discretion of a **PROPERLY TRAINED PERSONNEL*** only, based on his/her training and knowledge of response capabilities.

(*) **PROPERLY TRAINED PERSONNEL** include those employees that have successfully completed training in respiratory protection, hazard communication, Emergency Action Plan, use of personal protective equipment and decontamination procedures.

SODIUM HYPOCHLORITE

VAPOR THRESHOLDS:

- Detectable bleach odor at less than one part per million (ppm).
- Definite odor and irritation of eyes and nose at 1-3 ppm.
- Visible yellow-green vapor at 3 ppm (in still air).
- Throat irritation at 6 ppm.
- Intense coughing fits at 30 ppm.

INCIDENTAL RELEASE:

When there is a **MINIMAL SAFETY OR HEALTH HAZARD**, a release may be controlled by properly trained personnel following standard procedures such as:

- **DRESS IN LEVEL D** Personal Protection Equipment (rubber gloves, boots, aprons, and gauntlets to prevent skin contact and protective eyeglasses or chemical safety goggles)
- **ABSORB** small leaks using Polysorb absorbent material or floor dry.
- **NEUTRALIZE** contained sodium hypochlorite liquid by absorbing with sodium sulfite, sodium bisulfite, or ferrous salt solutions or dilute with lots of water in a contained area.
- Employ portable ventilation fans to exhaust remaining pockets of sodium hypochlorite vapors to the atmosphere.

UNCONTROLLED RELEASE:

If the release cannot be controlled by properly trained personnel (see above) or there is an immediate health threat due to fire, exposure or release of this substance, initiate emergency response support actions outlined below.

If spill reaches the water, notify agencies immediately (see details under "Agency Notifications").

FIRST RESPONDER ACTION:

NOTIFY by dialing **5201** (day) or **(619) 420-7383** (24hr).
ATTEND to any injured personnel, if safe to do so (see specific first-aid steps in this section).
EVACUATE entire area in a crosswind direction.
BARRICADE area from safe distance and deny entry (DOT barricading recommendations):

- Initial isolation, small leak.....50 feet in all directions
- Initial isolation, large leak.....150 feet in all directions
- If high vapor concentration downwind
- evacuation .....300 feet

SODIUM HYPOCHLORITE

DO NOT ATTEMPT APPROACH – if no remote container valves available.
INITIATE SECONDARY CONTAINMENT:

- Keep combustibles away from spilled material.
- Dike area with absorbent material, sand, soil, foamed polyurethane, or foamed concrete.

BEWARE of yellow-green vapor cloud and odor of liquid bleach.
WAIT for the arrival of properly trained personnel.

EMERGENCY RESPONSE SUPPORT:

CONTROL ROOM - dial **911** to notify Chula Vista Fire Department.
AMBULANCE: If 911 is called for an ambulance for personnel who have been chemically contaminated, **PROVIDE** the ambulance dispatcher the name of the chemical involved.
CONDUCT NOTIFICATIONS (details follow).
IMPLEMENT INCIDENT COMMAND STRUCTURE; integrate CVFD as lead in hazardous material response (details ⇒ ***ORANGE TAB)***.
PRIMARY LIAISON should -

- **ESCORT** CVFD to spill location
- **BRIEF** CVFD personnel as follows:
  - cause of the incident
  - amount released if known
  - is spill contained
  - whether rescue of personnel is necessary.
- **REMAIN** present until emergency no longer exists

CONTACT the Environmental Specialist, when the emergency situation is controlled, for assistance in obtaining cleanup contractors.

FIRE FIGHTING:

Follow procedures in the fire section (⇒ ***RED TAB***) plus the specific information below:

FOR SMALL FIRES in vicinity of sodium hypochlorite tank, use dry chemical, carbon dioxide, water spray, fog or foam.

FOR LARGE FIRES, notify CVFD immediately.

NOTIFY CVFD of all fires, including those that have been extinguished.

SODIUM HYPOCHLORITE

SPECIFIC FIRST-AID:

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. Keep warm and at rest. Do not try to induce vomiting. Get medical attention as soon as possible.

Eye contact: Immediately flush eyes with a directed stream of water for at least 15 minutes while forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissue. Get medical attention. Contact lenses should **NOT** be worn when working with sodium hypochlorite.

Skin contact: TREAT FOR INHALATION EXPOSURE FIRST. Quickly remove and isolate contaminated clothing. Flush exposed skin areas with plenty of water for at least 15 minutes. Clean affected areas with mild soap and warm water. If irritation is present after washing get medical attention.

Ingestion: NEVER give anything by mouth to an unconscious or convulsing person. Give large quantities (1 to 2 glasses) of water or milk. **AVOID** inducing vomiting. Get medical attention.

AGENCY NOTIFICATIONS:

NOTE: A release confined to a permanent secondary containment structure is not a release to the environment and does not trigger these reporting requirements, unless there is a specific threat to health or safety.

- IF Any release or threatened release of sodium hypochlorite which could significantly impact human health, safety, or the environment must be reported immediately upon discovery to:
  - California Office of Emergency Services 1-800-852-7550
  - Chula Vista Fire Department 911
  - San Diego County Health Department .....(619) 338-2222

- IF quantity released is <u>equal to or greater than</u> the REPORTABLE QUANTITY (RQ), and extends outside the facility boundaries, notify:

  <u>RQ = 100 POUNDS (≈ 80 GALLONS)</u>
  CERCLA listed hazardous material.....YES
  SARA TITLE III listed hazardous material.....NO

  - National Response Center 1-800-424-8802

SODIUM HYPOCHLORITE

- IF a substantial release to the ground or to an open storm drain occurs, notify:
  - Regional Water Quality Control Board .....(858) 467-2952
- IF spill reaches the bay or affects wildlife, notify:
  - Department of Fish and Game .....(916) 445-0045
    Office of Spill Prevention and Response
- At the discretion of the Environmental Specialist, the following agencies may be notified as a courtesy:
  - U.S. Coast Guard ..... (Day) (619) 683-6495 or (Night) (619) 683-6470
  - California Coastal Commission .....(415) 904-5200
  - State Land Commission .....(562) 499-6312

OTHER NOTIFICATIONS:

DEGS Media Rep (Incl. tips on media inquiries) ..... see ⇒ ***BLUE TAB***
DUKE ENERGY WESTERN REGION ..... see ⇒ ***BLUE TAB***

ADDITIONAL INFORMATION:

Description:	Sodium hypochlorite is a colorless or slightly yellow green liquid with a faint chlorine-like odor. Toxic by inhalation. Completely soluble in water.
Code Numbers:	CAS 7681-52-9 UN 1791
DOT Designation:	Corrosive.
Synonyms:	Bleach.
Incompatibilities:	Combustible substances and finely divided metals.
Determination in Air:	Use a chlorine detector tube (0.2 – 30 ppm) and an air-sampling pump
Permissible Exposure Limits (PEL) in Air:	None Established*
Threshold Limit Value (TLV):	None Established*
Flash Point:	Not Applicable. Not flammable.
Melting Point:	Decomposes
Boiling Point:	Decomposes @ 230°F to liberate hazardous chlorine gases
Vapor Pressure:	17.5 mm Hg @ 20°C

SODIUM HYPOCHLORITE

Vapor Density:	NA
Specific Gravity, Liquid (12% NaOCl):	1.2 @ 68°F (12% NaOCl)
Solubility in Water:	Soluble
pH:	11

* Genium Publishing Corporation. November, 1990. Material Safety Data Sheet for Sodium Hypochlorite Aqueous Solution.

(end of **SODIUM HYPOCHLORITE RELEASE** section)

MERCURY

MERCURY

SOURCES: Thermometers, metal and glass switches, thermocouples, manometers and mercury relays.

LOCATION: Various locations in instrumentation throughout the power plant.

APPEARANCE: Metallic mercury is a silvery, mobile, odorless liquid.

HEALTH HAZARDS

Both liquid and vapor are toxic by inhalation or absorption through skin at standard temperature and pressure. Can irritate skin and mucous membranes. Can attack nervous system. Will volatilize slowly at room temperature, and quickly at elevated temperatures.

FIRE AND EXPLOSION HAZARDS

Nonflammable and nonexplosive in air. When exposed to high temperature, mercury vaporizes to form extremely toxic fumes.

ATTENTION

Determination of an incidental release versus an uncontrolled release will be at the discretion of a **PROPERLY TRAINED PERSONNEL*** only, based on his/her training and knowledge of response capabilities.

(*) **PROPERLY TRAINED PERSONNEL** include those employees that have successfully completed training in respiratory protection, hazard communication, Emergency Action Plan, use of personal protective equipment and decontamination procedures.

Refer to DEGS Operations & Maintenance Procedures, Volume 7 – Health and Safety, Procedure No. 7-47, for mercury use, storage and handling procedures. Specifically, refer to section 7 – Mercury Spill Clean up, page 6.

MERCURY

INCIDENTAL RELEASE:

When there is a **MINIMAL SAFETY OR HEALTH HAZARD**, a release may be controlled by properly trained personnel following standard procedures. Examples of an incidental release include broken mercoid switches and small manometers.

STANDARD CONTROL PROCEDURES include (utilize proper PPE):

- **USE MERCURY-APPROVED** vacuum cleaner only (a suction bottle with a capillary tube may be used for small amounts). A Nilfise vacuum cleaner with a mercury HEPA filter cartridge is located in the Instrument/Electrical Shop.
- **CONVERT** mercury globules into sulfide form by sprinkling calcium polysulfide with excess sulfur. A dustpan and foxtail broom dedicated for sweeping up mercury is stored in a wall cabinet at the Instrument/Electrical Shop.
- **COLLECT** mercury in tightly sealed polyethylene or glass containers for recycling.

UNCONTROLLED RELEASE:

If the release cannot be controlled by trained personnel (see above) or there is an immediate health threat due to fire exposure or release of this chemical, initiate emergency response actions as follows:

FIRST RESPONDER ACTION:

NOTIFY by dialing **5201** (day) or **(619) 420-7383** (24hr).
DO NOT walk into or touch any spilled material.
ATTEND to injured personnel if safe to do so (see First-aid next page)
PROVIDE adequate **VENTILATION.**
BARRICADE area from safe distance and **DENY ENTRY** to unauthorized personnel.
DO NOT DISCHARGE mercury down plant floor drains, sewer lines, storm drains, or wastewater lines.
WAIT for the arrival of properly trained personnel.

EMERGENCY RESPONSE SUPPORT:

CONDUCT NOTIFICATIONS (details follow).
AMBULANCE: When calling an ambulance for personnel who have been chemically contaminated, **PROVIDE** the ambulance dispatcher the name of the chemical involved.
IMPLEMENT INCIDENT COMMAND STRUCTURE; integrate CVFD as lead in hazardous material response (details ⇒ ***ORANGE TAB)***.
OBTAIN approved mercury cleanup contractors.

MERCURY

FIRE FIGHTING: Follow procedures in fire fighting section ⇒ ***RED TAB*** plus specific information below:

SMALL FIRES - Select extinguishing media suitable for surrounding fire. Control small fires only if safe to do so.

LARGE FIRES - Notify CVFD immediately.

NOTIFY CVFD of all fires including those that have been extinguished.

SPECIFIC FIRST-AID:

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. Keep warm and at rest. Get medical attention as soon as possible.

Eye contact: Immediately flush eyes with a directed stream of water for at least 15 minutes while forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissue. Get medical attention. Contact lenses should not be worn when cleaning up mercury.

Skin contact: TREAT **FOR INHALATION EXPOSURE FIRST.** Remove and isolate contaminated clothing. Flush exposed skin areas with plenty of water for at least 15 minutes. Clean affected areas with mild soap and warm water. If irritation is present after washing get medical attention.

Ingestion: Give large quantities of water and induce vomiting. Do not make an unconscious person vomit. Get medical attention. Medical personnel: Gastric lavage with 5% solution of sodium formaldehyde sulfoxylate, followed by 2% NAHCO3, and finally leave 250 cc of the sodium formaldehyde sulfoxylate in the stomach.

AGENCY NOTIFICATIONS:

NOTE: A release confined to a permanent secondary containment structure is not a release to the environment and does not trigger these reporting requirements, unless there is a specific threat to health or safety.

- IF Any release or threatened release of mercury which could significantly impact human health, safety, or the environment must be reported immediately upon discovery to:
  - California Office of Emergency Services 1-800-852-7550
  - Chula Vista Fire Department 911
  - San Diego County Health Department .....(619) 338-2222

MERCURY

- IF quantity released is equal to or greater than the REPORTABLE QUANTITY (RQ), and extends outside the facility boundaries, notify:

  RQ = 1 POUND (≈ ¼ CUP)
  CERCLA listed hazardous material ..... YES
  SARA TITLE III listed hazardous material ..... NO

  - National Response Center 1-800-424-8802

- IF a substantial release to the ground or to an open storm drain occurs, notify:

  - Regional Water Quality Control Board ..... (858) 467-2952

- IF spill reaches the bay or affects wildlife, notify:

  - Department of Fish and Game ..... (916) 445-0045
    Office of Spill Prevention and Response

- At the discretion of the Environmental Specialist, the following agencies may be notified as a courtesy:

  - U.S. Coast Guard ..... (Day) (619) 683-6495 or (Night) (619) 683-6470
  - California Coastal Commission ..... (415) 904-5200
  - State Land Commission ..... (562) 499-6312

OTHER NOTIFICATIONS:
DEGS Media Rep (Incl. tips on media inquiries) ..... see ⇒ ***BLUE TAB***
Duke Energy Western Region ..... see ⇒ ***BLUE TAB***

ADDITIONAL INFORMATION:

Description:	Mercury is a silvery, mobile, odorless liquid.
Code Numbers:	CAS 7439-97-6 UN 2809
DOT Designation:	Corrosive
Synonyms:	Quicksilver, liquid silver
Incompatibilities:	Chlorine, acetylene, ammonia
Determine in Air:	Bacharach Mercury Vapor Sniffer or MSA hand detector with 0.1 to 2 mg/m^3 range tubes (located in the Environmental

MERCURY

	Health and Safety cabinet on the second floor by the mercury cleaning station).
Permissible Exposure Limit in Air:	The federal standard is 0.1 mg/m3 as a ceiling value. NIOSH has recd. a value averaged over 8 hours is 0.05 mg/m3. No STEL value
IDLH:	28 mg/m^3.
Flash Point:	Noncombustible.
Melting Point:	-38.9°F
Boiling Point:	674.1°F (356.6°C
Vapor Pressure:	0.0012
Vapor Density:	7.0 (Air=1)
Specific Gravity, Liquid:	13.5 (water = 1)
Solubility in Water:	Insoluble

* Genium Publishing Corporation. June 1994. Material Safety Data Sheet for Mercury.

(end of **MERCURY** section)

CALCIUM NITRATE
(AXXO-L01)

AXXO – L01 COMBUSTION CATALYST, CALCIUM NITRATE SOLUTION

LOCATION: East End of Plant
VOLUME: Up to 5,000 gallons in a tank
USES: Fuel Oil #6 Additive

APPEARANCE: White, odorless, deliquescent crystalline or flakes.

HEALTH HAZARDS

Oxidizer and irritant. May be harmful by inhalation, ingestion, or skin absorption. Causes eye and skin irritation. Material is irritating to mucous membranes and upper respiratory tract.

FIRE HAZARDS

Not flammable

ATTENTION

Determination of an incidental release versus an uncontrolled release will be at the discretion of a **PROPERLY TRAINED PERSONNEL*** only, based on his/her training and knowledge of response capabilities.

(*) **PROPERLY TRAINED PERSONNEL** include those employees that have successfully completed training in respiratory protection, hazard communication, Emergency Action Plan, use of personal protective equipment and decontamination procedures.

INCIDENTAL RELEASE: When there is a **MINIMAL SAFETY OR HEALTH HAZARD**, a release may be controlled by properly trained personnel following standard procedures such as:

- **DRESS IN LEVEL D** Personal Protection Equipment (PVC gloves with impervious boots, aprons, and gauntlets to prevent skin contact and protective eyeglasses or chemical safety goggles)
- **CLEAN UP** spills in a manner to avoid dust generation.
- **DO NOT DISCHARGE** directly into storm drains.

CALCIUM NITRATE
(AXXO-L01)

UNCONTROLLED RELEASE:

If the release cannot be controlled by properly trained personnel (see above) or there is an immediate health threat due to fire, exposure or release of this substance, initiate emergency response support actions outlined below.

If a spill reaches water, notify agencies immediately (see "Agency Notification" details below).

FIRST RESPONDER ACTION:

NOTIFY by dialing **5201** (day) or **(619) 420-7383** (24hr)
DO NOT walk into or touch any spilled material.
ATTEND to personnel in adequately ventilated areas; beware of odorless vapor.
EVACUATE immediate area.
BARRICADE area from safe distance and deny entry of unauthorized personnel.
INITIATE SECONDARY CONTAINMENT:

- Shut off valves to stop or control flow.
- Dike area with absorbent material or sand.
- Cover storm drains in area and divert flow.
- If solution is in storm drains, send crew to downline catch basin to stop flow with absorbent, sand, or pipe plug device. (See storm drain diagram in ⇒ *GREEN TAB)*
- Ensure the atmosphere in catch basins is safe to enter via use of an air monitor.
- Ensure main storm drain valve is closed.

WAIT for arrival of properly trained contract personnel.

EMERGENCY RESPONSE SUPPORT:

CONTROL ROOM - dial 911 to notify Chula Vista Fire Department
AMBULANCE: If 911 is called for an ambulance for personnel who have been chemically contaminated, **PROVIDE** the ambulance dispatcher the name of the chemical involved.
CONDUCT NOTIFICATIONS (details follow).
IMPLEMENT INCIDENT COMMAND STRUCTURE; integrate CVFD as lead in hazardous material response (details ⇒ *ORANGE TAB)*.

CALCIUM NITRATE
(AXXO-L01)

PRIMARY LIAISON SHOULD -

- **ESCORT** CVFD to spill location
- **BRIEF** CVFD personnel as follows:
  - cause of the incident
  - amount released if known
  - is spill contained
  - whether rescue of personnel is necessary.
- **REMAIN** present until emergency no longer exists

CONTACT the Environmental Specialist, when the emergency situation is controlled, for assistance in obtaining cleanup contractors.

FIRE FIGHTING:

Follow procedures in fire fighting section ⇒ ***RED TAB.***

NOTIFY CVFD of all fires, including those that have been extinguished.

SPECIFIC FIRST-AID:

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. Keep warm and at rest. Get medical attention as soon as possible.

Eye contact: DO NOT allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes while forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissue. Get medical attention. Contact lenses should **NOT** be worn when handling calcium nitrate.

Skin contact: TREAT FOR INHALATION EXPOSURE FIRST. Quickly remove and isolate contaminated clothing. Flush exposed skin areas with plenty of water for at least 15 minutes. Wash affected area with soap and water. If irritation is present after washing get medical attention.

Ingestion: NEVER give anything by mouth to an unconscious or convulsing person. Get medical attention.

AGENCY NOTIFICATIONS:

NOTE: A release confined to a permanent secondary containment structure is not a release to the environment and does not trigger these reporting requirements, unless there is a specific threat to health or safety.

CALCIUM NITRATE
(AXXO-L01)

- IF Any release or threatened release of calcium nitrate which could significantly impact human health, safety, or the environment must be reported immediately upon discovery to:
  - California Office of Emergency Services 1-800-852-7550
  - Chula Vista Fire Department 911
  - San Diego County Health Department .....(619) 338-2222

- IF quantity released is equal to or greater than the REPORTABLE QUANTITY (RQ), and extends outside the facility boundaries, notify:

  RQ = NOT APPLICABLE
  CERCLA listed hazardous material.....NO
  SARA TITLE III listed hazardous material.....NO

  - A report to the National Response Center is not required

ADDITIONAL INFORMATION:

Description:	White flake or crystalline powder with no odor.
Code Numbers:	CAS 13477-34-4 UN 1454
DOT Designation:	Oxidizer
Synonyms:	Calcium dinitrate tetrahydrate, calcium salt of nitric acid
Incompatibilities:	Strong reducing agents and acids
Permissible Exposure Limits (PEL) in Air:	No Data Available*
Threshold Limit Value (TLV):	No Data Available *
Flash Point:	Not Applicable. Non flammable.
Melting Point:	45□C
Boiling Point:	No Data Available
Vapor Pressure:	No Data Available
Solubility in Water:	Very Soluble
Specific Gravity, Solid:	No Data Available
pH:	Neutral

* Hummel Croton Inc. May 1996. Material Safety Data Sheet for Calcium Nitrate.

(end of **CALCIUM NITRATE** section)

NALCO 356 CORROSION INHIBITOR

NALCO 356 CORROSION INHIBITOR

LOCATION: Chemical Mixing Room
VOLUME: 75 Gallon Port A Feeds
USES: Condensate Chemical

HEALTH HAZARDS

Corrosive liquid. Causes eye injury and skin irritation. Corrosive to the eyes with possible permanent damage depending on length of exposure and on the first aid action given.

FIRE AND EXPLOSION HAZARDS

Flammable vapors occur only with increased temperatures. Emptied containers or tanks still contain hazardous vapor or liquid. Do not use pressure to empty drum or tank, as explosion may result. Surfaces that are sufficiently hot may ignite even liquid product in the absence of sparks or flame. Heavier than air vapors may accumulate and travel to ignition sources.

ATTENTION

Determination of an incidental release versus an uncontrolled release will be at the discretion of a **PROPERLY TRAINED PERSONNEL*** only, based on his/her training and knowledge of response capabilities.

(*) **PROPERLY TRAINED PERSONNEL** include those employees that have successfully completed training in respiratory protection, hazard communication, Emergency Action Plan, use of personal protective equipment and decontamination procedures.

INCIDENTAL RELEASE: When there is a **MINIMAL SAFETY OR HEALTH HAZARD**, a release may be controlled by properly trained personnel (*) following standard procedures such as:

- **DRESS IN LEVEL D** Personal Protection Equipment (chemical resistant gloves, boots, aprons, and gauntlets to prevent skin contact and protective eyeglasses or chemical safety goggles)

NALCO 356 CORROSION INHIBITOR

- **VENTILATING** the area.
- **ABSORB** any bulk liquids with absorbent, dry sand, earth, or similar material and deposit in sealed containers.
- **ENSURE** that there are no sources of ignition.

If the release is not incidental, see "Uncontrolled Release" below.

UNCONTROLLED RELEASE:

If the release cannot be controlled by properly trained personnel (see above) or there is an immediate health threat due to fire, exposure or release of this substance, initiate emergency response support actions outlined below.

If a spill reaches water, notify agencies immediately (see "Agency Notification" details below).

FIRST RESPONDER ACTION:

NOTIFY by dialing **5201** (day) or **(619) 420-7383** (24hr).
STAY UPWIND and out of **LOW AREAS.**
ATTEND to injured personnel if safe to do so.
BARRICADE area from safe distance and **DENY ENTRY**.
PREVENT personnel or sources of ignition from entering area.
ELIMINATE existing ignition source, if safe to do so.
INITIATE SECONDARY CONTAINMENT (if safe to do so):

- Use non-sparking tools if ignition hazard exists.
- Dike ahead of area with absorbent material or sand.
- Cover storm drains in area and divert flow.
- If material is in storm drains, send crew to downline catch basin to stop flow with absorbent, sand, or pipe plug device. (see storm drain diagram in ⇒ *GREEN TAB)*
- Ensure main storm drain valve is closed.
- Ensure the atmosphere in catch basins is safe to enter via use of an air monitor.

CAUTION: FIRE OR EXPLOSION HAZARD MAY EXIST IN STORM DRAIN SYSTEM.
WAIT for the arrival of properly trained response personnel.

NALCO 356 CORROSION INHIBITOR

EMERGENCY RESPONSE SUPPORT:

CONTROL OPERATOR - dial **911** to notify Chula Vista Fire Department
AMBULANCE: If 911 is called for an ambulance for personnel who have been chemically contaminated, **PROVIDE** the ambulance dispatcher the name of the chemical involved.
CONDUCT NOTIFICATIONS (details follow).
IMPLEMENT INCIDENT COMMAND STRUCTURE; integrate CVFD as lead in hazardous material response (details ⇒ ***ORANGE TAB***).
PRIMARY LIAISON should -

- **ESCORT** CVFD to spill location
- **BRIEF** CVFD personnel as follows:
  - cause of the incident
  - amount released if known
  - is spill contained
  - whether rescue of personnel is necessary.
- **REMAIN** present until emergency no longer exists

CONTACT the Environmental Specialist, when the emergency situation is controlled, for assistance in obtaining cleanup contractors.

FIRE FIGHTING:

Follow procedures in fire fighting section ⇒ ***RED TAB*** plus the specific information below:

SMALL FIRES, if safe to do so

- **EXTINGUISH** using Carbon Dioxide, dry chemical, foam, water fog, or vaporizing liquid-type media
- **COOL** using water fog or spray to tanks and containers exposed to fire to prevent vapor pressure buildup.

LARGE FIRES - notify CVFD immediately

NOTIFY CVFD of all fires, including those that have been extinguished

SPECIFIC FIRST-AID:

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. Keep warm and at rest. Get medical attention as soon as possible.

Eye contact: Immediately flush eyes with clean low-pressure water for at least 15 minutes while forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissue. If irritation persists get medical attention.

NALCO 356 CORROSION INHIBITOR

It is recommended that contacts should **NOT** be worn while handling NALCO 352 corrosion inhibitor.

Skin contact: Remove and isolate contaminated clothing. Flush exposed skin areas with plenty of water for at least 15 minutes. Clean affected areas with waterless skin cleanser followed by mild soap and warm water. Launder contaminated clothing before wearing.

Ingestion: If victim is conscious and alert, give 2 to 3 cups of milk or water to drink. **DO NOT** induce vomiting because product can enter lungs and cause chemical pneumonia. If vomiting occurs spontaneously, keep head below hips to prevent aspiration of liquid into the lungs. Get medical attention.

AGENCY NOTIFICATIONS:

NOTE: A release confined to a permanent secondary containment structure is not a release to the environment and does not trigger these reporting requirements, unless there is a specific threat to health or safety.

- IF Any release or threatened release of NALCO 356 which could significantly impact human health, safety, or the environment must be reported immediately upon discovery to:
  - California Office of Emergency Services 1-800-852-7550
  - Chula Vista Fire Department 911
  - San Diego County Health Department .....(619) 338-2222
- IF quantity released is <u>equal to or greater than</u> the REPORTABLE QUANTITY (RQ), and extends outside the facility boundaries, notify:

  <u>RQ = NOT APPLICABLE</u>
  CERCLA listed hazardous material.....NO
  SARA TITLE III listed hazardous material.....NO

  - A report to the National Response Center is not required

OTHER NOTIFICATIONS: DEGS Media Rep (Incl. tips on media inquiries)..... see ⇒ ***BLUE TAB***
Duke Energy Western Region ..... see ⇒ ***BLUE TAB***

NALCO 356 CORROSION INHIBITOR

ADDITIONAL INFORMATION: **NALCO 356 Corrosion Inhibitor**

Description:	Colorless to light yellow liquid with slight ammonia odor
Code Numbers:	CAS 110-91-8
DOT Designation:	Corrosive liquid.
Synonyms:	Morpholine
Incompatibilities:	Strong oxidizers and acids, aluminum, brass, nickel, copper
Determine in Air:	Organic vapor patch
Permissible Exposure Limits (PEL) in Air:	20 ppm* (skin)
Threshold Limit Value (TLV):	20 ppm* (skin)
Flash Point:	>200°F
Lower Explosive Limit (LEL):	NA
Upper Explosive Limit (UEL):	NA
Autoignition Temperature:	NA
Boiling Point:	NA
Vapor Pressure:	50 mm Hg @ 68°F
Density:	8.5 – 8.7 lbs/gal
Specific Gravity, Liquid:	1.02 – 1.04 @ 77°F (water = 1)
Solubility in Water:	Completely
pH:	10.5

* NALCO. September 1997. Material Safety Data Sheet for NALCO 356 Corrosion Inhibitor.

(end of **NALCO 356 CORROSION INHIBITOR** section)

DIETHYLENE GLYCOL MONOBUTYL ETHER

3M AFFF 3% CONCENTRATE (DIETHYLENE GLYCOL MONOBUTYL ETHER)

LOCATION: Various
VOLUME: 110 Gallons
USES: Various

HAZARDS

None

FIRE AND EXPLOSION HAZARDS

Non flammable

ATTENTION

Determination of an incidental release versus an uncontrolled release will be at the discretion of a **PROPERLY TRAINED PERSONNEL*** only, based on his/her training and knowledge of response capabilities.

(*) **PROPERLY TRAINED PERSONNEL** include those employees that have successfully completed training in respiratory protection, hazard communication, Emergency Action Plan, use of personal protective equipment and decontamination procedures.

INCIDENTAL RELEASE: When there is a **MINIMAL SAFETY OR HEALTH HAZARD**, a release may be controlled by properly trained personnel following standard procedures such as:

- **DRESS IN LEVEL D** Personal Protection Equipment (butyl rubber gloves, boots, aprons, and gauntlets to prevent skin contact and protective eyeglasses or chemical safety goggles)
- **VENTILATING** the area.
- **ABSORB** any bulk liquids with absorbent, dry sand, earth, or similar material and deposit in sealed containers.
- **FLUSH** contaminated area with water and discharge to wastewater treatment system

DIETHYLENE GLYCOL MONOBUTYL ETHER

UNCONTROLLED RELEASE:

If the release cannot be controlled by properly trained personnel (see above) or there is an immediate health threat due to fire, exposure or release of this substance, initiate emergency response support actions outlined below.

If a spill reaches water, notify agencies immediately (see "Agency Notification" details below).

FIRST RESPONDER ACTION:

NOTIFY by dialing **5201** (day) or **(619) 420-7383** (24hr).
STAY UPWIND and out of **LOW AREAS.**
ATTEND to injured personnel if safe to do so.
BARRICADE area from safe distance and **DENY ENTRY**.
PREVENT personnel or sources of ignition from entering area.
ELIMINATE existing ignition source, if safe to do so.
INITIATE SECONDARY CONTAINMENT (if safe to do so):

- Use non-sparking tools if ignition hazard exists.
- Dike ahead of area with absorbent material or sand.
- Cover storm drains in area and divert flow.
- If material is in storm drains, send crew to downline catch basin to stop flow with absorbent, sand, or pipe plug device. (see storm drain diagram in ⇒ *GREEN TAB)*
- Ensure main storm drain valve is closed.
- Ensure the atmosphere in catch basins is safe to enter via use of an air monitor.

WAIT for the arrival of properly trained response personnel.

EMERGENCY RESPONSE SUPPORT:

CONTROL OPERATOR - dial **911** to notify Chula Vista Fire Department
AMBULANCE: If 911 is called for an ambulance for personnel who have been chemically contaminated, **PROVIDE** the ambulance dispatcher the name of the chemical involved.
CONDUCT NOTIFICATIONS (details follow).
IMPLEMENT INCIDENT COMMAND STRUCTURE; integrate CVFD as lead in hazardous material response (details ⇒ *ORANGE TAB)*.
PRIMARY LIAISON should -

- **ESCORT** CVFD to spill location
- **BRIEF** CVFD personnel as follows:
  - cause of the incident
  - amount released if known

DIETHYLENE GLYCOL MONOBUTYL ETHER

- is spill contained
- whether rescue of personnel is necessary.

- **REMAIN** present until emergency no longer exists

CONTACT the Environmental Specialist, when the emergency situation is controlled, for assistance in obtaining cleanup contractors.

FIRE FIGHTING:

Follow procedures in fire fighting section ⇒ ***RED TAB*** plus the specific information below:

SMALL FIRES, if safe to do so

- **EXTINGUISH** using Carbon Dioxide, dry chemical, foam, water fog, or vaporizing liquid-type media
- **COOL** using water fog or spray to tanks and containers exposed to fire to prevent vapor pressure buildup.

LARGE FIRES - notify CVFD immediately

NOTIFY CVFD of all fires, including those that have been extinguished

SPECIFIC FIRST-AID:

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. Keep warm and at rest. Get medical attention as soon as possible.

Eye contact: Immediately flush eyes with clean low-pressure water for at least 15 minutes while forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissue. If irritation persists get medical attention. It is recommended that contacts should **NOT** be worn while handling AFFF 3% Concentrate Diethylene Glycol Monobutyl Ether.

Skin contact: Remove and isolate contaminated clothing. Flush exposed skin areas with plenty of water for at least 15 minutes. Clean affected areas with waterless skin cleanser followed by mild soap and warm water. Launder contaminated clothing before wearing.

Ingestion: ONLY induce vomiting at the instruction of a physician. Get medical attention.

AGENCY NOTIFICATIONS:

NOTE: A release confined to a permanent secondary containment structure is not a release to the environment and does not trigger these reporting requirements, unless there is a specific threat to health or safety.

DIETHYLENE GLYCOL MONOBUTYL ETHER

- IF Any release or threatened release of AFFF3% which could significantly impact human health, safety, or the environment must be reported immediately upon discovery to:
  - California Office of Emergency Services 1-800-852-7550
  - Chula Vista Fire Department 911
  - San Diego County Health Department .....(619) 338-2222

- IF quantity released is equal to or greater than the REPORTABLE QUANTITY (RQ), and extends outside the facility boundaries, notify:

  RQ = NOT APPLICABLE
  CERCLA listed hazardous material.....NO
  SARA TITLE III listed hazardous material.....NO

  - A report to the National Response Center is not required

OTHER NOTIFICATIONS: DEGS Media Rep (Incl. tips on media inquiries)..... see ⇒ ***BLUE TAB***
Duke Energy Western Region ..... see ⇒ ***BLUE TAB***

ADDITIONAL INFORMATION:

Description:	Clear, amber colored liquid
Code Numbers:	Unknown
DOT Designation:	Unknown
Synonyms:	None
Incompatibilities:	None known
Permissible Exposure Limits (PEL) in Air:	35 ppm* (TWA)
Flash Point:	None Established
Boiling Point:	93°C
Vapor Pressure:	17.7 mm Hg @ 20°C
Vapor Density:	0.7 (Air=1)
Specific Gravity, Liquid:	1.03 (water = 1)
Solubility in Water:	Miscible
pH:	8.5

* 3M. September 1998. Material Safety Data Sheet for 3M AFFF 3% Concentrate Diethylene Glycol Monobutyl Ether.

(end of **3M AFFF 3% CONCENTRATE DIETHYLENE GLYCOL MONOBUTYL ETHER** section)

AER-O-FOAM XL

AER-O-FOAM XL-33%

LOCATION: Various Firefighting Foam Stations
VOLUME: 2,405 Gallons
USES: Various

HAZARDS
None

FIRE AND EXPLOSION HAZARDS
Non flammable

ATTENTION

Determination of an incidental release versus an uncontrolled release will be at the discretion of a **PROPERLY TRAINED PERSONNEL*** only, based on his/her training and knowledge of response capabilities.

(*) **PROPERLY TRAINED PERSONNEL** include those employees that have successfully completed training in respiratory protection, hazard communication, Emergency Action Plan, use of personal protective equipment and decontamination procedures.

INCIDENTAL RELEASE: When there is a **MINIMAL SAFETY OR HEALTH HAZARD**, a release may be controlled by properly trained personnel following standard procedures such as:

- **DRESS IN LEVEL D** Personal Protection Equipment (rubber or PVC gloves to prevent skin contact and protective eyeglasses or chemical safety goggles)
- **VENTILATING** the area.
- **ABSORB** any bulk liquids with absorbent, dry sand, earth, or similar material and deposit in sealed containers.
- **FLUSH** contaminated area with water
- Get **APPROVAL** prior to discharge into wastewater treatment system

AER-O-FOAM XL

UNCONTROLLED RELEASE:

If the release cannot be controlled by properly trained personnel (see above) or there is an immediate health threat due to fire, exposure or release of this substance, initiate emergency response support actions outlined below.

If a spill reaches water, notify agencies immediately (see "Agency Notification" details below).

FIRST RESPONDER ACTION:

NOTIFY by dialing **5201** (day) or **(619) 420-7383** (24hr).
STAY UPWIND and out of **LOW AREAS.**
ATTEND to injured personnel if safe to do so.
BARRICADE area from safe distance and **DENY ENTRY**.
PREVENT personnel or sources of ignition from entering area.
ELIMINATE existing ignition source, if safe to do so.
INITIATE SECONDARY CONTAINMENT (if safe to do so):

- Use non-sparking tools if ignition hazard exists.
- Dike ahead of area with absorbent material or sand.
- Cover storm drains in area and divert flow.
- If material is in storm drains, send crew to downline catch basin to stop flow with absorbent, sand, or pipe plug device. (see storm drain diagram in ⇒ *GREEN TAB)*
- Ensure main storm drain valve is closed.
- Ensure the atmosphere in catch basins is safe to enter via use of an air monitor.

WAIT for the arrival of properly trained response personnel.

EMERGENCY RESPONSE SUPPORT:

CONTROL OPERATOR - dial **911** to notify Chula Vista Fire Department
AMBULANCE: If 911 is called for an ambulance for personnel who have been chemically contaminated, **PROVIDE** the ambulance dispatcher the name of the chemical involved.
CONDUCT NOTIFICATIONS (details follow).
IMPLEMENT INCIDENT COMMAND STRUCTURE; integrate CVFD as lead in hazardous material response (details ⇒ ***ORANGE TAB)***.
PRIMARY LIAISON should -

- **ESCORT** CVFD to spill location
- **BRIEF** CVFD personnel as follows:
  - cause of the incident

AER-O-FOAM XL

- amount released if known
- is spill contained
- whether rescue of personnel is necessary.

- **REMAIN** present until emergency no longer exists

CONTACT the Environmental Specialist, when the emergency situation is controlled, for assistance in obtaining cleanup contractors.

FIRE FIGHTING: Not Applicable

SPECIFIC FIRST-AID:

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. Keep warm and at rest. Get medical attention as soon as possible.

Eye contact: Immediately flush eyes with clean low-pressure water for at least 15 minutes while forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissue. If irritation persists get medical attention. It is recommended that contacts should **NOT** be worn while handling AER-O-FOAM XL-33%.

Skin contact: Remove and isolate contaminated clothing. Flush exposed skin areas with plenty of water for at least 15 minutes. Clean affected areas with waterless skin cleanser followed by mild soap and warm water. Launder contaminated clothing before wearing.

Ingestion: If victim is conscious and alert, give 2 to 3 cups of milk or water to drink. **DO NOT** induce vomiting. Get medical attention.

If an ambulance is requested, please inform the dispatcher the name of the chemical involved.

AGENCY NOTIFICATIONS:

NOTE: A release confined to a permanent secondary containment structure is not a release to the environment and does not trigger these reporting requirements, unless there is a specific threat to health or safety.

- IF Any release or threatened release of AER-O-FOAM XL which could significantly impact human health, safety, or the environment must be reported immediately upon discovery to:

AER-O-FOAM XL

- California Office of Emergency Services 1-800-852-7550
- Chula Vista Fire Department 911
- San Diego County Health Department .....(619) 338-2222

➢ IF quantity released is equal to or greater than the REPORTABLE QUANTITY (RQ), notify:

RQ = NOT APPLICABLE
CERCLA listed hazardous material.....NO
SARA TITLE III listed hazardous material.....NO

- A report to the National Response Center is not required

OTHER NOTIFICATIONS: DEGS Media Rep (Incl. tips on media inquiries)..... see ⇒ ***BLUE TAB***
Duke Energy Western Region ..... see ⇒ ***BLUE TAB***

ADDITIONAL INFORMATION: **AER-O-FOAM XL-33%**

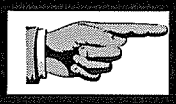
Description:	Dark brown liquid with an organic odor
Code Numbers:	Multiple
DOT Designation:	Fire extinguisher or compounds
Synonyms:	Fluoro-Protein Foam
Incompatibilities:	Burning metals, electrically-energized equipment and water reactive materials
Permissible Exposure Limits (PEL) in Air:	25 ppm* (hexylene glycol)
Threshold Limit Value (TLV):	25 ppm* (hexylene glycol)
Flash Point:	NA
Boiling Point:	NA
Vapor Pressure:	NA
Vapor Density:	NA
Specific Gravity, Liquid:	1.16 @ 25°C (water = 1)
Solubility in Water:	Completely soluble
pH:	7.3

* National Foam. December 1998. Material Safety Data Sheet for AER-O-FOAM XL-33%.

(end of **AER-O-FOAM XL-33%** section)

FIRE / EARTHQUAKE / BOMB THREAT / FLOOD

Fire *(General Procedures)* (F-1)



FIRE with HAZARDOUS Chemicals

Follow general procedures, and see fire info
Under specific substance at yellow tab section

Earthquake (EQ-1)

Bomb Threat (BT-1)

Flash Flood / Flood / Tsunami / Extremely High Tide (FD-1)

HYDROGEN GAS

HYDROGEN GAS

LOCATION: Behind Unit 2 and Unit 3
VOLUME: 50,000 cubic feet tank
USES: Generator Cooling

APPEARANCE: A colorless, tasteless, odorless gas.

HEALTH HAZARDS

Although non-toxic, it is a simple asphyxiate which can displace air and lead to shortness of breath, unconsciousness, and death from oxygen starvation in enclosed spaces. Invisible gas, approach with caution.

FIRE AND EXPLOSION HAZARDS

Forms explosive or flammable mixtures in air when the concentration exceeds 4% by volume. Flame is nearly invisible. Escaping gas may ignite "spontaneously" from static charge due to hydrogen's low ignition energy. A fireball is formed if gas cloud is ignited immediately after release. Forms explosive mixtures with air and oxidizing agents such as oxygen or chlorine. Container may rupture due to heat of fire. Lighter than air, hydrogen can be trapped by ceilings. In humid conditions, explosive atmosphere may linger.

ATTENTION

Determination of an incidental release versus an uncontrolled release will be at the discretion of a **PROPERLY TRAINED PERSONNEL*** only, based on his/her training and knowledge of response capabilities.

(*) **PROPERLY TRAINED PERSONNEL** include those employees that have successfully completed training in respiratory protection, hazard communication, Emergency Action Plan, use of personal protective equipment and decontamination procedures.

HYDROGEN GAS

INCIDENTAL RELEASE:

When there is a **MINIMAL SAFETY OR HEALTH HAZARD**, a release may be controlled by properly trained personnel following standard procedures such as:

- **FIELD TEST** for ambient air conditions using a combustible gas detector.
- **DRESS IN LEVEL D** Personal Protective Equipment (cryogenically gloves, boots, aprons, and gauntlets and protective glasses or chemical safety goggles)
- **VENTILATE** area to prevent flammable mixture from forming, but
- **DO NOT** use mechanical ventilation that may provide ignition source if device is within area of gaseous atmosphere.
- **STOP LEAK**, if safe, with Plug 'n Dike, mud, or putty; or smother with wet, heavy cloth. Small gas leaks can be detected by painting suspected area with a soapy water solution, checking for bubble formation.

UNCONTROLLED RELEASE:

If the release cannot be controlled by properly trained personnel (see above) or there is an immediate health threat due to fire, exposure or release of this substance, initiate emergency response support actions as follows:

NOTE: By definition, a hydrogen-fed fire is considered an uncontrolled release. Immediately initiate external notification procedures.

FIRST RESPONDER ACTION:

NOTIFY by dialing **5201** (day) or **(619) 420-7383** (24hr).
ATTEND to injured personnel if safe to do so (see First aid next page).
EVACUATE surrounding area.
DO NOT allow ignition sources (vehicles, etc.) into area and remove existing sources.
BARRICADE area from safe distance and deny entry (100-yard minimum radius for well-vented leak.
SHUT OFF valves gradually to stop or reduce flow if valves located at a remote location.
MONITOR breathing zone using a flammable gas meter (explosimeter). If unsafe work conditions are encountered (i.e., fire, flammable atmosphere (over 10% of lower explosive limit), or other immediate danger to life and health, leave the area at once.
VENTILATE area to prevent flammable mixture from forming, but

HYDROGEN GAS

DO NOT use mechanical ventilation that may provide ignition source if device is within area of gaseous atmosphere.
Again, DO NOT enter area of flammable atmosphere (over 4%). Use a suitable flammable gas meter (explosimeter). Do not use a halogen-based detection unit. Extreme hazard of fire and explosion may result from static electrical discharge or other ignition source.
WAIT for the arrival of properly trained response personnel.

EMERGENCY RESPONSE SUPPORT:

CONTROL ROOM - dial **911** to notify Chula Vista Fire Department
CONDUCT NOTIFICATIONS (details follow).
AMBULANCE: If 911 is called for an ambulance for personnel who have been chemically contaminated, **PROVIDE** the ambulance dispatcher the name of the chemical involved.
IMPLEMENT INCIDENT COMMAND STRUCTURE; integrate CVFD as lead in hazardous material response (details ⇒ ***ORANGE TAB)***.
PRIMARY LIAISON should -

- **ESCORT** CVFD to release location
- **BRIEF** CVFD personnel as follows:
  - cause of the incident
  - amount released if known
  - is release contained
  - whether rescue of personnel is necessary.
- **REMAIN** present until emergency no longer exists

CONTACT the Environmental Specialist, when the emergency situation is controlled, for assistance in obtaining cleanup contractors.

FIRE AND EXPLOSION HAZARDS:

Follow procedures in fire fighting section ⇒ ***RED TAB*** plus the specific information below:

FOR SMALL FIRES, if safe to do so -

- **STOP FLOW** of gas using remote valves only. Consider cooling containers using water spray from maximum distance, taking care not to extinguish flames. **<u>Allow fire to burn itself out</u>**.
- **NOTE:** Fusible plug melts at 212°F. Pressure release disc releases at 3000 psig (normal pressure is 2400 psig).
- **EXTINGUISH** using approved media such as Carbon dioxide, dry chemicals, water spray, or fog.
- **DO NOT** attempt to extinguish a continuously burning hydrogen leak. A release burning itself off may present less of a hazard than a non-

HYDROGEN GAS

burning leak. If flames are accidentally extinguished, explosive re-ignition may occur.

FOR LARGE FIRES - notify CVFD immediately.

NOTIFY CVFD of all fires, including those that have been extinguished.

SPECIFIC FIRST AID:

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. Keep warm and at rest. Get medical attention as soon as possible.

Eye contact: DO NOT allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately with flooding amounts of water for at least 15 minutes while forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissue. Get medical attention. Contact lenses should **NOT** be worn when working with hydrogen gas.

Skin contact: TREAT FOR INHALATION EXPOSURE FIRST. For frostbite; immerse exposed area in 107.6F (42C) until completely warmed. **DO NOT** use dry heat. Get medical attention as soon as possible.

Ingestion: Ingestion is unlikely because of hydrogen's physical properties. However, if liquid hydrogen is ingested, severe cold injury to the mouth and oral cavity results. Monitor the airway, have trained medical personnel administer oxygen, and seek medical attention.

NOTE: Hydrogen gas is inactive biologically and essentially non-toxic. It may cause asphyxiation by exclusion of oxygen. Moderate concentrations may cause headaches, drowsiness, dizziness, excitation, excess salivation, vomiting and unconsciousness.

AGENCY NOTIFICATIONS:

- IF Any release or threatened release of hydrogen gas which could significantly impact human health, safety, or the environment must be reported immediately upon discovery to:
  - California Office of Emergency Services 1-800-852-7550
  - Chula Vista Fire Department 911
  - San Diego County Health Department .....(619) 338-2222

HYDROGEN GAS

- IF quantity released is equal to or greater than the REPORTABLE QUANTITY (RQ), and extends outside the facility boundaries, notify:

  RQ = NOT APPLICABLE
  CERCLA listed hazardous material.....NO
  SARA TITLE III listed hazardous material.....NO

  - Reporting to the National Response Center is not required

OTHER NOTIFICATIONS:
DEGS Media Rep (Incl. tips on media inquiries)..... see ⇒ ***BLUE TAB***
Duke Energy Western Region. ..... see ⇒ ***BLUE TAB***

ADDITIONAL INFORMATION:

Description:	A colorless, odorless, tasteless flammable gas.
Numbers:	CAS 1333-74-0 UN 1049
DOT Designation:	Flammable gas.
Synonyms:	Protium, H2.
Incompatibilities:	Oxidizing agents, lithium, chlorine and other halogens.
Determine in Air:	LEL, O2 Monitor
Permissible Exposure Limits (PEL) in Air:	None Established
Threshold Limit Value (TLV):	An asphyxiant at high concentrations.
Flash Point:	Not Applicable (gas).
Autoignition temperature:	752°F (400°C)
Lower Explosive Limit (LEL):	4%
Upper Explosive Limit (UEL):	75%
Critical Pressure:	12.8 atm
Boiling Point:	-423°F (-253°C)
Freezing Point:	-434°F (-259°C)
Vapor Density:	0.0696 @ 70° F (Air=1) (0.0051 lbs/cu.ft @ 25°C)
Solubility in Water:	Slightly

(end of **HYDROGEN GAS RELEASE** section)

NATURAL GAS

NATURAL GAS

LOCATION: Various piping in power plant; Cylinders at the Gas Turbine Generator
VOLUME: up to 2,800 cubic feet
USES: Fuel for Boilers

HEALTH HAZARDS

A colorless gas with odorant added for identification. Natural gas consists primarily of methane (85%), with lesser amounts of ethane (9%), propane (3%), nitrogen (2%), and butane (1%). A simple asphyxiate, natural gas can displace air and lead to shortness of breath, unconsciousness, and death from oxygen starvation. Incomplete combustion may produce carbon monoxide.

FIRE AND EXPLOSION HAZARDS

EXTREMELY FLAMMABLE

Forms explosive or flammable mixtures in air when the concentration exceeds 5% by volume. Air containing more than 14% methane burns without noise. Forms explosive mixtures with oxidizers such as oxygen, chlorine, or fluorine. Sunlight explodes a mixture of chlorine and methane (2 volumes of chlorine with one of methane). Hazard of re-ignition or explosion exists if flame is extinguished without stopping flow of gas or cooling surroundings.

ATTENTION

Determination of an incidental release versus an uncontrolled release will be at the discretion of a **PROPERLY TRAINED PERSONNEL*** only, based on his/her training and knowledge of response capabilities.

(*) **PROPERLY TRAINED PERSONNEL** include those employees that have successfully completed training in respiratory protection, hazard communication, Emergency Action Plan, use of personal protective equipment and decontamination procedures.

NATURAL GAS

INCIDENTAL RELEASE:

When there is a **MINIMAL SAFETY OR HEALTH HAZARD**, a release may be controlled by properly trained personnel following standard procedures.

- **FIELD TEST** for ambient air concentration using a combustible gas detector.
- **DRESS IN LEVEL D** Personal Protective Equipment (protective glasses or chemical safety goggles)
- **VENTILATE** area to prevent flammable mixture from forming, but
- **DO NOT** use mechanical ventilation that may provide ignition source if device is within area of gaseous atmosphere.
- **STOP LEAK**, if safe, with Plug 'n Dike, mud, or putty; or smother with wet, heavy cloth. Small gas leaks can be detected by painting suspected area with a soapy water solution, checking for bubble formation.
- **REMOVE LEAKING CYLINDERS** to a safe discharge area, away from cylinders of oxygen. Allow gas to discharge at a moderate rate. When empty close valve. Return to supplier marked defective.

UNCONTROLLED RELEASE:

If the release cannot be controlled by properly trained personnel (see above) or there is an immediate health threat due to fire, exposure or release of this substance, initiate emergency response support actions as follows:

NOTE: By definition, a natural gas fed fire is considered to be an uncontrolled release. Immediately initiate external notification procedures.

FIRST RESPONDER ACTION:

NOTIFY by dialing **5201** (day) or **(619) 420-7383** (24hr).
ATTEND to injured personnel if safe to do so (see First aid next page)
DO NOT enter area of flammable atmosphere (over 5%). Use a suitable flammable gas meter (explosimeter) calibrated for methane. Extreme hazard of fire and explosion may result from static electrical discharge or other ignition sources.
EVACUATE immediate area from at least160 to 330 feet in all directions..
DO NOT allow ignition sources (vehicles, etc.) into area.
BARRICADE area from safe distance and **DENY ENTRY.**
VENTILATE area to prevent flammable mixture from forming.
DO NOT use mechanical ventilation unsuitable for Class I, Group D atmospheres if device is within area of gas.
SHUT OFF VALVES only if possible from remote location
WAIT for arrival of properly trained response personnel.

NATURAL GAS

EMERGENCY RESPONSE SUPPORT:

CONTROL ROOM - dial **911** to notify Chula Vista Fire Department
CONDUCT NOTIFICATIONS (details follow).
IMPLEMENT INCIDENT COMMAND STRUCTURE; integrate CVFD as lead in hazardous material response (details ⇒ ***ORANGE TAB).***
PRIMARY LIAISON should -

- **ESCORT** CVFD to release location
- **BRIEF** CVFD personnel as follows:
  - cause of the incident
  - amount released if known
  - is release contained
  - whether rescue of personnel is necessary.
- **REMAIN** present until emergency no longer exists

CONTACT the Environmental Specialist, when the emergency situation is controlled, for assistance in obtaining cleanup contractors.

FIRE FIGHTING:

Follow procedures in fire fighting section ⇒ ***RED TAB*** plus the specific information below:

SMALL FIRES, only if safe to do so.

- **STOP FLOW** of gas using remote valves only. Use water to keep adjacent areas cool. Allow fire to burn itself out.
- **DO NOT** attempt to extinguish a continuously burning natural gas leak. A release burning itself off may present less of a hazard than a non-burning leak.
- **EXTINGUISH** using carbon dioxide or dry chemical fire extinguishers if safe to do so.

LARGE FIRES - notify CVFD immediately.

NOTIFY CVFD of all fires including those that have been extinguished.

SPECIFIC FIRST-AID:

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. Keep warm and at rest. Get medical attention as soon as possible.

Eye contact: DO NOT allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately with flooding amounts of water for at least 15 minutes while forcibly holding eyelids apart to ensure

NATURAL GAS

complete irrigation of all eye and lid tissue. Get medical attention. Contact lenses should **NOT** be worn when working with natural gas.
Skin contact: TREAT FOR INHALATION EXPOSURE FIRST. Remove and isolate contaminated clothing. Flush exposed skin areas with plenty of water for at least 15 minutes. Clean affected areas with mild soap and warm water. If irritation is present after washing get medical attention.

Ingestion: Due to the physical properties of natural gas, ingestion is unlikely. Seek medical attention if necessary.

NOTE: Natural gas is inactive, biologically, and essentially non-toxic. It may cause asphyxiation by exclusion of oxygen. In very high concentrations, it may have a slight narcotic effect.

AGENCY NOTIFICATIONS:

- IF Any release or threatened release of natural gas which could significantly impact human health, safety, or the environment must be reported immediately upon discovery to:
  - California Office of Emergency Services 1-800-852-7550
  - Chula Vista Fire Department 911
  - San Diego County Health Department .....(619) 338-2222
- IF quantity released is <u>equal to or greater than</u> the REPORTABLE QUANTITY (RQ), and extends outside the facility boundaries, notify:

  <u>RQ = NOT APPLICABLE</u>
  CERCLA listed hazardous material.....NO
  SARA TITLE III extremely hazardous material .....NO

  - Reporting to the National Response Center is not required

OTHER NOTIFICATIONS: DEGS Media Rep (Incl. tips on media inquiries)..... see ⇒ ***BLUE TAB***
Duke Energy Western Region. ..... see ⇒ ***BLUE TAB***

NATURAL GAS

ADDITIONAL INFORMATION:

Description:	A colorless, odorless, flammable gas with odorant added for identification.
Numbers:	CAS (none) UN 1971/1972
DOT Designation:	Flammable gas.
Synonyms:	Swamp gas, marsh gas.
Incompatibilities:	organics, metals.
Determine in Air:	Methane detector tube (qualitative) and an air pump.
Permissible Exposure Limits (PEL) in Air:	None established
Threshold Limit Value (TLV):	None established
Flash Point:	Not Applicable (gas).
Autoignition temperature:	999° F (537°C)
Lower Explosive Limit (LEL):	5%
Upper Explosive Limit (UEL):	15%
Boiling Point:	-258°F (-161°C)
Vapor Pressure:	70
Vapor Density:	0.55 – 0.62 (Air=1)
Specific Gravity (Liquid):	0.37 – 0.5 (water=1)
Solubility in Water:	slight

(End of **NATURAL GAS RELEASE** section)

PROPANE GAS

PROPANE

LOCATION: Various
VOLUME: Up to 1000 gallons in a tank
USES: Operate Various Equipment

HEALTH HAZARDS

A colorless gas that is odorless when pure, but occasionally can have a rotten egg odor. Propane has an odor threshold of 5,000 to 20,000 ppm, but odor is not an adequate warning to prevent overexposure. A simple asphyxiate, propane can displace air and lead to shortness of breath, unconsciousness, and death from oxygen starvation.

FIRE AND EXPLOSION HAZARDS

Extremely Flammable

This material can be a dangerous fire and explosion hazard when mixed with air or exposed to heat and flame. Vapors may flow on surfaces for considerable distances, reach an ignition source, and flash back. One volume of propane requires about 25 volumes of air for complete combustion.

ATTENTION

Determination of an incidental release versus an uncontrolled release will be at the discretion of a **PROPERLY TRAINED PERSONNEL*** only, based on his/her training and knowledge of response capabilities.

(*) **PROPERLY TRAINED PERSONNEL** include those employees that have successfully completed training in respiratory protection, hazard communication, Emergency Action Plan, use of personal protective equipment and decontamination procedures.

PROPANE GAS

INCIDENTAL RELEASE:

When there is a **MINIMAL SAFETY OR HEALTH HAZARD**, a release may be controlled by properly trained personnel following standard procedures.

- **FIELD TEST** for ambient air concentration using a combustible gas detector.
- **DRESS IN LEVEL D** Personal Protective Equipment (neoprene or polyurethane gloves, boots, aprons, and gauntlets and protective glasses or chemical safety goggles)
- **VENTILATE** area to prevent flammable mixture from forming, but
- **DO NOT** use mechanical ventilation that may provide ignition source if device is within area of gaseous atmosphere.
- **STOP LEAK**, if safe, with Plug 'n Dike, mud, or putty; or smother with wet, heavy cloth. Small gas leaks can be detected by painting suspected area with a soapy water solution, checking for bubble formation.
- **REMOVE LEAKING CYLINDERS** outdoors to a safe discharge area, away from cylinders of oxygen. Allow gas to discharge at a moderate rate. When empty close valve. Return to supplier marked defective.

UNCONTROLLED RELEASE:

If the release cannot be controlled by properly trained personnel (see above) or there is an immediate health threat due to fire, exposure or release of this substance, initiate emergency response support actions as follows:

FIRST RESPONDER ACTION:

NOTIFY by dialing **5201** (day) or **(619) 420-7383** (24hr).
ATTEND to injured personnel if safe to do so (see First-aid next page)
DO NOT enter area of flammable atmosphere (over 5%). Use a suitable flammable gas meter (explosimeter) calibrated for propane. Extreme hazard of fire and explosion may result from static electrical discharge or other ignition sources.
EVACUATE immediate area.
DO NOT allow ignition sources (vehicles, etc.) into area.
BARRICADE area from safe distance and **DENY ENTRY** to unauthorized personnel.
VENTILATE area to prevent flammable mixture from forming.
DO NOT use mechanical ventilation unsuitable for Class I, Group D atmospheres if device is within area of gas.
SHUT OFF VALVES only if possible from remote.
WAIT for arrival of properly trained response personnel.

PROPANE GAS

EMERGENCY RESPONSE SUPPORT:

CONTROL ROOM - dial **911** to notify Chula Vista Fire Department
CONDUCT NOTIFICATIONS (details follow).
IMPLEMENT INCIDENT COMMAND STRUCTURE; integrate CVFD as lead in hazardous material response (details ⇒ ***ORANGE TAB).***
PRIMARY LIAISON should -

- **ESCORT** CVFD to release location
- **BRIEF** CVFD personnel as follows:
  - cause of the incident
  - amount released if known
  - is release contained
  - whether rescue of personnel is necessary.
- **REMAIN** present until emergency no longer exists

CONTACT the Environmental Specialist, when the emergency situation is controlled, for assistance in obtaining cleanup contractors.

FIRE FIGHTING:

Follow procedures in fire fighting section ⇒ ***RED TAB*** plus the specific information below:

SMALL FIRES, if safe to do so

- **STOP FLOW** of gas using remote valves only. Use water to keep adjacent areas cool. Allow fire to burn itself out.
- **DO NOT** attempt to extinguish a continuously burning propane leak. A release burning itself off may present less of a hazard than a non-burning leak.
- **EXTINGUISH** using carbon dioxide or dry chemical fire extinguishers if safe to do so.

LARGE FIRES - notify CVFD immediately.

NOTIFY CVFD of all fires including those that have been extinguished.

SPECIFIC FIRST-AID:

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. Keep warm and at rest. Get medical attention as soon as possible.

PROPANE GAS

Eye contact: Gently lift eyelids and flush immediately with flooding amounts of water for at least 15 minutes while forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissue. Get medical attention. Contact lenses should **NOT** be worn when working with propane.

Skin contact: TREAT FOR INHALATION EXPOSURE FIRST. Quickly remove contaminated clothing. Contact with liquid propane may cause frost burns. For frostbite; immerse exposed area in 107.6F (42C) until completely warmed. **DO NOT** use dry heat. After rinsing affected skin with flooding amounts of water, wash it with soap and water. Get medical attention as soon as possible.

Ingestion: Ingestion is unlikely because of propane's physical properties. However, if liquid propane is ingested, severe cold injury to the mouth and oral cavity results. Monitor the airway, have trained medical personnel administer oxygen, and seek medical attention.

AGENCY NOTIFICATIONS:

- IF Any release or threatened release of propane gas which could significantly impact human health, safety, or the environment must be reported immediately upon discovery to:
  - California Office of Emergency Services 1-800-852-7550
  - Chula Vista Fire Department 911
  - San Diego County Health Department .....(619) 338-2222
- IF quantity released is <u>equal to or greater than</u> the REPORTABLE QUANTITY (RQ), and extends outside the facility boundaries, notify:

  <u>RQ = NOT APPLICABLE</u>
  CERCLA listed hazardous material.....NO
  SARA TITLE III extremely hazardous material .....NO

  - Reporting to the National Response Center is not required

OTHER NOTIFICATIONS: DEGS Media Rep (Incl. tips on media inquiries)..... see ⇒ ***BLUE TAB***
Duke Energy Western Region. ..... see ⇒ ***BLUE TAB***

PROPANE GAS

ADDITIONAL INFORMATION:

Description:	A colorless, odorless when pure, flammable gas with odorant added for identification.
Numbers:	CAS 0074-98-6 UN 1075
DOT Designation:	Flammable gas.
Synonyms:	Dimethylmethane, liquified propane, propyl hydride
Incompatibilities:	Strong oxidizers such as nitrates, perchlorates, chlorine, and fluorine
Determine in Air:	Propane detector tube (0.5 – 1.3 Vol. %) and an air pump
IDLH:	2,100 ppm (10% LEL)*
Permissible Exposure Limits (PEL) in Air:	1,000 ppm (8-hour TWA)**
Threshold Limit Value (TLV):	None established**
Flash Point:	-156°F (-105°C)
Autoignition temperature:	852°F (450°C)
Lower Explosive Limit (LEL):	2.1% v/v
Upper Explosive Limit (UEL):	9.5% v/v
Melting Point:	-309.4°F (-189.7°C)
Boiling Point:	-43.8°F (-42.1°C)
Vapor Pressure:	760 mm Hg @ -43.8°F (-42.1C)
Vapor Density:	1.56 (Air=1)
Specific Gravity:	0.58 @ -44°F (-42.2°C) [Water=1]
Solubility in Water:	Slightly soluble

* US Dept. of Health and Human Services. June 1997. NIOSH Pocket Guide to Chemical Hazards.
** Genium Publishing Corporation. April 1990. Material Safety Data Sheet for Propane.

(end of **PROPANE GAS RELEASE** section)

ACETYLENE GAS

ACETYLENE GAS

LOCATION: Outside, East of Storeroom
VOLUME: Approximately 300 standard cubic feet in standard gas cylinders
USES: Welding

HEALTH HAZARDS

A colorless gas with a faint ether-like odor, sometimes garlic-like. Stored dissolved in acetone in pressurized cylinders. At high concentrations, acetylene may act as a mild narcotic, asphyxiate, and anesthetic.

CAUTION! Avoid use of acetylene in confined spaces due to its ability to displace oxygen and create an explosive atmosphere.

FIRE AND EXPLOSION HAZARDS

Extremely Flammable

Forms explosive mixtures with air over a very wide range of concentrations. Burns in air with an intensely hot (>5400°F) sooty flame. Cylinder safety fuse melts @ 212°F and releases gas.

ATTENTION

Determination of an incidental release versus an uncontrolled release will be at the discretion of a **PROPERLY TRAINED PERSONNEL*** only, based on his/her training and knowledge of response capabilities.

(*) **PROPERLY TRAINED PERSONNEL** include those employees that have successfully completed training in respiratory protection, hazard communication, Emergency Action Plan, use of personal protective equipment and decontamination procedures.

ACETYLENE GAS

INCIDENTAL RELEASE:

When there is a **MINIMAL SAFETY OR HEALTH HAZARD**, a release may be controlled by properly trained personnel following standard procedures such as:

- **FIELD TEST** for ambient air conditions, because acetylene displaces oxygen, monitor the ambient oxygen levels.
- **DRESS IN LEVEL D** Personal Protective Equipment (protective glasses or chemical safety goggles)
- **VENTILATE** area to prevent flammable mixture from forming, but
- **DO NOT** use mechanical ventilation that may provide ignition source if device is within area of gaseous atmosphere.
- **STOP LEAK**, if safe, with Plug 'n Dike, mud, or putty; or smother with wet, heavy cloth. Small gas leaks can be detected by painting suspected area with a soapy water solution, checking for bubble formation.
- **REMOVE LEAKING CYLINDERS** outdoors to a safe discharge area, away from cylinders of oxygen. Allow gas to discharge at a moderate rate. When empty close valve. Return to supplier marked defective.

UNCONTROLLED RELEASE:

If the release cannot be controlled by properly trained personnel (see above) or there is an immediate health threat due to fire, exposure or release of this substance, initiate emergency response support actions as follows:

FIRST RESPONDER ACTION:

NOTIFY by dialing **5201** (day) or **(619) 420-7383** (24hr).
ATTEND to injured personnel if safe to do so (see First-aid next page)
EVACUATE immediate area.
DO NOT allow ignition sources (vehicles, etc.) into area.
BARRICADE area from safe distance and **DENY ENTRY** to unauthorized personnel.
REMOVE SOURCES of ignition, heat, sparks, etc.
DO NOT enter area of flammable atmosphere (over 2.5%).
SHUT OFF flow if possible.
WAIT for the arrival of properly trained response personnel.

ACETYLENE GAS

EMERGENCY RESPONSE SUPPORT:

CONTROL ROOM - dial **911** to notify Chula Vista Fire Department
CONDUCT NOTIFICATIONS (details follow).
AMBULANCE: If 911 is called for an ambulance for personnel who have been chemically contaminated, **PROVIDE** the ambulance dispatcher the name of the chemical involved.
IMPLEMENT INCIDENT COMMAND STRUCTURE; integrate CVFD as lead in hazardous material response (details ⇒ ***ORANGE TAB)***.
PRIMARY LIAISON should -

- **ESCORT** CVFD to release location
- **BRIEF** CVFD personnel as follows:
  - cause of the incident
  - amount released if known
  - is release contained
  - whether rescue of personnel is necessary.
- **REMAIN** present until emergency no longer exists

CONTACT the Environmental Specialist, when the emergency situation is controlled, for assistance in obtaining cleanup contractors.

FIRE FIGHTING:

Follow fire-fighting procedures in ⇒ ***RED TAB*** plus the specific information below:

FOR SMALL FIRES, if safe to do so -

- **EXTINGUISH** fire by shutting off source of acetylene, allowing flame to burn itself out.
- **USE** water spray to cool fire-exposed cylinders.
- **EXTINGUISHING** surrounding materials, if necessary, using appropriately media.

FOR LARGE FIRES or fires involving the inner cylinder, notify CVFD immediately.

NOTIFY CVFD of all fires, including those that have been extinguished.

SPECIFIC FIRST-AID:

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. Keep warm and at rest. Get medical attention as soon as possible.

ACETYLENE GAS

Eye contact: DO NOT allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately with flooding amounts of water for at least 15 minutes while forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissue. Get medical attention. Contact lenses should **NOT** be worn when working with acetylene gas.

Skin contact: TREAT FOR INHALATION EXPOSURE FIRST. Remove and isolate contaminated clothing. Flush exposed skin areas with plenty of water for at least 15 minutes. Clean affected areas with mild soap and warm water. If irritation is present after washing get medical attention.

Ingestion: Ingestion is unlikely because of acetylene's physical properties. Seek medical attention if necessary.

AGENCY NOTIFICATIONS:

- IF Any release or threatened release of acetylene gas which could significantly impact human health, safety, or the environment must be reported immediately upon discovery to:
  - California Office of Emergency Services 1-800-852-7550
  - Chula Vista Fire Department 911
  - San Diego County Health Department .....(619) 338-2222
- IF quantity released is <u>equal to or greater than</u> the REPORTABLE QUANTITY (RQ), and extends outside the facility boundaries, notify:

  <u>RQ = NOT APPLICABLE</u>
  CERCLA listed hazardous material..... YES
  SARA TITLE III listed hazardous material.....NO

  - Reporting to the National Response Center is not required

OTHER NOTIFICATIONS: DEGS Media Rep (Incl. tips on media inquiries)..... see ⇒ ***BLUE TAB***
Duke Energy Western Region ..... see ⇒ ***BLUE TAB***

ACETYLENE GAS

ADDITIONAL INFORMATION:

Description:	A colorless, odorless, flammable gas. Impure acetylene often has a disagreeable garlic-like odor.
Code Numbers:	CAS 74-86-2 UN 1001
DOT Designation:	Flammable gas.
Synonyms:	Ethyne, C_2H_2, narcylene.
Incompatibilities:	Heat and pressure; copper and silver which form explosive acetylides; oxidizers (oxygen or chlorine).
Determination in Air:	PID with an 11.7 eV lamp (acetylene has an eV value of 11.4)
Permissible Exposure Limits (PEL) in Air:	2500 ppm (ceiling)*
Threshold Limit Value (TLV):	simple asphyxiate with no TLV value (non toxic)*
Flash Point:	0°F (-17.8°C)
Autoignition temperature:	581°F (305°C) @ 1 atm
Lower Explosive Limit (LEL):	2.5%
Upper Explosive Limit (UEL):	100%
Boiling Point:	-118°F (-75°C)
Vapor Pressure:	30503 mm Hg @ 62°F
Vapor Density:	0.9 (air = 1)
Solubility in Water:	Slight

*US Dept. of Health and Human Services. June 1997. NIOSH Pocket Guide to Chemical Hazards.

(end of **ACETYLENE GAS** section)

NITRIC OXIDE GAS

NITRIC OXIDE

LOCATION: 3rd Floor – Power Plant between Units 2 & 3; East of Control Room 1; West of Control Room 2
VOLUME: 400 cubic feet cylinders
USES: CEM and Confined Space Testers

APPEARANCE: A colorless gas, shipped as a compressed gas or a refrigerated liquid; slightly sweet odor and taste.

HEALTH HAZARDS

This material is an irritating gas that is used as an inhalation anesthetic. Initial exposure produces giddiness, euphoria, delirium, and inebriation; symptoms may progress to severe depression, coma, and death. Also an eye irritant.

FIRE AND EXPLOSION HAZARDS

Nitric oxide is nonflammable. However, since it is a strong oxidizer, it enhances combustion of other substances. Many reactions may cause fire or explosion. Gives off irritating or toxic fumes in a fire. Gas/air mixtures are explosive. Containers may explode in heat or fire. Do not use in the vicinity of fire or a hot surface.

ATTENTION

Determination of an incidental release versus an uncontrolled release will be at the discretion of a **PROPERLY TRAINED PERSONNEL*** only, based on his/her training and knowledge of response capabilities.

(*) **PROPERLY TRAINED PERSONNEL** include those employees that have successfully completed training in respiratory protection, hazard communication, Emergency Action Plan, use of personal protective equipment and decontamination procedures.

NITRIC OXIDE GAS

INCIDENTAL RELEASE:

When there is a **MINIMAL SAFETY OR HEALTH HAZARD**, a release may be controlled by properly trained personnel following standard procedures such as:

- **DRESS IN LEVEL D** Personal Protective Equipment (impervious gloves, boots, aprons, and gauntlets to prevent skin contact and protective glasses or chemical safety goggles)
- **VENTILATE** area to prevent toxic and/or flammable mixture from forming
- **STOP LEAK**, if safe, with Plug 'n Dike, mud, or putty; or smother with wet, heavy cloth. Small gas leaks can be detected by painting suspected area with a soapy water solution, checking for bubble formation.
- **REMOVE LEAKING CYLINDERS** outdoors to a safe discharge area, away from cylinders of oxygen. Allow gas to discharge at a moderate rate. When empty close valve. Return to supplier marked defective.

UNCONTROLLED RELEASE:

If the release cannot be controlled by properly trained personnel (see above) or there is an immediate health threat due to fire, exposure or release of this substance, initiate emergency response support actions as follows:

FIRST RESPONDER ACTION:

NOTIFY by dialing **5201** (day) or **(619) 420-7383** (24hr).
ATTEND to injured personnel if safe to do so (see First-aid next page).
EVACUATE surrounding area.
DO NOT allow ignition sources (vehicles, etc.) into area and remove existing sources.
BARRICADE area from safe distance and deny entry (100-yard minimum radius for well-vented leak.
SHUT OFF valves gradually to stop or reduce flow at cylinder only if release is from low-pressure source (100 psi), well ventilated, and conditions are evaluated as safe to approach.
VENTILATE area to prevent flammable mixture from forming, but **DO NOT** use mechanical ventilation that may provide ignition source if device is within area of gaseous atmosphere.
WAIT for the arrival of properly trained response personnel.

NITRIC OXIDE GAS

EMERGENCY RESPONSE SUPPORT:

CONTROL OPERATOR - dial **911** to notify Chula Vista Fire Department
CONDUCT NOTIFICATIONS (details follow).
AMBULANCE: If 911 is called for an ambulance for personnel who have been chemically contaminated, **PROVIDE** the ambulance dispatcher the name of the chemical involved.
IMPLEMENT INCIDENT COMMAND STRUCTURE; integrate CVFD as lead in hazardous material response (details ⇒ ***ORANGE TAB)***.
PRIMARY LIAISON should -

- **ESCORT** Chula Vista Fire Department to release location
- **BRIEF** Chula Vista Fire Department personnel as follows:
  - cause of the incident
  - amount released if known
  - is release contained
  - whether rescue of personnel is necessary.
- **REMAIN** present until emergency no longer exists

CONTACT the Environmental Specialist, when the emergency situation is controlled, for assistance in obtaining cleanup contractors.

FIRE AND EXPLOSION HAZARDS:

In case of a fire in the surrounding area: use powder, water spray, foam, or carbon dioxide as extinguishing agents.

SPECIFIC FIRST-AID:

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. Keep warm and at rest. Get medical attention as soon as possible.

Eye contact: Gently lift eyelids and flush immediately with flooding amounts of water for at least 15 minutes while forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissue. Get medical attention. Contact lenses should **NOT** be worn when working with nitric oxide.

Skin contact: TREAT FOR INHALATION EXPOSURE FIRST. Remove and isolate contaminated clothing. Wash the affected are with soap and water. Get medical attention as soon as possible.

Ingestion: Ingestion is unlikely because of nitric oxide's physical properties. Seek medical attention if necessary.

NITRIC OXIDE GAS

AGENCY NOTIFICATIONS:

- IF Any release or threatened release of nitric oxide which could significantly impact human health, safety, or the environment must be reported immediately upon discovery to:

  - California Office of Emergency Services 1-800-852-7550
  - Chula Vista Fire Department 911
  - San Diego County Health Department .....(619) 338-2222

- IF quantity released is equal to or greater than the REPORTABLE QUANTITY (RQ), and extends outside the facility boundaries, notify:

  RQ = 10 POUNDS
  CERCLA listed hazardous material.....YES
  SARA TITLE III listed hazardous material.....NO

  - National Response Center 1-800-424-8802

OTHER NOTIFICATIONS: DEGS Media Rep (Incl. tips on media inquiries).....see ⇒ ***BLUE TAB***
Duke Energy Western Region. .....see=>***BLUE TAB***

NITRIC OXIDE GAS

ADDITIONAL INFORMATION:

Description:	A colorless gas.
Numbers:	CAS 10102-43-9 UN 1660
DOT Designation:	Poison gas.
Synonyms:	Dinitrogen monoxide, laughing gas, and nitrogen monoxide.
Incompatibilities:	Reacts violently with sulphurous anhydride, amorphous born, phosphine, ethers, aluminum, hydrazine causing fire and explosion hazard.
Determine in Air:	Use a nitrous fumes detector tube (2 – 100 ppm) and an air sampling pump
IDLH:	100 ppm**
Permissible Exposure Limits (PEL) in Air:	25 ppm (8-hr TWA)*
Threshold Limit Value (TLV):	25 ppm**
Flash Point:	Non Flammable
Autoignition temperature:	Non Flammable
Melting Point:	-263°F (-164°C)
Boiling Point:	-242°F (-152°C)
Vapor Pressure:	34.2 atm
Vapor Density:	1.04 (Air=1)
Solubility in Water:	4.6 ml NO/100 ml water @ 68°F (20°C)

* Genium's Reference Collection. April 1988. Material Safety Data Sheet for Nitric Oxide.
** US Dept. of Health and Human Services. June 1997. NIOSH Pocket Guide to Chemical Hazards.

(end of **NITRIC OXIDE RELEASE** section)

VARIOUS NONFLAMMABLE GASES

CARBON DIOXIDE

LOCATION: 3rd Floor Power Plant – between Units 2 & 3
VOLUME: 4,000 Cubic Feet
USES: Degas Generators

ARGON

LOCATION: East side of storeroom
VOLUME: 500 Cubic Feet
USES: Welding

OXYGEN

LOCATION: East side of Storeroom
VOLUME: 2,400 Cubic Feet
USES: Welding

NITROGEN

LOCATION: 3rd Floor Power Plant – between Units 2 & 3; West of Control Room 1; East of Control Room 2; and the Gas Turbine Generator
VOLUME: 800 ft^3 up to 3,900 Cubic $Feet^3$
USES: Instrument Testing

HELIUM

LOCATIONS: Maintenance Shop #1; East side of Storeroom
VOLUMES: 400 Cubic Feet
USES: Testing Condensers for Leaks

APPEARANCE: All gases listed above are colorless and odorless.

HEALTH HAZARDS

Contact with carbon dioxide, oxygen and nitrogen gases may cause eye irritation. Carbon dioxide, argon, nitrogen and helium are asphyxiants. Inhalation may cause respiratory acidosis. High concentrations may cause rapid circulatory insufficiency leading to death.

Oxygen and nitrous oxide are nonflammable, but are a strong oxidizer, which supports combustion. Nitrous oxide is used as an inhalation anesthetic. Initial exposure produces giddiness, euphoria, delirium, and inebriation; symptoms may progress to severe depression, coma, and death. Also an eye irritant. Contact with liquefied nitrogen and carbon dioxide can cause severe frostbit.

VARIOUS NONFLAMMABLE GASES

FIRE AND EXPLOSION HAZARDS

Nonflammable. Listed gases may initiate fire/explosion in combustible materials. Gaseous oxygen from liquid is absorbed readily in clothing and any ignition source may cause flash burning. Containers may explode in heat or fire. Do not use in the vicinity of fire or a hot surface, or during welding.

ATTENTION

Determination of an incidental release versus an uncontrolled release will be at the discretion of a **PROPERLY TRAINED PERSONNEL*** only, based on his/her training and knowledge of response capabilities.

(*) **PROPERLY TRAINED PERSONNEL** include those employees that have successfully completed training in respiratory protection, hazard communication, Emergency Action Plan, use of personal protective equipment and decontamination procedures.

INCIDENTAL RELEASE: When there is a minimal safety or health hazard, a release may be controlled by properly trained personnel following standard procedures such as:

- **FIELD TEST** for ambient air concentration using a LEL, O2 Monitor
- **DRESS IN LEVEL D** Personal Protective Equipment (impervious gloves, boots, aprons, and gauntlets to prevent skin contact and protective glasses or chemical safety goggles)
- **VENTILATE** area to prevent flammable mixture from forming
- **STOP LEAK**, if safe, with Plug 'n Dike, mud, or putty; or smother with wet, heavy cloth. Small gas leaks can be detected by painting suspected area with a soapy water solution, checking for bubble formation.
- **REMOVE LEAKING CYLINDERS** outdoors to a safe discharge area, away from cylinders of oxygen. Allow gas to discharge at a moderate rate. When empty close valve. Return to supplier marked defective.

UNCONTROLLED RELEASE: If the release cannot be controlled by properly trained personnel (see above) or there is an immediate health threat due to fire, exposure or release of this substance, initiate emergency response support actions as follows:

VARIOUS NONFLAMMABLE GASES

FIRST RESPONDER ACTION:

NOTIFY by dialing **5201** (day) or **(619) 420-7383** (24hr).
ATTEND to injured personnel if safe to do so (see First-aid next page).
EVACUATE surrounding area.
DO NOT approach area without self-contained breathing apparatus and protective clothing.
BARRICADE area from safe distance and **DENY ENTRY**.
SHUT OFF valves gradually to stop or reduce flow.
VENTILATE area to prevent flammable mixture from forming, but **DO NOT** use mechanical ventilation that may provide ignition source if device is within area of gaseous atmosphere.
DO NOT enter area of oxygen deficiency (under 19.5% oxygen). Use an LEL-O2 Indicator meter to measure oxygen levels.
WAIT for the arrival of properly trained response personnel.

EMERGENCY RESPONSE SUPPORT:

CONTROL ROOM - dial **911** to notify Chula Vista Fire Department
CONDUCT NOTIFICATIONS (details follow).
AMBULANCE: If 911 is called for an ambulance for personnel who have been chemically contaminated, **PROVIDE** the ambulance dispatcher the name of the chemical involved.
IMPLEMENT INCIDENT COMMAND STRUCTURE; integrate CVFD as lead in hazardous material response (details ⇒ ***ORANGE TAB)***.
PRIMARY LIAISON should -

- **ESCORT** CVFD to release location
- **BRIEF** CVFD personnel as follows:
  - cause of the incident
  - amount released if known
  - is release contained
  - whether rescue of personnel is necessary.
- **REMAIN** present until emergency no longer exists

CONTACT the Environmental Specialist, when the emergency situation is controlled, for assistance in obtaining cleanup contractors.

FIRE AND EXPLOSION HAZARDS:

In case of a fire in the surrounding areas: all extinguishing agents are allowed.

VARIOUS NONFLAMMABLE GASES

SPECIFIC FIRST-AID:

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. Keep warm and at rest. Get medical attention as soon as possible.

Eye contact: DO NOT allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately with flooding amounts of water for at least 15 minutes while forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissue. Get medical attention. Contact lenses should **NOT** be worn when working with any of the listed gases.

Skin contact: (FOR CARBON DIOXIDE, OXYGEN, NITROGEN AND ARGON) TREAT FOR INHALATION EXPOSURE FIRST. Quickly remove and isolate contaminated clothing. For frostbite; immerse exposed area in 107.6F (42C) until completely warmed. **DO NOT** use dry heat. Get medical attention as soon as possible.

Ingestion: Ingestion is unlikely because of the gases physical properties. Seek medical attention if necessary.

AGENCY NOTIFICATIONS:

- IF Any release or threatened release of these gases which could significantly impact human health, safety, or the environment must be reported immediately upon discovery to:
  - California Office of Emergency Services 1-800-852-7550
  - Chula Vista Fire Department 911
  - San Diego County Health Department .....(619) 338-2222
- IF quantity released is <u>equal to or greater than</u> the REPORTABLE QUANTITY (RQ), and extends outside the facility boundaries, notify:

  <u>RQ = NOT APPLICABLE</u>
  CERCLA listed hazardous material.....NO
  SARA TITLE III listed hazardous material.....NO

  - Reporting to the National Response Center is not required

OTHER NOTIFICATIONS: DEGS Media Rep (Incl. tips on media inquiries)..... see ⇒ ***BLUE TAB***
Duke Energy Western Region. ..... see ⇒ ***BLUE TAB***

VARIOUS NONFLAMMABLE GASES

ADDITIONAL INFORMATION:	**Description:**	A colorless and odorless gas.
	Numbers:	Various
	DOT Designation:	Nonflammable gas
	Synonyms:	NA
	Incompatibilities:	Oxygen reacts explosively with phosphine, hydrazine, hydrogen sulfide, acetylene, acetaldehyde, acetone, secondary-alcohols, aluminum, alkali metals, ammonia, carbon tetrachloride, chlorinated hydrocarbons, benzene, carbon disulfide, halocarbons, hydrocarbons, metals, metal hydrides, methane and polymers.
	Determine in Air:	Use an LEL-O2 Indicator meter to measure oxygen levels.
	IDLH:	40,000 ppm (carbon dioxide)*
	Permissible Exposure Limits (PEL) in Air:	5,000 ppm (carbon dioxide)*
	Threshold Limit Value (TLV):	5,000 ppm (carbon dioxide)*
	Flash Point:	Not Applicable
	Vapor Pressure:	gas @ 70°F
	Vapor Density:	1.38 to 1.52
	Boiling Point:	-109°F to –452.1°F (-78°C to –268.9°C)
	Melting Point:	-345.8°F (-209.9°C)
	Solubility in Water:	slight
	Specific Gravity:	0.138 to 0.967 @ 70°F (21.1°C) and 1 atm

(end of **NON FLAMMABLE GAS RELEASE** section)

LIGHT OIL

INCLUDES:

PCBs (TRANSFORMER OILS)
HYDRAULIC FLUIDS
MOTOR OILS
TURBINE OILS
LUBRICATING OILS
INSULATING OILS
FUEL OIL ADDITIVE BLEND

HEALTH HAZARDS

Extensive exposure to vapors may cause irritation to nose, throat, and lungs, and can cause signs and symptoms of central nervous system depression.

FIRE AND EXPLOSION HAZARDS

Combustible liquids. At elevated temperatures these materials may release ignitable vapors that are heavier than air and invisible. Do not weld, heat, cut, braze, solder, grind, or drill containers. Emptied containers or tanks still contain hazardous vapor or liquid. Do not use pressure to empty drum or tank, as explosion may result. Surfaces that are sufficiently hot may ignite even liquid product in the absence of sparks or flame. Heavier than air vapors may accumulate and travel to ignition sources.

ATTENTION

Determination of an incidental release versus an uncontrolled release will be at the discretion of a **PROPERLY TRAINED PERSONNEL*** only, based on his/her training and knowledge of response capabilities.

(*) **PROPERLY TRAINED PERSONNEL** include those employees that have successfully completed training in respiratory protection, hazard communication, Emergency Action Plan, use of personal protective equipment and decontamination procedures.

LIGHT OIL

INCIDENTAL RELEASE:

When there is a minimal safety or health hazard, a release may be controlled by properly trained personnel following standard procedures such as:

- **DRESS IN LEVEL D** Personal Protection Equipment (neoprene or polyvinyl alcohol gloves, boots, aprons, and gauntlets to prevent skin contact and protective eyeglasses or chemical safety goggles)
- **VENTILATING** the area.
- **ABSORB** any bulk liquids with absorbent, dry sand, earth, or similar material and deposit in sealed containers.
- **ENSURE** that there are no sources of ignition.

UNCONTROLLED RELEASE:

If the release cannot be controlled by properly trained personnel (see above) or there is an immediate health threat due to fire, exposure or release of this substance, initiate emergency response support actions outlined below.

If a spill reaches water, notify agencies immediately (see "Agency Notification" details below).

FIRST RESPONDER ACTION:

NOTIFY by dialing **5201** (day) or **(619) 420-7383** (24hr).
ATTEND to injured personnel, if safe to do so (see First-aid next page)
SHUT OFF power to pumps if running uncontrolled.
STAY UPWIND and out of **LOW AREAS.**
BARRICADE area from safe distance.
PREVENT personnel or sources of ignition from entering area.
INITIATE SECONDARY CONTAINMENT:

- Dike ahead of area with absorbent material or sand.
- Cover storm drains in area and divert flow.
- If material is in storm drains, send crew to downline catch basin to stop flow with absorbent, sand, or pipe plug device. (see storm drain diagram in ⇒ *GREEN TAB)*
- Ensure the atmosphere in catch basins is safe to enter via use of an air monitor.
- Ensure main storm drain valve is closed.

WAIT for the arrival of properly trained personnel.

LIGHT OIL

EMERGENCY RESPONSE SUPPORT:

CONTROL ROOM - dial **911** to notify Chula Vista Fire Department
AMBULANCE: If 911 is called for an ambulance for personnel who have been chemically contaminated, **PROVIDE** the ambulance dispatcher the name of the chemical involved.
CONDUCT NOTIFICATIONS (details follow).
IMPLEMENT INCIDENT COMMAND STRUCTURE; integrate CVFD as lead in hazardous material response (details ⇒ ***ORANGE TAB)***.
PRIMARY LIAISON should -

- **ESCORT** CVFD to spill location
- **BRIEF** CVFD personnel as follows:
  - cause of the incident
  - amount released if known
  - is spill contained
  - whether rescue of personnel is necessary.
- **REMAIN** present until emergency no longer exists

CONTACT the Environmental Specialist, when the emergency situation is controlled, for assistance in obtaining cleanup contractors.

FIRE FIGHTING:

Follow procedures in fire fighting section ⇒ ***RED TAB*** plus the specific information below:

FOR SMALL FIRES, if safe to do so -

- **EXTINGUISH** using Carbon Dioxide, dry chemical, foam, water fog or vaporization liquid type media.
- **COOL** containers with water fog or spray to prevent vapor pressure build up.
- **DO NOT** use direct stream of water if leak has ignited.

FOR LARGE FIRES - notify CVFD immediately

NOTIFY CVFD of all fires, including those that have been extinguished.

SPECIFIC FIRST-AID:

Inhalation: Since vapor pressure is very low, inhalation under ambient conditions is normally not a problem. If overcome by vapor from heated product, remove from exposure. If not breathing, give artificial respiration. Keep warm and at rest. Get medical attention as soon as possible.

LIGHT OIL

Eye contact: Immediately flush eyes with clean low-pressure water for at least 15 minutes while forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissue. If irritation persists get medical attention. It is recommended that contacts should **NOT** be worn while handling light oils. Seek medical attention.

Skin contact: Remove and isolate contaminated clothing. Flush exposed skin areas with plenty of water for at least 15 minutes. Clean affected areas with waterless skin cleanser followed by mild soap and warm water. **DO NOT** use gasoline, thinners, or solvents to remove product from skin. Launder contaminated clothing before wearing. Remove lightly contaminated shoes and thoroughly clean and dry before reuse. Discard saturated leather goods. Seek medical attention.

Ingestion: If victim is conscious and alert, give 2 to 3 cups of milk or water to drink. **DO NOT** induce vomiting because product can enter lungs and cause chemical pneumonia. If vomiting occurs spontaneously, keep head below hips to prevent aspiration of liquid into the lungs. Get medical attention.

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Ingestion of Triyrixylenyl Phosphate Fyrquel Fire-Resistant Hydraulic Fluid: If victim is conscious and alert, give 2 to 3 cups of milk or water to drink. Induce vomiting by touching the back of the throat with a finger. Get medical attention.

Note to Medical Personnel: Emesis or lavage is not recommended for ingestion of minute quantities or tastes of most hydrocarbons. Medical opinion is divided for larger ingestions. Suggested level: If more than 2.0 ml per kg has been ingested and vomiting has not occurred, emesis should be induced with medical supervision. If symptoms such as loss of gag reflex, convulsions, or unconsciousness occur before emesis, gastric lavage with a cuffed endotracheal tube should be considered.

AGENCY NOTIFICATIONS:

NOTE: A release confined to a permanent secondary containment structure is not a release to the environment and does not trigger these reporting requirements, unless there is a specific threat to health or safety.

LIGHT OIL

- **IF** Any release or threatened release of these oils which could significantly impact human health, safety, or the environment, or **IF** **42 gallons or more** is spilled outside of a containment (i.e., soil), then the release must be reported immediately upon discovery to:
  - California Office of Emergency Services 1-800-852-7550
  - Chula Vista Fire Department 911
  - San Diego County Health Department .....(619) 338-2222

- IF quantity released is equal to or greater than the REPORTABLE QUANTITY (RQ), to an unpaved portion of the facility, or extends outside the facility boundaries, notify:

  RQ = NOT APPLICABLE
  CERCLA listed hazardous material.....NO
  SARA TITLE III listed hazardous material.....NO
  [CERCLA's Petroleum Exclusion applies]

  - Reporting to the National Response Center is not required

- IF a substantial release to the ground or to an open storm drain occurs, notify:

  - Regional Water Quality Control Board .....(858) 467-2952

- IF a release of any amount reaches **WATER**, notify the following agencies:

  - California Office of Emergency Services 1-800-852-7550
  - U.S. Coast Guard..... (Day) (619) 683-6495 or (Night) (619) 683-6470
  - Regional Water Quality Control Board .....(858) 467-2952
  - Department of Fish and Game -
    Office of Spill Prevention and Response.....(916) 445-0045
  - Department of Toxic Substances Control
    (Emergency Response Unit) .....(916) 255-6504

- IF Any oil release resulting from a **PIPELINE** rupture, fire or explosion must be reported to:

  - State Fire Marshal.....(916) 323-7390
  - National Response Center 1-800-424-8802
    To satisfy Department of Transportation (DOT) reporting requirements

LIGHT OIL

- At the discretion of the Environmental Specialist, the following agencies may be notified as a courtesy:

  - U.S. Coast Guard ..... (Day) (619) 683-6495 or (Night) (619) 683-6470
  - California Coastal Commission .....(415) 904-5200
  - State Land Commission .....(562) 499-6312

OTHER NOTIFICATIONS: DEGS Media Rep ..... see ⇒ ***BLUE TAB***
Duke Energy Western Region ..... see ⇒ ***BLUE TAB***

ADDITIONAL INFORMATION:

Description:	Pale liquid with a petroleum oil odor.
Code Numbers:	Various
DOT Designation:	Combustible liquid
Synonyms:	Petroleum hydrocarbons
Incompatibilities:	Oxidizing agents such as chlorine and oxygen
Permissible Exposure Limits in Air:	5 mg/m^3* (mineral oil mist)
Threshold Limit Value (TLV):	5 mg/m^3* (mineral oil mist)
Flash Point:	145°C (293°F) to >207°C (405°F)
Lower Explosive Limit (LEL):	Not Determined
Upper Explosive Limit (UEL):	Not Determined
Autoignition temperature:	Not Determined
Vapor Pressure:	<0.1mm Hg @ 20°C to 0.33 mmHg @ 200°C
Vapor Density:	>2.0 (Air=1)
Specific Gravity, Liquid:	0.8816 to 1.130-1.155 @ 20°C (water = 1)
Boiling Point:	>316°C°600°F)
Solubility in Water:	Negligible

* US Dept. of Health and Human Services. June 1997. NIOSH Pocket Guide to Chemical Hazards.

(end of **LIGHT OILS** section)

SOLVENTS

C12-C13 Paraffinic Hydrocarbon D-Limonene Skysol Solvent

LOCATION: Drum Storage Area NW of Unit 1; Various locations
VOLUME: 55 Gallon drums
USES: Various Parts Cleaning and Maintenance activities

HEALTH HAZARDS

Vapors are heavier than air and invisible. Extensive exposure to vapors may cause irritation to nose, throat, and lungs, and can cause signs and symptoms of central nervous system depression. Eye irritation can also occur after 15 minutes exposure to vapors at 470 ppm.

FIRE AND EXPLOSION HAZARDS

Combustible liquid. Flammable vapors occur only with increased temperatures. In a fire situation, or when heated or misted, becomes a hazardous, highly flammable material. Emptied containers or tanks still contain hazardous vapor or liquid. Do not use pressure to empty drum or tank, as explosion may result. Surfaces that are sufficiently hot may ignite even the liquid product in the absence of sparks or flame. Heavier than air vapors may accumulate and travel to ignition sources.

ATTENTION

Determination of an incidental release versus an uncontrolled release will be at the discretion of a **PROPERLY TRAINED PERSONNEL*** only, based on his/her training and knowledge of response capabilities.

(*) **PROPERLY TRAINED PERSONNEL** include those employees that have successfully completed training in respiratory protection, hazard communication, Emergency Action Plan, use of personal protective equipment and decontamination procedures.

INCIDENTAL RELEASE: When there is a **MINIMAL SAFETY OR HEALTH HAZARD**, a release may be controlled by properly trained personnel following standard procedures such as:

- **DRESS IN LEVEL D** Personal Protection Equipment (chemical resistant gloves, boots, aprons, and gauntlets to prevent skin contact and protective eyeglasses or chemical safety goggles)

SOLVENTS

- **VENTILATING** the area.
- **ABSORB** any bulk liquids with absorbent, dry sand, earth, or similar material and deposit in sealed containers.
- **ENSURE** that there are no sources of ignition.

UNCONTROLLED RELEASE:

If the release cannot be controlled by properly trained personnel (see above) or there is an immediate health threat due to fire, exposure or release of this substance, initiate emergency response support actions outlined below.

If a spill reaches water, notify agencies immediately (see "Agency Notification" details below).

FIRST RESPONDER ACTION:

NOTIFY by dialing **5201** (day) or **(619) 420-7383** (24hr).
STAY UPWIND and out of **LOW AREAS.**
ATTEND to injured personnel if safe to do so.
BARRICADE area from safe distance and **DENY ENTRY**.
PREVENT personnel or sources of ignition from entering area.
ELIMINATE existing ignition source, if safe to do so.
INITIATE SECONDARY CONTAINMENT (if safe to do so):

- Use non-sparking tools if ignition hazard exists.
- Dike ahead of area with absorbent material or sand.
- Cover storm drains in area and divert flow.
- If material is in storm drains, send crew to downline catch basin to stop flow with absorbent, sand, or pipe plug device. (see storm drain diagram in ⇒ *GREEN TAB)*
- Ensure main storm drain valve is closed.
- Ensure the atmosphere in catch basins is safe to enter via use of an air monitor.

CAUTION: FIRE OR EXPLOSION HAZARD MAY EXIST IN STORM DRAIN SYSTEM.
WAIT for the arrival of properly trained response personnel.

EMERGENCY RESPONSE SUPPORT:

CONTROL OPERATOR - dial **911** to notify Chula Vista Fire Department
AMBULANCE: If 911 is called for an ambulance for personnel who have been chemically contaminated, **PROVIDE** the ambulance dispatcher the name of the chemical involved.
CONDUCT NOTIFICATIONS (details follow).
IMPLEMENT INCIDENT COMMAND STRUCTURE; integrate CVFD as lead in hazardous material response (details ⇒ *ORANGE TAB)*.

SOLVENTS

PRIMARY LIAISON should -

- **ESCORT** CVFD to spill location
- **BRIEF** CVFD personnel as follows:
  - cause of the incident
  - amount released if known
  - is spill contained
  - whether rescue of personnel is necessary.
- **REMAIN** present until emergency no longer exists

CONTACT the Environmental Specialist, when the emergency situation is controlled, for assistance in obtaining cleanup contractors.

FIRE FIGHTING:

Follow procedures in fire fighting section ⇒ ***RED TAB*** plus the specific information below:

SMALL FIRES, if safe to do so

- **EXTINGUISH** using Carbon Dioxide, dry chemical, foam, water fog, or vaporizing liquid-type media
- **COOL** using water fog or spray to tanks and containers exposed to fire to prevent vapor pressure buildup.

LARGE FIRES - notify CVFD immediately

NOTIFY CVFD of all fires, including those that have been extinguished

SPECIFIC FIRST-AID:

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. Keep warm and at rest. Get medical attention as soon as possible.

Eye contact: Immediately flush eyes with clean low-pressure water for at least 15 minutes while forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissue. If irritation persists get medical attention. It is recommended that contacts **NOT** be worn while handling solvents.

Skin contact: Remove and isolate contaminated clothing. Flush exposed skin areas with plenty of water for at least 15 minutes. Clean affected areas with waterless skin cleanser followed by mild soap and warm water. Launder contaminated clothing before wearing.

Ingestion: If victim is conscious and alert, give 2 to 3 cups of milk or water to drink. **DO NOT** induce vomiting because product can enter lungs and cause chemical pneumonia. If vomiting occurs spontaneously, keep

SOLVENTS

head below hips to prevent aspiration of liquid into the lungs. Get medical attention.

Note to Medical Personnel: Emesis or lavage is not recommended for ingestion of minute quantities or tastes of most hydrocarbons. Medical opinion is divided for larger ingestions. Suggested level: If more than 2.0 ml per kg has been ingested and vomiting has not occurred, emesis should be induced with medical supervision. If symptoms such as loss of gag reflex, convulsions, or unconsciousness occur before emesis, gastric lavage with a cuffed endotracheal tube should be considered.

AGENCY NOTIFICATIONS:

NOTE: A release confined to a permanent secondary containment structure is not a release to the environment and does not trigger these reporting requirements, unless there is a specific threat to health or safety.

- IF Any release or threatened release of these solvents which could significantly impact human health, safety, or the environment, or **IF 42 gallons or more** is spilled outside of a containment (i.e., soil), then the release must be reported immediately upon discovery to:
  - California Office of Emergency Services 1-800-852-7550
  - Chula Vista Fire Department 911
  - San Diego County Health Department .....(619) 338-2222

- IF quantity released is equal to or greater than the REPORTABLE QUANTITY (RQ), to an unpaved portion of the facility, or extends outside the facility boundaries, notify:

  RQ = NOT APPLICABLE
  CERCLA listed hazardous material.....NO
  SARA TITLE III listed hazardous material.....NO

  - National Response Center 1-800-424-8802

- IF a release of any amount reaches **WATER**, notify the following agencies:

  - California Office of Emergency Services 1-800-852-7550
  - U.S. Coast Guard ..... (Day) (619) 683-6495 or (Night) (619) 683-6470
  - Regional Water Quality Control Board .....(858) 467-2952
  - Department of Fish and Game -
    Office of Spill Prevention and Response.....(916) 445-0045
  - Department of Toxic Substances Control
    (Emergency Response Unit) .....(916) 255-6504

SOLVENTS

- At the discretion of the Environmental Specialist, the following agencies may be notified as a courtesy:

  - U.S. Coast Guard ..... (Day) (619) 683-6495 or (Night) (619) 683-6470
  - California Coastal Commission .....(415) 904-5200
  - State Land Commission .....(562) 499-6312

OTHER NOTIFICATIONS: DEGS Media Rep (Incl. tips on media inquiries) ..... see ⇒ ***BLUE TAB***
Duke Energy Western Region ..... see ⇒ ***BLUE TAB***

ADDITIONAL INFORMATION:

Description:	Clear to green liquid with characteristic hydrocarbon odor.
Code Numbers:	CAS 8032-32-4 UN 1256
DOT Designation:	Flammable liquid.
Synonyms:	Mineral Spirits, Petroleum distillates, Stoddard solvent, Petroleum Naphtha.
Incompatibilities:	Oxidizing agents such as chlorine and oxygen; strong acids, strong bases.
Determine in Air:	Organic vapor badge for complex mixtures
Permissible Exposure Limits in Air:	OSHA PEL - 300 ppm* ACGIH TLV - 300 ppm*
Flash Point:	100 to 125°F. TCC
Lower Explosive Limit (LEL):	0.7 % volume in air.
Upper Explosive Limit (UEL):	6.0 % volume in air.
Autoignition Temperature:	473° F.
Boiling Point:	304° to 435°F
Vapor Pressure:	2 to 5 mm Hg @ 68°F.
Vapor Density:	4.9 (Air=1)
Specific Gravity, Liquid:	0.775 to 0.795 (water = 1)
Solubility in Water:	Slight.

* Mallinckrodt Baker, Inc. December 1996. Material Safety Data Sheet for Petroleum Ether.

(end of **SOLVENTS** section)

FUEL OILS

KEROSENE

LOCATION: Unit 1 Condensor; Drum Storage Area
VOLUME: 55 Gallon drums
USES: Steam Cleaners/Various

#6 FUEL OIL

LOCATION: South Tank Farms
VOLUME: Up to 20,286,000 Gallons
USES: Various

JET-A-KEROSENE aka JP-5 JET FUEL

LOCATION: Gas Turbine Tank
VOLUME: Up to 98,000 Gallons
USES: Gas Turbine Fuel Tank

NOTE: THE SPILL PREVENTION CONTROL AND COUNTERMEASURES (SPCC) PLAN SHOULD BE USED WITH THE RESPONSE GUIDE BELOW.

HEALTH HAZARDS

At elevated temperatures these materials may release ignitable vapors that are heavier than air and invisible.

FIRE AND EXPLOSION HAZARDS

Combustible liquid. Liquid evaporates and forms vapor, which can catch fire and burn with explosive violence. Invisible vapor spreads easily and can be ignited and flash back. Fire hazard is greater as liquid temperature rises above 85°F. Do not weld, heat, cut, braze, solder, grind, or drill containers. Emptied containers or tanks still contain hazardous vapor or liquid.

FUEL OILS

ATTENTION

Determination of an incidental release versus an uncontrolled release will be at the discretion of a **PROPERLY TRAINED PERSONNEL*** only, based on his/her training and knowledge of response capabilities.

(*) **PROPERLY TRAINED PERSONNEL** include those employees that have successfully completed training in respiratory protection, hazard communication, Emergency Action Plan, use of personal protective equipment and decontamination procedures.

INCIDENTAL RELEASE:

When there is a minimal safety or health hazard, a release may be controlled by properly trained personnel following standard procedures such as securing steam flow, shutting off pumps and closing valves.

- **DRESS IN LEVEL D** Personal Protection Equipment (neoprene or polyvinyl alcohol gloves, boots, aprons, and gauntlets to prevent skin contact and protective eyeglasses or chemical safety goggles)
- **VENTILATING** the area.
- **ABSORB** any bulk liquids with absorbent, dry sand, earth, or similar material and deposit in sealed containers.
- **ENSURE that** there are no sources of ignition.

UNCONTROLLED RELEASE:

If the release cannot be controlled by properly trained personnel (see above) or there is an immediate health threat due to fire, exposure or release of this substance, initiate emergency response support actions outlined below.

If the spill reaches water, notify agencies immediately (see "Agency Notifications" details below).

FIRST RESPONDER ACTION:

BEWARE of heavier than air vapors if heated.
NOTIFY by dialing **5201** (day) or **(619) 420-7383** (24hr).
ATTEND to injured personnel, if safe to do so.

FUEL OILS

BARRICADE area from safe distance and **DENY ENTRY** to unauthorized personnel.
PREVENT sources of ignition from entering area.
ELIMINATE EXISTING IGNITION SOURCES if this can be done safely.
SHUT OFF power to pumps if running uncontrolled.
INITIATE SECONDARY CONTAINMENT:

- Dike ahead of area with absorbent material, sand, or structural materials.
- Cover storm drains in area and divert flow.
- If material is in storm drains, send crew to downline catch basin to stop flow with absorbent, sand, or pipe plug device. (see storm drain diagram in ⇒ *GREEN TAB)*
- Ensure the atmosphere in catch basins is safe to enter via use of an air monitor.
- Ensure main storm drain valve is closed.

CAUTION: FIRE OR EXPLOSION HAZARD MAY EXIST IN STORM DRAIN SYSTEM.
WAIT for the arrival of properly trained response personnel.

EMERGENCY RESPONSE SUPPORT:

CONTROL OPERATOR - dial **911** to notify Chula Vista Fire Department.
AMBULANCE: If 911 is called for an ambulance for personnel who have been chemically contaminated, **PROVIDE** the ambulance dispatcher the name of the chemical involved.
CONDUCT NOTIFICATIONS (details follow).
IMPLEMENT INCIDENT COMMAND STRUCTURE; integrate CVFD as lead in hazardous material response (details ⇒ *ORANGE TAB)*.
PRIMARY LIAISON should -

- **ESCORT** CVFD to spill location
- **BRIEF** CVFD personnel as follows:
  - cause of the incident
  - amount released if known
  - is spill contained
  - whether rescue of personnel is necessary.
- **REMAIN** present until emergency no longer exists

CONTACT the Environmental Specialist, when the emergency situation is controlled, for assistance in obtaining cleanup contractors.

FUEL OILS

FIRE FIGHTING:

Follow procedures in fire fighting section ⇒ ***RED TAB*** plus the specific information below:

FOR SMALL FIRES, if safe to do so

- **EXTINGUISH** using carbon dioxide, dry chemical, foam, water fog or vaporizing liquid media
- **COOL** containers with water fog or spray to prevent vapor pressure buildup
- **DO NOT** use direct-stream of water on ignited leak
- **DO NOT** enter any enclosed or confined space

FOR LARGE FIRES - notify CVFD immediately

NOTIFY CVFD of all fires including those that have been extinguished.

SPECIFIC FIRST-AID:

Inhalation: Since vapor pressure is very low, inhalation under ambient conditions is normally not a problem. If overcome by vapor from heated product, remove from exposure. If not breathing, give artificial respiration. Keep warm and at rest. Get medical attention as soon as possible. If an ambulance is requested, please inform the dispatcher the name of the chemical involved.

Eye contact: Immediately flush eyes with clean low-pressure water for at least 15 minutes while forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissue. If irritation persists get medical attention. It is recommended that contacts **NOT** be worn while handling fuel oils.

Skin contact: Remove and isolate contaminated clothing. Clean affected areas with waterless skin cleanser followed by mild soap and warm water. **DO NOT** use gasoline, thinners, or solvents to remove product from skin. Launder contaminated clothing before wearing. Remove lightly contaminated shoes and thoroughly clean and dry before reuse.

Ingestion: If swallowed, give a large amount of water to drink, and induce vomiting. Get medical attention.

FUEL OILS

AGENCY NOTIFICATIONS:

> **NOTE:** A release confined to a permanent secondary containment structure is not a release to the environment and does not trigger these reporting requirements, unless there is a specific threat to health or safety.

- IF Any release or threatened release of fuel oil which could significantly impact human health, safety, or the environment, or **IF 42 gallons or more** is spilled outside of a containment (i.e., soil), the release must be reported immediately upon discovery to:

  - California Office of Emergency Services 1-800-852-7550
  - Chula Vista Fire Department 911
  - San Diego County Health Department .....(619) 338-2222

- IF quantity released is equal to or greater than the REPORTABLE QUANTITY (RQ), to an unpaved portion of the facility, or extends outside the facility boundaries, notify:

  RQ = NOT APPICABLE
  CERCLA listed hazardous material.....NO
  SARA TITLE III listed hazardous material.....NO
  [Petroleum Exclusion Applies]

  - Reporting to the National Response Center is not required

- IF a release of any amount reaches **WATER**, notify the following agencies:

  - California Office of Emergency Services 1-800-852-7550
  - U.S. Coast Guard..... (Day) (619) 683-6495 or (Night) (619) 683-6470
  - Regional Water Quality Control Board .....(858) 467-2952
  - Department of Fish and Game -
    Office of Spill Prevention and Response.....(916) 445-0045
  - Department of Toxic Substances Control
    (Emergency Response Unit) .....(916) 255-6504

- IF Any oil release resulting from a **PIPELINE** rupture, fire or explosion must be reported to:

  - State Fire Marshal.....(916) 323-7390

  - National Response Center 1-800-424-8802
    To satisfy Department of Transportation (DOT) reporting requirements

FUEL OILS

- At the discretion of the Environmental Specialist, the following agencies may be notified as a courtesy:

  - U.S. Coast Guard ..... (Day) (619) 683-6495 or (Night) (619) 683-6470
  - California Coastal Commission .....(415) 904-5200
  - State Land Commission .....(562) 499-6312

OTHER NOTIFICATIONS: DEGS Media Rep (Incl. tips on media inquiries) ..... see ⇒ ***BLUE TAB***
Duke Energy Western Region ..... see ⇒ ***BLUE TAB***

ADDITIONAL INFORMATION:

Kerosene and Jet-A-Kerosene aka JP-5 Jet Fuel

Description:	A colorless and light straw liquid with a characteristic petroleum hydrocarbon odor.
Code Numbers:	CAS 8008-20-6 UN 1223
DOT Designation:	Combustible liquid.
Synonyms:	No. 1 fuel oil, kerosene jet fuel
Incompatibilities:	Strong acids and oxidizing agents
Determine in Air:	Organic vapor badge for complex mixtures
Permissible Exposure Limits (PEL) in Air:	100 mg/m^3 (8-hr TWA)*
Flash Point:	120°F – 145°F
Autoignition Temperature:	410°F
Lower Explosive Limit (LEL):	0.7%
Upper Explosive Limit (UEL):	5%
Boiling Point:	370-520°F
Vapor Density:	>1 (Air=1)
Specific Gravity:	0.82 – 0.84 (Water=1)
Gravity, Degrees API:	38-41
Pour Point:	NA
Solubility in Water:	Negligible

* Kern Oil & Refining Co. January 1992. Material Safety Data Sheet for Kerosene.

FUEL OILS

DIESEL FUEL #2

Description:	Red liquid
Code Numbers:	CAS 68476-34-6 UN 1202
DOT Designation:	Combustible liquid.
Synonyms:	Diesel fuel oil no. 2; diesel oil medium; no. 2 diesel
Incompatibilities:	Strong oxidizing agents such as chlorates, nitrates, and peroxides
Determine in Air:	Organic vapor badge for complex mixtures
Permissible Exposure Limits in Air:	Non established
Flash Point:	125°F
Lower Explosive Limit (LEL):	0.6% volume in air
Upper Explosive Limit (UEL):	4.7% volume in air
Autoignition Temperature:	NA
Vapor Pressure:	0.04 psi @40°C
Vapor Density:	NA
Specific Gravity, Liquid:	0.84 (water = 1)
Boiling Point:	348° to 698°F (176 – 370°C)
Solubility in Water:	Insoluble.

FUEL OIL #6

Description:	Black liquid
Code Numbers:	CAS 68553-00-4 UN 1202
DOT Designation:	Combustible liquid.
Synonyms:	Diesel fuel oil no. 2; diesel oil medium; no. 2 diesel
Incompatibilities:	Strong oxidizing agents such as chlorates, nitrates, and peroxides
Determine in Air:	Organic vapor badge for complex mixtures
Permissible Exposure Limits in Air:	No federal standard due to varied composition. For kerosene, a similar

FUEL OILS

	distillate, NIOSH as of 1977 has adopted a PEL of 100 ppm (10 hour) and a STEL value of 1800 ppm (15 minute).
Flash Point:	150°F
Lower Explosive Limit (LEL):	No Data Available
Upper Explosive Limit (UEL):	No Data Available
Autoignition Temperature:	765°F (487°C)
Vapor Pressure:	No Data Available
Vapor Density:	No Data Available
Specific Gravity, Liquid:	1.0 (water = 1)
Boiling Point:	No Data Available
Solubility in Water:	Insoluble

(end of **FUEL OIL** section)

RESPONSE TO A

FIRE

PERSON DISCOVERING THE FIRE

1. **NOTIFY** the Control Room Operator (CO):
   - Plant phone: **5201**
   - Cell phone and 24 hr numbers: **619-498-5201**
   - 450 MHz Radio: **Control Room Operator**, operations channel

2. **STAY ON THE LINE** and provide the following information until released by the CO:
   - LOCATION of fire.
   - OBJECT:
     - Class A - wood, paper, trash
     - Class B - flammable liquids, grease, solvents
     - Class C - electrical
     - Class D - metals
   - CONDITION – extinguished, incipient, controlled or uncontrolled.
   - ACTIONS – that have been taken.
   - RESCUE – whether ambulance or rescue is needed.
   - Any other information the CO may need. REMEMBER, stay on the line until released by the CO.

3. **USE FIRE SUPPRESSION EQUIPMENT**:
   - Portable fire extinguishers
   - Fixed fire suppression systems
     - Either "Automatic" or "Manual" use of portable dry chemical or raw city water

> **LIMITATIONS: INCIPIENT, SMALL FIRES ONLY!**
> "Incipient" level fire is one that is in the early stage and has not developed beyond which can be extinguished using portable fire extinguishers or handlines flowing up to 125 gallons per minute (gpm). Fires that have the potential to cause an explosion are **NOT** considered incipient level.
>
> **RESPONDERS SHALL STOP** fire suppression when they must take evasive actions to avoid heat, smoke or flames.

4. **REMOVE** or **ISOLATE** unaffected containers, equipment or hazardous material, if safe.

5. **ISOLATE** and **EVACUATE** the immediate area, **SOUND THE STATION ALERT** and announce for all personnel to leave the area affected by the fire and wait for the arrival of the Chula Vista Fire Department.

RESPONSE TO A

FIRE

IMMEDIATE NOTIFICATIONS MUST BE MADE IF A FIRE IS UNCONTROLLED BEYOND THE INCIPIENT STAGE.

CONTROL ROOM OPERATOR

1. **COLLECT INFORMATION** from the caller related to the fire to assess response needed.
2. **SOUND THE STATION ALERT** if not already done so. Announce that there is a fire and the location where it is and that all personnel should leave the area.
3. **NOTIFICATIONS** – make the following notifications:
   - **CVFD – CALL 9-1-1.**
     Include in the notification:
     - If the fire is extinguished, on going and controlled or uncontrolled.
     - Whether rescue of personnel or medical treatment is necessary.
   - **PTL** – to implement the Incident Command System **[IC-1 ⇒ *ORANGE TAB*]**
   - **GATE GUARD** at extension **5293** and dispatch an Operator to the Main Gate to direct the fire department to the fire location.
4. **MONITOR** and **COORDINATE COMMUNICATIONS** from the control room between plant IC and the 9-1-1 response units.
5. Maintain a **WRITTEN LOG** of events throughout the incident.

INCIDENT COMMANDER

1. **INITIATE INCIDENT COMMAND SYSTEM** [IC-1 ⇒ *ORANGE TAB*]
   - Cleary communicate who is IC
   - Designate other ICS positions as necessary
2. Immediately **REPORT TO THE EMERGENCY LOCATION**. At this point the fire may have already been extinguished. Depending on the extent of the fire the IC may assign personnel to work in safety/medical/rescue roles as needed.

   NOTE: If the fire is uncontrolled or not extinguished upon arrival, CVFD WILL ASSUME LEAD ROLE IN FIRE SUPPRESSION AND ASSUME IC. AT THIS POINT, A UNIFIFIED COMMAND SYSTEM WILL BE INITIATED [IC-2].

3. **ENSURE** CVFD first responders are directed to the scene. Order someone to the gate to escort CVFDs to the incident location.

RESPONSE TO A

FIRE

4. **BRIEF** CVFD personnel with the following information:
   - Location and magnitude of fire
   - Source and cause of the fire, if known,
   - Potential hazards
     - Explosion potentials - location of gas lines
     - Health and safety concerns associated with the fire to plant personnel and 9-1-1 responders - burn injury, smoke inhalation and compromised structural integrity.
   - Status of injuries if applicable,
   - Status of the electrical, chemical and mechanical systems affected – is equipment de-energized,
   - Status of fixed fire suppression systems,
   - If a hazardous material is potentially involved, refer CVFD personnel to fire fighting information for that specific chemical at ⇒ YELLOW TAB.

5. Assist Fire Department with development of an **INCIDENT ACTION PLAN** by considering the following:
   - Safety of SBPP personnel and responders.
   - Location of on-site fire fighting equipment, hydrants, etc.
   - Procurement of resources.
   - Impact of fire to other areas of the plant.

6. Assist in **EXECUTING A RESPONSE**
   - Mobilize necessary personnel and equipment.
   - Shutdown systems that may contribute or be affected by the fire.
   - Monitor systems for leaks, pressure buildup, gas generation, or ruptures in valves, pipes, or other equipment.
   - If safe to do so remove or isolate unaffected containers, equipment or hazardous materials.

7. **COMMUNICATE** continuously throughout the incident to insure resources are available and actions are effective.

8. **NOTIFICATIONS**

   - IF, the incident threatens human health or the environment outside of the facility, immediately notify the National Response Center (NRC) and the San Diego County Heath Department.

     NATIONAL RESPONSE CENTER 1-800-424-8802
     SAN DIEGO COUNTY HEALTH DEPARTMENT..... 1-408-755-4511

RESPONSE TO A

FIRE

Be prepared to provide:

- Your name/telephone number
- Name/address of the facility
- Time/type of incident
- Name and quantity of material involved
- Extent of injuries, if any
- Possible hazards to human health or the environment outside the facility.

Make sure to document the Control Number issued by the NRC so that follow-up information may be appropriately issued.

- IF, the fire involves Fuel Oil #6, Jet-A-Fuel or diesel, there is a potential to exceed a Reportable Quantity (RQ) for several different combustion products, such as sulfur dioxide, and nitrogen oxide(s). The emission potential needs to be evaluated by the environmental specialist or an engineer. Contact the environmental scientist for reporting guidance.

- MAKE NOTIFICATION & DOCUMENTATION, as appropriate, of the incident per the requirements of:
  - Volume #7-05 Injury/Illness Reporting & Investigation and,
  - Volume #7-43 EHS Communication.

RESPONSE TO A

FIRE

SUPPLEMENTARY INFORMATION

This "Fire" section has established emergency response actions to be taken in the case of:

- Incipient Level Fires
- Uncontrolled Fires

Safe and expedient fire control is essential to protect the health and safety of the plant personnel and to mitigate damage to the environment and equipment. In order to respond safely and appropriately South Bay Power Plant (SBPP) employees must be able to recognize the type of fire and their response capabilities.

INCIPIENT LEVEL FIRES

Employees of SBPP are trained to the "incipient" level of fire response -ONLY.

According to the National Fire Protection Agency Standards, NFPA 600, Standard on Industrial Fire Brigades, an "incipient" stage fire is one that is in the early stage and has not developed beyond which can be extinguished using portable fire extinguishers or handlines flowing up to 125 gallons per minute (gpm). Fires that have the potential to cause an explosion are **NOT** considered incipient level.

"Incipient" fire response also includes: reporting of fires; use of portable fire extinguishers; use of fixed fire suppression systems which may be either "Automatic" or "Manual".

Response to an incipient level fire will include:

1. ATTEMPT TO EXTINGUISH THE FIRE (fire suppression) using:
   - Portable fire extinguishers
   - Fixed fire suppression systems
     - Either "Automatic" or "Manual" use of portable dry chemical or raw city water

RESPONDERS SHALL STOP fire suppression activities with hand-held fire extinguishers when they must take evasive actions to avoid heat, smoke or flames.

2. REPORTING OF FIRE

   IMPORTANT: It is the policy at SBPP that any fire emergency, even extinguished fires, be reported to the Chula Vista Fire Department.

RESPONSE TO A

FIRE

UNCONTROLLED FIRES

Employees of SBPP are NOT trained to attempt containment of uncontrolled fires. Uncontrolled fires are to be reported immediately.

According to NFPA 600, a fire is considered to be beyond the incipient stage when the use of thermal protective clothing or self-contained breathing apparatus is required or a responder is required to crawl on the ground or floor to stay below smoke and heat.

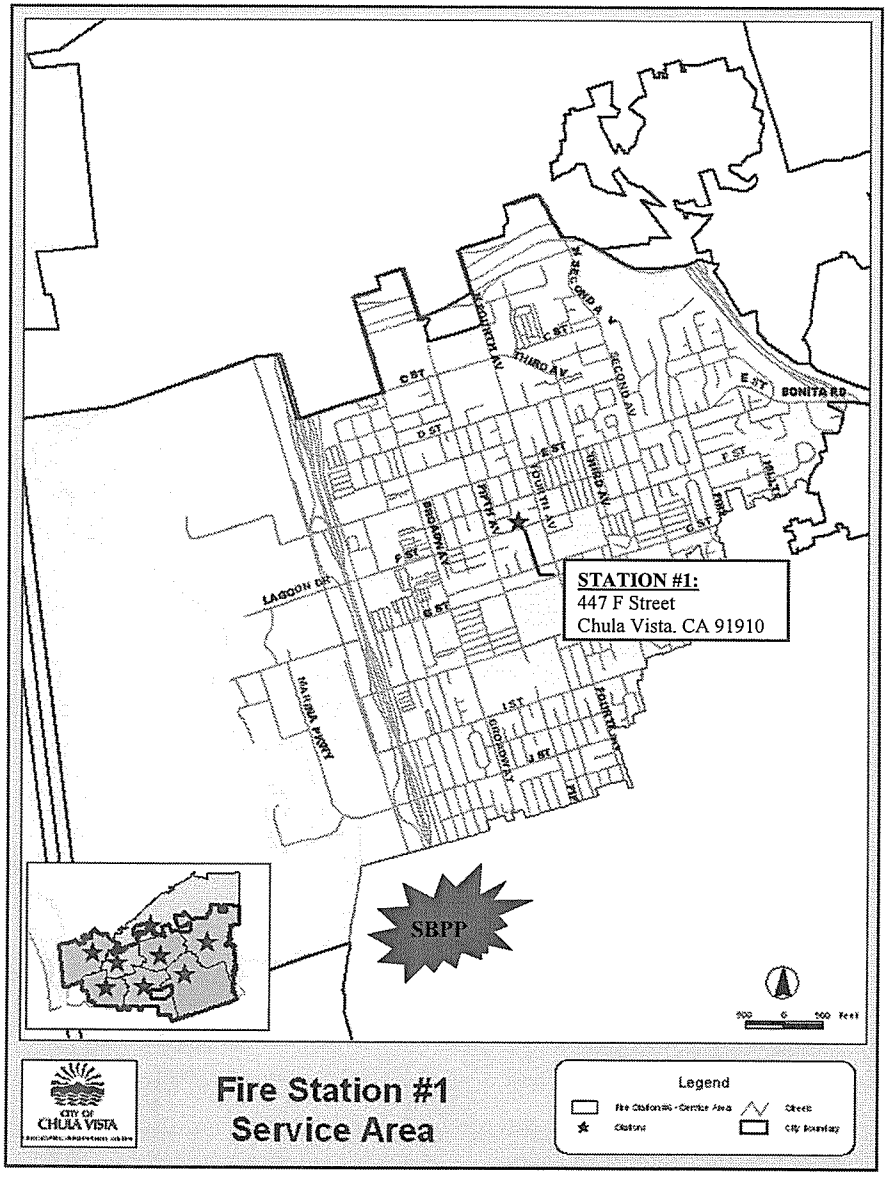
This may be a fire which:

- Started as an incipient level fire but has grown despite fire suppression efforts
- Spread, or has the potential to spread, instantaneously as in the case of a chemical spill
- Resulted from an explosion or is likely to cause immediate explosion

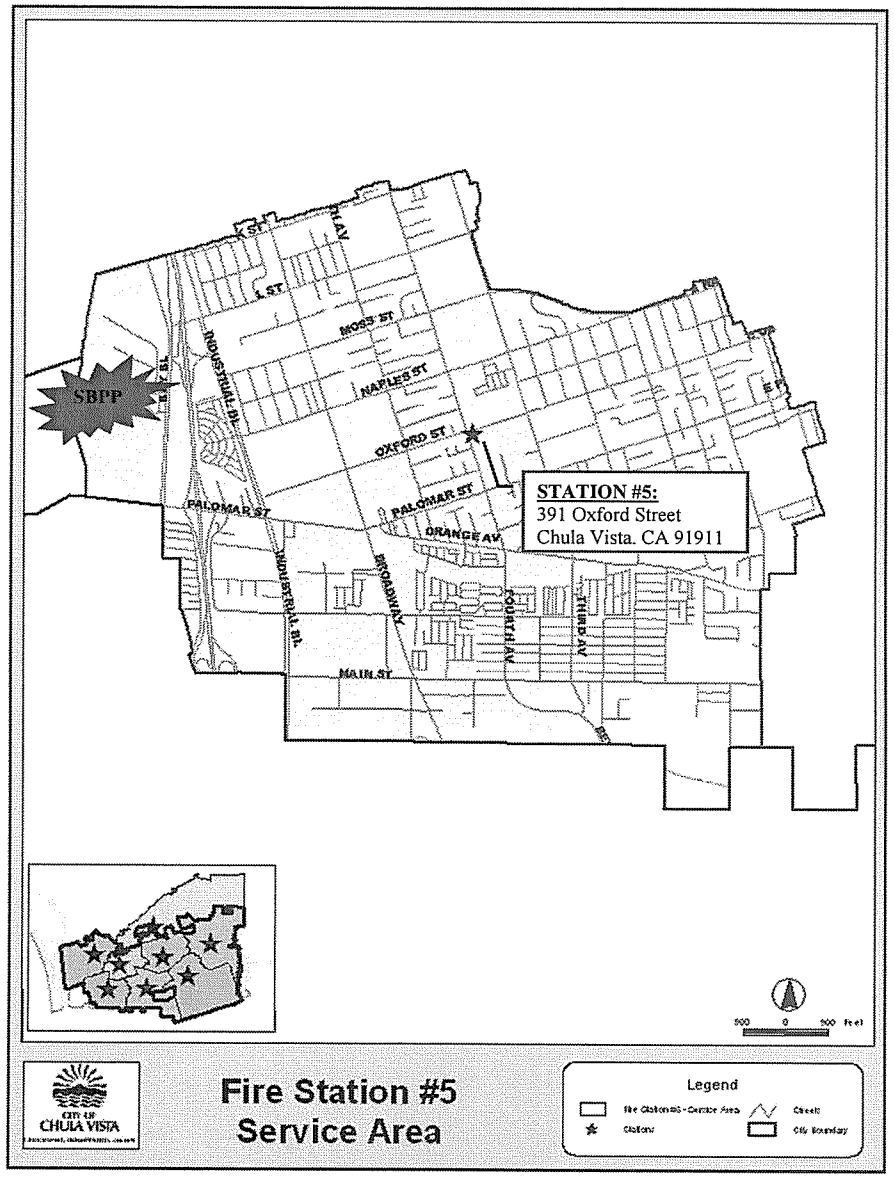
CVFD SERVICE AREAS

SBPP is located within Fire Station #5s service area and adjacent to Fire Station #1s service area. Attached is a figure displaying the service area geographical span for both Fire Stations. The Fire Stations respective location and address is highlighted on the figure.

(end of **FIRE** section)



Fire Station #1
Service Area



Fire Station #5
Service Area

RESPONSE TO A

MAJOR EARTHQUAKE

This section outlines steps to take in the event of a **MAJOR EARTHQUAKE** to insure safety of plant personnel, and to protect the environment, property, and equipment. For the purpose of this section, a *major earthquake* is defined as one that will cause physical damage to people, equipment or the environment.

> NOTE: When any catastrophic event occurs, outside emergency services may not be available to respond, as such, in case of an earthquake.
>
> If there is an obvious visible emergency associated with an earthquake (i.e. uncontrolled fire, explosion or release), the **CITY OF CHULA VISTA FIRE DEPARTMENT** is expected to respond when requested.

INCIDENT COMMANDER

The SBPP IC plays the lead emergency management role during an earthquake response, regardless of the magnitude of the earthquake. The extent of the response will depend on the magnitude of the earthquake and the resultant damage. Therefore, the IC will decide the level to which the SBPP Incident Command System shall be implemented.

The following RESPONSE EFFORTS serve as a guide FOR THE IC when responding to a major earthquake. [Refer to IC ⇒ *ORANGE TAB*]

1. EVACUATE PERSONNEL

- SOUND the evacuation alarm.
- IMPLEMENT EVACUATION PROCEDURES [EP-1 ⇒ *ORANGE TAB*]:
  - All personnel are to proceed to one of the Evacuation Assembly Areas.
  - Coordinate with Production Team Leader(s) to account for all personnel.

> BE PREPARED FOR AFTERSHOCKS. AFTERSHOCKS MAY BE LARGE ENOUGH TO DO ADDITIONAL DAMAGE.

- SECURE the facility. Instruct the gate guard to do the following:
  - Man the main entrance and keep the front gate closed.
  - Log all persons leaving the facility (provides control of accountability).
  - Deny entry into the facility unless instructed otherwise by the IC or his/her designee.
  - If two security guards are on shift, patrol the perimeter of the facility periodically to monitor for trespassing and encroachment.

RESPONSE TO A

MAJOR EARTHQUAKE

2. INITIATE ICS

- Assign ICS positions – initially assign personnel for the following positions, as available:

  1. Operations Chief
  2. Safety Officer
  3. Logistics Officer
  4. Planning Officer
  5. Public Information Officer

  NOTE: IC will act as Operations Chief until relieved of IC by a more senior level of management.

- Delegate immediate response actions. Be sure to communicate clearly and prioritize tasks, as necessary.

3. CONDUCT INITIAL HAZARD ASSESSMENT

- ENSURE personnel have been evacuated to a safe location.
- Determine need to SEARCH FOR MISSING PERSONNEL.
  - Organize search team, as needed.
  - Always deploy two person teams, at a minimum.
  - Suggestion: Delegate to the SBPP OPERATIONS CHIEF
- Determine EXTENT OF INJURIES
  - If serious injuries exist, request outside assistance via 9-1-1
    - Do not attempt to move seriously injured persons unless they are in immediate danger of further injury.
  - Otherwise, initiate onsite first aid efforts.
  - Suggestion: Delegate to the SBPP SAFETY OFFICER
- Conduct or coordinate INITIAL ASSESSMENT of damage.
  - This is intended to be a "cursory", visual assessment – not a detailed inspection.
  - The goal is to identify obvious hazardous conditions.
  - Ensure critical plant operations are shutdown or, at a minimum, not posing any immediate hazards.
  - Suggestion: Delegate to the SBPP OPERATIONS CHIEF
- Use Control Room instrumentation and check the following for abnormal changes and correct as required:
  - Steam Flow
  - Feed Water
  - Firing Rate
  - Unit Load
- Use information gathered through initial assessment to prioritize response actions.

RESPONSE TO A

MAJOR EARTHQUAKE

4. COMMUNICATIONS

- Inventory communications capabilities.
- Do not use telephones except to report medical, fire or operating emergencies.
- Create Communication Plan
  - Suggestion: Delegate to the SBPP LOGISTICS OFFICER
  - Gather communication equipment.
  - Designate use of 2-channel 2-way 450 MHz radio system.
  - Anticipate that personnel will want to contact family – how can this best be accomplished?
- Designate someone to man the 450 MHz radios and relay communications.
  - Suggestion: Delegate to the SBPP PLANNING OFFICER

5. NOTIFICATIONS

Use **911** to contact Local Emergency Services to report any situations that will require a response from outside services

(i.e., fire, medical emergencies, spill or releases)

SBPP employees can best assist local emergency response services by calling the Fire Department's non-emergency number [619-691-5055] and offering feedback about the status of the plant. Report any damage, injuries or incidents that occurred as a result of the earthquake.

- Ensure someone is designated to alert the IC should the Fire Department or other emergency service to arrive onsite.
- The following notifications shall be made as soon as possible, but not to preclude the response necessary to insure the safety of personnel and environmental conditions. If the earthquake causes or threatens to cause a loss of generation or the interruption of distribution, call:

  - DUKE ENERGY TRADING & MARKETING (DETM).....1-801-531-5130
  - AREA CONTROL CENTER, SDG&E MISSION CONTROL.....1-619-296-5400
  - GAS CONTROL OPERATIONS CENTER.....1-323-266-5888
    OR.....1-800-858-5601

RESPONSE TO A

MAJOR EARTHQUAKE

6. CONDUCT MORE DETAILED HAZARD ASSESSMENT

- ASSESS FACILITY DAMAGE
  - Check Facility for hazardous or potentially hazardous conditions resulting from any damage.
  - Deny access to areas where conditions exist that may cause injury to personnel.
  - Check for damage to the following:
    - Water pipes for damage. Shut off the supply at the main valve. Initiate repairs to preserve the water supply.
    - Facility Structures and Components (refer to ***Checklist For Inspection Of Structures and Components*** ⇒ **EQ-5**).
    - Hazardous materials and hazardous waste storage areas (refer to the attached ***Checklist For Inspection Of Hazardous Materials Storage Areas*** ⇒ **EQ-7**).
    - Check catch basins for potential drainage of materials to the bay. Dike and insure valves are closed as necessary. [Storm Drain Layout in ⇒ ***GREEN TAB*** for catch basin locations].
    -
- Identify SPECIFIC HAZARDS:
  - Fires and explosions – In the event of fire beyond incipient level, immediately contact the local Chula Vista Fire Department [F-3 ⇒ ***RED TAB***].
  - Health and safety hazards – including unsafe conditions related to spills and releases, production of toxic gases, structural integrity of buildings and structures and potential aftershocks.
  - Spill or Release - In the event of a spill or release, refer to the response procedures for specific hazardous materials ⇒ YELLOW TABS.

7. DETERMINE WHAT TO DO WITH "NON-ESSENTIAL" PERSONNEL

- Decide whether to keep everyone at the facility or allow personnel to leave
- Note that many personnel will want to leave and check on loved ones
- Document which personnel remain or leave the Facility

CHECKLISTFOR INSPECTION OF
SBPP STRUCTURES AND COMPONENTS

The following Structures and Components should be included as part of any post-earthquake assessment. Note any damage or movement/displacement of equipment or structures. Report findings to SBPP Incident Commander.

	DAMAGE	MOVEMENT	NOTES
	NOTE YES OR NO		
STRUCTURES AND COMPONENTS			
PIPING – check for leakage, cracks and excessive sagging and distortion.			
Boiler Feedwater			
Condensate, Circulating, and Cooling Water			
Instrument Air			
Fuel Oil and Natural Gas			
Generator Seal Oil Sys.			
Stator Cooling Oil Sys.			
Ammonia Injection Piping			
Generator Hydrogen Sys.			
Tank Farm			
STEAM LINES – check steam lines at boiler interface and throughout the units.			
Main Steam			
Hot Reheat Steam			
Cold Reheat Steam			
Auxiliary Steam			
Extraction Steam			
ELECTRICAL COMPONENTS			
ISO Phase Busses			
Transformers			
Batteries			
Electrical connections at boiler burners, etc.			
Condition of unit control cabinets and remote panels			
ROTATING EQUIPMENT – ***Check while operating for signs of rotor rubbing, alignment and operability***			
HP Turbine and Generator			
Boiler Feed Pumps			
Forced Draft Fans			
Gas Recirculating Fans			
Circulating Water Pumps			
STRUCTURAL INTEGRITY / FOUNDATION DAMAGE			
BUILDING AND STRUCTURE FOUNDATIONS – Check:			
❑ **I beams for permanent deformation**	❑ **Building foundations at columns for cracks**	❑ **Building walls at ground level for cracking**	❑ **General cracking of floors**
❑ **Steel beams that equipment is hung from**	❑ **Tank anchors and foundations**	❑ **Equipment foundations**	

CHECKLISTFOR INSPECTION OF
SBPP STRUCTURES AND COMPONENTS

	DAMAGE	MOVEMENT	NOTES
	NOTE YES OR NO		
STRUCTURAL INTEGRITY / FOUNDATION DAMAGE (Continued)			
MAJOR COMPONENTS – Check exterior walls and casings for damage as well as operability.			
Main Condensers			
Boiler burners and gas/oil headers			
Gas Turbine			
Boiler Feed Pumps			
Feedwater Heaters			
Condensate Storage Tanks			
Hydrogen Tanks			
Nitrogen Tanks			
Deaerator Heater/Storage Tank			
Domestic and Waste Water Tanks			
Forced Draft Fans			
Ammonia Tanks			
Dilution Air Blowers			
Heat Exchangers			
F.O. Tanks			
Hypochloride Tank			
CIRCULATING WATER SYSTEM			
Intake Structure			
Discharge Conduits			
Tunnel			
POWER PLANT			
Turbine Generator Foundation			
Turbine Generator Pedestal			
Superstructure			
Main Station Crane			
Stacks			
Forced Draft Fan Ducts			
SCR and SCR Ducts			
MACHINE SHOP			
ADMIN. BUILDING			
RECEIVING BUILDING			
OTHER –			

INSPECTED BY: _____ DATE: _____

REPORT FINDINGS TO IC AND PLANT EH&S STAFF

CHECKLIST FOR INSPECTION OF HAZARDOUS MATERIALS STORAGE AREAS

The following Hazardous Materials Storage Areas should be included as part of any post-earthquake assessment. If any release of hazardous material is discovered, refer to the appropriate tab in the ***Spill or Release*** section of the **Facility Emergency Plan**.

Hazardous Materials Storage Area	**Damage?**		**Non-contained Release?**	
	NO	**YES**	**NO**	**YES**
Hazardous Waste Storage Area				
Hazardous Waste Accumulation Areas				
Sodium Hypochlorite Storage Tank				
Waste Water Treatment Area				
South Bay Substation Oil-filled Equipment				
Switchyard Oil-filled Equipment				
Fuel Oil Storage Tanks (South-40 Tank Farm)				
Jet-A Fuel Tank				
Gas Turbine Area				
Transformers				
Propane Tanks				
Lube Oil Tank and Reservoirs				
Compressed Hydrogen Gas Tanks				
Liquid Nitrogen Tank				
Aqueous Ammonia Storage Tanks				
Natural Gas pipelines and cylinders				
Compressed gas cylinders				
Drum Storage Areas				
OTHER:				
OTHER:				

Actions Taken: _____

_____

_____

INSPECTED BY: _____ DATE: ___/___/___

REPORT FINDINGS TO IC AND PLANT **EH&S STAFF**

RESPONSE TO A

MAJOR EARTHQUAKE

SUPPLEMENTARY INFORMATION

Unless there is an obvious visible emergency (i.e. uncontrolled fire, explosion or release), the **CITY OF CHULA VISTA FIRE DEPARTMENT** may not come to SBPP after an earthquake.

SBPP employees can best assist local emergency response services by calling the Fire Department's non-emergency number [619-691-5055] and offering feedback about the status of the plant. Report any damage, injuries or incidents that occurred as a result of the earthquake.

NOTE: Employees within a five (5) mile radius of the plant may report to the power plant to assist after an earthquake has subsided, but are not expected to leave their families unless it is safe to do so. Telephone lines may be down, which will prevent personnel at the plant from being able to call out for assistance. The gate guard will either allow or deny personnel from entry, based on the IC's request.

The CITY OF CHULA VISTA has an established DISASTER PREPAREDNESS PLAN.

- In the event of a major earthquake Chula Vista's emergency response services such as, fire, police and building construction crews, would be first sent out to conduct an assessment of the City's damage to determine where their efforts would need to be focused.
- Upon completion of the assessment the Disaster Preparedness Team would coordinate to determine which areas require special consideration due to damage.
- The City's emergency response services would then be dispatched to areas that require the most help.

The City of Chula Vista's Disaster Preparedness Team will set up an Emergency Operations Center (EOC) normally located in the basement of the Chula Vista Fire Department.

In the event of a major earthquake the City of Chula Vista's emergency response services are responsible for the first level of response. However, if these services prove to be insufficient the City can request help first from neighboring cities. Depending on the severity of the situation, the City of Chula Vista may request additional help from the county, state and federal resources (in that order).

(end of **EARTHQUAKE** section)

RESPONSE TO A

BOMB THREAT

This bomb threat response plan provides procedures to be followed when a threat is received and establishes a clear chain of command for decision-making.

ALL BOMB THREATS SHALL BE CONSIDERED SERIOUS UNLESS OTHERWISE DETERMINED BY THE SBPP MANAGEMENT TEAM.

CALLER RECEIVING A BOMB THREAT BY TELEPHONE

1. **DO NOT PANIC** – remain calm.
2. Take the initial message down **WORD-FOR-WORD**.
3. Use the ***Bomb Threat Call Checklist*** ⇒ **BT-5** as guidance to ask the caller specific questions and document the response. A copy of these forms should be placed at each telephone that is capable of receiving an outside call.
   - KEEP THE CALLER ON THE PHONE as long as possible by asking the questions and make notation of the information as its being gathered.
   - DO NOT INTERRUPT the caller except to ask questions. A calm response to the bomb threat caller could result in obtaining additional information.
4. **IF THE FORMS ARE NOT AVAILABLE**, at a minimum, ask and note the following:
   - MAKE NOTATION OF:
     - Time of call;
     - Sex of caller;
     - Estimated age of caller;
     - Accent and speech impediments;
     - Emotional State (angry, emotional, normal, depressed, etc.)
     - Peculiar background noises such as motors, music, and any noise, which may give a clue as to the location of the caller.
     - Any other characteristics that will aid in identification of the caller.
   - ASK THE CALLER:
     - Where is the bomb right now (which building and where in the building);
     - What does the bomb look like (wrapped in a package, briefcase, etc.);
     - Type of explosive involved; and
     - Why was the bomb placed;
     - Inform the caller that the building is occupied and the detonation of a bomb could result in death or serious injury to many innocent people.
5. **NOTIFY** the Plant Manager (PM) or the Production Team Leader (PTL) and provide them all the information collected during the call.

RESPONSE TO A

BOMB THREAT

INCIDENT COMMANDER

The following **RESPONSE EFFORTS** serve as a guide **FOR THE IC** when responding to a bomb threat.

1. **INITIATE ICS**
   - Clearly communicate who is IC.
   - Designate other ICS positions are necessary.

2. **REPORT BOMB THREAT**

IC will ensure the following notifications are made. CEASE use of all cellular telephones since such signals can be used to detonate bomb devices.

   - Call the POLICE (local law enforcement will manage the bomb threat response upon arrival at the facility).

     CHULA VISTA FIRE/POLICE DEPARTMENT.....**CALL 9-1-1**

   - Notify GATE GUARD at extension **5293** and dispatch an Operator to the Main Gate to direct the police/fire department to a safe, designated area at the plant where response planning will occur as directed by the DEGS IC.
   - Notify CORPORATE SECURITY at (888) 893-8104 [paging system].
   - Notify the REGIONAL ENVIRONMENTAL MANAGER at (805) 595-4295 or (805) 550-4595 [cell].
   - Notify the PUBLIC AFFAIRS MANAGER at (805) 595-5597 or (805) 441-6912 [cell].

3. **DETERMINE CREDIBILITY** of the threat and its **ASSOCIATED RISK** by considering:
   - Who claimed responsibility;
   - Callers knowledge of the plant and personnel;
   - Bombs stated location and risk to employees;
   - Prior knowledge of potential real threat;
   - Description or even a detection of a bomb;
   - Scale of threat, including time given for detonation;
   - Method used to communicate the bomb;
   - The prevalence and similarity of such crimes in the area and their consequences;
   - Information concerning ongoing or adverse issues involving the site; and
   - Law enforcement recommendations.

4. **MEET WITH ARRIVING BOMB SQUAD**
   - Assist Bomb Squad in development of an INCIDENT ACTION PLAN
   - Considering the following:
     - Location of bomb – known or unknown
     - Organization of search, *limited* or *detailed* (see ***Supplementary Information, BT-7***)
     - Use of DEGS personnel during search, team members

RESPONSE TO A

BOMB THREAT

IF BOMB LOCATION IS KNOWN

- **DO NOT TOUCH OR MOVE SUSPICIOUS OBJECTS.** Call the Incident Commander (PTL or PM) if suspicious objects are found.
- **DO NOT USE A PORTABLE RADIO OR CELL TELEPHONE WITHIN 25 FEET OF THE BOMBS DESIGNATED AREA AND/OR A SUSPICIOUS OBJECT.** The radio/telephone may cause ignition of the bomb.

- ❑ EVACUATE PERSONNEL from the immediate area.
  - SOUND THE STATION ALERT – announce the location that must be evacuated.
    - ✓ All personnel are to proceed to one of the Evacuation Assembly Areas.
    - ✓ Coordinate with Production Team Leader(s) to account for all personnel.
- ❑ ENSURE CLEAR ZONE of at least 300-feet around the known location, if not already done so (includes floors above and below object).
- ❑ Organize TWO-PERSON SEARCH TEAM (S) that will include persons that normally occupy and are familiar with the area.
- ❑ SEARCH THE AREA using the following techniques.
  - Firs, quietly listen for ticking/unusual noises.
  - Divide the known location by height and search thoroughly from ground up.
  - Check cupboards, shelves, air conditioning ducts, drawers, wall hangings, etc.
  - Look for out of the ordinary objects.
  - Identified SUSPICIOUS OBJECTS:
    - ✓ REPORT the location and a description of the object to the IC.
    - ✓ The IC will coordinate with local Law enforcement to respond.
- ❑ At the conclusion of the response:
  - Communicate an "ALL-CLEAR"
  - NOTIFY Corporate Security, Public Affairs and Regional EH&S Manager.

RESPONSE TO A

BOMB THREAT

IF BOMB LOCATION is NOT KNOWN

- **DO NOT TOUCH OR MOVE SUSPICIOUS OBJECTS.** Call the Incident Commander if suspicious objects are found.
- **DO NOT USE A PORTABLE RADIO OR CELL TELEPHONE WITHIN 25 FEET OF THE BOMBS DESIGNATED AREA AND/OR A SUSPICIOUS OBJECT.** The radio/telephone may cause ignition of the bomb.

- ❑ EVACUATE PERSONNEL from the ***operating plant*** (operational units, administration, maintenance, and office buildings).
  - SOUND THE STATION ALERT – announce to evacuate.
  - IMPLEMENT EVACUATION PROCEDURES [**EP-1** ⇒ ***ORANGE TAB***].
    - ✓ All personnel are to proceed to one of the Evacuation Assembly Areas.
    - ✓ Coordinate with Production Team Leader(s) to account for all personnel.
- ❑ ENSURE CLEAR ZONE of at least 300-feet, if not already done so (includes floors above and below object).
- ❑ Using a plot plan of the facility, divide the ***operating plant*** into sections (refer to ***Search Zone Areas*** ⇒ **BT-6** for guidance when defining search zones).
- ❑ Organize MULTIPLE TWO-PERSON SEARCH TEAMS that will include persons that normally occupy and are familiar with each section. Have enough teams to cover all the defined sections.
- ❑ DIVIDE SECTION AREAS into search zones based on number of objects in the area, and not the size of the area. In each zone:
  - First, quietly listen for ticking/unusual noises.
  - Search around the edge of each zone from the outside in, with team members starting back-to-back and work toward each other.
  - Search from the bottom up. First, search the zone from ground up to hip height. Then search the zone from hip height to the ceiling and in any false or suspended ceiling areas.
  - Check cupboards, shelves, air conditioning ducts, drawers, wall hangings, etc.
  - Look for out of the ordinary objects.
  - This technique may be expanded for larger areas using the same basic techniques.
- ❑ On a plot plan, mark off the sections that have been searched to ensure all areas have been inspected.
- ❑ Identified SUSPICIOUS OBJECTS:
  - ✓ REPORT the location and a description of the object to the IC.
  - ✓ The IC will coordinate with local Law enforcement to respond.
- ❑ At the conclusion of the response, the IC shall:
  - Communicate an "ALL-CLEAR", and
  - NOTIFY Corporate Security, Public Affairs, and Regional EH&S Manager.

BOMB THREAT CALL CHECKLIST

This information is vitally important. You must pay particular attention to detail about what is being said so that others can evaluate the credibility of the incident and determine the proper response.

WRITE THE EXACT LANGUAGE OF THE THREAT:

_____
_____
_____
_____

QUESTIONS TO ASK:	EXACT WORDING OF THE RESPONSE
1. When is the bomb going to explode?	_____
2. Where is it?	_____
3. What does it look like?	_____
4. What kind of bomb is it?	_____
5. What will cause it to explode?	_____
6. Did you place the bomb?	_____
7. What is your name?	_____
8. Why are you doing this?	_____
9. Where are you?	_____
10. How can we contact you?	_____

Sex of caller M / F Age _____ Race _____ Length of call _____

Callers' Voice

□ Calm	□ Laughing	□ Lisp	□ Disguised
□ Angry	□ Crying	□ Raspy	□ Accent
□ Excited	□ Normal	□ Deep	□ Familiar
□ Slow	□ Distinct	□ Ragged	If voice is familiar, whom did it sound like?
□ Fast	□ Slurred	□ Clearing throat	_____
□ Soft	□ Nasal	□ Deep Breathing	_____
□ Loud	□ Stutter	□ Cracking voice	_____

Background Sounds

□ Street Traffic	□ House Noises	□ Clear	□ Silence
□ Airplanes	□ Office Machines	□ Static	□ Other: _____
□ Trains	□ Factory Machines	□ Local	_____
□ PA System	□ Animal Noises	□ Long Distance	_____
□ Voices	□ TV/Radio	□ Music	_____

Threat Language

□ Well spoken (educated)	□ Foul	□ Incoherent	□ Message read by Threat maker?
□ Nervous	□ Irrational	□ Emotional	

Remarks : _____

Report call immediately to the Plant Manager or the Production Team Leader

Phone number call received on: _____ Time of Call: _____

Name: _____

SEARCH ZONE AREAS

AREA #	AREA DESCRIPTION	ASSIGNED TO (TEAM MEMBERS)
1	Maintenance Shop	
2	Electric / Instrument Shop	
3	Admin. Office / Storeroom / Loading Deck	
4	Gas Turbine / Compressed Air Tanks / Ammonia Tanks	
5	#1 & #2 C. W. Deck / Pump Pit / Control House / Engineering Building	
6	Softener to #4 Heat Exchanger	
7	#3 & 4 C. W. Deck / CL2 Tank / #3 & 4 Control House	
8	#1 & 2 Units Mezz to Basement (Lab)	
9	#1 & 2 Units "O" Floor to 8th Level	
10	#3 Unit Mezz to Basement	
11	#3 Unit "O" Floor to 8th Level	
12	#4 Unit Mezz to Basement	
13	#4 Unit "O" Floor to 8th Level	
14	#4 Unit 8th Level to Ammonia Skid	
15	MUD and RO / WWTF & Warehouse 3	
16	SO-40 Pump Pits / East & West Control House Tanks	
17	#1 & 2 Control Rooms	

Note: This list of defined areas mirrors the areas defined for safety audits conducted by the SBPP Safety Audit Teams.

RESPONSE TO A

BOMB THREAT

SUPPLEMENTARY INFORMATION

Anonymous bomb threats are generally intended to intimidate, frighten and disrupt normal business activities rather than to warn employees of the existence of an actual bomb. Only on rare occasions is an explosive device actually discovered. However, all bomb threat notices shall be treated as if an explosion will result.

ALL BOMB THREATS SHALL BE CONSIDERED SERIOUS UNLESS OTHERWISE DETERMINED BY THE SBPP MANAGEMENT TEAM.

Therefore, expedient actions must be taken when a bomb threat occurs to protect the safety and health of personnel and to minimize damage to the environment and plant equipment. This section described the steps to be taken in the event that a bomb threat is received at the facility.

ROLES AND RESPONSIBILITIES

Response to a bomb threat by plant personnel, including evacuation and search actions, regardless of Law Enforcement assistance, will be decided and directed by Incident Commander. This may be a Production Team Leader (PTL), Plant Manager (PM) or his/her designee. Search actions will most likely be conducted by supervisory and other personnel working at the suspected bomb location because they are more familiar with the area and can more readily identify suspected objects.

NOTE: Law Enforcement and Public safety agencies will generally not conduct the search. However, they will be available to offer advice. Once a suspicious object is identified, they will gain control of the incident and decide on response actions.

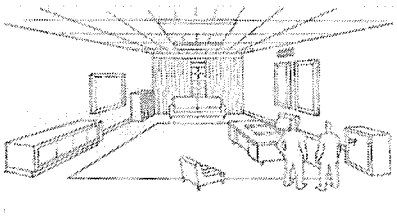
Although the SBPP Management team is the ultimate decision-making authority during a bomb threat, Corporate Security is available to provide guidance and direction.

SEARCH RESPONSE ACTIVITIES

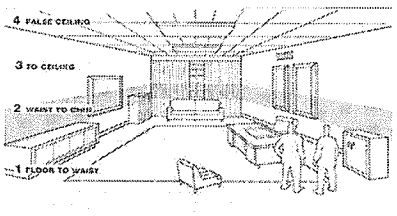
Generally, there are two types of searches, *limited* and *detailed.*

1. LIMITED SEARCH – conducted in areas that are accessible to the public. For SBPP, sense the facility is fenced and secured, this may include the shoreline of the bay, intake and discharge channels and the perimeter of the facility.
2. DETAILED SEARCH – conducted in all areas including those accessible to the public.

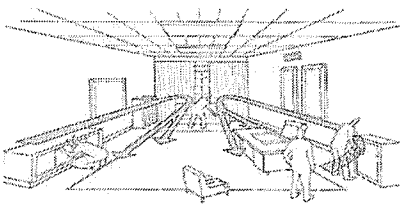
Search techniques:



1. Upon entering the room for a search, stop and listen for anything out of the ordinary



2. Divide the room by height to search from the floor up to the ceiling



3. Search room by height and assigned area (this example is for one height zone, repeat for each defined height zone)

RESPONSE TO A

BOMB THREAT

THREATS RECEIVED BY NOTE/MAIL

If a threat is received in the form of a note, letter or mail, the information should be preserved and as much information as possible about the discovery of the letter or note should be documented using the ***Bomb Threat Call Checklist*** ⇒ **BT-5,** as a guide. The letter or note should be handled by as few people as possible and immediately enclosed in a clear plastic bag to preserve evidence.

REFERENCES

A Bomb Threat Response Plan and Procedure (Plan) has been written and implemented at all the Duke Energy's facilities operated by DEGS. This section of the Facility Emergency Plan is a summary of directives written in the Plan and supplements the Plan with site-specific steps and information. For more information on Duke Corporations expectations during a bomb threat, refer to this Plan, which is maintained by the Business Team Leader at the South Bay Power Plant.

Reference:
Bomb Threat Response Plan and Procedure, Duke Energy Corporation, March 22, 2002.

(end of **BOMB THREAT** section)

RESPONSE GUIDELINES FOR A

FLASH FLOOD, FLOOD OR EXTREMELY HIGH TIDE

The probability of flash flood, flood or extremely high tide is not of significant concern at the South Bay Power Plant. SBPP does not lie within a 50-100 year flood plain. The assumption is that if flash flood, flood or extremely high tide conditions were anticipated, local news and weather reports would provide SBPP with sufficient time to implement the following preparations.

FLASH FLOOD

- **IF TIME PERMITS,** ensure that all containers are moved into the building and secured to keep them from floating away in the rising waters.

- **AS A LAST RESORT,** tighten all lids and bungs and securely fasten all equipment, hazardous waste containers and hazardous material containers in place.

- **EVACUATE** all personnel to higher ground. Follow the instructions of local emergency departments for best evacuation routes.

FLOOD/EXTREMELY HIGH TIDE

- **IF TIME PERMITS**:
  - Ensure that all containers are moved into the building and secured to keep them from floating away in the rising waters.

  - Make arrangements to transport all **HAZARDOUS WASTES** on an emergency basis to a licensed treatment, storage, and disposal (TSD) facility or hazardous waste transfer facility by a registered hauler.

  - Make arrangements to transport all **HAZARDOUS MATERIALS** to the nearest company facility unaffected by the approaching flood/high tide. Depending upon the circumstances, it may be more practical to have the materials also transferred to a local TSD facility or waste transfer facility along with the hazardous wastes.

> **NOTE:** Do not attempt to transport **HAZARDOUS MATERIALS** if the flood/extremely high tide is imminent. Ensure the registered hauler has sufficient time and resources to complete the transport before the flood/extremely high tide impinges on the facility.

RESPONSE GUIDELINES FOR A

FLASH FLOOD, FLOOD OR EXTREMELY HIGH TIDE

- If materials/waste are moved off-site, make all efforts to ensure all waste shipments are manifested, but at an absolute minimum, carefully record the following information for product shipments:
  - Transporter's name;
  - Volume of hazardous waste/materials;
  - Name of facility receiving hazardous waste/materials; and
  - Type and description of hazardous waste/materials.

- **IF MATERIALS OR WASTES CANNOT BE TRANSPORTED OFF-SITE,** ensure that all containers are moved into the building and secured to keep them from floating away in the rising waters.

- If necessary, **EVACUATE ALL PERSONNEL.** Follow the instructions of local emergency departments for evacuation routes.

  - Insert contact information

Websites of Interest:
National Weather Service, Hydrologic Information Center
http://www.nws.noaa.gov/oh/hic/flooding.shtml
Disaster Help
www.disasterhelp.gov

EMERGENCY RESPONSE / ICS / MEDICAL EMERGENIES / EVACUATION PLAN

General Emergencies

Incident Command System (ICS)

Medical Emergencies

Evacuation Plan

GENERAL EMERGENCY RESPONSE

Information contained in this section provides a clear understanding of organizational roles and responsibilities during plant emergencies to ensure a prompt and proper response. An ***EMERGENCY*** is an unexpected situation or sudden event, which involves physical, medical and/or chemical hazards. Examples would be hazardous chemical releases, oil spills, fires, bomb threats, explosions and natural disasters. Any emergency shall be acted upon according to the guidelines established by this section. Refer to the specified guidelines for responses to fires, bomb threats, earthquakes, spills and releases, medical emergencies and floods contained in the ***RED*** and ***ORANGE*** Tabs.

INITIATING EMERGENCY RESPONSE

In general, the nature and magnitude of any incident will govern the level of response necessary. The following steps should be taken for any emergency.

PERSON DISCOVERING THE INCIDENT

- NOTIFY the Control Room Operator from a safe location:
  - Plant phone: **5201**
  - Cell phone and 24hr numbers: **619-498-5201** or **420-7383** or **420-7385**
  - 450 MHz Radio: **OPERATIONS CHANNEL**
- STAY ON THE LINE and provide information until released by the CO:

CONTROL ROOM OPERATOR

1. COLLECT INFORMATION from the caller related to the emergency to assess the response needed. Use the ***EMERGENCY INFORMATION FORM*** ⇒ **ER-3** as a tool. Consider:
   - Type of emergency
   - Exact location
   - Resources needed
2. If necessary, activate the PLANT EVACUATION ALARM.
3. NOTIFICATIONS:
   - **CALL 9-1-1** to request off-site emergency assistance.
   - MAIN GATE GUARD at extension **5293** and dispatch an Operator to the Main Gate to direct off-site emergency response personnel to the emergency location.
   - PRODUCTION TEAM LEADER (PTL) – convey emergency information.

GENERAL EMERGENCY RESPONSE

3. NOTIFICATIONS (CON'T)
   - DISPATCH RESCUE TEAM – if necessary.
     - If members of the Rescue Team are not present, dispatch First Aid Trained personnel if not already present at the scene by making a general announcement on the Paging System or 450 radios.

   STATE: location and condition of injured, and assistance needed so that the person(s) may respond with the necessary medical supplies promptly.

NOTE: All Operations and Maintenance personnel have received CPR & First Aid instruction.

3. MONITOR and COORDINATE COMMUNICATIONS from the control room by telephone, pager, and/or 450 MHz radio.

4. DOCUMENT incident actions and maintain a timeline of events.

INCIDENT COMMANDER (PTL)

➢ **ACTIONS**

1. INITIATE INCIDENT COMMAND SYSTEM [IC ⇒ *ORANGE TAB*]
   - ➢ Clearly communicate who is IC
   - ➢ Designate other IC positions, as necessary

2. Immediately REPORT to the emergency location.

3. ASSESS safety/medical/rescue needs.

4. ENSURE response support is promptly and efficiently directed to the location of the emergency.

5. If necessary, issue instructions to de-energize equipment.

6. COORDINATE safety/medical/rescue activities with the off-site emergency responders.

7. COMMUNICATE continuously throughout the incident with municipal responders and plant personnel to insure resources are available and actions are effective via 450 MHz radio or the plant paging system.

8. DOCUMENT the incident.

GENERAL EMERGENCY RESPONSE

➢ RESPONSE OBJECTIVES

- ❑ Minimize chance for personnel injury and/or chemical exposure.
- ❑ Any spills should be contained from a safe distance.
- ❑ Protect nearby persons, property and the environment.
- ❑ Extinguish fires and eliminate fire/explosion conditions.

> **NOTE:** Only trained employees will respond to and attempt to extinguish incipient level fires, if safe to do so. Fire fighting duties will be relinquished to the local municipal Fire Department when they arrive. (see **FIRE** ⇒ ***RED TAB)***

- ❑ Coordinate DEFENSIVE RESPONSE ACTIONS. The IC must insure that non-essential personnel are evacuated from the hazardous area(s) and that only qualified employees assist in handling the emergency. Examples of defensive actions include:
  - De-energizing electrical circuits near the hazardous area;
  - Activation of fixed fire suppression systems (either "Automatic" or "Manual" use of portable dry chemical or raw city water);
  - Providing ventilation for smoke/fume removal if possible;
  - Barricading hazardous areas; and
  - Initiating partial or complete plant evacuations.

- ❑ IF THE PTL IS THE IC, assume the role of incident liaison with municipal responders until reassigned by the Plant Manager or his/her designee.
- ❑ MAINTAIN COMMUNICATIONS with the Control Room Operator (CO) to keep the CO informed of the emergency situation.
- ❑ COORDINATE TECHNICAL SUPPORT from the Plant's engineering and maintenance staff as needed.

> **Notice for Duke Personnel Not Directly Supporting the Emergency**
> During an emergency, all Duke personnel that do not have a designated emergency response function shall remain where they are or proceed to the designated assembly area (in the event of an emergency evacuation) until a verbal "all clear" is given. Do not go to the emergency scene, and/or call the Control Room, unless specifically asked to do so by responding personnel.

EMERGENCY INFORMATION FORM

Time call received: _____

Name of caller: _____

Nature of emergency: ( ) Medical, ( ) Fire, ( ) Chemical Spill, Other: _____

Emergency location: _____ _____ _

Resources Needed at the Scene: Fire Department, Paramedics, Confined Space Rescue Equipment

NOTE: Sound the station alert for fire or general emergencies only. When the alert is done sounding the Control Operator (CO) shall announce the nature of the emergency and its location.

NOTE: THE STATION ALERT SHOULD NOT BE SOUNDED FOR MEDICAL EMERGENCIES.

Control Room Operator Notification List

Notified Plant Rescue Team/ PTL via 450 radio.	Yes / No (Time: _____)
Notified municipal responders 911.	Yes / No (Time: _____)
Notified Plant Management.	Yes / No (Time: _____)

INCIDENT COMMAND SYSTEM

DEGS ICS / UCS System	Page IC-1
Command Post Plans/Forms	Page IC-4
ICS Functions (Roles) - Incident Commander - Safety Officer - Public Information Officer - Operations - Planning - Logistics - Finance - Liaison - Staging	Page IC-5 IC-6 IC-7 IC-8 IC-9 IC-10 IC-11 IC-12 IC-13
Supplementary Information - Decontamination Procedures - Emergency Prevention/Planning - Critique of Response and Follow-up	Page IC-14
Incident Command System Plans & Forms	Attachments

INCIDENT COMMAND SYSTEM

South Bay Power Plant (SBPP) has adopted the principles of the National Interagency Incident Management System (NIIMS) Incident Command System (ICS) to ensure a safe and effective response to Facility emergencies. ICS provides a model tool for command, control and coordination of any emergency response, including fires, floods, earthquakes, and hazardous materials releases.

INCIDENT COMMAND SYSTEM (ICS)

Incident Command System (ICS) is a nationally recognized system to manage an organized response to an emergency incident such as:

- Chemical releases
- Fires/explosions
- Natural disasters

ICS is utilized by most local, state and federal emergency response agencies throughout the United States. Using ICS allows for a methodical approach to managing emergencies involving numerous agencies, company representatives and response support personnel. ICS provides an opportunity for a coordinated response effort by all parties, with an emphasis on safety. The system is organized such that all decisions are made through the Incident Commander.

ICS is an emergency management system that accomplishes three major goals:

1. Ensures a manageable span of control
2. Provides consistent terminology
3. Establishes a clear chain of command

These three goals are intended to maintain clear communication during emergency response efforts. The following are the three goals defined:

Manageable Span of Control

Is defined as the maximum number of people one individual can effectively manage. During emergencies, one person can effectively manage six people. More than six requires separate Sections to be established. A Section is a group usually managed by a Section Chief with a specific response objective.

Consistent Terminology

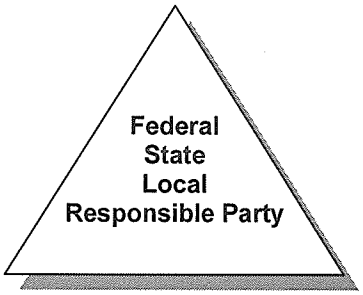
Perhaps most important when communicating during emergencies is consistent terminology. Consistent terminology allows responders to communicate quickly and effectively by understanding established ICS terms. Examples include: hazard zones, wind direction, command position titles, command post, etc.

Chain of Command

Emergency response personnel need to organize themselves quickly and effectively. During times of crisis, this is best accomplished by a hierarchical organization structure. This allows for decisive actions to be communicated quickly through a clear chain of command.

INCIDENT COMMAND SYSTEM

UNIFIED COMMAND SYSTEM (UCS)



Although DEGS utilizes ICS, almost all emergencies requiring this system will be governed by a lead agency. Depending on the extent of the emergency, the lead agency may be a representative from a federal, state or local agency. This jurisdictional authority is loosely based on product involved and the safety and environmental impact.

Examples may include:

- Fire Department (Local): Public safety
- US Coast Guard (Federal): Spills on navigable waters
- Fish and Game (State): Spills impacting inland waters, state coastal waters and sensitive lands
- EPA (State and Federal): Spills to environment

The most effective responses are those that involve the concerted efforts of agencies and the expertise of DEGS personnel. Unifying command with lead agencies allows DEGS to participate in the decision-making process, allowing for the most effective and efficient mitigation of the incident.

UCS SHOULD NOT BE ASSUMED. Lead agencies will only be receptive to unifying command if DEGS demonstrates competency with its own ICS organization. The DEGS IC will need to request that a unified command structure be established with involved agencies. In the event that lead agencies do not wish to unify command, DEGS will continue to function within ICS and serve as technical support to the agencies.

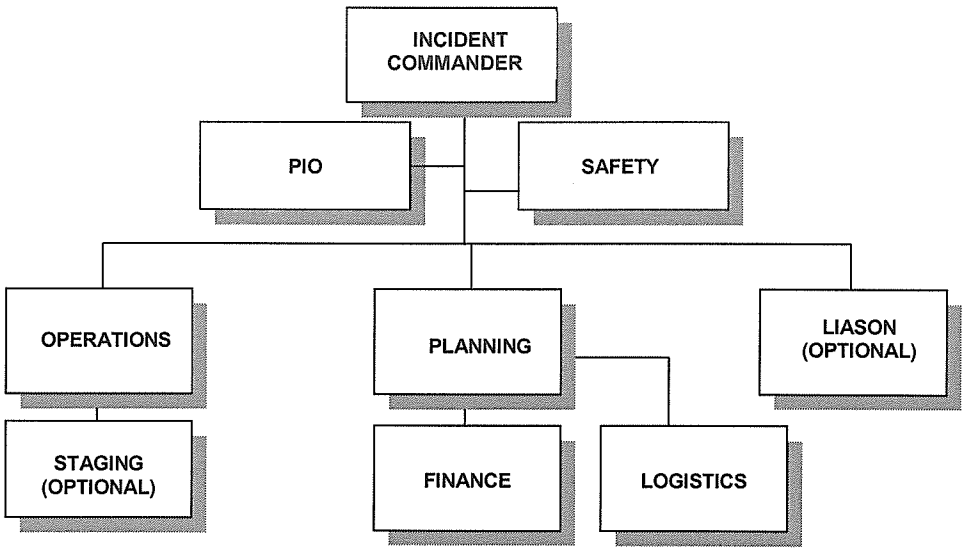
DEGS INCIDENT COMMAND POSITIONS

The following table lists the DEGS ICS positions and a brief description of overall responsibilities. A more detailed description of the DEGS ICS positions, responsibilities and checklist is provided later in this section.

DEGS ICS Positions/Staff	Overview of Responsibilities
Incident Commander	▪ Manages overall emergency ▪ Assigns and delegates to other ICS positions
Safety Officer	▪ Works with IC to ensure for the protection of personnel and responders ▪ Develops health & safety plan
Public Information Officer	▪ Manage the release of information to the media ▪ Coordinate release of information with IC, Agency PIOs and DEGS Management
Operations	▪ Coordinates tactical response actions ▪ Provides technical expertise to IC and agencies as needed
Planning	▪ Assistant to IC ▪ Ensures adequate documentation of emergency
Logistics	▪ Determine resource needs (coordinate with ICS positions) ▪ Procure resources (personnel or equipment)
Finance	▪ Manages financial matters related to the incident ▪ Generally only instituted for high level emergencies
Liaison (Optional)	▪ Meet, greet and brief arriving agency representatives ▪ Escort agency representative to Command Post as needed
Staging (Optional)	▪ Establish staging area and control access to the scene ▪ Manage personnel and visitor sign-in sheet

INCIDENT COMMAND SYSTEM

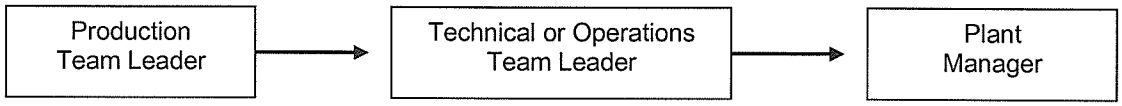
SBPP ICS Organization Chart



DEGS INCIDENT COMMANDER

For most DEGS incidents, the Plant Manager will assume the responsibilities of Incident Commander. However, the Plant Manager may not always be onsite or available to fill is role. Therefore, the responsibility of IC may begin with a Production Team Leader. As more senior DEGS employees arrive on-site, they will assume the IC position. The following illustration demonstrates the flow of the IC position within SBPP.

Flow of DEGS IC responsibility →



Before a more senior employee assumes the role of IC, they must be fully briefed on the incident. Once the senior employee is comfortable with the information, they will assume command. This transition of command must be clearly communicated to all DEGS responders. Be aware that the role of IC does not have to be passed upwards if the transition will cause undo confusion. However, there must be a defendable reason for not passing up the IC position (i.e. the incident is not escalating and is being well managed, or another more senior employees will be arriving shortly).

The DEGS IC has the authority to approve the use of a contractor even if pre-established contract do not exist. IC has the authority to commit monies to initiate response and clean-up activities. Overall responsibility for the health and safety of DEGS personnel is the duty of the IC. IC may delegate this responsibility to a Safety Officer, however ultimately responsibility is his/hers.

INCIDENT COMMAND SYSTEM

COMMAND POST

The Command Post serves as the main communication and action planning post for the duration of the emergency. The command post is to be located in a safe (upwind, uphill, upstream) position, within the cold zone. The Command Post can be in a predetermined conference room or, in many cases, at the back of a Fire Department Battalion Chief's vehicle. It is important for a Command Post to be established as soon as possible. The DEGS IC should coordinate with arriving mutual aid responders to ensure the command post location meets their approval. Adjust the location as necessary and communicate it to all DEGS responders. Foot traffic and disruptions within the command post should be kept to a minimum.

COMMAND POST LOCATIONS AT SOUTH BAY

- PRIMARY: Administrative Building Conference Room
- SECONDARY: School House, West of the Warehouse.

PLANS/FORMS

Duke Energy South Bay, LLC (SBPP) maintains a fuel oil terminal and transfer facility, 24th Street Marine Terminal/National City Fuel Oil Facility, and is therefore required to have an *Oil Spill Contengency Plan* and a *Response Manual* pursuant to 14 CCR 817 as required by the Department of Fish and Game. In addition, because the fuel oil inventory at the power plant is in excess of one million gallons, SBPP is also required to have a *Facility Response Plan* pursuant to 40 CFR Part 112. Incorporated into and required as a component of these plans is an emergency response structure that includes the use of certain plans and forms. These plans and forms are mostly designed for oil spill response into the water of the State that would involve multiple levels of response organizations. However, they may be used for many types of emergencies to organize an effective response.

Attached herein at the end of this section (ICS-FORMS) are the subject forms and plans. The intent for inclusion is not to replace the three subject Plans, but to incorporate consistency for the Response Personnel. If there is an oil spill to the waters of the State, refer to the subject Plans to insure proper reponse pursuant to the 14 CCR 817 and 40 CFR Part 112.

INCIDENT COMMAND SYSTEM

DEGS INCIDENT COMMANDER (IC)

For most DEGS incidents, the responsibilities of Incident Commander will begin with a Production Team Leader. As more senior DEGS employees arrive on-site, they will assume the IC position. IC has the authority to approve the use of a contractor even if pre-established contracts do not exist. IC has the authority to commit monies to initiate response and clean-up activities. Overall responsibility for the health and safety of DEGS personnel is the duty of the IC. IC may delegate this responsibility to a Safety Officer, however ultimately responsibility is his/hers.

IC Responsibilities:

- ❑ Verify internal DEGS notifications have been made
- ❑ Conduct site assessment
- ❑ Initiate DEGS Incident Command System
- ❑ Assign ICS positions
  - Safety Officer
  - Operations
  - Planning
  - Logistics
  - Finance
  - Public Information Officer (PIO)
  - Liaison (Optional)
  - Staging (Optional)
- ❑ Delegate responsibility based on the needs of the incident
- ❑ Establish safe command post location
- ❑ Meet with Lead Agency IC
- ❑ Request Unified Command, as appropriate
- ❑ Health & Safety
- ❑ Assesses the situation
- ❑ Initiate evacuation of facility, as needed
- ❑ Ensure safety procedures are followed, such as: hazard zones, PPE etc.
- ❑ Ensure Health & Safety plan is being developed
- ❑ Ensure H&S Plan is being communicated to persons entering site
- ❑ Maintain site control – establish hazard zones and appropriate corridors (i.e. decon)
- ❑ Ensure Staging Area has been established
- ❑ Facilitate briefings and planning meetings, as appropriate
- ❑ Manage and coordinate overall incident actions
- ❑ Ensure that briefings and planning meetings are scheduled regularly
- ❑ Assure good documentation is being kept by all participants
- ❑ Assure orderly transition of IC responsibilities when relieved
- ❑ Arrange and ensures that incident critics are performed
- ❑ Oversee and approves requests for resources (avoid duplication)
- ❑ Provide oversight of media management
- ❑ Anticipate the need for relief of ICS positions
- ❑ Incident Action Plan (IAP)
- ❑ Coordinate with Lead Agency to develop a clear plan of action (IAP)
- ❑ Communicate the IAP to appropriate DEGS IC staff
- ❑ Coordinate with DEGS IC staff to implement the IAP
- ❑ Ensure documentation of the IAP
- ❑ Provide updates to DEGS Corporate, as necessary
- ❑ Declare "all clear" of incident for DEGS response team - record:
- ❑ Date: _____ Time:_____

INCIDENT COMMAND SYSTEM

DEGS SAFETY OFFICER

The DEGS Safety Officer is responsible for assessing the overall emergency site and Incident Action Plan procedures to ensure the health and safety of all response personnel. **The Safety Officer also has the authority to suspend operations based on health and safety concerns.** The Health and Safety Plan (attached at the end of this section) is the primary tool to help the Safety Officer methodically conduct a thorough site assessment. The Safety Officer is also responsible for communicating the H&S Plan to all response personnel.

Safety Officer Responsibilities:

- ❑ Receive briefing of incident
- ❑ Coordinate with IC to discuss priority response actions
- ❑ Identify and evaluate safety and health hazards that may impact responders and the public
- ❑ Ensure responders have adequate skills to safely perform assigned tasks
- ❑ Ensure initial response personnel are located in a safe location
- ❑ Designate exclusion zone boundaries and deter mine level of PPE required
- ❑ Begin developing the Site Specific Health and Safety Plan
- ❑ Establish contact with on-scene agency Safety Officer(s)
- ❑ Ensures lead agency is in agreement with established Hazard Zones – revise as needed
- ❑ Conduct initial briefing of the H&S Plan
- ❑ Establish regularly scheduled safety meetings
- ❑ Ensure that an "attendance roster" is maintained for the H&S Plan briefings
- ❑ Work with Staging to conduct H&S Plan briefings with arriving response personnel
- ❑ Assess need for atmospheric monitoring – coordinate as needed
- ❑ Assess need for triage location. Coordinates with appropriate agencies a s needed
- ❑ Attend briefing and planning meetings
- ❑ Review Incident Action Plans to ensure safety oversight
- ❑ Establish smoking areas
- ❑ Anticipate the need for relief of position and insure orderly transition
- ❑ Investigate accidents (post emergency phase)

INCIDENT COMMAND SYSTEM

DEGS PUBLIC INFORMATION OFFICER (PIO)

The DEGS Public Information Officer (PIO) is responsible for managing the media during emergencies. This is most effectively done through coordination with the IC, DEGS Public Affairs Office and lead agency PIO(s). The DEGS PIO coordinates with the IC and lead agency PIO(s) to manage media representatives at the incident (through establishing a Media Area and scheduling briefings). The DEGS PIO coordinates the development and release of appropriate media information with the DEGS Public Affairs Office.

PIO Responsibilities:

- Receive briefing of incident
- Coordinate with IC to discuss priority media management actions
- Serve as the central clearing point for the dissemination of official information
- Resolve conflicting information and identify media concerns
- Anticipate need for and establish a Media Area
- Coordinate with lead agency PIOs – request one if necessary
- Coordinate with the DEGS Public Affairs Office for development and release of appropriate media information
- Provide general DEGS press release form, as appropriate
- Keep IC apprised of media management activities
- Schedule, organize and conduct media briefing, interviews and tours, if needed
- Anticipate the need for relief of position
- Maintain a log of agency PIOs, news media, news releases etc.

INCIDENT COMMAND SYSTEM

DEGS OPERATIONS

The DEGS Operations is responsible for coordinating all tactical response actions taken by DEGS or contract personnel. The Operations should have a general understanding of response actions including equipment isolation, product containment, fire suppression systems, equipment repair, decontamination systems, waste handling, wildlife response, etc. The Operations will work closely with response agencies and clean-up support contractors to develop and implement operational (tactical) incident action plans within the requirements of the Health & Safety Plan.

Operations Responsibilities:

- ❑ Receive briefing of incident
- ❑ Coordinate with IC to discuss priority response actions
- ❑ Determines available resources and initiate requests for additional resources as needed
- ❑ Anticipate the need for relief of position and coordinate work schedules
- ❑ Assist with creating operational (tactical) Incident Action Plans based on projected response needs
- ❑ Identify and mitigate hazards associated with tactical response
- ❑ Establishes relations with on-scene agency Operations if available
- ❑ Directs DEGS personnel and emergency response contractors performing operations activities
- ❑ Establishes communication with Safety Officer
- ❑ Reviews and ensures communication of the H&S Plan to DEGS personnel and emergency response contractors performing operations activities
- ❑ Ensures Decontamination system is set-up and functional prior to Hot Zone entry
- ❑ Keep IC apprised of tactical progress
- ❑ Attend briefings and planning meetings, as necessary
- ❑ Maintain or ensure documentation of:
- ❑ Resource requests (equipment and contractors)
- ❑ Operational (tactical) incident action plans
- ❑ Coordinate with Safety Officer to update H&S Plan, as necessary
- ❑ Assist with preparation of waste management plans

INCIDENT COMMAND SYSTEM

DEGS PLANNING

DEGS Planning is the closest to what could be considered an "Assistant IC". Planning works closely with the IC to manage information flowing to and from the command post. Planning plays a critical role in ensuring adequate documentation of the incident (e.g. Incident Action Plans, critical communications, meeting minutes, etc.). Additional responsibilities may differ depending on the complexity of the incident and the needs of the IC.

Planning Responsibilities:

- ❑ Receive briefing of incident
- ❑ Coordinate with IC to discuss priority response actions
- ❑ Participate in Incident Action Plan development by evaluating alternative strategies and tactical operations plans that anticipate changing requirements
- ❑ Identify resource needs
- ❑ Ensure the DEGS ICS organization chart is being developed for future posting
- ❑ Collect, evaluate and disseminate timely and pertinent incident information and event status
- ❑ Log important communication transmissions
- ❑ Establish contact with on-scene agency Planning (s)
- ❑ Assist IC to ensure that briefings and planning meetings are scheduled regularly
- ❑ Communicate up-coming briefing/meeting times
- ❑ Ensure documentation of Incident Action Plans
- ❑ Consider development of a waste management plan for anticipated response wastes
- ❑ Assure good documentation is being kept by all participants
- ❑ Compile an accurate and detailed record of all aspects of the incident from commencement to termination of the response operations
- ❑ Collect and disseminate weather data, as necessary
- ❑ Anticipate the need for relief of position
- ❑ Plan for demobilization

INCIDENT COMMAND SYSTEM

DEGS LOGISTICS

DEGS Logistics is responsible for the procurement of response resources. Response resources may include equipment as well as personnel. Most resources requested by Operations will be used in tactical response efforts. However, additional resources may be requested to assist with managing the emergency such as communication equipment, restroom facilities, food and drink, etc.

Logistics Responsibilities:

- ❑ Receive briefing of incident
- ❑ Coordinate with IC and Operations to discuss priority response resources
- ❑ Request inventory of resources already mobilized
- ❑ Order and arrange resources as requested by DEGS Command or agency staff
- ❑ Get clear understanding of resource priorities
- ❑ Establish contact with on-scene agency Logistics (s)
- ❑ Gather pertinent information when ordering (ETA, contact person, etc.)
- ❑ Inform Staging of anticipated resources
- ❑ Coordinate with Operations to allocate resources upon arrival
- ❑ Assure good documentation of resource requests, procurement and availability
- ❑ Coordinate with Safety Officer to update H&S Plan, as needed
- ❑ Ensure response personnel have adequate communications resources
- ❑ Create communications plan (i.e. radio channel use), if necessary
- ❑ Assist in preparing service and support elements of Incident Action Plan
- ❑ Estimate incident needs for next planning cycle
- ❑ Keep IC informed updated on resources, activities and progress
- ❑ Oversee availability of necessities – food, drink, restroom facilities, rest areas, etc.
- ❑ Arrange hotel accommodations as needed
- ❑ Anticipate the need for relief of position

INCIDENT COMMAND SYSTEM

DEGS FINANCE

DEGS Finance is responsible for all financial and cost analysis aspects for the incident. Finance needs to keep the DEGS IC aware of all financial matters relating to the incident and provide possible cost savings recommendations for the incident. Finance is also responsible for ensuring that all financially related documentation is completed and maintained.

The Finance position is usually only assigned for high-level, multi-agency emergencies, such as a significant release on water.

Finance Responsibilities:

- ❑ Receive briefing of incident
- ❑ Coordinate with IC to gather information on overall strategy
- ❑ Coordinate with the Logistics to determine resource needs
- ❑ Meet with cooperating agencies as required
- ❑ Provide financial and cost analysis input in planning meetings
- ❑ Track time records for employees and contractors
- ❑ Track costs associated with equipment rental, field purchases and other expenses
- ❑ Track and review compensation and claims that are filed due to the incident
- ❑ Ensure that required documents for the incident are properly completed and maintained
- ❑ Ensure that the amount of time equipment is used/assigned for the incident is recorded
- ❑ Participate in demobilization planning

INCIDENT COMMAND SYSTEM

DEGS LIAISON

DEGS Liaison serves as a "go-between" linking the IC to various response and regulatory agencies, as appropriate. Liaison intercepts, greets and briefs response and regulatory agency representatives as they arrive on scene. It is the responsibility of the Liaison to notify the IC before escorting anyone to the Command Post. Any Federal On-Scene Coordinator, State and Local ICs are to be escorted to the Command Post. A separate Liaison Area may need to be established to accommodate agency representatives not permitted to enter the Command Post.

Liaison Responsibilities:

- ❑ Receive briefing of incident
- ❑ Coordinate with IC to discuss priority response actions
- ❑ Coordinate with lead agency Liaison (s), if available
- ❑ Coordinate with Staging to ensure agency personnel are directed to you
- ❑ Intercept, greet, brief and serve as the initial point of contact for response and regulatory agency representatives
- ❑ Ensure agency representative(s) have signed-in with Staging and reviewed H&S Plan
- ❑ Request identification (e.g. business card), as needed
- ❑ Inquire about agency responsibilities and potential concerns
- ❑ Inquire about agency's potential support abilities (e.g. expertise, resources)
- ❑ Relay information to IC or request whether agency representative should be escorted to the Command Post
- ❑ Anticipate need for a Liaison Area –establish and communicate the location, if needed
- ❑ Provide on-going briefings to agency representatives, as needed
- ❑ Keep IC apprised of arriving agency representatives
- ❑ Anticipate the need for relief of position
- ❑ Maintain a log of agency representatives
- ❑ Coordinate with Safety Officer to update H&S Plan, as needed

INCIDENT COMMAND SYSTEM

DEGS STAGING

DEGS Staging manages the first access control point into the emergency, known as the Staging Area. Any DEGS responders, emergency response contractors, equipment, regulatory agency representatives and visitors will be required to check in with Staging before entering the incident site. Once arriving personnel or equipment have checked-in, Staging is responsible for communicating this information to the appropriate ICS position for further direction.

Staging Responsibilities:

- ❑ Receive briefing of incident
- ❑ Coordinate with IC Staff to establish a defined Staging Area
- ❑ Ensure Staging Area is clearly visible to everyone arriving at the scene (e.g. put up a "STAGING" sign)
- ❑ Develop Incident sign-in sheet
- ❑ Ensure all DEGS responders, contractors, agency representatives and visitors sign-in
- ❑ Control traffic flow and parking within the Staging Area
- ❑ Coordinate with Logistics to manage and track arriving resources
- ❑ Work closely with Logistics and Operations to coordinate swift distribution of resources
- ❑ Coordinate with Liaison to ensure agency personnel receive appropriate consideration
- ❑ Anticipate the need for relief of position

INCIDENT COMMAND SYSTEM

SUPPLEMENTARY INFORMATION

DECONTAMINATION PROCEDURES

Decontamination is required whenever contamination is suspected, in order to prevent further spread. It may apply to responders, victims, equipment, and property. Personnel decon may be necessary any time responders leave the hot zone to receive tools, change air cylinders, exchange information, repair damaged suits, or at completion of tasks.

1. The decon area should be set up in the warm zone, upwind/upgrade of the release.
2. Define the perimeter with barricades, tape, or cones.
3. Decon setup should be completed prior to entry into the hot zone.
4. Decon personnel must be in proper protective equipment (PPE) – generally one level below hot zone workers.
5. Avoid contact with contaminants by using long handled brushes, mops, etc.
6. Water for dilution may be supplied by garden type hoses, fire hoses, or buckets/drums.
7. Hot zone workers may decontaminate each other using equipment and decon solutions left at the hot zone perimeter line.
8. Full consideration must be given to runoff control.

EMERGENCY PREVENTION/PREEMERGENCY PLANNING
(Incorporated by reference)

Procedures to prevent spills or releases of hazardous materials from becoming emergencies are included in the response guidelines throughout this plan. In addition, emergency prevention procedures and techniques at this facility are incorporated into various operating and maintenance procedures, specific operating plans, Company Standard Practices, and personnel training programs at the plant. They are not duplicated here, so that this response manual can remain streamlined and efficient, and response information can be retrieved and implemented quickly in an emergency. This manual and the training accompanying it constitute pre-emergency planning.

CRITIQUE OF RESPONSE AND FOLLOW-UP

Post emergency critiques will be conducted following any response actions. The purpose of critiques is for identification of lessons learned in the implementation of the plan, and to provide new information for follow-up revisions to the procedures in the plan.

The format for the critique is open forum, no-fault, and collaborative. Participants from any agencies or response contract groups involved will be included. The focus of the critique should be constructive and on the general response, not on individual performance. Topics should include the following:

- What actions/events helped or hindered the response activities?
- What were the pros and cons of the plan as applied to this event?
- What was left undone or could have been improved?

(end INCIDENT COMMAND SYSTEM section)

INCIDENT COMMAND SYSTEM

FORMS & PLANS

FORMS & PLANS
INDEX

NUMBER	DESCRIPTION
ICS FORMS	EXECUTIVE SUMMARY
ICS FORMS	IAP COVER SHEET
ICS FORM 201	INCIDENT BRIEFING
ICS FORM 202 – 206, 232	INCIDENT ACTION PLAN
ICS FORM 202	INCIDENT OBJECTIVES
ICS FORM 203	ORGANIZATION ASSIGNMENT LIST
ICS FORM 204	ASSIGNMENT LIST
ICS FORM 204a	ASSIGNMENT LIST ATTACHMENT
ICS FORM 205	INCIDENT RADIO COMMUNICATIONS PLAN
ICS FORM 206	MEDICAL PLAN
ICS FORM 232	RESOURCES AT RISK SUMMARY
ICS FORM 209	INCIDENT STATUS SUMMARY
ICS FORM 211e	CHECK-IN LIST (EQUIPEMENT)
ICS FORM 214a	INDIVIDUAL LOG
ICS FORM 215	OPERATIONAL PLANNING WORKSHEET
ICS FORM 220	AIR OPERATIONS SUMMARY
ICS FORM 221	DEMOBILIZATION CHECK-OUT
ICS FORM 230	DAILY MEETING SCHEDULE
ICS FORM 231	MEETING SUMMARY
PLANS	INCIDENT WASTE MANAGEMENT PLAN
	EMERGENCY RESPONSE SITE SPECIFIC HEALTH SAFETY PLAN

ICS FORMS

INCIDENT WASTE MANAGEMENT PLAN

EMERGENCY RESPONSE
SITE SPECIFIC
HEALTH AND SAFETY PLAN

SOUTH BAY POWER PLANT

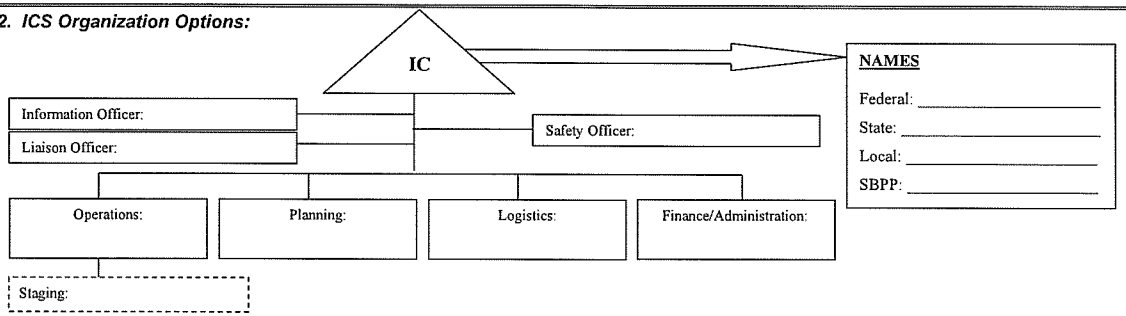
EMERGENCY RESPONSE SITE SPECIFIC HEALTH & SAFETY PLAN

1. Incident Information:

Incident Type:
- ☐ **Fire / Explosion**
- ☐ **Spill / Release**
- ☐ **Rescue**
- ☐ **Injury**
- ☐ **Other:** _____

Incident Name: _____ Incident Date: _____
Incident Time: _____ Incident Location: _____
H&S Plan Time Period: _____
Incident Description: _____

2. ICS Organization Options:



3. Chemical Hazards Involved:

☐ Ammonium Hydroxide ☐ # 6 Fuel Oil ☐ Jet A Fuel ☐ Hydrogen Gas ☐ Light Oil ☐ Acid/Base
☐ Sodium Hypochlorite ☐ Liquid Nitrogen ☐ Propane ☐ Natural Gas ☐ Transformer Oil
☐ Other: _____ ☐ Amount: _____ Units: _____
(see Table 5 on back for chemical & physical properties)

MSDS & Emergency Response Guide Available? ☐ Yes ☐ No

4. Potential Hazards:

- ☐ Fire/Explosion
- ☐ Smoke
- ☐ Vapors/Gases
- ☐ Heavy Equipment
- ☐ Excavations
- ☐ Noise
- ☐ Confined Spaces
- ☐ Heat/Cold Stress
- ☐ Electrocution
- ☐ Skin Adsorption
- ☐ Slips/Trips/Falls
- ☐ Corrosives/Acidic
- ☐ Other: _____

Summarize Primary Hazards: _____

(see Table 2 on back for secondary hazard precautions)

5. Isolation Zones (description/feet):

Hot/Exclusion: _____
Warm/Decon: _____
Cold/Support: _____

6. Demarcation of Isolation Zone? ☐ Yes ☐ No

☐ Tape ☐ Physical Barriers
☐ Site Security Officer: _____

7. Evacuation Plan:

Evacuation signal : **High/Low Siren**
Primary Area: _____
Secondary Area: _____
Off-site: _____

8. Nearest Hospital:

Name: Scripps Memorial Hospital
Address: 435 H Street, Chula Vista, CA
Phone#: (619) 691-7000
Directions:
Go North on Bay Blvd.
Turn right onto L Street.
Turn right onto Industrial Blvd.
Take I-5 North to the H Street exit.
Turn right onto H Street.

9. Site Map:

Weather Conditions					
Time:					
General Description:					
Wind Direction:					
Wind Speed:					
Low Tide: Ft(+/-)					
High Tide: Ft(+/-)					

Indicate the following:
☐ Wind Direction ☐ Hazard Zones ☐ Staging ☐ Command Post ☐ Decon ☐ Cross streets ☐ Sensitive receptors

10. Enforcement / Regulatory Agencies (On Site):

Agency (Fed/State/Local)	Name	Time of Arrival

11. Contractors (On Site):

12. DECON: *(see Table 4, Decon Checklist, on back for reference)*

Decon Required? ☐ YES ☐ NO
Decon Procedures Provided? ☐ YES ☐ NO
Organization Managing Decon: _____

13. Atmospheric/Exposure Monitoring:

Conducted by: _____ Organization: _____
Monitoring Equipment:
☐ Direct reading instrument ☐ Colormetric Tubes ☐ Other: _____
Summarize Results:

Time	Results	Time	Results

14. Authorization Signatures:

Incident Commander: ***Time:*** ***Date:***

Safety Officer: ***Time:*** ***Date:***

Fill in applicable information by checking boxes or line entry.

EMERGENCY RESPONSE SITE SPECIFIC HEALTH & SAFETY PLAN

Table 1. Incident Action Plan

Incident Priority Checklist:

- ☐ Evacuate
- ☐ Secure area/restrict access
- ☐ Evaluate self / others (rescue?)
- ☐ Notification: Internal/External
- ☐ Initiate ICS
- ☐ Conduct Hazard Assessment (H&S Plan)
- ☐ Meet with response authorities
- ☐ Create/implement Incident Action Plan
- ☐ Determine protective equipment/actions
- ☐ Containment & control
- ☐ Decon
- ☐ Mobilize response resources
- ☐ Disposal alternatives
- ☐ Documentation

Incident Action Plan:

Incident Objectives:	*Status:*
1.	
2.	
3.	
4.	
5.	
6.	

Table 2. Hazards

Hazards	Recommended Precaution(s)
☐ Fire (potential)	• Remain safe distance away • Eliminate ignition sources • Keep upwind of smoke • Provide vapor suppression (if safe) • Do not impede Fire Dept. efforts
☐ Heavy Equipment	• Qualified operators only • Hardhats and safety boots needed around heavy equip. • Minimum 10ft. clearance from power lines • Make "one call" if excavating • Proper machine guarding in place
☐ Excavations	• Trenches/excavations equal to or greater than 5ft. deep must meet OSHA requirements • No one allowed to enter excavation > 5ft. unless shored, sloped or protected• Excavations < 5ft. and judged by competent person as cave-in hazard must also follow OSHA requirements
☐ Noise	• Portable generators & heavy equip. can generate potentially high noise levels • Hearing protection available to workers • Hearing protection must be worn in area with noise levels above 85dBA.
☐ Confined Spaces	• Site Safety Officer will determine whether confined space will be entered • All confined space entries must meet OSHA requirements (permits, atmospheric monitoring, attendants, etc.)
☐ Heat Stress	• Potential hazard when temp >80°F • Workers should take more breaks and drink plenty of appropriate liquids • More PPE = higher risk • Be aware of heat cramps (stomach cramps), heat exhaustion (excessive sweating, flushed/clammy skin) – treat with rest and liquids. Heat stroke (dry, hot, pale skin; no sweating) can be deadly – get medical help immediately, reduce core body temp by applying cold water to body & fanning.
☐ Cold Stress	• Skin takes on gray-glossy look • Appendages become non-responsive • Blisters or sores may appear • Do not rub • Submerse affected areas in warm water or wrap in warm cloth.
☐ Rain / Lightning	• Stop excavation activities during excessive rainfall • Avoid shock hazards by stopping work during thunderstorm or lightening • Prevent & control erosion & transport of soils out of incident area.
☐ General	• Slip, trip & fall hazards • Keep work area clear of debris • Ventilate when working with flammable materials • Smoking not permitted in work areas • Use hand tools safely
☐ Other:	

Table 3. PPE

Personal Protective Equipment:

Cold Zone / Staging - ☐ Hardhat ☐ Sturdy Boots ☐ Safety Glasses ☐ Life Jacket ☐ Traffic Vest

Warm Zone / Decon - Level ☐ A ☐ B ☐ C ☐ D

Hot Zone - Level ☐ A ☐ B ☐ C ☐ D

LEVEL A	LEVEL B	LEVEL C	LEVEL D
Respiratory Protection ☐ SCBA or Air Line ☐ Positive pressure full face piece supplied air w/ escape SCBA Required Equipment ☐ Totally encapsulating, gas tight chemical resistant suit ☐ Inner chemical resistant gloves ☐ Chemical resistant safety boots Optional Equipment ☐ Hearing protection ☐ Hard Hat ☐ Disposable glove & boot covers	Respiratory Protection ☐ SCBA or Air Line ☐ Positive pressure full face piece supplied air w/ escape SCBA Required Equipment ☐ Non-encapsulating chemical resistant suit (Tyvek/Nomex) ☐ Inner & outer chemical resistant gloves ☐ Chemical resistant safety boots ☐ Hard Hat Optional Equipment ☐ Hearing protection ☐ Coveralls ☐ Disposable boot covers ☐ Face shield/safety glasses	Respiratory Protection ☐ Full / Half Face respirator w/: ☐ cartridge (gas/vapor): _____ ☐ filter (particulate): _____ Required Equipment ☐ Non-encapsulating chemical resistant suit ☐ Tyvek ☐ Nomex ☐ Inner & outer chemical resistant gloves ☐ Chemical resistant safety boots ☐ Hard Hat Optional Equipment ☐ Hearing protection ☐ Coveralls ☐ Disposable boot covers ☐ Face shield/safety glasses	Respiratory Protection ☐ None Required Equipment ☐ Coveralls ☐ Safety Boots ☐ Safety Glasses ☐ Hard Hat Optional Equipment ☐ Hearing protection ☐ Gloves ☐ Face shield/safety glasses

Table 4. DECON Checklist

☐ Establish/Communicate location	☐ Eyewash	☐ DECON Solution:
☐ Assign supervision for decon	☐ Lighting	▪ Soap/Water
☐ Maintain entrant log	☐ Plastic tarps	▪ Simple Green
☐ Boot brush/pools	☐ Disposal containers	▪ Chlorine bleach
☐ Absorbent material	☐ Other: _____	▪ Other: _____

Table 5. Chemical & Physical Properties

Chemical Hazards	Flammability Range		Toxicity	Chemical / Physical Properties				
	LEL	UEL	PEL[a]/TLV[b]	Flash Pt.	Vapor Pressure	Vapor Density	Specific Gravity	NFPA 704 Health/Flammable/Reactive
☐ Natural Gas								
☐ Diesel								
☐ Jet A Fuel								
☐ Hydrogen Gas								
☐ Lubricating Oils								
☐ Propane								
☐ Fuel Oil #6								
☐ Sodium Hypochlorite								
☐ Ammonium Hydroxide								
Other Chemicals								
☐								

1 atm = 760 mmHg = 14.7 psi

RESPONSE TO A

MEDICAL EMERGENCY

Information contained in this section provides direction to the Plant's Operating Department so that appropriate actions are followed to ensure that prompt medical care is provided should a medical condition threaten the health and well being of on-site personnel. During a medical emergency, a clear understanding of organizational roles and responsibilities is necessary to ensure a prompt and proper response. A ***medical emergency*** for the purpose of this section, is an unexpected situation or sudden event that results in the need for immediate medical action. Any incident involving a medical emergency shall be acted upon according to the guidelines established by this section.

INITIATING MEDICAL EMERGENCY RESPONSE

In general, the nature and magnitude of any incident will govern the level of response necessary. The following steps should be taken for any medical emergency.

PERSON DISCOVERING THE INCIDENT

- NOTIFY the Control Room Operator (CO):
  - Plant phone: **5201**
  - Cell phone & 24hr numbers: **619-498-5201** or **420-7383** or **420-7385**
  - 450 MHz Radio: **OPERATIONS CHANNEL**

- STAY ON THE LINE and have the following information ready to communicate to the CO:
  - LOCATION of injured person,
  - CONDITION – of injured person,
  - ACTIONS – that have already been taken,
  - RESCUE – type of help you need, and whether ambulance or rescue is needed.
  - Any other information the CO may need. Remember, stay on the line until released by the CO.

CONTROL ROOM OPERATOR

1. COLLECT INFORMATION from the caller related to the medical emergency to assess the response needed:
   - Time call received,
   - Name of caller,
   - Name of injured,
   - Exact location, and
   - Type of medical emergency and condition of the injured person.

2. NOTIFICATIONS:
   - DISPATCH RESCUE TEAM & PRODUCTION TEAM LEADER (PTL)
     - If members of the Rescue Team are not present, dispatch First Aid Trained personnel if not already present at the scene by making a general announcement on the Paging System or 450 radios.

       STATE: location and condition of injured, and assistance needed so that the person(s) may respond with the necessary medical supplies promptly.

RESPONSE TO A

MEDICAL EMERGENCY

2. NOTIFICATIONS (CON'T)
   - ❑ CALL 9-1-1 to request off-site emergency assistance.
   - ❑ MAIN GATE GUARD at extension 5293 and dispatch an Operator to the Main Gate to direct off-site emergency response personnel to the emergency location.

3. MONITOR and COORDINATE COMMUNICATIONS from the control room between plant IC and the off-site medical responders, as appropriate.

4. DOCUMENT incident actions and maintain a timeline of events.

INCIDENT COMMANDER

1. INITIATE INCIDENT COMMAND SYSTEM [IC ⇒ *ORANGE TAB*]
   - ➢ Clearly communicate who is IC
   - ➢ Designate other IC positions, as necessary

2. Immediately REPORT to the emergency location.

3. ASSESS safety/medical/rescue needs.

4. ENSURE medical support is promptly and efficiently directed to the location of the injury.

5. COORDINATE safety/medical/rescue activities with the off-site emergency responders.

6. COMMUNICATE continuously throughout the incident to insure resources are available and actions are effective.

7. DOCUMENT the incident.

Notice for Duke Personnel Not Directly Supporting the Emergency

During an emergency, all Duke personnel that do not have a designated emergency response function should refrain from going to the emergency scene, and/or call the Control Room unless specifically asked to do so by responding personnel.

RESPONSE TO A

MEDICAL EMERGENCY

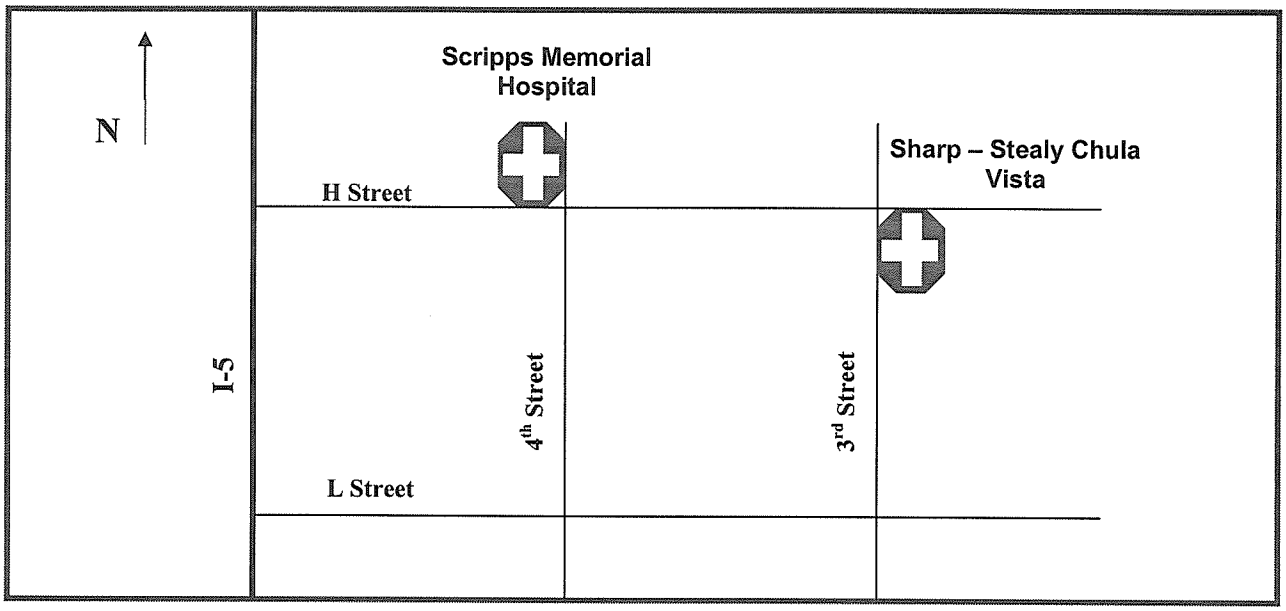
HOSPITAL LOCATIONS

- **Scripps Memorial Hospital**
  435 H Street, Chula Vista, CA
  (619) 691-7000

  Go North on Bay Blvd. Turn right onto L Street.
  Turn right onto Industrial Blvd.
  Take I-5 North to the H Street exit
  Turn right onto H Street

- **Sharp-Stealy Chula Vista**
  525 Third Avenue, Chula Vista, CA
  (619) 482-5800

  Go North on Bay Blvd. Turn right onto L Street.
  Turn right onto Industrial Blvd.
  Take I-5 North to the H Street exit
  Turn right onto H Street



EVACUATION PLAN

Potential emergencies, such as fire, explosion, release of hazardous material or hazardous waste, bomb threat or an earthquake may require that personnel evacuate portions of, or the entire facility. This section establishes actions to be taken if it is necessary to evacuate personnel or the public from locations within or around the facility.

EVACUATE SIGNAL

The evacuation order will be transmitted via STATION ALERT followed by a VOICE MESSAGE. The signal indicating persons should begin evacuation is:

- **Oscillating Siren** – accompanied by a voice message of instructions.

EVACUATION ASSEMBLY AREAS

Upon hearing the evacuation signal all persons should:

- Ensure that nearby personnel are aware of the emergency.
- If safe, quickly secure any work that might be a hazard otherwise.
- Evacuate the area immediately
  - Use nearest safe exit without walking through the building or operating area. Then walk around any structures to reach the designated assembly area.
  - Close doors as you exit
  - Do not stop to pick up personal belongings
  - Do not linger to finish tasks
- Essential Personnel (Operations): Report to the Control Room for direction/instruction.
  - The PTL on shift will account for Operations personnel
  - Radio the count (all accounted for or missing) to the IC at the assembly area.
- Non-Essential Personnel (Administration, Maintenance, Visitors, Contractors, etc.): Report to the designated on-site evacuation assembly area.
- The IC or his/her designee shall obtain a current list of visitors from the Gate Guard.

PRIMARY EVACUATION ASSEMBLY AREAS:
- Administration Building, across from the Machine Shop
- Contractor Lay-down Area, east side of power building

SECONDARY EVACUATION ASSEMBLY AREAS (as designated by the IC):
- Warehouse/Engineering Building Parking Lot

(see **EMERGENCY EVACUATION PLAN** in **MAPS** ⇒ ***GREEN TAB***)

EVACUATION PLAN

If a designated Assembly Area is or becomes unsafe, this will be communicated by a voice message over the Station Paging System or radio. All personnel will be instructed to proceed to another Evacuation Assembly Area or to an off-site location to be determined by the Incident Commander (IC).

ACCOUNTABILITY OF PERSONNEL

A headcount will be conducted at the Evacuation Assembly Area(s).

- All personnel are to report to their immediate Supervisor.
  - If you're immediate Supervisor is not at the assembly area, report to any available Supervisor or Production Team Leader (PTL).
- Contractors and Visitors are to report to their SBPP point of contact.

IF YOU DO NOT REPORT TO THE AREA, YOU MAY BE DETERMINED MISSING AND A SEARCH WILL BE UNNECESSARILY CONDUCTED.

- Supervisors and PTL(s) will begin accounting for personnel that fall under their supervision. [refer to the ***Personnel Accountability Checklist*** ⇒ **EP-5** to assist tracking accountability]
- Supervisors and PTL(s) are to determine if:
  - Anyone is unaccounted for
  - Anyone is "extra"
  - All Contractors (and their employees) are accounted for
  - All Visitors are accounted for
  - If employees have information on last known locations of missing persons they should report the information to their PTL. PTL will then relay the information to the IC.

If members of the SBPP EMERGENCY RESCUE TEAM are needed for response efforts, they must first notify their PTL/Supervisor before leaving the Evacuation Assembly Area.

- PTL(s) and Supervisors at any designated Assembly Area should then coordinate the information and SELECT ONE PERSON TO RELAY THE INFORMATION TO THE IC.
  - The IC should receive no more than one report of accountability from any designated Evacuation Assembly Area.
  - The report shall include personnel status: present and accounted for, or missing. For 'missing' personnel, employees that may have information on the last known location of the missing person should be queried. This information should then be relayed to the IC.
- Based on the information received, the IC will determine if there are any missing persons. Depending on the emergency, the IC may choose to conduct a search for missing persons using company personnel or wait for outside emergency services to conduct the search.
- All employees shall wait in the Evacuation Assembly Area for further instructions. Do not leave the area unless instructed to do so by the Incident Commander.

EVACUATION PLAN

OFF-SITE EVACUATION

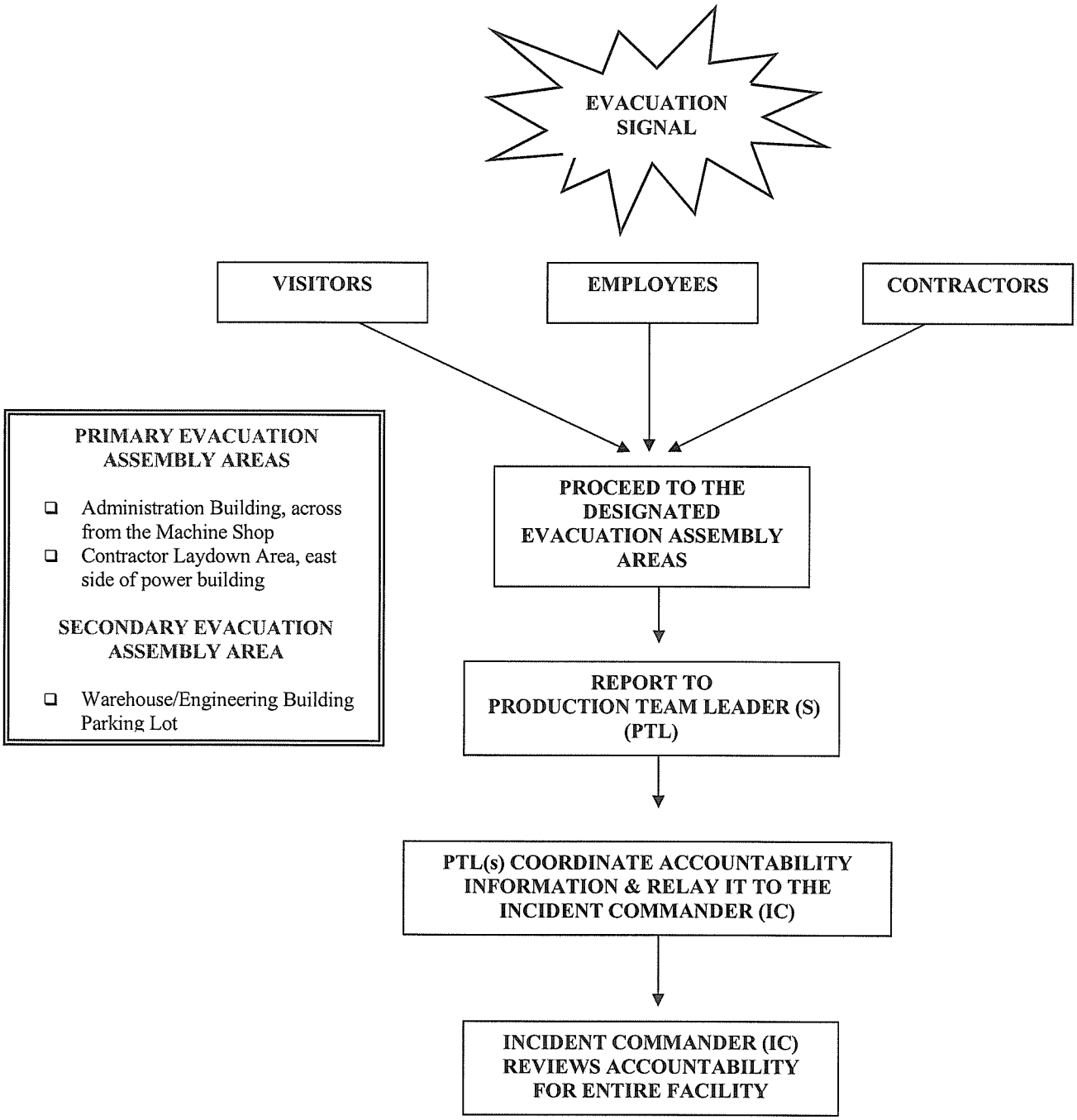
- Depending on the severity of the situation, the IC will determine if an off-site evacuation is necessary.
- The IC will contact the Production Team Leaders (PTLs) via portable radio (450 MHz) and give them instructions to begin off-site evacuation.

AN OFF-SITE EVACUATION ASSEMBLY AREA WILL BE DETERMINED AND COMMUNICATED BY THE IC BASED ON THE TYPE OF EMERGENCY, WIND DIRECTION AND OTHER FACTORS.

- All persons should stay with their on-site assembly group for accountability purposes.
- Once the assembly group arrives at the off-site assembly area, the PTL will conduct a head count to ensure that all persons were safely evacuated off-site.

EVACUATION PLAN

FLOW OF EVACUATION ACCOUNTABILITY INFORMATION



PERSONNEL ACOUNTABILITY CHECKLIST

DEPARTMENT:	EMPLOYEE:	ACCOUNTED FOR?
ADMINISTRATION		
MANAGER:	**David Barnhardt**	
	Davis, Roger	
	Gobel, Micki	
	Liebst, Tom	
	Nylander, Jim	
	Ostrander, Cliff	
	Pitts, Tom	
	Ruiz, Paul	
	Sena, Siggie	
	Sesma, Elvira	
	Tabadisto, Cliff	
	Townsend, Steve	
	TOTAL=	
INSTRUMENT & ELECTRICAL		
SUPERVISOR:	**Tim McGregor**	
	Buckley, Leo T. (Tim)	
	Corning, Patricia A.	
	Cronin Mark	
	Engwis, Scott E.	
	Golden, Richard	
	Hecht, Galen D.	
	Mesquita, David	
	Rodriquez, Daniel J.	
	Shaffer, Karen L.	
	TOTAL=	
SECURITY - ON-DUTY OFFICERS		
	TOTAL=	

DEPARTMENT:	EMPLOYEE:	ACCOUNTED FOR?
MAINTENANCE		
SUPERVISOR:	**Michael Brunner**	
	Adams, Jose J.	
	Ausonio, Salvatore W.	
	Espinoza, Tony V.	
	Hughes, Samuel L.	
	Lawrence, Wayne	
	Leyvas, Anthony G.	
	Otto, Stanley R.	
	Seehausen, Ronald J.	
	Woodhouse, Larry E.	
	Yerbury, Stephen C.	
	TOTAL=	
ENGINEERING		
SUPERVISOR:	**Fred Goossens**	
	Rick Traywick	
	Lynn Trimble	
	John Rodosevich	
	Joe Otahal	
	Pete Melanese	
	TOTAL=	
TECHNICAL TEAM		
	Contractors:	
	Visitors:	
	TOTAL=	

IMMEDIATELY FORWARD COMPLETED EVACUATION ACCOUNTABILITY CHECKLISTS TO THE IC

PERSONNEL ACOUNTABILITY CHECKLIST

TEAM:	EMPLOYEE:	ACCOUNTED FOR?
TEAM 1		
PTL:	**Winston, Pat**	
	Bailey, Hazel	
	Dvorak, Chester	
	Fitzpatrick, Andre	
	Herrero, Ron	
	Hines, Terry	
	Johanning, Dan	
	Ortman, Russ	
	TOTAL=	
TEAM 2		
PTL:	**Cigainero, Leonard J.**	
	Diaz, Ralph	
	Harrison, Brett	
	Leavy, Dennis	
	Sheppard, Willie J.	
	Story, Clyde	
	Sunderland, Bill	
	Wilber, John	
	TOTAL=	

TEAM:	EMPLOYEE:	ACCOUNTED FOR?
TEAM 3		
PTL:	**Kemp, Todd L.**	
	Coughlin, Byron	
	Harmon, Luke	
	Kemsley, Frank	
	Tysick, Amos	
	Wanner, Rick	
	McDonald, Wally	
	Steagall, Mike	
	TOTAL=	
TEAM 4		
PTL:	**Hillis, Erv**	
	Alexander, Alvin	
	Bayan, Bayani	
	Calabrese, Nick	
	Casillas, Ralph	
	Huey, Jim	
	Stant, Rick	
	TOTAL=	

TEAMS AND CONTACTS

Fire / Rescue / Police / Ambulance

Plant Emergency Response Personnel

News Media Inquiries

Private Spill Response Organizations

Government Response Organizations & Contacts

Other Services / Suppliers

Community Notification Network

FIRE / RESCUE / POLICE / AMBULANCE

SOUTH BAY POWER PLANT

Primary: Chula Vista Fire Department (CVFD) 911
(619) 691-5055

San Diego Fire Department 911
(858) 573-1300

National City Fire Department 911
(619) 441-1621

Chula Vista Police Department 911
(619) 691-5151

Harbor Police Department: Non-emergency ..... (619) 686-6272
24-hour emergency ..... (619) 223-1133

National City Police Department 911
Non-emergency ..... (619) 336-4411

Sheriff or Police Department: San Diego County Emergency Center 911

LIST OF AMBULANCE AND HOSPITAL SERVICES

Normally, assistance from these services would be obtained by calling 911 (See Section 1). However, for non-emergency information they may be called directly, if necessary.

AMBULANCE

Primary: Paramedics 911

Alternate: American Medical Response ..... (619) 492-8111

HOSPITAL

Scripps Memorial Hospital 911
or (619) 691-7000

Sharp Chula Vista Medical Center 911
or (619) 482-5800

PLANT PERSONNEL

South Bay Power Plant Incident Commander and Response Personnel		Telephone Number
David Barnhardt, Plant Manager	Office	(619) 498-5317
	Cell	(619) 250-0350
Steve Townsend, Assistant Plant Manager	Office	(619) 498-5214
	Cell	(619) 250-0354
Pat Winston, Production Team Leader	Office	(619) 498-5215
	Cell	(619) 250-0407
Lynn Cigainero, Production Team Leader	Office	(619) 498-5215
	Cell	(619) 250-0411
Ervin Hillis, Production Team Leader	Office	(619) 498-5215
	Cell	(619) 250-0409
Todd Kemp, Production Team Leader	Office	(619) 498-5215
	Cell	(619) 250-0405
Mike Bruner, Maintenance Team Leader	Office	(619) 498-5330
	Cell	(619) 250-0384
Fred Goossens, Engineering Supervisor	Office	(619) 498-5370
	Cell	(619) 250-0396
Tim McGregor	Office	(619) 498-5231
	Cell	(619) 250-0367
Cliff Ostrander, Purchasing Agent	Office	(619) 498-5385
	Cell	(619) 250-0358
Cliff Tabadisto, Business Team Leader	Office	(619) 498-5243

South Bay Power Plant Environmental Support		
Jim Nylander, Environmental Engineer	Office	(619) 498-5344
	Cell	(619) 250-0392
Tom Liebst, Plant Chemist	Office	(619) 498-5223
	Cell	(619) 250-0434

PLANT PERSONNEL

Duke Energy Western Region

James White (Morro Bay), Regional EH&S Manager	Office	(805) 595-4295
	Cell	(805) 550-4595
Kathy Woodard (Morro Bay), Environmental Specialist	Office	(805) 595-4213
	Cell	(805) 801-0600
David Crosby (Morro Bay), Safety Specialist	Office	(805) 595-4283
	Cell	(805) 801-9699
Patrick Mullen (Morro Bay), Public Affairs Manager	Office	(805) 595-5597
	Cell	(805) 441-6912

PRIVATE RESPONSE

CHEMTREC:

24 Hour Hotline 1-800-424-9300

The Chemical Transportation Emergency Center (CHEMTREC) is a 24-hour public service of the Chemical Manufacturers Association. It has the capability of providing the following:

- Immediate emergency action information for spill, leak, exposure, or fire control measures.
- Precautionary information.
- Assistance in identification of hazardous substances, if the manufacturer is known or shipping papers are present.
- Immediate notification of manufacturers or shippers through their emergency contacts or notification of industry mutual aid networks.

NRC ENVIRONMENTAL SERVICES

San Diego, CA ..... 24 hour: 1-800-337-7455

Complete clean-up capability (marine & shore emphasis). 1-858-346-2900

BAKER TANKS

500 barrel portable steel tanks 1-800-225-3712

1-760-745-1790

CROSBY and OVERTON

Long Beach, CA..... 24 hour: (562) 432-5445

Waste transportation and disposal services.

PACIFIC TRANS ENVIRONMENTAL SERVICES

Emergency line (El Cajon).....(619) 441-1818

Oil Spill cleanup.

GOVERNMENT RESPONSE ORGANIZATIONS and CONTACTS

NATIONAL RESPONSE CENTER 1-800-424-8802

When a regulated quantity (RQ) of designated hazardous substances has been released into the environment, this center is immediately notified. (Specific reporting requirements for each chemical are described in the ⇒ *YELLOW TAB).* The center records the report, provides basic information on procedures for specific chemicals, and if necessary alerts the Federal On-scene Coordinator, who may set the Regional or National response mechanism into action.

CALIFORNIA OFFICE OF EMERGENCY SERVICES (OES)

Hazardous materials spill reporting 1-800-852-7550
Non-hazardous materials related incidents, 24-hour warning center.....(916) 262-1621
Day time phone number..... (916) 427-4287

Immediate verbal notification to the OES State Warning Center is required as described in spill response section at ⇒ *YELLOW TAB.* OES relays notifications to other agencies, coordinates the Mutual Aid Radio Communications System, and provides support.

(ALPHABETIZED)

CALIFORNIA COASTAL COMMISSION ..... (415) 904-5200
San Diego, CA.....(619) 767-2370

Land uses in coastal zone. Protection of coastal zone from adverse impacts due to releases of oil or other hazardous materials. Immediate notification of major spills within the coastal zone is requested.

CALIFORNIA DEPARTMENT OF FISH AND GAME

Violation Reporting Only 1-800-952-5400
Oil Spills to Marine Water-Office of Oil Spill Prevention & Response..... (916) 445-0045
Wildlife Biologist (Randy Botta) for wildlife encounters ..... (760) 751-4023
Regional Office, San Diego.....(858) 467-4201

CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL (DTSC)

Hazardous Waste violation reporting only 1-800-698-6942
Spill Reporting ..... (916) 255-6504

CALIFORNIA DIVISION OF OCCUPATIONAL SAFETY AND HEALTH .... (619) 767-2280
Cal-OSHA, District Office, San Diego

GOVERNMENT RESPONSE ORGANIZATIONS and CONTACTS

LOCAL EMERGENCY PLANNING COMMITTEE ..... (619) 683-6470 [night]
U.S. Coast Guard, Captain of the Port ..... (619) 683-6495 [day]

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION ..... (206) 526-6317
(NOAA) (answer phone HazMat)
U.S. Department of Commerce
Office of Oceanography and Marine Assessment
Hazardous Material Response Branch

POISON CONTROL CENTER for San Diego County:
Regional Poison Control Center 1-800-876-4766

PORT OF SAN DIEGO
Bill Hays, Environmental Specialist ..... (619) 686-6584
Environmental Services Department ..... (619) 686-6254
Unified Port District ..... (619) 686-6200

SAN DIEGO AIR POLLUTION CONTROL DISTRICT ..... (858) 650-4700

SAN DIEGO COUNTY, DEPARTMENT OF ENVIRONMENTAL HEALTH . (619) 338-2222
Administering agency for Hazardous Materials Management Plan (858) 565-5255 (after hours)

SAN DIEGO COUNTY, OFFICE OF EMERGENCY SERVICES ..... (562) 795-2900

SAN DIEGO REGIONAL WATER QUALITY CONTROL BOARD ..... (858) 467-2952

STATE FIRE MARSHAL, PIPELINE SAFETY DIVISION ..... (916) 445-8419
Duty Chief, 24-hour emergency number (pager) ..... (916) 323-7390

STATE LANDS COMMISSION ..... Headquarters, (562) 499-6312
Southern California Field Office, (562) 499-6348
Marine Facilities Inspection and Management Division, Long Beach, CA
Marine terminal inspection and spill reporting.

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
Region IX, San Francisco, spills only ..... (415) 947-4400
Public Information Center (general information) ..... (415) 947-8000

GOVERNMENT RESPONSE ORGANIZATIONS and CONTACTS

U.S. COAST GUARD (24 hour) San Diego, CA ..... (619) 683-6470 [night]
Captain of the Port ..... (619) 683-6495 [day]

U.S. NAVY
Duty Officer ..... (619) 524-2314
Commander of Naval Base San Diego Pollution Control Officer ..... (619) 532-2925

OTHER SERVICES AND SUPPLIERS

AMERICAN RED CROSS, San Diego .....(619) 542-7400

LOCAL WATER SUPPLY
Sweetwater Authority .....(619) 420-1413

UNDERGROUND SERVICE ALERT (USA)
24-hour number.....1-800-642-2444
USA has the capability of providing the location of any underground structures which could impact the response to hazardous materials incidents. Also notifies responsible companies for pipeline leaks or ruptures.

WEATHER REPORT .....(619) 289-1212

NEWS MEDIA

THE ONLY AUTHORIZED SPOKESPERSON FOR SBPP IS THE PLANT MANAGER OR HIS DESIGNATED SPOKESPERSON.

The media may arrive on the scene immediately following an explosion, spill, fire, gas main rupture, or other event. Reporters arriving on the scene of an emergency will try to gather information from any available source.

Responding to news media inquiries requires special attention, therefore, all media inquiries are to be immediately directed to the appropriate person as follows in order of preference:

- SBPP PLANT MANAGER
- Contact PAT MULLEN, Regional Public Affairs Manager (available 24/7) at:
  - Pager: (877) 380-1972
  - Cell: (805) 441-6912
- PUBLIC AFFAIRS DUTY PERSON [INTERNAL INQUIRIES ONLY, paging system, available 24/7]:
  - Dial 1-888-266-DUKE (3853)
  - PRESS **3** at the prompt and leave a message with a return phone number. A Duke Energy Public Affairs Professional will return your call.
- LASTLY, if Public Affairs does not call within 20 minutes, call 1-704-594-0013.

MEDIA MANAGEMENT

The following are recommendations on how to manage media representatives when a microphone and camera are unexpectedly directed toward you.

The best thing to do is state up front, "**I cannot speak for DUKE ENERGY**." If questions persist, make it clear that any opinions or observations are strictly personal, and again emphasize that you cannot speak on behalf of the company or management. Usually this approach will discourage a reporter because he/she is looking for something more than a casual observation. If they request more information, direct them to the Plant Manager.

IF SPEAKING TO THE MEDIA REMEMBER:

- **DO NOT** make assumptions on the status of an incident.
- **DO NOT** assume responsibility for an incident on behalf of yourself or the company.
- **DO NOT** accept or attempt to place blame.
- **DO NOT** be "bullied" or forced into making an official comment.
- **DO NOT** say, "No comment", or "We have no comments at this time".
- **DO** say you are not speaking on behalf of the company, and give them the 24-hour number for Public Affairs to respond to external inquiries from the media: **(704) 382-8333**

COMMUNITY NOTIFICATION NETWORK

At the start of any emergency incident both internal and external notifications are to be made by SBPP personnel. Internal notifications may include the Control Room Operator and the Production Team Leader (PTL). External notifications may include the Chula Vista Fire Department, California Office of Emergency Services and National Response Center. These notifications are essential and must be completed to keep response efforts moving forward. Detailed information regarding what notifications must be made for the various emergency scenarios is provided in the color-coded sections of this plan ⇒YELLOW and **RED** Tabs.

In the event a catastrophic incident, additional community notifications may be advised. By "catastrophic", it is meant that the incident could result in public health concerns or raise significant questions from the community at large. In this case, it may be advisable to notify public officials.

It is at the discretion of the Incident Commander and the Public Affairs Manager (in coordination with outside response agencies) to determine whether an incident is "catastrophic" or whether it will greatly impact the surrounding community.

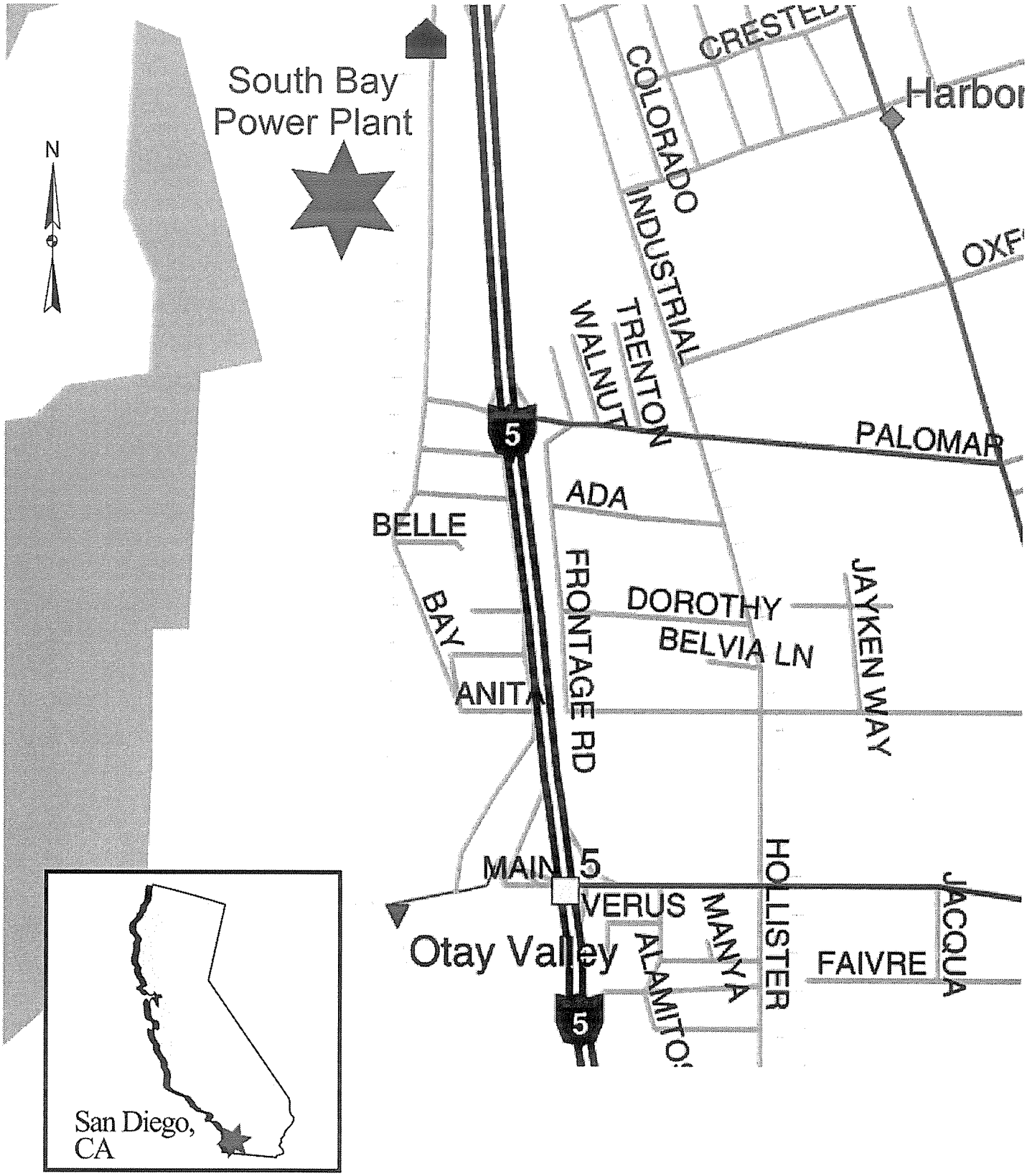
NOTIFICATIONS TO PUBLIC OFFICIALS ARE INTENDED AS A "COURTESY CALL" AND ARE TO BE MADE AT THE DESCRETION OF THE INCIDENT COMMANDER AND PUBLIC AFFAIRS MANAGER.

MAPS AND DIAGRAMS

Facility Location Map

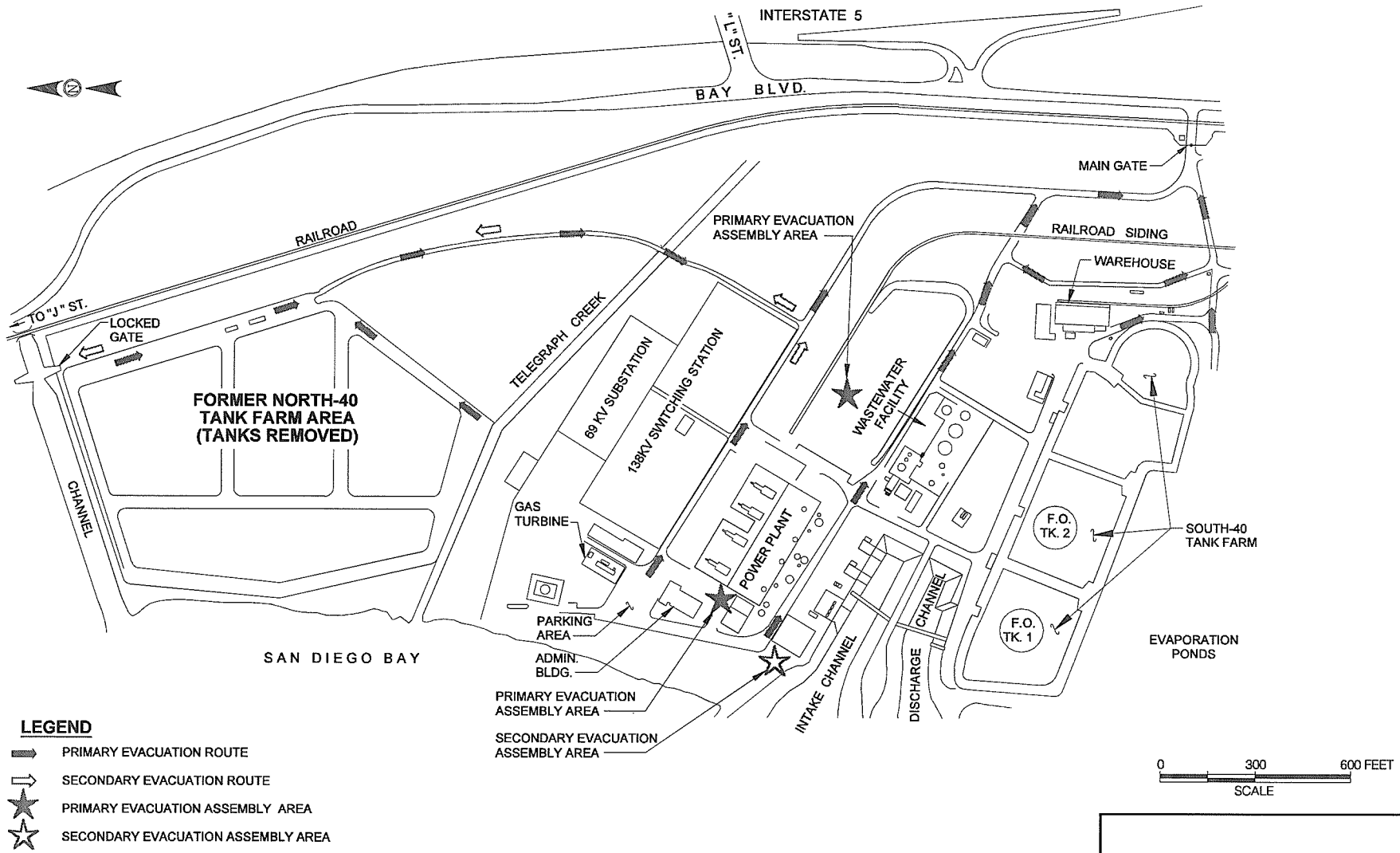
Evacuation Assembly Areas

Storm Drain Piping / Catch Basin



DATE: 5/05/00	Facility Location Map
REF: 0009.04.00058.02.00000	
FILE: Location.xar	
Duke Energy	South Bay Power Plant, Chula Vista, Ca. — Figure 1

99-3633PCP1-10 REV 03/09/05



LEGEND

- PRIMARY EVACUATION ROUTE
- SECONDARY EVACUATION ROUTE
- PRIMARY EVACUATION ASSEMBLY AREA
- SECONDARY EVACUATION ASSEMBLY AREA

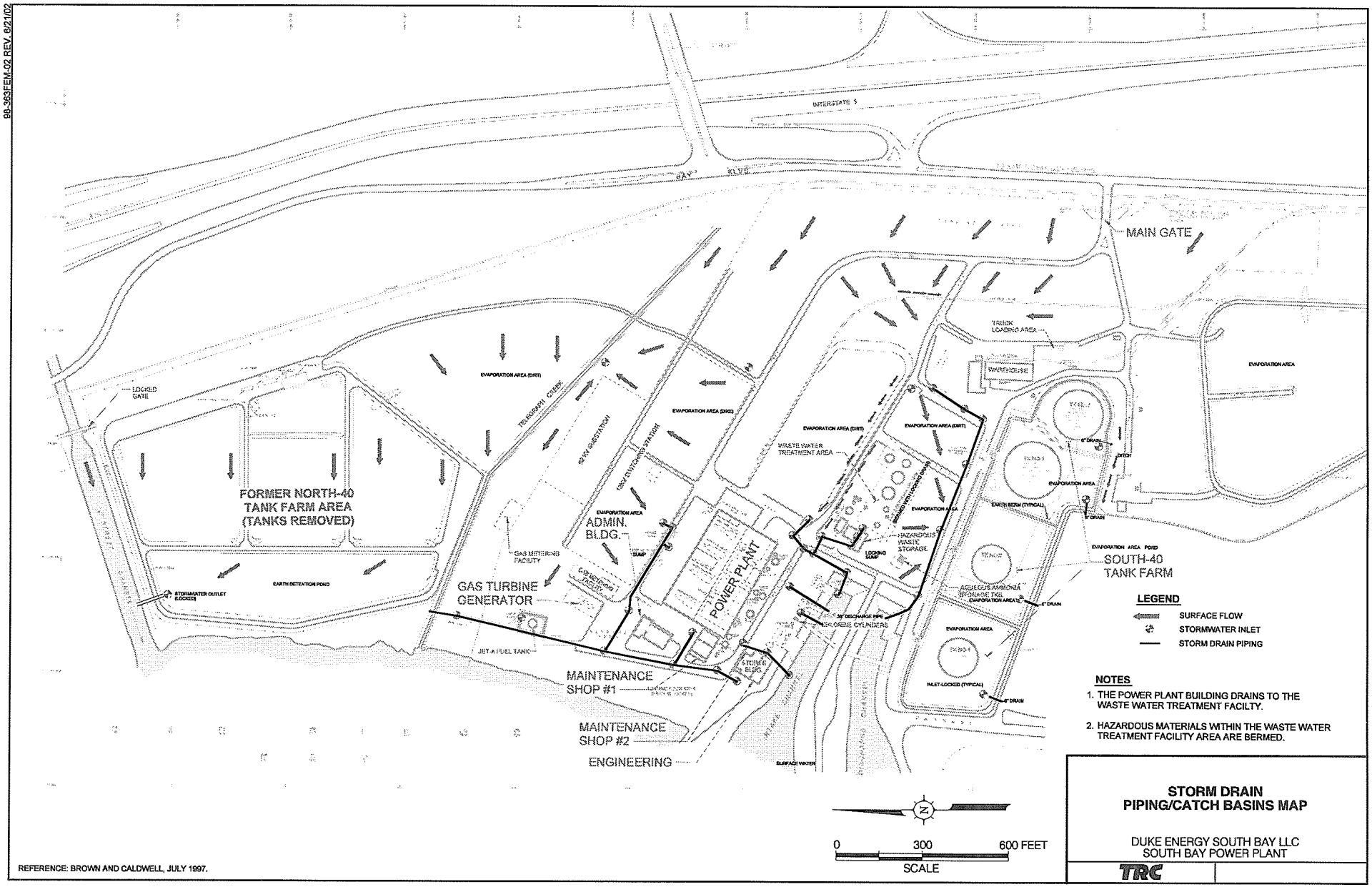
SOURCE: BASE MAP FROM DRAWING EP-4166 SHEET 1 OF 7, SAN DIEGO GAS AND ELECTRIC CO., SOUTH BAY POWER PLANT, REV. 10/29/96.

EVACUATION ROUTES

DUKE ENERGY SOUTH BAY LLC
SOUTH BAY POWER PLANT

TRC | FIGURE 2

98-363FEM-02 REV. 6/21/02



LEGEND

- SURFACE FLOW
- STORMWATER INLET
- STORM DRAIN PIPING

NOTES

1. THE POWER PLANT BUILDING DRAINS TO THE WASTE WATER TREATMENT FACILTY.
2. HAZARDOUS MATERIALS WITHIN THE WASTE WATER TREATMENT FACILITY AREA ARE BERMED.

REFERENCE: BROWN AND CALDWELL, JULY 1997.

STORM DRAIN PIPING/CATCH BASINS MAP

DUKE ENERGY SOUTH BAY LLC
SOUTH BAY POWER PLANT

TRC

TENTATIVE

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

TENTATIVE CLEANUP AND ABATEMENT ORDER NO. R9-2005-0126
FOR

- **NATIONAL STEEL AND SHIPBUILDING COMPANY**
- **SOUTHWEST MARINE, INC.**
- **CITY OF SAN DIEGO**
- **MARINE CONSTRUCTION AND DESIGN COMPANY AND CAMPBELL INDUSTRIES, INC.**
- **CHEVRON, A SUBSIDIARY OF CHEVRONTEXACO**
- **BP**
- **SAN DIEGO GAS AND ELECTRIC, A SUBSIDIARY OF SEMPRA ENERGY COMPANY**
- **UNITED STATES NAVY**

CONTAMINATED MARINE SEDIMENT IN SAN DIEGO BAY WITHIN AND ADJACENT TO SOUTHWEST MARINE, INC. AND NATIONAL STEEL AND SHIPBUILDING COMPANY LEASEHOLDS GENERALLY BETWEEN SAMPSON STREET EXTENSION AND MOUTH OF CHOLLAS CREEK

The California Regional Water Quality Control Board, San Diego Region (hereinafter Regional Board), finds that:

JURISDICTION

1. **WASTE DISCARGE.** Elevated levels of pollutants above San Diego Bay background conditions exist in the San Diego Bay bottom marine sediment within and adjacent to the National Steel and Shipbuilding Company (hereinafter "NASSCO") and Southwest Marine, Inc. (hereinafter "Southwest Marine) leaseholds (hereinafter collectively referred to as "Shipyard Sediment Site"), City of San Diego, Marine Construction and Design Company and Campbell Industries, Inc., Chevron, a subsidiary of ChevronTexaco, BP as the parent company and successor to Atlantic Richfield Company, San Diego Gas and Electric, a subsidiary of Sempra Energy Company, and the United States Navy have each caused or permitted the discharge of pollutants to the Shipyard Sediment Site resulting in the accumulation of pollutants in the marine sediment The concentrations of these pollutants causes or threatens to cause conditions of pollution, contamination, and nuisance in San Diego Bay that adversely affects three categories of beneficial uses Aquatic Life, Aquatic-

Dependent Wildlife, and Human Health.

PERSONS RESPONSIBLE

2. **NATIONAL STEEL AND SHIPBUILDING COMPANY (NASSCO), A SUBSIDIARY OF GENERAL DYNAMICS COMPANY.** The National Steel and Shipbuilding Company, a subsidiary of General Dynamics Company (hereinafter NASSCO) owns and operates a full service ship construction, modification, repair, and maintenance facility on 126 acres of tidelands property leased from the San Diego Unified Port District (SDUPD) on the eastern waterfront of central San Diego Bay at 2798 Harbor Drive in San Diego. Shipyard operations have been conducted at this site by NASSCO over San Diego Bay waters or very close to the waterfront since 1945. Shipyard facilities operated by NASSCO over the years at the Site have included concrete platens used for steel fabrication, a graving dock, shipbuilding ways, and berths on piers or land to accommodate the berthing of ships. An assortment of waste is generated at the facility including spent abrasive, paint, rust, petroleum products, marine growth, sanitary waste, and general refuse. NASSCO has caused or permitted pollutants from its shipyard operations, including metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc), butyl tin species, polychlorinated biphenyls (PCBs), polychlorinated triphenyls, (PCTs), polynuclear aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH), to be discharged to San Diego Bay in violation of waste discharge requirements prescribed by the Regional Board. NASSCO also deposited these pollutants in the catch basins and collection sumps associated with the on-site storm water conveyance system (SWCS), inside the SWCS, and other locations where they were discharged into San Diego Bay. Metals, butyl tin species, polychlorinated biphenyls (PCBs), polychlorinated triphenyls, (PCTs), and polynuclear aromatic hydrocarbons (PAHs) from NASSCO's shipyard operations have contributed to the accumulation of pollutants in the marine sediments at the Shipyard Sediment Site to levels which cause, and threaten to cause, conditions of pollution, contamination, and nuisance by exceeding applicable water quality objectives for toxic pollutants in San Diego Bay. Based on these considerations NASSCO is referred to as "Discharger(s)" in this Cleanup and Abatement Order.

3. **SOUTHWEST MARINE, INC. (SOUTHWEST MARINE).** Southwest Marine owns and operates a ship repair, alteration, and overhaul facility on approximately 27 acres of tidelands property leased from the San Diego Unified Port District (SDUPD) on the eastern waterfront of central San Diego Bay at the foot of Sampson Street in San Diego. Southwest Marine has conducted shipyard operations at this site over San Diego Bay waters or very close to the waterfront since 1979. Shipyard facilities operated by Southwest Marine over the years have included concrete platens used for steel fabrication, floating dry docks, and five piers. An assortment of waste is generated at the facility including spent abrasive, paint, rust, petroleum products, marine growth, sanitary waste, and general refuse. Southwest Marine has caused or permitted pollutants from its shipyard operations, including metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc), butyl tin species, polychlorinated biphenyls (PCBs), polychlorinated triphenyls, (PCTs), polynuclear aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH), to be discharged into San Diego Bay in

violation of waste discharge requirements prescribed by the Regional Board. NASSCO also deposited these pollutants in the catch basins and collection sumps associated with the on-site storm water conveyance system (SWCS), inside the SWCS, and other locations where they were discharged into San Diego Bay. Metals, butyl tin species, polychlorinated biphenyls (PCBs), polychlorinated triphenyls, (PCTs), and polynuclear aromatic hydrocarbons (PAHs) from Southwest Marine's shipyard operations have contributed to the accumulation of pollutants in the marine sediments at the Shipyard Sediment Site to levels which cause, and threaten to cause, conditions of pollution, contamination, and nuisance by exceeding applicable water quality objectives for toxic pollutants in San Diego Bay. Based on these considerations Southwest Marine is referred to as "Discharger(s)" in this Cleanup and Abatement Order

4. **CITY OF SAN DIEGO**. The City of San Diego owns and operates a municipal separate storm water conveyance system (MS4) through which it discharges pollutants commonly found in urban runoff to San Diego Bay subject to the terms and conditions of a NPDES Storm Water Permit. The City of San Diego has caused or permitted the discharge of urban storm water pollutants directly to San Diego Bay at the Shipyard Sediment Site, including metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc); total suspended solids, sediment (due to anthropogenic activities), petroleum products, and synthetic organics (pesticides, herbicides, and PCBs) through its SW4 (located on the Southwest Marine leasehold) and SW9 (located on the NASSCO leasehold) MS4 conduit pipes as well as other MS4 conduit pipes which historically discharged directly into the Shipyard Sediment Site. The City of San Diego has also caused or permitted the discharge of these urban storm water pollutants through its MS4 to Chollas Creek resulting in the exceedance of chronic and acute California Toxics Rule copper, lead and zinc criteria for the protection of aquatic life, in violation of waste discharge requirements prescribed by the Regional Board. U.S. Navy studies indicate that during storm events, Chollas Creek discharges sediment plumes, containing urban storm water pollutants, up to 2 kilometers into San Diego Bay, including the Shipyard Sediment Site. The urban storm water pollutants in the on-site and off-site MS4 discharges have contributed to the accumulation of pollutants in the marine sediments at the Shipyard Sediment Site to levels which cause, and threaten to cause, conditions of pollution, contamination, and nuisance by exceeding applicable water quality objectives for toxic pollutants in San Diego Bay. Based on these considerations the City of San Diego is referred to as "Discharger(s)" in this Cleanup and Abatement Order.

5. **MARINE CONSTRUCTION AND DESIGN COMPANY AND CAMPBELL INDUSTRIES, INC**. Marine Construction and Design Company (MARCO) and Campbell Industries, Inc. (Campbell) are the parent companies to the operators of San Diego Marine Construction Corp (SDMC). SDMC operated a ship repair, alteration, and overhaul facility on what is now the Southwest Marine leasehold at the foot of Sampson Street in San Diego from approximately the 1920s to 1979. Shipyard operations were conducted at this site by SDMC over San Diego Bay waters or very close to the waterfront. An assortment of waste was generated at the facility including spent abrasive, paint, rust, petroleum products, marine growth, sanitary waste, and general refuse. SDMC has caused or permitted pollutants from

its shipyard operations, including metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc), butyl tin species, polychlorinated biphenyls (PCBs), polychlorinated triphenyls, (PCTs), polynuclear aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH), to be discharged to San Diego Bay in violation of waste discharge requirements prescribed by the Regional Board. SDMC also deposited these pollutants in the catch basins and collection sumps associated with the on-site storm water conveyance system (SWCS), inside the SWCS, and other locations where they were discharged into San Diego Bay. Metals, butyl tin species, polychlorinated biphenyls (PCBs), polychlorinated triphenyls, (PCTs), and polynuclear aromatic hydrocarbons (PAHs) from SDMC's shipyard operations have contributed to the accumulation of pollutants in the marine sediments at the Shipyard Sediment Site to levels which cause, and threaten to cause, conditions of pollution, contamination, and nuisance by exceeding applicable water quality objectives for toxic pollutants in San Diego Bay. Based on these considerations Marine Construction and Design Company and Campbell Industries, Inc. are referred to as "Discharger(s)" in this Cleanup and Abatement Order

6. **CHEVRON, A SUBSIDIARY OF CHEVRONTEXACO.** Chevron owns and operates the Chevron Terminal, a bulk fuel storage facility currently located at 2351 East Harbor Drive in the City of San Diego. Fuel products containing petroleum hydrocarbons and related constituents such as polynuclear aromatic hydrocarbons (PAHs) have been stored at Chevron Terminal since the early 1900s at both the currently operating 7 million gallon product capacity upper tank farm and the closed 5 million gallon capacity lower tank farm. Storm water flows from Chevron Terminal enter a City of San Diego MS4 storm drain that terminates in San Diego Bay in the Shipyard Sediment Site approximately 300 feet south of the Sampson Street extension. Industry-wide operational practices, especially in the years prior to the State of California's passage of the Aboveground Petroleum Storage Act in 1990, often led to discharges from aboveground storage tank facilities such as the Chevron Terminal as a result of leaks and spills from tanks due to advanced age, defects in design or installation, human error, and equipment failure. Available records provide evidence of specific discharges of petroleum hydrocarbon pollutants from the Chevron Terminal facility to San Diego Bay at the Shipyard Sediment Site as a result of various spills and leaks in 1913, 1967 and 1973. Elevated concentrations of phase separated hydrocarbons (PSH) pollutants have also been found in soil and ground water at the upper and the former lower tank farm site. These pollutants may eventually migrate to San Diego Bay at the Shipyard Sediment Site via various preferential pathways. Chevron also discharges storm water runoff from Chevron Terminal to San Diego Bay at the Shipyard Sediment Site subject to the terms and conditions of the statewide Industrial NPDES Storm Water Permit. Monitoring reports submitted by Chevron during the years 1994 through 2004 indicate elevated levels of zinc, lead, cadmium, and copper are consistently present in the storm water discharge from the site. Based on these considerations Chevron caused or permitted the discharges of petroleum hydrocarbons, PAHs, zinc, lead, cadmium, and copper into San Diego Bay at the Shipyard Sediment Site, in violation of waste discharge requirements prescribed by the Regional Board. The discharges cited above have contributed to the accumulation of pollutants in the marine sediments at the Shipyard Sediment Site to levels which cause, and threaten to cause,

conditions of pollution, contamination, and nuisance by exceeding applicable water quality objectives for toxic pollutants in San Diego Bay. Accordingly Chevron is referred to as "Discharger(s)" in this Cleanup and Abatement Order.

7. **BP AS THE PARENT COMPANY AND SUCCESSOR TO ATLANTIC RICHFIELD COMPANY.** BP owns and operates the Atlantic Richfield Company (ARCO) Terminal, a bulk fuel storage facility with approximately 9 million gallons of capacity located at 2295 East Harbor Drive in the City of San Diego. Fuel products containing petroleum hydrocarbons and related constituents such as polynuclear aromatic hydrocarbons (PAHs) have been stored at ARCO Terminal since the early 1900s. ARCO owned and operated ancillary facilities include a wharf, fuel pier (currently Southwest Marine Pier 4), and a marine fueling station used for loading and unloading petroleum products, and fueling from 1925 to 1978, and five pipelines connecting the terminal to the pier and wharf in use from 1925 to 1978. Storm water flows from ARCO Terminal enter a City of San Diego MS4 storm drain that terminates in San Diego Bay in the Shipyard Sediment Site approximately 300 feet south of the Sampson Street extension. Industry-wide operational practices, especially in the years prior to the State of California's passage of the Aboveground Petroleum Storage Act in 1990, often led to discharges from aboveground storage tank facilities such as the ARCO Terminal due to leaks and spills from tanks due to advanced age, defects in design or installation, human error, and equipment failure. Similarly old fueling piers and pipelines were often the sources of releases and leaks due to the same factors. Available records provide evidence of specific discharges of petroleum hydrocarbon pollutants from the ARCO Terminal facility. Elevated concentrations of petroleum hydrocarbon pollutants have been found in soil and ground water at the ARCO Terminal. These pollutants may eventually migrate to San Diego Bay at the Shipyard Sediment Site via various preferential pathways. BP also discharges storm water runoff from ARCO Terminal to San Diego Bay at the Shipyard Sediment Site subject to the terms and conditions of the statewide Industrial NPDES Storm Water Permit. Monitoring reports submitted by BP during the years 2003, 2004, and 2005 indicate elevated levels of petroleum hydrocarbons (benzene, oil and grease) are present in the storm water discharge from the site. Prior to the early 1990s storm water was not analyzed prior to discharge. Based on these considerations BP caused or permitted the discharges of petroleum hydrocarbons into San Diego Bay at the Shipyard Sediment Site. The discharges cited above have contributed to the accumulation of pollutants in the marine sediments at the Shipyard Sediment Site to levels which cause, and threaten to cause, conditions of pollution, contamination, and nuisance by exceeding applicable water quality objectives for toxic pollutants in San Diego Bay. Accordingly Chevron is referred to as "Discharger(s)" in this Cleanup and Abatement Order.

8. **SAN DIEGO GAS AND ELECTRIC, A SUBSIDIARY OF SEMPRA ENERGY COMPANY.** San Diego Gas and Electric, a subsidiary of Sempra Energy Company (hereinafter SDG&E) owned and operated the Silvergate Power Plant along the north side of the Southwest Marine leasehold from approximately 1943 to the 1990s. SDG&E utilized an easement to San Diego Bay along Southwest Marine's north property boundary for the intake and discharge of cooling water via concrete tunnels at flow rates ranging from 120 to 180

million gallons per day. SDG&E operations included discharging waste to holding ponds above the tunnels near the Shipyard Sediment Sites. SDG&E has caused or permitted pollutants from its power plant operations, including chromium, iron, copper, total suspended solids, and petroleum hydrocarbons to San Diego Bay in violation of waste discharge requirements prescribed by the Regional Board. In addition, polychlorinated biphenyls (PCBs) are present in the location of the former waste holding ponds where it discharged or threatens to discharge to San Diego Bay at the location of the Shipyard Sediment Sites. Based on these considerations SDG&E is referred to as "Discharger(s)" in this Cleanup and Abatement Order.

9. **UNITED STATES NAVY.** The US Navy is referred to as "Discharger(s)" in this Cleanup and Abatement Order based on the following considerations:

   a. ***US Navy Floating Dry Dock and Dockside Discharges.*** Between the early 1950s through the early 1970s, the United States Navy (US Navy) owned and operated a floating dry dock (AFDL-37) located within the NASSCO leasehold that was used for naval vessel repair including solvent cleaning and degreasing of vessel parts and surfaces, abrasive blasting for paint removal and surface preparations, metal plating, and surface finishing and painting. The US Navy also used dockside space within the NASSCO leasehold for painting and scraping operations, which generate wastes that can be conveyed by water flows, become airborne (especially during dry blasting), or fall directly into receiving waters. Prevailing industry–wide shipyard operational practices in floating dry docks and adjacent work areas during the 1950s through the 1970s were not sufficient to adequately control or prevent pollutant discharges and often led to uncontrolled discharges of pollutants, including metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc), butyltin species, polychlorinated biphenyls (PCBs)/ polychlorinated triphenyls\(PCTs), polynuclear aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH). The types of pollutants found in elevated concentrations at the Shipyard Sediment Site (metals, butyltin species, polychlorinated biphenyls (PCBs)/ polychlorinated triphenyls\(PCTs), polynuclear aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH)) are associated with the characteristics of the waste the US Navy operations generated at the NASSCO site. Based on these considerations the US Navy caused or permitted the discharges of these pollutants into the Shipyard Sediment Site. The discharges cited above have contributed to the accumulation of pollutants in the marine sediments at the Shipyard Sediment Site to levels which cause, and threaten to cause, conditions of pollution, contamination, and nuisance by exceeding applicable water quality objectives for toxic pollutants in San Diego Bay.

   b. ***Naval Station San Diego Discharges.*** The US Navy also owns and operates a municipal separate storm water conveyance system (MS4) through which it discharges pollutants commonly found in urban runoff including metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc); total suspended solids, sediment (due to anthropogenic activities) petroleum products, and synthetic organics (pesticides,

herbicides, and PCBs) to Chollas Creek from its Naval Station San Diego facility located at 32nd Street and Harbor Drive in the City of San Diego. The US Navy has caused or permitted the discharge of these urban storm water pollutants through its MS4 to Chollas Creek contributing to exceedances of chronic and acute California Toxics Rule copper, lead and zinc criteria for the protection of aquatic life. U.S. Navy studies indicate that, during storm events, Chollas Creek discharges sediment plumes containing urban runoff pollutants up to 2 kilometers into San Diego Bay over an area including the Shipyard Sediment Site. Based on these considerations the US Navy caused or permitted the discharge of urban runoff pollutants into the Shipyard Sediment Site from its Naval Station San Diego facility. The off-site MS4 discharges cited above have contributed to the accumulation of pollutants in the marine sediments at the Shipyard Sediment Site to levels which cause, and threaten to cause, conditions of pollution, contamination, and nuisance by exceeding applicable water quality objectives for toxic pollutants in San Diego Bay.

FACTUAL BACKGROUND

10. **CLEAN WATER ACT SECTION 303(d) LIST**. The San Diego Bay shoreline between Sampson and 28th Streets is listed on the Clean Water Act 303(d) list for elevated levels of copper, mercury, polynuclear aromatic hydrocarbons (PAH), and polychlorinated biphenyls (PCB) in the marine sediment. These pollutants are impairing the aquatic life, aquatic-dependent wildlife, and human health beneficial uses designated for San Diego Bay. The Shipyard Sites occupy this shoreline.

11. **SEDIMENT QUALITY INVESTIGATION.** Unless otherwise explicitly stated, the Regional Board's finding and conclusions in this Cleanup and Abatement Order are based on the data and other technical information contained in the report prepared by NASSCO's and Southwest Marine's consultant, Exponent entitled *NASSCO and Southwest Marine Detailed Sediment Investigation, September 2003.*

AQUATIC LIFE BENEFICIAL USE IMPAIRMENT

12. **AQUATIC LIFE IMPAIRMENT.** Aquatic life beneficial uses designated for San Diego Bay are impaired due to the elevated levels of pollutants present in the marine sediment at the Shipyard Sediment Site. Aquatic life beneficial uses include: Estuarine Habitat (EST), Marine Habitat (MAR), and Migration of Aquatic Organisms (MIGR). This finding is based on the considerations described below in this *Impairment Of Aquatic Life Beneficial Uses* section of the Cleanup and Abatement Order.

13. **MULTIPLE LINES OF EVIDENCE.** There is no single method that measures the adverse effects of contaminated sediments at all times and to all organisms. The Regional Board used a multiple lines of evidence approach to assess the potential risks to aquatic life beneficial uses from pollutants at the Shipyard Sediment Site. The approach focused on measuring exposure and adverse effects to the benthic macroinvertebrate community and to fish.

Pollutant exposure and adverse effects to the benthic macroinvertebrate community were evaluated using sediment quality triad measurements, bioaccumulation analyses, and interstitial water (i.e., pore water) analyses. The Regional Board evaluated pollutant exposure and adverse effects to fish using fish histopathology analyses and analyses of polynuclear aromatic hydrocarbon (PAH) breakdown products in fish bile.

14. **SEDIMENT QUALITY TRIAD MEASURES.** The Regional Board used the sediment quality triad approach to evaluate potential risks to the benthic community from pollutants present in the Shipyard Sediment Site. The sediment quality triad provides a "weight-of-evidence" approach to sediment quality assessment by integrating synoptic measures of sediment chemistry, toxicity, and benthic community composition. All three measures provide complementary evidence for the degree of pollution-induced degradation in the benthic community.

15. **BASELINE SEDIMENT QUALITY CONDITIONS.** Implicit in evaluating if aquatic life impairments exist using the Sediment Quality Triad approach is the assumption that pollution in terms of sediment chemistry, toxicity, and benthic community structure is worse at the Shipyard Sediment Site than other areas in San Diego Bay used to define baseline conditions. The Regional Board selected a pool of reference stations in San Diego Bay to characterize the baseline condition (Baseline Pool). The pool of reference stations were sampled from three independent sediment quality investigations: (1) Southern California Bight 1998 Regional Monitoring Program (Bight 98), (2) 2001 Mouth of Chollas Creek and Mouth of Paleta Creek TMDL studies, and (3) 2001 NASSCO and Southwest Marine sediment investigation. Criteria for selecting acceptable reference stations included low levels of anthropogenic pollutant concentrations, locations remote from pollution sources, similar biological habitat to the Shipyard Sediment Site, sediment total organic carbon (TOC) and grain size profiles similar to the Shipyard Sediment Site, adequate sample size for statistical analysis, and sediment quality data comparability. The reference stations selected for the Baseline Pool are shown below.

Reference Stations Used To Establish Baseline Sediment Quality Conditions

2001 Chollas/Paleta Reference Station Identification Number	2001 NASSCO/Southwest Marine Reference Station Identification Number	1998 Bight'98 Reference Station Identification Number
2231	2231	2235
2243	2243	2241
2433	2433	2242
2441	2441	2243
2238		2256
		2257
		2258
		2260
		2265

16. **SEDIMENT QUALITY TRIAD RESULTS.** Based on the synoptic measures of sediment chemistry, toxicity, and benthic community composition at the Shipyard Sediment Site, the Regional Board categorized 14 of 30 triad sampling stations at the Shipyard Sediment Site as having sediment pollutant levels "likely" to adversely affect the health of the benthic community. The results of this analysis are summarized in the table below.

Results of the Sediment Quality Triad Approach

Site	Station	Sediment Chemistry(1)	Toxicity(2)	Benthic Community(3)	Weight-of-Evidence Category(4)
NASSCO	NA01	High	Low	Low	Possible
	NA03	High	Low	Low	Possible
	NA04	High	Low	Low	Possible
	NA05	High	Low	Low	Possible
	NA06	High	Low	Low	Possible
	NA07	High	Low	Low	Possible
	NA09	High	Moderate	Low	Likely
	NA11	High	Moderate	Low	Likely
	NA12	Moderate	Moderate	Low	Possible
	NA15	High	Low	Low	Possible
	NA16	High	Moderate	Low	Likely
	NA17	High	Low	Low	Possible
	NA19	High	Moderate	Low	Likely
	NA20	Moderate	Low	Moderate	Likely
	NA22	High	Moderate	Moderate	Likely
SWM	SW02	High	Low	Low	Possible
	SW03	High	Low	Low	Possible
	SW04	High	Low	Moderate	Likely
	SW08	High	Low	Low	Possible
	SW09	High	Low	Low	Possible
	SW11	High	Low	Low	Possible
	SW13	High	Moderate	Low	Likely
	SW15	High	Moderate	Low	Likely
	SW17	High	Moderate	Low	Likely
	SW18	High	Low	Low	Possible
	SW21	High	Low	Low	Possible
	SW22	High	Moderate	Low	Likely
	SW23	High	Moderate	Low	Likely
	SW25	High	Moderate	Low	Likely
	SW27	High	Moderate	Low	Likely

(1) Relative likelihood that the chemicals present in the sediment are adversely impacting organisms living in or on the sediment based on the comparison to sediment quality guidelines (e.g. Effects Range Medium (ERM), Sediment Quality Guideline Quotients (SQGQ)) and to the baseline condition.
(2) Relative likelihood of toxic effects based on the combined toxic response from three tests: amphipod survival, sea urchin fertilization, and bivalve development.

(3) Relative likelihood of benthic community degradation based on four metrics: total abundance, total number of species, Shannon-Wiener Diversity Index, and the Benthic Response Index.
(4) Relative likelihood that the health of the benthic community is adversely impacted based on the three lines of evidence: sediment chemistry, toxicity, and benthic community.

17. **BIOACCUMULATION.** The Regional Board evaluated initial laboratory bioaccumulation test data to ascertain the bioaccumulation potential of the sediment chemicals at the Shipyard Sediment Site. The bioaccumulation tests involved the exposure of the clam *Macoma nasuta* to site sediments for 28 days using the protocols specified by ASTM. *Macoma nasuta* was selected as the test species for the initial bioaccumulation testing because it is native to the West Coast and actively ingests surface sediments (likely to be the most direct route of exposure to pollutants that accumulate in tissues). Examination of the chemical concentrations in *Macoma nasuta* tissue relative to the pollutant concentrations in sediment indicates that bioaccumulation of chemical pollutants is occurring at the Shipyard Sediment Site. The data indicates for several chemical pollutants that concentrations in *Macoma nasuta* tissue increase in proportion to as chemical pollutant concentrations in sediment increase. Statistically significant relationships were found for arsenic, copper, lead, mercury, zinc, TBT, total PCBs, and HPAHs. These chemicals have a bioaccumulation potential at the Shipyard Sediment Site and are therefore considered bioavailable to benthic organisms. No statistically significant relationships were found for cadmium, chromium, nickel, selenium, silver, or PCTs.

18. **PORE WATER.** The Regional Board evaluated the chemistry of pore water, the water occupying the spaces between sediment particles, at the Shipyard Sediment Site to determine the potential risks to the benthic community from pollutants present in the sediment. Pore water chemistry concentrations at the site were compared to water quality criteria established in the California Toxics Rule contained in 40 CFR 131.38. Comparisons were made to the criterion continuous concentration, which is the highest concentration of a pollutant to which aquatic life can be exposed for an extended period of time without deleterious effects. Of the 12 site stations sampled for pore water (SW02 was excluded due to the presence of some suspended material remaining after centrifugation), 12 stations exceeded the copper CTR value, 6 stations exceeded the lead CTR value, and 12 stations exceeded the total PCBs CTR value. Although the comparisons to the CTR criteria identified several pollutants for which measured pore water concentrations are above levels of concern, the measured pore water concentrations may be biased high due to the possible presence of very fine suspended or colloidal material in the pore water samples that could not be removed by centrifugation. The pore water samples collected at the Shipyard Sediment Site were not filtered (in accordance with EPA guidance) and were reported as total concentrations, whereas the CTR values are filtered and are reported as dissolved fractions.

Comparison of Pore Water Concentrations at the Shipyard Sediment Site to CTR Water Quality Criteria

Station	Metals and PCBs (ug/L)								
	As	Cd	Cr (VI)	Cu	Pb	Ni	Se	Zn	PCBs (sum of homologs)
NA01	19	0.05	25	14	5.2	2.3	5.2	23	68
NA06	9.1	0.05	25	33	12	2.2	2.5	44	200
NA13	12	0.05	25	14	6.5	2.5	2.5	30	56
NA16	17	0.05	25	22	9	2.7	2.5	33	94
NA17	20	0.05	25	23	7	2.9	2.5	32	84
SW01	6.1	0.05	25	17	6.6	3	2.5	22	500
SW02 (outlier)	11	4.2	25	390	120	37	6.1	610	51,600
SW04	15	0.05	25	55	20	3.3	2.5	60	600
SW08	9.9	0.05	25	33	12	2	2.5	34	520
SW12	19	0.05	25	17	7.1	2.8	2.5	32	80
SW24	10	0.05	25	25	9.8	2.6	2.5	37	670
SW25	17	0.05	25	28	13	2.9	2.5	42	180
SW28	9	0.05	25	19	7.5	2.4	2.5	31	290

Note: Boxed and shaded values for Shipyard Sediment Site locations exceed CTR water quality criteria.

19. **FISH HISTOPATHOLOGY.** The Regional Board evaluated fish histopathology data to determine the potential exposure and associated adverse effects of fish to chemical pollutants present within and adjacent to the Shipyard Sediment Site. A total of 253 spotted sand bass were examined for various histopathological lesions. These spotted sand bass were collected from four discrete assessment units at the Shipyard Sediment Site and at a reference area located across San Diego Bay near Reference Station 2240. The fish histopathology data indicates a total of 70 types of histopathological lesions were found in the spotted sand bass. Of the 70 types of lesions found, only four lesions exhibited statistically significant elevations relative to reference conditions. However, a fifth lesion (i.e., abundant hemosiderin in liver) was considered important by the pathologist and was nearly statistically significant for the purposes of this study. The five lesions and their severity with respect to reference conditions are summarized below.

Summary of Microscopic and Macroscopic Lesions Significantly Elevated Relative to Reference Conditions

		Prevalence of Lesions (percent)				
		NASSCO		Southwest Marine		Reference Area
Lesion	Severity Scores	Inside	Outside	Inside	Outside	
Microscopic						
Liver						

		Prevalence of Lesions (percent)				
		NASSCO		Southwest Marine		Reference Area
Lesion	**Severity Scores**	**Inside**	**Outside**	**Inside**	**Outside**	
Abundant Lipofuscin	0 – None	**74**	92	**75**	88	96
	1 – Mild	**12**	6	**6**	12	4
	2 – Moderate	**2**	2	**8**	0	0
	3 – Severe	**12**	0	**12**	0	0
Abundant Hemosiderin	0 – None	98	**78**	98	80	94
	1 – Mild	2	**22**	2	20	6
	2 – Moderate	0	**0**	0	0	0
	3 – Severe	0	**0**	0	0	0
Cholangitis /Biliary Hyperplasia	0 – None	**66**	76	80	80	88
	1 – Mild	**28**	24	14	20	12
	2 – Moderate	**6**	0	6	0	0
	3 – Severe	**0**	0	0	0	0
Kidney						
Nephritis	0 – None	**48**	66	76	66	75
	1 – Mild	**48**	32	22	32	25
	2 – Moderate	**4**	2	0	2	0
	3 – Severe	**0**	0	2	0	0
Macroscopic						
Gill						
Shiny Gill Foci	0 – None	12	10	**0**	0	10
	1 – Mild	62	81	**0**	70	69
	2 – Moderate	24	8	**100**	28	20
	3 – Severe	2	0	**0**	2	2

Note: Boxed and shaded values indicate results significantly different relative to reference values.

Of the five lesions identified as significantly elevated with respect to reference conditions, none has been identified in other scientific field studies as being associated with sediment pollutant exposure. Scientific literature describing lesions that are potential biomarkers of environmental stressors in fish does not attribute causation of liposuscin, hemosiderin, cholangitis/biliary hyperplasia, nephritis, and shiny gill foci to pollution-related factors. It is plausible that the five lesions could have been caused by naturally occurring environmental factors such as infectious parasites. Based on these considerations the fish histopathology data does not indicate that the fish lesions observed in the data set can be conclusively attributed to pollutant exposure at the Shipyard Sediment Site

20. **FISH BILE.** The Regional Board evaluated fish bile to determine the potential exposure of fish to PAH compounds within and adjacent to the Shipyard Sediment Site. PAH breakdown products were detected in bile of spotted sand bass captured inside and outside of the Shipyard Sediment Site, and within a reference area located across the bay from the shipyard sites near Reference Station 2240. The bile breakdown products include naphthalene, phenanthrene, and benzo[a]pyrene. Of the three breakdown products, two exhibited statistically significant elevations relative to reference conditions in spotted sand bass collected immediately outside of the Shipyard Sediment Site. No bile breakdown products were significantly elevated relative to reference conditions in spotted sand bass collected inside of the Shipyard Sediment Site. These results indicate that fish at the Shipyard Sediment Site are no more greatly exposed to PAH compounds than fish at the reference area in San Diego Bay.

Summary of Bile PAH Breakdown Products Significantly Elevated Relative to Reference Conditions

		NASSCO		Southwest Marine	
	Reference Area	Inside	Outside	Inside	Outside
Naphthalene Metabolites (ug/mg protein)					
Mean	79	74.5	84.2	68.9	74
Standard Deviation	27.4	45.7	24.8	11.2	25.5
Minimum	58	26	64	55	49
Maximum	150	160	150	96	130
95% Upper Confidence Limit	89.5	--	--	--	--
Phenanthrene Metabolites (ug/mg protein)					
Mean	12.8	13.6	**26.7**	13.9	18.9
Standard Deviation	4.7	7.4	7.8	1.9	3.1
Minimum	7.1	5.7	20	11	14
Maximum	25	28	46	18	25
95% Upper Confidence Limit	14.6	--	--	--	--
Benzo[a]pyrene Metabolites (ug/mg protein)					
Mean	2.1	2.9	**5.3**	1.7	**6.0**
Standard Deviation	1.2	1.6	2.1	0.9	1.6
Minimum	0.7	0.5	2.7	0.7	2.8
Maximum	4.6	6	9.8	3.7	8.5
95% Upper Confidence Limit	2.8	--	--	--	--

Note: Boxed and shaded values indicate results significantly greater than reference values (i.e., site mean greater than reference using 95% upper confidence limit on the mean).

21. **INDICATOR SEDIMENT CHEMICAL.** The Regional Board evaluated the relationships between sediment chemicals and biological responses to identify indicator chemicals (i.e., chemicals of potential concern) that may be impacting aquatic life. A two-step process was conducted. The first step in the selection of indicator chemicals was to identify chemicals representative of the major classes of sediment pollutants: metals, butyltins, PCBs and PCTs, PAHs, and petroleum hydrocarbons. The second step was the evaluation of relationships between these chemicals and biological responses. Results of the three toxicity tests, benthic community assessment, and bioaccumulation testing conducted in Phase 1 of the Shipyard study were all used to evaluate the potential of such relationships. Chemicals were selected as indicator chemicals if they had any statistically significant relationship with amphipod mortality, echinoderm fertilization, bivalve development, total benthic macroinvertebrate abundance, total benthic macroinvertebrate richness, or tissue chemical concentrations in *Macoma nasuta*. Chemicals selected as indicator chemicals include arsenic, copper, lead, mercury, zinc, TBT, total PCB homologs, diesel range organics (DRO), and residual range organics (RRO).

AQUATIC-DEPENDENT WILDLIFE BENEFICIAL USES IMPAIRMENT

22. **AQUATIC-DEPENDENT WILDLIFE IMPAIRMENT.** Aquatic-dependent wildlife beneficial uses designated for San Diego Bay are impaired due to the elevated levels of pollutants present in the marine sediment at the Shipyard Sites. Aquatic-dependent wildlife beneficial uses include: Wildlife Habitat (WILD), Preservation of Biological Habitats of Special Significance (BIOL), and Rare, Threatened, or Endangered Species (RARE). This finding is based on the considerations described below in the *Impairment Of Aquatic-Dependent Wildlife Beneficial Uses* section of the Cleanup and Abatement Order.

23. **RISK ASSESSMENT APPROACH.** The Regional Board evaluated potential risks to aquatic-dependent wildlife from pollutants present in the sediments at the Shipyard Sediment Site based on a two-tier approach. This approach used an area use factor (AUF) of 1 and other conservative assumptions. The Tier I screening level risk assessment was based on tissue data derived from the exposure of the clam *Macoma nasuta* to site sediments for 28 days using the protocols specified by American Society of Testing Material (ASTM). The Tier II comprehensive risk assessment was based on tissue data derived from resident fish and shellfish caught within and adjacent to the Shipyard Sediment Site. The key receptors of concern considered in both tiers include:

    a. Aquatic-Dependent Birds - California least tern (*Sterna antillarum brownie*), California brown pelican (*Pelecanus occidentalis californicus*), Surf scoter (*Melanitta perspicillata*), and Western grebe (*Aechmophorus occidentalis*);

    b. Marine Mammals - California sea lion (*Zalophus californianus*);

    c. Marine Reptiles - East Pacific green turtle (*Chelonia mydas agassizii*); and

d. Submerged Aquatic Plants - Eelgrass (*Zostera marina*)

24. **TIER I SCREENING LEVEL RISK ASSESSMENT.** The Tier I objective was to determine whether or not Shipyard Sediment Site conditions pose a potential unacceptable risk to aquatic-dependent wildlife receptors of concern and to identify whether a comprehensive, site-specific risk assessment was warranted (i.e., Tier II).[1] Potential risks were characterized by: (1) applying the hazard quotient (HQ) approach using *Macoma nasuta* tissue data from the bioaccumulation tests, and (2) comparing *Macoma nasuta* tissue concentrations from the shipyard sites to *Macoma nasuta* tissue concentrations from baseline conditions. Based on the Tier I results, the Regional Board identified six of nine Shipyard Sediment Site stations with *Macoma nasuta* tissue data as "likely" risks to the receptors of concern; thus requiring a Tier II risk assessment. The chemical pollutants of concern targeted for further study included arsenic, copper, lead, zinc, benzo[a]pyrene, and total PCBs.

Summary of Tier I Screening Level Risk Assessment Results

Station	Receptors "Likely" at Risk					Contaminants Posing "Likely" Risk to Receptors
	Brown Pelican	Least Tern	Sea Lion	Surf Scoter	Western Grebe	
NA06	X	X		X	X	Lead
SW04			X			Arsenic
	X	X		X	X	Copper, Lead
	X	X	X	X	X	Zinc
		X				Benzo[a]pyrene
SW08	X	X		X	X	Lead
		X				Zinc
		X				Benzo[a]pyrene, PCBs
SW13	X	X		X	X	Copper
		X				Zinc
	X	X				PCBs
SW21	X	X		X	X	Lead
		X				Zinc, Benzo[a]pyrene
	X	X				PCBs
SW28		X				Zinc, PCBs

Note: The East Pacific green turtle and eelgrass were not included in the analysis due to the lack of specific exposure parameters and toxicity reference values for these receptors of concern.

25. **TIER II COMPREHENSIVE RISK ASSESSMENT.** The Tier II objective was to more conclusively determine whether or not Shipyard Sediment Site conditions pose an unacceptable risk to aquatic-dependent wildlife receptors of concern. The Tier II baseline risk assessment was based on tissue measurements from prey items collected from four discrete

[1] Potential risks were characterized by (1) applying the hazard quotient (HQ) approach using *Macoma nasuta* tissue data from the bioaccumulation tests, and (2) comparing *Macoma nasuta* tissue concentrations from the shipyard sites to *Macoma nasuta* tissue concentrations from baseline conditions.

assessment units at the Shipyard Sediment Site and from a reference area located across San Diego Bay . The prey items collected from these areas included topsmelt (*Atherinops affinis*), anchovies (*Engraulis mordax*), spotted sand bass (*Paralabrax masculatofasciatus*), benthic mussels (*Musculista senhousi*), and eelgrass (*Zostera marina*). Although the Tier I screening level risk assessment identified only six chemicals as "likely" risks to receptors of concern, all chemicals of potential concern were analyzed in the Tier II baseline risk assessment.[2] The Regional Board evaluated the Tier II risk assessment results and concluded that ingestion of the prey items caught within all four assessment units at the Shipyard Sediment Site poses a theoretical risk to all receptors of concern (excluding the East Pacific green turtle). The primary contaminants contributing to the cumulative cancer risk using the toxicity reference values (TRVs) developed by U.S. EPA Region 9 Biological Technical Assistance Group (BTAG) include lead, mercury, and selenium. Because BTAG TRVs were not available for benzo[a]pyrene and chromium, no-observed-adverse-effect level (NOAEL) TRVs were used as a substitute to determine the potential adverse effects from these chemicals of concern. Based on the risk results using the NOAEL TRVs, benzo[a]pyrene and chromium are also considered primary contaminants contributing to the cumulative cancer risk.

Summary of Tier II Baseline Risk Assessment Results using the BTAG TRVs

Assessment Unit	BTAG Low	Cumulative Risk			Primary Contaminant Drivers (% Contribution to cumulative risk)
		> 1	> Reference	Risk	
Inside NASSCO Leasehold	Brown Pelican	Yes	Yes	Yes	Lead (71%)
	Least Tern	Yes	Yes	Yes	Lead (81%)
	Sea Lion	Yes	Yes	Yes	Selenium (36%) Mercury (24%)
	Surf Scoter	Yes	Yes	Yes	Lead (91%)
	Western Grebe	Yes	Yes	Yes	Lead (89%)
Outside NASSCO Leasehold	Brown Pelican	Yes	Yes	Yes	Lead (74%)
	Least Tern	Yes	Yes	Yes	Lead (74%)
	Sea Lion	Yes	Yes	Yes	Selenium (35%) Mercury (24%)
	Western Grebe	Yes	Yes	Yes	Lead (85%)
Inside Southwest Marine Leasehold	Brown Pelican	Yes	Yes	Yes	Lead (74%)
	Least Tern	Yes	Yes	Yes	Lead (85%)
	Sea Lion	Yes	Yes	Yes	Selenium (42%) Mercury (17%)
	Surf Scoter	Yes	Yes	Yes	Lead (94%)
	Western Grebe	Yes	Yes	Yes	Lead (90%)

[2] Tier II risks were characterized by quantifying the cumulative risks at each of the four assessment units described above for each of the receptors of concern and then comparing those risks to the cumulative risks quantified for each of the receptors of concern at the reference area. An assessment unit was classified as a risk to a receptor of concern when the cumulative risk exceeded both the Hazard Quotient of 1 and reference risk levels.

Assessment Unit	BTAG Low	Cumulative Risk			Primary Contaminant Drivers (% Contribution to cumulative risk)
		> 1	> Reference	Risk	
Outside Southwest Marine Leasehold	Brown Pelican	Yes	Yes	Yes	Lead (71%)
	Least Tern	Yes	Yes	Yes	Lead (78%)
	Sea Lion	Yes	Yes	Yes	Selenium (31%) Mercury (26%)
	Western Grebe	Yes	Yes	Yes	Lead (87%)

Note: The East Pacific green turtle was not included in the analysis due to the lack of specific exposure parameters and toxicity reference value.

Summary of Tier II Baseline Risk Assessment Results using the NOAEL TRVs (for benzo[a]pyrene and chromium)

Assessment Unit	NOAEL HQ	Cumulative Risk			Primary Contaminant Drivers (% Contribution to cumulative risk)
		> 1	> Reference	Risk	
Inside NASSCO Leasehold	Brown Pelican	Yes	Yes	Yes	Mercury (49%) PCBs (23%)
	Least Tern	Yes	No	No	Not applicable
	Sea Lion	Yes	Yes	Yes	PCBs (49%) Arsenic (30%)
	Surf Scoter	Yes	Yes	Yes	BAP (32%) Chromium (21%)
	Western Grebe	Yes	Yes	Yes	Chromium (23%) Mercury (21%) PCBs (19%) BAP (17%)
Outside NASSCO Leasehold	Brown Pelican	Yes	Yes	Yes	Mercury (53%)
	Least Tern	Yes	No	No	Not applicable
	Sea Lion	No	No	No	Not applicable
	Western Grebe	No	No	No	Not applicable
Inside Southwest Marine Leasehold	Brown Pelican	Yes	Yes	Yes	Mercury (39%) PCBs (23%)
	Least Tern	Yes	Yes	Yes	PCBs (28%) BAP (22%) Mercury (18%)
	Sea Lion	Yes	Yes	Yes	PCBs (49%) Arsenic (31%)
	Surf Scoter	Yes	Yes	Yes	BAP (57%)
	Western Grebe	Yes	Yes	Yes	BAP (26%) PCBs (21%) Mercury (17%)
Outside Southwest	Brown Pelican	Yes	Yes	Yes	Mercury (55%) PCBs (19%)

Assessment Unit	NOAEL HQ	Cumulative Risk			Primary Contaminant Drivers (% Contribution to cumulative risk)
		> 1	> Reference	Risk	
Marine Leasehold	Least Tern	Yes	Yes	Yes	PCBs (27%) Mercury (24%) BAP (16%)
	Sea Lion	No	No	No	Not applicable
	Western Grebe	Yes	Yes	Yes	Mercury (23%) PCBs (22%) Chromium (17%)

Note: The East Pacific green turtle was not included in the analysis due to the lack of specific exposure parameters and toxicity reference value.

HUMAN HEALTH BENEFICIAL USES IMPAIRMENT

26. **HUMAN HEALTH IMPAIRMENT.** Human health beneficial uses designated for San Diego Bay are impaired due to the elevated levels of pollutants present in the marine sediment at the Shipyard Sediment Site. Human health beneficial uses include: Contact Water Recreation (REC-1), Non-contact Water Recreation (REC-2), Shellfish Harvesting (SHELL), and Commercial and Sport Fishing (COMM). This finding is based on the considerations described below in this *Impairment Of Human Health Beneficial Uses* section of the Cleanup and Abatement Order.

27. **RISK ASSESSMENT APPROACH.** The Regional Board's assessment of potential human health risks from pollutants present in the Shipyard Sediment Site was based on a two-tier approach. This approach used a fractional intake (FI) of 1 and other conservative assumptions. The Tier I screening level risk assessment was based on tissue data derived from the exposure of the clam *Macoma nasuta* to site sediments for 28 days using American Society of Testing Material (ASTM) protocols. The Tier II comprehensive risk assessment was based on tissue data derived from resident fish and shellfish caught within and adjacent to the Shipyard Sediment Site. Two types of receptors (i.e., members of the population or individuals at risk) were evaluated:

    a. Recreational Anglers – Persons who eat the fish and/or shellfish they catch recreationally; and

    b. Subsistence Anglers – Persons who fish for food, for economic and/or cultural reasons, and for whom the fish and/or shellfish caught is a major source of protein in their diet.

28. **TIER I SCREENING LEVEL RISK ASSESSMENT.** The Tier I objectives were to determine whether or not Shipyard Sediment Site conditions pose a potential unacceptable risk to recreational and subsistence anglers, and to identify whether a comprehensive, site-specific risk assessment was warranted (i.e., Tier II). Tier I was based on clam (*Macoma nasuta*) tissue concentrations derived from 28-day laboratory bioaccumulation tests.

Potential risks were characterized by comparing *Macoma nasuta* tissue concentrations from nine Shipyard Sediment Site stations to:

a. Tissue residue guidelines published by the California Office of Environmental Health Hazard, and

b. The 95% upper prediction limits (UPL) calculated from the Baseline Pool *Macoma nausta* tissue concentrations.

A Shipyard Sediment Site station was classified as a "possible" risk when one or more chemicals in the *Macoma nasuta* tissue exceeded both the TRGs and the 95% UPL thresholds. Based on the Tier I results, the Regional Board concluded that *Macoma nasuta* tissue data at eight of nine shipyard stations with *Macoma nasuta* tissue data were at levels that constituted a "possible" human health risk, subject to confirmation in a Tier II human health risk assessment study. The chemical pollutants of concern found to pose a "possible" cancer risk to both recreational and subsistence anglers include inorganic arsenic, benzo[a]pyrene, and total PCBs; tributyltin was determined to be a "possible" cancer risk to subsistence anglers only. PCBs were found to pose a "possible" non-cancer risk to both recreational and subsistence anglers; inorganic arsenic was found to pose a "possible" non-cancer risk to subsistence anglers.

Summary of Tier I Screening Level Risk Assessment Results for Recreational Anglers

Station	Contaminants Posing "Possible" Cancer Risk	Contaminants Posing "Possible" Non-Cancer Risk
NA06	PCBs, benzo[a]pyrene	PCBs
NA11	benzo[a]pyrene	None
NA20	benzo[a]pyrene	None
SW04	PCBs, benzo[a]pyrene, inorganic arsenic	PCBs
SW08	PCBs, benzo[a]pyrene	PCBs
SW13	PCBs, benzo[a]pyrene	PCBs
SW21	PCBs, benzo[a]pyrene	PCBs
SW28	PCBs, benzo[a]pyrene	PCBs

Summary of Tier I Screening Level Risk Assessment Results for Subsistence Anglers

Station	Contaminants Posing "Possible" Cancer Risk	Contaminants Posing "Possible" Non-Cancer Risk
NA06	PCBs, benzo[a]pyrene	PCBs
NA11	benzo[a]pyrene	None
NA20	benzo[a]pyrene	None
SW04	PCBs, tributyltin, benzo[a]pyrene, norganic arsenic	PCBs, inorganic arsenic
SW08	PCBs, tributyltin, benzo[a]pyrene	PCBs
SW13	PCBs, benzo[a]pyrene	PCBs
SW21	PCBs, benzo[a]pyrene	PCBs

SW28	PCBs, benzo[a]pyrene	PCBs

29. **TIER II COMPREHENSIVE RISK ASSESSMENT.** The Tier II objective was to more conclusively determine whether Shipyard Sediment Site conditions posed an unacceptable human health risk. The Tier II human health risk assessment was based on tissue measurements from fish and shellfish collected from four discrete assessment units within and adjacent to the shipyard leaseholds: inside NASSCO, outside NASSCO, inside Southwest Marine, and outside Southwest Marine. Additionally, fish and shellfish were collected from a reference area located across the bay from the Shipyard Sediment Site. The fish and shellfish included spotted sand bass (*Paralabrax masculatofasciatus*) and spiny lobsters (*Panulirus interruptus*), respectively. While the Tier I screening level risk assessment identified only four chemicals as "possible" risks to the recreational and subsistence anglers (inorganic arsenic, benzo[a]pyrene, tributyltin, and PCBs), all chemicals of potential concern were analyzed in the Tier II human health risk assessment.[3] The Regional Board evaluated the Tier II risk assessment results and concluded that ingestion of spotted sand bass (whole body and fillet) and lobster (edible tissue only) caught within all four assessment units at the Shipyard Sediment Site poses a theoretical increased cancer risk, greater than one-in-a-million ($1x10^{-6}$) and greater than reference, to both the recreational and subsistence anglers. The primary contaminants contributing to the cumulative cancer risk include inorganic arsenic, benzo[a]pyrene, and total PCBs. Ingestion of spotted sand bass (whole body and fillet) and lobster (whole body and edible tissue) caught within all four assessment units at the Shipyard Sediment Site poses theoretical non-cancer risk, greater than the hazard index threshold of 1.0 and reference risk levels, to both the recreational and subsistence anglers. The primary contaminants contributing to the cumulative non-cancer risk include copper, total mercury, and total PCBs.

Summary of Tier II Risk Assessment Results for Recreational and Subsistence Anglers (Cumulative Cancer Risk)

Assessment Unit		Cumulative Cancer Risk			Primary Contaminant Drivers (% contribution to cumulative risk)
		> 1x10^-6	> Reference	Cancer Risk	
Inside NASSCO Leasehold	Whole Body Sand Bass	Yes	Yes	Yes	PCBs (97%)
	Fillet Sand Bass	Yes	Yes	Yes	PCBs (38%) BAP (25%)
	Whole Body Lobster	Yes	No	No	Not applicable

[3] Tier II risks were characterized by quantifying the cumulative cancer risks and cumulative non-cancer hazard index at each of the four assessment units described above and then comparing those risks to the cumulative cancer risks and cumulative non-cancer hazard index quantified at the reference area. An assessment unit was classified as a cancer risk to recreational or subsistence anglers when the cumulative risk exceeded both the target risk level of $1x10^{-6}$ and reference risk levels. An assessment unit was classified as a non-cancer risk to recreational or subsistence anglers when the cumulative hazard index exceeded both the hazard index threshold of 1.0 and reference risk levels.

Assessment Unit		Cumulative Cancer Risk			Primary Contaminant Drivers (% contribution to cumulative risk)
		> 1x10^-6	> Reference	Cancer Risk	
	Edible Tissue Lobster	Yes	Yes	Yes	Inorganic arsenic (84%)
Outside NASSCO Leasehold	Whole Body Sand Bass	Yes	Yes	Yes	PCBs (88%)
	Fillet Sand Bass	Yes	Yes	Yes	PCBs (42%) BAP (22%)
Inside Southwest Marine Leasehold	Whole Body Sand Bass	Yes	Yes	Yes	PCBs (96%)
	Fillet Sand Bass	Yes	Yes	Yes	PCBs (84%)
	Whole Body Lobster	Yes	No	No	Not applicable
	Edible Tissue Lobster	Yes	Yes	Yes	Inorganic arsenic (63%) PCBs (20%)
Outside Southwest Marine Leasehold	Whole Body Sand Bass	Yes	Yes	Yes	PCBs (93%)
	Fillet Sand Bass	Yes	Yes	Yes	PCBs (62%) BAP (17%)

Summary of Tier II Risk Assessment Results for Recreational and Subsistence Anglers (Cumulative Non-Cancer Risk)

Assessment Unit		Cumulative Non-Cancer Risk			Primary Contaminant Drivers (% contribution to cumulative risk)
		> 1	> Reference	Non-Cancer Risk	
Inside NASSCO Leasehold	Whole Body Sand Bass	Yes	Yes	Yes	PCBs (98%)
	Fillet Sand Bass	Yes	No	No	Not applicable
	Whole Body Lobster	Yes	Yes	Yes	PCBs (55%) Copper (26%)
	Edible Tissue Lobster	Yes	Yes	Yes	Total Mercury (75%)
Outside NASSCO Leasehold	Whole Body Sand Bass	Yes	Yes	Yes	PCBs (92%)
	Fillet Sand Bass	Yes	No	No	Not applicable
Inside Southwest Marine Leashold	Whole Body Sand Bass	Yes	Yes	Yes	PCBs (97%)
	Fillet Sand Bass	Yes	Yes	Yes	PCBs (89%)
	Whole Body Lobster	Yes	Yes	Yes	PCBs (52%) Copper (27%)
	Edible Tissue Lobster	Yes	Yes	Yes	PCBs (64%) Total mercury (22%)

Assessment Unit		Cumulative Non-Cancer Risk			Primary Contaminant Drivers (% contribution to cumulative risk)
		> 1	> Reference	Non-Cancer Risk	
Outside Southwest Marine Leashold	Whole Body Sand Bass	Yes	Yes	Yes	PCBs (96%)
	Fillet Sand Bass	Yes	Yes	Yes	PCBs (73%) Total mercury (25%)

CLEANUP TO BACKGROUND SEDIMENT QUALITY CONDITIONS

30. **RESOLUTION 92-49.** The Regional Board must apply State Water Resources Control Board Resolution 92-49 (hereinafter Resolution 92-49), *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under California Water Code §13304* when setting cleanup levels for contaminated marine sediments if such sediments threaten beneficial uses of the waters of the state, and the contamination or pollution is the result of a discharge of waste. In applications dealing with cleanup of contaminated marine sediments Resolution 92-49 is interpreted to require cleanup to background sediment quality unless it is technologically[4] or economically[5] infeasible to do so.

31. **BACKGROUND SEDIMENT QUALITY.** The Regional Board derived sediment chemistry levels for use in evaluating the feasibility of cleanup to background sediment quality conditions from the pool of San Diego Bay reference stations as described in Finding 15. The background sediment chemistry levels at these reference stations are described below.

Background Sediment Chemistry Levels

Chemical	Units (dry weight)	Background Sediment Chemistry Levels (1)
Metals		
Arsenic	mg/kg	7.5
Cadmium	mg/kg	0.33
Chromium	mg/kg	57
Copper	mg/kg	121
Lead	mg/kg	53
Mercury	mg/kg	0.57
Nickel	mg/kg	15

[4] Technological feasibility is determined by assessing available technologies, which have been shown to be effective in reducing the concentration of the pollutants of concern.

[5] Economic feasibility is an objective balancing of the incremental benefit of attaining further reductions in the concentrations of constituents of concern as compared with the incremental cost of achieving those reductions. The evaluation of economic feasibility includes consideration of current, planned, or future land use, social, and economic impacts to the surrounding community including property owners other than the discharger. Economic feasibility does not refer to the dischargers' ability to finance cleanup. Availability of financial resources is considered in the establishment of reasonable compliance schedules.

Chemical	Units (dry weight)	Background Sediment Chemistry Levels (1)
Silver	mg/kg	1.1
Zinc	mg/kg	192
Organics		
Dibutyltin	ug/kg	21
Monobutyltin	ug/kg	14
Tributyltin	ug/kg	22
Tetrabutyltin	ug/kg	(1.4)
HPAH (2)	ug/kg	673
PPPAH (3)	ug/kg	1,234
Benzo[a]pyrene	ug/kg	202
Total PCB Congeners (4)	ug/kg	84
Polychlorinated terphenyls	ug/kg	(142)

(1) Based on the 95 percent upper prediction limit calculated from a pool of reference stations in San Diego Bay. Parentheses ( ) indicates non-detects accounted for more than or equal to half the values.
(2) HPAH = High Molecular Weight Polynuclear Aromatic Hydrocarbons
(3) PPPAH = Priority Pollutant Polynulear Aromatic Hydrocarbons
(4) PCB = Polychlorinated Biphenyls

32. **TECHNOLOGICAL FEASABILITY CONSIDERATIONS:** It is technologically feasible to cleanup to background sediment quality levels at the Shipyard Sediment Site. The Regional Board considered three remedial technologies for the cleanup to background evaluation: (1) Natural Recovery, (2) Subaqueous Capping, and (3) Dredging. Natural recovery was considered to be technologically infeasible due to sediment disturbance from normal shipyard activities (e.g., vessel propeller wash, ship traffic, dry dock movements, maintenance/navigational dredging, engine tests, construction, etc.). Subaqueous capping was also considered to be technologically infeasible because of the ever-larger ships being serviced at the shipyards, the associated navigational requirements, and the likelihood of cap disturbance resulting from normal shipyard activities (e.g., vessel propeller wash). Dredging, although difficult to implement because the Shipyard Sediment Site is currently a working shipyard, is considered to be technologically feasible. Dredging is a proven technology and it has been used not only in San Diego Bay but also throughout the United States for remediating contaminated sediment.

33. **ECONOMIC FEASABILITY CONSIDERATIONS:** It is economically infeasible to cleanup to background sediment quality levels at the Shipyard Sediment Site. The Regional Board evaluated a number of criteria to determine tradeoffs in risks, costs, and benefits associated with cleanups between the background sediment chemistry levels defined above and six alternative cleanup levels greater than background. The criteria included factors such as total cost, volume of sediments dredged, short- and long-term effects on beneficial uses (aquatic life, aquatic-dependent wildlife, and human health), effects on shipyards and associated economic activities, effects on local businesses and neighborhood quality of life, and effects on recreational, commercial, or industrial uses of aquatic resources. Based on these considerations the Regional Board concluded that it is not economically feasible to cleanup to the background sediment chemistry levels. The overall benefit of conducting

cleanup at background sediment quality is approximately equal to the overall benefit of achieving cleanup at levels 5 times greater than background[6]. Furthermore, the total cost to cleanup to background versus the total cost to cleanup to levels 5 times greater than background is significantly higher. There is an estimated $26,000,000 difference in total costs between cleanup to background and cleanup to 5 times background.

Summary Of Economic Feasibility Evaluation

Cleanup Alternatives	Approximate Dredge Volume (cu yd)	Approximate Total Cost
Natural Recovery	0	$900,000
Exponent LAET	75,000	$15,000,000
20x Background	252,060	$33,000,000
15x Background	295,460	$37,000,000
10x Background	502,450	$58,000,000
5x Background	885,580	$96,000,000
Background	1,200,000	$122,000,000

Summary Of Economic Feasibility Evaluation (continued)

Cleanup Alternatives	Short-Term Effects			Long-Term Effects			Effects on Shipyards & Economic Activities	Effects on Local Businesses & Neighborhoods	Effects on Aquatic Resources
	Aquatic Life	Wildlife	Human Health	Aquatic Life	Wildlife	Human Health			
Natural Recovery	0	0	0	-4	-5	-5	0	0	0
Exponent LAET	-1	-1	-2	+2	+1	+1	-1	-1	+1
20x Background	-3	-1	-3	+3	+3	+3	-3	-3	+3
15x Background	-3	-1	-3	+3	+3	+3	-3	-3	+3
10x Background	-4	-1	-4	+3	+3	+4	-3	-3	+3
5x Background	-4	-2	-4	+4	+4	+5	-4	-4	+4
Background	-4	-2	-4	+4	+4	+5	-4	-4	+4

[6] Many of the elevated chemical concentrations exist in the same area, cleaning up some chemicals to 5 times background will result in the reduction of the majority of chemicals to levels much lower than 5 times background as reflected in the table in Finding 37 Alternative Cleanup Levels.

Note: Scores are given on the basis of the degree of positive or negative effects relative to a neutral baseline condition (i.e., current condition at the Shipyard Sediment Site). Scores range from +5 (major improvement compared to current conditions) to –5 (major adverse effects compared to current conditions).

ALTERNATIVE SEDIMENT CLEANUP LEVELS

34. **ALTERNATIVE CLEANUP LEVELS.** The Regional Board has selected the alternative cleanup levels presented below for the Shipyard Sediment Site. In approving alternative cleanup levels less stringent than background the Regional Board has considered the factors contained in Resolution 92-49 and the California Code of Regulations, Title 23, section 2550.4, subdivision (d)[7].

    a. ***Alternative Cleanup Levels are Appropriate.*** NASSCO and Southwest Marine's Sediment Investigation Report indicates that attainment of background sediment quality is not feasible because it would require removal of approximately 1,200,000 cubic yards of sediment at a cost of $122,000,000. Removal of that much sediment would be extremely expensive; cause harm to beneficial uses from the large-scale dredging (due to physical disturbance of habitat and re-suspension of pollutants into the water column); and cause substantial disruption of streets, businesses, and neighborhoods while producing little or no benefit to beneficial uses over that which could be attained from the alternative cleanup levels based on 5 times background.

    b. ***Alternative Cleanup Levels Are Consistent With Water Quality Control Plans And Policies.*** The alternative cleanup levels will not result in water quality less than prescribed in water quality control plans and policies adopted by the State Water Resources Control Board and the Regional Board.[8]. The alternative sediment quality levels are well below levels expected to cause toxicity to aquatic life and will substantially reduce existing risks to aquatic dependent wildlife and human health.

    c. ***Alternative Cleanup Levels Are Consistent With The Maximum Benefit To The People Of The State.*** The level of water quality that will be attained upon implementation of the

[7] Resolution 92-49 provides that in approving any alternative cleanup levels less stringent than background sediment quality the Regional Board must consider the conditions described in California Code of Regulations, Title 23, section Section 2550.4. Resolution 92-49 further requires that any alternative cleanup levels shall (1) be consistent with maximum benefit to the people of the state; (2) not unreasonably affect present and anticipated beneficial use of such water; and (3) not result in water quality less than that prescribed in the Water Quality Control Plans and Policies adopted by the State and Regional Water Boards.

[8] Applicable numerical and narrative water quality objectives for San Diego Bay Waters include the Regional Board's Toxicity Objective, the California, California Toxics Rule Water Quality Criteria and the State Board Policy for Implementation of Toxics Standards (the SIP) which provides that mixing zones shall not result in "objectionable bottom deposits." This term is defined as "an accumulation of materials . . . on or near the bottom of a water body which creates conditions that adversely impact aquatic life, human health, beneficial uses, or aesthetics. These conditions include, but are not limited to, the accumulation of pollutants in the sediments (SIP at Appendix 4)

alternative cleanup levels at the Shipyard Sediment Site is consistent with the maximum benefit to the people of the state. The San Diego Bay shoreline between Sampson and 28th Streets is listed on the Clean Water Act 303(d) list for elevated levels of copper, mercury, polynuclear aromatic hydrocarbons (PAH), and polychlorinated biphenyls (PCB) at the Shipyard Sediment Site. While it is impossible to determine the precise level of water quality that will be attained given the residual sediment pollutants constituents that will remain at the site, compliance with the alternative cleanup levels will markedly improve water quality conditions in the Shipyard Sediment Site and result in attainment of water quality standards at the site.

Alternative Sediment Cleanup Levels

Chemical	Units (dry weight)	Alternative Sediment Cleanup Levels (1)
Metals		
Arsenic	mg/kg	10
Cadmium	mg/kg	1.0
Chromium	mg/kg	81
Copper	mg/kg	200
Lead	mg/kg	90
Mercury	mg/kg	0.7
Nickel	mg/kg	20
Silver	mg/kg	1.5
Zinc	mg/kg	300
Organics		
Tributyltin	ug/kg	110
Benzo[a]pyrene	ug/kg	1,010
Total PCB Congeners (2)	ug/kg	420

(1) Cleanup levels for tributyltin, benzo[a]pyrene, and total PCB congeners are based on 5 times background, constituents which, at 5 times background, determine the largest cleanup footprint. The other chemical concentrations are based on an evaluation that cleanup footprint.
(2) PCB = polychlorinated biphenyl

STATUTORY AND REGULATORY FINDINGS

35. **LEGAL AND REGULATORY AUTHORITY.** This Order is based on (1) Section 13267 and Chapter 5, Enforcement, of the Porter-Cologne Water Quality Control Act (Division 7 of the Water Code, commencing with Section 13000), commencing with Section 13300; (2) applicable state and federal regulations; (3) all applicable provisions of statewide Water Quality Control Plans adopted by the State Water Resources Control Board and the *Water Quality Control Plan for the San Diego Basin* (Basin Plan) adopted by the Regional Board including beneficial uses, water quality objectives, and implementation plans; (4) State Water Board policies for water quality control, including State Water Board Resolution No. 68-16 (*Statement of Policy with Respect to Maintaining High Quality of Waters in California*) and Resolution No. 92-49 (*Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304*); and (5) relevant standards,

criteria, and advisories adopted by other state and federal agencies.

36. **CEQA EXEMPTION**. This enforcement action is exempt from the provisions of the California Environmental Quality Act (CEQA) in accordance with Section 15321 (Enforcement Actions by Regulatory Agencies), Chapter 3, Title 14 of the California Code of Regulations.

37. **PUBLIC NOTICE**. The Regional Board has notified all known interested persons and the public of its intent to adopt this Cleanup and Abatement Order and has provided them with an opportunity to submit written comments and recommendations.

38. **PUBLIC HEARING**. The Regional Board has considered all comments pertaining to this Cleanup and Abatement Order submitted to the Regional Board in writing, or by oral presentations at the public hearing held on June 29, 2005. Detailed response to relevant comments has been incorporated into the final Technical Analysis of the Cleanup and Abatement Order adopted by this Order.

ORDER DIRECTIVES

IT IS HEREBY ORDERED that, pursuant to Sections and 13267 and 13304 of the California Water Code, National Steel and Shipbuilding Company; Southwest Marine, Inc.; City of San Diego; Marine Construction and Design Company and Campbell Industries, Inc; Chevron, a subsidiary of ChevronTexaco; BP; San Diego Gas and Electric, a subsidiary of Sempra Energy Company; and the United States Navy (hereinafter Discharger(s)), shall comply with the following directives:

A. CLEANUP AND ABATE

1. The Discharger(s) shall take all corrective actions[9] necessary to cleanup contaminated marine bay sediment at the Shipyard Sediment Site to attain the sediment quality levels specified below:

Chemical	Units (dry weight)	Sediment Quality Levels (1)
Metals		
Arsenic	mg/kg	10
Cadmium	mg/kg	1.0
Chromium	mg/kg	81
Copper	mg/kg	200
Lead	mg/kg	90
Mercury	mg/kg	0.7
Nickel	mg/kg	20

[9] Corrective Actions include the phases of cleanup and abatement described in Directives A through D of this Cleanup and Abatement order.

Chemical	Units (dry weight)	Sediment Quality Levels (1)
Silver	mg/kg	1.5
Zinc	mg/kg	300
Organics		
Tributyltin	ug/kg	110
Benzo[a]pyrene	ug/kg	1,010
Total PCB Congeners (2)	ug/kg	420

(1) PCB = polychlorinated biphenyl

B. REMEDIAL ACTION PLAN AND IMPLEMENTATION

1. ***Remedial Action Plan (RAP).*** The Discharger(s) shall submit a Remedial Action Plan (RAP) to the Regional Board by [date based on 90 days after adoption to be inserted]. The RAP shall contain the following information:

   a. *Implementation Activities.* A detailed description of all activities planned to implement the corrective actions necessary to comply with all the directives herein;

   b. *Shipyard Sediment Site Map.* A map(s), using an appropriate modeling program, illustrating the horizontal and vertical distribution of pollutants within the remediation area defined by the sediment quality cleanup levels described in Directive A.1;

   c. *Schedule.* A schedule detailing the sequence of events and time frame for each activity; and

   d. *Short-Term Effectiveness Monitoring Activities.* A monitoring program as described in Directive D, Cleanup and Abatement Verification, to demonstrate the effectiveness of the RAP. The monitoring program shall be effective in determining compliance with the cleanup levels and in determining the success of the remedial action measures.

2. ***Remedial Action Plan (RAP) Implementation.*** In the interest of promoting prompt cleanup, the Discharger(s) may begin implementation of the RAP sixty (60) calendar days after submittal to the Regional Board, unless otherwise directed in writing by the Regional Board. Before beginning RAP implementation activities, the Discharger(s) shall:

   a. Notify the Regional Board of its intention to begin cleanup; and

   b. Comply with any conditions set by the Regional Board, including mitigation of adverse consequences from cleanup activities.

3. ***Remedial Action Zone.*** The Discharger(s) shall implement remedial action measures that ensure that marine sediment pollutants attain their respective cleanup levels at all monitoring points and throughout the Shipyard Sediment Site.

4. ***Implementation Schedule.*** Implementation of the RAP shall be completed on a schedule to be established by the Regional Board in a subsequent amendment to this Cleanup and Abatement Order.

5. ***Monitoring and Evaluation.*** The Discharger(s) shall monitor, evaluate, and report the results of implementation of the RAP on a schedule to be established by the Regional Board in a subsequent amendment to this Cleanup and Abatement Order.

6. ***Modify or Suspend Cleanup Activities.*** The Discharger(s) shall modify or suspend cleanup activities when directed to do so by the Regional Board.

C. CLEANUP AND ABATEMENT COMPLETION VERIFICATION

1. ***Cleanup and Abatement Completion Report.*** The Discharger(s) shall submit a final Cleanup and Abatement Completion Report verifying completion of the Remedial Action Plan (RAP) through sampling of the Shipyard Sediment Site. The monitoring period shall begin immediately after the completion of remedial action measures and be conducted at intervals proposed by the Discharger(s) and agreed to by the Regional Board. The report shall provide a demonstration, based on a sound technical analysis, that marine sediment quality cleanup levels specified in Directive A.1. for all pollutants are attained at all monitoring points and throughout the Shipyard Sediment Site;

D. POST CLEANUP MONITORING

1. ***Post Cleanup Monitoring Plan.*** The Discharger(s) shall submit a Post Cleanup Monitoring Plan to the Regional Board by March 1, 2006. The Post Cleanup Monitoring Plan shall be designed to confirm the short-term and long-term effectiveness of the cleanup. The Post Cleanup Monitoring Plan shall contain the following information:

   a. *Monitoring Activities.* A detailed description of monitoring and sampling activities designed to assess the site conditions, including the benthic community health, after the remedial action is completed. The monitoring activities shall include sampling for a period of not less than three years; and

   b. *Schedule* – A schedule detailing the sequence of events and time frame for each activity. The schedule shall also include the dates for submittal of the Post-Cleanup Monitoring annual progress reports and final report as detailed in Section D.2. below.

2. ***Post Cleanup Monitoring Report.*** The Discharger shall submit annual progress reports and a final Post Cleanup Monitoring Report, on a schedule to be established by the

Regional Board in a subsequent amendment to this Cleanup and Abatement Order, containing the following information:

a. *Monitoring Activities* – A detailed description of the post cleanup monitoring activities performed; and

b. *Interpretations and Conclusions.* Interpretations and conclusions regarding the potential presence and chemical characteristics of any newly deposited sediments within the cleanup areas, and interpretations and conclusions regarding the health and recovery of the benthic communities.

E. REGIONAL BOARD CONCURRENCE

1. ***Regional Board Concurrence.*** Upon concurrence with the findings of the Cleanup and Abatement Completion Report (Directive C.1) and the Post Cleanup Monitoring Report (Directive D.2) that remedial actions and monitoring are complete and that compliance with this Cleanup and Abatement Order is achieved, the Regional Board will inform the Discharger(s) and other interested persons in writing that no further remedial work is required at this time, based on available information. This written notice shall constitute Regional Board concurrence with the completed remedial actions.

F. PROVISIONS

1. ***Cost Recovery.*** The Discharger(s) shall reimburse the State of California for all reasonable costs actually incurred by the Regional Board to investigate, oversee, and monitor cleanup and abatement actions required by this Cleanup and Abatement Order, according to billing statements prepared from time to time by the State Water Resources Control Board. If the Discharger(s) is enrolled in a reimbursement program managed by the State Water Resources Control Board for the discharge addressed by this Cleanup and Abatement Order, reimbursement shall be made pursuant to the procedures established in that program.

2. ***Waste Management.*** The Discharger(s) shall properly manage, store, treat, and dispose of contaminated soils and ground water in accordance with applicable federal, state, and local laws and regulations. The storage, handling, treatment, or disposal of contaminated marine sediment and associated waste shall not create conditions of pollution, contamination or nuisance as defined in California Water Code section 13050. The Discharger(s) shall, as required by the Regional Board, obtain, or apply for coverage under, waste discharge requirements or a conditional waiver of waste discharge requirements for the removal of waste from the immediate place of release and discharge of the waste to (a) land for treatment, storage, or disposal or (b) waters of the state.

3. ***Request to Provide Information.*** The Discharger(s) may present characterization data, preliminary interpretations and conclusions as they become available, rather than waiting

until a final report is prepared. This type of on-going reporting can facilitate a consensus being reached between the Discharger(s) and the Regional Board and may result in overall reduction of the time necessary for regulatory approval.

4. ***Waste Constituent Analysis.*** Unless otherwise permitted by the Regional Board, all analyses shall be conducted at a laboratory certified for such analyses by the State Department of Health Services. Specific methods of analysis must be identified. If the Discharger(s) proposes to use methods or test procedures other than those included in the most current version of *"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846"* (U.S. Environmental Protection Agency) or 40 CFR 136, "*Guidelines Establishing Test Procedures for the Analysis of Pollutants; Procedures for Detection and Quantification* ", the exact methodology must be submitted for review and must be approved by the Regional Board prior to use. The director of the laboratory whose name appears on the certification shall supervise all analytical work in his/her laboratory and shall sign all reports submitted to the Regional Board.

5. ***Duty to Operate and Maintain***. The Discharger(s) shall, at all times, properly operate and maintain all facilities and systems of treatment, control, storage, disposal and monitoring (and related appurtenances) which are installed or used by the Discharger(s) to achieve compliance with this Cleanup and Abatement Order. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities, which are installed by the Discharger(s) only when the operation is necessary to achieve compliance the conditions of this Cleanup and Abatement Order.

6. ***Duty to Use Registered Professionals.*** The Discharger(s) shall provide documentation that plans and reports required under this Cleanup and Abatement Order are prepared under the direction of appropriately qualified professionals. California Business and Professions Code Sections 6735, 7835 and 7835.1 require that engineering and geologic evaluations and judgments be performed by or under the direction of registered professionals. A statement of qualifications and registration numbers of the responsible lead professionals shall be included in all plans and reports submitted by the Discharger(s). The lead professional shall sign and affix their registration stamp to the report, plan or document.

7. ***Corporate Signatory Requirements.*** All reports required under this Order shall be signed and certified by a responsible corporate officer(s) of the Discharger(s) described in paragraph 5.a. of this provision or by a duly authorized representative of that person as described in paragraph 5.b.of this provision.

   a. *Responsible Corporate Officer(s).* For the purposes of this provision, a responsible corporate officer means: (i) A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy - or decision-making functions for the corporation, or (ii) the

manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

b. *Duly Authorized Representative.* A person is a duly authorized representative only if:
   (1) The authorization is made in writing by a person described in paragraph (a) of this provision;
   (2) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual (A duly authorized representative may thus be either a named individual or any individual occupying a named position.); and
   (3) The written authorization is submitted to the Regional Board.

c. *Changes to Authorization.* If an authorization under paragraph (b) of this provision is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph (b) of this provision must be submitted to the Regional Board prior to or together with any reports or information to be signed by an authorized representative.

d. *Certification Statement.* Any person signing a document under paragraph a. or b. of this provision shall make the following certification:

   "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

8. ***Duty to Submit Other Information.*** When the Discharger(s) becomes aware that it failed to submit any relevant facts in any report required under this Cleanup and Abatement Order, or submitted incorrect information in any such report, the Discharger(s) shall promptly submit such facts or information to the Regional Board.

9. ***Electronic and Paper Media Reporting Requirements***. The Discharger(s) shall submit both electronic and paper copies of all reports required under this Cleanup and Abatement Order including workplans, technical reports, and monitoring reports.

10. ***Report Submittals.*** All monitoring and technical reports required under this Cleanup and Abatement Order shall be submitted to:

    Executive Officer
    California Regional Water Quality Control Board
    San Diego Region
    9174 Sky Park Court, Suite 100
    San Diego, CA 92123-4340

11. ***Identify Documents Using Code Number.*** In order to assist the Regional Board in the processing of correspondence and reports submitted in compliance with this Cleanup and Abatement Order, the Discharger(s) shall include the following code number in the header or subject line portion of all correspondence or reports submitted to the Regional Board:

G. NOTIFICATIONS

1. ***Enforcement Discretion.*** The Regional Board reserves its right to take any enforcement action authorized by law for violations of the terms and conditions of this Cleanup and Abatement Order.

2. ***Enforcement Notification***. The Porter-Cologne Water Quality Control Act commencing with Chapter 5, Enforcement and Implementation, Section 13308, provides that if there is a threatened or continuing violation of a cleanup and abatement order, the Regional Board may issue a Time Schedule Order prescribing a civil penalty in an amount not to exceed $10,000 per day for each day compliance is not achieved in accordance with that time schedule. Section 13350 provides that any person may be assessed administrative civil liability by the Regional Board for violating a cleanup and abatement order in an amount not to exceed $5,000 for each day the violation occurs, or on a per gallon basis, not to exceed $10 for each gallon of waste discharged. Alternatively the court may impose civil liability in an amount not to exceed $15,000 for each day the violation occurs, or on a per gallon basis, not to exceed $20 for each gallon of waste discharged. Section 13385 provides that any person may be assessed administrative civil liability by the Regional Board for violating a cleanup and abatement order for an activity subject to regulation under Division 7, Chapter 5.5 of the California Water Code, in an amount not to exceed the sum of both of the following: (1) $10,000 for each day in which the violation occurs; and (2) where there is a discharge, any portion of which is not susceptible to cleanup or is not cleaned up, and the volume discharged but not cleaned up exceeds 1,000 gallons, an additional liability not to exceed $10 multiplied by the number of gallons by which the volume discharged but not cleaned up exceeds 1,000 gallons.

Alternatively the civil liability may be imposed by the court in an amount not to exceed the sum of both of the following: (1) $25,000 for each day in which the violation occurs; and (2) where there is a discharge, any portion of which is not susceptible to cleanup or is not cleaned up, and the volume discharged but not cleaned up exceeds 1,000 gallons, an additional liability not to exceed $25 multiplied by the number of gallons by which the volume discharged but not cleaned up exceeds 1,000 gallons.

I, John H. Robertus, Executive Officer, do hereby certify the forgoing is a full, true, and correct copy of a Cleanup and Abatement Order issued on June 29,2005.

_____
John H. Robertus
Executive Officer