Bell Canyon Residence Sampling
Soil Sampling Work Plan
Ventura County, California
Attachments

Prepared for

Boeing North American, Inc.
Rocketdyne Propulsion and Power

Prepared by

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San Diego, California

June 1998
Project No. 313150002

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ATTACHMENT 1

U.S. ENVIRONMENTAL PROTECTION AGENCY (USEPA) FACT SHEET

US Environmental Protection Agency

August 1994

"Who Oversees Environmental Activities at SSFL?"

Numerous government agencies are involved in overseeing environmental monitoring and restoration activities at the Santa Susana Field Laboratory (SSFL). These agencies are responsible for ensuring that programs are implemented by Rockwell/Rocketdyne to protect the public health and environment, and for ensuring that these programs are in compliance with applicable federal, state, and local environmental statutes and regulations. The purpose of this fact sheet is to identify the principal agencies that are involved at SSFL and discuss their respective roles and responsibilities. Questions and requests for additional information can be directed to the point of contact that is listed for each agency on the last page of this fact sheet.

United States Environmental Protection Agency (US EPA) - Hazardous Waste Management Division (HWMD)

Under the authority of the Resource Conservation and Recovery Act (RCRA), the US EPA-HWMD was the lead agency responsible for overseeing the initial RCRA facility assessment that was conducted at SSFL in 1990. This assessment identified potential sources of hazardous waste releases on the site. The lead responsibility for implementing the RCRA corrective action process, including cleanup of non-radiological hazardous waste, now lies with the California Environmental Protection Agency - Department of Toxic Substances Control. However, the HWMD provides technical assistance to the State as needed. The HWMD also ensures coordination of regulatory activities between all agencies involved at SSFL. The Division's role as coordinator includes chairing the quarterly meetings of the SSFL Work Group and participation in the offsite multi-media sampling study.

United States Environmental Protection Agency (US EPA) - Office of Radiation and Indoor Air (ORIA)

The US EPA-ORIA is the lead agency responsible for enforcing those provisions of the National Emissions Standards for Hazardous Air Pollutants (NESHAPSs) related to radionuclides. Established in response to the federal Clean Air Act, these standards limit the levels of radionuclides (radioactive contaminants) that can be emitted into the air by certain industries and Department of Energy (DOE) facilities. Limits are established on the basis of the highest annual dose that any member of the public is expected to receive. Although nuclear operations are no longer conducted at SSFL, these standards also apply to ongoing decontamination and decommissioning (D&D) activities that might produce air emissions. To ensure facility compliance, ORIA reviews the results of SSFL's radionuclide monitoring program documented in the annual NESHAPs reports and conducts periodic facility inspections. D&D Plans are also reviewed in advance by ORIA for possible NESHAPs concerns.

US Nuclear Regulatory Commission (NRC) - Division of Waste Management

The NRC is responsible for regulating and licensing special nuclear materials at SSFL. This authority is established under provisions of the Atomic Energy Act of 1954, as amended, and Title II of the Energy Reorganization Act of 1974. Currently, the only NRC license maintained at SSFL covers those nuclear materials and activities primarily associated with the Rockwell International Hot Laboratory (RIHL). As the licensing agent, the NRC is responsible for performing inspections, authorizing renewals and amendments to the license, reviewing and approving the licensee's decommissioning plan, and authorizing the release of facilities for unrestricted use once decommissioning is complete. Under the terms of the license, Rocketdyne is responsible for, and is currently carrying out, decommissioning of the RIHL.

US Department of Energy - Environmental Restoration Division (DOE-ERD)

The DOE-ERD provides project funding and oversight of environmental monitoring and restoration activities conducted through the Energy Technology Engineering Center (ETEC) at SSFL. Activities include site characterization surveys to determine the extent and nature of radioactive contaminants and pollutants on DOE portions of the site. DOE-ERD also oversees decontamination and decommissioning (D&D) activities associated with inactive and surplus DOE facilities at SSFL that have been contaminated with radioactive or hazardous materials. DOE-ERD involvement in the D&D process includes the following: review and approval of D&D plans, oversight of D&D processes, and coordination of radiological surveys for final release of facilities after D&D completion.

US Department of Energy - Waste Management Division (DOE-WMD)

The DOE-WMD provides project funding and oversight of activities associated with the disposal of waste materials resulting from DOE-sponsored test programs and environmental restoration of DOE facilities at SSFL. Waste materials include chemically hazardous, low-level radioactive, and mixed wastes (chemical and radioactive). All radioactive wastes are processed for disposal at DOE disposal sites while non-radioactive hazardous wastes are shipped to EPA-approved sites. DOE-WMD conducts periodic facility visits to inspect disposal processing activities, including packaging, labeling, and temporary storage, and to ensure compliance with applicable DOE orders and policies covering waste disposal.

California Environmental Protection Agency (Cal-EPA) - Department of Toxic Substances Control (DTSC)

The DTSC is the lead agency responsible for regulating hazardous waste management activities at SSFL. Under provisions of federal RCRA and state hazardous waste laws, DTSC is responsible for reviewing and approving permits for treatment, transfer, or storage (over 90 days) of hazardous (non-radioactive) waste. To date, four RCRA permits have been issued to SSFL and two draft "post-closure" permits have been prepared for public comment. The pending post-closure permits cover continued operation of the groundwater extraction/treatment system and maintenance of nine capped surface impoundments (pools formerly used for storing potentially contaminated liquids). Once a permit is issued, DTSC continues to monitor the facility to ensure compliance with all provisions of the permit. The Department is also responsible for overseeing the RCRA corrective action process which is being implemented at SSFL as the result of a RCRA facility assessment conducted in 1990. The RFA identified 121 possible areas of hazardous chemical release. The corrective action process requires SSFL to conduct a site investigation to determine the significance of possible releases, followed (if necessary) by development of alternative corrective measures and implementation of final corrective actions. All plans and corrective actions are reviewed by DTSC and submitted for public comment prior to approval and implementation. Although SSFL is currently in the investigative phase of the RCRA corrective action process, site cleanup efforts have already begun under many non-RCRA initiatives.

California Department of Health Services - Radiologic Health Branch (DHS-RHB)

The DHS-RHB is responsible for regulating radioactive materials and other sources of radiation not associated with US Department of Energy (DOE) activities at SSFL. Regulated materials typically include materials used for industrial or equipment calibration purposes. Under an agreement between the US Nuclear Regulatory Commission (NRC) and the State of California, DHS-RHB licenses the possession and use of radioactive materials and conducts inspections of the receipt, use, transfer, and disposal of these materials and sources at SSFL. The Branch conducts unannounced inspections to verify the amounts and types of radioactive materials being used onsite, evaluates radiation exposures to employees and the general public, and reviews company records related to radiation usage at the facility. The Branch also ensures that all facilities and equipment released for unrestricted or offsite use meet standards set by DHS-RHB. Independent measurements and evaluations are made by the Branch to confirm that these standards are met.

California Department of Health Services Environmental Management Branch (DHS - EMB)

Under provisions of the Agreement in Principle (AIP) with the US Department of Energy (DOE), DHS-EMB is responsible for conducting independent technical reviews of radiological monitoring programs at SSFL for DOE and providing recommendations to DOE as necessary. The AIP, which is an agreement between the state of California and DOE, provides funding for the state to provide non-regulatory oversight of environmental programs at six DOE sites within the State of California, one of which entails the DOE-optioned portion of Area IV at SSFL. DHS-EMB conducts independent monitoring of radiation levels on and near the SSFL site and is a participant in the offsite multi-media sampling study. DHS-EMB is also participating in the radiological survey of Area IV being conducted by Rocketdyne and will collect replicate soil samples for data verification. DHS-EMB receives technical assistance from the State Water Resources Control Board on issues related to water quality and hydrology through an interagency agreement.

Regional Water Quality Control Board (RWQCB) - Los Angeles Region

The RWQCB is the lead agency responsible for regulating surface water discharge activities at SSFL. Under the authority of the Clean Water Act and the National Pollution Discharge Elimination System (NPDES), the RWQCB sets maximum limits for chemical and radiological contaminants in surface water being discharged from the SSFL site. These limits, along with requirements for discharge sampling, are incorporated into the site's NPDES Permit which must be renewed every five years. The RWQCB ensures compliance with the requirements of the permit by reviewing SSFL's sampling results on a monthly and quarterly basis, and by conducting independent sampling to verify the adequacy of SSFL's monitoring program. The RWQCB also establishes and enforces waste discharge requirements (WDRs) for disposal of domestic and industrial waste onsite and shares responsibilities with California EPA-DTSC for monitoring discharges to the groundwater.

Ventura County Environmental Health Division (VCEHD)

The Ventura County Environmental Health Division (VCEHD) is the principle agency regulating underground tanks used for storage of hazardous materials at SSFL. There are currently eleven VCEHD-permitted underground tanks used for storage of sodium, one of which is in the process of being removed. The VCEHD has responsibility for issuing permits for new and existing underground storage tanks, as well as overseeing tank removal and cleanup activities in the event of leaks. The VCEHD is responsible for overseeing Rocketdyne's underground storage tank site assessment which is being conducted to determine the environmental impact of storage tanks that were previously removed from the site. Through an agreement with the State of California, VCEHD is also responsible for enforcing regulations on hazardous waste generation, including manifest preparation (shipment documentation) and temporary on-site storage. VCEHD also administers state requirements for developing a risk management and prevention program, which is required of all facilities that store acutely hazardous materials.

Ventura County Air Pollution Control District (VCAPCD)

The VCAPCD is the lead agency responsible for regulating non-radioactive air emissions at SSFL. The District is responsible for establishing and enforcing local air pollution regulations that meet or exceed requirements of the Federal and California State Clean Air Acts, and the California Health and Safety Code. The District is also responsible for issuing permits that establish requirements for construction, modification and operation of equipment and processes that may result in air emissions. SSFL currently has five VCAPCD air permits, covering various process equipment and groundwater treatment facilities. Other responsibilities of the District include regulation of asbestos removal projects, implementation of vehicle trip reduction programs, and oversight of the state-mandated Air Toxics "Hot Spot" Program. This program requires facilities to inventory all toxic materials that could result in airborne releases, and in high-priority cases, to prepare a health risk assessment. The District conducts periodic inspections to collect data and verify compliance with permits and regulations.

Agency Contact Information

US Environmental Protection Agency
Hazardous Waste Management Division
Waste Compliance Branch
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San Francisco, CA 94105
Tom Kelly
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US Environmental Protection Agency
Office of Radiation and Indoor Air
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US Nuclear Regulatory Commission
Office of Nuclear Material Safety
and Safeguards
Division of Waste Management
Washington D.C. 20555-0001
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(301) 415-6721

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Edgar D. Bailey
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California Department of Health Services
Environmental Management Branch
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Regional Water Quality Control Board
Los Angeles Region
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Monterey Park, CA 91754-2156
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Ventura County Environmental Health Division
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Ventura, CA 93009-1730
~~Mike McFadden~~ Bruce KELLER
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Ventura County Air Pollution Control District
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Ventura, CA 93003
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ATTACHMENT 2

BELL CANYON SAMPLING
HEALTH AND SAFETY PLAN (HSP)

ATTACHMENT 2

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LIST OF ATTACHMENTS

Number	Title
I	MSDSs and Selected Chemical Data Sheets
II	Project Health and Safety Forms
	a) Ogden Tailgate Safety Meeting Report
	b) Instrument Calibration Log
	c) Site Air Surveillance Record
	d) Workplace Exposure Monitoring Form
	e) First-aid Incident Report
	f) Supervisor's Report of Accident
	g) Record of Change
	h) Employee/Visitor Daily Roster
III	Potential Chemical Hazard Properties and Exposure Information

LIST OF ACRONYMS

ACGIH	American Conference of Government Industrial Hygienists
a.k.a.	Also Known As
AOC	Area of Concern
Bla	Bladder
Blo	Blood
BZ	Breathing Zone
Cart.	Cartridge
cc	cubic centimeter
CFR	Code of Federal Regulations
CNS	Central Nervous System
CPR	Cardio-Pulmonary Resuscitation
CRZ	Contamination Reduction Zone
CV	Cardiovascular
dBA	Decibels (A-weighted scale)
decon	Decontamination
DOE	Department of Energy
EC	Emergency Coordinator
EM	Electromagnetic
Encap	Encapsulating
EPA	Environmental Protection Agency
eV	Electronvolt
FM	Field Manager
FP	Field Procedure
ft	foot/feet
H&S	Health and Safety
H:V	Horizontal to Vertical
HBV	Hepatitis B Virus
HIV	Human Immunodeficiency Virus (AIDS)
Hrt	Heart
HSM	Health and Safety Manager
HSMP	Health and Safety Management Plan
HSP	Health and Safety Plan
IDLH	Immediately Dangerous to Life and Health
IDW	Investigative-derived Waste
IP	Ionization Potential (eV)
IPA	Isopropyl Alcohol
Kid	Kidney
lbs	Pounds

LIST OF ACRONYMS (Continued)

LEL	Lower Explosive Limit
Liv	Liver
mg/m^3	Milligrams (contaminant) per Cubic Meter (air)
Mod.	Modified
MSDS	Material Safety Data Sheet
NIOSH	National Institute of Occupational Safety and Health
OEES CHSM	Ogden Environmental and Energy Services Corporate Health and Safety Manual
SHSC	Site Health and Safety Coordinator
OSHA	Occupational Safety and Health Administration
OV/AG	Organic Vapor/Acid Gas
OVM	Organic Vapor Monitor (PID)
PE	Polyethylene
PEL	Permissible Exposure Level (OSHA)
PID	Photoionization Detector
PPE	Personal Protective Equipment
ppm	parts per million
Purif. Resp.	(Air) Purifying Respirator
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
Resp.	Respiratory System
ROC	Record of Change (HSP)
SAP	Sampling and Analysis Plan
SCBA	Self-contained Breathing Apparatus
SOP	Standard Operating Procedure
SSFL	Santa Susana Field Laboratory
STEL	Short Term Exposure Limit
TBD	To Be Determined
TBP	To Be Prepared
TCA	Trichloroethane
TCE	Trichloroethylene
TLV	Threshold Limit Value (ACGIH)
TPH	Total Petroleum Hydrocarbons
UEL	Upper Explosive Limit
UL	Underwriter's Laboratory
VOC	Volatile Organic Compound

GENERAL INFORMATION

Project: Bell Canyon Sampling

Project Manager (PM): Dixie Hambrick

Health and Safety Manager (HSM): Denise Daggett

Field Manager (FM): Don Barrie

Field Personnel: Don Barrie, Karen Jamieson, Rocketdyne personnel

Site Health and Safety Coordinator (SHSC): Don Barrie

Subcontractors: N/A

SITE DESCRIPTION AND FEATURES

The Bell Canyon residential area is located south of the Rocketdyne Santa Susana Field Laboratory (SSFL). The residential area is near the crest of the Simi Hills. The Simi Hills, a moderate to rugged canyon and hill terrain, are bordered on the east by the San Fernando Valley and to the north by the Simi Valley. Site map is depicted in Figure 1.

SCOPE OF WORK/PLANNED SITE ACTIVITIES

The purpose of the planned activities is to collect soil and / or sediment samples for analysis in Bell Canyon (see sampling work plans).

The scope of field work at the Bell Canyon residential and undeveloped locations includes the following tasks:

1. Conduct site reconnaissance.
2. Soil sampling for chemical analysis will be performed using a slide hammer. Sampling depths will be between 0 and 2 feet.
3. Soil sampling for radionuclide analysis will be performed using a trowel. Sampling depths will be between 0 and 2 feet.
4. Decontamination of equipment and personnel.
5. Management of investigative-derived waste (IDW).

The duration of field work is anticipated to require 2 to 3 days.

PERSONNEL RESPONSIBILITIES

Site Health and Safety Coordinator:

Reports jointly to the Health and Safety Manager (HSM) and the FM for all aspects of the project and is the primary contact for health and safety during all field activities. Establishes work zones, evacuation routes, and assembly areas. Makes the day-to-day decision to modify levels of protection provided in the Health and Safety Plan (HSP) based on site conditions or monitoring data. Serves jointly with the FM as Emergency Coordinator (EC). Has the authority to stop all work if conditions are judged to be hazardous to onsite personnel or the public, and reports and investigates accidents and near misses.

Health and Safety Manager:

Responsible for the approval of the HSP and coordinating the implementation of health and safety procedures. Responsible for approval of all changes made to this HSP, supervision of the SHSC, and the conduct of site audits.

Field Manager:

Has responsibility for implementing project health and safety for field activities through correcting unsafe acts or conditions, enforcing procedures, and conducting daily tailgate meetings. Serves as primary EC in emergency situations. Also responsible for assuring the submittal of the Supervisor's Report of Accident and First-aid Incident Report to the HSM within 24 hours of an incident.

Field Staff:

All Ogden personnel are responsible for compliance with this HSP in its entirety. They are responsible for taking all reasonable precautions to prevent injury to themselves and to their fellow employees and for being alert to potentially harmful situations. Technical staff are expected to perform only those tasks that they believe can be done safely and to immediately report any accidents, near misses, and/or unsafe conditions to the SHSC or the FM.

PERSONNEL PROTECTION

The prescribed methods and procedures used to protect personnel (site workers) while sampling are grouped into three primary categories: Administrative Controls, Engineering Controls, and Personal Protective Equipment (PPE).

ADMINISTRATIVE CONTROLS

TRAINING

Comprehensive: All routine onsite workers performing intrusive activities will have completed the OSHA 40-hour Hazardous Waste Operations Training, 24-hour onsite supervised training, and appropriate annual updates. Supervisors will have completed an additional 8 hours of OSHA Supervisory Training. All Ogden staff will have completed training in First Aid/CPR and fire extinguisher usage.

Specialized: Prior to the initiation of site activities for each phase, the SHSC and FM will conduct a Health & Safety "kickoff" orientation. At this time, pertinent Ogden SOPs and the site-specific HSP will be discussed in detail with special attention being given to site hazards, PPE, emergency procedures, etc. Upon completion of this briefing, all routine field personnel will be required to read and sign the acceptance sheet of this HSP.

Daily: "Tailgate" Safety meetings will be conducted each morning by the SHSC or FM for all phases of work. Topics of discussion will include work tasks and designated PPE, emergency procedures, evacuation routes, instruction in use of safety equipment (as required), prior safety problems, recognition of signs and symptoms of overexposure, importance of proper decontamination and personal hygiene, etc. These meetings must be documented.

MEDICAL SURVEILLANCE

Periodic Comprehensive Exam: All Ogden site personnel will have completed a pre-assignment medical examination and a periodic (usually annual) update examination prior to assignment, in accordance with OSHA 29 CFR 1910.120(f). The exam must be performed by an Occupational Health Physician, who will provide a written clearance for hazardous waste site work and for respirator usage.

Emergency Medical Treatment: Personnel who have been injured on the job might also seek medical services. See also the Emergency Response section for specific information regarding emergency services and required report submittals.

Special: Field personnel should have current (within 10 years) tetanus shots.

SAFE WORK PRACTICES:

1) Work groups will always consist of at least two (2) team members.

2) A high standard of personal hygiene will be observed. Smoking, eating, drinking, chewing gum or tobacco, taking medication, and applying cosmetics will not be permitted within any restricted or exclusion zone.

3) Wearing of contact lenses is prohibited.

4) Use of open flames or spark-producing equipment is not allowed anywhere onsite without a hot-work permit.

5) Personnel under the obvious influence of alcohol or controlled substances are not allowed onsite; those taking medications must notify the SHSC.

6) Personnel will practice good personal hygiene practices through the washing of the hands and face, as applicable.

7) Personnel will discard and replace any damaged or protective equipment.

8) Personnel should notify the SHSC of any defective monitoring, emergency, or other protective/safety equipment.

9) A supply of potable water, electrolyte replacement solutions, shaded break area, and sufficient lighting will be maintained onsite; sanitary facilities will be accessible to personnel.

10) All unsafe conditions will be made safe immediately. All unsafe conditions not in the scope of the project will be reported to the PM and the condition corrected.

11) All site personnel will familiarize themselves with these and the emergency procedures during daily tailgate, prework, safety meetings.

INITIAL ASSIGNMENTS OF PROTECTION LEVELS, TRAINING, AND MEDICAL SURVEILLANCE FOR SITE WORK TASKS

Task Name	Level of Protection	HAZWOPER 40 Hr	Training 24 Hr	Med. Surv.
Site Reconnaissance	D		X	Yes
Manual Soil Sampling	D	X		Yes
Decontamination	D	X		Yes
Management of IDW	D	X		Yes

Initial assignments may be modified by the SHSC as warranted by site conditions. Any changes will be noted in this HSP and documented on ROCs.

SANITATION AND ILLUMINATION

Potable drinking water shall be supplied in tightly closed containers and shall be clearly marked for its intended use. If vehicles are available for use by field crews, restrooms and a field washing area with potable water will be available within a reasonable distance from the site.

It is anticipated that all site work will be conducted during daylight hours. If circumstances arise in which field work is to be conducted before or after daylight, or sunlight is obstructed, illumination within all general site areas will be maintained at or above 5 foot-candles for general site areas.

RECORD KEEPING

The health and safety field binder/files maintained by the SHSC, or his/her designee, will be the primary form of record keeping and documentation of site activities. These documents, primarily the forms provided in Appendix 2, will be completed in sufficient detail to describe the work performed, note any unusual or significant circumstances under which the work was performed, explain any unanticipated/unplanned action taken to mitigate or to otherwise cope with unexpected field conditions, and include pertinent comments about site-specific conditions that could have a bearing on the work performed. Documentation is required for all phases of work. See also the SHSC duties listed under Personnel Responsibilities. Record keeping practices will follow 29 CFR 1910.20.

ENGINEERING CONTROLS

<u>Barricades</u>: Residents will be verbally notified of a safe distance to maintain during soil sampling on residential property. Barriers will be appropriate for the level of work activities and anticipated traffic.

<u>Rinsate Collection/Containment</u>: A system for collection of rinsate from decontamination operations (sampling equipment and personnel decon) will be required. Setting up temporary stations for personnel and other sampling equipment will be the responsibility of the SHSC and FM. Decon buckets should be placed in larger, plastic bins to contain splash. All spent fluids will be containerized in accordance with procedures/guidelines referenced in this HSP.

Dust Suppression: Dust suppression techniques will be employed, if necessary, to minimize the generation of dust/particulates. The water tap should be fitted with a nozzle or other device to create a water spray to contain dust. Modification (reduction) of work pace may be necessary to reduce visible emissions.

PERSONAL PROTECTIVE EQUIPMENT

The initial level of personal protection for the site sampling crew is Level D. Level D consists of work clothing (pants and long-sleeved shirt), safety-toe boots, safety glasses, and a hard hat when overhead hazards are present. Disposable gloves will be used during the sampling activities to prevent inadvertent cross contamination of the soil samples as described in the Quality Assurance Plan. All PPE will be inspected before donning. PPE may be upgrade by the SHSC based on site conditions and monitoring. Potential upgrades include:

Modified Level D PPE: (not anticipated for use)

- Level D equipment
- Tyvek suits
- Outer chemical-resistant gloves and inner nitrile or vinyl gloves
- Boot covers or chemical-resistant boots

Level C PPE: (not anticipated for use)

- Level Modified D equipment, with taping of suits to boots and gloves as necessary
- NIOSH-approved half-face or full-face air purifying respirator with organic vapor/acid gas cartridges and particulate prefilters

HAZARD EVALUATION

Table 1, Summary of Potential Health and Safety Hazards, provides a description of the site sampling hazards, an estimation of relative risk of the hazards, and appropriate control measures. The physical hazards (slip, trip, fall; poison oak, etc.) present during the sampling activities are expected to pose the highest risk to the sampling crew. Historical sampling data at other SSFL property sites indicate that the chemical and radiological hazards are expected to be at background levels or non-detectable.

Sampling personnel will protect themselves from primarily the physical hazards by practicing good hazard recognition skills acquired through HAZWOPER and task-specific training, and by the use of appropriate personal protective equipment. The selection of appropriate control measures by work task based upon the hazards is addressed in Table 2, Task Hazard Assessment.

Additional Hazard Communication Information

The following hazardous substances are anticipated to be brought onsite to supplement investigation activities:

- Alconox detergent
- Calibration Gases
- Isopropyl Alcohol

These hazardous substances are subject to the Hazard Communication Standard; required Material Safety Data Sheets (MSDSs) are presented in Attachment 1. This list must be updated and MSDSs obtained and filed for any other hazardous substances brought onsite.

Table 1 (Page 1 of 4)

SUMMARY OF POTENTIAL HEALTH AND SAFETY HAZARDS

Health and Safety Hazards	Relative Hazard Risk	Control or Protective Measures
PHYSICAL HAZARDS Slips, trips, and falls	Moderate to High	• Clear work area of obstructions and debris as best as possible. • Watch where you are walking. Avoid uneven terrain and areas of dense brush. • Wherever possible, slip, trip, and fall hazards will be eliminated or clearly identified with caution tape, cones, or equivalent means.
Back injuries due to improper lifting of heavy objects	Low to Moderate	• Workers will use proper lifting techniques, lifting with the legs and not the back. Loads >50 lbs. require a second person or mechanical device.
Poisonous Plants (Poison oak)	Moderate to High	• In spring, poison oak is green, in fall the leaves turn red, orange, or yellow. • Wear long pants and a long sleeve shirt to avoid contact with poison oak. • Poison oak tends to grow where there is a source of water. Be cautious of plant contact in river basin, creek beds, or canyons. • Wash any exposed skin, especially the hands, with soap and water after contact with any plants. • Carefully remove clothing at the end of the workday and launder in hot water with detergent. • Report any development of a rash or blisters to the SHSC.

Table 1 (Page 2 of 4)

SUMMARY OF POTENTIAL HEALTH AND SAFETY HAZARDS

Health and Safety Hazards	Relative Hazard Risk	Control or Protective Measures
PHYSICAL HAZARDS (cont.) Poisonous or disease causing insects and reptiles (scorpions, rattlesnakes, ticks, black widow spiders)	Low to Moderate	• Wear sturdy safety boots with ankle protection and long pants. • Exercise extreme care around woodpiles, tall grass, and rock crevices where snakes and scorpions nest or rest. • Use a stick or other long-handled device to inspect a probable poisonous reptile or insect area before proceeding. • In the event of a snake or black widow spider bite, keep the victim calm, wrap a pressure bandage (not a tourniquet) above the wound, and proceed immediately to the emergency room or call 911. • Try to remember any distinguishing markings on the snake to tell the Emergency Room staff. • If moving through brush, wear light-colored clothing and check yourself regularly for ticks. • Use insect repellent especially around neck, arms, and ankles to repel ticks. • Carefully remove any ticks with tweezers dipped in alcohol. • Seek medical advice if a red spot develops at the site of a tick bite.
Hanta virus carried by deer mice (droppings)	Low	• Do not otherwise disturb any rodent wastes or the immediate area surrounding such materials. • Do not leave food laying around. And, do not handle or feed rodents of any kind. • Unless assigned, avoid areas such as sheds and other dormant buildings where mice might reside.

Table 1 (Page 3 of 4)

SUMMARY OF POTENTIAL HEALTH AND SAFETY HAZARDS

Health and Safety Hazards	Relative Hazard Risk	Control or Protective Measures
PHYSICAL HAZARDS (cont.) Fire	Low to Moderate	• The sampling team will carry a 5 lb. ABC fire extinguishers. • Flammable liquids must be stored in UL- and OSHA-approved metal safety cans with spark arrestors. • Calibration gases must be stored and used in a safe manner. • Smoking is prohibited in sampling area.
Heat Stress	Moderate	• Workers are trained to recognize signs and symptoms of heat illnesses. • Seek shelter or shaded area for work tasks (as feasible) and break areas. • Adjust work schedules by rotation of personnel or alternate job functions to minimize heat stress or overexertion at one task. • Perform work during cooler hours of the day (or night) as feasible. • Maintain normal body fluid levels by consuming 16 oz. (2 cups) of water prior to each shift and about 8 oz (1 cup) every 15-20 minutes. Two gallons of water should be consumed over an 8-hour period. • Wear nonbinding cotton clothing, e.g., cotton pants, shirts, and cotton undergarments to absorb moisture and to help prevent heat rash.

Table 1 (Page 4 of 4)

SUMMARY OF POTENTIAL HEALTH AND SAFETY HAZARDS

Health and Safety Hazards	Relative Hazard Risk	Control or Protective Measures
CHEMICAL HAZARDS • Semi-volatile organic compounds • Total petroleum hydrocarbons • Volatile organic compounds • Metals • Polychlorinated biphenyls • Dioxins	Low	• See Attachment 3 for additional specific information about the chemical properties of potential individual constituents. • See Table 2, Task Hazard Assessment of field tasks, for appropriate PPE.
RADIOLOGICAL HAZARDS	Low	• Use appropriate direct-reading radiation monitoring device, such as a Geiger-Mueller (GM) counter. • See Table 2, Task Hazard Assessment of field tasks, for appropriate PPE.

Table 2

TASK HAZARD ASSESSMENT

Task	Hazards	PPE Selection
Site Reconnaissance	• Slips, Trips, and Falls • Poisonous Plants • Poisonous Snakes/Insects • Hanta Virus • Heat Stress	Level D: This requires a work shirt and full-length cotton pants or coveralls; safety-toe boots, safety glasses.
Manual Soil Sampling	• Slips, Trips, and Falls • Poisonous Plants • Heat Stress • Chemical • Radiological	As described above
Decontamination	• Fire (IPA) • Heat Stress • Chemical (IPA) • Radiological	As described above
Management of Investigative-derived Waste	• Lifting • Heat Stress	As described above

IPA = Isopropyl alcohol (rubbing alcohol)

SITE CONTROLS

WORK AREAS:

Equipment Cleaning Area: An area shall be established for personnel and sampling equipment cleaning.

Sampling Area: Approximately a 15 foot radius around sampling activities. Access should be restricted to field sampling crews.

AIR SURVEILLANCE

EXPOSURE MONITORING:

Type	Minimum Recommended
Background:	To be determined by SHSC based on site conditions.
Area:	At the time of soil sampling with the slide hammer and trowels.

EQUIPMENT: The SHSC will maintain equipment standard operating procedures (SOPs) onsite that specify calibration, general use, and troubleshooting procedures. All monitoring equipment will be field calibrated on a daily basis according to the manufacturer's instructions and will be recorded on the calibration log (Attachment 2).

Equipment	Contaminant	Work Activity
Thermo PID, or equiv.	Ionizable hydrocarbons	All sampling activity
Geiger-Mueller Counter, or equiv.	Radionuclides	All sampling activity

ACTION LEVELS: Action levels are established for conducting sampling activities and/or upgrading/downgrading PPE. Action levels for upgrade/downgrade of respirator are sustained readings above background in the breathing zone of site personnel. Record readings on Air Surveillance Record forms in Attachment 2.

ACTION LEVELS

Equipment	Action Level	Action to be Taken
PID (OVM) equiv. units	≥25 units for 5 minutes in BZ	Upgrade to Level C (OV/AG/HEPA)
	>50 units for 5 minutes in BZ	Cease work until levels return to 25 units or less
Geiger-Mueller Counter	1 mR / hr	Upgrade to Level C
	>2 mR / hr	Cease work until levels return to equal or less than 1 mR / hr

DECONTAMINATION PROCEDURES

PERSONNEL DECONTAMINATION:

Equipment: Soft-bristled brushes; wash tubs or equivalent; spray bottles; garbage bags; paper towels, and duct tape.
Decon Solution: Alconox (biodegradable lab-grade detergent); isopropyl alcohol; tap and deionized water for rinsing.
Procedures: Wash/rinse (if necessary) excess mud or other debris from outer boots, gloves, and clothing while doffing. Place all disposable and reusable PPE in designated (separate) containers. Doff all PPE before leaving sampling area. In case of PPE upgrades, consult with the SHSC.

EQUIPMENT DECONTAMINATION:

All equipment that will potentially contact samples will be decontaminated prior to and following sampling events. Temporary decon stations (buckets) will be located near work areas.

DISPOSAL PROCEDURES:

All discarded materials that accumulate from onsite activities (PPE, decon fluids, supplies, etc.) will be segregated by matrix and returned to the SSFL site.

EMERGENCY CONTINGENCY PLAN

PRE-PLANNING AND GENERAL PROCEDURES:

General: Site personnel should be constantly alert to recognize potentially unsafe work environments. Emergency response procedures (this section) should be reviewed daily.

In the event of an emergency, the FM is expected to notify the PM, HSM, and Rocketdyne, and evacuate the area. If appropriate, contact trained emergency staff to respond to the situation. The safety and well-being of site personnel, the residents, visitors, and the adjacent community will be of utmost importance in determining the appropriate response to a given emergency.

Emergency Coordinator: Both the FM and SHSC will serve jointly as ECs during an actual emergency response situation. The FM will serve as the primary EC at all times. All foreseeable first-aid and rescue equipment should be stored onsite in an accessible area.

EMERGENCY REFERENCE LIST

(Keep posted in vehicles and near communication system)

Medical Emergencies*: See Hospital Route Map in Figure 2. The hospital route must be verified by the Site Health and Safety Coordinator (SHSC) and Field Manger (FM) once onsite.

Hospital Name: **West Hills Regional Medical Center**

Hospital Address: 7300 Medical Center Dr. West Hills, CA 91307

Hospital Telephone: **(818) 712-4100**

Directions: From the Bell Canyon residential area, go east on Bell Canyon Road, it will turn into Bell Canyon Boulevard. Turn left onto Valley Circle Blvd. Follow Valley Circle Blvd. to Roscoe Blvd. and turn right. Follow Roscoe Blvd. to Fallbrook. Turn right onto Fallbrook. Follow Fallbrook to Sherman Way and turn right. The hospital is about a half mile down Sherman Way on the right hand side.

Call List:

Title	Name	Telephone Number
H&S Manager	Denise Daggett	(619) 458-9044 ext. 328
Acting Office HSC	Anita Broughton	(619) 458-9044 ext. 301
Rocketdyne	Art Lenox	(818) 586-5695/ (818) 607-8032 (pager)
Rocketdyne	Michael Sullivan	(818) 586-6004/ (818) 328-6510 (pager)
Rocketdyne Security		(818) 586-5333
Rocketdyne Health & Safety		(818) 586-2275
Poison Control Center		(800) 876-4766
Hartford SRS.*	Teleclaim	(800) 327-3636

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* In the event of an occupational accident or incident, please indicate to the medical facility that this is a workers' compensation case (Plan ID #RMWC1163005), that your employer is Ogden Allied, and that the insurance carrier is Hartford SRS located at Lisle Service Center, Wheaton, IL.

Emergency Equipment: Maintained in field vehicle or sampling location. All items must be checked and maintained by the SHSC at least weekly or after used.

(x) First-aid Kit
( ) SCBA
(x) Spill Equipment
( ) Other
(x) Fire Extinguisher
( ) Escape Packs
( ) Mobile Phone
(x) Hospital Route Map
( ) Field showers
( ) Alarms
( ) Fire Blanket

SITE-SPECIFIC RESPONSE SCENARIOS:

Natural Disasters

Weather Related Emergencies

All work will cease should any of the following weather conditions arise:

- Poor visibility
- Precipitation severe enough to impair safe movement/travel
- Lightning in the immediate area
- Winds in excess of 40 miles per hour
- Flooding
- Other conditions as determined by the SHSC or FM

Injury to Protect Personnel or Visitors

The ECs will determine whether to transport the injured Ogden employee to the nearest hospital or summon an ambulance. The Site Control and Security Measures will be implemented. Any offsite responding agencies will be given the Site Map and informed about the site-specific hazards so that they can be optimally helpful in an emergency situation. The injured Ogden employee shall remove any PPE, if possible, and be immediately transported to the designated medical facility.

Spill of Hazardous Materials

There is a potential for a spillage/leakage of hazardous materials. In case of a spill, select appropriate PPE and response equipment, contain the spill to the extent possible, neutralize or contain the liquid as per the MSDS, transfer to an IDW container, document with an Incident Report; and notify the HSM.

Fire or Explosion

Small-scale fires (less than half the responder's height) should be extinguished with an accessible, ABC fire extinguisher by any team member who has received training. Trained Emergency Crews will be summoned to control any large-scale or potentially unmanageable incident. Any offsite responding agencies will be given the Site Map, and briefed about the site-specific hazards so that they can be optimally helpful in an emergency situation. The EC will notify the HSM and PM and will complete the appropriate reports.

Accident Reporting and Record keeping

The SHSC will contact the HSM, conduct an investigation jointly with the FM, and complete the supervisor's Report of Accident and First-aid Incident Report located in Attachment 2. These completed reports must be transmitted to the HSM within 24 hours of an occurrence; a fax is acceptable. Human Resources must be notified by telephone as soon as possible.

Description Of Emergency Routes

Bell Canyon Route to Canoga Park:

Take the unpaved fire road adjacent to Bell Creek. Follow this unpaved road approximately 0.9 miles to a paved road. Take this paved road 1.6 miles through the Buffer Zone to Gate 575. Pass through the gate to Hacienda St. of the Bell Canyon Estates. Follow Hacienda to Stagecoach Road and turn right. Take Stagecoach Road to Hackamore Lane and turn right. Follow Hackamore Lane to Bell Canyon Road and turn left. Follow Bell Canyon Road through the guard post to Valley Circle Blvd. Expected travel time to Valley Circle Blvd. from CTL V Road, is 17 minutes and a distance of 3.6 miles.

BLOODBORNE PATHOGEN EXPOSURE CONTROL PLAN

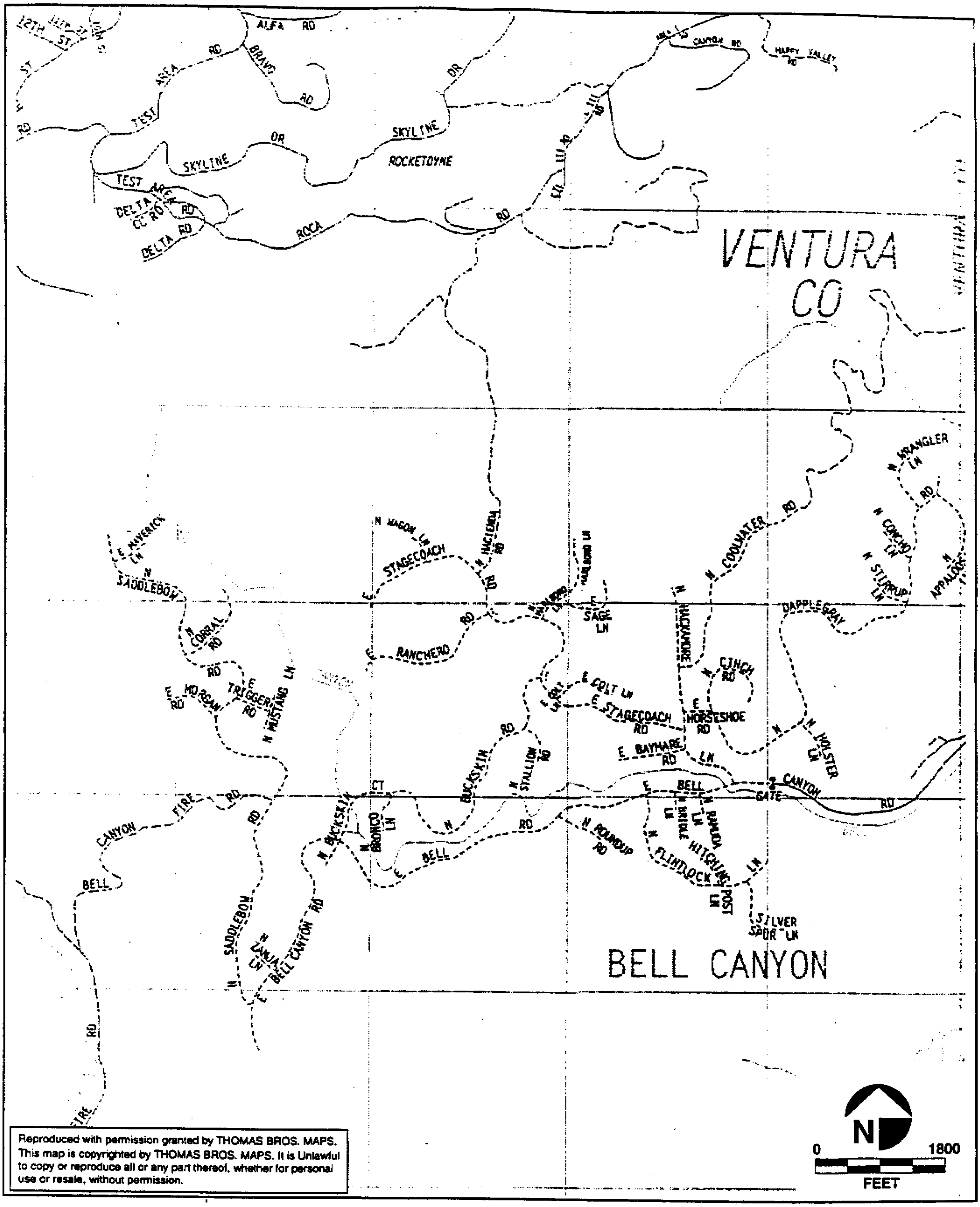
Exposure Determination:

First-aid responders have the potential to be exposed to bloodborne pathogens. All workers onsite shall have currently updated training and certification in standard first aid that covers the subject of bloodborne pathogen. The potential for exposure to bloodborne pathogens outside of emergency response is not anticipated.

Exposure Control:

Training: Field personnel are trained in the recognition and control of bloodborne pathogens.

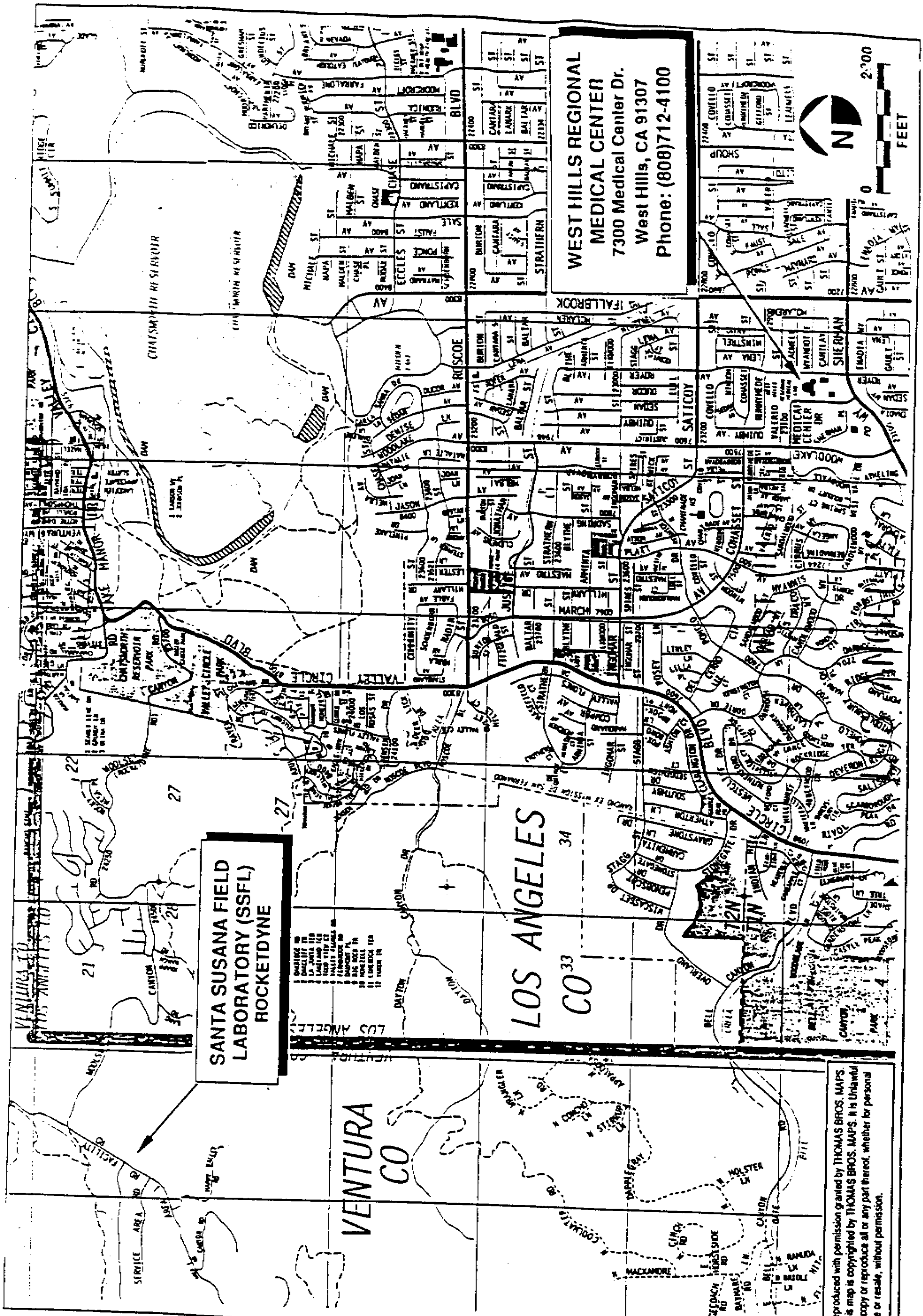
Universal Precautions: Use of the Center for Disease Control "Universal Precautions" as an approach to infection control, which assumes that all human blood and certain human bodily fluids are treated as if known to be infectious for HIV, HBV, and other bloodborne pathogens. Minimally, latex or blue nitrile gloves are to be donned. Other suggested PPE in the event of a serious injury include safety glasses, Tyvek coveralls and, boot covers - all of which should be available onsite. In addition, a one-way CPR mask to prevent direct contact between the rescuer and recipient will also be available in the first-aid kit should the need arise.



OGDEN

Project Location Map

FIGURE 1



WEST HILLS REGIONAL MEDICAL CENTER
7300 Medical Center Dr.
West Hills, CA 91307
Phone: (808)712-4100

SANTA SUSANA FIELD LABORATORY (SSFL) ROCKETDYNE

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FIGURE 2

Hospital Route Map

HEALTH AND SAFETY PLAN ACCEPTANCE

I have had the opportunity to read and ask questions about this HSP. My signature certifies that I understand the procedures, equipment, and restrictions of this plan and agree to abide by them.

Signature*	Printed Name	Company	Date

* This acceptance form is required for all routine site staff and subcontracting personnel.

REVIEW AND APPROVALS:

Prepared by:

Deborah J. Buol

Corporate Health and Safety Specialist

6-3-98

Date

Approved by:

Dennis L. Daggett, CIH

Corporate Health and Safety Manager

3 June 1998

Date

Project Manager

6/4/98

Date

ATTACHMENT I

Material Safety Data Sheets

Genium Publishing Corporation
One Genium Plaza
Schenectady, NY 12304-4690 USA
(518) 377-8854

Sheet No. 65
Hydrogen Gas/Liquid

Issued: 5/80 Revision: B. 9/92

Section 1. Material Identification

Hydrogen (H_2) Description: The most abundant element on earth, present as free hydrogen in air at ~ 1 ppm. Produced by reacting steam with natural gas and subsequent purification, dissociation of ammonia, passing steam over iron, electrolysis of water (simplest process and used when a high degree of purity is needed but because of high energy consumption is seldom produced in large quantities), or the most economical, the conversion of hydrocarbon gases (i.e. interaction of methane with water vapor). Used in production of ammonia, metals that resist fusion (molybdenum and bismuth), and methyl alcohol; in reducing metal oxides at high temperatures, welding and cutting steel, hydrogenation of liquid fuels and plant oils, extraction of liquid fuel from coal, and organic synthesis for reduction reactions. Liquid H_2 is used as a coolant, in balloons and airships, thermonuclear reactions, and to study subatomic particles in bubble chambers.

Other Designations: CAS No. 1333-74-0, protium.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.

Cautions: Hydrogen is highly flammable and explosive when exposed to heat, flame, oxidizers. The gas is relatively inert although it becomes a simple asphyxiant at high concentrations by replacing oxygen. Rapid release of compressed gas or contact with the liquid may cause frostbite or severe burns.

Gas

				NFPA
R	1	HMIS		4
I	-	H	0	0 0
S	-	F	4	-
K	4	R	0	
		PPE*		
		* Sec. 8		

Liquid

R	1	HMIS		4
I	-	H	3	3 0
S	3	F	4	-
K	4	R	0	

Section 2. Ingredients and Occupational Exposure Limits

Hydrogen, ca 100%

1991 OSHA PEL
None established

1990 DFG (Germany) MAK
None established

1992-93 ACGIH TLV
Classified as 'inert'; a simple asphyxiant at high concentrations.

1990 NIOSH REL
None established

1985-86 Toxicity Data*
None reported

* Monitor NIOSH, *RTECS* (MW8900000), for future toxicity data.

Section 3. Physical Data

Boiling Point: -423 °F (-253 °C)
Freezing Point: -434 °F (-259 °C)
Critical Pressure: 12.8 atm
Vapor Density (Air = 1): 0.069
Ionization Potential: 13.59 eV

Molecular Weight: 2.02
Density (liquid): 0.07 at -423 °F (-253°C)
Water Solubility*: Slightly, 1:50 parts water at 32 °F (0 °C).
Other Solubilities: Slightly soluble in alcohol and ether.
Critical Temperature: -399.8 °F (-239 °C)
Expansion Ratio, liquid to gas at b.p. to 70 °F: 1 to 851.33

Appearance and Odor: Colorless, tasteless, odorless gas which is much lighter than air.

* Contact with water at ambient temperatures will cause vigorous hydrogen vaporization.

Section 4. Fire and Explosion Data

Flash Point: None reported | **Autoignition Temperature:** 752 °F (400 °C) | **Explosion Range:** 4 to 75% v/v | **Detonation Range:** 20 to 65% v/v

Extinguishing Media: Use flooding quantities of water as fog and apply from as far away as possible. If possible without risk, stop flow of gas before extinguishment.

Unusual Fire or Explosion Hazards: Liquefied or compressed gas has a low ignition energy and burns with a light blue to nearly invisible flame. Container may explode in heat of fire. Hydrogen has a burning rate of 9.9 mm/min.

Special Fire-fighting Procedures: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Approach fire with caution since high temperature flame is practically invisible. Approach release from upwind as flame can flash back easily. Use water spray to cool fire-exposed containers. Structural firefighter's protective clothing provides only limited protection. Stay away from ends of tanks. For massive fire in cargo area use monitor nozzles or unmanned hose holder; if impossible, withdraw and let fire burn. Withdraw immediately if you hear a rising sound from venting safety device or notice tank discoloration due to fire. Do not release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Hydrogen is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: Under normal temperatures hydrogen is not very chemically reactive, but as temperatures increase so does reactivity. "Explodes on contact with bromine trifluoride, fluorine, chlorine trifluoride, hydrogen peroxide + catalysts, and acetylene + ethylene. Explodes when heated with 3,4-dichloronitrobenzene + catalysts, calcium carbonate + magnesium, vegetable oil + catalysts, ethylene + nickel catalysts, difluorodiazene (> 90 °C), 2-nitroanisole (> 250 °C/34 bar + 12% catalyst), copper (II) oxide, nitryl fluoride, (> 200 °C), or polycarbon monofluoride (> 500 °C). Forms shock sensitive compounds with bromine, chlorine, iodine heptafluoride (heat or spark sensitive), chlorine dioxide, dichlorine oxide, dinitrogen oxide, dinitrogen tetraoxide, and oxygen (gas). Reacts with liquid nitrogen and heat to create an explosive product. A violent reaction or ignition occurs with air + catalysts (platinum or similar metals containing absorbed O_2 and H_2), iodine, dioxane + nickel, lithium, nitrogen trifluoride, oxygen difluoride, palladium + isopropyl alcohol, lead trifluoride, nickel + oxygen, fluorine perchlorate (ignition on contact), xenon hexafluoride (violent reaction), nitogen oxide + oxygen (ignition above 360 °C), palladium powder + 2-propanol + air (spontaneous ignition). Produces a vigorous exothermic reaction with benzene + Raney nickel catalyst, metals (lithium, calcium, barium, strontium, sodium, and potassium above 300 °C), palladium (II) oxide, palladium trifluoride, and 1,1,1-tris(hydroxymethyl)-nitromethane + nickel catalyst. Some metals are susceptible to hydrogen attack or embrittlement.

Conditions to Avoid: Exposure to heat, flame, and incompatibles.

Continue on next page

Section 6. Health Hazard Data

Carcinogenicity: The IARC,[164] NTP,[169] and OSHA[164] do not list hydrogen as a carcinogen.

Summary of Risks: Hydrogen gas is generally inert but can cause asphyxiation at high concentrations by replacing air. Symptoms of exposure end on the degree and duration of oxygen deficiency and are characterized by air hunger, fatigue, decreased vision, mood disturbances, bness of extremities, headache, decreased coordination and judgement, cyanosis, and unconsciousness. Hydrogen can also be narcotic at evated pressures.

Medical Conditions Aggravated by Long-Term Exposure: None reported

Target Organs: Respiratory and nervous systems.

Primary Entry Routes: Inhalation.

Acute Effects: Asphyxia. Skin exposure to liquid hydrogen or rapid bursts of compressed air can cause frostbite.

Chronic Effects: None reported.

FIRST AID *Rescuers should protect against asphyxiation and possible fire/explosion when entering areas having potentially dangerous H_2 levels.*

Eyes: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin: For frostbite; immerse exposed area in 107.6 °F (42 °C) until completely rewarmed. Do not use dry heat.

Inhalation: Remove exposed person to fresh air and support breathing and administer 100% humidified-supplemental oxygen as needed.

Note to Physicians: Treatment is symptomatic and supportive.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Immediately notify safety personnel. Isolate and ventilate area, deny entry, and stay upwind. Shut off all ignition sources. If possible without risk, stop gas flow. Use water spray to reduce gas. Small leaks can be detected by bubbles that form when a suspected leak area has been painted with soapy water. Because hydrogen ignites readily and burns with a nearly invisible flame in daylight, leaks must be approached in a manner to protect against a jet flame. Remove leaking cylinder to a safe, outdoor area and repair or allow to empty. If impossible, place in a fume hood with good forced ventilation. Allow gas to be discharged at a slow rate. Tag the empty cylinder to reflect the defect, close the valve and return it to the supplier. Follow applicable OSHA regulations (29 CFR 1910.120).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

RCRA Hazardous Waste (40 CFR 261.33): Not listed

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

SARA Toxic Chemical (40 CFR 372.65): Not listed

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 100 lb (45.4 kg) [*per RCRA, Sec. 3001]

OSHA Designations

Air Contaminant (29 CFR 1910.1000, Subpart Z):Not listed

Section 8. Special Protection Data

gles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because ct lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. ow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA *using air, not pure oxygen! Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear cryogenically (extreme cold) protective gloves, boots, aprons, and gauntlets to prevent skin contact with liquid hydrogen. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations low enough to prevent oxygen displacement (O_2 levels should not go below 18% by volume). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.[103] **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes and launder before reuse. Clean PPE. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Prevent physical damage to containers. Store in a cool, dry, well-ventilated area away from heat, sun, flame, and oxidizers. Store and transport in labeled, steel containers under pressure of not more than 150 atm. Outside or detached storage is preferred. Install electrical equipment Class I, Group B. Use only non-sparking tools when opening and closing H_2 containers. "A compact portable ultrasafe unit for hydrogen for laboratory use has been developed based on a lanthanum-nickel alloy hydride storage capsule, to eliminate hazards associated with use of high-pressure storage of hydrogen".[149] Comply with handling, use, storage, and inspection procedures (29 CFR 1910.103).

Engineering Controls: To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. Never allow air or oxygen to enter a liquid hydrogen system as fractionation can produce a spark causing an explosion. See NFPA (Sec. 50B, 1989) for complete coverage of construction, siting, piping, components and safety devices in consumer systems for liquid hydrogen. Electrically ground and bond piping.

Administrative Controls: Train employees on safe handling of liquid H_2 and follow procedure in the Confined Space Standard (29 CFR 1910.146) when work requires entry into confined spaces. Consider preplacement and periodic medical exams of exposed workers.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Hydrogen, compressed
DOT Hazard Class: 2.1
No.: UN1049
Packing Group: --
Label: Flammable Gas
Special Provisions (172.102): --

Packaging Authorizations
a) Exceptions: 173.306
b) Non-bulk Packaging: 173.302
c) Bulk Packaging: 173.302, 173.314

Vessel Stowage Requirements
a) Vessel Stowage: E
b) Other: 40, 57

Quantity Limitations
a) Passenger, Aircraft, or Railcar: Forbidden
b) Cargo Aircraft Only: 150 kg

MSDS Collection **References:** 73, 103, 124, 126, 127, 132, 136, 139, 149, 153, 159, 163, 164

Prepared by: M Gannon, BA; **Industrial Hygiene Review:** D Wilson, CIH; **Medical Review:** AC Darlington, MPH, MD

Material Safety Data Sheet
Required under USDL Safety and Health Regulations for Shipyard Employment (29 CFR 1915)

U.S. Department of Labor
Occupational Safety and Health Administration

OMB No. 1218-[illegible]
Expiration Date [illegible]/31/86

PREPARED 1/10/86

Section I

Manufacturer's Name	ALCONOX, INC.	Emergency Telephone Number	(212) 473-1300
Address (Number, Street, City, State, and ZIP Code)	215 PARK AVENUE SOUTH	Chemical Name and Synonyms	N.A.
	NEW YORK, N.Y. 10003	Trade Name and Synonyms	ALCONOX
	C6300-1, C6301-1, C6301-2,-3,-4,-5	Chemical Family	ANIONIC DETERGENT
		Formula	N.A.

Section II - Hazardous Ingredients

DSI-.S02

Paints, Preservatives, and Solvents		%	TLV (Units)	Alloys and Metallic Coatings		%	TLV (Units)
Pigments	NONE			Base Metal	NONE		
Catalyst	NONE			Alloys	NONE		
Vehicle	NONE			Metallic Coatings	NONE		
Solvents	NONE			Filler Metal Plus Coating or Core Flux	NONE		
Additives	NONE			Others	NONE		
Others	NONE				—		

Hazardous Mixtures of Other Liquids, Solids or Gases	%	TLV (Units)
NONE		

Section III - Physical Data

Boiling Point (°F)	N.A.	Specific Gravity ($H_2O=1$)	N.A.
Vapor Pressure (mm Hg.)	N.A.	Percent Volatile by Volume (%)	N.A.
Vapor Density (Air=1)	N.A.	Evaporation Rate ________ =1)	N.A.

Solubility in Water: APPRECIABLE

Appearance and Odor: WHITE POWDER INTERSPERSED WITH CREAM COLORED FLAKES - ODORLESS

Section IV - Fire and Explosion Hazard Data

Flash Point (Method Used)	NONE	Flammable Limits	N.A.	Lel	N.A.	Uel	N.A.

Extinguishing Media: WATER, CO_2, DRY CHEMICAL, FOAM, SAND/EARTH

Special Fire Fighting Procedures:
FOR FIRES INVOLVING THIS MATERIAL, DO NOT ENTER WITHOUT
PROTECTIVE EQUIPMENT AND SELF CONTAINED BREATHING APPARATUS

Unusual Fire and Explosion Hazards:
NONE

Threshold Limit Value
NO DATA AVAILABLE - TREAT AS NUISANCE DUST

Effects of Overexposure
PROLONGED EXPOSURE TO DUST MAY IRRITATE MUCOUS MEMBRANES

Emergency First Aid Procedures
EYES - FLUSH WITH PLENTY OF WATER FOR 15 MINUTES, SKIN-FLUSH W
PLENTY OF WATER. INGESTION - DRINK LARGE QUANTITIES OF WATER
TO DILUTE MATERIAL. GET MEDICAL ATTENTION FOR DISCOMFORT.

Section VI - Reactivity Data

Stability	Unstable		Conditions to Avoid NONE
	Stable X		

Incompatibility (Materials to Avoid)
AVOID STRONG ACIDS

Hazardous Decomposition Products
MAY RELEASE CO_2 GAS ON BURNING

Hazardous Polymerization	May Occur		Conditions to Avoid NONE
	Will Not Occur X		

Section VII - Spill or Leak Procedures

Steps to be Taken in Case Material is Released or Spilled
MATERIAL FOAMS PROFUSELY, SHOVEL AND RECOVER
AS MUCH AS POSSIBLE. RINSE REMAINDER TO SEWER. MATERIAL IS COMPLETE[illegible]
BIODEGRADABLE.

Waste Disposal Method
SMALL QUANTITIES MAY BE DISPOSED OF IN SEWER. LARGE
QUANTITIES SHOULD BE DISPOSED OF ACCORDING TO LOCAL REQUIREMENTS
FOR NON-HAZARDOUS DETERGENT

Section VIII - Special Protection Information

Respiratory Protection (Specify Type)
DUST MASK

Ventilation	Local Exhaust	NORMAL	Special	N.A.
	Mechanical (General)	N.A.	Other	N.A.

Protective Gloves	USEFUL - NOT REQUIRED	Eye Protection	USEFUL - NOT REQUIRED

Other Protective Equipment
NOT REQUIRED

Section IX - Special Precautions

Precautions to be Taken in Handling and Storing
SHOULD BE STORED IN A DRY AREA TO
PREVENT CAKING

Other Precautions
NO SPECIAL REQUIREMENTS OTHER THAN THE GOOD INDUSTRIA[illegible]
HYGIENE AND SAFETY PRACTICES EMPLOYED WITH ANY INDUSTRIAL CHEMICAL.

************************* CHEMTOX TOXICOLOGICAL DATA *************************

CHEMTOX RECORD :3539
NAME :ISOPROPYL ALCOHOL
CAS NUMBER :67-63-0

IDLH :12000 ppm Source: NIOSH
OSHA DATA :Transitional Limits:
PEL = 400 ppm(980mg/M3)
Final Rule Limits:
TWA = 400 ppm (980 mg/M3)
STEL = 500 ppm(1225 mg/M3)

ACGIH TLV :TLV = 400 ppm(980 mg/M3) STEL: 500 ppm
TARGET ORGANS :EYES,SKIN,RESP SYS Source: NIOSH
REPRODUCTIVE TOX :This chemical is a reproductive toxin to mammals.
SHORT TERM TOX :Inhalation: IRRITATION OF THE NOSE AND THROAT MAY
OCCUR AT 400 PPM AND ABOVE.ªSkin: 5% SOLUTION MAY
CAUSE IRRITATION AND DRYNESS.ªEyes: VAPOR LEVELS OF
CAUSE IRRITATION AND DRYNESS.ªEyes: VAPOR LEVELS OF
20 PPM OR ABOVE MAY RESULT IN IRRITATION. LIQUID
MAY CAUSE CORNEAL BURNS AND EYE DAMAGE.ªIngestion:
22.5 ML (2/3 OZ.) HAS CAUSED SALIVATION, REDDENING
OF FACE, STOMACH PAIN, DEPRESSION, DIZZINESS, HEADACHE,
VOMITING AND UNCONSCIOUSNESS. INGESTION OF 100 ML
(3 OZ.) HAS CAUSED DEATH.(NYDH)
LONG TERM TOX :NO REPORTED LONG TERM EXPOSURE EFFECTS.(NYDH)
MEDICAL CON'DTION
AGGRAVATED . :No data available
SIGNS/SYMPTOMS :Vapors cause mild irritation of eyes and upper respiratory
tract; high concentrations may be anesthetic. Liquid
irritates eyes and may cause injury; harmless to skin;
if ingested causes drunkenness and vomiting. Source:
CHRIS MILD IRRITATION TO EYES, NOSE, THROAT; DROWSINESS,
DIZZINESS, HEADACHE; DRY, CRACKING SKIN; GASTRO-INTESTINAL
CRAMPS, NAUSEA, DIARRHEA. Source: 2
LD50 (mg/Kg) : orl-rat LD50:5045 mg/ kg

THIS CHEMICAL IS A KNOWN OR SUSPECTED CARCINOGEN LISTED BY NPT, IARC OR OSHA

SIGNS/SYMPTOMS :CHILLS, STUFFY HEAD, EYE IRRITATION, NAUSEA, VOMITING,
ABDOMINAL PAIN AND DIARRHEA. Source: 1
LD50 (mg/Kg) :No LD50 in RTECS 1991

OTHER TOXICITY DATA: (RTECS 1990)
ipr-mus LD50:3500 ug/kg 38MKAJ 2A,1623,81

PHYSICAL DATA SUMMARY

CHEMTOX ID NUMBER : 3539
CHEMTOX NAME : ISOPROPYL ALCOHOL
CAS NUMBER : 67-63-0
FORMULA/CHEMICAL CLASS : C_3H_8O/Alcohol
MOLECULAR WEIGHT : 60.11
PHYSICAL DESCRIPTION : COLORLESS LIQUID WITH A SWEET ODOR
BOILING POINT : 180.5 F
MELTING POINT : -128 F
VAPOR PRESSURE : 89.26 mm @ 56.77 C
WATER SOLUBILITY : MISCIBLE
SPECIFIC GRAVITY : 0.785 @ 20C
IONIZATION POTENTIAL : 10.15 eV
FLASH POINT (CC) : 69.8 F
UEL : 12.7 %
LEL : 2.3 %
AUTOIGNITION TEMP : 750.2 F

ATTACHMENT II

Project Health and Safety Forms

OGDEN

Ogden Tailgate Safety Meeting Report

Check One:

☐ Initial Kickoff Safety Meeting ☐ Regular/Daily Tailgate Safety Meeting ☐ Unscheduled Tailgate Safety Meeting

Date: ____________________ Site: ______________________________

Field Manager: ____________________ *(print)* Site Health and Safety Coordinator: ____________________ *(print)*

Order of Business

Topics Discussed (check all that apply):

- ☐ Site History/Site Layout
- ☐ Scope of Work
- ☐ Personnel Responsibilities
- ☐ Medical Surveillance Requirements
- ☐ Training Requirements
- ☐ Safe Work Practices
- ☐ Logs, Reports, Recordkeeping
- ☐ Sanitation and Illumination
- ☐ Air Surveillance Type and Frequency
- ☐ Monitoring Instruments and Personal Monitoring
- ☐ Action Levels
- ☐ Accident Reporting Procedures
- ☐ Site Control (visitor access, buddy system, work zones, security, communications)
- ☐ Discussion of previous "near misses" including work crew suggestions to correct work practices to avoid similar occurrences
- ☐ Engineering Controls
- ☐ PPE Required/PPE Used
- ☐ Define PPE Levels, Donning, Doffing Procedures
- ☐ Physical Hazards and Controls (i.e., overhead utility lines)
- ☐ Decontamination Procedures for Personnel and Equipment
- ☐ General Emergency Procedures (i.e., locations of air horns and what 1 or 2 blasts indicate)
- ☐ Site/Regional Emergency Procedures (i.e., earthquake response, typhoon response, etc.)
- ☐ Medical Emergency Response Procedures (i.e., exposure control precautions, location of first aid kit, etc.)
- ☐ Hazardous Materials Spill Procedures
- ☐ Applicable SOPs (i.e., Hearing Conservation Program, Safe Driving, etc.)
- ☐ Injury/Illness Reporting Procedures
- ☐ Route to Hospital and Medical Care Provider Visit Guidelines
- ☐ Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazards and effects)

Safety suggestions by site workers: ______________________________

____

____

Action taken on previous suggestions: ______________________________

____

____

Injuries/accidents/personnel changes since previous meeting: ______________________________

____

____

OGDEN

Ogden Tailgate Safety Meeting Report *(continued)*

Observations of unsafe work practices/conditions that have developed since previous meeting: ______

Location of (or changes in the locations of) evacuation routes/safe refuge areas: ______

Additional comments: ______

Attendees signatures below indicate acknowledgment of the information, and willingness to abide by the procedures, discussed during this safety meeting.

Name (print)	Company	Signature

Meeting conducted by: ______ *(print)* Title: ______

Signature: ______ Time: ______

INSTRUMENT CALIBRATION LOG

PROJECT ____________________

Date/Time	Instrument	Serial Number	Span Gas Substance	Span Conc.	Instrument Reading at Calibration	Instrument Reading After Calibration	Comments

INSTRUMENT CALIBRATION LOG

PROJECT ____________________

Date/Time	Instrument	Serial Number	Span Gas Substance	Span Conc.	Instrument Reading at Calibration	Instrument Reading After Calibration	Comments

SITE AIR SURVEILLANCE RECORD

SITE INFORMATION

SITE MANAGER

DATE:

H&S COORDINATOR:

Page ____of____

SITE LOCATION:

SITE CONDITIONS

SITE PERSONNEL:

TEMPERATURE:
RELATIVE HUMIDITY:
WIND SPEED & DIRECTION:

SAMPLE NO.	TIME	SAMPLE DESCRIPTION	LOCATION	INSTRUMENT	READING	COMMENTS

Page _____ of _____

SAMPLE NO.	TIME	SAMPLE DESCRIPTION	LOCATION	INSTRUMENT	READING	COMMENTS

WORKPLACE EXPOSURE MONITORING RECORD

Name: ______________________

Soc. Sec. No.: ______________________

Employer/Office: ______________________

Job Function: ______________________

Project No.: ______________________

Project Name: ______________________

Project Dates: ______________________

Project Location: ______________________

SAMPLING METHOD:

☐Adsorber : ______________

☐Detector Tube: ______________

☐Dosimeter Badge: ______________

☐Filter: ______________

☐Impinger: ______________

☐Meter: ______________

☐Other: ______________

SAMPLE TYPE:

☐Area

☐Background

☐Biological

☐Personal

WORK ZONE:

☐Contamination Reduction

☐Exclusion

☐Support

☐Other ______________

SAMPLE COLLECTION:

Sample No.: ______________________

Instrument Make/Model: ______________________

Calibration Date: ______________________

Sample Date: ______________________

Collected By: ______________________

Analyzed By: ______________________

(Use reverse side for calculations and sketches as necessary)

Sample Duration: ______________________ (min.)

Sample Rate: ______________________ (L/min.)

Sample Vol.: ______________________ (L)

ATMOSPHERIC CONDITIONS:

Humidity (%): ☐Low 0-30 ☐Med 30-70 ☐High 70-100

Wind (mph): ☐Light 0-5 ☐Moderate 5-20 ☐High >20

Temp.: ________ °F

Direction: ______________________

ANALYTICAL RESULTS:

Contaminant	Concentration	Units	Analytical Method	Detection Limit

PPE WORN: (√ = Yes)

☐Half-Face Purifying Respirator

☐Full-Face Purifying Respirator

☐Air Supplied Respirator

☐Disposable Respirator

☐Chemical Cartridge

☐HEPA Cartridge

☐Disposable Coverall

☐Chemical Gloves

☐Chemical Boots

☐Slicker

☐Unknown

☐Safety Glasses

☐Goggles

☐Hearing Protection

☐Other ______________

OTHER REPRESENTATIVE PERSONNEL:

GENERAL COMMENTS:

Distribution: H & S Personnel File, Project File, Employee, Other ______________________

FIRST AID INCIDENT REPORT

Date of Report:

Date of Accident/Incident:

Report Completed by:

Description of the Accident/Incident: (time, location, event, description of injuries)

Name of Injured Person:

Employer:

Name of First Aid Providers(s):

Social Security No.:

Bloodborne Pathogen Exposure Incident Evaluation:

1. Was the First Aid Responder exposed to blood or other potentially infectious materials?

☐ Exposure Occurred (see question 2)
☐ No Exposure

2. Exposure occurred by contact with the following (check all that apply):

☐ Eye
☐ Mouth
☐ Other Mucous Membrane
☐ Non Intact Skin (cuts, abrasions)
☐ Needlestick
☐ Human Bite

Exposure Control Precautions Taken (check all that apply):

☐ Gloves
☐ Face Mask
☐ One-way CPR valve
☐ Eye Protection
☐ Immediate Personal Hygiene
☐ Previous HBV Immunization
☐ Recommended for HBV Immunization
☐ Other ____________________

Please attach this completed form to the Supervisor's First Report of Injury and forward to Human Resources and your Office Health and Safety Coordinator or, as applicable, to the CLEAN Health and Safety Manager (HSM).

SUPERVISOR'S REPORT OF ACCIDENT

NOTE In order to prevent accidents, it is necessary to know how and why they occur. State facts as accurately as possible. Accurate reporting of all facts will help in the preparation of the "Employer's Report." Submit your complete report within 24 hours. If additional space is needed, use reverse side.

Name of Injured Employee		Department in Which Regularly Employed
Injury Date	Time a.m. p.m.	Date Employer was Notified of Injury
Did Accident Occur on Employer's Premises? ☐ Yes ☐ No	Where? (Specify dept., job site, etc.)	Name of witnesses.

What was employee doing when injured? (Such as: walking, lifting, operating machines, etc.) Be specific

Please describe fully the events that resulted in injury or occupational disease. Tell what happened and how it happened? (Do not describe nature of injury.)

What machine, tool, substance or object was most closely connected with the injury? (e.g., the machine employee struck against or which stuck him; the chemical that irritated his skin; in cases of strain, the thing he was lifting, pulling, etc.)

Nature of injury and part of body affected.

CAUSES OF ACCIDENT: CHECK ALL THAT APPLY

UNSAFE BUILDING OR WORKING CONDITIONS

- ☐ LAYOUT OF OPERATIONS
- ☐ LAYOUT OF MACHINERY
- ☐ (UNSAFE PROCESSES
- ☐ IMPROPER VENTILATION
- ☐ IMPROPER SANITATION/HYGIENE
- ☐ IMPROPER LIGHT
- ☐ EXCESSIVE NOISE
- ☐ FLOORS OR PLATFORMS
- ☐ MISCELLANEOUS

HOUSEKEEPING

- ☐ IMPROPERLY PILED OR STORED MATERIAL
- ☐ CONGESTION

PHYSICAL HAZARDS OR EQUIPMENT

- ☐ INEFFECTIVELY GUARDED
- ☐ UNGUARDED
- ☐ GUARD REMOVED
- ☐ DEFECTIVE TOOLS
- ☐ DEFECTIVE MACHINES
- ☐ DEFECTIVE MATERIALS

INSTRUCTIONS AND TRAINING

- ☐ NONE
- ☐ INCOMPLETE
- ☐ ERRONEOUS
- ☐ NOT FOLLOWING INSTRUCTIONS
- ☐ OPERATING WITHOUT AUTHORITY
- ☐ WORKING AT UNSAFE SPEED
- ☐ INEXPERIENCE
- ☐ UNTRAINED IN PROCEDURE
- ☐ INCORRECT USE OF TOOL OR EQUIPMENT
- ☐ MPROPER JUDGMENT
- ☐ IMPROPER LIFTING
- ☐ LIFTING EXCESSIVE WEIGHT

DISCIPLINE

- ☐ NOT FOLLOWING SAFETY RULES
- ☐ HORSEPLAY

APPAREL OR PERSONAL PROTECTIVE EQUIPMENT

- ☐ PROTECTIVE EQUIPMENT NOT USED
- ☐ UNSUITABLE PROTECTIVE EQUIPMENT
- ☐ UNSUITABLE CLOTHING OR FOOTWEAR

What can be done to prevent such an accident from happening again?

Approx. date condition will be corrected?	Signature of Supervisor:	Date:

RECORD OF CHANGE
SITE-SPECIFIC HEALTH AND SAFETY PLAN

GENERAL SITE INFORMATION

SITE NAME:

DATE:

PROJECT MANAGER:

ENGINEER-IN-CHARGE:

SITE MANAGER:

SITE H&S COORDINATOR:

DESCRIPTION OF AND JUSTIFICATION FOR CHANGE

SHSC SIGNATURE: ______________________ DATE: __________

HSM AUTHORIZATION: ____________________ DATE: __________

EMPLOYEE/VISITOR DAILY ROSTER

PROJECT NO. ____________________ **SITE NAME:** ____________________

DATE: ____________________ **PROJECT MANAGER:** ____________________

DATE	NAME	COMPANY	TIME ONSITE	TIME OFFSITE

Note: Visitors will be informed of site-specific health and safety precautions prior to signing this roster.

ATTACHMENT III

Potential Chemical Hazard Properties and Exposure Information

POTENTIAL CHEMICAL HAZARD PROPERTIES AND EXPOSURE INFORMATION*

CHEMICAL NAME/ SYNONYM	ACGIH TLV/ OSHA PEL	STEL/ IDLH	IP (eV)	LEL/ UEL	ROUTE/ SYSTEMS**		PROPERTIES/ CHARACTERISTICS
					Route	Symptoms	
METALS: Antimony	0.5mg/m^3 0.5mg/m^3	80mg/m^3	N.E.	N.E.	Inh	Irrit nose, throat, mouth; cough; stomach cramps; insom; anor; irrit skin	Silver-white, lustrous, hard, or a dark gray, lustrous powder
Arsenic	200 mg/m^3 0.01mg/m^3	N.E. 100mg/m^3	N.E.	N.E.	Inh Abs Con Ing	Ulceration of nasal septum, derm, GI disturbances, peri neur, resp irrit, hyperpig of skin	Silver-gray or tin-white brittle, odorless solid
Chromium	0.5 mg/m^3 1.0 mg/m^3	NE/NE	NA	NA	Inh Ing	Histologic fibrosis of lungs	Blue-white to steel gray, lustrous, brittle, solid
Lead	0.15 mg/m^3 0.05 mg/m^3	NE/ 700mg/m^3	NA	NA/NA	Inh Ing	Weak, lass, insom; facial pallor; pal eye, anor, low-wt, colic; anemia; gingival lead line; tremor; para wrist, ankles encephalopathy; nephropathy; irrit eyes; hypotension	Heavy ductile soft gray solid
Mercury	0.1 mg/m^3 1.0 mg/m^3	NE/NE	unknown	NA/NA	Inh Con	Pares; ataxia, vision, hearing skin burns; emotional dist	Silver-white, heavy, odorless
TPHs (fuels): Diesel	N.E./ N.E.	N.E./ N.E.	N.E.	1.4%/ 7.5%	Inh Abs Ing Con	Dizz, head, nau; irrit eyes, nose, throat; nausea	Clear liquid
JP-4	200 ppm (CHRIS)	2500 mg/m^3	N.E.	1.3%/ 8.0%	Inh Abs Ing Con	Vapor causes slight irritation to eyes and nose, liquid irritates stomach; if taken into lungs, it may cause coughing, distress, and pulmonary edema	Colorless to light brown liquid, with a fuel-like odor
Oils	N.E. / N.E.	N.E./ N.E.	N.E.	N.E.	Ing	Minimal gastrointestinal tract irritation	Yellow-brown, oily liquid with lube-oil odor
VOCs: Freon-113	1000ppm / 7600mg/m^3	N.E. / 2000ppm	11.99	NA/NA	Inh Ing Con	Irrit skin, throat; drow; derm; CNS depression	Colorless to water-white, with an odor like carbon tetrachloride at high concent
Methyl Chloroform/ 1,1,1 -Trichloroethane	N.E./ 350 ppm	350 ppm/ 700 ppm	11.0	7.5%/ 12.5%	Inh Ing Con	Head, lass, CNS depress, poor equi; irrit eyes; derm; card arrhy	Colorless liquid, with a mild, chloroform-like odor
Trichloroethylene (TCE)	50 ppm/ 100 ppm	N.E./ 1000 ppm	9.45	8.0%/ 10.5%	Inh Ing Con	Irrit. eyes, skin; headache; tremor; nau; vomit; derm; card arrhy (carc)	Colorless liquid with a chloroform-like odor

NOTE: The above information was derived from NIOSH Pocket Guide to Chemical Hazards June 1997, ACGIH Threshold Limit Values 1997 and Chemical Hazard Response Information System (CHRIS). Permissible Exposure Limits OSHA 1989, as adopted by the states of California and Hawaii.

* The information listed is provided for Ogden personnel to satisfy OSHA Standards. Based on previous soil and surface water sampling in and near Bell Canyon, chemicals detected above background levels are not expected during sampling activities.

POTENTIAL CHEMICAL HAZARD PROPERTIES AND EXPOSURE INFORMATION*

CHEMICAL NAME/ SYNONYM	ACGIH TLV/ OSHA PEL	STEL/ IDLH	IP (eV)	LEL/ UEL	ROUTE/ SYSTEMS**		PROPERTIES/ CHARACTERISTICS
					Route	Symptoms	
SVOCs: Benzo(b)fluoranthene/ Benzo(f)acephenanthrylene	A2 / 0.2 mg/m^3	2 ppm / N.E.	N.E.	N.E. / N.E.	Inh Con Ing	(carc)	Polynuclear aromatic hydrocarbon that crystallizes as colorless needles melting at 167-168 celsius degrees.
Benzo(f)fluoranthene	A2 / 0.2 mg/m^3	2 ppm / N.E.	N.E.	N.E. / N.E.	Inh Con Ing	(carc)	Polynuclear aromatic hydrocarbon
Chrysene/ 1,2-Benzophenanthrene	A2 / 0.2 mg/m^3	A2/ N.E.	N.E.	N.E. / N.E.	Inh Ing Con	Irrit skin; (carc)	An odorless polynuclear aromatic hydrocarbon that forms red, blud, fluorescent crystals
Fluoranthene	N.E. / N.E.	N.E. / N.E.	NA	N.E. / N.E.	Inh Ing Con	Irrit skin, muc membrane; may cause tremors	Plates crystalized from alcohol, insoluble in water.
Naphthalene	10 ppm/ 10 ppm	NE/ 500 ppm	8.12	0.9% / 5.9%	Inh Abs Ing Con	Eye irrit; head; conf, excitement; mal; nau, vomit, abdom pain; irrit bladder; profuse sweat; jaun; hema, hemog, renal shutdown; derm	Colorless to brown solid with an odor of mothballs
Phenanthrene	N.E./ 0.2 mg/m^3	N.E. / N.E.	N.E.	N.E. / N.E.	Con	Photo sensitizer of skin; (carc)	NA
Pyrene	N.E./ 0.2 mg/m^3	N.E./ N.E.	N.E.	N.E. / N.E.	Con	Irrit skin; (carc)	Colorless solid, solutions have a slight blue color
PCBs: Chlorodiphenyl (42% chlorine)	0.001 mg/m^3 1 mg/m^3	N.E. / 5 mg/m^3	N.E.	N.E. / N.E.	Inh Ing	Irrit eyes; chloracne; repro effects; (carc)	Colorless to light-colored, viscous liquid with a mild hydrocarbon odor
Chlorodiphenyl (54% chlorine)	0.001 mg/m^3/ 0.5 mg/m^3	N.E. / 5 mg/m^3	N.E.	N.E. / N.E.	Inh Ing	Irrit eyes; chloracne; repro effects; (carc)	Colorless to pale-yellow, viscous liquid or solid with a mild, hydrocarbon odor
Dioxins (TCDD)	no numerical values/ none	N.E. / N.E.	N.E.	N.E. / N.E.	Inh Abs Ing Con	Irrit eyes; allergic derm, chloroacne; GI dist; possible repro effects; hemorr; (carc)	Colorless to white crystalline solid

NOTE: The above information was derived from NIOSH Pocket Guide to Chemical Hazards June 1997. ACGIH Threshold Limit Values 1997 and Chemical Hazard Response Information System (CHRIS). Permissible Exposure Limits OSHA 1989, as adopted by the states of California and Hawaii.

* The information listed is provided for Ogden personnel to satisfy OSHA Standards. Based on previous soil and surface water sampling in and near Bell Canyon, chemicals detected above background levels are not expected during sampling activities.

POTENTIAL CHEMICAL HAZARD PROPERTIES AND EXPOSURE INFORMATION

*C	OSHA Ceiling Limit	PEL	OSHA Permissible Exposure Limit	IP	Ionization potential
IDLH	Immediately dangerous to life or death	NE	None established	STEI	Short-term exposure limit
LEL	Lower explosive limit	ppm	Parts per million	UEL	Upper explosive limit
mg/m^3	Milligrams per cubic meter	STEL	Short term exposure limit	TLV	ACGIH threshold limit values
NA	Not applicable	TWA	Time weighted average		

**abd=abdominal
Abs=skin absorption
anes=anesthesia
anor=anorexia
arrhy=arrhythmias
Asb=asbestosis
asphy=asphyxia
BP=blood pressure
bron=bronchitis
carc=carcinogen
card=cardiac
CNS=central nervous system
Con=contact
conf=confusion
constip=constipation
convuls=convulsions
cyan=cyanosis
decrs=decrease
depres=depressant
derm=dermatitis
diarr=diarrhea
dist=disturbance
dizz=dizziness
drow=drowsiness
dysp=dyspnea
emphy=emphysema
equi=equilibrium
eryt=erythema
euph=euphoria
extrm=extremities
fail=failure
fasc=fasiculation
FEV=forced expiratory volume
fib=fibrosis
ftg=fatigue
func=function
GI=gastrointestinal
gidd=giddiness
haul=hallucinations
head=headache
hemato=hemotopoietic
hemog=hemoglobinuria
hemorr=hemorrhage
hyper=hypersenstivity
hypox=hypoxemia
ict=icterus
inco=incoordination
incr=increase
inflam=inflammation
Ing=ingestion
Inh=inhalation
inj=injury
insom=insomnia
irreg=irregular
irrit=irritant
jaun=jaundice
kera=keratitis
lac=lacrimation
lar=laryngeal
lass=lassitude
leucyt=leukocytosis
leupen=lukopenia
li-head=lightheadedness
low-wgt=weight loss
mal=malaise
malnut=malnutrition
ment=mental
monocy-=monocytosis
muc memb=mucous membrane
musc=muscle
nau=nausea
nerv=nervous
palp=palpitations
para=paralysis
pares=paresthesia
perf=perforation
peri neur = peripheral neuropathy
periob=periorbital
phar=pharyngeal
photo=photophobia
pig=pigmentaiton
pneu=pneumonia
pneuitis=pneumonitis
PNS=peripheral nervous system
polneur=polyneuro-pathy
prot=proteninuria
pulm=polmonary
resp=respiratory
retster=retrosternal
salv=salivation
sens=sensitization
sez=seizure
som=somnolence
subs=substernal
sweat=sweating
swell=swelling
sys=system
tacar=tachycardia
tend=tenderness
tght=tight
uncon=unconsciousness
verti=vertigo
vesic=vesicuation
vomit=vomiting
weak=weakness
<wgt=weight loss

POTENTIAL CHEMICAL HAZARD PROPERTIES AND EXPOSURE INFORMATION

- ACGIH TLVs and OSHA PELs are "Time Weighted Average" (TWA) concentrations that must not be exceeded during any 8-hour shift or a 40-hour work week.
- Ceiling concentrations must not be exceeded during any part of the workday; if instantaneous monitoring is not feasible, the ceiling must be assessed as a 15-minute TWA exposure.
- IDLH represents the maximum concentration from which in the event of respiratory failure one could escape within 30 minutes without a respirator and without experiencing any escape-impairing (e.g., severe irritation) or irreversible health effects.
- [skin] designates the potential for dermal absorption; skin exposure should be prevented. The value only represents inhalation hazards.
- "ppm" is parts per million by volume in air and is not equivalent to mg/kg by weight.
- IPs (given in electron volt (ev) units) are presented for photoionization detector (PID) usefulness evaluation.
- A2 = suspected human carcinogen and exposure levels should be a low as possible.

\+ Exceeds PID detection capabilities.

ATTACHMENT 3

STANDARD OPERATING PROCEDURES (SOPS)

[Appendix D of the RCRA Facility Investigation Work Plan Addendum (September 1996)]

TABLE OF CONTENTS - APPENDIX D

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INTRODUCTION

This document describes the Standard Operating Procedures (SOPs) to be used during the environmental investigations at the Santa Susana Field Laboratory (SSFL). The SOPs have been developed to provide personnel with guidance on administrative, field, data management, health and safety, and other procedures.

This document has been prepared to ensure that field personnel understand their authority, their responsibilities, and the objectives and schedule of the field sampling program. All field tasks will be completed in a safe and responsible manner. Field tasks will be performed following the SOPs and will be coordinated with the tasks described in the Work Plan Addendum and the Quality Assurance Project Plan (Appendix G).

These procedures are presented in approximate order in which they will occur in the field. These procedures are intended as guidance and may be modified as appropriate on a project and/or site-specific basis. Modifications made to the SOPs will require approval by the project manager and will be clearly documented.

Each SOP in this document follows a consistent format. Each procedure contains the following numbered major sections. If a section is not required for a particular procedure, the heading will be entered and a term such as "None" or "Not Applicable" is entered.

1.0 PURPOSE

This section contains a short statement of the objective of the procedure.

2.0 SCOPE

This section defines the extent of the application of the procedure.

3.0 DEFINITIONS

This section contains definitions of terms which are not commonly used or have a unique meaning as used in the procedure.

4.0 RESPONSIBILITIES

This section identifies responsibilities and interfaces for the activities described in the procedure.

5.0 PROCEDURE

This section describes how, and in what sequence, the activities addressed by the procedure are to be performed.

6.0 RECORDS

This section defines the documents developed during the implementation of the procedures that are required to be retained as records.

7.0 REFERENCES

This section identifies other documents which contain requirements related to the procedure.

8.0 ATTACHMENTS

This section lists any attachments to the procedure. Attachments shall be numbered consecutively as they appear in the procedure.

The SOPs covered in this document have been modified from the Ogden Master Plan of SOPs for the work to be conducted during the Resource, Conservation, and Recovery Act

(RCRA) Corrective Action Program at the SSFL. Only those SOPs that are applicable to the scheduled RCRA Facility Investigation (RFI) work to be conducted at the SSFL facility are included. Each SOP is internally paginated, and the SOP numbers from the Ogden Master Plan of SOPs are maintained for consistency.

The SOPs covered in this document include:

- SOP FP-B-7, *Utility Clearance*;
- SOP FP-B-1, *Surface Geophysics*;
- SOP FP-C-3, *Soil Gas Survey*;
- SOP FP-C-1, *Soil and Rock Classification*;
- SOP FP-C-2, *Soil Sampling*;
- SOP FP-C-4, *Surface Water Sampling*;
- SOP FP-D-5, *Equipment Decontamination*;
- SOP FP-B-8, *Investigation Derived Waste Management*;
- SOP FP-F-5, *Field Logbooks*;
- SOP FP-F-2, *Field QC Samples (Water, Soil);*
- SOP FP-F-6, *Record Keeping, Sample Labeling and Chain-of -Custody*;
- SOP FP-F-7, *Sample Handling, Storage and Shipping*;
- SOP DMP-9 *Chain-of-Custody Logbook*; and
- SOP DMP-2, *Data Management*.

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UTILITY CLEARANCE

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the process for determining the presence of subsurface utilities and/or other cultural features at locations where planned site activities involve the physical disturbance of subsurface materials. This SOP is applicable to the following activities: soil gas surveying, excavating, trenching, drilling of borings and installation of monitoring wells, use of soil recovery or slide-hammer hand augers, and all other intrusive sampling activities. The primary purpose of this SOP is to minimize the potential for damaging underground utilities or other subsurface features which could result in physical injury, disruption of utility service, or disturbance of other subsurface cultural features.

2.0 SCOPE

These procedures should be utilized to locate and identify the positions and types of underground utilities at sites where subsurface work is to be directed by Ogden. This procedure has been developed to serve as management-approved professional guidance for subsurface investigation programs. As professional guidance for specific activities, these procedures are not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviances from these procedures in planning or in execution of planned activities must be approved by the Project Manager and fully documented.

3.0 DEFINITIONS

3.1 UTILITY

For this procedure a utility is defined as a man-made underground line or conduit, cable, pipe, vault or tank which is, or was at sometime in the past, used for the transmission of material or energy (e.g., gas, electrical, telephone, steam, water or sewer, product transfer lines, or underground storage tanks.

3.2 AS-BUILT PLANS

Plans or blueprints depicting the locations of structures and associated utilities on a property.

3.3 TONING

Toning refers to the process of surveying an area utilizing one or more surface geophysical methods to determine the presence or absence of underground utilities. Following identification of underground utility locations, toning is typically conducted following careful examination of all available site utilities. Colored spray paint is typically used to mark locations with colors corresponding to the type of utility being identified. In addition areas cleared are typically flagged or staked to indicate that all identified utilities in a given area have been toned.

4.0 RESPONSIBILITIES

It is the responsibility of the Project Manager to verify that these utility locating procedures are performed prior to active subsurface exploration work begins.

The onsite Field Program Manager is responsible for planning, and performance of underground utility field location and marking following these procedures. All field personnel involved in subsurface investigations shall be familiar with these procedures.

5.0 PROCEDURES

The following steps shall be followed at all sites where subsurface exploration is to include excavations, drilling or any other subsurface investigative method that could damage existing utilities at a site. In addition to the steps outlined below, personnel must always exercise caution while conducting subsurface exploratory work.

5.1 PREPARE PRELIMINARY SITE PLAN

A preliminary, scaled site plan depicting the proposed exploratory locations shall be prepared as part of the work plan. This plan should include as many of the cultural and natural features as practical.

5.2 REVIEW BACKGROUND INFORMATION

A search of existing plan files to review the as-built plans is necessary to identify the known location of utilities at the site. The locations of utilities identified shall be plotted onto the preliminary, scaled site plan. If utilities are within close proximity to a proposed exploration activity, the Project Manager shall be informed. The Project Manager or Field Manager will determine if it is necessary to relocate the exploration activity.

Interviews with onsite and facility personnel familiar with the site will be conducted to obtain additional information regarding the known and suspected locations of underground utilities. Utilities other than those identified on the as-built plans will be penciled in on the preliminary plans, at their approximate location including identification of dimensions, orientation, and depth. A corresponding entry into the field log will be made describing the type of utility, the personnel who provided the information and the date the information was provided.

During the pre-fieldwork interviewing process, the interviewer will determine what personnel at the site would need to be notified of any incident involving the damage to existing utilities. This information will be recorded in the field log book with the corresponding telephone numbers and addresses.

5.3 SITE VISIT - LOCATE UTILITIES - TONING

Prior to the initiation of field activities, a site visit shall be made by the field task manager or similarly qualified staff personnel. Careful observations of existing structures and evidence of associated utilities, such as fire hydrants, irrigation systems, manhole and vault box covers, standpipes, telephone switch boxes, free-standing light poles, gas or electric meters, pavement cuts, and linear depression, should be noted. Comparisons between the preliminary site plan and the actual site configuration will be made. Any deviations should be noted in the field logbook and on the preliminary site plan. All areas where subsurface exploration is proposed shall be accurately located or surveyed, and clearly marked with stakes, pins, flags, paint, or other suitable devices. These areas shall correspond with the locations drawn on the preliminary site plan.

Following the initial site visit by the field program managers, a trained utility locator will locate, identify and tone all utilities depicted on the preliminary site plan. The locator should utilize appropriate sensing equipment to attempt to locate any utilities that may not have appeared on the as-built plans. This may involve the use of surface geophysical methods (Procedure FP-B-1). At a minimum a utility locator, metal detector and/or magnetometer should be utilized; however, it is important to consider the possibility that non-metallic utilities or tanks may be present at the site. If the potential for the presence of non-metallic cultural features at the site is believed to be significant, other appropriate surface geophysical methods, such as Ground Penetrating Radar, should be used. Proposed exploration areas shall be cleared of all utilities. All anomalous areas should be clearly toned. All toned areas shall be clearly identified on the preliminary site plan. Upon completion of toning and the plotting on the preliminary site plan of all known or suspected buried utilities, the utility locator shall provide the field program manager with a copy of the completed preliminary site plan.

Any anomalous areas detected and toned that are in close proximity to the exploration areas shall be reported to the Field Program Manager. The field program manager shall determine the safe distance to maintain from the known or suspected utility. It may be necessary to relocate proposed exploration areas. If this is required, the field program manager or a similarly qualified individual shall relocate these areas and clearly mark them using the methods described above. The markings at the prior location shall be completely removed. The new locations shall be plotted on the site plan and the prior locations shall be deleted from the areas plan. In some instances, such as in areas extremely congested with subsurface utilities, it may be necessary to hand dig, hand auger, or excavate with a backhoe to determine the location of the utilities.

5.4 PREPARE SITE PLAN

Prior to the initiation of field activities, a final site plan shall be drafted which indicates the location of subsurface exploration areas and all known or suspected utilities present at the site. Copies of this site plan shall be provided to the field task manager, the Project Manager and the subcontractor who is to conduct the subsurface exploration work. The site plan should be reviewed with the client representative to verify its accuracy prior to initiating subsurface sampling activities.

6.0 RECORDS

A bound field logbook detailing all activities conducted during the utility locating procedure shall be kept. The logbook will describe any changes and modifications made to the original exploration plan. A report prepared by the trained utility locator shall be prepared and kept in the project file. A copy of the final site plan shall also be kept on file.

7.0 REFERENCES

Procedure FP-B-1, Surface Geophysics.

8.0 ATTACHMENTS

None.

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SURFACE GEOPHYSICS

1.0 PURPOSE

This procedure describes the procedures needed to acquire surface geophysical data to facilitate the collection of geologic, hydrogeologic, and geotechnical data related to hazardous waste site characterization.

2.0 SCOPE

This procedure has been developed as an aid in determining whether surface geophysics should be used at a site, the most applicable methods for a particular objective and proper field procedures to be followed. As professional guidance for specific guidance activities, this procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure in planning or in the execution of planned activities must be approved by management personnel and documented.

3.0 DEFINITIONS

The following definitions apply to a number of terms contained herein. For a more complete set of terms and definitions, refer to R.E. Sheriff (1990).

3.1 COUPLING

Interaction between systems.

1. Device for fastening together, as the plugs for connecting electrical cables.
2. Aspects which affect energy transfer. Thus the "coupling of a geophone to the ground" involves the quality of the plant (how firmly the two are in contact) and also considerations of the geophone's weight and base area, because the

geophone-ground coupling system has natural resonances and introduces a filtering action.

3. The type of mutual electrical relationship between two closely related circuits. As coupling would exclude DC voltages by employing a series capacitive element. DC or direct coupling may exclude higher frequency signals by using a capacitive element across the inputs or may allow all components to pass.

4. Capacitive coupling may occur because of mutual capacitive impedance, as between the wires in IP circuits or between a wire and ground.

5. Inductive coupling occurs because of mutual inductive impedance, such as between grounded IP transmitter and receiver circuits, especially at higher frequencies, greater distances, or lower earth resistivity. This may give rise to false IP anomalies. Also called electromagnetic or EM coupling.

6. Resistive coupling in IP surveying is due to leakage between wires, between a wire and ground, or through the resistance of the ground itself between two grounded circuits.

3.2 ELECTRICAL LOG

1. A generic term including all electrical borehole logs (SP, normal, lateral, induction, microresistivity logs).

2. Also used for records of surface resistivity surveying; compare electrical survey.

3. Electrolog, a borehole log which usually consists of SP and two or more resistivity logs, such as short and long normal and long lateral resistivity logs. Electrolog is a Dresser Atlas tradename.

3.3 ELECTRICAL SOUNDING

An IP, resistivity method, or electromagnetic method in which electrode or antenna spacing is increased to obtain information from successively greater depths at a given surface location. Electromagnetic sounding can also be done with a fixed spacing by varying the frequency (time-domain technique). Electrical sounding is intended to detect changes in resistivity of the earth with depth at this location (assuming horizontal layering).

Electrical Survey:

1. Measurements at or near the earth's surface of natural or induced electrical fields to map mineral concentrations or for geological or basement mapping. See electrical profiling, electrical sounding, electromagnetic method, resistivity method, self-potential method, induced-polarization method, telluric method, and magnetotelluric method.

2. Electrical logs run in a borehole.

3.4 ELECTROMAGNETIC METHODS

A method in which the magnetic or electrical fields associated with artificially generated subsurface currents are measured. In general, electromagnetic methods are those in which the electric and magnetic fields in the earth satisfy the diffusion equation (which ignores displacement currents) but not Laplace's equation (which ignores induction effects) nor the wave equation (which includes displacement currents). One normally excludes methods which use microwave or higher frequencies (and which consequently have little effective penetration) and methods which use DC or very low frequencies in which induction effects are not important (resistivity and IP methods). Some methods such as Afmag which employ natural energy as the source are usually classified as electromagnetic methods whereas other methods using natural energy such as the magnetotelluric method are not.

3.5 GEOPHYSICS

1. The study of the earth by quantitative physical methods, especially by seismic reflection and refraction, gravity, magnetic, electrical, and radiation methods.

2. The application of physical principles to studies of the earth. Includes the branches of (a) seismology (earthquakes and elastic waves), (b) geothermometry (heating of the earth, heat flow, and volcanology and hot springs), (c) hydrology (ground and surface water and sometimes including glaciology), (d) oceanography, (e) meteorology, (f) gravity and geodesy (the earth's gravitational field and the size and form of the earth), (g) atmospheric electricity and terrestrial magnetism (including ionosphere, Van Allen belts, telluric currents, etc.), (h) tectonophysics (geological processes in the earth), and (i) exploration and engineering geophysics. Geochronology (the dating of earth history) and geocosmogony (the origin of the earth) are sometimes added to the foregoing list. Enthusiasts in particular branches are inclined to appropriate the word "geophysics" to their own branch exclusively, whether that branch be ianospheric studies or exploration for oil.

3. Exploration geophysics is the use of seismic, gravity, magnetic, electrical, electromagnetic, etc., methods in the search for oil, gas, minerals, water, etc., for economic exploitation.

3.6 INDUCED POLARIZATION

1. Usually abbreviated IP. An exploration method involving measurement of the slow decay of voltage in the ground following the cessation of an excitation current pulse (time-domain method) or low frequency (below 100 hz) variations of earth impedance (frequency-domain method). Also known as the overvoltage method. Refers particularly to electrode polarization (overvoltage) and membrane polarization of the earth. Also called induced potential, overvoltage, or interfacial polarization. Various electrode configurations are used.

2. The production of a double layer of charge at mineral interfaces or of changes in such double layers as a result of applied electric or magnetic fluids.

3.7 LOW-VELOCITY LAYER

1. Weathering; a near-surface belt of very low-velocity material.
2. A layer of velocity lower than that of shallower refractors. See blind zone.
3. The B-layer in the upper mantle from 60 to 250 km deep, where velocities are about 6 percent lower than in the outermost mantle.
4. The region just inside the earth's core.

3.8 RESISTANCE

Opposition to the flow of a direct current.

3.9 RESISTIVITY

The property of a material which resists the flow of electrical current. Also called specific resistance. The ratio of electric-field intensity to current density. The reciprocal of resistivity is conductivity. In nonisotropic material the resistivity is a tensor.

3.10 RESISTIVITY LOGS

1. Well logs which depend on electrical resistivity, normal, lateral, laterolog, and induction log. Most resistivity logs derive their readings from 10 to 100 ft^3 of material about the sonde. Microresistivity logs on the other hand derive their readings from a few cubic inches of material near the borehole wall.
2. Records of surface resistivity methods.

3.11 RESISTIVITY METHOD

1 Observation of electric fields caused by current introduced into the ground as a means for studying earth resistivity in geophysical exploration. The term is normally restricted to include only those methods in which a very low frequency or direct current is used to measure the apparent resistivity. Includes electrical profiling and electrical sounding. Various array types are used.

2. Sometimes includes induced-polarization and electromagnetic-survey methods also.

3.12 SEISMIC SURVEY

A program for mapping geologic structure by creating seismic waves and observing the arrival time of the waves reflected from acoustic-impedance contrasts or refracted through high-velocity members. A reflection survey is usually implied unless refraction survey is specifically mentioned. The energy source for creating the waves is usually impulsive (i.e., energy is delivered to the earth for a very short period of time) although energy is introduced for considerable time with the Vibroseis method. The energy is detected by arrays of geophones or hydrophones connected to amplifiers, and the information is amplified and recorded for interpretation. The data often are processed to enhance the wanted information (signal) and displayed in record-section form. Signal is recognized as a coherent event, although noise often is coherent also. Events considered to be reflections from acoustic-impedance contrasts (reflectors) are used to locate the reflectors, it being assumed that their attitudes are that of the geologic structure. Events attributed to be head waves are used to locate the refractors of which they are characteristic, it being assumed that the attitudes of these refractors are those of the geologic structure. Velocity analysis is also done on reflection data where the offset varies.

3.13 SELF-POTENTIAL/SPONTANEOUS POTENTIAL (SP)

1. A well log of the difference between the potential of a movable electrode in the borehole and a fixed reference electrode at the surface. The SP results from electrochemical SP and electrokinetic potentials which are present at the interface between permeable beds adjacent to shale. In impermeable shales, the SP is fairly constant at the shale base-line value. In permeable formations the deflection depends on the contrast between the ion content of the formation water and the drilling fluid, the clay content, the bed thickness, invasion, and bed-boundary effects, etc. in thick, permeable, clean nonshale formations, the SP has the fairly constant sand line value, which will change if the salinity of the formation water changes. In sands containing disseminated clay (shale), the SP will not reach the sand line and a pseudostatic SP value will be recorded. The SP is positive with respect to the shale base-line in sands filled with fluids fresher than the borehole fluid (also SSP).

2. The DC or slowly varying natural ground voltage observed between nearby nonpolarizing electrodes in field surveying. In many mineralized areas this is caused by electrochemical reaction at an electrically conducting sulfide body.

3.14 TELLURIC

Of the earth. Often refers specifically to telluric currents.

3.15 TELLURIC CURRENT

A natural electrical earth current of very low frequency which extends over large regions and may vary cyclically in that direction. Telluric currents are widespread, originating in variations of the earth's magnetic field.

4.0 RESPONSIBILITIES

The Project Manager is responsible for determining whether surface geophysical methods should be used on a project and if so, which methods should be used. This information should be included in the site sampling plan.

The Field Program Manager (FPM) is responsible for ensuring that the appropriate selected procedures are conducted according to the instructions in this manual and the project specific sampling plan. In many cases, these procedures will be conducted by subcontractors. In these situations, the FPM is responsible for overseeing and directing the activities of the subcontractor. Of particular importance is the need to establish site-specific quality control procedures.

5.0 PROCEDURES

5.1 METHOD SUMMARY

A wide variety of surface-based geophysical methods exist that may apply to contamination delineation, geologic, hydrogeologic, or other site characterization/investigation requirements. In general, geophysical exploration methods provide for a non-invasive mapping of subsurface features through the measurement of the physical properties of a subsurface. Typically, an active signal (e.g., acoustic or electrical) propagates into the earth and the interaction of the signal with the subsurface materials is measured at the surface. Interpretation of the data provides for a map or image of the subsurface, for example, electrical conductivity of soils govern the propagation of an electrical signal through the subsurface. The geologic/hydrologic/waste characteristics are then inferred from an interpretation of the data or correlated with borehole data.

For a geophysical survey to be successful, the method of choice must be capable of resolving a particular physical characteristic that relates to the goals of the investigation. For example, if a zone of contaminated groundwater is being investigated by an electrical method, the electrical conductivity of the contaminated portion of the aquifer should be sufficiently different from the non-contaminated portion to allow for identification of the 'plume'. If the target (i.e., the high conductivity plume in this example) does not contrast sufficiently with the non-contaminated portion, then the geophysical survey will not be successful. Often, preliminary calculations or a trial survey can be performed to evaluate a particular method.

For purposes of this SOP, the geophysical methods discussed herein are classified as follows:

- Seismic methods. These include seismic refraction and reflection method and are typically applied to investigate depths to water or geologic structures (stratigraphic horizons or depth to bedrock).

- Electrical Methods. A wide variety of these exist. Included are Direct Current (DC) Resistivity, Complex Resistivity/Induced Polarization, Low-Frequency Electromagnetic (EM) Induction (i.e., loop-loop methods), VLF (Very Low Frequency EM), GPR (Ground Penetrating Radar), and metal detection equipment. These respond to variations in the electrical properties of a site, specifically the electrical conductivity and (for GPR) the dielectric/permitivity constant. Applications include general geologic/hydrologic mapping, identification of solute 'plumes,' and the detection of conductive metallic debris/objects.

- Potential Field Methods. Some methods do not require an active signal source and instead measure naturally occurring potential fields of the earth. These include measurements of the Earth's magnetic or gravitational fields. Magnetic methods are often used to detect the response of the Earth's magnetic field to metallic objects and can be very effective in locating buried metallic materials. Gravity methods respond to subtle density variations and are typically used to map the depth/thickness of alluvial basins or to detect cavities within consolidated sediments (e.g., Karst sinkholes).

While a number of geophysical methods may be applied at hazardous waste sites, the scope of this procedure is limited to the following commonly applied methods:

Seismic:	Refraction
Electrical:	DC Resistivity
	EM Induction (loop-loop)
	GPR
	Metal Detection
	Induced Polarization (IP)
Potential Field:	Magnetics

Often, geophysical contractors specialize in a particular survey method. The following references may be useful to provide additional information:

Journals: Geophysics (Society of Exploration Geophysics); Geophysical Exploration European Association of Exploration Geophysicists; occasionally - Groundwater, Groundwater Monitoring Review (National Water Well Association).

Telford, W.M., L.P. Geldart, R.E. Sheriff, D.A. Keys. 1978. Applied Geophysics, Cambridge University Press.

Dobrin, M.B. 1976. Introduction to Geophysical Prospecting, McGraw-Hill.

Sheriff, R.E. 1973, 1990. Encyclopedic Dictionary of Exploration Geophysics, Society of Exploration Geophysics.

5.2 METHOD LIMITATIONS/INTERFERENCES AND POTENTIAL PROBLEMS

Each of the geophysical methods discussed herein are typically designed and implemented on a site-specific basis. Care must be exercised to ensure that a particular method is applicable and that an identifiable target is likely to exist. A determination must be made that the exploration target can be resolved versus the background signal/site conditions and that cultural or other 'noise' problems will not interfere. 'Cultural Noise' is defined as near-surface or surficial features (e.g., power lines or traffic vibrations) that can potentially mask or overwhelm the signal produced by the subsurface target.

All of the survey methods require field instrumentation and electronics that may be impacted by extreme climactic variations. The equipment should be checked regularly (daily, at a minimum) to ensure internal calibration. The manufacturers' guidelines and specifications should be reviewed prior to any field application.

5.2.1 Seismic Method Limitations and Potential Problems

5.2.1.1 Refraction Surveys

Care should be exercised in avoiding the following potential problems:

- Poorly emplaced geophones, for example in loose soil;
- Poor couplings of induced signal (e.g., strike plate) with ground;
- Intermittent electrical shorts in geophone cable (never drag geophone cables);
- Wet geophone connections;
- Vibration due to wind and traffic-induced noise;
- Improper gain/filter settings;
- Insufficient signal strength; and
- Topographic irregularities. An accurate topographic survey is often required prior to field operations.

5.2.2 Electrical Method Limitations and Potential Problems

5.2.2.1 DC Resistivity

Measurement of electrical resistivity represents a bulk average of subsurface material resistivity. In some instances, the resistivity of the target material may not contrast sufficiently with 'background' material to be observed with this method, especially as the target material gets thinner and/or deeper. If highly conductive soils/rock are present at shallow depths, electrical current may not penetrate to depths beyond this layer. An electrical current always follows the path of least resistance.

The DC resistivity method has the following limitations or potential problems that may occur during a survey:

- Poorly coupled electrodes (insufficient grounding);
- Unshielded wires causing intermittent shorts;
- Background electrical noise such as natural currents (S.P. or telluric effects);
- Electromagnetic coupling with power lines, causing the introduction of induced electrical currents into the receiver wire;
- Grounded fence lines, power lines interfering with the survey;
- Inadequate signal power (increase current levels to produce sufficient signal to noise ratios);
- Very low resistivity layer at the surface preventing the electrical field from penetrating deeper layers; and
- Very high resistivity layer at the surface (e.g., dry sandy gravel) preventing the electrical field from penetrating the surface layer.

5.2.2.2 EM Method

A variety of EM methods may be applied; however, in practice the Geonics EM-31 and EM-34 Loop-Loop instruments are typically used in hazardous waste surveys. The EM methods are similar to DC methods in application and are sensitive to conductive materials except for the basic distinction that they are not electrically grounded. Complications may arise in the EM method in developed sites because above-ground, metallic objects or electrical fields may interfere. Power lines, automobiles, train tracks, water tanks, and other objects may completely dominate data results and render the method useless.

5.2.2.3 Ground Penetrating Radar (GPR) Methods

Ground penetrating radar (GPR) methods are often not useful where highly conductive conditions or clay is present at shallow depth. The high-frequency signal propagates as a function of both electrical conductivity and dielectric constant (permitivity). The selection of transmission frequency is important as high frequencies are rapidly attenuated and the signal may not penetrate. Often, a choice of frequencies is available and it is suggested that site-specific field tests be performed over known, observable targets to determine whether GPR is appropriate for use.

A number of potential problems may occur:

- Improperly adjusted/configured equipment (e.g., antenna gain, filter slopes or gain thresholds);

- Insufficient signal and/or poor transmission qualities of the materials found at a site (e.g., clay, saline water conditions); and

- The influence of reflected signals outside of the immediate zone of investigation upon the radar record (e.g., fences, power poles, buildings).

5.2.2.4 Metal Detection

Metal objects which are not targets of the survey, including those worn or carried by the operator, may interfere with measurements.

5.2.3 Potential Field Method Limitations and Problems

5.2.3.1 Magnetics

The signal measured by a magnetometer is time-varying and subject to solar storm induced variations. Specific problems that may occur include:

- Metal objects which are not survey targets, such as surficial metallic objects, may interfere with measurements;

- Metallic objects worn or carried by the operator;

- Lack of base station control to measure background field fluctuations; and

- Failure to maintain a constant sensor height with respect to ground elevation.

5.3 SURVEY DESIGN/PRE-FIELD PREPARATION

5.3.1 Survey Design

Prior to performing a field investigation, it is often possible to estimate the effectiveness of a surface geophysical survey using data interpretation software relevant to the survey or by other calculation methods. A sensitivity analysis is typically performed to determine if a geophysical target possesses sufficient contrast with background conditions to be detected using surface geophysics. In some instances, available site data or prior geophysical investigations may be available to obtain estimates of the geophysical characteristics of the site.

5.3.2 Field Preparation

A. Verify that the required geophysical equipment is pre-calibrated and operational.

B. Establish grid locations or set-up traverses for location of sampling stations. Survey the station locations and record on a scaled site plan.

C. Test and calibrate geophysical equipment.

5.4 FIELD PROCEDURES

The following procedures apply to geophysical surveys conducted at a hazardous waste site. Procedures may vary since equipment capabilities and methodologies are rapidly evolving. In general, make sure that field locations are surveyed, and recorded accurately and that the equipment is functional and calibrated. Typically, a control or base station location will be established to check the equipment response over the duration of the field investigation. In addition, make sure a high signal to noise (S/N) ratio can be maintained to obtain a geophysical response representative of the target/zone of interest.

5.4.1 Seismic Refraction Methods

Seismic refraction techniques are used to determine the structure of a site based upon the travel time or velocity of seismic waves within layers. Interpretation of the travel time variation along a traverse of geophones can yield information regarding the thickness and depth of buried strata. Seismic methods are often used to determine depths to specific horizons of contrasting seismic velocities such as bedrock, clay layers, or other lithologic contrasts, and the water table (under unconfined conditions).

Procedures

1. Check the seismic signal and noise conditions on the instrument to verify the proper functioning of geophones and cables and to check the instrument settings.

2. When hard copies of seismic records are not produced by the seismic field equipment, arrival time selected from the electronic display should be immediately plotted on a time/distance graph in the field. A hard copy of the data should generally be produced and kept in the record file. Problems with improper picks are often discovered by early inspection of these plots.

3. Background or offsite data may be required for correlation to site conditions. Correlation of the seismic data with electrical method results, if obtained, or

with borehole or outcrop data may be a useful means of assigning thickness or seismic velocities.

If possible, boring logs or other data should be analyzed to determine if low velocity (inverse layers) or thin beds may be present that might not be detected otherwise.

4. The seismic system should be run at a known standard base station for periodic check of instrument operation.

5. Properly store the data in digital form for subsequent processing and data evaluation.

5.4.2 Electrical Methods

5.4.2.1 DC Resistivity

The resistivity method provides a measurement of the bulk electrical resistivity of subsurface materials. Application of the method requires that a known electrical current be induced into the ground through a pair of surface electrodes. The resulting potential field (voltage) is measured between a second pair of surface electrodes. Evaluation of the subsurface electrical properties is performed based upon the current, voltage, and electrode position (array configuration).

Given the length of the wire cables, their connections to the electrodes and the coupling of the electrodes with the ground, there are a number of potential problems for obtaining reliable data (e.g., poor electrical contact, short and open circuits). These conditions can be minimized by careful observation of instrument readings and trends.

Procedures

Apparent resistivities should be calculated and plotted during field acquisition as a means of quality control. If VES sounding is performed, the data plots (curves) should be smooth, and discontinuous jumps in the data should not occur. Profiling data should also show a general trend in the data from one station to the next. However, abrupt changes may occur in both sounding and profiling data due to "noise" from near-surface inhomogeneities or electrode contact problems.

The resistivity instrument can be calibrated using standard resistors or by using the internal calibration circuits often contained within the equipment. Calibration is particularly important if the data are to be compared to resistivity measurements from other instruments or other parameters, such as specific conductance of water samples.

5.4.2.2 EM Methods

Electromagnetic methods (EM) provide a means of measuring the electrical conductivity of subsurface soil, rock, and groundwater. Electrical conductivity (the inverse of electrical resistivity) is a function of the type of soil, porosity, permeability, and the conductivity of fluids in the pore spaces. The EM method can be used to map natural subsurface conditions and conductive contaminant plumes. Additionally, trench boundaries, buried conductive wastes such as steel drums, metallic utility lines and steel underground storage tanks may potentially be located using EM techniques.

Following factory calibration, the instruments will generally retain their accuracy for long periods. However, a secondary standard area should be established at the field site by the user for periodic recalibration. This will provide a reference base station, to check "drift" in the instrument's performance and to permit correlation between instruments.

While precision can be easily checked simply by comparing subsequent measurements with the instrument at a standard site, accuracy is much more difficult to establish and maintain.

EM instruments are often used to obtain relative measurements. For these applications, maintenance of absolute accuracy is not critical; however, the precision of the instrument can be important. For example, in the initial mapping of the spatial extent of a contaminant plume, a moderate level of precision is necessary. If the same site is to be resurveyed annually to detect small changes in plume migration and movement, a very high level of precision is necessary.

If the objective of the survey is to obtain quantitative results from the EM data, for correlation to other measurable parameters (e.g., specific conditions), proper steps should be taken to assure good instrument calibration. This is particularly important when performing surveys in areas of low conductivity, where measurement errors can be significant.

The dynamic range of EM instruments varies from 1 to 1000 millmhos/meter (mmho/m). At the lower conductivities, near 1 mmho/m and less, it is difficult to induce sufficient current in the ground to produce a detectable response, hence readings may become unreliable. At conductivity values greater than about 100 mm/m, the received signal is no longer linearly proportional to subsurface conductivities, and corrections must be applied to the data, if it is to be used for quantitative purposes.

Procedures

1. Maintain or verify calibration records from the equipment supplier or manufacturer. The EM system should be regularly calibrated.

2. Prior to conducting a survey, a temporary site shall be selected on location for daily calibration checks. Calibration checks shall be made twice daily, before and after conducting daily survey operations. Readings shall repeat to +/-5 percent. Originals of all calibration records shall remain on-site, copies shall be submitted to the records file.

   Note: Calibration checks should be made outside the influence of power lines, buried utilities, buried metal objects, fences, etc. on a relatively flat surface.

3. Instrument stability shall be checked by the field operating party when there is local or distant thunderstorm activity. Electromagnetic radiation from

thunderstorms can generate noise in the EM system. Operations may have to be postponed during rainstorms and resumed when these have ceased.

4. Technical judgment shall be exercised such that conductivity readings recorded in the field are reasonable with respect to existing site conditions.

5. Instrument sensitivity settings should be recorded in the field notebook as readings are taken. The notebook should be submitted to the records file.

5.4.2.3 Ground Penetrating Radar

Ground Penetrating Radar (GPR) uses high frequency radio waves to acquire subsurface information. Energy is radiated downward into the subsurface through a small antenna which is moved slowly across the surface of the ground. Energy is reflected back to the receiving antenna, where variations in the return signal are continuously recorded. This data produces a continuous cross sectional "picture" or profile of shallow subsurface conditions. These responses are caused by radar wave reflections from interfaces of materials having different electrical properties. Such reflections are often associated with natural hydrogeologic conditions such as bedding, cementation, moisture content, clay content, voids, fractures, and intrusions, as well as man-made objects. The radar method has been used at numerous hazardous waste sites to evaluate natural soil and rock conditions, as well as to detect buried wastes and buried metallic objects.

The radar system measures two-way travel time from the transmitter antenna to a reflecting surface and back to the receiver antenna. Calibration of the radar system and data requires a two-step process:

1. First, the total time window (range) set by the operator must be accurately determined.

2. Second, the electromagnetic velocity (travel time) of the local soil-rock condition must be determined.

After completing these two steps, the radar data may then be calibrated for depths of particular features.

The time window (range) which has been picked for the survey is calibrated by use of a pulse generator in the field. This generator is used to produce a series of time marks on the graphic display, measured in nanoseconds. These pulses are counted to determine the total time range of the radar. A calibration curve can be made up for each radar system.

In order to precisely relate travel time to actual depth units, the velocity (or two-way travel time per unit distance) must be determined for the particular soil or rock found at the site.

Various levels of accuracy in determining travel time can be used. These may range from first order estimates to precisely measured onsite values.

Using the depth of a known target (trenches, road cuts or buried pipes/road culverts can provide a radar target of known depth), a radar record taken over the known target, and a time scale provided by the pulse generator will provide basic calibration record. From these data a two-way travel time can be accurately determined at the given target location. Since this approach may give accurate calibration at the specific site, the assumption must be made that conditions in other areas to be surveyed are the same as in the calibration areas. If they are not, errors will occur in determining depths.

If significant changes in soil type or moisture content occur with depth, travel time will not be the same throughout the vertical radar profile, and the vertical radar depth scale may be non-linear. Such a condition is common, and occurs whenever an unsaturated zone exists over a saturated zone.

Procedures

1. The time scale of the GPR unit shall be checked regularly for accuracy. This can be done either on or off the site by placing the GPR unit at a known distance from the ground, a wall, etc., and measuring the two-way travel time to that reflecting surface in the air. The velocity of electromagnetic waves in air

is 1 foot per nanosecond ($3x10^8$ m/sec.). The following equation shall be used:

$$t = 2d/c$$

where:

t = two-way travel time from antenna to the surface, (nanoseconds)
d = distance of antenna to the surface, (feet)
c = velocity of light in air, (1 foot/nanosecond)

2. Prior to conducting a survey, a GPR traverse should be conducted over a buried object of known depth (if available). From the two-way travel time and the measured burial depth of the object, the average electromagnetic wave velocity in soil can be calculated from the following equation:

$$V = 2d/t$$

The average dielectric constant of the soil is then calculated using:

$$Er = c^2/v^2$$

where:

Er = average relative dielectric constant of soil (unitless)
c = velocity of light in air (1 foot/nanosecond)
v = average electromagnetic wave velocity of the soil (feet/nanosecond)

Note: The equation above assumes a soil with a relative magnetic permeability of 1. Technical judgment shall be exercised such that soil velocity and relative dielectric constant values are reasonable with respect to existing site conditions.

3. A short GPR traverse shall be repeated twice daily over a known feature prior to and after conducting daily operations. Technical judgment shall be exercised to

ensure that variations between repeat readings are due to changing soil conditions rather than the electronics.

5.4.2.4 Magnetometers

Magnetometers are designed to provide measurements of the earth's magnetic field. In hazardous waste site investigations, magnetometers are invaluable for detecting buried drums and for delineating the boundaries of areas containing ferrous metallic debris.

Procedures

1. Check the proposed date of the magnetic survey for solar flares to ensure that anticipated background conditions do not occlude data collection (Bureau of Standards, Boulder, CO, Goldendale, WA).

2. Obtain a daily background reading in the immediate vicinity of the site to be surveyed. This reading should be outside the influence of all sources of cultural magnetic fields (e.g., power lines, pipeline, etc.). Technical judgment should be exercised such that the background reading is reasonable with regard to published data for the total magnetic field intensity at the site latitude and longitude. This daily background reading should repeat to within reasonable diurnal variations in the earth's magnetic field.

3. Sequential readings should be taken twice daily, before and after normal magnetic surveying operations. These readings (within 10 seconds of each other) shall be taken at any location onsite, distant from cultural magnetic fields, and recorded in the field notebook. Two or three sequential readings should be sufficient. In the absence of magnetic storms (sudden and violent variations in the earth's magnetic field), the readings should compare within 0.1 to a few tenths of a gamma. Variations during magnetic storms may approach 1 gamma.

4. Base station readings should be taken so that the efforts of diurnal variation in the earth's magnetic field may be removed from the data. Magnetic storms can

be detected if the base station sampling frequency is high enough. It may be prudent to suspend operations during a magnetic storm and resume them when the storm has passed. Identification of such periods of rapid synoptic variation may be documented at a permanent base stations set-up onsite where continuous readings are automatically recorded every ten to fifteen minutes. Alternatively, readings may be manually recorded at a base stations during the survey every 45 to 60 minutes.

5. Use of automatic recording magnetometers requires recording in a field notebook the magnetometer readings for the first and last station of each traverse. The data recorded in the field notebook should be compared at the end of the day with data from the automatic recording device. Data recorded in the field notebook should be within 1 gamma of the values derived from the recording device. It is recommended that the data be transferred onto hard copies from the recording device on a daily basis.

   Total field measurements may be corrected for these time variations by employing a reference base station magnetometer; changes in the earth's field are removed by subtracting fixed base station readings from the moving survey data. Gradiometers do not require the use of a base station, as they inherently eliminate time variation in the data.

5.4.3 Post-Operations

Standard hazardous waste site protocols should be followed by geophysical personnel working at a site. In many cases, the geophysical survey may precede services that may result in personnel contact with hazardous waste/materials. Standard hazardous waste site decontamination procedures should be followed by geophysical personnel at all sites.

5.5 DATA REDUCTION/DATA INTERPRETATION

Geophysical surveys typically require significant data reduction and processing. The exact methodology depends upon the purpose, scope, and type of survey.

Data interpretation and presentation reports should note the following:

- Data reduction technique;
- Data processing steps;
- Technical basis for data processing;
- Survey location data;
- Site base map showing survey location or transects;
- Dates and times of survey;
- Interpretation results;
- Theoretical assumptions for the interpretation;
- Equipment used; and
- Data format (digital format, ASCII, SEG B., etc.).

5.6 QUALITY ASSURANCE/QUALITY CONTROL

The following quality assurance procedures apply to all of the geophysical instrumentation and their use during data acquisition.

- All data transmittals will be documented on standard Chain-of-Custody forms. Copies of the Chain-of-Custody forms will be maintained with the field files on site.

- All geophysical instrumentation shall be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan.

- Battery voltage levels for all instruments shall be monitored each day throughout the survey. Battery packs should be charged or replaced when voltage levels fall below the recommended level specified by geophysical equipment manufacturers.

6.0 RECORDS

The Field Program Manager is responsible for documenting all field activities in the field notebook. The Field Program Manager should also oversee all subcontractor activities and make sure that their documentation is complete.

7.0 REFERENCES

Benson, Richard C., Glaccum, Robert A., and Noel, Michael R. 1983. Geophysical Techniques and Sensing Buried Wastes and Waste Migration, USEPA, Las Vegas, Nevada, 236 p.

Weston. 1983. Standard Operating Procedure (Draft), CGMP.

Dobrin, M.B. 1976. Introduction to Geophysical Prospecting, McGraw-Hill.

Telford, W.M., L.P. Geldart, R.E. Sheriff, D.A. Keys. 1978. Applied Geophysics, Cambridge University Press.

Sheriff, R.E. 1973, 1990. Encyclopedic Dictionary of Exploration Geophysics, Society of Exploration Geophysics.

U.S Army Corps of Engineers.

8.0 ATTACHMENTS

None.

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SOIL GAS SURVEY

1.0 PURPOSE

This standard operating procedure (SOP) describes recommended soil gas surveying procedures for use by Ogden personnel. The soil gas surveys will be conducted by subcontractors following procedures specified by the Los Angeles Regional Water Quality Control Board (provided as Attachment 1). This procedure should be used to provide guidance to Ogden field personnel in providing subcontractor oversight.

2.0 SCOPE

This document applies to all Ogden personnel involved with managing or participating in soil gas survey activities. As professional guidance for specific activities, this procedure is not intended to obviate the need for professional judgement to accommodate unforeseen circumstances. Deviance from this procedure in planning, or in the execution of planned activities, must be approved by both the Project Manager.

3.0 DEFINITIONS

None.

4.0 RESPONSIBILITIES

The Project Manager is responsible for ensuring that the soil gas survey activities conducted during the field program are in compliance with this procedure. The Project Manager is also responsible for ensuring that the soil gas survey is conducted under the supervision of an Ogden representative. It is recommended that supervisory personnel have a thorough understanding of the principles of soil gas and the physical characteristics of the vadose zone.

The Field Manager is responsible for ensuring that all project field staff are familiar with these procedures.

5.0 PROCEDURES

5.1 BACKGROUND INFORMATION

The soil gas survey is a semi-quantitative technique for evaluating the distribution of contaminants in soil gas. The resulting data can be used to qualitatively evaluate the potential for, and extent of, certain types of contamination in soil and ground water.

The use of soil gas surveying to locate potential source areas of subsurface contamination is based on aqueous phase/vapor phase equilibrium in the subsurface. Because of their relatively low solubilities and high vapor pressures, volatile organic compounds (VOCs) have a tendency to partition from the aqueous phase into the soil vapor phase. Certain semi-volatile compounds also behave in this manner. Generally speaking, an organic compound with a relatively high Henry's law constant (i.e., the ratio of a compound's vapor pressure to its solubility in water) is likely to partition from soil or ground water into soil gas. The detection of VOCs in shallow soil gas is dependent on the following factors: 1) the volatilization of VOCs from soil or ground water into the soil gas, 2) the presence of a chemical gradient in soil gas between the contaminant source and the ground surface, and 3) the physical properties of the soil.

Fixed gas (i.e., O_2 and N_2) and biogenic gas (i.e., CO_2, CH_4, N_2O, and H_2S) data obtained during a soil gas survey also provides an indication of potential subsurface contamination. A concurrent increase in carbon dioxide and decrease in oxygen often indicates increased chemical or biological breakdown of organic compounds. This phenomenon is usually associated with the degradation of petroleum hydrocarbons; however, moisture content, natural organic content, and reduction/oxidation (redox) conditions in the soil can also affect fixed gas/biogenic gas ratios.

In most cases, soil gas surveys performed during the field program will be conducted by subcontractors. Ogden program personnel will be responsible for selecting the subcontractor and directing their performance onsite.

Each soil gas subcontractor shall possess the necessary sample collection and analytical instruments to perform the survey. The field methods employed by the subcontractor must be in compliance with the methods specified in the Los Angeles Regional Water Quality Control Board guidance (Attachment 1). The methods and equipment proposed for use by the subcontractor should be evaluated prior to awarding the job. The individual responsible for recommending selection of the subcontractor shall evaluate the subcontractor to determine if compliance with this procedure is possible. If not, another subcontractor shall be recommended. Alternatively, project-specific data quality objectives shall be evaluated and modified, if appropriate, in a manner such that this procedure can generally be followed.

5.2 EQUIPMENT

The following types of equipment are generally required to conduct the soil gas survey:

- Hydraulic driving/hammering system designed to drill through pavement and install or remove sampling probes;
- Stainless steel probes for collecting soil samples over specified depth intervals;
- Tubing, pumps, mini-bailers, vials, and centrifuges for collecting and preparing soil gas and/or ground-water samples;
- Oilless air pump and evacuation chamber for collecting exact volumes of ambient air or soil gas at atmospheric pressure.

Analytical instrumentation and chemical supplies may include the following:

- Gas chromatographs (GCs);
- Computer-based data management and GC integration systems;
- Photoionization/Hall Electrolitic Capture Detectors (ElCDs), Flame Ionization Detector (FID), and other detectors as necessary;
- UHP grade compressed analytical gases (nitrogen, helium, hydrogen, air);
- Analytical standards for priority pollutants, gaseous hydrocarbons, and fixed/biogenic gases.
- High resolution megabore, packed, and capillary gas chromatographic columns; and
- Fittings, tools, plumbing, and glass syringes required for normal GC operation.

5.3 SELECTION OF SAMPLING LOCATIONS AND ANALYSES

The design of a soil gas survey program is dependent on the objectives of the program and the types of contaminants anticipated to be present. The following items shall be considered when designing a soil gas program.

- **Number of Samples**. This is dependent upon the extent of anticipated contamination, the size of the site, and the selected sample spacing.
- **Soil Types Expected to be Encountered (if known)**. The lithology of the subsurface must be considered when determining sampling locations, distance between samples, and sampling depth.

- **Depth of Samples**. This will depend on the type of contamination, the depth to ground water, and the objectives of the survey. For instance, evaluation of surface contamination may require only a 3- to 5-foot sampling depth while evaluation of contaminated ground water may require penetration to 25 feet. Samples may also be collected at several discrete intervals to provide a depth profile. Some flexibility exists in choosing a sampling depth or depths; however, once chosen, consistency across the site should be attempted.

- **Distance Between Samples**. For detecting the limits of plumes, spacing may be 50 to 100 feet or greater. Around a buried tank, spacing may be a few feet. The relative air permeability of the soil type(s) present must also be considered. Soils with low air permeabilities (i.e., clays) may require closer sample spacing. Spacing should be selected based on the objective(s) of the survey, subsurface conditions, and the nature of the target compounds.

- **Sampling Point Selection**. Large spills, leaks, or plumes are often sampled on a predetermined sampling grid. Initial surveys may be random or based on real-time field data. Location access may also be an important factor.

- **Objectives of the Survey**. If plume definition is the objective, probe locations should be established to define the down-gradient and lateral extent of the VOCs in soil vapor. If source delineation is the objective, probes should be located in proximity to suspected source areas. In either case, some sampling points should be included within the known plume area in order to provide a basis for correlation and comparison.

- **Timing of Sampling**. Probe locations can be sampled in stages to meet the objectives of the survey. The first stage of sampling may involve widespread spacing of the probes. Later sampling should focus on areas where VOCs were detected during the first stage of sampling to define the lateral extent of soil gas contaminants, or delineate a source area. Later sampling events should include some overlap with earlier sampling points in order to provide a basis for correlation between data sets.

- **Selection of Analytes**. In general, only contaminants with relatively high Henry's law constants are amenable to detection using soil gas. However, biodegradative breakdown products (CO_2, O_2, and CH_4) of less volatile contaminants can be used to evaluate certain semi-volatile and non-volatile compounds. Analysis should focus on known indicator compounds at the site. The more analytes selected, the fewer locations that can be sampled in a day. Analytes should be selected to sample the compounds necessary to meet the objectives of the study and to maximize the number of locations sampled in a given period of time.

5.4 SAMPLING PROCEDURES

All soil gas sampling procedures conducted by the subcontractor will be performed following Los Angeles Regional Water Quality Control Board guidance (Attachment 1).

5.5 ANALYTICAL PROCEDURES

All soil gas samples will be analyzed onsite in a climate-controlled mobile laboratory. All soil gas analytical procedures will follow those specified in the Los Angeles Regional Water Quality Control Board guidance (Appendix F).

6.0 DOCUMENTATION/RECORDS

Each sampling event shall be documented by the subcontractor in a bound log book or appropriate field log sheets. The following information shall be recorded for each sampling event:

- Sample number;
- Project name and number;

- Sample location and depth;
- Date and time;
- Name(s) of sampling personnel;
- Site location;
- Miscellaneous observations; and
- Analytical equipment utilized (e.g., GC, column, detector, etc.).

Other documentation will be recorded on a daily basis in the bound field notebook, and will include:

- Calibration results and
- Blank measurement results.

The original field records will be placed in the project files immediately upon completion of field work. All records will be completed using indelible ink whenever possible. When this is not possible, records will be photocopied promptly after completion, and the photocopies signed and dated. Subcontractors will also be required to submit a report providing all the documentation required under this procedure.

7.0 HEALTH AND SAFETY

Pursuant to the Ogden Corporate Health and Safety Management Plan (HSMP), soil gas surveyors are considered task specific workers and, therefore, must meet all requirements of said workers for health and safety reasons. In addition, adherence to safe work practices as outlined in the site-specific Health and Safety Plan (HSP) is required.

Analyses should be conducted in a location that will not contaminate analytical equipment nor expose the public or analyst to unacceptable levels of contaminants. "Detector" and "vent" outlets should be vented through a combustion furnace (2 1500°F), an activated charcoal filter, or to an external atmosphere not endangering the general public. If anticipated conditions warrant a real/time immediate response instrument such as an OVA, PID, HNU, Thermo, or Draeger or Sensidyne tubes, it should be used to monitor the atmosphere as recommended in Section 6.0 of the HSMP.

When real/time instrument response exceeds the Permissible Exposure Limit (PEL), or the more conservative threshold limit value (TLV), appropriate previously defined PPE will be donned, as outlined in Section 8 of the HSMP, and alternate arrangements to ensure analytical personnel safety shall be considered. If safe alternatives are not achievable, the soil gas survey will be discontinued immediately.

When there is a danger of leakage from sample or gas standards containing hazardous materials and reagents, they should be stored outside of the workplace occupied by the analyst in a manner consistent with storage of hazardous or compressed gases and in a configuration such that the public will not be endangered by exposure.

In addition to the aforementioned precautions, the following safe work practices will be employed:

Chemical Hazards Associated With Soil Gas Survey

1. Avoid skin contact with and/or incidental ingestion of solvents.
2. Utilize PPE as deemed necessary while collecting samples and performing analyses.
3. Refer to Manufacturer Safety Data Sheets (MSDSs), safety personnel, and/or consult sampling personnel regarding appropriate safety measures.
4. Take necessary precautions when handling reagents and samples.

Physical Hazards Associated With Soil Gas Survey:

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

2. To avoid heat/cold stress as a result of exposure to extreme temperature and PPE, drink electrolyte replacement fluids (1-2 cups/hour is recommended) and, in cases of extreme cold, wear fitted insulating clothing.
3. Be aware of restricted mobility due to the wearing of PPE.

8.0 REFERENCES

U.S. EPA Environmental Response Team. 1988. Response Engineering and Analytical Contract Standard Operating Procedures. U.S. EPA, Research Triangle Park, NC.

9.0 ATTACHMENTS

1. State of California, California Regional Water Quality Control Board, Los Angeles Region, Interium Guidance for Active Soil Gas Investigation (March 1996)

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Attachment

STATE OF CALIFORNIA
California Regional Water Quality Control Board
Los Angeles Region

INTERIM GUIDANCE FOR ACTIVE SOIL GAS INVESTIGATION
(March 1996)

Introduction

Volatile organic compounds (VOCs) within the unsaturated zone partition into the adsorbed, dissolved, free liquid, and vapor phases. Measurement of VOCs through an active soil gas investigation allows: 1) evaluation of whether waste discharges of VOCs have occurred which may impact groundwater, 2) determination of spatial pattern and extent of vapor phase soil contamination, 3) establishment of vapor distribution for the design of soil vapor extraction (SVE) system, and 4) determination of the efficiency of reduction in threat to groundwater from any cleanup action, including SVE. The work plan should include, but not be limited to, the following:

1.0 Survey Design

1.1
Provide a scaled facility map depicting potential sources and proposed sampling points. Include locations and coordinates of identifiable geographic landmarks (e.g., street center-line, benchmark, street intersection, wells, north arrow, property line).

1.2
Locate initial sampling points in potential source areas and areas with known soil contamination using an adjustable 10 to 20 foot grid pattern. Provide rationale for the number, location and depth of sampling points. Screen the remainder of the site with a 100-foot or less grid pattern.

1.3
Conduct a close interval (10 to 20 foot grid pattern) and multi-level sampling (5 to 10 feet vertical distance between points) in areas with known or relatively high VOC concentrations.

1.4
Use an on-site mobile laboratory with laboratory-grade certifiable instrumentation and procedures for real-time analysis of individual VOCs. Non-specific portable organic vapor analyzers and/or GC-based handheld detectors may not be used for analysis, except for daily or weekly vapor monitoring during SVE.

1.5
Maintain flexibility in the sampling plan such that field modifications (grid pattern density, location and depth) can be made as real-time evaluation of analytical test results occurs. Include in the work plan decision-making criteria for these adjustments and explain decisions in the report. Field decisions shall be made in consultation with Regional Board staff.

1.6
Re-sample at any sampling point if anomalous data (i.e., 2 to 3 orders of magnitude difference from surrounding samples) are obtained. Board staff may require additional points to resolve the spatial distribution of the contaminants within the interval in question.

2.0 Sample Collection

2.1
Obtain samples at an adequate depth (nominally 5 feet) below ground surface (bgs) to minimize potential dilution by ambient air.

2.2
Conduct a site-specific purge volume versus contaminant concentration test at the start of the initial soil gas survey and vapor monitoring well sampling. The purpose of the test is to purge ambient air in the sampling system with minimal disturbance of soil gas around the probe tip. Conduct this test based on soil type and where VOC concentrations are suspected to be highest. Describe specific method and equipment to determine optimal purge rates and volumes. Take into account the potential sorption of target compounds to the tubing and adjust the purge rate and time to achieve the optimal purge volume. Limit the sampling vacuum to collect proper samples. Optimum purge volume may be compound specific. "Lighter" early eluting VOCs, such as vinyl chloride, may reach their highest concentration with less purging than "heavier" late eluting VOCs like PCE. Therefore, optimize the purge volume for the compound(s) of greatest concern.

2.3
Explain the expected zone of influence for sample points, taking into consideration soil types, land cover, drive point construction and sample purge rate/time/volume. The vertical zone of influence for purging and sampling must not intersect the ground surface.

2.4

Discuss soil gas sample collection and handling procedures. Discuss the procedures to prevent collection of samples under partial vacuum and the methods to minimize equipment cross-contamination between sampling points.

2.5

Avoid making a pilot hole (e.g., using a slam bar) prior to inserting the probe rod, except to drill through asphalt or concrete. The process of making a pilot hole may promote vapor contaminant aeration and result in lower sample concentration.

2.6

Specify that the sampling equipment (e.g., gas tight syringe, sorbent trap) will not compromise the integrity of the samples. Tedlar bags may only be used for qualitative analysis.

2.7

Assure that the probe tip, probe and probe connectors have the same diameter to provide a good seal between the formation and the sampling assembly. If a space develops between the probe and the formation, as a result of probe advancement, seal (e.g., with bentonite) the area around the probe at the surface to minimize the potential for ambient air intrusion.

2.8

Some sampling systems (e.g., Geoprobe) utilize the probe rod as a conduit for the tubing that connects to the probe tip. Assure a tight fit between the tubing and probe tip to minimize potential for leakage and dilution of the sample.

2.9

Follow the sampling method specified in the soil gas consultant's standard operating procedure (SOP). Discuss with Board staff any deviations from the SOP before it is implemented in the field.

3.0 Laboratory Analysis of Soil Gas Samples

3.1 Primary Target Compounds

1. Carbon tetrachloride
2. Chloroethane
3. Chloroform
4. 1,1-Dichloroethane
5. 1,2-Dichloroethane
6. 1,1-Dichloroethene
7. cis-1,2-Dichloroethene
8. trans-1,2-Dichloroethene
9. Dichloromethane (methylene chloride)
10. Tetrachloroethene
11. 1,1,1,2-Tetrachloroethane
12. 1,1,2,2-Tetrachloroethane
13. 1,1,1-Trichloroethane
14. 1,1,2-Trichloroethane
15. Trichloroethene
16. Vinyl chloride
17. Benzene
18. Toluene
19. Ethylbenzene
20. Xylenes
21. Trichlorofluoromethane (Freon 11)
22. Dichlorodifluoromethane (Freon 12)
23. 1,1,2-Trichloro-trifluoroethane (Freon 113)

3.2 Other Target Compounds

Analyze for other VOCs (e.g., methyl ethyl ketone, methyl isobutyl ketone, ethylene dibromide, petroleum hydrocarbons, etc.) based upon site history and conditions.

3.3 Detection Limit (DL)

Attain a DL of not more than 1 µg/L for all target compounds. A higher DL is acceptable only for the compound(s) whose concentration exceeds the initial calibration range.

3.4 Detectors

Use the following detectors in appropriate combinations:

Electrolytic conductivity detector (ELCD) (e.g., Hall)
Photoionization detector (PID)
Flame ionization detector (FID)
Mass spectrometer (MS)
Electron capture detector (ECD)

3.5.0 Identification of Calibration Standards & Laboratory Control Sample (LCS)

3.5.1

Properly and clearly identify all calibration standards and LCS. The identification must agree with the data on record for the standards and LCS.

3.5.2

Prepare LCS from a second source standard that is totally independent from the standards used for the initial calibration. Second source means a different supplier (whenever possible) or a different lot from the same supplier.

3.6.0 GC Conditions

3.6.1

Use a type of column that can separate all the target compounds. Coelution of the target compounds is not acceptable unless the compounds are distinguished and quantified by two different types of detectors i[illegible] use at that time.

3.6.2
Analyze the initial calibration and daily mid-point calibration check standards, LCS, blank, and samples using the same GC conditions (i.e., detector, temperature program, etc.).

3.6.3
Use a GC run time that is long enough to identify and quantify all the target compounds.

3.7.0 Initial Calibration (Record in Table 1)

3.7.1
Perform an initial calibration:

1. for all 23 compounds listed in Section 3.1;
2. when the GC column type is changed;
3. when the GC operating conditions have changed;
4. when the daily mid-point calibration check cannot meet the requirement in Section 3.8.3; and
5. when specified by Regional Board staff based on the scope and nature of the investigation.

3.7.2
Include at least three different concentrations of the standard in the initial calibration, with the lowest one not exceeding 5 times the DL for each compound.

3.7.3
Calculate the response factor (RF) for each compound and calibration concentration prior to analyzing any site samples. Calculate the average RF for each compound. The percent relative standard deviation (%RSD) for each target compound must not exceed 20% except for the following compounds which must not exceed 30%:

Trichlorofluoromethane (Freon 11)
Dichlorodifluoromethane (Freon 12)
Trichlorotrifluoromethane (Freon 113)
Chloroethane
Vinyl chloride

3.7.4
Verify the true concentration of the standard solutions used with the LCS after each initial calibration. Conduct the verification using a LCS with a mid-point concentration within the initial calibration range. The LCS must include all the target compounds. The RF of each compound must be within ±15% difference from the initial calibration, except for freon 11, 12 and 113, chloroethane, and vinyl chloride which must be within ±25% difference from the initial calibration.

3.8.0 Daily Mid-point Calibration Check (Record in Table 1)

3.8.1
Check the calibration using the calibration standard solution with a mid-point concentration within the linear range of the initial calibration before any sample is analyzed.

3.8.2
Include in the daily mid-point calibration check standard the following compounds and every compound expected or detected at the site:

1. 1,1-Dichloroethane
2. 1,2-Dichloroethane
3. 1,1-Dichloroethene
4. cis-1,2-Dichloroethene
5. trans-1,2-Dichloroethene
6. Tetrachloroethene
7. 1,1,1-Trichloroethane
8. 1,1,2-Trichloroethane
9. Trichloroethene
10. Benzene
11. Toluene
12. Xylenes

3.8.3
Assure that the RF of each compound (except for freons 11, 12 and 113, chloroethane, and vinyl chloride) is within ±15% difference from the initial calibration's average RF. The RF for freons 11, 12 and 113, chloroethane, and vinyl chloride must be within ±25%.

3.9.0 Blank

3.9.1
Analyze field blank(s) to detect any possible interference from ambient air.

3.9.2
Investigate and determine the source(s) and resolve any laboratory contamination problem prior to analyzing any samples if the blank shows a measurable amount (≥1 μg/L) of the target compound(s).

3.10.0 Sample Analysis

3.10.1
Assure that the requirements for initial calibration, daily mid-point check, blank, and LCS are met before any site samples are analyzed.

3.10.2
Analyze samples within 30 minutes after collection to

minimize VOC loss. Longer holding time may be allowed if the laboratory uses a special sampling equipment (e.g., sorbent trap, glass bulb) and demonstrates that the holding time can exceed 30 minutes with no decrease in results.

3.10.3

Assure that the concentrations of constituent(s) in a sample do not exceed 50% of the highest concentration in the calibration range. Reanalyze the sample using a smaller volume or dilution if the detected concentration exceed 50% of the highest concentration in the calibration range.

3.10.4

Attain DL of not more than 1 µg/L for all target compounds. If lesser sample volumes or dilutions are used to off-set possible high concentration of constituents in the initial run, use the initial run to calculate the results for constituents that are not affected by the high concentration so that DL of 1 µg/L for these compounds can be achieved.

3.10.5

Quantify sample results using the average RF from the most recent initial calibration.

3.10.6

Add surrogate compounds to all samples if GC/MS is not used for analysis or compound confirmation.

3.11.0 Compound Confirmation and Surrogate Recovery

3.11.1

Conduct compound confirmation by GC/MS whenever possible. Use second column confirmation with surrogate for compound confirmation if GC/MS is not used.

3.11.2

Add surrogate compounds to all calibration and daily mid-point check standards, blanks, site samples, and samples for second column confirmation to monitor the relative retention time (RRT) shift and surrogate recovery between GC runs. This is required for better compound identification when ELCD, PID, ECD, and FID are used for analysis. Two to three different surrogate compounds [one aromatic hydrocarbon and two chlorinated compounds (early and middle eluting, except gases)] should be used to cover the different temperature programming range for each GC run.

Calculate the surrogate recovery for each GC run. Surrogate recovery must not exceed ±25% difference from the true concentration of the surrogate, as the sample result would be considered questionable and may be rejected by this Regional Board.

3.11.3

Assure that the surrogate compound concentration is within the initial calibration range.

3.11.4

Use a surrogate in second column confirmation. Usually one sample is adequate and quantitation is not required. Second column confirmation can be done with a different GC. The representative sample can be collected in Tedlar bag and confirmation can be done off site.

3.11.5

Second column confirmation is not necessary if the compounds present have been confirmed from previous soil gas investigations.

3.12.0 Samples with High Concentration

3.12.1

DL may be raised above 1 µg/L for compounds with high results (i.e., the limit as specified in Section 3.10.3) and those closely eluting compounds for which quantitation may be interfered by the high concentrations.

3.12.2

Quantify sample results according to Section 3.10.4 for analytes which are not affected by the high concentration compounds.

3.12.3

If high VOC concentration in an area is known from previous soil gas analysis, Sections 3.12.1 and 3.12.2 are not necessary when analyzing samples from the area in question.

3.12.4

When dilution with ambient air is used for samples with high results, dilute and analyze in duplicate each day at least one sample to verify the dilution procedure. Ambient air should be checked periodically during each day of analysis.

3.13.0 Shortened Analysis Time

3.13.1

Shorten the GC run time under the following conditions only:

1. The exact number and identification of compounds are known from previous soil and soil gas investigations; and

2. The consultant has been given permission by Regional Board staff to analyze only fo specific compounds.

3.13.2
Meet the following requirements when shortening GC run-time:

1. Regional Board staff must approved the shortened run time;
2. The compounds must not coelute;
3. Perform initial calibration and daily mid-point calibration check and analyze LCS and samples under the same conditions as the shorter GC run-time;
4. Quantitate using the average RF from the initial calibration utilizing the shorter run-time; and
5. Perform a normal run-time analysis whenever peaks are detected within retention time windows where coelution, as indicated by the calibration chromatograms, is likely.

3.14.0 Last GC Test Run Per Day of Analysis (Record in Table 1)

3.14.1
A LCS as the last GC run of the day is not mandatory, except under conditions in Section 3.14.2. Include the same compounds used in the daily mid-point calibration check analysis, as listed in Section 3.8.2. Attain RF for each compound within ±20% difference from the initial calibration's average RF, except for freons 11, 12, 113, chloroethane, and vinyl chloride which must be within ±30%.

3.14.2
Analyze a LCS at the detection limit concentration instead of the mid-point concentration if all samples from same day of analysis show non-detect (ND) results. The recovery for each compound must be at least 50%. If it is less than 50%, all the ND results of the samples become questionable.

3.15.0 On-site Evaluation Check Sample

3.15.1
Analyze on-site the evaluation check sample as part of the QA/QC procedures when presented with such a check sample by Regional Board staff. Provide preliminary results on-site.

3.15.2
If the results show that the soil gas consultant has problems with the analysis, all the results generated during the same day may be rejected. Correct all problems before any more samples are analyzed.

3.16.0 Site Inspection

3.16.1
Unannounced, on-site inspection by Regional Board staff is routine. Provide upon request hard copies of the complete laboratory data, including raw data for initial calibration, daily mid-point check, LCS and blank results. Failure to allow such inspection or to present these records or field data may result in rejection of all sample results.

3.16.2
The soil gas consultant must understand the instruments, analytical and QA/QC procedures and must be capable of responding to reasonable inquiries.

3.17.0 Recordkeeping in the Mobile Laboratory
Maintain the following records in the mobile laboratory:

1. A hard copy record of calibration standards and LCS with the following information:
    a. Date of receipt
    b. Name of supplier
    c. Lot number
    d. Date of preparation for intermediate standards (dilution from the stock or concentrated solution from supplier)
    e. ID number or other identification data
    f. Name of person who performed the dilution
    g. Volume of concentrated solution taken for dilution
    h. Final volume after dilution
    i. Calculated concentration after dilution
2. A hard copy of each initial calibration for each instrument used for the past few months.
3. The laboratory standard operating procedures.

4.0 Reporting of Soil Gas Sample Results and QA/QC Data (Record in Table 1 and 2)

4.1
Report all sample test results and QA/QC data using the reporting formats in Appendix A. Compounds may be listed by retention time or in alphabetical order. Include in the table of sample results all compounds in the analyte list. Report unidentified or tentatively identified peaks. Submit upon request all data in electronic format and raw data, including the chromatograms. Identify the source(s) of the contaminants detected in the investigation, as indicated by the data.

4.2

Report the following for all calibration standards, LCS and environmental samples:

1. Site name
2. Laboratory name
3. Date of analysis
4. Name of analyst
5. Instrument identification
6. Normal injection volume
7. Injection time
8. Any special analytical conditions/remark

4.3

Provide additional information, as specified, for different types of analyses. Tabulate and present in a clear legible format all information according to the following grouping:

1. Initial calibration

   a. Source of standard (**STD LOT ID NO.**)
   b. Detector for quantitation (**DETECTOR**)
   c. Retention time (**RT**)
   d. Standard mass or concentration (**MASS/CONC**)
   e. Peak area (**AREA**)
   f. Response factor (**RF**)
   g. Average response factor (RF_{ave})
   h. Standard deviation (SD_{n-1}) of RF, i.e.,

      $$\left[\sum_{i=1}^{n} (RF_{ave} - RF_i)^2 / (n - 1)\right]^{1/2}$$

      n = number of points in initial calibration

   i. Percent relative standard deviation (**% RSD**), i.e., $(SD_{n-1} / RF_{ave}) \times 100$ (%)
   j. Acceptable range of %RSD (**ACC RGE**)

2. Daily calibration check sample

   a. Source of standard
   b. Detector
   c. Retention time (RT)
   d. Standard mass or concentration
   e. Peak area
   f. Response factor (RF)
   g. Percent difference between RF and RF_{ave} from initial calibration (**% DIFF**)
   h. Acceptable range of %DIFF (**ACC RGE**)

3. LCS. Same format as daily calibration

4. Environmental sample

   a. Sample identification
   b. Sampling depth
   c. Purge volume
   d. Vacuum pressure
   e. Sampling time
   f. Injection time
   g. Injection volume
   h. Dilution factor (or concentration factor if trap is used)
   i. Detector for quantitation
   j. Retention time (RT)
   k. Peak area
   l. Concentration in μg/L (**CONC**)
   m. Total number of peaks found by each detector
   n. Unidentified peaks and/or other analytical remarks

5. Surrogate and second column confirmation

   Mark RT and compound name on: a) second column chromatogram of standard and b) second column chromatogram of confirmation sample.

4.4

Discuss the method(s) to be used for data interpolation (contouring). Provide isoconcentration maps for each VOC detected, total chlorinated volatile organics, total aromatic hydrocarbons, and petroleum-based hydrocarbons for each sampling depth, as applicable. Provide cross-section(s) depicting the geology and changes in contaminant concentration with depth, as justified by the data.

5.0 Companion Soil Sampling

5.1

Discuss soil boring locations with Regional Board staff. Locate borings and sampling depths based on all available information including soil gas test results.

5.2

Conduct the soil sampling and analysis per this Regional Board's **Well Investigation Program General Requirements for Subsurface Investigations, Requirements for Subsurface Soil Investigation and Laboratory Requirements for Soil and Water Sample Analyses.**

6.0 Soil Vapor Monitoring Well/Vertical Profiling

Install soil vapor monitoring wells for vertical profiling in areas where significant VOC concentrations were identified during the vapor investigation. The objectives of vertical profiling are to: 1) assess the vertical distribution of VOCs in the vapor phase within the unsaturated zone, 2) determine the spatial pattern of vapor phase soil contamination at different depths within the unsaturated zone, 3) identify migration pathways at depth along which VOCs may have migrated from sources, and 4) serve as discrete monitoring points to evaluate the efficiency of a cleanup action. Soil vapor monitoring wells offer the opportunity to resample as many times as necessary to monitor soil vapor changes over time.

Address appropriate items in the following sections when conducting vertical profiling.

6.1
Install nested, cluster, and/or multi-port vapor monitoring wells to obtain discrete multi-depth soil vapor data in the unsaturated zone. Provide a schematic diagram of the well design and a cross-section of the site showing the major lithologic units and zones for vapor monitoring.

6.2
Collect undisturbed soil samples if fine-grained soils are encountered during drilling of the boring for the probes. Due to air-stripping effect, VOC analysis of soil samples is not acceptable if air drilling method is used. Refer to Section 5.2 for sampling and testing requirements.

6.3
Use all available information (e.g., geologic log, organic vapor concentration reading) to select appropriate depths for vapor monitoring. Install probes at depths with elevated vapor readings (headspace) and/or slightly above fine-grained soils which can retard the migration of VOCs. The deepest probe should be installed above the capillary fringe.

6.4
Consider installing nested vapor probes in the annular space of the groundwater monitoring well to serve as a dual-purpose well if both vapor and groundwater monitoring are required. This design saves costs by installing vapor and groundwater monitoring wells in a single borehole.

6.5
Use small-diameter (e.g., ≤¼-inch) continuous tubing attached from the vapor probe to the ground surface to minimize purge volume.

6.6
Design and construct the vapor wells to serve as long-term monitoring points to evaluate the efficiency of a cleanup action and soil vapor changes over time. Protect the tubing from being damaged or clogged by subsurface soil materials especially in deep installations (e.g., place inside a PVC casing) or consider using ½-inch PVC pipe in place of the tubing. If a tubing is used, consider attaching a weight at the probe tip and/or attaching the tubing onto a supporting pipe or rod to ensure that the probe tip remains in-place during installation.

Properly cap the top end of each tubing/pipe (e.g., control valve) and label each tubing/pipe with the correct sampling depth.

6.7
Attach the bottom-end of the tubing to an appropriate vapor probe (e.g., PVC screen, stainless steel wire screen, stainless steel probe, or brass elbow, etc). If a vacuum pump is used for purging and sampling, include a wire screen around the probe to prevent soil particles from blocking the probe's airways. Ensure that the connection between the tubing and the vapor probe is tight to prevent leakage.

6.8
Place the filter pack (e.g., sand or pea gravel) around each vapor probe and isolate each monitoring zone with bentonite seals. Use an appropriate method (e.g., tremie method) to avoid bridging or segregation during placement of the filter packs and bentonite seals.

Extend the filter pack to a sufficient distance above the probe to allow for settling of backfill materials. In general, the filter pack should not exceed 3 feet in thickness. In deep borings, the filter pack should extend about four feet above the probe to allow for settling of backfill materials and to reduce the potential for the bentonite seal settling around the probe.

Consider placing fine sand above the filter pack to prevent the bentonite seal from entering the filter pack. Place a minimum of two feet thick bentonite seal above and below the filter pack. Allow sufficient time (e.g., one-half to one hour) for bentonite seal to properly hydrate before placing filter pack or cement-based sealing materials.

6.9
Prevent infiltration of surface runoff and unauthorized access (e.g., use a locking subsurface utility vault).

6.10
Specify the schedule for sampling the vapor probes. In general, soil vapor monitoring is required a minimum of one and two months after installation. Due to the VOC stripping caused by air drilling methods, conduct soil vapor monitoring at least two and four months following well completion. Regional Board staff may require a different sampling schedule and additional sampling based upon site conditions and test results.

6.11

Specify the procedures to properly decommission vapor wells that are no longer needed. The decommissioning activity should achieve an effective and long-term seal of subsurface geologic materials and prevent cross contamination in the subsurface.

7.0 Partial List of Soil Gas Consultants

A partial list of soil gas consultants is available for the convenience of the public who require assistance to select soil gas consultants for conducting soil gas investigations.

The Regional Board requested soil gas consultants to submit a laboratory data package demonstrating their analytical capabilities. The purpose is to produce reliability and some comparability between data obtained by different consultants. We have found the analytical testing methods of the soil gas consultants on the list to be acceptable. Although other soil gas consultants not on the list may be used, their laboratory capabilities must be demonstrated **prior** to performing any work. Sample collection and handling procedures employed must not compromise the integrity of the samples.

Retaining a soil gas consultant from the list does not assure acceptance of that consultant's work. This Regional Board reserves the authority to review any soil gas consultant's work to assure compliance with all applicable statutes, regulations, orders, and guidelines. It is your responsibility to ascertain that the individual directing the field investigation is professionally qualified and conducts the field work in accordance with the Board's guidance for active soil gas investigations.

Acknowledgements

This guideline was prepared under the direction of Roy R. Sakaida by David Bacharowski, Alex Carlos, Wayne Chiou, Keith Elliott, Jack Price, Yue Rong, Hiam Tan and Rueen Fang Wang of the California Regional Water Quality Control Board-Los Angeles Region (CRWQCB-LA) Soil Gas Committee. Special thanks go to the staff of the CRWQCB-LA for reviewing the information contained in this document. In addition, discussions and written comments received from soil gas consultants have greatly improved its content. Former CRWQCB-LA staff Philip Chandler and Samuel Yu assisted in preparing previous versions of this guideline.

Ta 1

SOIL GAS INITIAL CALIBRATION

SITE NAME: ______________________ LAB NAME: ______________________ DATE: __________

ANALYST: ______________ STD LOT ID NO.: ______________ INSTRUMENT ID: ______________

NORMAL INJECTION VOLUME: ______________________ INJECTION TIME: ______________________

COMPOUND	DETECTOR	RT/RRT	1st CONC MASS/CONC	AREA	RF	RT/RRT	2nd CONC MASS/CONC	AREA	RF	RT/RRT	3rd CONC MASS/CONC	AREA	RF	RF_{ave}	SD_{n-1}	%RSD	ACC RGE

-- OR --

COMPOUND	DETECTOR	RT/RRT	MASS/CONC	AREA	RF	RF_{ave}	SD_{n-1}	%RSD	ACC RGE
Compound 1		________	1st conc	________	________				
		________	2nd conc	________	________				
		________	3rd conc	________	________				
Compound 2 (Surrogate)									

SOIL GAS DAILY MID-POINT CALIBRATION STANDARD

AND

SOIL GAS LABORATORY CONTROL SAMPLES (LCS)

SITE NAME: ______________________ LAB NAME: ______________________ DATE: __________

ANALYST: ______________ STD LOT ID NO.: ______________ INSTRUMENT ID: ______________

NORMAL INJECTION VOLUME: ______________________ INJECTION TIME: ______________________

COMPOUND (SURROGATE)	DETECTOR	RT/RRT	MASS/CONC	AREA	RF	%DIFF	ACC RGE

Table 2
SOIL GAS SAMPLE RESULTS

SITE NAME: ______________________ LAB NAME: ________________ DATE: ________

ANALYST: ________________ COLLECTOR: ____________ INSTRUMENT ID: ___________

NORMAL INJECTION VOLUME: ____________________

			Sample 1			Sample 2			Sample 3	
Sample ID										
Sampling Depth										
Purge Volume										
Vacuum										
Sampling Time										
Injection Time										
Injection Volume										
Dilution Factor										
COMPOUND	DETECTOR	RT	AREA	CONC	RT	AREA	CONC	RT	AREA	CONC
Compound 1										
Compound 2										
Compound 3										
.										
.										
.										
.										
.										
Surrogate 1										
Surrogate 2										

Total Number of Peaks
by Detector 1 (specify)
by Detector 2 (specify)

Unidentified peaks and/or other analytical remarks

ALTERNATIVE FORMAT FOR REPORTING SOIL GAS SAMPLE RESULTS

SITE NAME: ____________ LAB NAME: ____________ DATE: ________

Sample ID Sampling Depth	Sample 1	Sample 2	Sample 3 ...
COMPOUND	CONC	CONC	CONC
Compound 1			
Compound 2			
Compound 3			
.			
.			
.			
.			
.			
.			

(Page 1 of 2, Results Summary)

SITE NAME: ____________ LAB NAME: ____________ DATE: ________

ANALYST: __________ COLLECTOR: __________ INSTRUMENT ID: ________

NORMAL INJECTION VOLUME: ________

Sample ID Sampling Depth Purge Volume Vacuum Sampling Time Injection Time Injection Volume Dilution Factor		Sample 1		Sample 2		Sample 3 ...	
COMPOUND	DETECTOR	RT	AREA	RT	AREA	RT	AREA
Compound 1							
Compound 2							
Compound 3							
.							
.							
.							
Surrogate 1							
Surrogate 2							
.							
.							

Total Number of Peaks
by Detector 1 (specify)
by Detector 2 (specify)

Unidentified peaks and/or other analytical remarks

(Page 2 of 2, Analytical Raw Data)

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SOIL AND ROCK CLASSIFICATION

1.0 PURPOSE

This standard operating procedure (SOP) describes the soil and rock classification procedures to be used by Ogden personnel during surface and subsurface sampling programs.

2.0 SCOPE

This document applies to all Ogden personnel involved with managing or participating in drilling and sampling activities who are responsible for soil and rock description. As professional guidance for specific activities, this procedure is not intended to obviate the need for professional judgement to accommodate unforeseen circumstances. Deviance from this procedure in planning, or in the execution of planned activities, must be approved by the Project Manager.

3.0 DEFINITIONS

None.

4.0 RESPONSIBILITIES

The Project Manager is responsible for ensuring that these standard soil and rock classification activities are utilized during field projects and that they are conducted or supervised by a California-registered geologist (RG) or certified engineering geologist (CEG). If soil and rock classification is not conducted by an RG or CEG, it will be performed by a qualified individual under the direct supervision of an RG or CEG. A qualified individual is defined as a person with a degree in geology, hydrogeology, soil science, or geotechnical/civil engineering with at least one year of experience in the classification of soils. Supervision is defined as onsite monitoring of the individual conducting soil classification. Following completion of classification procedures, all field logs will be reviewed and approved by the registered professional overseeing the field activities.

The Field Program Manager is responsible for ensuring that all project field staff utilize these procedures.

5.0 PROCEDURES

5.1 SOIL CLASSIFICATION

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

Describing soils on a common basis is essential so that soils described by different site geologists are comparable. Site geologists describing soils as part of site activities must use the classification system described herein to provide the most useful geologic database for all present and future subsurface investigations and remedial activities at field sites.

The site geologist shall describe the soil and record the description in a boring log or logbook. The items that are essential in any written soil description are as follows:

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

Soils can be categorized into the following 15 basic groups, according to the USCS:

GW[1]	Well graded (poorly sorted) gravel (>50% gravel, <5% fines)
GP[1]	Poorly graded (well sorted) gravel (>50% gravel, <5% fines)
GM[1]	Silty gravel (>50% gravel, >15% silt)
GC[1]	Clayey gravel (>50% gravel, >15% clay)
SW[1]	Well graded (poorly sorted) sand (>50% sand, <5% fines)
SP[1]	Poorly graded (well sorted) sand (>50% sand, <5% fines)
SM[1]	Silty sand (>50% sand, >15% silt)
SC[1]	Clayey sand (>50% sand, >15% clay)
ML[2]	Inorganic, low plasticity silt (slow to rapid dilatancy, low toughness and plasticity)
CL[2]	Inorganic, low plasticity (lean) clay (no or slow dilatancy, medium toughness and plasticity)
MH[2]	Inorganic elastic silt (no to slow dilatancy, low to medium toughness and plasticity)
CH[2]	Inorganic, high plasticity (fat) clay (no dilatancy, high toughness and plasticity)
OL	Organic low plasticity silt or organic silty clay
OH	Organic high plasticity clay or silt
PT	Peat and other highly organic soils

---

[1] If percentage of fines is 5% to 15%, a dual identification shall be given (e.g., a soil with >50% well graded gravel and 10% clay is designated GW-GC.

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

The soil classification chart (Figure FP-C-1-1) shows the basic USCS groups. Flow charts presented in Figures FP-C-1-2 and FP-C-1-3 indicate the process for describing soils. The particle size distribution and the plasticity of the fines are the two properties of soil used for classification. In some cases, it may be appropriate to use a borderline

DEFINITION OF TERMS					
MAJOR DIVISIONS			**SYMBOLS**		**TYPICAL DESCRIPTIONS**
COARSE GRAINED SOILS More Than Half of Material is Larger Than No. 200 Sieve Size	**GRAVELS** More Than Half of Coarse Fraction is Larger Than No. 4 Sieve	**CLEAN GRAVELS** (Less Than 6% Fines)	▨	**GW**	Well graded gravels, gravel-sand mixtures, little or no fines
			▨	**GP**	Poorly graded gravels, gravel-sand mixtures, little or no fines
		GRAVEL With Fines	▨	**GM**	Silty gravels, gravel-sand-silt mixtures, non-plastic fines
			▨	**GC**	Clayey gravels, gravel-sand-clay mixtures, plastic fines
	SANDS More Than Half of Coarse Fraction is Smaller Than No. 4 Sieve	**CLEAN SANDS** (Less Than 6% Fines)	▨	**SW**	Well graded sands, gravelly sands, little or no fines
			▨	**SP**	Poorly graded sands, gravelly sands, little or no fines
		SANDS With Fines	▨	**SM**	Silty sands, sand-silt mixtures, non-plastic fines
			▨	**SC**	Clayey sands, sand-clay mixtures, plastic fines
FINE GRAINED SOILS More Than Half of Material is Smaller Than No. 200 Sieve Size	**SILTS AND CLAYS** Liquid Limit is Less Than 50%		▨	**ML**	Inorganic silts, rock flour, fine sandy silts or clays, and clayey silts with non- or slightly-plastic fines
			▨	**CL**	Inorganic clays of low to medium plasticity, gravelly clays, silty clays, sandy clays, lean clays
			▨	**OL**	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS Liquid Limit is Greater Than 50%		▨	**MH**	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts, clayey silt
			▨	**CH**	Inorganic clays of high plasticity, fat clays
			▨	**OH**	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			▨	**PT**	Peat and other highly organic soils

GRAIN SIZES							
SILTS AND CLAYS	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		
	200	40	10	4	3/4"	3"	12"
	U.S. STANDARD SERIES SIEVE			CLEAR SQUARE SIEVE OPENINGS			

Figure FP-C-1-1. Unified Soil Classification System

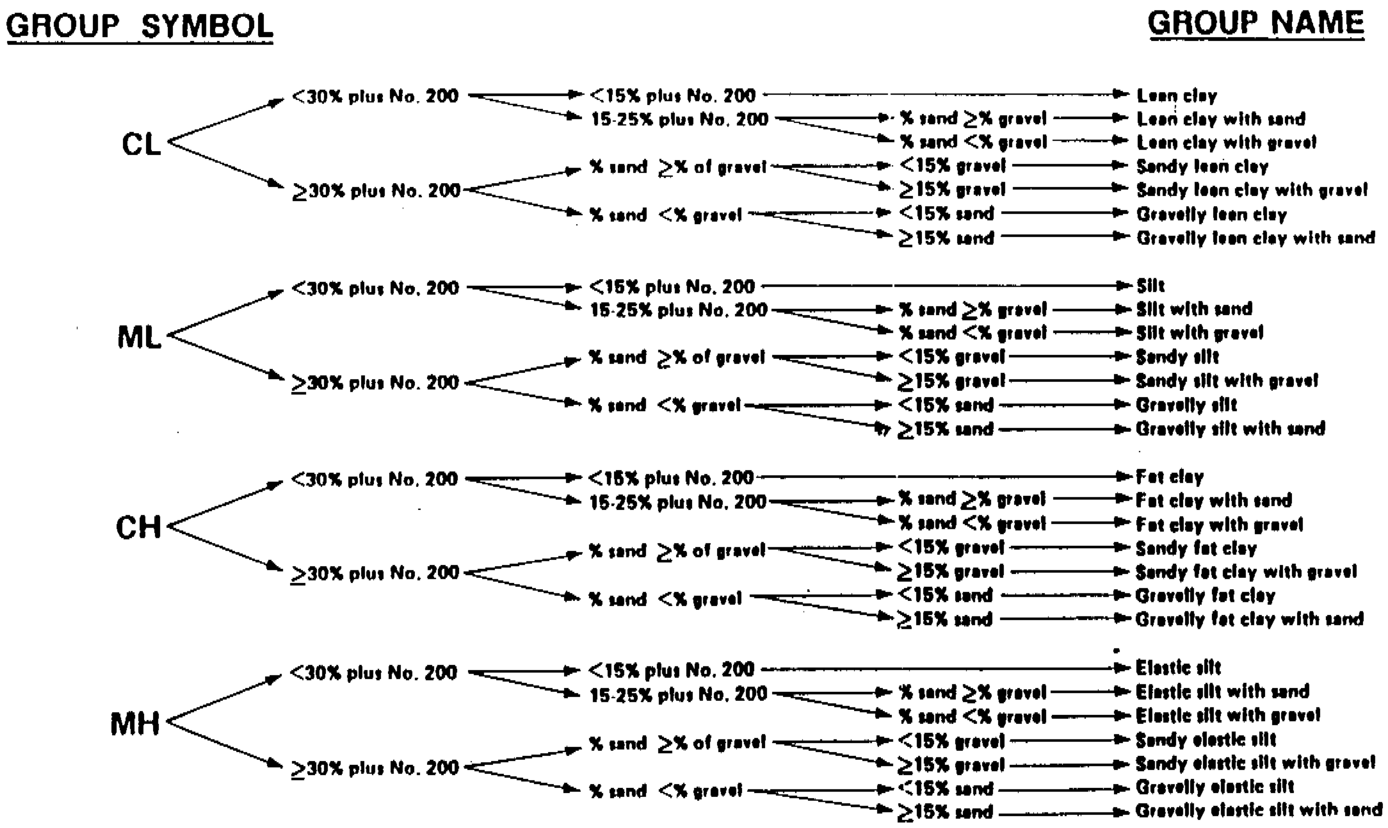

Figure FP-C-1-2. Flow Chart for Fine-Grained Soils

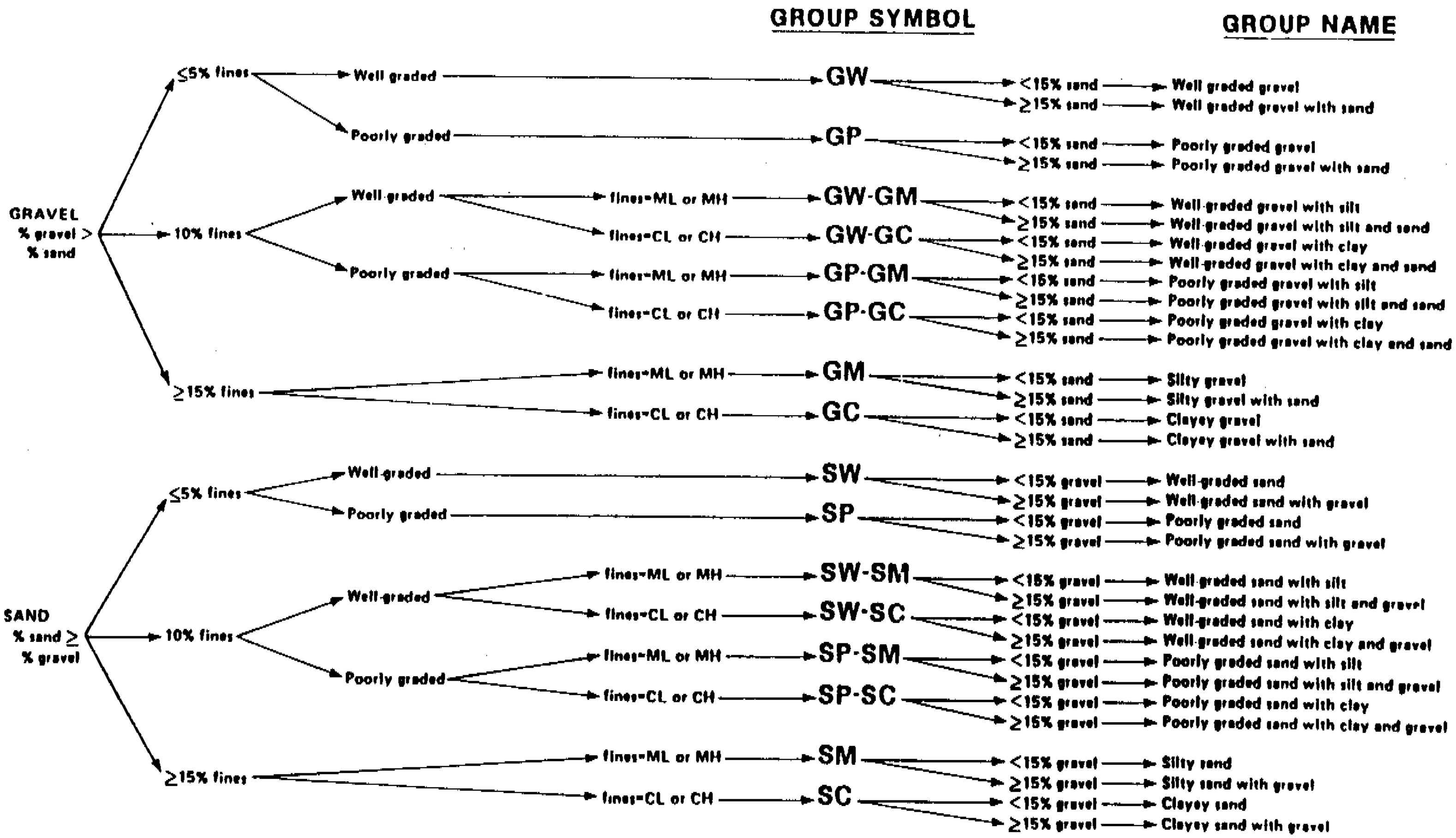

Figure FP-C-1-3. Flow Chart for Coarse-Grained Soils classification, e.g., SC/CL, if the soil has been identified as having properties that do not distinctly place the soil into a specific group.

5.1.1 Estimation of Particle Size Distribution

The estimate of the percentage of soil constituents in each particle size range is one of the most important factors in classifying a soil. To be proficient in this estimation requires extensive practice and frequent checking. The following steps are required to determine particle size distribution.

1) Select a representative sample;

2) Remove all particles larger than 3 inches from the sample. Estimate and record the percent by volume of these particles. Only the fraction of the sample smaller than 3 inches is classified;

3) Estimate and record the percentage of dry mass of gravel (less than 3 inches and greater than 1/4 inch);

4) Considering the rest of the sample, estimate and record the percentage of dry mass of sand particles (about the smallest particle visible to the unaided eye);

5) Estimate and record the percentage of dry mass of fines in the sample (do not attempt to separate silts from clays);

6) Estimate percentages to the nearest five percent. If one of the components is present in a quantity considered less than five percent, indicate its presence by the term "trace"; and

7) The percentages of gravel, sand, and fines must add up to 100 percent. "Trace" is not included in the 100 percent total.

5.1.2 Soil Dilatancy, Toughness, and Plasticity

Dilatancy

To evaluate dilatancy (reaction to shaking), the following procedures shall be followed:

- From the specimen, select enough material to mold into a ball about 1/2 inch (12 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 in Table FP-C-1-1. The reaction is the speed with which water appears while shaking, and disappears while squeezing.

Toughness

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

Table FP-C-1-1

CRITERIA FOR DESCRIBING DILATANCY

Description	Criteria
None	No visible change in the specimen.
Slow	Water appears slow 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 freezing.

Table FP-C-1-2

CRITERIA FOR DESCRIBING TOUGHNESS

Description	Criteria
Low	Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft.
Medium	Medium pressure is required to roll the thread 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.

Plasticity

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

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

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

The criteria for describing plasticity in the field using the rolled thread method is presented in Table FP-C-1-3.

5.1.3 Angularity

The angularity of the coarse sand and gravel particles is described according to the following criteria:

- Rounded - particles have smoothly-curved sides and no edges;
- Subrounded - particles have nearly plane sides, but have well-rounded corners and edges;

Table FP-C-1-3

CRITERIA FOR DESCRIBING PLASTICITY

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

- Subangular - particles are similar to angular, but have somewhat rounded or smooth edges; and

- Angular - particles have sharp edges and relatively plane sides with unpolished surfaces. Freshly broken or crushed rock would be described as angular.

5.1.4 Color, Moisture, and Odor

The natural moisture content of soils is very important information. The terms for describing the moisture condition and the criteria for each are shown in Table FP-C-1-4.

Table FP-C-1-4

SOIL MOISTURE CONTENT QUALIFIERS

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

Color is described by hue and chroma using the Munsell Soil Color Chart and all site geologists shall utilize this chart during soil classification. This color chart is a small booklet with color chips that have numbers and color names such as "5YR 5/6, yellowish-red." Use of the color chart to describe color allows different field geologists to describe similar colors in a similar fashion. This facilitates correlation of geologic units between boreholes logged by different geologists. Mottling or banding of colors should be noted. Staining is also particularly important to note and describe as it may indicate contamination.

In general, respirators should be worn if strong organic odors are present. However, if odors are noted, they should be described if they are unusual or suspected to result from contamination. An organic odor may have a distinctive decaying-vegetation smell. Unusual odors may be related to hydrocarbons, solvents, or other chemicals in the subsurface. An organic vapor analyzer (OVA) or photoionization detector (PID) can also be used to detect the presence of volatile organic contaminants.

5.1.5 In-place Conditions

Soil conditions for undisturbed samples shall include a description of the density/consistency (i.e., compactness), cementation, and structure utilizing the following guidelines:

5.1.5.1 Density/Consistency

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

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

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

The sampler should be driven and blow counts recorded for each 6-inch increment of penetration until one of the following occurs:

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

If the sampler is driven less than 18 inches, the number of blows per each partial increment shall be recorded on the boring log. If refusal occurs during the first 6 inches of penetration, the number of blows will represent the N-value for this sampling interval. Representative descriptions of soil density/consistency vs. N-values are presented below:

Relative Density
(Sands, Gravels)

	Field Criteria (N-Value)	
Description	(1 3/8" I.D. Sampler)	(2" I.D. Sampler using 1.43 factor)
Very loose	0-4	0-6
Loose	4-10	6-14
Medium dense	10-30	14-43
Dense	30-50	43-71
Very Dense	>50	>71

Consistency
(Fine-Grained Cohesive Soils)

Field Criteria (N-Value)

Description	(1 3/8" I.D. Sampler)	(2" I.D. Sampler using 1.13 factor)
Very soft	0-2	0-2
Soft	2-4	
Medium Stiff	4-8	4-9
Stiff	9-18	
Very Stiff	16-32	18-36
Hard	>32	>36

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

Description	Pocket Penetrometer Reading (PSF)
Very soft	0 to 250
Soft	250 to 500
Medium Stiff	500 to 1000
Stiff	1000 to 2000
Very Stiff	2000 to 4000
Hard	>4000

Consistency can also be estimated using thumb pressure using the following table:

Description	Criteria
Very soft	Thumb will penetrate soil more than 1 inch (25 mm)
Soft	Thumb will penetrate soil about 1 inch (25 mm)
Medium Stiff	Thumb will penetrate more than 1/4 inch (6 mm) with moderate effort
Stiff	Thumb will penetrate about 1/4 inch (6mm), but only with great effort
Very Stiff	Thumb will not indent soil but readily indented with thumbnail
Hard	Thumbnail will not indent soil

5.1.5.2 Cementation

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

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

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

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

5.1.5.3 Structure

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

Granular - spheroically shaped aggregates with faces that do not accommodate adjoining ped faces.

Stratified - alternating layers of varying material or color with layers at least 6 mm (1/4 inch) thick; note thickness.

Laminated - alternating layers of varying material or color with layers less than 6 mm (1/4 inch) thick; note thickness.

Blocky - cohesive soil that can be broken down into small angular or subangular lumps that resist further breakdown.

Lensed - inclusion of a small pocket of different soils, such as small lenses of sand, should be described as homogeneous if it is not stratified, laminated, fissured, or blocky. If lenses of different soils are present, the soil being described can be termed homogeneous if the description of the lenses is included.

Prismatic or Columnar - particles arranged about a vertical line, ped is bounded by planar, vertical faces that accommodate adjoining faces; prismatic has a flat top; columnar has a rounded top.

Platy - particles are arranged about a horizontal plane.

5.1.5.4 Other Features

Mottled - soil that appears to consist of material of two or more colors in blotchy distribution.

Fissured - breaks along definite planes of fracture with little resistance to fracturing

Slickensided - fracture planes appear polished or glossy, sometimes striated (parallel grooves or scratches)

5.1.6 Development of Soil Description

Standard soil descriptions will be developed according to the following examples. In general, there are three principal categories under which all soils can be classified. These three primary soil categories are described below.

5.1.6.1 Coarse-grained Soils

Coarse-grained soils are divided into sands and gravels. A soil is classified as a sand if 50% or greater of the coarse fraction is "sand-sized." It is classified as a gravel if over 50% of the coarse fraction is composed of "gravel-sized" particles. The written description of a coarse-grained soil shall contain, in order of appearance:

> Typical name including the second highest percentage constituent as an adjective, if applicable (underlined), grain size of coarse fraction, Munsell color and color number, moisture content, relative density, sorting, angularity, other features such as stratification (sedimentary structures) and cementation, possible formational name, primary USCS classification, secondary USCS classification (when necessary), and approximate percentages of minor constituents (i.e., sand, gravel, shell fragments, rip-up clasts, etc.) in parentheses.
>
> Example: POORLY-GRADED SAND WITH SILT, medium- to coarse-grained, light olive gray, 5Y 6/2, wet, loose, subrounded clasts, SP-SM (approximately 20% coarse-grained sand-sized shell fragments, 70% medium-grained quartz sand, and 10% fines).

5.1.6.2 Fine-grained Soils

Fine-grained soils are further subdivided into clays and silts according to their plasticity. Clays are rather plastic, while silts have little or no plasticity. The written description of a fine-grained soil should contain, in order of appearance:

Typical name including the second highest percentage constituent as an adjective, if applicable (underlined), Munsell color, moisture content, consistency, plasticity, other features such as stratification, possible formation name, primary USCS classification, secondary USCS classification (when necessary), and the percentage of minor constituents in parentheses.

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

5.1.6.3 Organic Soils

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

5.2 ROCK CLASSIFICATION

The purpose of rock classification is to thoroughly describe the physical and mineralogical characteristics of the specimen and to classify it according to an established system. The generalized rock classification system described below was developed to accommodate a variety of rock types. This generalized system was developed because, unlike the USCS for soils, there is no universally accepted rock classification system. This classification system was designed to provide for a generalized classification of rocks. In some instances, a more detailed and thorough rock classification system may be appropriate. Any modifications to this classification system, or the use of an alternate classification system must be approved by the Project Manager.

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

In order to provide a more consistent rock classification between geologists, a rock classification template has been designated as shown in Figure FP-C-1-4. The template includes classification of rocks by origin and mineralogical composition. This template shall be used by all site geologists when classifying rocks.

The site geologist shall describe the rock specimen and record the description in a borehole log or logbook. The items essential in any written rock description are as follows:

Classification group (i.e., metamorphic foliated);
Classification Name (i.e., schist);
Color;
Mineralogical composition and percent;
Texture/Grain size (i.e., fine-grained, pegmatitic, aphlitic, glassy, etc.);
Structure (i.e., foliated, fractured, lenticular, etc.); and
Classification symbol (i.e., MF).

6.0 RECORDS

Soil classification information collected during soil sampling should be documented onto the field boring logs, field trench logs, and into the field notebook. Copies of the field boring log form are presented in SOP FP-C-2, *Soil Sampling*. Copies of this information should be sent to the Project Manager and to the project files.

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

Figure FP-C-1-4. Rock Classification System

7.0 HEALTH AND SAFETY

Standard Health and Safety (H&S) practices should be observed according to the site-specific Health and Safety Plan (HSP). Monitoring during excavation activities should determine contaminant concentrations and any required personal protective equipment (PPE) that may be necessary. Required PPE will be listed in each site-specific HSP.

Suggested minimum protection during soil and rock classification activities in conjunction with field excavations shall include inner disposable vinyl or nitrile gloves, outer chemical protective nitrile gloves, Tyvek® coveralls, steel-toed boots and overboots, safety glasses, hearing protection, and an ANSI-Standard hard hat. Half-face respirators and cartridges may be necessary depending on the contaminant concentrations and shall always be available onsite. At no time during classification activities are personnel to reach for debris near machinery that is in operation, place any samples in their mouth, or come in contact with the soils/rocks without the use of gloves.

In addition to the aforementioned precautions, the following safe work practices will be employed:

Physical Hazards Associated With Soil and Rock Classification:

1. To avoid lifting injuries associated with large specimens, use large muscles of the legs, not the back.
2. Be wary of uneven terrain to avoid slip/trip/fall conditions.
3. To avoid heat/cold stress as a result of exposure to extreme temperatures and PPE, drink electrolyte replacement fluids (1-2 cups/hour is recommended) and, in cases of extreme cold, wear fitted insulating clothing.
4. Be aware of restricted mobility due to the wearing of PPE.

8.0 REFERENCES

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9.0 ATTACHMENTS

None.

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SOIL SAMPLING

1.0 PURPOSE

This standard operating procedure (SOP) describes the soil sampling procedures (surface samples, trench samples, and borehole samples) to be used by Ogden personnel.

2.0 SCOPE

This procedure applies to all Ogden personnel involved with the managing or participating in drilling and soil sampling activities. As professional guidance for specific activities, this procedure is not intended to obviate the need for professional judgement to accommodate unforeseen circumstances. Deviance from this procedure in planning, or in the execution of planned activities, must be approved by both the Project Manager.

3.0 DEFINITIONS

None.

4.0 RESPONSIBILITIES

The Project Manager is responsible for ensuring that these standard soil sampling procedures are utilized during field projects and that they are conducted or supervised by a California-registered geologist (RG) or certified engineering geologist (CEG). If soil and rock classification is not conducted by an RG or CEG, it will be performed by a qualified individual under the direct supervision of an RG or CEG. A qualified individual for subsurface sampling is defined as a person with a degree in geology, hydrogeology, or geotechnical/civil engineering with at least one year of experience in the supervision of soil sampling during boring construction. A qualified individual for trenching or surface sampling supervision is one who has sufficient training and experience to accomplish the objectives of the sampling program. The Project Manager shall also ensure that soil classification during all types of soil sampling is conducted by a qualified person as defined in SOP FP-C-1, *Soil and Rock Classification*.

The Field Program Manager is responsible for ensuring that all project field staff utilize these procedures.

5.0 PROCEDURES

5.1 SUBSURFACE SOIL SAMPLING

The purpose of subsurface soil sampling is to acquire accurate, representative information about subsurface materials penetrated during drilling. This is accomplished by logging lithologic information, classifying lithologic materials, and collecting lithologic samples for analysis by geotechnical or chemical methods.

5.1.1 Inspection of Equipment

The collection of reliable samples of subsurface materials depends partially on the type of samples that can be collected when using various drilling techniques. These procedures are described in Section 5.2. However, no matter which drilling method is chosen, the drill rig shall be inspected prior to commencement of drilling for signs of fluid leakage which might result in the introduction of contaminants to the soil. If, at any time during drilling, fluid is observed to be leaking from the rig, operations shall cease and the leak will be immediately repaired or contained. All soil and other materials affected by the leak will be collected, containerized, and labeled for proper disposal (see SOP FP-B-8, *IDW Management*).

5.1.2 Preparation of Drilling Site

Proper preparation of the site prior to the commencement of drilling is important to ensure smooth drilling operations and adherence to appropriate health and safety procedures. Initially, the site shall be inspected to ensure that there are no overhead hazards that could impact drilling operations. In addition, all drilling locations shall be assessed using geophysical methods and hand excavated to a depth of 2 to 3 feet prior to drilling. Hand excavation is required to minimize the potential to impact subsurface utilities if possible. If surface or shallow samples are required, it is suggested that the hand excavation be done as close to the actual drill site as possible.

The drilling rig shall be located so that it is situated upwind or side-wind of the borehole. The area surrounding, and in the vicinity of, the borehole shall be covered with plastic. This includes the area where cuttings are placed into 55-gallon drums and the equipment decontamination area. The required exclusion zones shall be established by using plastic tape or cones to designate the various areas.

5.1.3 Equipment Decontamination

In order to ensure that cross-contamination does not occur, all equipment utilized for borehole drilling and soil sampling shall be thoroughly decontaminated as described in the procedure on decontamination (see SOP FP-D-5, *Equipment Decontamination*). At a minimum, all equipment shall be steam-cleaned or undergo the wash and rinse process. All wash and rinse water shall be collected, containerized, and labeled for proper disposal. Clean equipment (e.g., augers and samplers) shall not come into contact with contaminated soils or other contaminated materials. Equipment shall be kept on plastic or protected in another suitable fashion.

5.1.4 Handling of Drill Cuttings

All soil cuttings from borehole drilling shall be placed into 55-gallon DOT-approved drums or other appropriate containers such as a roll-off bin. The containerized cuttings shall be stored in a centralized area pending sample analysis to determine their final disposition. Detailed drum handling and labeling procedures are described in the procedure on investigative-derived waste (see SOP FP-B-8).

5.2 SOIL SAMPLE COLLECTION METHODS

Table FP-C-2-1 describes the characteristics of the sampling methods available for the drilling techniques frequently employed for conducting soil borings. The split-spoon

Table FP-C-2-1

CHARACTERISTICS OF COMMON SUBSURFACE FORMATION-SAMPLING METHODS

Type of Formation	Sample Collection Method	Sample Quality	Potential for Continuous Sample Collection	Samples Suitable for Analytical Testing	Discrete Zones Identifiable?
Unconsolidated	Bulk Sampling (Cuttings)	Poor	No	No	No
	Thin Wall	Good	Yes	Yes	Yes
	Split Spoon	Good	Yes	Yes	Yes
	Trench	Good	No	Yes	Yes
	Core Barrels	Good	Yes	Yes	Yes
Consolidated	Cuttings (direct rotary)	Poor	No	No	No
	Core Barrels	Good	Yes	Yes	Yes

sampling method is generally the most commonly used soil sampling technique. However, in certain circumstances, other methods may have to be used to obtain optimal soil sampling results. The following text describes the primary soil sampling methods used on various field projects.

5.2.1 Split-spoon Samples

Split-spoon sampling is generally utilized in conjunction with the hollow-stem or direct push drilling method and can be used for sampling most unconsolidated sediments. It is less frequently used for air and mud rotary, and casing drive methods. It cannot generally be used to sample bedrock such as basalt, limestone, or granite. The method can be used for highly unconsolidated sands and gravels if a stainless-steel sand catcher is placed in the lower end of the sampler.

The split-spoon sampler consists of a hardened metal barrel that is generally 2 to 3 inches in diameter (2 to 2.5 inches inner diameter) with a threaded, removable fitting on the top end for connection to the drill rods and a threaded, removable "shoe" on the lower end that is used to penetrate the formation. The barrel can be split along its length to allow removal of the sample.

The steps required to obtain a representative soil sample using a split-spoon sampler are presented below.

- The borehole is advanced by augering or hydraulic pushing until the top of the desired sampling interval is reached.

- If samples are to be retained for laboratory analytical analysis, the sampler shall be equipped with interior liners that are composed of materials compatible with the suspected contaminants. Generally, these liners consist of brass, stainless steel, or acetate and are slightly smaller than the inner diameter of the sampler. Acetate liners are used exclusively in conjunction with direct push drilling methods (e.g., geoprobe, strataprobe). If samples are to be analyzed for metals, it is recommended that stainless steel or acetate liners be used rather than brass. The composition of the liners shall always be evaluated with respect to the types of contaminants that are suspected.

- The properly decontaminated split-spoon sampler (equipped with liners) is either attached to the drill rods or to a cable system and lowered to the bottom of the borehole through the augers.

- The sampler is then driven into the formation by either a manual or automatic hammer (usually a 140-pound weight dropped through a 30-inch interval), or by direct pushing. The number of blows required to drive the sampler should be recorded at 6-inch intervals in the boring log since blow counts provide an indication of the relative density/consistency of the soils being sampled. The field geologist shall carefully observe the internal measuring technique of the driller and keep track of sampling materials to ensure that accurate location of samples is achieved. Continuous samples can be collected with the split-spoon method by augering or drilling to the bottom of the previously sampled interval and repeating the operation. Alternatively, continuous samples can also be collected with a split-spood sampler using a direct-push hydraulic and percussion drive-point sampling system (e.g., geoprobe or strataprobe). Whether continuous or intermittent, the sample collected with these methods are somewhat disturbed and cannot be used for certain geotechnical tests where undisturbed samples are required.

- Following sample acquisition, the split-spoon sampler is brought to ground surface and removed from the drill rods or cable system. The upper and lower fittings are loosened and the sampler is taken to the sample handling area. At the sample handling area, the fittings are removed, the barrel of the sampler is split, and one side of the sampler is removed. At this time, it is important to observe and record the percentage of sample recovery.

- The liner(s) containing the soil samples are immediately removed from the sampler. Generally, the lowermost liner (or lowermost portion of the liner if a single acetate liner is used in conjunction with a direct-push/percussion sampling system) is considered the least disturbed and shall be retained as the analytical laboratory sample. However, in certain circumstances (such as with the use of a sand catcher), other liners may be more appropriate for retention as the laboratory sample. The ends of the sample liner to be retained as the analytical laboratory sample shall be covered with Teflon® film and sealed with plastic caps. The site geologist shall observe the ends of the liner destined for analytical sampling. The sample shall then be labeled according to SOP FP-F-6, *Record Keeping, Sample Labeling, and Chain-of-Custody*, and immediately placed on ice in a cooler.

- The other two remaining liners collected from the sample can then be used for other purposes. These include providing a duplicate sample for field QC or material for lithologic logging. These samples can also be used for headspace analysis.

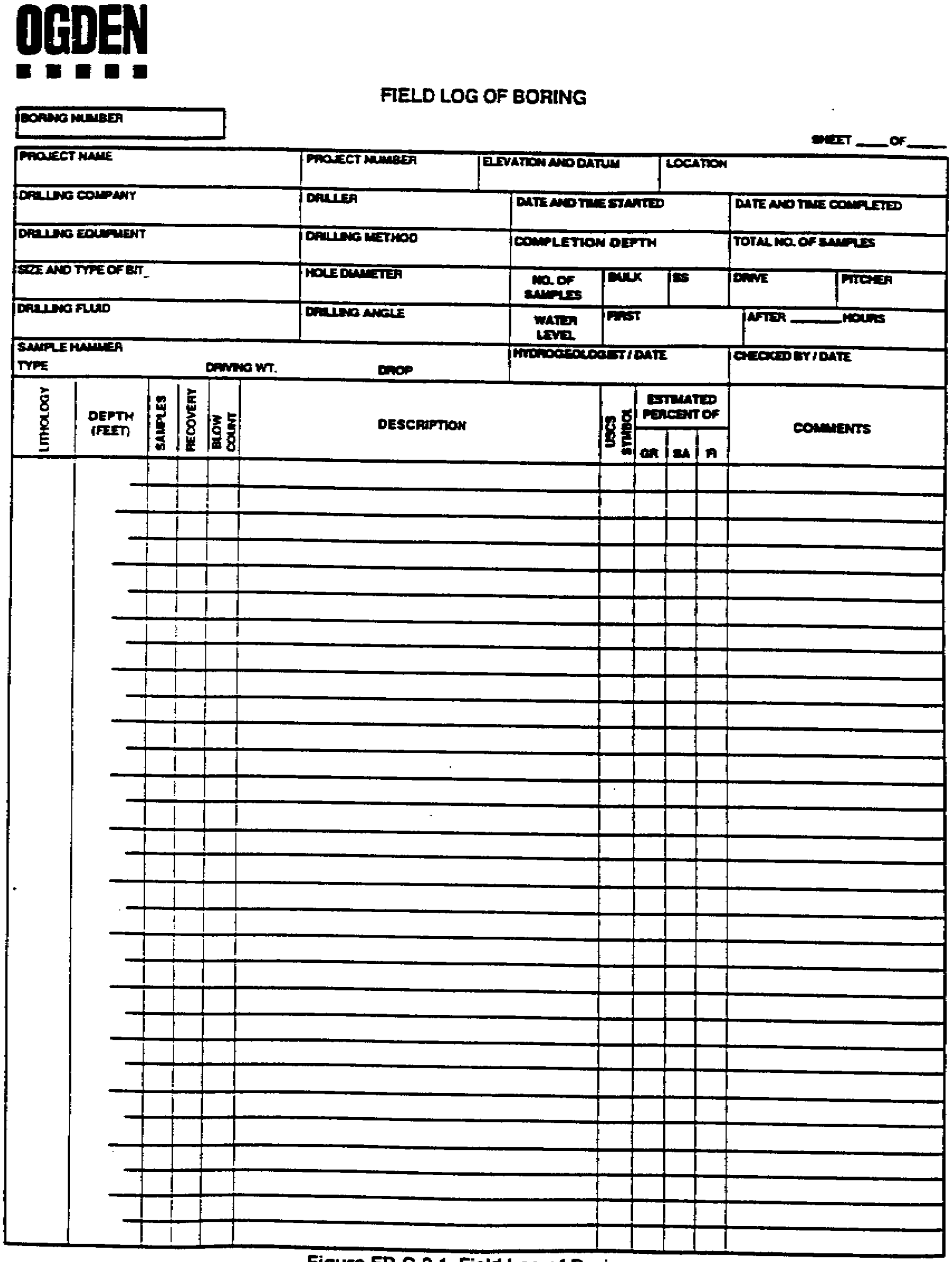
- Lithologic logging of each sample shall be conducted in accordance with the methods outlined in SOP FP-C-1, *Soil and Rock Classification*, and entered into the boring log presented in Figure FP-C-2-1.

- If volatile organic constituents are suspected to be present, screening of the sample with an OVM or equivalent, and collection of headspace samples shall also be conducted according to the methods outlined in Section 5.4.

- All sampling equipment must be decontaminated prior to each use according to the methods presented in SOP FP-D-5.

5.2.2 Thin-wall Samples

The thin-wall or Shelby tube sampler is generally used in conjunction with the hollow-stem and solid-stem auger drilling methods and is most useful when sampling clay- and silt-rich sediments. It can also be used with air and mud rotary, and casing drive drilling techniques. It is amenable only to lithologies that are relatively soft and, in some cases, is not capable of penetrating even hard clays or compacted sands. In addition, samples of



OGDEN

FIELD LOG OF BORING

BORING NUMBER

SHEET ____ OF ____

PROJECT NAME	PROJECT NUMBER	ELEVATION AND DATUM	LOCATION
DRILLING COMPANY	DRILLER	DATE AND TIME STARTED	DATE AND TIME COMPLETED
DRILLING EQUIPMENT	DRILLING METHOD	COMPLETION DEPTH	TOTAL NO. OF SAMPLES
SIZE AND TYPE OF BIT_	HOLE DIAMETER	NO. OF SAMPLES: BULK / SS	DRIVE / PITCHER
DRILLING FLUID	DRILLING ANGLE	WATER LEVEL: FIRST	AFTER ______ HOURS
SAMPLE HAMMER TYPE DRIVING WT. DROP		HYDROGEOLOGIST / DATE	CHECKED BY / DATE

LITHOLOGY	DEPTH (FEET)	SAMPLES	RECOVERY	BLOW COUNT	DESCRIPTION	USCS SYMBOL	ESTIMATED PERCENT OF			COMMENTS
							GR	SA	FI	

Figure FP-C-2-1. Field Log of Boring

unconsolidated sands cannot generally be acquired because they cannot be retained within the sampler, although a sand catcher can be utilized in some cases with moderate success.

The thin-wall sampler often consists of a single thin tube that is 3 to 4 inches in outer diameter and 1 to 3 feet in length. The upper end of the sampler has a solid metal section with a fitting for attachment to the drill rods. There is no fitting for the lower end of the sampler and it is usually open to allow sample acquisition; however, when sampling in poorly consolidated materials, a sand catcher may be placed in the lower end to ensure retention of the sample.

The steps required to obtain a representative soil sample using a thin-wall sampler are presented below.

- The borehole is advanced by augering or drilling until the top of the desired sampling interval is reached.
- The sampler is placed on the end of the drill rods and lowered to the bottom of the borehole.
- Instead of driving the sampler, the hydraulic apparatus associated with the kelly bar on the drilling rig is used to press the sampler into the undisturbed formation. The thin-wall sampler may not have sufficient structural strength to penetrate the materials, in which case another sampling technique may be required. The samples obtained using this method cannot be used for certain geotechnical tests where undisturbed samples are required.
- Following sample acquisition, the thin-wall sampler is brought to the ground surface, removed from the drill rods, and taken to the sample handling area.
- If the sample is to be retained as a laboratory sample, the ends of the sample should be immediately covered with Teflon® film and sealed with plastic caps. The sample shall then be labeled according to SOP FP-F-6 and immediately

placed on ice in a cooler. If the sample is to be used only for lithologic logging, it may be extruded from the sampler and inspected.

- Lithologic logging of each sample shall be conducted in accordance with the methods outlined in SOP FP-C-1, *Soil and Rock Classification*, and entered into the boring log presented in Figure FP-C-2-1.

- If volatile organic constituents are suspected to be present, screening of the sample with an OVM or equivalent, and collection of headspace samples shall also be conducted according to the methods outlined in Section 5.4.

- All sampling equipment must be decontaminated prior to each use according to the methods presented in SOP FP-D-5.

5.2.3 Cores

Acquisition of core samples using a core barrel is often utilized for obtaining samples from harder lithologic materials such as basalt, granite, and limestone, in instances where undisturbed samples are required for geotechnical testing, and in cases where completely continuous sampling is required. Complete recovery of samples during coring is often difficult when sampling unconsolidated and semi-consolidated lithologies such as clays, silts, and sands.

Rock coring methods have been generally standardized by the American Society for Testing and Materials (ASTM D-2113). Several standardized core sizes for bits, shells, and casings have been established. The various size standards for core barrels and bits are summarized in Table FP-C-2-2.

The selection of the most practical core barrel for the anticipated bedrock conditions is important. The selection of the correct drill bit is also essential to good recovery and drilling production. Although the final responsibility of bit selection usually rests with the drilling contractor, there is a tendency in the trade to use "whatever happens to be at hand." The selection of the diamond size, bit crown contour, and number of water ports is

Table FP-C-2-2

STANDARD CORE BARREL SIZES
(in inches)

Description	RX or RW	EX or EW	AX or AW	BX or BW	NX or NW	HX or HW	PX or PW	SX or SW	UX or UW	ZX or ZW
Bit Set Normal I.D.	0.750	0.845	1.185	1.655	2.155	3.000	—	—	—	—
Bit Set Normal and Thin-wall O.D.	1.160	1.470	1.875	2.345	2.965	3.890	—	—	—	—
Bit Set Thin-wall I.D.	0.735	0.905	1.281	1.750	2.313	3.187	—	—	—	—
Shell Set Normal and Thin-wall O.D.	1.175	1.485	1.890	2.360	2.980	3.907	—	—	—	—
Casing Bit Set I.D.	1.000	1.405	1.780	2.215	2.840	3.777	4.632	5.632	6.755	7.755
Casing Bit Set and Shoe O.D.	1.485	1.875	2.345	2.965	3.615	4.625	5.650	6.780	7.800	8.810

dependent upon the characteristics of the rock mass. The use of an incorrect bit can be detrimental to the overall core recovery. Generally, fewer and larger diamonds are used to core soft formations and more numerous, smaller diamonds, which are mounted on the more commonly used, semi-round bit crowns, are used in hard formations. Special impregnated diamond core bits have been recently developed for use in severely weathered and fractured formations where bit abrasion can be very high.

Core barrels are manufactured in three basic types: single tube, double tube, and triple tube. These basic units all operate on the same principle of pumping drilling fluid through the drill rods and core barrel. This is done to cool the diamond bit during drilling and to carry the borehole cuttings to the surface. A variety of coring bits, core retainers, and liners are used in various combinations to maximize the recovery and penetration rate of the selected core barrel.

The simplest type of rotary core barrel is the single tube, which consists of a case hardened, hollow steel tube with a diamond drilling bit attached at the bottom. The diamond bit cuts an annular groove or kerf in the formation to allow passage of the drilling fluid and cuttings up the outside of the core barrel. However, the drilling fluid must pass over the recovered sample during drilling and the single tube core barrel cannot be employed in formations that are subject to erosion, slaking, or excessive swelling.

The most popular and widely used rotary core barrel is the double tube, which is basically a single tube barrel with a separate and additional inner liner and is available in either a rigid or swivel type of inner liner construction. In the rigid types, the inner liner is fixed to the outer core barrel so that it rotates with the outer tube. In contrast, the swivel type of inner liner is supported on a ball bearing carrier which allows the inner tube to remain stationary, or nearly so, during rotation of the outer barrel. The sample or core is cut by rotation of the diamond bit. The bit is in constant contact with the drilling fluid as it flushes out the borehole cuttings. The addition of bottom discharge bits and fluid control valves to the core barrel system minimizes the amount of drilling fluid and its contact with the sample, which further decreases sample disturbance.

The third and most recent advancement in rotary core barrel design is the triple-tube core barrel, which adds another separate, non-rotating liner to the double tube core barrel. This liner, which retains the sample, consists of a clear plastic solid tube or a split, thin metal liner. Each type of liner has its distinct advantages and disadvantages; however, they are both capable of obtaining increased sample recovery in poor quality rock or semi-cemented soils, with the additional advantage of minimizing sample handling and disturbance during removal from the core barrel.

The rotary core barrels which are available range from 1 to 10 inches in diameter, and the majority may be used with water, drilling mud, or air for recovering soil samples. Of the three basic types of core barrels, the double tube core barrel is most frequently used in rock core sampling for geotechnical engineering applications. The triple tube core barrel is used in zones of highly variable hardness and consistency. The single tube, because of its sample recovery and disturbance problems, is rarely used.

Coring to obtain analytical samples shall only utilize filtered air as the drilling fluid. The core barrel operates by rotating the outer barrel to allow the bit to penetrate the formation. The sample is retained in the inner liner, which in most samplers does not rotate with the outer barrel. As the outer barrel is advanced, the sample rises in the inner liner. In general, a secondary liner consisting of plastic or metal is present within the inner liner to ensure the integrity of acquired samples.

Soil or rock core samples shall be obtained with a core barrel or a 5-foot split-spoon core barrel using the following procedure:

- The core barrel shall be drilled to the appropriate sampling depth. Note: the only drilling fluid to be used while coring to obtain samples for laboratory analysis is clean, filtered air.
- The core barrel is then retrieved from the hole. Care must be taken to ensure that the contents of the core barrel do not fall out of the bottom of the core barrel during withdrawal and handling.
- Open the core barrel by removing both the top and bottom fittings. The sample within the inner liner can then be removed from the core barrel and taken to the sample handling area.
- Lithologic logging of each sample shall be conducted in accordance with the methods outlined in SOP FP-C-1 and entered into the boring log presented in Figure FP-C-2-1.
- If volatile organic constituents are suspected to be present, screening of the sample with an OVM or equivalent, and collection of headspace samples shall also be conducted according to the methods outlined in Section 5.4.
- If rock samples are to be recovered for analytical laboratory or geotechnical analyses, they shall be placed in stainless steel tubes and sealed with plastic

caps. The tubes shall be labeled according to SOP FP-F-6 and immediately placed on ice in a cooler.

- If samples are to be cataloged and stored, they shall be placed in core boxes. The project number, site name, borehole number, start depth, end depth, date, and name of the geologist shall be affixed to the core box. Storage shall only occur onsite; samples should not be brought back to the office or equipment storage area.

- All sampling equipment must be decontaminated prior to each use according to the methods presented in SOP FP-D-5.

5.2.4 Bulk Samples

The term "bulk sample" is used to represent a sample collected from borehole cuttings either from the hollow-stem auger flights or the discharge of any of the rotary or cable tool drilling techniques. This type of sample is useful for describing soils or consolidated materials, where no undisturbed samples representative of a specific depth are being collected. It should be noted that this type of sample is generally considered to be the least acceptable of the types of samples previously described in this section and shall be used only when detailed lithologic data are not needed.

General handling and lithologic logging of bulk samples should be performed in a manner consistent with that used for split-spoon samples. An estimate of the depth (or range of depths) from which the sample was obtained, and date and time of collection should be recorded on the boring log. Samples are usually collected every 5 feet, preferably at several different times during a 5-foot drilling run so that lithologic variations occurring over the drilling interval can be noted. Rock fragments commonly range in size from 1/16 to 1/2 inch, with many fragments larger than 1/4 inch. Larger fragments can often be obtained with reverse circulation rotary drilling. Rotary-tool samples usually contain some caved materials from above and, when drilling with mud or water rotary, the cuttings may contain soil and rock recirculated by the mud/water pump; therefore, care must be exercised when interpreting lithologic logs completed using data from this type of sample.

Because the collection of samples at the surface lags behind the actual drilling of a given lithologic bed at depth, the samples usually represent a depth less than that of the current depth of the drill bit. The amount of lag may be significant in deeper boreholes, but can be eliminated by collecting samples after circulating for a period of time sufficient to permit the most recently drilled materials to reach the surface.

5.2.5 Borehole Abandonment

Following completion of soil sampling, the borehole shall be properly abandoned unless a monitoring well is to be installed. Abandonment shall occur immediately following acquisition of the final sample in the boring and shall consist of the placement of a bentonite-cement grout from the bottom of the boring to within 2 feet of ground surface. The grout mixture shall consist of a mix of 7 to 9 gallons of water per 94 pound bag of Portland cement with 3 percent to 5 percent by weight of powdered bentonite. Other commercial products such as Volclay® are also acceptable with approval of the Project Manager. The bentonite-cement grout shall be placed in one continuous pour from the bottom of the boring to within at least 0.5 to 2 feet of ground surface through a tremie pipe or hollow-stem augers. Additional grout may need to be placed if significant settlement occurs. The remaining portion of the boring can be filled with topsoil.

5.2.6 Trenching

Trenching is used in situations where the depth of investigation generally does not exceed 10 to 15 feet and is most suitable for assessing surface and near-surface contamination and geologic characteristics. In addition, trenching allows detailed observation of shallow subsurface features and exposes a wider area of the subsurface than is exposed in borings.

A backhoe is generally utilized to excavate shallow trenches to a depth of no greater than 15 feet. Typically, the trench has a width of one to two backhoe buckets and generally ranges in length from 5 to 20 feet, although larger trenches can be conducted depending on the objectives of the study. Soils removed from the trench should be carefully placed on plastic sheeting or other appropriate materials in the order of removal from the trench. The shallow excavated materials can be placed on one side of the trench and deeper materials on the other side to allow better segregation of shallow and deep materials.

Soil sampling locations within each trench shall be chosen based on visual inspection and any VOC screening results. Samples shall be collected from either the sidewalls or the bottom of the trenches. Soil sampling should generally be conducted outside the trench and in no cases shall personnel enter a trench greater than 4 feet in depth unless shoring is used and confined entry procedures are implemented.

Equipment employed for trench sampling may include hand augers, core samplers (slide hammer), liners inserted manually into the soil, or hand trowels. In addition, samples may be obtained directly from the trench or from the backhoe bucket. All samples shall be properly sealed, labeled according to SOP FP-F-6, and immediately placed on ice in a cooler. Sample locations and descriptions shall be described and recorded in the field trench log.

Following completion of the trenching operation, the exposed materials shall be observed for lithologic and contaminant characteristics. Detailed mapping of the exposed walls of the trench shall be conducted, although in no instance shall the geologist enter a trench deeper than 4 feet unless shoring and confined entry procedures are utilized. A useful mapping technique in extremely long trenches is to examine the vertical profile of the trench at horizontal intervals of 5 to 10 feet, in a manner similar to the method typically used for preparation of a geologic cross-section using soil borings. Field observations shall be noted in the field notebook and described in detail in the trench log. A copy of the field trench log is presented in Figure FP-C-2-2. The lithologic description shall include all soil classification information listed in SOP FP-C-1. A cross-section of the trench should also be included in the field trench log. Photographs of the trench are also an excellent way to document important features of the trench.

During backfilling of the trench, the materials excavated from depth should be placed back into the excavation first. Lithologic materials should be replaced in 2- to 4-foot lifts and recompacted by tamping with the backhoe bucket. The backfilled trench should be capped with the original surface soil.

OGDEN

Field Log of Trench

Project Name			Sheet 1 of _____
Trench Number	Project Number	Elevation and Datum	Location
Equipment Supplier	Operator	Date and Time Started	Date and Time Completed
Equipment Type	Trench Orientation	Total Depth	Total Number of Samples

Bucket Width	Trench Length	Trench Width	No. of Samples	Bulk	Grab	Drive	Hand Auger

Geologist or Hydrogeologist/Date	Checked by/Date

Soil Description

Lithology	Depth (ft.)	Surface Description	USCS SYMBOL	Est. % of			Comments
				G	S	F	
							Description taken _____ feet
							from _____ end of trench.

Figure FP-C-2-2. Field Log of Trench

5.3 SURFACE SAMPLING

All surface soil samples shall be accurately located on field maps and detailed soil classification descriptions completed in accordance with SOP FP-C-1 shall be recorded on the surface soil sampling log (Figure FP-C-2-3). Methods commonly utilized for collection of surface soil samples are described below.

5.3.1 Hand Trowel

A stainless steel or disposable hand trowel may be utilized for surface soil sampling in instances where samples are not to be analyzed for volatile organics. The hand trowel is initially used to remove the uppermost 2 inches of soil and is then utilized to acquire a representative sample of deeper materials to a depth of 6 inches. Generally, only samples within the upper 6 inches of soil should be sampled using these methods. The depth of the sample shall be recorded in the surface soil sampling log (Figure FP-C-2-3). The soil classification shall include all the information outlined in SOP FP-C-1.

Soil samples collected using a hand trowel are generally placed into precleaned, wide-mouth glass jars. The jar is then sealed with a tight fitting cap, labeled according to SOP FP-F-6, and placed on ice in a cooler.

All sampling equipment must be decontaminated prior to each use according to the methods presented in SOP FP-D-5.

5.3.2 Hand Auger

A soil recovery hand auger (SRA) consisting of a metal rod, handle, detachable stainless steel core barrel, and inner sleeves can be used to obtain both surface soil and trench samples. Multiple extensions can be connected to the sampler to facilitate the acquisition of samples at depths up to 15 feet below the existing ground surface.

Surface and Shallow Soil Sample Log

Project Number	Project Name	Date	Time
Sample Identification Number and Time		Checked by	
Sampled by		Recorded by	
Method of Collection			
Surface Description			
Notes			

Soil Sample Data

Location	
Coordinates	Elevation

Lithology	Depth (in.)	Soil Description	USCS SYMBOL	Est. % of			Comments
				G	S	F	

Figure FP-C-2-3. Surface and Shallow Soil Sample Log

Precleaned sample liners are loaded into the core barrel prior to sampling. In general, these liners are used not only to acquire samples, but also serve as the sample container. Alternatively, in instances where VOCs are not to be analyzed or where not enough samples can be collected to completely fill a liner, samples can be transferred to wide-mouth glass jars. In either case, the sample shall be labeled according to SOP FP-F-6 and immediately placed on ice in a cooler.

To minimize possible cross-contamination, the SRA and sample liners should be decontaminated prior to each use according to the decontamination procedures described in SOP FP-D-5.

5.3.3 Slide Hammer Sampling

In instances where the soil type precludes the acquisition of soil samples using the SRA, a manually operated slide hammer can be used to collect relatively undisturbed soil samples from both trenches and surface soils. The slide hammer consists of a 6- to 12-inch core barrel that is connected to the slide hammer portion of the device using detachable extensions.

The core sampler is typically loaded with two to four sample liners, depending on the liner length, which are not only used to acquire the samples, but also serve as the sample container. Immediately following acquisition, samples shall be labeled according to SOP FP-F-6 and placed on ice in a cooler.

All of the sampling equipment which comes into contact with the sample medium shall be decontaminated in accordance with the procedures outlined in this manual (SOP FP-D-5). Split-barrel slide hammer core samplers, which have recently become available, are much easier to decontaminate than the older, single piece core barrel, and should be utilized in place of the older core barrels, where possible.

5.3.4 Hand Sampling Using Sample Liners

Surface soil samples can sometimes be collected by hand using just the sample liners. This method can be used in cases where the surface soils are soft or where it is advantageous to minimize the disturbance of the sample (such as when sampling for volatiles). Obtaining surface soil samples with this method consists merely of pushing or driving the sample tube into the ground by hand.

The sample tube (with the collected sample inside) is then removed from the ground. The sample is then labeled according to SOP FP-F-6 and immediately placed on ice in a cooler. Since the only equipment used are the sample liners themselves, this method minimizes or obviates the need for equipment decontamination.

5.3.5 Sludge/Pond Sediment Sampling

Use of a standard core sampler may not be appropriate when sampling sludge or subaqueous pond sediments because such materials contain substantial liquid, rendering sample recovery difficult. Use of a sludge sampler is therefore recommended for sampling sludge and pond sediments. A sludge sampler incorporates a twin butterfly valve to prevent sample escape, and interchangeable auger and coring bits for varying sludge consistencies. A sludge sampler also includes a removable solid top cap equipped with a threaded connection for hand auger extensions. Samples are recovered in removable plastic liners that fit inside the sludge sampler. Once recovered, the liners are labeled according to SOP FP-F-6 and placed on ice in a cooler.

5.4 VOLATILE ORGANICS SCREENING AND HEADSPACE ANALYSIS

Volatile organics screening and headspace analysis is performed to preliminarily assess if the sample contains volatile organic constituents. Volatile organics screening and headspace analysis of samples shall be performed using a Foxboro Model 128-GC portable OVA, an HNU mode PI 101 portable PID, a Microtip MP 100 PID, or other similar instrument.

Volatile organics screening and headspace analysis is intended as a field screen for the presence of VOCs. The method measures the presence or absence of volatile constituents in the headspace (air) above a soil sample. Various factors affect the level of VOCs volatilizing from soils such as concentration in the soil, temperature of the soil and air, organic carbon content of the soil, equilibration time, moisture content of the soil, and the chemical and physical characteristics of the VOCs. Therefore, headspace readings can only be regarded as qualitative assessments of volatiles, and caution should be exercised if using this technique to select samples for analytical testing. OVA and PID readings can vary because the two instruments have different sensitivities to the various VOCs and are usually calibrated relative to different gas standards (i.e., methane for the OVA and isobutylene for the PID).

In order to screen samples for VOCs, the instrument probe shall be inserted into the top of the sample liner immediately after the sampler is opened. The instrument response (normally in ppm) is then recorded in the field notebook and/or the field log.

For headspace analysis, a portion of the sample is transferred into a ziplock bag or precleaned glass jar, which is then sealed and agitated. The VOCs are allowed to volatilize into the headspace and equilibrate. The instrument probe is then inserted into the container to sample the headspace. The instrument response is then recorded in the field notebook and/or the field log.

6.0 RECORDS

Soil classification information collected during soil sampling should be documented onto borehole, trench, and surface soil log forms. All logs shall be filled out with indelible ink. Information concerning sampling activities shall be recorded on sample log forms or in the field logbook. Procedures for these activities are contained in this manual. Copies of this information should be sent to the Project Manager and to the project files.

7.0 HEALTH AND SAFETY

Standard Health and Safety (H&S) practices shall be observed according to the site-specific Health and Safety Plan (HSP). Ambient air and soil vapor monitoring during excavation activities shall provide data related to relative volatile contaminant concentrations and any required personal protective equipment (PPE) that may be necessary. In addition, an air monitoring program and suggested PPE is listed in the site-specific HSP.

Suggested minimum PPE during soil sampling activities in conjunction with field excavations shall include inner disposable vinyl gloves, outer chemical protective nitrile gloves, Tyvek® coveralls, steel-toed boots and overboots, safety glasses, hearing protection (around heavy equipment in operation), and an ANSI-Standard hard hat. Half-face respirators and cartridges may be necessary depending on the contaminant concentrations and shall always be available onsite. At no time during soil sampling activities are personnel to reach for debris near machinery that is in operation.

In addition to the aforementioned precautions and depending upon the type of contaminant expected, the following safe work practices will be employed:

Particulate or Metal Compounds:

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

Volatile Organic Compounds:

1. Avoid breathing constituents venting from soil borings, trenches, pits, or holes by approaching upwind, and/or by use of respiratory protection.
2. In the case of trenches, pits, or holes, presurvey the area with a FID/PID prior to sampling.
3. If monitoring results indicate organic vapors that exceed action levels as specified in the site-specific HSP, sampling activities may need to be conducted in Level C

protection. At a minimum, skin protection will be required by use of gloves and Tyvek® or other media that is protective against the media being encountered.

Flammable or Explosive Conditions:

1. Explosive gases should be monitored as continuously as possible using an explosimeter and oxygen meter.
2. All ignition sources should be placed upwind or crosswind of the borehole.
3. If explosive gases exceed the designated action levels as specified in the site-specific HSP, cease operations and evaluate conditions.

Physical Hazards Associated With Soil Sampling:

1. To avoid possible back strain associated with sample collection, use the large muscles of the legs, not the back when retrieving soil samplers.
2. Stay clear of all moving equipment and avoid wearing loose fitting clothing.
3. To avoid slip/trip/fall hazards, be wary of open trenches, pits, or holes.
4. To avoid heat/cold stress as a result of exposure to extreme temperature and PPE, drink electrolyte replacement fluids (1-2 cups/hour is recommended) and, in cases of extreme cold, wear fitted insulating clothing.
5. Be aware of restricted mobility due to the wearing of PPE.
6. To avoid hand, wrist, arm, shoulder, and back trauma due to the use of slide hammers or hand augers, rotate sampling among field personnel.

8.0 REFERENCES

EPA SW-846-Appendix 2, Technical Guidance Manual for Solid Waste Water Quality Assessment Test (SWAT) Proposals and Reports.

USEPA. 1987. A Compendium of Superfund Field Operations Methods. U.S. Environmental Protection Agency/540/P-87/001.

U.S. EPA Environmental Response Team. 1988. Response Engineering and Analytical Contract Standard Operating Procedures. U.S. EPA, Research Triangle Park, NC.

ASTM Sampling Methods

9.0 ATTACHMENTS

None.

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SURFACE WATER SAMPLING

1.0 PURPOSE

The purpose of this procedure is to establish standard protocols for all Ogden field personnel for use in conducting surface water sampling.

2.0 SCOPE

This procedure shall apply to all surface water sample collection conducted during field program activities. As professional guidance for specific activities, this procedure is not intended to obviate the need for professional judgement to accommodate unforeseen circumstances. Deviance from this procedure in planning or in the execution of planned activities must be approved by management personnel and documented.

3.0 DEFINITIONS

None.

4.0 RESPONSIBILITIES

Ogden field personnel are responsible for following these procedures during conduct of sampling activities.

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

The Project Manager is responsible for ensuring that all project field personnel follow these procedures when conducting surface water sampling.

The QA Program Manager is responsible for evaluating Project Manager and project compliance with these procedures.

5.0 PROCEDURES

Surface water bodies that could be affected by a release from a hazardous waste site may be selected for monitoring. This procedure provides a general description of sample collection methods for a surface water monitoring program.

Proper sampling point selection and collection methodology selection is essential in meeting surface water monitoring objectives. The sampling points selected for collection of surface water samples will be based upon characteristics of the surface water body to be monitored, and the location of the surface water body and its hydrologic boundaries with respect to the site. Other considerations include the contaminants of concern, logistical considerations such as access to the surface water body, the direction of flow, and determination of a background location.

Methods for collection of surface water samples vary from hand sampling procedures at a single point to more sophisticated multipoint sampling techniques. The number and type of samples to be collected depends on the characteristics of the surface water body, the amount of suspended sediment that a moving body carries, the size of the discharge area at the site and other factors. Multipoint sampling techniques are applicable to larger bodies of water; the samples are composited to provide a more representative sample.

A dip or grab sample is appropriate for a small body of water, or for collecting near-surface samples in a larger surface water body. The sampling method involves the filling of a sample container by submerging it either just below the surface, or by lowering the container to a desired depth by using a weighted holder. For shallow surface water bodies, the sample container shall be held carefully just beneath the water surface to avoid disturbing the streambed and stirring the sediment. Further, for shallow streams, the container's mouth should be positioned so that it faces upstream, while the sampling personnel are standing downstream. Any preservative added to the sample should be added after sample collection to avoid loss of preservative. Alternatively, a transfer device may be dipped into the water, then the contents transferred to the appropriate container containing the preservative.

For deeper surface water bodies, either sample containers or transfer devices may be used to collect a sample. A weighted holder that allows either a sample transfer device or a sample container to be lowered, opened for filling, closed, and returned to the surface is suggested for sampling deeper surface water bodies. This is because concentrations of constituents near the surface of a deeper surface water body may be different than the total concentration distributed throughout the water column cross section and thus a surface sample would not be representative of the water body. An open container that is lowered and raised to the surface at a uniform rate so that the bottle is just filled on reaching the surface is appropriate for deeper stagnant water bodies, however this method does not collect a truly representative sample in deeper flowing surface water bodies.

In general, the use of a sampling device, either disposable or constructed of a nonreactive material of at least 500 ml, if possible, to minimize the number of times the liquid must be disturbed, thus reducing agitation of any sediment layers. A 1-liter polypropylene or stainless steel beaker with pour spout and handle works well. Any sampling device may contribute contaminants to a sample. The sampling devices that should be selected are those that will not compromise sample integrity and will give the desired analytical results.

Collecting a representative sample from a larger body of surface water is difficult but not impossible. Samples should be collected near the shore unless boats are feasible and permitted. If boats are used, the body of water should be cross sectioned, and samples should be collected at various depths across the water in accordance with the specified sampling plan. For this type of sampling, a weighted-bottle sampler is used to collect samples at any predetermined depth. The sampler consists of a glass bottle, a weighted sinker, a bottle stopper, and a line that is used to open the bottle and to lower and raise the sampler during sampling. There are variations of this sampler, as illustrated in ASTM methods D 270 and E 300. This sampler can be either fabricated or purchased. The procedure for use is as follows:

1. Assemble the weighted bottle sampler.

2. Gently lower the sampler to the desired depth so as not to remove the stopper prematurely.
3. Pull out the stopper with a sharp jerk of the sampler line.
4. Allow the bottle to fill completely, as evidenced by the cessation of air bubbles.
5. Raise the sampler and cap the bottle.
6. Wipe the bottle clean. The bottle can also be used as the sample container.

Teflon™ bailers have also been used while feasible for collecting samples in deep bodies of water. Where cross-sectional sampling is not appropriate, near-shore sampling may be done using a pond sampler.

In this instance, a modification that extends the reach of the sampling technician is most practical. The modification incorporates a telescoping heavy-duty aluminum pole with an adjustable beaker clamp attached to the end. A disposable glass, plastic container, or the actual sample container itself can be fitted into the clamp. In situations where cross contamination is of concern, use of a disposable container or the actual sample container may be advantageous.

Another method of extending the reach of sampling efforts is through the use of a small peristaltic pump. In this method the sample is drawn through heavy-wall Teflon™ tubing and pumped directly into the sample container. This system allows the operator to reach into the liquid body, sample from depth, or sweep the width of narrow streams.

If medical-grade silicon tubing is used in the peristaltic pump, the system is suitable for sampling almost any analyte including most organics. Some volatile stripping, however, may occur; though the system may have a high flow rate, some material may be lost on the tubing. Therefore, pumping methods should be avoided for sampling volatile organics or oil and grease. Battery-operated pumps of this type are available and can be easily carried by hand or with a shoulder sling. It is necessary in most situations to change both the

Teflon™ suction line and the silicon pump tubing between sample locations to avoid cross contamination. This action requires maintaining a sufficiently large stock of material to avoid having to clean the tubing in the field.

When medical-grade silicon tubing is not available or the analytical requirements are particularly strict, the system can be altered. In this configuration, the sample volume accumulates in the vacuum flask and does not enter the pump. The integrity of the collection system can now be maintained with only the most nonreactive material contacting the sample. Some loss in lift ability will result since the pump is now moving air, a compressible gas rather than an essentially noncompressible liquid. Also, this system cannot be used if volatile compounds are to be analyzed. The potential for losing volatile fractions because of reduced pressure in the vacuum flask renders this method unacceptable for use.

It may sometimes be necessary to sample large bodies of water where a near-surface sample will not sufficiently characterize the body as a whole. In this instance, the above-mentioned pump is quite serviceable. It is capable of lifting water from depths in excess (but not much in excess) of 6 meters. It should be noted that this lift ability decreases somewhat with higher density fluids and with increased wear on the silicone pump tubing. Similarly, increases in altitude will decrease the pump's ability to lift from depth. When sampling a liquid stream that exhibits a considerable flowrate, it may be necessary to weight the bottom of the suction line.

Samples from various locations and depths can be composited where investigative goals indicate that it is appropriate; otherwise, separate samples will have to be collected. Approximate sampling points should be identified on a sketch of the water body. The following procedures are used for samples collected using transfer devices:

1. Submerge a stainless steel dipper or other suitable device with minimal surface disturbance. Note the approximate depth and location of the sample source (for example, 1 foot up from bottom or just below the surface).

2. Allow the device to fill slowly and continuously.

3. Retrieve the dipper or device from the surface water with minimal disturbance.

4. Remove the cap from the sample bottle and slightly tilt the mouth of the bottle below the dipper or device edge.

5. Empty the dipper or device slowly, allowing the sample stream to flow gently down the side of the bottle with minimal entry turbulence.

6. Continue delivery of the sample until the bottle is almost completely filled. Check all procedures for recommended headspace for expansion.

7. Preserve the sample, if necessary, as per guidelines in the sampling plan. In most cases, preservatives should be placed in sample containers before sample collection to avoid overexposure of samples and overfilling of bottles during collection.

8. Check that a Teflon™ liner is present in the cap if required. Secure the cap tightly. Tape cap to bottle; then date and initial the tape. The tape is used as a custody seal.

9. Label the sample bottle with an appropriate sample tag. Be sure to label the tag carefully and clearly, addressing all the categories or parameters. Record the information in the field logbook and complete the chain-of-custody form.

10. Dismantle the sampler, wipe the parts with terry towels or rags, and store them in plastic bags for subsequent disposal. Follow all instructions for proper decontamination of equipment and personnel.

For samples collected using peristaltic pumps:

1. Install clean, medical-grade silicone tubing in the pump head, as per the manufacturer's instructions. Allow sufficient tubing on the discharge side to

facilitate convenient dispensation of liquid into sample bottles but only enough on the suction end for attachment to the intake line. This practice will minimize sample contact with the silicone pump tubing. (Some types of thinner Teflon™ tubing may be used.)

2. Select the length of suction intake tubing necessary to reach the required sample depth and attach it to the tubing on the intake side of the pump. Heavy-wall Teflon™ of a diameter equal to the required pump tubing will suit most applications. (A heavier wall will allow for a slightly greater lateral reach.)

3. If possible, allow several liters of sample to pass through the system before actual sample collection. Collect this purge volume, and then return it to source after the sample aliquot has been collected.

4. Fill necessary sample bottles by allowing pump discharge to flow gently down the side of bottle with minimal entry turbulence. Cap each bottle as filled.

5. Preserve the sample, if necessary, as per guidelines in sampling plan. In most cases, preservatives should be placed in sample containers before sample collection to avoid overexposure of samples and overfilling of bottles during collection.

6. Check that a Teflon™ liner is present in the cap, if required. Secure the cap tightly. Tape cap to bottle; then date and initial the tape. The tape is used as a custody seal.

7. Label the sample bottle with an appropriate tag. Be sure to label the tag carefully and clearly, addressing all the categories or parameters. Record the information in the field logbook and complete the chain-of-custody documents.

8. Place the properly labeled sample bottle in an appropriate carrying container.

9. Allow system to drain thoroughly; then disassemble and decontaminate.

Multipoint sampling techniques that represent both dissolved and suspended constituents and both vertical and horizontal distributions are applicable to larger bodies of water. Subsequent to sample collection, multipoint sampling techniques may require a compositing and sub-sampling process to homogenize all the individual samples into the number of subsamples required to perform the analyses of interest. Homogenizing samples is discouraged for samples collected for volatile organic analysis due to aeration resulting in loss of volatile compounds.

The sampling devices selected must not compromise sample integrity. Samples must be collected with either disposable devices, or devices constructed of a nonreactive material such as glass, stainless steel, or Teflon™. The device must have adequate capacity to minimize the number of times the liquid must be disturbed, reducing agitation of any sediment layers. Further, the device must be able to transfer the water sample into the sample container without loss of volatile compounds. A single- or double-check valve or stainless steel bailer made of Teflon™ equipped with a bottom discharging device may be utilized.

All equipment used for sample collection must be decontaminated before and after use.

6.0 RECORDS

During the completion of sampling activities, the sample logbook will be filled out and forms will be transmitted to the Project Manager for storage in project files.

7.0 REFERENCES

USEPA. 1986. RCRA Ground-Water Monitoring Technical Enforcement Guidance Document (TEGD).

USEPA. 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (EPA USWER Directive 9355 3-01).

USEPA. 1987. A Compendium of Superfund Field Operations Methods.

8.0 ATTACHMENTS

None.

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EQUIPMENT DECONTAMINATION

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide standard equipment decontamination methods for use during field activities.

2.0 SCOPE

These procedures shall be employed where applicable during decontamination of field equipment used for sampling environmental media. As professional guidance for specific activities, this procedure is not intended to obviate the need for professional judgement to accommodate unforeseen circumstances. Deviance from this procedure in planning or in the execution of planned activities must be approved by the Project Manager.

3.0 DEFINITIONS

None.

4.0 RESPONSIBILITIES

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

The Project Manager is responsible for identifying instances of non-compliance with this procedure and ensuring that decontamination activities are in compliance with this procedure.

5.0 PROCEDURES

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

- The location where the decontamination procedures will be conducted;
- The types of equipment requiring decontamination;
- The frequency of equipment decontamination;
- The cleaning technique and types of cleaning solutions;
- The method for containing the residual contaminants and wash water from the decontamination process; and
- The use of a quality control measure to determine the effectiveness of the decontamination procedure.

This subsection describes standards for decontamination. The techniques to be used, frequency of decontamination, cleaning solutions, and effectiveness are among the standards presented.

5.1 DECONTAMINATION AREA

An appropriate location for the decontamination area at a site shall be selected based on the ability to control access to the area, control residual material removed from equipment, store clean equipment, and access to the area being investigated. The decontamination area shall be located at an adequate distance away and upwind from potential contaminant sources to avoid contamination of clean equipment. Once equipment is cleaned, it shall be stored sufficiently far enough away from the potential contamination sources and the decontamination area to ensure that the equipment remains clean.

5.2 TYPES OF EQUIPMENT

Decontamination of drilling equipment includes drill bits, auger sections, drill-string tools, drill rods, split barrel samplers, tremie pipes, clamps, hand tools, and steel cable. Decontamination of monitoring well development and ground-water sampling equipment includes submersible pumps, bailers, interface probes, water level meters, bladder pumps, air lift pumps, peristaltic pumps, and lysimeters. Other sampling equipment that requires decontamination includes, but is not limited to, hand trowels, hand augers, slide hammer samplers, shovels, stainless steel spoons and bowls, soil sample liners and caps, wipe sampling templates, COLIWASA samplers, and dippers. Equipment with a porous surface, such as rope, cloth hoses, and wooden blocks, cannot be thoroughly decontaminated and shall be properly disposed after one use.

5.3 FREQUENCY OF EQUIPMENT DECONTAMINATION

Down-hole drilling equipment and monitoring well development and purging equipment shall be decontaminated prior to initial use and between each borehole or well. However, down-hole drilling equipment may require more frequent cleaning to prevent cross-contamination between vertical zones within a single borehole. Where drilling through a shallow contaminated zone and installing a surface casing to seal off the contaminated zone, the drilling tools shall be decontaminated prior to drilling deeper. Ground-water sampling shall be initiated by sampling ground water from the monitoring well where the least contamination is suspected. All ground-water, surface water, and soil sampling devices shall be decontaminated prior to initial use and between collection of each sample to prevent the possible introduction of contaminants into successive samples.

5.4 CLEANING SOLUTIONS AND TECHNIQUES

Decontamination can be accomplished using a variety of techniques and fluids. The preferred method of decontamination of major equipment such as drill bits, augers, drill string, pump drop-pipe, etc., involves the use of steam cleaning. Steam cleaning is accomplished using a portable, high pressure steam cleaner equipped with a pressure hose and fittings. For this method, equipment shall be thoroughly steam washed and rinsed with potable tap water to remove particulates and contaminants.

A rinse decontamination procedure is acceptable for equipment such as bailers, water level meters, re-used soil sample liners, and hand tools. The decontamination procedure shall consist of the following: 1) wash with a non-phosphate detergent (alconox, liquinox, or other suitable detergent) and potable water solution, 2) rinse in a bath with potable water,

3) spray with isopropyl alcohol, 4) rinse in a bath with deionized or distilled water, and 5) spray with deionized or distilled water. If possible, equipment shall be disassembled prior to cleaning. A second wash should be added at the beginning of the process if very soiled equipment is present.

Submersible pumps require additional effort to properly decontaminate because internal surfaces become contaminated during usage. These pumps shall be decontaminated by washing and rinsing the outside surfaces using the procedure described for small equipment or by steam cleaning. The internal surfaces shall be decontaminated by recirculating fluids through the pump while it is operating. This recirculation can be done using several large diameter pipes (4-inch or greater) equipped with bottom caps. These pipes shall be filled with the decontamination fluids, the pump placed within the closed pipes, and the pump operated while recirculating the fluids. The decontamination sequence shall include 1) detergent and potable water, 2) potable water rinse, 3) isopropyl spray into the pump, 4) potable water rinse, and 5) deionized water rinse. The decontamination fluids shall be changed after each decontamination cycle.

Solvents other than isopropyl alcohol may be used, depending upon the contaminants involved. For example, if polychlorinated biphenyls (PCBs) or chlorinated pesticides are contaminants of concern, hexane may be used as the decontamination solvent. However, if samples are also to be analyzed for volatile organics, hexane shall not be used. In addition, some decontamination solvents have health effects which must be considered.

Distilled or deionized water shall not use steam-distilled source water.

Equipment for measuring field parameters such as pH, temperature, specific conductivity, and turbidity shall be rinsed with deionized or distilled water after each measurement. New, unused soil samples liners and caps will also be washed with a fresh detergent solution and rinsed with potable water followed by distilled or deionized water to remove any dirt or cutting oils that may be on them prior to use.

5.5 CONTAINMENT OF RESIDUAL CONTAMINANTS AND CLEANING SOLUTIONS

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

When contaminated material and cleaning fluids must be contained from heavy equipment such as drill rigs and support vehicles, the area must be properly floored, preferably with a concrete pad which is sloped toward a sump pit. If a concrete pad is impractical, planking can be used to construct a solid flooring that is then covered by a nonporous surface and sloped toward a collection sump. If the decontamination area does not have a collection sump, plastic sheeting and blocks or other objects should be used to create a bermed area for collection of equipment decontamination water. Items such as auger flights, which can be placed on stands, saw horses, wooden pallets, or other similar equipment, should be situated on this equipment during decontamination to prevent contact with fluids generated by previous equipment decontamination. Clean equipment should also be stored in a separate location than the decontamination area to prevent recontamination. Decontamination fluids contained within the bermed area shall be collected and stored in secured containers as described below.

Catchment of fluids from the decontamination of lighter-weight drilling equipment and hand-held sampling devices shall be accomplished using wash buckets or tubs. The decontamination fluids shall be collected and stored onsite until their disposition is determined based upon laboratory analytical results. Storage shall be in secured containers such as DOT-approved drums. Containers shall be labeled in accordance with SOP FP-B-8, *IDW Management*.

5.6 EFFECTIVENESS OF DECONTAMINATION PROCEDURES

A decontamination program needs to incorporate quality control measures for determining the effectiveness of the cleaning methods. Quality control measures typically include collection of equipment rinsate samples or wipe testing. Equipment rinsates consist of analyte-free water, which has been poured over or through the sample collection equipment after its final decontamination rinse. Wipe testing is performed by wiping a cloth over the surface of the equipment after cleaning. Further descriptions of these samples and their required frequency of collection is provided in SOP FP-F-2, *Field QC Samples (Water, Soil)*. These quality control measures provide "after-the fact" information that may be useful to determine whether or not the cleaning methods were effective in removing the contaminants of concern.

6.0 RECORDS

Records shall be maintained as required by implementing procedures.

7.0 HEALTH AND SAFETY

The Ogden Corporate Health and Safety Management Plan provides decontamination (decon) guidelines primarily for personnel. It is the responsibility of the Onsite Health and Safety Coordinator (OHSC) to set up the site zones (i.e., exclusion, transition, and clean) and decon areas. Generally the decon area is located within the transition zone, upwind of intrusive activities, and serves as the area where both personnel and equipment are washed to minimize the spread of contamination into the clean zone. For equipment, a series of buckets within a visqueen-lined bermed area is set up for decon purposes. In addition, separate spray bottles containing isopropyl alcohol and distilled water are available for final rinsing of equipment. Depending on the nature of hazards and the site location, decontamination of heavy equipment such as augers, pump drop pipe, and vehicles may be accomplished using a variety of techniques.

Personnel responsible for equipment decon must wear the PPE specified in the site-specific Health and Safety Plan (HSP). Generally this includes at a minimum Tyvek® coveralls, steel-toed boots with boot covers or steel-toed rubber boots, safety glasses, ANSI-Standard hard hats, and hearing protection (if heavy equipment is in operation). It should also be noted that air monitoring by the OHSC may warrant an upgrade to the use of half-face respirators and cartridges in the decon area; therefore, this equipment must be available onsite. If safe alternatives are not achievable, site activities will be discontinued immediately.

In addition to the aforementioned precautions, the following safe work practices will be employed:

Chemical Hazards Associated With Equipment Decontamination:

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

Physical Hazards Associated With Equipment Decontamination:

1. To avoid possible back strain, it is recommended that the decon area be raised 1 to 2 feet above ground level.
2. To avoid heat stress, over exertion, and exhaustion, it is a recommended Ogden health and safety policy that equipment decon be rotated among **all** Ogden site personnel.
3. Take necessary precautions when handling field sampling equipment.

8.0 REFERENCES

U.S. EPA Environmental Response Team. 1988. Response Engineering and Analytical Contract Standard Operating Procedures. U.S. EPA, Research Triangle Park, NC.

9.0 ATTACHMENTS

None.

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IDW MANAGEMENT

1.0 PURPOSE

This procedure describes the activities and responsibilities of Ogden and Rocketdyne pertaining to management of investigation-derived waste. The purpose of this procedure is to provide guidance for the minimization, handling, labeling, temporary storage, and inventory of investigative-derived waste (IDW) generated during field activities. The information presented will be used to prepare and implement Work Plans (WP) and Field Sampling Plans (FSP) for IDW related field activities. Results from implementation of WPs and FSPs will then be used to develop and implement final IDW disposal by Rocketdyne.

2.0 SCOPE

This document applies to all Ogden personnel involved in the development and implementation of WPs and FSPs that include the generation of IDW.

This procedure was developed to serve as management-approved professional guidance for the management of IDW generated during the field program. This procedure is focused on the requirements for minimizing, segregating, handling, labeling, storing, and inventorying IDW in the field. Certain drum inventory requirements related to the screening, sampling, classification, and disposal of IDW are also noted in this procedure. This procedure is not intended to obviate the need for professional judgement to accommodate non-specified or unforeseen circumstances. Specific guidance from local regulatory agencies must be obtained and acted upon. Deviance from this procedure in planning or in the execution of planned activities must be documented and approved by management personnel.

IDW management practices shall also conform to applicable requirements within the Rocketdyne System of Procedures for hazardous waste management at the SSFL (RSOP C-203). A complete copy of RSOP C-203 is included as Attachment 1. Applicable general requirements within RSOP C-203 include items 1, 4, 6, 7, and 10 through 14

(Attachment 1). In the event that discrepancies arise between the IDW management procedures given in this SOP and the Rocketdyne procedures listed in RSOP C-203, preference shall be given to RSOP C-203 requirements.

3.0 DEFINITIONS

The following definitions apply to a number of technical terms contained in the text of this procedure.

3.1 INVESTIGATIVE-DERIVED WASTE

Investigative-derived waste (IDW) consists of all materials generated during site investigation activities that may be contaminated with chemicals of concern identified at the site. IDW consists of many different types of potentially contaminated materials, including but not limited to, personal protective equipment (PPE); disposable sampling and decontamination equipment; investigation-derived soil, sludge, and sediment; well development and purge water; and decontamination fluids.

3.2 PERSONAL PROTECTIVE EQUIPMENT (PPE)

PPE, as defined in this procedure, refers to all disposable materials used to protect personnel from contact with potentially contaminated site media, such as inner and outer gloves, Tyvek® suits and overboots, and disposable respirator cartridges. Non-consumable items such as steel-toe boots, respirators, and hard hats are not included in this procedure.

3.3 DISPOSABLE SAMPLING EQUIPMENT

Disposable sampling equipment consists of all single-use equipment that may have come in contact with potentially contaminated site media, including sample bailers, Draeger® air monitoring tubes, used soil sampling trowels and spatulas, plastic drop cloths, plastic bags and bucket liners, and sample containers from field analytical test kits.

3.4 INVESTIGATIVE-DERIVED SOIL, SLUDGE, AND SEDIMENT

Investigative-derived soil consists of all potentially contaminated soil that is disturbed as part of site investigation activities. The most commonly encountered form of IDW soil is drill cuttings brought to the ground surface by hollow stem auger drilling methods. Other forms of disturbed soil, including trenching spoils and excess soil remaining from surface sampling, should not be stored as IDW. Excavated soil should be returned to its source, if site conditions permit.

Investigative-derived sludge consists of all potentially contaminated sludge materials generated or disturbed during site investigation activities. Generated sludge may consist of drilling mud used or created during intrusive activities. Other sludge may include solvents or petroleum-based materials encountered at the bottom of storage tanks and grease traps.

Investigative-derived sediment consists of all potentially contaminated sediments that are generated or disturbed during site investigation activities. Generated sediments may include solids that settle out of suspension from well development, purge, or decontamination water (see Definitions 3.5 and 3.6) while stored in 55-gallon drums or during sample filtration. Disturbed sediments may also consist of catch basin sediments or excess sediment from surface water activities.

3.5 WELL DEVELOPMENT AND PURGE WATER

Development water consists of ground water withdrawn from newly installed monitoring wells in preparation for well purging or pump testing. Purge water consists of ground water that is removed from monitoring wells immediately prior to sampling.

3.6 DECONTAMINATION FLUIDS

Decontamination fluids consist of all fluids used in decontamination procedures conducted during site investigation activities. These fluids consist of wash water and rinse water for the decontamination of non-consumable PPE, sampling equipment, and drilling equipment. Decontamination procedures are discussed in SOP FP-D-5, *Equipment Decontamination*.

3.7 NON-IDW TRASH

Non-IDW trash is all waste materials such as waste paper, drink containers, food, and packaging generated in the support zone that have not come in contact with potentially contaminated site media.

3.8 NON-INDIGENOUS IDW

Non-indigenous IDW consists of all waste materials from offsite sources that are generated in the transition or contamination reduction zones that have generally not come in contact with potentially contaminated site media. Non-indigenous IDW includes materials such as PPE from "clean" field activities (e.g., field blank generation, water sampling events); and refuse from monitoring well installation (e.g., unused sections of well casing, used bentonite buckets, sand bags, and cement bags).

3.9 RCRA HAZARDOUS WASTE

Under the Resource Conservation and Recovery Act (RCRA), a solid waste that is not excluded from regulation is defined as hazardous if it is listed as a hazardous waste in Chapter 40, Code of Federal Regulations (CFR), Parts 261.31 through 261.33; it exhibits any of four hazardous characteristics: ignitibility, corrosivity, reactivity, or toxicity (as determined using the Toxicity Characteristic Leachate Procedure [TCLP]); or, it is subject to certain mixture rules (EPA 1992). If IDW is determined to be RCRA hazardous waste, then RCRA storage, transportation, and disposal requirements may become applicable.

3.10 LAND DISPOSAL RESTRICTIONS (LDR)

Land disposal, as defined in RCRA, is any placement of RCRA hazardous waste on the land in a waste pile, landfill, impoundment, well, land treatment area, etc. LDRs are regulatory restrictions placed on land disposal including pre-treatment standards, engineered containment, capacity constraints, and reporting and permitting requirements.

3.11 AREA OF CONTAMINATION (AOC)

The United States Environmental Protection Agency (EPA) considers the area of contamination (AOC) to be a single land-based disposal unit, usually a "landfill," and including non-discrete land areas in which there is generally dispersed contamination (EPA 1991). Note that storing IDW in a container (i.e., portable storage devices such as drums and tanks) within the AOC and returning it to its source, whether RCRA hazardous or not, does not trigger RCRA LDRs. In addition, sampling and direct replacement of wastes within an AOC do <u>not</u> constitute land disposal (EPA 1992).

3.12 OGDEN TECHNICAL INFORMATION SYSTEM

The Ogden Technical Information System (OTIS) is the centralized data management system that has been designed and equipped to manage large volumes of data generated during performance of field programs. OTIS incorporates not only chemical data, but also topographical, meteorological, lithological, geotechnical, hydrogeological, and other pertinent site investigation data that can ultimately be used for subsequent site analysis, such as site modeling and exposure assessments. The IDW drum inventory to be generated from the implementation of this procedure will be stored and updated in OTIS. OTIS provides the capability for customized reporting using selected data and report formats.

4.0 RESPONSIBILITIES

The Project Manager is responsible for preparing WPs and FSPs in compliance with this procedure, and is responsible for documenting instances of non-compliance.

The Field Program Managers are responsible for implementing this IDW procedure and for ensuring that all project field personnel utilize these procedures.

5.0 PROCEDURES

The procedures for IDW management in the field are described below in Sections 5.1 to 5.5. The implementation of these procedures requires Project Managers, Field Program Managers, and their designates to perform the following tasks:

- Minimize IDW as it is generated;
- Segregate IDW by matrix and source location;
- Apply suitable procedures for IDW drum handling and labeling;
- Apply protective methods for IDW drum storage;
- Prepare an IDW drum inventory; and
- Update and report changes to the IDW drum inventory.

5.1 IDW MINIMIZATION

Field Program Managers and their designates shall minimize the generation of onsite IDW to reduce the need for special storage or disposal requirements that may result in substantial additional costs and provide little or no reduction in site risks (EPA 1992). The volume of IDW shall be reduced by applying minimization practices throughout the course of site investigation activities. These minimization strategies include substitution of biodegradable raw materials; using low-volume IDW-generating drilling techniques; where possible, returning excess material to the source location; use of disposable sampling equipment versus generating more decontamination fluids from reusable sampling equipment; use of bucket and drum liners; and separating trash from IDW.

Material substitution consists of selecting materials that degrade readily or have reduced potential for chemical impacts to the site and the environment. An example of this practice is the use of biodegradable detergents (e.g., Alconox® or non-phosphate detergents) for decontamination of non-consumable PPE and sampling equipment. In addition, field equipment decontamination can be conducted using isopropyl alcohol rather than hexane or other solvents (for most analytes of concern), to reduce the potential onsite chemical impacts of the decontamination solvent. Decontamination solvents shall be selected carefully so that the solvents, and their known decomposition products, are not potentially RCRA hazardous waste.

Drilling methods that minimize potential IDW generation should be given priority. Hollow stem auger and air rotary methods should be selected, where feasible, over mud rotary methods. Mud rotary drilling produces significant quantities of waste drilling mud, while hollow stem and air rotary drilling methods produce relatively low volumes of soil waste. Small diameter borings and cores shall be used when soil is the only matrix to be sampled at the boring location; the installation of monitoring wells requires the use of larger diameter borings.

Soil, sludge, or sediment removed from borings, containment areas, and shallow test trenches shall be returned to the source immediately after sampling and/or geological logging of the soils (EPA 1991, 1992). Immediate replacement of solid waste in the source location during investigation activities avoids RCRA land disposal restrictions (LDRs), which permit movement of IDW within the same area of contamination (AOC) without considering land disposal to have occurred, even if the IDW is later determined to contain RCRA hazardous material (EPA 1991). Following excavation, the soil IDW shall be replaced into the boring or trench and compacted. Soil IDW from borings or trenches deeper than 10 feet or that penetrate into a saturated layer shall be contained in drums.

The quantity of decontamination rinse water generated can be reduced by using dedicated and disposable sampling equipment such as plastic bailers, trowels, and drum thiefs, that do not require decontaminating. In general, decontamination fluids, and well development and purge water, should not be minimized because the integrity of the associated analytical data may be affected.

The storage of visibly soiled PPE and disposable sampling equipment IDW shall be minimized by implementing decontamination procedures. If, according to the Field Program Manager's best professional judgement, the PPE and disposable sampling equipment can be rendered non-hazardous after decontamination, then the PPE and disposable sampling equipment shall be double-bagged and disposed offsite as municipal waste (EPA 1991, 1992).

Bucket liners can be used in the decontamination program to reduce the volume of solid IDW generated and reduce costs on larger projects. The plastic bucket liners can be crushed into a smaller volume than the buckets, and only a small number of plastic decontamination buckets are required for the entire project. The larger, heavy-duty, 55-gallon drum liners can be used for heavily contaminated IDW to provide secondary containment, and reduce the costs of disposal and drum recycling. Drum liners may extend the containment life of the drums in severe climates and will reduce the costs of cleaning out the drums prior to recycling.

All waste materials generated in the support zone are considered non-IDW trash. To minimize the total volume of IDW, all trash shall be separated from IDW, sealed in garbage bags, and properly disposed offsite as municipal waste.

Excess cement, sand, and bentonite grout prepared for monitoring well construction shall be kept to a minimum. Well construction shall be observed by Field Program Managers to ensure that a sufficient, but not excessive, volume of grout is prepared. Some excess grout may be produced. Unused grout (that should not come in contact with potentially contaminated soil or ground water) shall be considered non-hazardous trash and shall be disposed offsite by the drilling subcontractor. Surplus materials from monitoring well installation such as scrap PVC sections, used bentonite buckets, and cement/sand bags that do not come in contact with potentially contaminated soil, shall be considered non-IDW trash and shall be disposed offsite by the drilling subcontractor.

IDW generated from the use of field analytical test kits consists of those parts of the kit that have come into contact with potentially contaminated site media, and used or excess extracting solvents and other reagents. Potentially contaminated solid test kit IDW shall be contained in plastic bags and stored with PPE or disposable sampling equipment IDW from the same source area as soil material used for the analyses. The small volumes of waste solvents, reagents, and water samples used in field test kits should be segregated, and evaporated onsite or disposed to the sanitary sewer, as appropriate. Most other test kit materials should be considered non-IDW trash, and shall be disposed as municipal waste.

5.2 SEGREGATION OF IDW BY MATRIX AND LOCATION

To facilitate subsequent IDW screening, sampling, classification and/or disposal, IDW shall be segregated by matrix and source location at the time it is generated. Each drum of solid IDW shall be completely filled, when possible. For liquid IDW, drums should be left with headspace of approximately 5 percent by volume to allow for expansion of the liquid and potential volatile contaminants. IDW from only one matrix shall be stored in a single drum (e.g., soil, water or PPE shall not be mixed in one drum). If practical, IDW from separate sources should not be combined in a single drum.

It is possible that monitoring well development and purge water will contain suspended solids which will settle to the bottom of the storage drum as sediment. Significant observations on the turbidity or sediment load of the development or purge water shall be included in the field notebook and reported in attachments to the quarterly drum inventory report to the client (see SOP FP-F-5, *Logbooks* and Section 5.5). To avoid having mixed matrixes in a single drum (i.e., sediment and water), it may be necessary to decant the liquids into a separate drum, after the sediments have settled out. This segregation may be accomplished during subsequent IDW sampling activities or during consolidation in a holding tank prior to disposal to the sanitary sewer.

Potentially contaminated well construction materials shall be placed in a separate drum. No soil, sediment, sludge, or liquid IDW shall be placed in drums with potentially contaminated waste well construction materials, and potentially contaminated well construction materials from separate monitoring wells shall not be commingled.

Potentially hazardous PPE and disposable sampling equipment shall be stored in drums separate from other IDW. PPE from generally clean field activities such as water sampling shall be segregated from visibly soiled PPE, double-bagged and disposed offsite as municipal waste. Disposable sampling equipment from activities such as soil, sediment, and sludge sampling includes plastic sheeting used as liner material in containment areas around drilling rigs and waste storage areas; disposable sampling equipment; and soiled decontamination equipment. If, according to the Field Program Manager's best professional judgement, the visibly soiled PPE can be decontaminated and rendered nonhazardous, then the decontaminated PPE shall be double-bagged and disposed offsite as municipal waste (EPA 1991, 1992). PPE and disposable sampling equipment generated on separate days in the field may be combined in a single drum, provided clean and visibly soiled IDW are segregated as discussed above.

Decontamination fluids shall be stored in drums separate from other IDW. If practical, decontamination fluids generated from different sources should not be stored in the same drum. If decontamination fluids generated over several days or from different sources are stored in a single drum, information about the dates and IDW sources represented in the drum shall be recorded. This information shall be noted in the field notebook, on the drum label (see Section 5.3), and in the drum inventory (see Section 5.5).

Part of IDW segregation by the Field Program Manager and designated personnel should include separating the liquid and sediment portions of the equipment decontamination fluid present in the containment unit used by the drilling or excavation field crew. The contents of this unit normally consist of turbid decontamination fluid above a layer of predominantly coarse-grained sediment. When the contents of the containment unit are to be removed for storage in IDW drums, the field crew shall be instructed by the Field Program Manager to place as much of the liquid into drums as possible and transfer the remaining solids into separate drums. Observations of the turbidity and sediment load of the liquid IDW should be noted in the field notebook, on the drum label (see Section 5.3), and in attachments to the drum inventory (see Section 5.5). It is likely that decontamination fluids will contain minor amounts of suspended solids that will settle out of suspension to become sediment at the bottom of IDW storage drums. As noted above, it may be necessary to segregate the drummed water from sediment during subsequent IDW sampling or disposal activities.

5.3 DRUM HANDLING AND LABELING

Drum handling consists of those actions necessary to prepare an IDW drum for labeling. Drum labeling consists of those actions required to legibly and permanently identify the contents of an IDW drum.

5.3.1 Drum Handling

The drums used for containing IDW shall be approved by the United States Department of Transportation (DOT HM-181 1990). The drums shall be made of steel or plastic, generally of 55-gallon capacity, they shall be completely painted or opaque, and they should have removable lids (i.e., type 17-H or United Nations Code 1A2 or 1H2). New steel drums are preferred over recycled drums. For short-term storage of liquid IDW prior to discharge, double-walled bulk steel or plastic storage tanks may be used. For this scenario, consideration must be given to the scheduling and cost-effectiveness of this type of bulk storage, treatment, and discharge system versus longer-term drum storage.

For long-term IDW storage at other project locations, the DOT-approved drums with removable lids are recommended. The integrity of the foam or rubber sealing ring located on the underside of some drum lids shall be verified prior to sealing drums containing IDW liquids. If the ring is only partially attached to the drum lid, or if a portion of the ring is missing, select another drum lid with a sealing ring that is in sound condition.

To prepare IDW drums for labeling, the outer wall surfaces and drum lids shall be wiped clean of all material that may prevent legible and permanent labeling. If potentially contaminated material adheres to the outer surface of a drum, that material shall be wiped from the drum, and the paper towel or rag used to remove the material shall be segregated with visibly soiled PPE and disposable sampling equipment. All IDW drums shall be labeled and placed on pallets prior to storage (see Section 5.4).

5.3.2 Drum Labeling

Proper labeling of IDW drums is essential to the success and cost-effectiveness of subsequent waste screening and disposal activities. Labels shall be permanent and descriptive to facilitate correlation of field analytical data with the contents of individual IDW drums. All IDW drums must be labeled using the two distinct labeling methods described below to ensure durability of the information. These two recommended methods are completing and affixing preprinted labels and marking information on drum surfaces with paint. Use of the preprinted labels, and painted labeling is <u>mandatory</u>. These methods are described below.

Preprinted Labels

Two preprinted Rocketdyne drum labels shall be completed and sealed in separate heavy-duty, clear plastic bags to prevent moisture damage. One label shall be on the outside of the drum with the label data facing outward. The bag shall be affixed to the drum at the midpoint of the drum height using a sufficient quantity of adhesive tape (e.g., duct tape, packing/strapping tape) to enable the bag to remain on the drum as long as possible during storage. A second copy of the preprinted label shall be prepared, sealed in a plastic bag, affixed to the underside of the drum lid, and sealed inside the drum. If appropriate, a third label may be prepared and placed in the plastic bag, behind the outside label and facing the drum.

The drum labels to be used for the field investigation at the Santa Susana Field Laboratory are shown in Attachment 1 (see Attachments A and D within Attachment 1). A preprinted Rocketdyne *Hazardous Waste Pending Analysis* drum label shall be affixed to each drum as soon as IDW is added. If applicable analytical results indicate that the IDW is a hazardous waste, preprinted Rocketdyne *Hazardous Waste* drum labels shall be affixed to the drum as described above. If the analytical results indicate that the IDW is not a hazardous waste, a note shall be added to the *Hazardous Waste Pending Analysis* drum label identifying the waste as non-hazardous. Additional *Hazardous Waste Pending Analysis* drum labels shall also be affixed to the drum in the manner described above.

It is essential that all relevant information recorded on individual drum labels be repeated in the field notebook for later development of the OTIS drum inventory data base (see Section 5.5 and SOP FP-F-5, *Logbooks*).

Painted Labels

The second method for labeling drums is to paint label information directly on the outer surface of the drum. At a minimum, the information placed on the drum shall include the project number, the drum number (following the numbering convention given above), the source identification type and number, the type of IDW, the generation date(s), and the telephone number provided at the bottom of the preprinted label appropriate for the project location. The drum surface shall be dry and free of material that could prevent legible labeling. Label information shall be confined to the upper two-thirds of the total drum height. The top surface of the drum lid may be used as an additional labeling area, but this area should only be used in addition to the upper two-thirds of the sides of the drum. The printing on the drum shall be large enough to be easily legible. Yellow, white, or red paint markers (oil-based enamel paint) that are non-photodegradable are recommended to provide maximum durability and contrast with the drum surface.

5.4 DRUM STORAGE

Drum storage procedures shall be implemented to minimize potential human contact with the stored IDW and prevent extreme weathering of the stored drums. All IDW drums shall be placed upright on pallets before the drums are stored. RCRA storage requirements include the following: containers shall be in good condition and closed during storage; wastes shall be compatible with containers; storage areas shall have a containment system; and spills or leaks shall be removed as necessary. However, until the IDW is conclusively determined to be a RCRA hazardous waste, the Project Manager shall manage the IDW in a protective manner, and not necessarily in accordance with these listed RCRA storage requirements (EPA 1992). In general, drums of IDW shall be stored within the area of contamination (AOC) so that RCRA land disposal restrictions (LDRs) will not apply in future, if onsite disposal is an option. If the IDW is determined to be RCRA hazardous waste, then RCRA storage, transportation, and disposal requirements may become applicable, including a limited 90-day storage permit exemption period prior to required disposal. The AOC concept does not affect the approach for managing IDW that did not come from the AOC, such as PPE, decontamination equipment and fluids, and ground water. If RCRA hazardous, these wastes must be drummed and disposed offsite (EPA 1991).

Drums shall be stored onsite within the AOC prior to disposal, except as directed by RCRA requirements for removal when professional judgement suggests the IDW may pose an immediate or permanent public endangerment (EPA 1991). All IDW drums generated during field activities at a single AOC shall be placed together in a secure, fenced area onsite to prevent access to the drums by unauthorized personnel. When a secure area is not available, drums shall be placed in an area of the site with the least volume of human traffic; at a minimum, plastic sheeting (or individual drum covers) and yellow caution tape shall be placed around the stored drums. Drums from projects involving multiple AOCs shall remain at the respective source areas where the IDW was generated. IDW should not be transferred offsite for storage elsewhere, except under rare circumstances such as the lack of a secure storage area onsite.

Proper drum storage practices shall be implemented to minimize damage to the drums from weathering. When possible, drums shall be stored in dry, shaded areas and covered with impervious plastic sheeting or tarpaulin material. Every effort shall be made to protect the preprinted drum labels from direct exposure to sunlight, which causes ink on the labels to fade. In addition, drums shall be stored in areas that are not prone to flooding. The impervious drum covers shall be appropriately secured to prevent dislodging by the wind. It may be possible to obtain impervious plastic covers designed to fit over individual drums; however, the labeling information shall be repeated on the outside of these opaque covers.

Drums in storage shall be placed with sufficient space between rows of drum pallets and shall not be stacked, such that authorized personnel may access all drums for inspection. Proper placement will also render subsequent IDW screening, sampling, and disposal more efficient. It is recommended that IDW drums be segregated in separate rows/areas by matrix (i.e., soil, liquid or PPE/other).

If repeated visits are made to the project site, the IDW drums shall be inspected to clear encroaching vegetation, check the condition and integrity of each drum, check and replace aluminum tags as necessary, and replace or restore the tarpaulin covers.

5.5 OTIS DRUM INVENTORY

Accurate preparation of an IDW drum inventory is essential to all subsequent activities associated with IDW drum tracking and disposal. An inventory shall be prepared for each project in which IDW is generated, stored, and disposed. The inventory data from each project will be entered into OTIS to become part of the field program data base.

An updated inventory of all IDW drums associated with the field program shall be generated from OTIS, to be compiled and transmitted by Ogden to Rocketdyne personnel at the completion of field work or on a quarterly basis. The drum inventory information in OTIS shall include 12 elements that identify drum contents and indicate their fate (see Attachment 2, Table A4-1).

Attachment 3 to this procedure indicates the type and format of the IDW information that will be provided by the Field Program Manager to the Data Base Administrator or designate for input to OTIS, on a monthly basis. Uploading drum inventory information and site characterization data into the OTIS data base will provide users an efficient means for conducting the initial screening of IDW by automating the comparison of site analytical data with relevant regulatory criteria. The inventory information required includes the drum identification number; the storage location of the drum prior to disposal; the origin or source(s) of the drum contents; the type of drum contents; the amount of waste; the starting waste generation date; the expected disposal date; and the actual date of disposal (see Attachment 3, Table A5-1).

In addition, the recommended analytical methods to adequately characterize the IDW contained in each drum and the recommended or actual disposition of the IDW drum contents (see Attachment 4), will be provided by the Field Program Manager to the Project Manager on an as-needed basis for attachment to the quarterly IDW drum inventory report.

5.5.1 Generator/Site Name

Inventory data shall include the field activity and the site name where the IDW was generated.

5.5.2 Project Number

Inventory data shall include the four-digit project number associated with each drum.

5.5.3 Drum Number

The drum number assigned to each drum shall be included in the inventory data base.

5.5.4 Storage Location Prior to Disposal

The storage location of each drum prior to disposal shall be included in the inventory (e.g., west of Building 304, north of well SH-8, etc.).

5.5.5 Origin of Contents

The source identification of the contents of each IDW drum shall be specified in the inventory (e.g., soil boring number, monitoring well number, sediment sampling location, or the multiple sources for PPE- or rinse water-generating activities).

5.5.6 IDW Type

Inventory data shall include the type of IDW in each drum (e.g., soil, PPE, disposable sampling equipment, sludge, sediment, development water, steam cleaning water, decontamination rinse water).

5.5.7 Waste Volume

The amount of waste in each drum shall be specified in the inventory as a percentage of the total drum volume or an estimated percentage-filled level (e.g., 95 percent maximum for liquid IDW).

5.5.8 Recommended Analytical Methods and Test Results Compared with Applicable Regulatory Standards

The EPA analytical methods recommended to adequately characterize IDW contained in each drum will be summarized in a tabular format (e.g., TCLP Metals, TCLP Benzene, 8080 Pesticides, 8015 Mod. BTEX, Total Cadmium, etc.) and attached to the quarterly IDW drum inventory report (see Attachment 4).

5.5.9 Recommended or Actual Disposition of IDW Drum Contents

The recommended means of IDW disposal for each drum shall be summarized in a tabular format (e.g., Offsite, Encapsulated Onsite, Treatment/Sewer, Offsite Incinerator) and attached to the quarterly IDW drum inventory report (see Attachment 4). Additional narrative discussion of the rationale for the recommended disposal option shall be attached to the quarterly IDW drum inventory report as data become available.

5.5.10 Generation Date

Inventory data shall include the date IDW was placed in each drum. If a drum contains IDW generated over more than one day, the start date for the period shall be specified in dd-Mon-yy format. This date is <u>not</u> to be confused with a RCRA hazardous waste accumulation date (40 CFR 262).

5.5.11 Expected Disposal Date

The date each drum is expected to be disposed shall be specified as part of the inventory in Mon-yy format. This date is for informational purposes only to Rocketdyne, and shall not be considered contractually binding.

5.5.12 Actual Disposal Date

The actual drum disposal date occurs at the time of onsite disposal, or acceptance by the offsite treatment or disposal facility. It shall only be entered in the drum inventory data base when such a date is available in dd-Mon-yy format.

In order to provide information for all 12 of the inventory elements for the quarterly inventory report described above, and summarized in Attachment 2, the main source of information will be provided to OTIS by Project Managers in the format presented in Attachment 3. The information that does not appear in Attachment 3 will be available from other sources.

The recommended analytical test methods along with actual test results compared with applicable regulatory standards will be provided by Project Manager to Rocketdyne personnel in the format presented in Attachment 4, when such data are available. Recommended disposal options or actual disposition of the IDW drum contents will also be provided by Project Manager in the format presented in Attachment 4 as data becomes available. This information constitutes the results of preparing and implementing an IDW screening, sampling, classification, and disposal program for each site.

6.0 RECORDS

The Project Manager is responsible for completing and updating the site-specific IDW drum inventory spreadsheet (see Attachment 3), and submitting it as needed to the Database Manager for updating in OTIS. The original information for uploading into OTIS shall be available in the detailed notes recorded in the site-specific field notebook. In addition, actual site or drum sampling results shall be forwarded to the Rocketdyne personnel, along with a comparison to the applicable regulatory standards. As necessary, the backup documentation to the quarterly IDW drum inventory report shall also include the recommended means for IDW disposal for each drum (see Section 5.5.9 and Attachment 4). After disposal, the actual means and/or location of disposal shall be indicated in tabular format with supporting narrative per Attachment 4.

Field Project Managers and designates are responsible for documenting all IDW-related field activities in the field notebook, including most elements of the IDW drum inventory spreadsheet. The correct methods for developing and maintaining a field notebook are presented in SOP FP-F-5, *Logbooks*.

The Data Base Administrator or designate is responsible for providing an updated copy of the OTIS IDW drum inventory to the Ogden Project Manager, on a quarterly basis. The Ogden Project Manager is responsible for compiling the IDW drum inventories and associated documentation from active projects, and submitting it to the Rocketdyne Project Manager on a quarterly basis at the completion of field work.

7.0 IDW Disposal Plan

Upon receipt of analytical data from the investigation, an IDW Disposal Plan shall be prepared that will include the following:

- identify criteria for selecting disposal options;
- identify possible disposal options;
- provide a comparison between analytical data for each drum of IDW and the comparative criteria; and
- identify the disposal option selected for each drum of IDW.

The IDW Disposal Plan must be approved by Rocketdyne and, in some cases, pertinent regulatory agencies. It must also be amended following each phase of field work.

8.0 REFERENCES

Department of Transportation (DOT). 1990. Transporting Hazardous Materials (HM-181). December 21.

EPA. 1991. Management of Investigation-Derived Wastes During Site Inspections. U.S. Environmental Protection Agency/540/G-91/009. May.

EPA. 1992. Guide to Management of Investigation-Derived Wastes. Quick Reference Guide. U.S. Environmental Protection Agency: 9345.3-03FS. January.

Ogden. 1992. Quality Assurance Management Plan. CLEAN Program. June 26.

9.0 ATTACHMENTS

1. Rocketdyne System of Procedures C-203
2. Example Format _ Quarterly IDW Drum Inventory Updates
3. Example Format _ IDW Drum Inventory Updates to OTIS
4. Example Format _ Attached Documentation for the Analytical Methods, Test Results, and Disposition of Drums, for the Quarterly or Final IDW Drum Inventory

ATTACHMENT 1

Rocketdyne System of Procedures C-203

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RSOP C-203, HAZARDOUS WASTE MANAGEMENT PROGRAM, MAY 1, 1996, F. SWANSON, EH&S

PROCEDURE CHANGE SUMMARY - This procedure replaces Environmental Control Procedures EC 4.00 dated November 15, 1990, EC 4.10 dated January 7, 1994, and EC 7.20 dated April 25, 1994, and Manufacturing Procedure L03-12, dated November 5, 1993.

PURPOSE

This procedure provides requirements for the management of hazardous wastes to ensure compliance with relevant regulations. On-site permitted treatment, storage, and disposal facilities may have additional existing procedures which are applicable to the management of hazardous waste.

DEFINITIONS

Date of Accumulation - The date waste is first added to the container or tank.

Date of Storage - (applies only to satellite accumulation areas and on-site permitted TSDF's) The date when one or more of the listed criteria are met in a Satellite accumulation area: (1) the container is filled; (2) an excess of 55 gallons of hazardous waste or one quart of extremely hazardous waste or per recyclable or compatible wastestream(See Section 6.c.) has been accumulated in a satellite accumulation area; and/or (3) 180 days have passed since the first addition of waste.

Hazardous Waste - a waste that, because of it's quantity, concentration, physical, or chemical characteristics, poses a significant present or potential hazard to human health and safety or the environment if released into the workplace or environment.

Incompatible Wastes - Any hazardous waste unsuitable for commingling with another waste material, where the commingling might produce heat, fire or explosion, violent reaction, toxic or flammable dusts, mists, fumes, vapors or gases which might endanger public health, safety or the environment.

GENERAL REQUIREMENTS (see Figure 1)

1. The Hazardous Waste Generator (generator) determines if there is potential hazardous waste generation. If waste is corrosive, reactive, ignitable or toxic, it is hazardous. Generator will contact Environmental Protection (EP). EP will assist generators in waste characterization.

   If the generator is not sure the waste is hazardous, the waste will be managed as hazardous. The generator will label the waste using the Hazardous Waste Pending Analysis label, Form 653-T-003 (Attachment A). EP will then characterize the waste.

2. Generators must attend Hazardous Waste Handling, Course 4004, and must attend refresher training annually.

PRINTOUTS of this document are for INFORMATION ONLY

3. Generators will accumulate or store their waste in "red cans", satellite accumulation points, generator container storage, or generator tank storage. Generators must follow storage requirements. EP will assist generators in setting up these hazardous waste management areas.

4. Generators must label the hazardous waste container or tank with a Hazardous Waste Label, Form 642-J. Generators may choose instead to stencil tanks with "Hazardous Waste" and a generic waste name. Specific examples of labels are in Attachments B-D.

5. Red Can Storage Requirements

   a. Generators will use red cans for storing flammable or combustible hazardous waste.

   b. Generator will enter "Daily" as the Date of First Accumulation and N/A as the Date of Storage on the red can Hazardous Waste Label (Attachment B).

   c. Generator will empty red can daily. EP may perform this task if generator does not have an authorized generator storage area.

6. Hazardous Waste Satellite Accumulation Point Requirements (see Figure 2)

   a. Generator will accumulate hazardous waste at the initial point of generation in the same or adjacent work area.

   b. Generator will maintain control of the Satellite Accumulation Area. The generator will keep the container in the operator's line of sight. The generator may also keep the waste in a locked compartment to which the generator controls access.

   c. Generator will have less than 55 gallons of hazardous waste or one quart of extremely hazardous waste stored at a satellite accumulation point. There are two exceptions: (1) if wastes are incompatible, the volume limits apply to each waste, and/or (2) if a single container prevents recycling, is unsafe to the generator or to the environment, then the volume limits apply to each compatible wastestream.

   d. Generator will enter Date of First Accumulation when waste is first added to container (Attachment C).

   e. Generator will store hazardous waste at the satellite accumulation point up to 180 days.

   f. When the stored waste reaches the volume or time limits for satellite storage, or when container is full, the generator will store the container by entering the Date of Storage on the hazardous waste label.

   g. Generator must ship the "stored" hazardous waste container to the HWSA or the applicable TSDF within 72 hours. Container must remain in satellite area until picked up by Internal Trucking.

7. Hazardous Waste Generator Area Storage Requirements (see Figure 3)

   a. Generator may store any amount of containerized hazardous waste in an approved generator storage area.

b. Generator storage area must have communication equipment, fire extinguisher, emergency spill equipment, safety shower, hazardous waste warning sign, and secondary containment.

c. Generator may store hazardous waste for up to 60 days.

d. Generator must inspect the generator area weekly. The generator will complete the Hazardous Waste Container Weekly Container Checklist, Form 624-T-1.

e. Generator must maintain checklists in area for one year.

f. Generator must maintain emergency spill cabinets.

g. Generator must maintain aisle space to allow for drum movement, emergency equipment, and inspection.

8. Hazardous Waste Tank Storage Requirements (see Figure 4)

a. Tank must meet specific design requirements which EP will assist in determining.

b. Tank storage area must have communication equipment, fire extinguisher, emergency spill equipment, safety shower, hazardous waste warning sign and secondary containment.

c. Generator must only store hazardous waste which is compatible with the tank.

d. Generators may only store 5000 gallons or less of hazardous waste in tanks.

e. Generators may store hazardous waste for up to 90 days.

f. Generators must perform tank inspections each operating day. The generator must complete Hazardous Waste Tank Inspection Checklist, Form 653-T-4 (Attachment F).

g. Generators must maintain completed Checklists near the tank for on e year.

h. Generators must maintain Emergency Spill Cabinet Supplies.

9. Generators will obtain hazardous waste containers from the Hazardous Waste Storage Area(HWSA) located at each facility.

10. Generators must use containers or tanks which are compatible with the hazardous waste.

11. Generators must segregate incompatible wastes.

12. Generators must keep containers closed when not adding or removing hazardous waste from the container. The generator must keep bungs wrench tight, drum rings tightened, or latches locked.

13. Generators will ensure hazardous wastes are accumulated in a manner which minimizes the potential for storm water pollution.

14. Generators will minimize the generation of hazardous waste to the extent it is economically feasible.

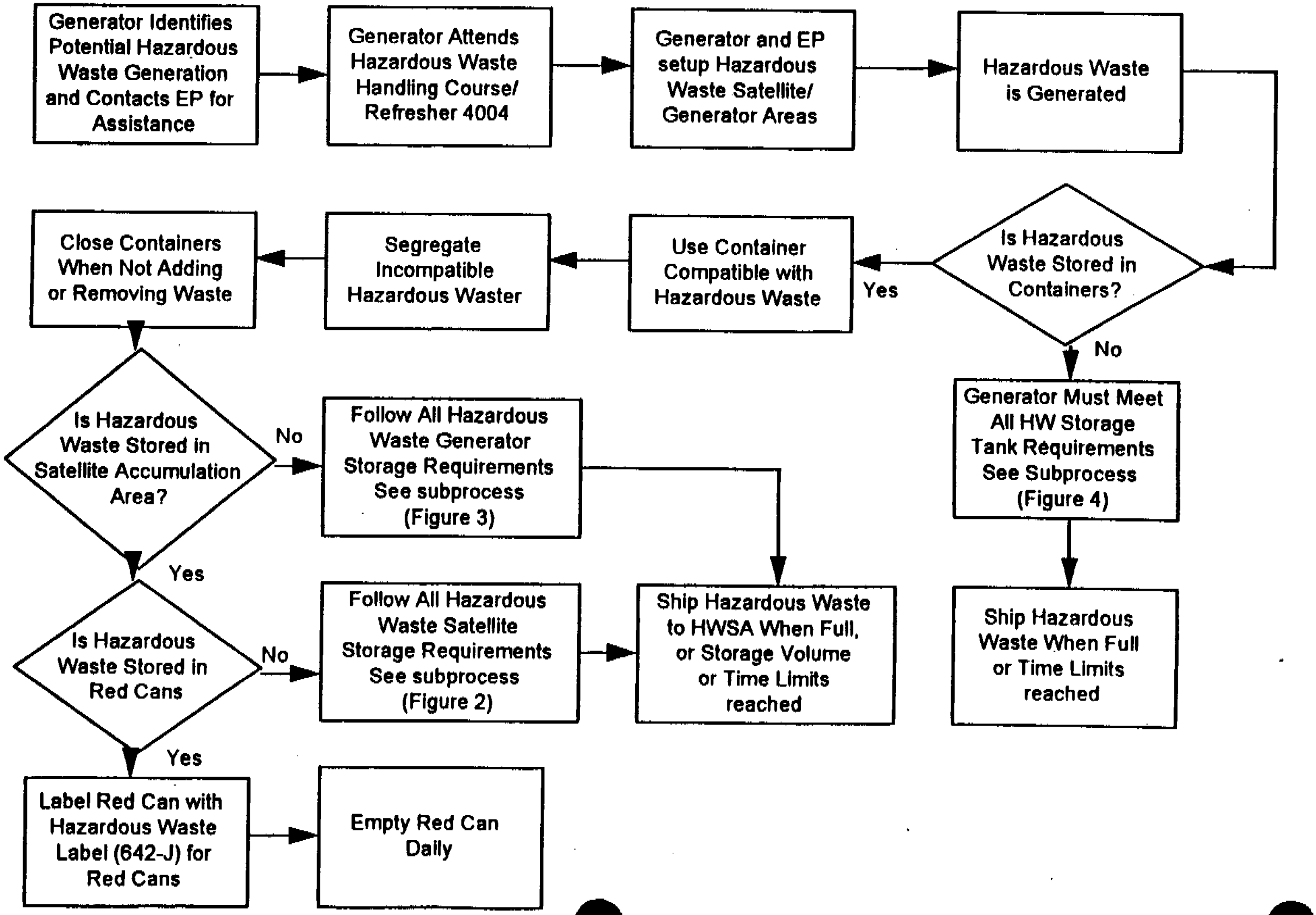

Figure 1 - Hazardous [illegible]te Management Program

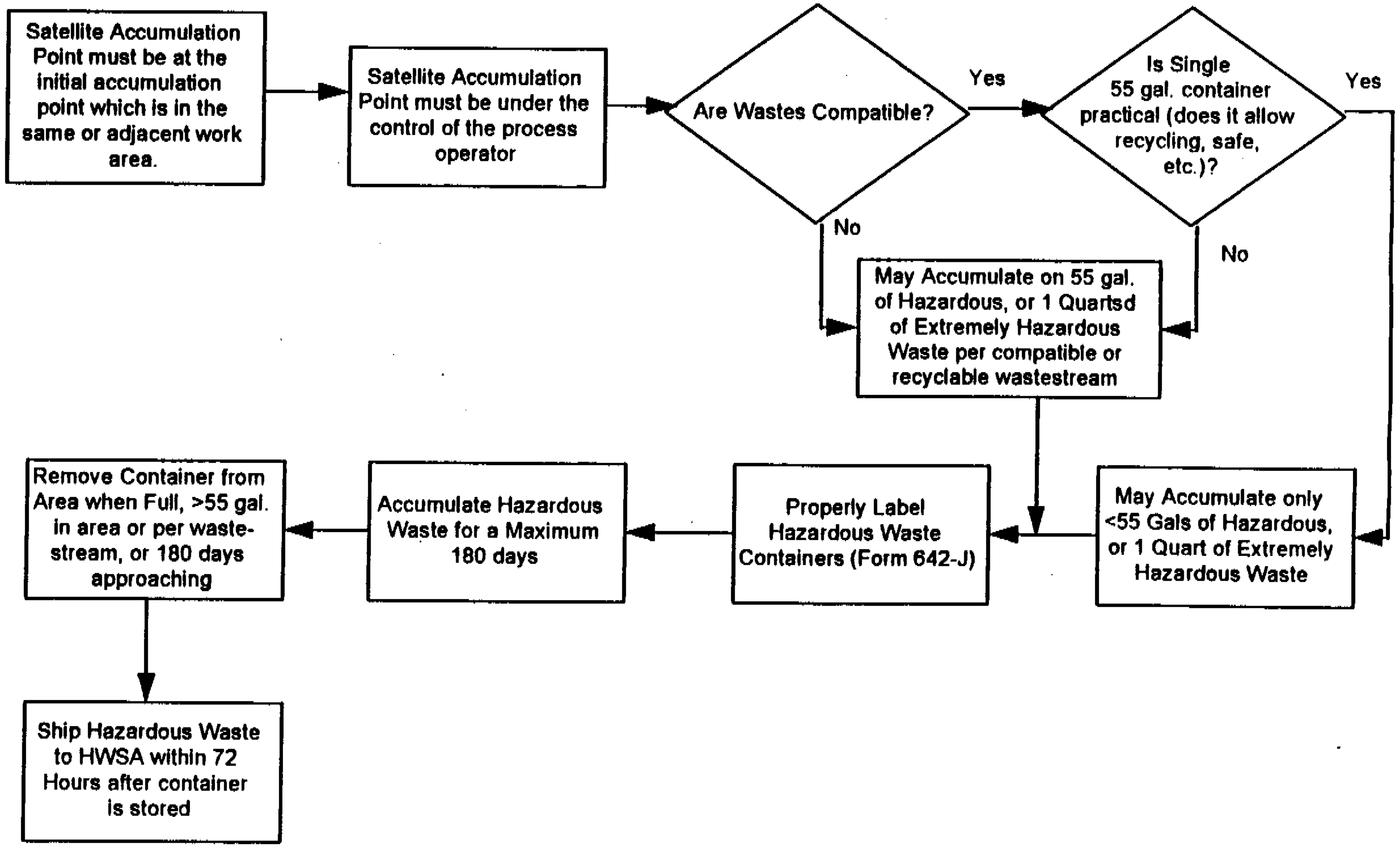

Figure 2 - Hazardous Waste Satellite Accumulation Point Requirements

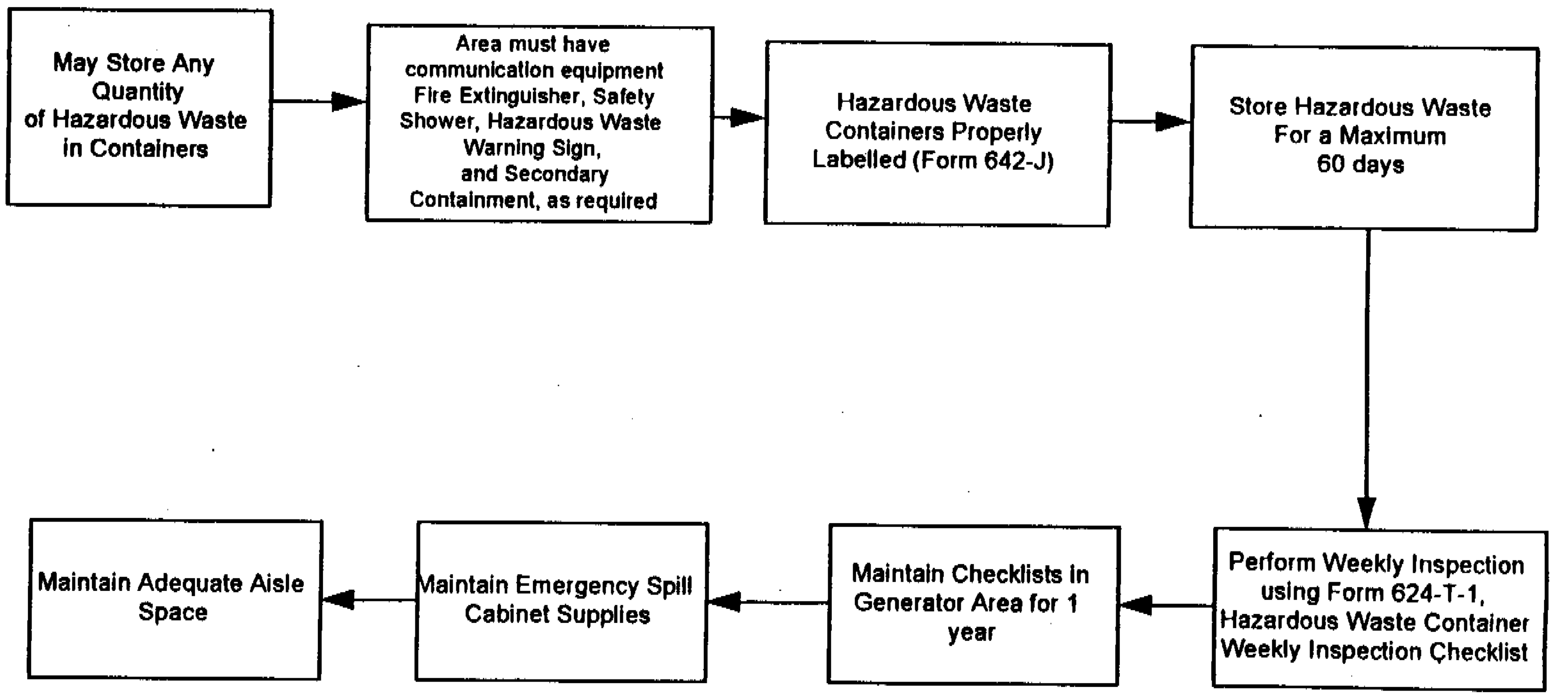

Figure 3 - Hazardous Waste Generator Storage Requirements

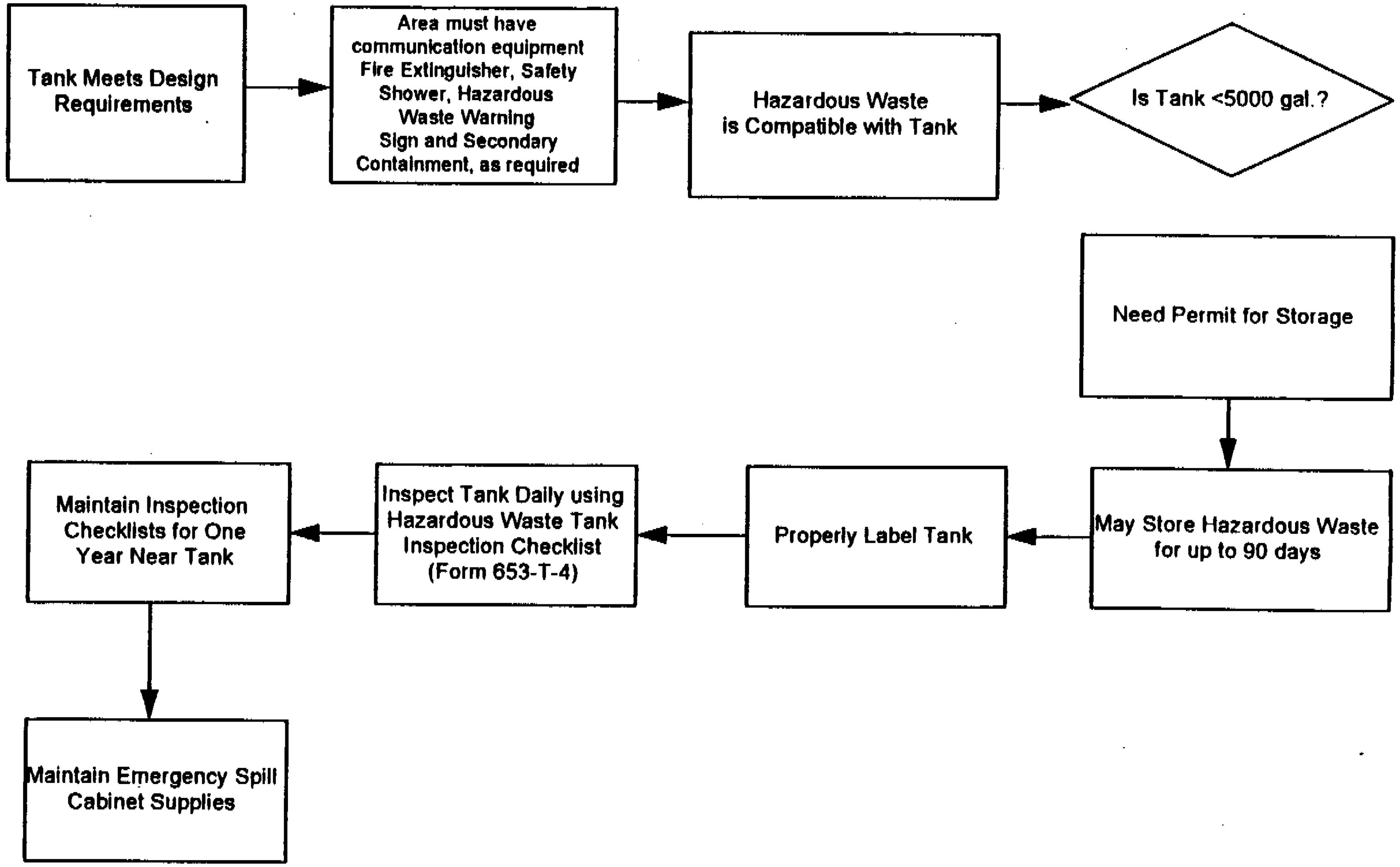

Figure 4 - Hazardous Waste Tank Storage Requirements

HAZARDOUS WASTE
PENDING ANALYSIS

☐ Canoga
6633 Canoga Avenue
Canoga Park, CA 91303

☐ DeSoto
8900 DeSoto Avenue
Canoga Park, CA 91304

☐ SSFL
End of Woolsey Canyon Road
Simi Hills, CA 91311

☐ Westlake
2825 Townsgate Rd.
Westlake, CA 91361

☐ Plummer
21415 Plummer Ave
Chatsworth, CA 91311

☐ Other

Date of Storage ____________________

Date of 1st Accum./Date Deemed to be a Waste ____________________

Department Number / Name ____________ **Area/Site** __________ **Bldg. No.** ______ **Area Contact / Phone** __________

____________________ ______**% Known** ☐ **Ignitability** ☐ **Corrosivity** ☐ **Toxicity**
____________________ ______**% Properties:** (F.P.< 140 °) (PH <2 or> 12.5)
____________________ ______**%** ☐ **Reactivity** ☐ **Other** __________
____________________ ______**% Known**
____________________ ______**% Physical State:** ☐ **Solid** ☐ **Liquid** ☐ **Sludge** ☐ **Gas** ☐ **Other** __________
____________________ ______**%**
____________________ ______**% Quantity in Container:** __________ ☐ **gal.** ☐ **lbs.** ☐ **cu. yds**
____________________ ______**% Process Generating Waste** __________
____________________ ______**%** ____________________

Analysis Log No. ____________________ **Date Sampled** ____________________

Rockwell International Corporation/Rocketdyne Division, 6633 Canoga Avenue, Canoga Park, CA 91303 818/710-6163

FORM 653-T-003 REV. 3-96

Form 653-T-003 - Haza[illegible]s Waste Pending Analysis

Attachment B to RSOP C-203
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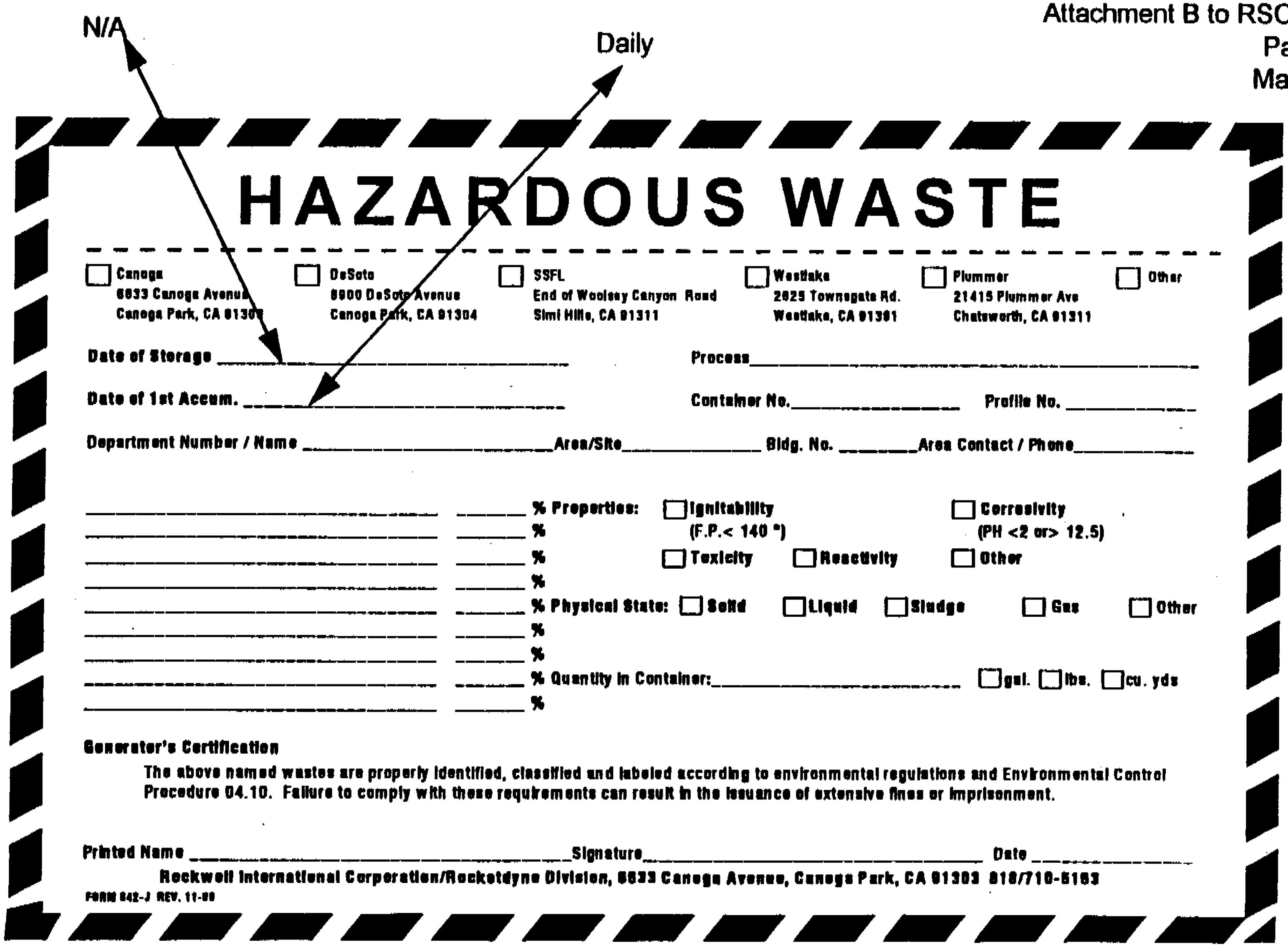

N/A

Daily

HAZARDOUS WASTE

☐ Canoga
6633 Canoga Avenue
Canoga Park, CA 91303

☐ DeSoto
8900 DeSoto Avenue
Canoga Park, CA 91304

☐ SSFL
End of Woolsey Canyon Road
Simi Hills, CA 91311

☐ Westlake
2825 Townsgate Rd.
Westlake, CA 91361

☐ Plummer
21415 Plummer Ave
Chatsworth, CA 91311

☐ Other

Date of Storage ____________________ Process ____________________

Date of 1st Accum. ____________________ Container No. __________ Profile No. __________

Department Number / Name ____________________ Area/Site __________ Bldg. No. ________ Area Contact / Phone __________

____________________ ______ % Properties: ☐ Ignitability (F.P.< 140 °) ☐ Corrosivity (PH <2 or> 12.5)
____________________ ______ %
____________________ ______ % ☐ Toxicity ☐ Reactivity ☐ Other
____________________ ______ %
____________________ ______ % Physical State: ☐ Solid ☐ Liquid ☐ Sludge ☐ Gas ☐ Other
____________________ ______ %
____________________ ______ %
____________________ ______ % Quantity in Container: ____________________ ☐ gal. ☐ lbs. ☐ cu. yds
____________________ ______ %

Generator's Certification

The above named wastes are properly identified, classified and labeled according to environmental regulations and Environmental Control Procedure 04.10. Failure to comply with these requirements can result in the issuance of extensive fines or imprisonment.

Printed Name ____________________ Signature ____________________ Date __________

Rockwell International Corporation/Rocketdyne Division, 6633 Canoga Avenue, Canoga Park, CA 91303 818/710-5163

FORM 642-J REV. 11-88

Form 642-J, Red Can

Attachment C to RSOP C-203
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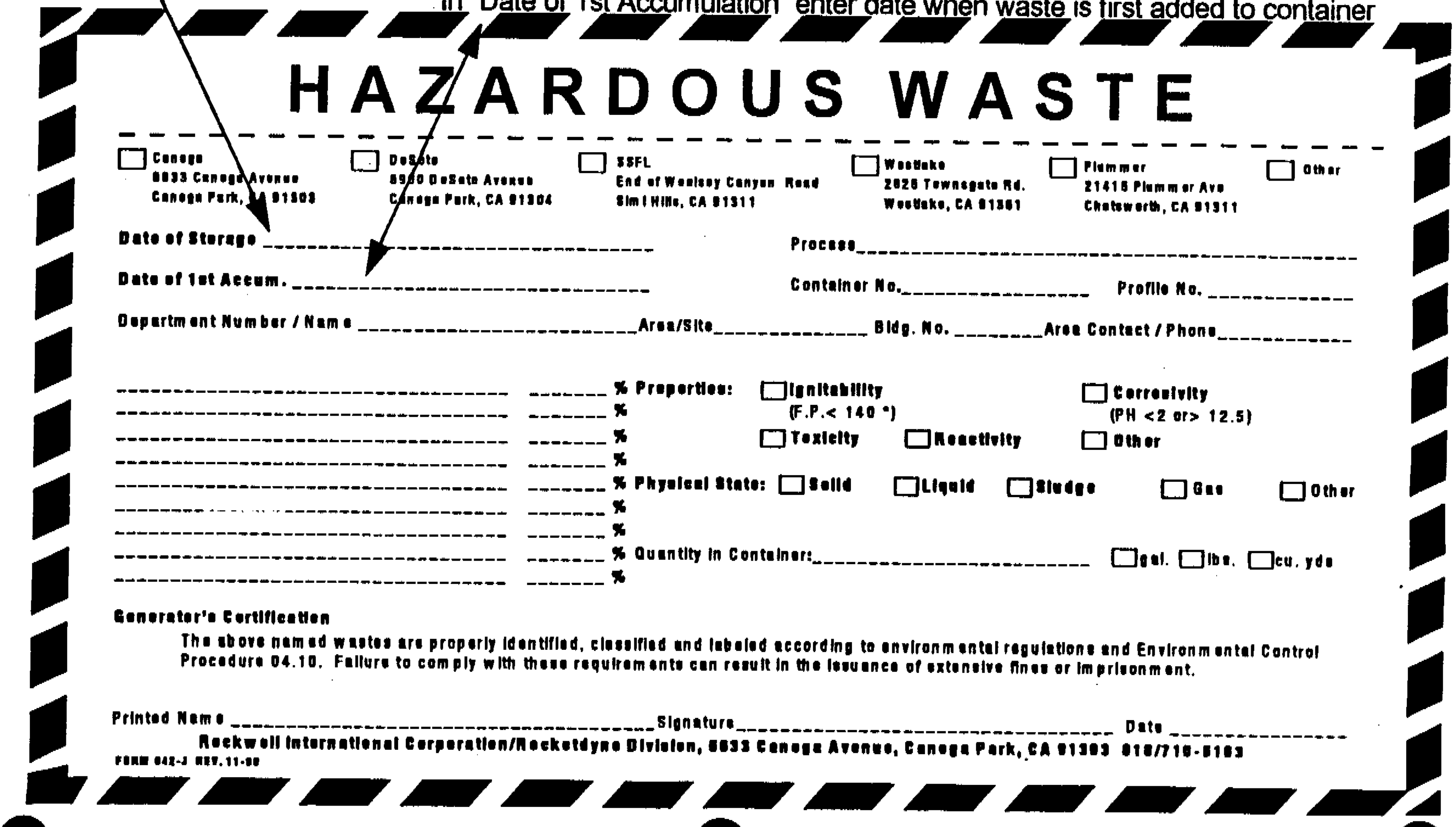
Enter date on "Date of Storage" line when any one of these criteria is met:

1. Container is full
2. 55 gallons of hazardous waste or one quart of acutely or extremely hazardous waster is accumulated in area
3. 180 days have passed since the first addition of waste

Immediately arrange for shipment of container to hazardous waste storage area

In "Date of 1st Accumulation" enter date when waste is first added to container



HAZARDOUS WASTE

☐ **Canoga**
6633 Canoga Avenue
Canoga Park, CA 91303

☐ **DeSoto**
8900 DeSoto Avenue
Canoga Park, CA 91304

☐ **SSFL**
End of Woolsey Canyon Road
Simi Hills, CA 91311

☐ **Westlake**
2825 Townsgate Rd.
Westlake, CA 91361

☐ **Plummer**
21415 Plummer Ave
Chatsworth, CA 91311

☐ **Other**

Date of Storage ______________________ Process ______________________

Date of 1st Accum. ______________________ Container No. ____________ Profile No. ____________

Department Number / Name ______________ Area/Site ____________ Bldg. No. ________ Area Contact / Phone ____________

______________________ ______ % Properties: ☐ Ignitability (F.P.< 140 °) ☐ Corrosivity (PH <2 or> 12.5)

______________________ ______ %

______________________ ______ % ☐ Toxicity ☐ Reactivity ☐ Other

______________________ ______ %

______________________ ______ % Physical State: ☐ Solid ☐ Liquid ☐ Sludge ☐ Gas ☐ Other

______________________ ______ %

______________________ ______ %

______________________ ______ % Quantity in Container: ______________ ☐ gal. ☐ lbs. ☐ cu. yds

______________________ ______ %

Generator's Certification

The above named wastes are properly identified, classified and labeled according to environmental regulations and Environmental Control Procedure 04.10. Failure to comply with these requirements can result in the issuance of extensive fines or imprisonment.

Printed Name ______________________ Signature ______________________ Date ____________

Rockwell International Corporation/Rocketdyne Division, 6633 Canoga Avenue, Canoga Park, CA 91303 818/710-5163

FORM 642-J REV.11-90

Form 642-J, Authoriz Satellite Accumulation Area

Attachment D to RSOP C-203
Page 1 of 1
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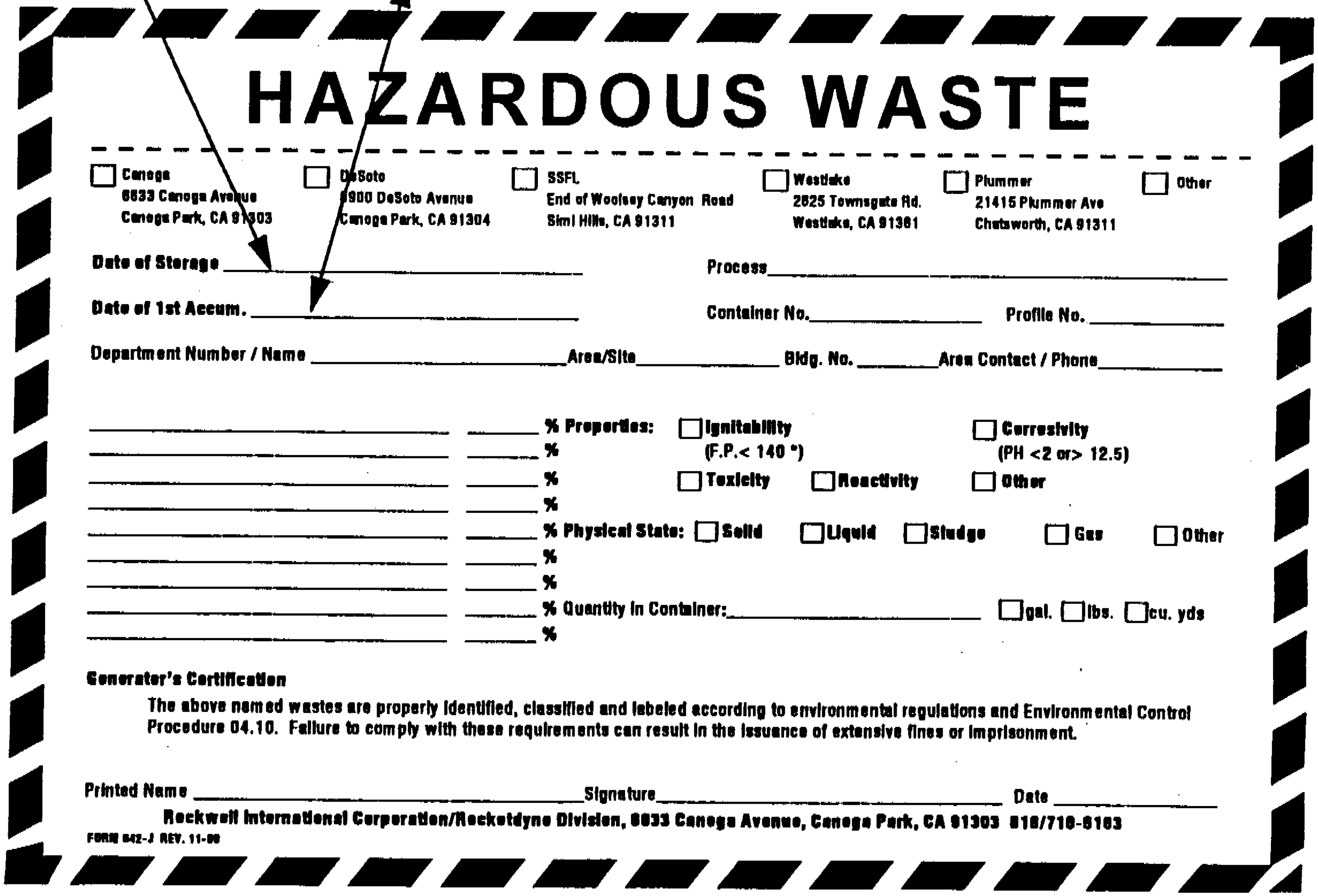
N/A

Enter the date when waste is first added to container



HAZARDOUS WASTE

☐ Canoga
6633 Canoga Avenue
Canoga Park, CA 91303

☐ DeSoto
8900 DeSoto Avenue
Canoga Park, CA 91304

☐ SSFL
End of Woolsey Canyon Road
Simi Hills, CA 91311

☐ Westlake
2825 Townsgate Rd.
Westlake, CA 91361

☐ Plummer
21415 Plummer Ave
Chatsworth, CA 91311

☐ Other

Date of Storage ____________________ **Process** ____________________

Date of 1st Accum. ____________________ **Container No.** __________ **Profile No.** __________

Department Number / Name ____________________ **Area/Site** __________ **Bldg. No.** ______ **Area Contact / Phone** __________

____________________ ______ **% Properties:** ☐ **Ignitability** (F.P.< 140 °) ☐ **Corrosivity** (PH <2 or> 12.5)
____________________ ______ %
____________________ ______ % ☐ **Toxicity** ☐ **Reactivity** ☐ **Other**
____________________ ______ %
____________________ ______ **% Physical State:** ☐ **Solid** ☐ **Liquid** ☐ **Sludge** ☐ **Gas** ☐ **Other**
____________________ ______ %
____________________ ______ %
____________________ ______ **% Quantity in Container:** ____________________ ☐ **gal.** ☐ **lbs.** ☐ **cu. yds**
____________________ ______ %

Generator's Certification

The above named wastes are properly identified, classified and labeled according to environmental regulations and Environmental Control Procedure 04.10. Failure to comply with these requirements can result in the issuance of extensive fines or imprisonment.

Printed Name ____________________ **Signature** ____________________ **Date** __________

Rockwell International Corporation/Rocketdyne Division, 6633 Canoga Avenue, Canoga Park, CA 91303 818/710-6163

FORM 642-J REV. 11-90

Form 642-J, Authorized Generator Storage Area

Rockwell International
Rocketdyne Division

HAZARDOUS WASTE CONTAINE
WEEKLY INSPECTION CHECKLIS

NOTE: All Rocketdyne authorized generator storage areas which accumulate hazardous waste are required to conduct inspections of their containers on a weekly b Completed weekly container inspection checklists are to be kept at or near the location where the hazardous waste containers are stored. Copies of ins discrepancies shall be mailed to the Environmental Protection Department 543, 055-T486.

INSPECTION DATE	INSPECTION TIME AM PM	FACILITY (e.g. Canoga, DeSoto, SSFL)	DEPT. NAME & NO.
HAZARDOUS WASTE CONTAINERS LOCATION BLDG./AREA	COLUMN		NUMBER OF CONTAINERS INSPECTED

Evaluation and Action

All "Yes" answers mean no discrepancies exist. A "No" answer to any question means a discrepancy exists that requ immediate corrective action. Notify the area manager of the discrepancy and indicate the action taken in the Methoc Correction area. The area manager must co-sign the inspection checklist when a discrepancy exists. When discrepancy h been corrected, area management must fill in date of correction and sign at bottom of form.

	YES	NO
Are hazardous waste containers in good condition?	____	____
Are hazardous waste containers free from leaks and residues on the outside of the container?	____	____
Is the area surrounding the containers free from leaks and residues?	____	____
Are hazardous waste container lids securely closed and latched?	____	____
Is the hazardous waste being stored compatible with the container?	____	____
Are incompatible hazardous wastes segregated?	____	____
Is the **Hazardous Waste Identification Tag** (Form 642-J) completely filled out and attached to the container?	____	____
Are containers stored less than 60 days?	____	____
Is hose and safety shower/eye wash unobstructed and operational?	____	____
Is emergency communication system (phone, audible alarm) in working condition?	____	____
Are hazardous waste warning signs in place?	____	____
Is fire extinguisher in area?	____	____
Is spill control cabinet properly stocked per inventory sheet?	____	____

Inspector's Name ______________________ Inspector's Signature ______________________

Date: ______________________

COPIES OF INSPECTIONS WITH DISCREPANCIES SHALL BE MAILED TO ENVIRONMENTAL PROTECTION, D/543, 055-T486

DISCREPANCY INDICATION AND CORRECTION AREA

Area Manager Co-Sign ______________________ **Date:** ______________________

Describe Method of Correction (Use additional sheet if necessary): ______________________

Date Discrepancy Corrected ______________________

Area Manager Name ______________________ **Signature** ______________________ **Date:** ______________________

FORM 624-T-1 NEW 9-82

Rockwell International

Rocketdyne Division

HAZARDOUS WASTE TANK INSPECTION CHECKLIST

NOTE: All Rocketdyne departments which accumulate hazardous wastes in tanks are required to conduct daily inspections of the tanks each operating day. In addition, a weekly checklis (below) must be completed once per week. Completed checklists are to be maintained at or near the tank location and made available for inspection. Copies of inspections with discrepancie shall be mailed to Environmental Protection Department 543, 055-T486.

INSTRUCTIONS FOR COMPLETING TANK INSPECTION FORM 653-T-4

Evaluation and Action

All "Yes" answers mean no discrepancies exist. A "No" answer to any question means a discrepancy exists that requires immediate corrective action. An "N/A" answer means the question does not apply to your tank system. This inspection is required to be performed each operating day. Check the "Not In Operation" box below on non-operational days, i.e., Saturday, Sunday and Holidays. All questions must be answered. If a discrepancy is found, corrective action must be taken immediately. Notify the area manager of the discrepancy and indicate the action taken in the Method of Correction area. The area manager must co-sign the inspection checklist when a discrepancy exists. When discrepancy has been corrected, area management must fill in date of correction and sign at bottom of form.

FACILITY

LOCATION OF TANK

DEPARTMENT NAME/NUMBER

DESCRIPTION OF WASTE IN TANK

	NOT IN OPERATION ☐	NOT IN OPERATION ☐	NOT IN OPERATION ☐	NOT IN OPERATION ☐	NOT IN OPERATION ☐	NOT IN OPERATION ☐	NOT IN OPERATION ☐
	MONDAY	TUESDAY	WED.	THURS.	FRIDAY	SAT.	SUNDAY
DATE AND TIME							
INSPECTOR'S NAME							
INSPECTOR'S SIGNATURE							
§66265.195. Inspections. (a) The owner or operator shall inspect, where present at least once each operating day:	YES NO N/A	YES NO N/A	YES NO N/A	YES NO N/A	YES NO N/A	YES NO N/A	YES NO N/A
(1) Is overfill/spill control equipment (e.g., waste-feed cutoff systems, bypass systems, and drainage systems) in good working order?	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐
(2) Are the aboveground portions of the tank system free from leakage and corrosion?	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐
(3) Is data gathered from monitoring equipment and leak-detection equipment, (e.g., pressure and temperature gauges, monitoring wells) ensuring that the tank system is being operated according to its design?	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐
(4) Are the construction materials and the area immediately surrounding the externally accessible portion of the tank system including secondary containment structures (e.g., dikes) free from erosion or releases of hazardous waste (e.g., wet spots, dead vegetation)?	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐
(5) For uncovered tanks, are at least 2 feet of freeboard maintained?	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐
(6) Is the tank properly labeled with a Form 642-J, and date of accumulation is less than 90 days from the first addition of waste to the tank?	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐

WEEKLY CHECKLIST - To be Completed Once Per Week

Date: ______________________

Time: ______________________

Sign: ______________________

	YES	NO
Is hose and safety shower/eye wash unobstructed and operational?	☐	☐
Is emergency communication system (phone, audible alarm) in working condition?	☐	☐
Are hazardous waste warning signs in place?	☐	☐
Is fire extinguisher in area?	☐	☐
Is spill control cabinet properly stocked per inventory sheet?	☐	☐

COPIES OF INSPECTIONS WITH DISCREPANCIES SHALL BE MAILED TO ENVIRONMENTAL PROTECTION, D/543, 055-T486

DISCREPANCY INDICATION AND CORRECTION AREA

Area Manager Co-Sign ______________________ **Date:** ______________________

Describe Method of Correction (use additional sheet if necessary): ______________________

Date Discrepancy Corrected ______________________

Area Manager Name ______________________ **Signature** ______________________ **Date** ______________________

FORM 653-T-4 REV. 8-92

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ATTACHMENT 2
Quarterly IDW Drum Inventtory Updates
Table A4-1

Navy Activity/Site Name (generator/site)	CTO Number 0bbb	Drum Number (xxxx-AA-Dzzz)	Drum Storage Location	Origin of Contents (source ID #)	IDW Type	Waste Volume (fill level %)	Waste Generation Date (dd-Mon-yy)	Expected Disposal Date (Mon-yy)	Actual Disposal Date (dd-Mon-yy)
NSC Pearl Harbor/Landfill	0068	0068-LF-D001	NSC, Near Bldg. 7	SB-1	Soil Cuttings	100	16-Dec-92	Dec-93	NA
		0068-LF-D002	NA	MW-1 MW-2 MW-3	Purge Water	75	20-Dec-92	Jul-93	26-Jul-93
		0068-LF-D003	NA	MW-1 MW-2 MW-3	Decon Water	95	20-Dec-92	Jul-93	26-Jul-93
		0068-LF-D004	In NSC Bldg.16	SB-1 SB-2 SB-3 SB-4 MW-1 MW-2 MW-3	PPE	50	16-Dec-92	Oct-93	NA
NAVSTA Guam/Drum Storage	0047	0047-DS-001	HazMat Storage Area	SB-1 SB-2	Soil Cuttings	100	18-Feb-93	Sep-93	NA

Notes:
NA = Not Applicable

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ATTACHMENT 3

IDW Drum Inventory Updates to OTIS

The IDW Drum Inventory updates to OTIS from active field projects shall be generated as needed by using MicroSoft Excel® version 3.0 or higher. One copy of all IDW Drum Inventory updates shall be submitted on 3.5- or 5.25-inch disks, formatted under MS/DOS. All MS/DOS Excel® file names shall be unique. Each disk shall be given an identification label as follows:

IDW Drum Inventory Update to OTIS

Project Number:____________
Site Name:______________________

____
Date:____________

Table A3-1 is an Excel® spreadsheet template that contains the headings and columns that shall be followed when submitting the IDW inventory updates to the Data Base Administrator or designate assigned to perform data management tasks. A hardcopy printout of the IDW Drum Inventory Excel® spreadsheet shall be submitted as necessary, along with an electronic copy.

The **MAXIMUM** character width of each column in the IDW inventory spreadsheet will be as follows:

Drum Number	12 Characters
Drum Storage Location	40 Characters
IDW Source(s)	30 Characters
IDW Type	40 Characters
Waste Volume (percent)	3 Characters
Start Generation Date	9 Characters
Expected Disposal Date	6 Characters
Actual Disposal Date	9 Characters

Total Characters per row	**149**

Some guidelines for completing the IDW drum inventory spreadsheet are as follows:

All columns and rows are required fields except for Drum Storage Location and Actual Disposal Date. You shall specify the Drums Storage Location or the Actual Disposal Date. Fields that do not apply shall be recorded as "NA".

For drums with more than one source of IDW, each source shall be listed **SEPARATELY** on a different row in the spreadsheet. Note the examples in Table A5-1 for drums 0068-LF-D002, D003, and D004.

The Start Waste Generation Date and Actual Disposal Date shall be single dates completed in the dd-Mon-yy format. The Expected Disposal Date shall be estimated in a Mon-yy format.

Table A3-1

Attached Documentation for the Analytical Methods, Test Results, and Disposition of Drums for the Quarterly IDW Drum Inventory Update

Navy Activity/Site Name (generator/site)	Drum Number (xxxx-AA-Dzzz)	IDW Type	Recommended EPA Analytical Methods	IDW Sampling Results (ppm)	Relevant Regulatory Criteria (e.g. TCLP, Guam EPA, HI DOH) (ppm)	Drum Storage Location	Recommended/Actual IDW Disposition	Expected Disposal Date (Mon-yy)	Actual Dispos Date (dd-Mon-yy)
NSC Pearl Harbor/Landfill	0068-LF-D001	Soil Cuttings	TCLP Metals TCLP Benzene Total Lead 8015 Mod. BTEX			NSC, Near Bldg. 7	Offsite	Dec-93	NA
	0068-LF-D002	Purge Water	Total Lead Total Chromium			NA	Carbon Filtration Prior to PWC Sewer Discharge	Jul-93	26-Jul-93
	0068-LF-D003	Decon Water	PWC Water Quality Parameters			NA	Carbon Filtration Prior to PWC Sewer Discharge	Jul-93	26-Jul-93
	0068-LF-D004	PPE	None			In NSC Bldg.16	Offsite incinerator	Oct-93	NA
NAVSTA Guam/Drum Storage	0047-DS-001	Soil Cuttings	8080 PCBs only			HazMat Storage Area	Offsite Incinerator	Sep-93	NA

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ATTACHMENT 4

Table A4-1 is an Excel® spreadsheet template that contains an example of the format and headings that shall be followed when submitting the following updated information to the quarterly IDW drum inventory report to the Ogden Project Manager: the recommended analytical methods to characterize the waste, or a summary of actual test results compared with relevant regulatory criteria; and the disposal option selected, or the actual disposition of the contents of each drum of IDW. A hardcopy printout of the example Excel® Table A4-1 shall be submitted along with a narrative description of the rationale for recommending each analytical method or for selecting each disposal option; a detailed comparison of actual IDW analytical results versus relevant regulatory criteria; or a description of the actual disposition of the contents of each drum of IDW. If applicable, the narrative shall be summarized by matrix, analytical method, or disposal location.

The Recommended EPA Analytical Methods are those analytical methods required to characterize the IDW in a drum Sampling Plan, based on the analytes of concern at the site. The analytes of concern shall be determined from implementation of an IDW drum Screening Plan, by comparing available analytical site data and estimated IDW analyte concentrations, against applicable regulatory criteria.

The Recommended Disposition selected shall initially be a generic determination of where the IDW should be disposed. The table entry and supporting rationale shall be as specific as the data allows. The disposal option selected shall be based on the Program Manager's professional judgement; the results from the screening, sampling, and classification of the IDW against relevant regulatory criteria; regulatory agency approval of the screening, sampling, <u>and</u> classification methodologies; written acceptance criteria from applicable treatment/disposal facilities; and practical considerations for the treatment, transportation, and/or disposal of the waste.

Table A4-1

IDW DRUM INVENTORY UPDATE to OTIS
EXAMPLE FORMAT

Drum Number (xxxx-AA-Dzzz)	Drum Storage Location (be specific)	IDW Source(s) (source ID #)	IDW Type (one type per drum)	Waste Volume (fill level %)	Start Waste Generation Date (dd-Mon-yy)	Expected Disposal Date (Mon-yy)	Actual Disposal Date (dd-Mon-yy)
0068-LF-D001	NSC, Near Bldg. 7	SB-1	Soil Cuttings	100	16-Dec-92	Dec-93	NA
0068-LF-D002	NSC, Near Bldg. 7	MW-1	Purge Water	75	20-Dec-92	Jul-93	26-Jul-93
0068-LF-D002	NSC, Near Bldg. 7	MW-2	Purge Water	75	20-Dec-92	Jul-93	26-Jul-93
0068-LF-D002	NSC, Near Bldg. 7	MW-3	Purge Water	75	20-Dec-92	Jul-93	26-Jul-93
0068-LF-D003	NSC, Near Bldg. 7	MW-1	Decon Water	95	20-Dec-92	Jul-93	26-Jul-93
0068-LF-D003	NSC, Near Bldg. 7	MW-2	Decon Water	95	20-Dec-92	Jul-93	26-Jul-93
0068-LF-D003	NSC, Near Bldg. 7	MW-3	Decon Water	95	20-Dec-92	Jul-93	26-Jul-93
0068-LF-D004	In NSC Bldg.16	SB-1	PPE	50	16-Dec-92	Oct-93	NA
0068-LF-D004	In NSC Bldg.16	SB-2	PPE	50	16-Dec-92	Oct-93	NA
0068-LF-D004	In NSC Bldg.16	SB-3	PPE	50	16-Dec-92	Oct-93	NA
0068-LF-D004	In NSC Bldg.16	SB-4	PPE	50	16-Dec-92	Oct-93	NA
0068-LF-D004	In NSC Bldg.16	MW-1	PPE	50	16-Dec-92	Oct-93	NA
0068-LF-D004	In NSC Bldg.16	MW-2	PPE	50	16-Dec-92	Oct-93	NA
0068-LF-D004	In NSC Bldg.16	MW-3	PPE	50	16-Dec-92	Oct-93	NA
0047-DS-D001	HazMat Storage Area	SB-1	Soil Cuttings	100	18-Feb-93	Sep-93	NA
0047-DS-D001	HazMat Storage Area	SB-2	Soil Cuttings	100	18-Feb-93	Sep-93	NA

Notes:
NA = Not Applicable

LOGBOOKS

1.0 PURPOSE

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

2.0 SCOPE

This document applies to all Ogden personnel involved with the use and control of logbooks and associated records pertaining to quality-related activities. As professional guidance for specific activities, this procedure is not intended to obviate the need for professional judgement to accommodate unforeseen circumstances. Deviance from this procedure in planning or in the execution of planned activities must be approved by the Project Manager and Technical Director/QA Program Manager.management personnel and documented.

3.0 DEFINITIONS

3.1 LOGBOOK

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

3.2 DATA FORM

A predetermined format utilized for recording field data that may become, by reference, a part of the logbook. For example, soil boring logs, trenching logs, surface soil sampling logs, ground-water sample logs, well construction logs.

4.0 RESPONSIBILITIES

The Project Manager is responsible for determining which team members shall record information in field logbooks and for obtaining and maintaining control of the required logbooks. The Field Program Manager is responsible for ensuring that the logbook is completed properly and daily. The Field Program Manager is also responsible for submitting copies to the Project Manager, who is responsible for filing it.

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

5.0 PROCEDURE

The field logbook serves as the primary record of field activities. Entries shall be made chronologically and in sufficient detail to allow the writer or a knowledgeable reviewer to reconstruct the applicable events. The logbook shall be stored in a clean location and used only when outer gloves used for personal protective equipment have been removed.

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

All field descriptions and observations are entered into the logbook, as described in Attachment 1, using indelible black ink.

Typical information to be entered includes, but is not limited to, the following:

- Date and time of all onsite activities;
- Site location and description;
- Weather conditions;

- Field work documentation;
- Field instrumentation readings;
- Personnel present;
- Photograph references;
- Sample locations;
- Sample EPA number and sample identification;
- Sample naming;
- Field QC sample information;
- Field descriptions, equipment used, and field activities accomplished to reconstruct field operations;
- Meeting information;
- Important times and dates of telephone conversations, correspondence, or deliverables;
- Field calculations;
- PPE level;
- Calibration records; and
- Subcontractors present. and
- Equipment decontamination procedures and effectiveness.

The logbook shall reference data maintained in other logs, forms, etc. Entry errors shall be corrected by drawing a single line through the incorrect entry, then initialing and dating this change. An explanation for the correction should be entered if the correction is for more than just a mistake.

Each entry or group of entries shall be signed or initialed by the person making the entry at least at the end of each day.

Logbook page numbers will be entered on each page to facilitate identification of photocopies.

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

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

A technical review will be performed of each logbook, by a knowledgeable individual, such as the Field Manager, Project Manager or QC Supervisor, at a frequency commensurate with the level of activity (weekly is suggested, or at a minimum at the end of each phase of field work). These reviews will be documented by the dated signature of the reviewer on the last page or page immediately following the material reviewed.

6.0 RECORDS

The field logbook shall be retained as a permanent project record. If a particular field project requires submittal of photocopies of logbooks, this shall be performed as required. The field logbook shall be reviewed by the Project Manager on a monthly basis..

7.0 HEALTH AND SAFETY

In order to keep the logbook clean, it should be stored in a clean location and used only when outer gloves used for personal protective equipment have been removed.

8.0 REFERENCES

None.

9.0 ATTACHMENTS

1. Description of Logbook Entries

ATTACHMENT 1

DESCRIPTION OF LOGBOOK ENTRIES

Logbook entries shall contain the following information, as applicable, for each activity recorded. Some of these details may be entered on data forms as described previously.

Name of Activity

For example, Asbestos Bulk Sampling, Charcoal Canister Sampling, Aquifer Testing.

Task Team Members and Equipment

Name all members on the field team involved in the specified activity. List equipment used by serial number or other unique identification, including calibration information.

Activity Location

Indicate location of sampling area as indicated in the Field Sampling Plan.

Weather

Indicate general weather and precipitation conditions.

Level of Personal Protective Equipment

The level of personal protective equipment (PPE), e.g., Level D, should be recorded.

Methods

Indicate method or procedure number employed for the activity.

Sample Numbers

Indicate the unique numbers associated with the physical samples. Identify QC samples.

Sample Type and Volume

Indicate the media, container type, preservative, and the volume for each sample.

Time and Date

Record the time and date when the activity was performed (e.g., 0830/08/OCT/89). Utilize the 24-hour clock for recording the time and two digits for recording the day of the month and the year.

Analyses

Indicate the appropriate code for analyses to be performed on each sample, as specified in the Field Sampling Plan.

Field Measurements

Indicate measurements and field instrument readings taken during the activity.

Chain-of-Custody and Distribution

Indicate chain-of-custody for each sample collected and indicate to whom samples are transferred and the destination.

References

If appropriate, indicate references to other logs or forms, drawings or photographs employed in the activity.

Narrative (including time and location)

Create a factual, chronological record of the team's activities throughout the day, including the time and location of each activity. Include descriptions of any general problems encountered and their resolution. Provide the names and affiliations of non-field team personnel who visit the site, request changes in activity, impact to the work schedule, requested information, or observe team activities. Record any visual or other observations relevant to the activity, the contamination source, or the sample itself.

It should be emphasized that logbook entries are for data recording and chronologies of events. As a part of this, the logbook author must include observations and descriptive notations, taking care to be objective and recording no opinions or subjective comments unless appropriate.

Recorded by

Include the signature of the individual responsible for the entries contained in the logbook and referenced forms.

Checked by

Include the signature of the individual who performs the review of the completed entries.

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FIELD QC SAMPLES (WATER, SOIL)

1.0 PURPOSE

This standard operating procedure (SOP) describes in general the number and types of field Quality Control (QC) samples that will be collected during project field work. Additional information regarding the number and types of field QC samples is provided in the site-specific Quality Assurance Project Plan (QAPP).

2.0 SCOPE

This procedure applies to all site sample collection activities conducted during the field program. As professional guidance for specific activities, this procedure is not intended to obviate the need for professional judgement to accommodate unforeseen circumstances. Deviance from this procedure in planning or in the execution of planned activities must be approved by the Project Manager.

3.0 DEFINITIONS

None.

3.1 TRIP BLANK

Trip blanks are samples which originate from ASTM Type III analyte-free water taken from the laboratory to the sampling site and returned to the laboratory with samples to be analyzed for volatile organic compounds (NEESA 1988).

3.2 EQUIPMENT RINSATE SAMPLES

An equipment rinsate (i.e., "decontamination rinsate," or "equipment blank") sample consists of analyte-free water which has been poured over or through the sample collection equipment after its final decontamination rinse. Analytical results of equipment rinsate samples are used to access equipment cleanliness and the effectiveness of the decontamination process.

3.3 FIELD BLANKS

Field blanks are samples of the source water used as the final decontamination rinse water of sampling equipment, and should be from the same source water as used to generate the equipment rinsate sample.

3.4 FIELD DUPLICATE

A field duplicate is a second sample taken from the same source at the same time and analyzed under identical conditions to assist in evaluating sample variance. There are two types of duplicates: replicates and collocates. Replicates are identical samples that have typically been homogenized, while collocates are samples collected next to each other (e.g., laterally or vertically, in separate containers, and not homogenized).

4.0 RESPONSIBILITIES

The Field Program Manager and the Project Manager are responsible for ensuring that field QC samples are collected and analyzed according to this procedure. The Laboratory Manager is responsible for ensuring that field QC samples are analyzed according to the specifications of the project Statement of Work and the analytical methods used.

5.0 PROCEDURES

Field QC checks may include submission of trip blank, equipment rinsate, field blank, duplicate, and reference samples to the laboratory. Suggested frequency and types of QC check samples are discussed in the following guidance documents: *RCRA Technical Enforcement Guidance Document*, Section 4.6.1 (EPA 1986) and *Data Quality Objectives for Remedial Response Activities: Development Process*, Section C.6 (EPA 1987); the use and frequency of these field QC samples should be incorporated as appropriate. Types of field QC samples are discussed in general below. The frequency at which field QC samples should be collected for each QC level is provided in Table FP-F-2-1.

5.1 TRIP BLANKS

Trip blanks are samples which originate from analyte-free water taken from the laboratory to the sampling site and returned to the laboratory with samples to be analyzed for volatile organic compounds. Trip blanks shall be placed in sample coolers prior to transport to the site so that they accompany the samples throughout the sample collection/handling/transport process. Once prepared, trip blanks should not be opened before they reach the laboratory. One set of two 40 milliliter vials will form a trip blank and will accompany each cooler containing samples to be analyzed for volatile organics (VOCs) by methods such as CLP VOCs, 8010/601, 8020/602, 8240/624, and modified 8015 (only if purge and trap analysis is performed, e.g., for gasoline, not for extraction and analysis for diesel fuel). Trip blanks will only be analyzed for VOCs (EPA 1987). Results of trip blank analyses are used to determine whether samples have been contaminated by VOCs during sample handling and transport to the laboratory containing samples to be analyzed for volatile organics (VOCs) by methods such as CLP VOCs, 8010/601, 8020/602, 8240/624, and modified 8015 (only if purge and trap analysis is performed, e.g., for gasoline, not for extraction and analysis for diesel fuel). Trip blanks will only be analyzed for VOCs (EPA 1987). Results of trip blank analyses are used to assess whether samples have been contaminated by VOCs during sample handling and transport to the laboratory.

Table FP-F-2-1

FIELD QC SAMPLES PER SAMPLING EVENT

Type of Sample	Level C		Level D		Level E	
	Metal	Organic	Metal	Organic	Metal	Organic
Trip blank (for volatiles only)	NA[1]	1/cooler	NA[1]	1/cooler	NA[1]	1/cooler
Equipment rinsate[2]	1/day	1/day	1/day	1/day	1/day	1/day
Field blank	1/decontamination water source/event/for all QC levels and all analytes					
Field duplicates[3]	10%	10%	10%	10%	5%	5%
Background samples at least 1/sample media/sample event[4]						

Notes:
1) NA means not applicable.
2) Samples are collected daily; however, only samples from every other day are analyzed. Other samples are held and analyzed only if evidence of contamination exists.
3) The duplicate must be taken from the same sample that will become the laboratory matrix/spike duplicate for organics or for the sample used as a duplicate in inorganic analysis.
4) Sample event is defined from the time sampling personnel arrive at the site until they leave the site for more than a period of one week; the use of controlled-lot source water makes one sample per lot rather than per event an option.

Because trip banks are typically not analyzed for in tissue samples, they are not required for tissue sampling programs.

5.2 EQUIPMENT RINSATE SAMPLES

An equipment rinsate (i.e., "decontamination rinsate," or "equipment blank") sample consists of analyte-free water which has been poured over or through the sample collection equipment after its final decontamination rinse. One equipment rinsate sample shall be collected per day per sampling technique utilized that day (EPA 1986). Initially, rinsate samples from every other day will be analyzed. The samples will be analyzed for the same parameters for which samples collected utilizing a particular sampling method were analyzed. If analytes pertinent to the project are found in the rinsates, the remaining rinsate samples will be analyzed unless holding times have been exceeded. If no analytes are found in any rinsate samples, the frequency of analysis may be decreased from every other day to weekly. Results of rinsate samples are used to determine whether equipment decontamination was effective.

When disposable or dedicated sampling equipment is utilized, only one equipment rinsate sample will be collected per equipment lot or project phase. Disposable and/or dedicated sampling equipment may include stainless steel bowls or trowels that will be used for collection of only one soil sample, disposable bailers for ground-water sampling, dedicated submersible pumps for ground-water sampling, or other such equipment. These disposable and/or dedicated sampling equipment are typically pre-cleaned and individually wrapped by the manufacturer prior to delivery to the site. In this case, the equipment rinsate sample is used to provide verification that contaminants are not being introduced to the samples via sampling equipment.

Sampling devices (e.g., gloved hands, dip nets, or traps) for collection of tissue samples are generally non-intrusive into the organisms collected, so equipment rinsate samples will not be collected as long as the devices have been properly cleaned following SOP FP-D-5, *Equipment Decontamination*, and the devices appear clean.

5.3 FIELD BLANKS

Field blanks, consisting of samples of the source water used as the final decontamination rinse water, (both potable and deionized or distilled water sources) will be analyzed to assess whether the wash or rinse water contained contaminants that may have been carried over into the site samples.

The final decontamination rinse water source, the field blank source water, and equipment rinsate source water should all be from the same purified water source. Tap water used for steam cleaning augers or used in the initial decontamination buckets need not be collected and analyzed as a field blank, because augers typically do not touch the actual samples and because the final decontamination rinse water should be from a purified source.

Field blanks are collected at a frequency of one per sampling event per each source of water for all levels of QC. A sampling event is considered to be from the time sampling personnel arrive at a site until they leave for more than a week. Field blanks will be analyzed for the same analyses as the samples collected during the period that the water sources are being used for decontamination. If the same lot of the water source is used, a field blank needs to be collected only once per lot.

5.4 FIELD DUPLICATES

Field duplicates consist of either collocated or replicate samples. Collocated samples (soil samples collected from adjacent locations or liners or water samples collected from the same well at the same time) provide information on the entire sample measurement system, including sampling, analysis, and non-homogeneities of the media sampled. Replicates, which are collected at the same point in time (e.g., homogenized or split samples), provide information for various points in the analytical process. Sampling error can be approximated by the inclusion of collocated and replicated versions of the same sample.

Field duplicates for ground-water and surface water samples will generally consist of replicates. Field duplicates for soil samples will consist primarily of collocates. Soil field duplicates that are to be analyzed for volatile constituents will only consist of collocates; no soil samples that are to be analyzed for volatiles will be replicated (i.e., homogenized or otherwise processed or split) in the field. A separate sample will be collected to provide duplicates for non-volatile analyses. The sample may be homogenized and split in the field to form an original and duplicate (replicate) sample, or an additional volume into a separate sample container may be collected to form a duplicate (collocate) sample. Alternatively, replicates may be formed by homogenization in the laboratory. Duplicates will be analyzed for the same analytical parameters as their associated original sample.

Field duplicates for biological tissue samples will consist of splits of the original sample. Twice the required volume of organisms for one sample will be collected and placed into one foodgrade self-sealing bag. The sample will later be homogenized in the laboratory and split, producing an original and a replicate sample. Replicates will be analyzed for the same analytical parameters as their associated original samples.

6.0 RECORDS

Records of the collection of field QC samples should be kept in the sample logbook by the methods discussed in SOP III-EFP-F-6 *Record Keeping, Sample Labeling, and Chain-of-Custody.*

7.0 HEALTH AND SAFETY

Not applicable.

8.0 REFERENCES

EPA. 1986. RCRA Technical Enforcement Guidance Document.

EPA. 1987. Data Quality Objectives for Remedial Response Activities: Development Process

9.0 ATTACHMENTS

None.

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RECORD KEEPING, SAMPLE LABELING, AND CHAIN-OF-CUSTODY

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish standard protocols for all field personnel for use in maintaining field and sampling activity records, writing sample logs, labeling samples, ensuring that proper sample custody procedures are utilized, and completing chain-of-custody/analytical request forms. Additional information regarding record keeping, sample labeling, and sample custody procedures are provded in the site-specific Quality Assurance Project Plan (QAPP).

2.0 SCOPE

This procedure shall apply to all sample collection conducted during field program activities. As professional guidance for specific activities, this procedure is not intended to obviate the need for professional judgement to accommodate unforeseen circumstances. Deviance from this procedure in planning or in the execution of planned activities must be approved by the Project Manager and Technical Director/QA Program Manager.management personnel and documented.

3.0 DEFINITIONS

3.1 LOGBOOK

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

3.2 CHAIN-OF-CUSTODY

The process by which possession of a sample changes hands from the time of its collection in the field to its receipt by the analytical laboratory.

3.3 LABORATORY COORDINATOR

The person for each field project who is the main point of contact with the Laboratory Project Manager.

4.0 RESPONSIBILITIES

Field personnel are responsible for following these procedures during conduct of sampling activities. Field personnel are responsible for recording pertinent data into the logbook to satisfy project requirements and for attesting to the accuracy of the entries by dated signature.

The Field Program Manager is responsible for ensuring that all field personnel follow these procedures. The Laboratory Coordinator is responsible for verifying that the COC/Analytical Request Forms have been completed properly and match the sampling and analytical plan. The Project Manager or Laboratory Coordinator is responsible for notifying the laboratory, data managers, and data validators in writing if analytical request changes are required as a corrective action. These small changes are different from change orders, which involve changes to the scope of the subcontract with the laboratory and must be made with assistance from the Purchasing Department.

The Project Manager is responsible for determining which team members shall record information in the field logbook and for checking sample logbooks and chain-of-custody forms to ensure compliance with these procedures.

The Laboratory Project Manager or Sample Control Department Manager is responsible for reporting any sample documentation or chain-of-custody problems to the Project Manager or Laboratory Coordinator within 24 hours of sample receipt.

5.0 PROCEDURES

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

5.1 RECORD KEEPING

The field logbook serves as the primary record of field activities. Entries shall be made chronologically and in sufficient detail to allow the writer or a knowledgeable reviewer to reconstruct each day's events. Field logs such as soil boring logs and ground-water sampling logs will also be used. These procedures are described in SOP FP-F-5, *Field Logbooks*.

5.2 SAMPLE LABELING

A sample label with adhesive backing shall be affixed to each individual sample container. Clear tape will then be placed over each label (preferably prior to sampling) to prevent the labels from tearing off, falling off, being smeared, and to prevent loss of information on the label. The following information shall be recorded with a waterproof marker on each label:

- Project name or number (optional);
- EPA sample number;
- Date and time of collection;
- Sampler's initials;
- Matrix (optional);
- Sample preservatives (if applicable); and

- Analysis to be performed on sample (typically for water samples only). This shall be identified by the method number or name identified in the subcontract with the laboratory.

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

5.3 CUSTODY PROCEDURES

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

5.3.1 Sample Collection Custody Procedures

According to EPA *NEIC Policies and Procedures*, a sample is considered to be in custody if:

- It is in one's actual physical possession or view;

- It is in one's physical possession and has not been tampered with (i.e., it is under lock or official seal);

- It is retained in a secured area with restricted access; or

- It is placed in a container and secured with an official seal such that the sample cannot be reached without breaking the seal.

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

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

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

Field personnel shall also log individual samples onto carbon copy chain-of-custody forms when a sample is collected. These forms may also serve as the request for analyses. Procedures for completing these forms are discussed in Section 5.4 indicating sample EPA number, matrix, date and time of collection, number of containers, analytical methods to be performed on the sample, and preservatives added (if any). The samplers will also sign the COC form signifying that they were the personnel who collected the samples. The COC form shall accompany the samples from the field to the laboratory. When a cooler is ready for shipment to the analytical laboratory, the person delivering the samples for transport will sign and indicate the date and time on the accompanying COC form. One copy of the COC form will be retained by the sampler and the remaining copies of the COC form shall be placed inside a self-sealing bag and taped to the inside of the cooler. Each cooler must be associated with a unique COC form. Whenever a transfer of custody takes place, both parties shall sign and date the accompanying carbon copy COC forms, and the individual relinquishing the samples shall retain a copy of each form. One exception is when the samples are shipped; the delivery service personnel will not sign or receive a copy because they do not open the coolers. The laboratory shall attach the original completed

COC forms to the reports containing the results of the analytical tests. An example of a COC form is provided in Attachment 2.

5.3.2 Laboratory Custody Procedures

The following are custody procedures to be followed by an independent laboratory receiving samples for chemical analysis. A designated sample custodian shall take custody of all samples upon their arrival at the analytical laboratory. The custodian shall inspect all sample labels and COC forms to ensure that the information is consistent, and that each is properly completed. The custodian will also measure the temperature of the samples in the coolers upon arrival. The custodian shall also note the condition of the samples including:

- If the samples show signs of damage or tampering;
- If the containers are broken or leaking;
- If headspace is present in sample vials;
- Proper preservation of samples (made by pH measurement); and
- If any sample holding times have been exceeded.

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

Any discrepancy or improper preservation shall be noted by the laboratory as an out-of-control event and shall be documented on an out-of-control form with corrective action taken. The out-of-control form shall be signed and dated by the sample control custodian and any other persons responsible for corrective action.

The custodian shall then assign a unique laboratory number to each sample and distribute the samples to secured storage areas maintained at 4°C. The unique laboratory number for each sample, the EPA sample number, the client name, date and time received, analysis due date, and storage shall also be manually logged onto a sample receipt record and later entered into the laboratory's computerized data management system. The custodian shall also sign the shipping bill and maintain a copy.

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

5.4 COMPLETING CHAIN-OF-CUSTODY/ANALYTICAL REQUEST FORMS

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

Attachment 2 is an example of a generic COC/analytical request form that may be used by field personnel. Multi-ply copies may be tailored to the project so that much of the information described below need not be handwritten each time. Completed COC/ analytical request forms must contain the following information:

- **Project Manager:** This name shall be the name that will appear on the report.

- **Project Name:** Shall be written as it is to appear on the report.

- **Project Number:** Shall be written as it is to appear on the report. It shall include the project number, task number, and general ledger section code. The laboratory subcontract number should also be included.

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

- **Sample Disposal Instructions:** These instructions will be stated in the Basic Ordering Agreement (BOA) or each statement of work with each laboratory.

- **Shipment Method:** e.g., FED EX, AIR BORNE, DHL, hand carry

- **Comment:** This area shall be used by the field team to communicate observations, potential hazards, or limitations which may have occurred in the field or additional information regarding analysis. For example: a specific metals list, explanation of Mod 8015, Mod 8015 + Kerosene, samples expected to contain high analyte concentrations.

- **Cooler Number:** This will be written somewhere on the inside or outside of the cooler and shall be included on the COC. Some laboratories attach this number to the trip blank ID which helps track VOA samples. If a number is not on the cooler, field personnel shall assign a number, write it on the cooler, and write it on the COC.

- **QC Level:** Enter the reporting/QC requirements, e.g., NEESA QC Level C, D, or E

- **Turn around time (TAT):** TAT for contract work will be determined by a sample delivery group (SDG) which may be formed over a 14-day period, not to exceed 20 samples. Standard turnaround time once the SDG has been completed is 35 calendar days from receipt of the last sample in the SDG. Entering NORMAL or STANDARD in this field will be acceptable. If quicker TAT is required, it shall be in the subcontract with the laboratory and reiterated on each COC to remind the laboratory.

- **Type of containers:** The type of container used, e.g., 1 liter glass amber, for a given parameter in that column.

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

- **EPA number:** Five-character alpha-numeric identifier to be used by the laboratory to identify samples. The use of this identifier is important since the labs are restricted to the number of characters they are able to use. See SOP I-A-9FP-B-8, *Sample Naming*.

- **Description (sample identification):** This name will be determined by the location and description of the sample, as described in SOP FP-B-8, *Sample Naming*. This sample identification should not be submitted to the laboratory, but should be left blank. If a computer COC version is used, the sample identification can be input but printed with this block black. A cross-reference list of EPA number and sample identification must be maintained separately., as stated in SOP DMP-9, *Chain-of-Custody Logbook*.

- **Date Collected:** Collection date must be recorded in order to track the holding time of the sample. Note: For trip blanks, record the date it was placed in company with samples.

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

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

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

- **Analytical Parameters:** Enter the parameter by descriptor and the method number desired. For example, Attachment 3 shows OLM01.8V as a column heading; this includes the CLP revision number and an indicator of the analytical category. When requesting metals that are modifications of the standard lists, define the list in the comment section. This would not be necessary when requesting standard list metals such as priority pollutant metals (PPM), target compound list (TCL) from ILM03.0, and Title 22 metals which are groups of metals commonly requested and should not cause any confusion as to what metals are being analyzed. Whenever possible, list the parameters as they appear in the laboratory subcontract to maintain consistency and avoid confusion.

  In the boxes below the analytical parameter, indicate the number of containers collected for each parameter by marking an "X". If more than one container is used for a sample, write a number in the desired box to indicate a request for analysis and to indicate the number of containers sent for that analysis.

- **Sampler's Signature:** Person who collected samples

- **Relinquished By:** Person's signature who turned over the custody of the samples to a second party other than a carrier such as FED EX, DHL or Air Borne.

- **Received By:** Typically, this is signed by a representative of the receiving laboratory. Or, this signature could be from a field crew member who would deliver the samples in person from the field to the laboratory. A courier such as Federal Express or DHL does not sign this because they do not open the coolers. It must also be used by the prime contracting laboratory when samples are to be sent to a subcontractor.

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

- **Received By (Laboratory):** Final destination, e.g., at a subcontracted laboratory.

- **Lab Number and Questions:** This box is to be filled in by the laboratory only.

- **Control Number:** "COC" followed by the first EPA number in that cooler, or contained on that COC. This control number must be unique and never used twice. Record the date the COC is completed. This should be the same date the samples are collected.

- **Total No. of Containers/row:** Sum the number of containers in that row.

- **Total No. of Containers/column:** Sum the number of containers in that column. Because COC forms contain different formats based upon who produced the form, not all of the information listed in items 1 to 13 may be recorded. However, as much of this information as possible shall be included.

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

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

6.0 RECORDS

The COC/analytical request form shall be faxed daily to the Laboratory Coordinator for verification of accuracy. Following the completion of sampling activities, the sample logbook and COC forms will be transmitted to the Project Manager for storage in project files. The Project Manager shall review COC forms on a monthly basis at a minimum. The data validators shall receive a copy also. The original COC/analytical request form shall be submitted by the laboratory along with the data delivered. Any changes to the analytical requests that are required shall be made in writing to the laboratory. A copy of this written change shall be sent to the data validators and placed in the project files. The reason for the change shall be included in the project files so that recurring problems can be easily identified.

7.0 HEALTH AND SAFETY

Not applicable.

8.0 REFERENCES

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

USEPA. 1986. EPA NEIC Policies and Procedures, National Enforcement Investigations Center, Denver, Colorado.

USEPA. 1986. RCRA Ground-Water Monitoring Technical Enforcement Guidance Document (TEGD).

USEPA. 1986. Test Methods for Evaluating Solid Waste (SW-846), Third edition.

USEPA. 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (EPA USWER Directive 9355 3-01).

9.0 ATTACHMENTS

1. Chain-of-Custody Seal
2. Generic Chain-of-Custody/Analytical Request Form

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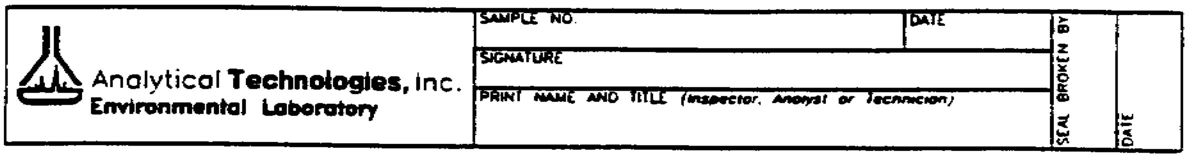
ATTACHMENT 1

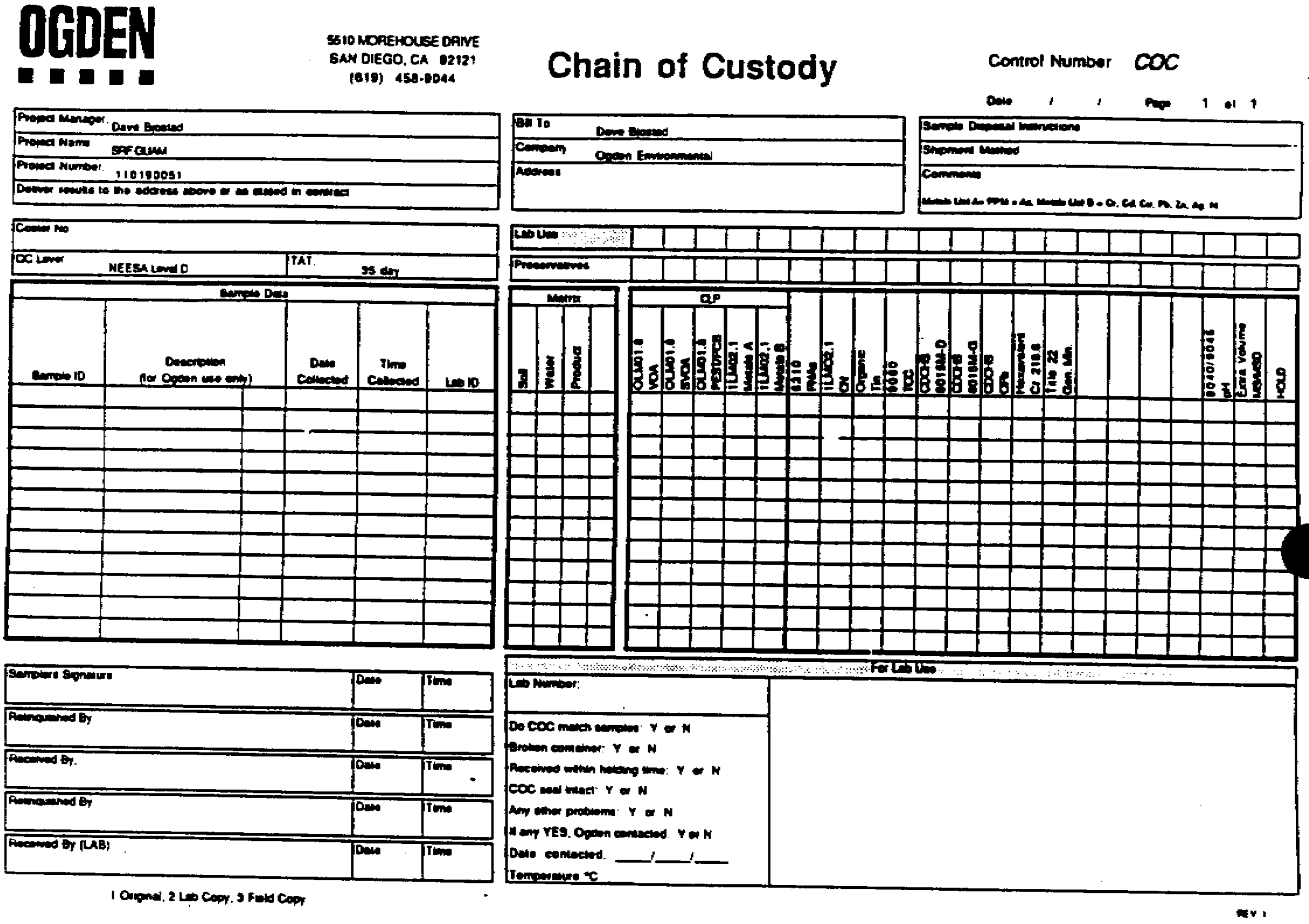
CHAIN-OF-CUSTODY SEAL



Analytical **Technologies**, Inc.
Environmental Laboratory

SAMPLE NO.
DATE
SIGNATURE
PRINT NAME AND TITLE *(Inspector, Analyst or Technician)*
SEAL BROKEN BY
DATE

ATTACHMENT 2
CHAIN-OF-CUSTODY FORM



OGDEN

5510 MOREHOUSE DRIVE
SAN DIEGO, CA 92121
(619) 458-9044

Chain of Custody

Control Number COC

Date / / Page 1 of 1

Project Manager: Dave Bjostad
Project Name: SRF GUAM
Project Number: 110190051
Deliver results to the address above or as stated in contract

Bill To: Dave Bjostad
Company: Ogden Environmental
Address:

Sample Disposal Instructions
Shipment Method
Comments
Metals List A = PPM + As, Metals List B = Cr, Cd, Cu, Pb, Zn, Ag, Ni

Cooler No
QC Level: NEESA Level D
TAT: 35 day

Lab Use
Preservatives

Sample Data				
Sample ID	Description (for Ogden use only)	Date Collected	Time Collected	Lab ID

Matrix				CLP																				
Soil	Water	Product		OLM01.8 VOA	OLM01.8 SVOA	OLM01.8 PEST/PCB	ILM02.1 Metals A	ILM02.1 Metals B	8310 PAHs	ILM02.1 CN	Organic Tin	8080 TOC	CDD-8 8015M-D	CDD-8 8015M-G	CDD-8 CFs	Hexavalent Cr 218.6	Title 22 Gen. Min.					8040/8048 pH	Extra Volume MS/MSD	HOLD

Samplers Signature	Date	Time
Relinquished By	Date	Time
Received By.	Date	Time
Relinquished By	Date	Time
Received By (LAB)	Date	Time

1 Original, 2 Lab Copy, 3 Field Copy

For Lab Use

Lab Number:

Do COC match samples: Y or N
Broken container: Y or N
Received within holding time: Y or N
COC seal intact: Y or N
Any other problems: Y or N
If any YES, Ogden contacted. Y or N
Date contacted. ____/____/____
Temperature °C

REV 1

SAMPLE HANDLING, STORAGE, AND SHIPPING

1.0 PURPOSE

The objective of this standard operating procedure (SOP) is to provide standard methods for use by field personnel in handling, storing, and transporting samples following their collection. Additional information regarding the handling, storing, and transporting samples is provided in the site-specific Quality Assurance Project Plan (QAPP).

2.0 SCOPE

This procedure is applicable to all samples, and sample containers handled, stored, shipped, or otherwise transported during project field activities. As professional guidance for specific activities, this procedure is not intended to obviate the need for professional judgement to accommodate unforeseen circumstances. Deviance from this procedure in planning or in the execution of planned activities must be approved by the Project Manager.

3.0 DEFINITIONS

None.

4.0 RESPONSIBILITIES

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

The Project Manager and the Laboratory Project Manager are responsible for identifying instances of non-compliance with this procedure and ensuring that future sample transport activities are in compliance with this procedure.

5.0 PROCEDURE

5.1 HANDLING AND STORAGE

Immediately following collection, all samples will be labeled according to the procedures in SOP FP-F-6, *Record Keeping, Sample Labeling, and Chain-of-Custody*. The lids of the containers shall not be sealed with duct tape, but may be covered with custody seals or placed directly into self-sealing bags. The sample containers will be placed in an insulated cooler with frozen gel packs (such as "blue ice") or ice in double, sealed self-sealing bags. Samples should occupy the lower portion of the cooler, while the ice should occupy the upper portion. Styrofoam pads shall be placed on the bottom and top (and optionally on the sides) of the inside of the cooler. An absorbent material (e.g., proper absorbent cloth material) shall be placed on the bottom of the cooler to contain liquids in case of spillage. All empty space between sample containers shall be filled with styrofoam "peanuts" or other appropriate material. Prior to shipping, glass sample containers should be wrapped on the sides, tops, and bottoms with bubble wrap or other appropriate padding and/or surrounded by styrofoam to prevent breakage during transport. All glass containers for water samples must be packed in a upright position, not on their sides or stacked. Prior to shipment, the ice or cold packs in the coolers will be replaced so that samples will be maintained as close to 4°C as possible from the time of collection through transport of the samples to the analytical laboratory. Samples shall be shipped within 24 hours as soon as possible to allow the laboratory to meet holding times for analyses.

Another activity that may be performed to keep samples as close to 4°C as possible during sample storage prior to shipment is to place dry ice in the cooler with soil samples during sample collection. Dry ice should be removed prior to shipment and be replaced with ice in two self-sealing bags or frozen gel packs. Dry ice should only be used with non-glass sample containers, since the dry ice may freeze the samples.

5.2 SHIPPING

All appropriate U.S. Department of Transportation (DOT) regulations (e.g., 49 Code of Federal Regulations (CFR), Parts 171-179) shall be followed in shipment of air, soil, water, and other samples.

5.2.1 Hazardous Materials Shipment

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

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

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

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

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

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

5.2.2 Non-hazardous Materials Shipment

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

When a cooler is ready for shipment to the laboratory, two copies of the chain-of-custody form shall be placed inside a self-sealing bag and taped to the inside of an insulated cooler. The coolers will then be sealed with waterproof tape and labeled "Fragile," "This-End-Up" (or directional arrows pointing up), or other appropriate notices. Chain-of-custody seals will be placed on the coolers as discussed in SOP FP-F-6, *Record Keeping, Sample Labeling, and Chain-of-Custody.*

6.0 RECORDS

Records shall be maintained as required by implementing these procedures.

7.0 HEALTH AND SAFETY

Avoid lifting heavy coolers with back muscles; instead, use leg muscles or dollies. Wear proper gloves when handling sample containers to avoid contacting any materials that may have spilled out of the sample containers.

8.0 REFERENCES

None.

9.0 ATTACHMENTS

1. Example Package Marking
2. Packing Groups
3. Label for Dangerous Goods in Excepted Quantities
4. SW-846 Preservative Exception

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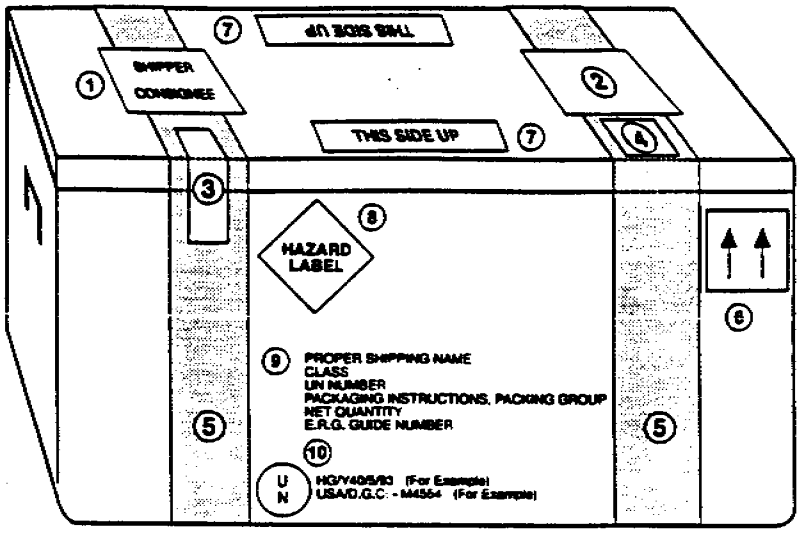
ATTACHMENT 1
EXAMPLE HAZARDOUS MATERIAL PACKAGE MARKING



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

ATTACHMENT 2
PACKING GROUPS

Quantity Limits for Inner and Outer Packagings

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

Note A: *Packing groups are not used for this class or division.*

Note B: *For inner packagings, the quantity contained in receptacle with a water capacity of 30 mL. For outer packagings, the sum of the water capacities of all the inner packagings contained must not exceed 1 L.*

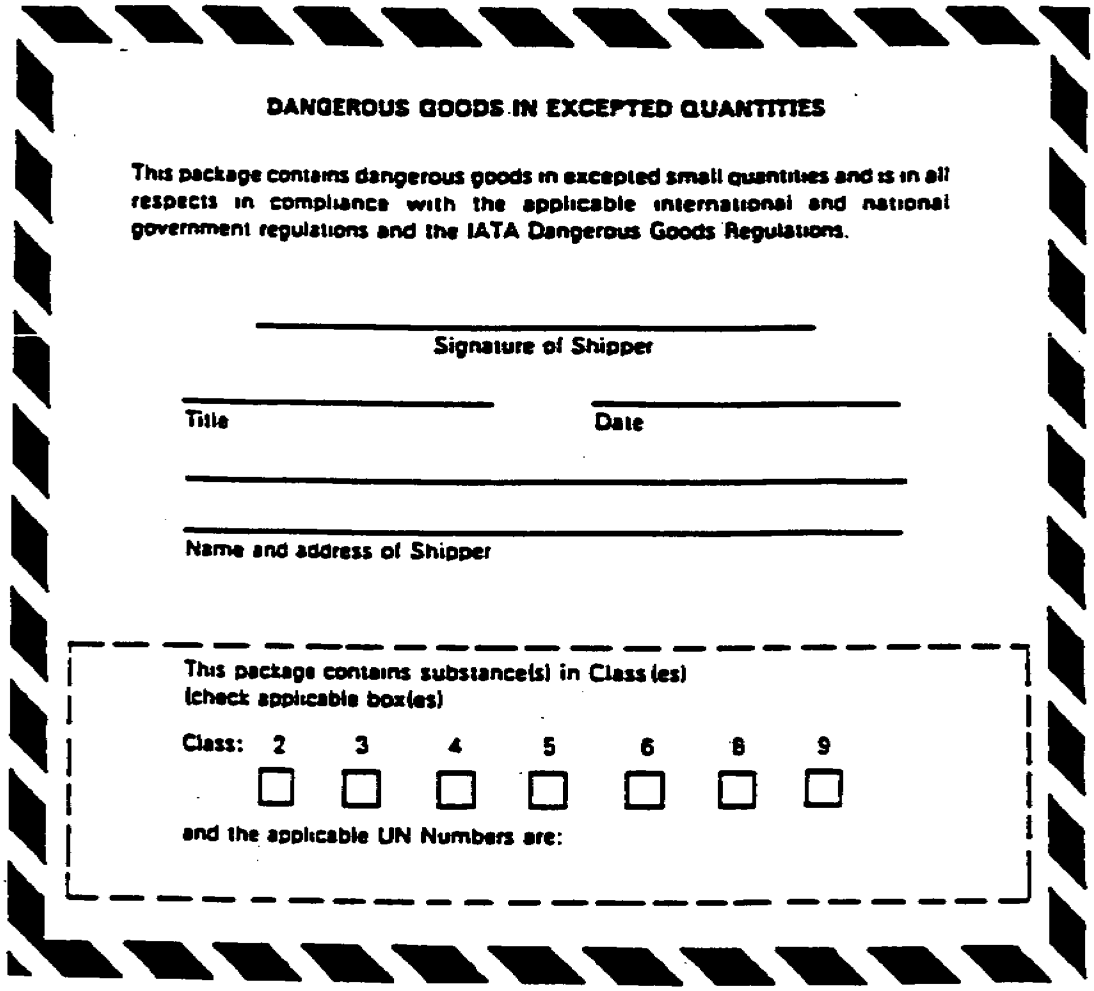
Note C: *Applies only to Organic Peroxides when contained in a chemical kit, first aid kit or polyester resin kit.*

Note D: *See 6.1.4.1, 6.1.4.2 and 6.2.1.1 through 6.2.1.7, radioactive material in excepted packages.*

Note E: *For substances in Class 9 for which no packing group is indicated in the List of Dangerous Goods, Packing Group II quantities must be used.*

ATTACHMENT 3

LABEL FOR DANGEROUS GOODS IN EXCEPTED QUANTITIES



DANGEROUS GOODS IN EXCEPTED QUANTITIES

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

Signature of Shipper

Title

Date

Name and address of Shipper

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

Class:	2	3	4	5	6	8	9
	☐	☐	☐	☐	☐	☐	☐

and the applicable UN Numbers are:

ATTACHMENT 4

PRESERVATIVE EXCEPTION

Measurement	Vol. Req. (ml)	Container[2]	Preservative[3,4]	Holding Time[5]
MBAS	250	P,G	Cool, 4°C	48 Hrs.
NTA	50	P,G	Cool, 4°C	24 Hrs.

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

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

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

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

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

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

CHAIN-OF-CUSTODY LOGBOOK

1.0 PURPOSE

This standard operating procedure (SOP) describes the general process recommended for tracking sample and analytical information for sampling projects.

2.0 SCOPE

This procedure applies to Ogden projects and personnel that involve field sample collection, laboratory analysis, and database management using Paradox software, especially where large amounts of data are involved. Smaller projects, or those that will not manage data in the Paradox database, may use a modified procedure or do not need to follow this procedure.

3.0 DEFINITIONS

Chain-of-Custody (COC) Logbook - This is a database file that contains sample and sampling information for a specific field project. Information which has been manually entered can be used to track samples and associated analyses for each sample, as well as other sample information. Section 5.2 below defines the structure of the COC Logbook. Attachment 1 shows an example COC Logbook printout.

4.0 RESPONSIBILITIES

The Project Manager shall ensure that this procedure is followed. The database manager, laboratory coordinator, and field QC Coordinator shall coordinate with each other from the planning stage through implementation to ensure that this procedure is followed.

5.0 PROCEDURES

5.1 USE OF THE COC LOGBOOK

The Project Manager, Database Manager, Office Laboratory Coordinator, and/or Field QC coordinator shall plan the structure and use of the COC Logbook in advance of the start of field sampling.

The COC Logbook shall be created as a Paradox database if the database will be used to store, sort, and query data. The fields in the COC Logbook database may be modified for each project, depending on the analytical methods to be used and other special information desired. Typical information used and a description of its use is provided in Attachment 1. An example table printout for a COC Logbook is included as Attachment 2.

The COC Logbook may be partially completed prior to the start of field sampling and be used as a reference for field sampling personnel. For example, the analytical request portion may be completed in advance, which will help the field sampling personnel avoid mistakes.

The COC Logbook may be completed in the field or later in the office via faxed copies of the COC/analytical requests. If the COC Logbook is updated daily or at least weekly, it can be used on a more timely basis to verify that the sampling and analysis plan is being followed. To update the COC Logbook, information from the COC/analytical request form is manually entered into the COC Logbook.

The COC Logbook may be used as a tool to check that the analytical plan is being followed, to check the data received to ensure that all requested analyses were performed, to facilitate invoice payment, to sort and query data in the database, and to place as a table in the project report to identify sample information and analyses performed for each sample. It may be used as a cross-reference of EPA number to sample identification for each sample. Data validators may use information regarding associated field QC samples, cooler temperature, and date collected.

Costing information can be incorporated into the COC Logbook, but may be better handled by downloading data regarding numbers of samples per matrix per analytical method into a spreadsheet, then computing costs. Alternatively, the process per matrix per field project may be entered into, calculated in, then printed as a report from the database.

The COC Logbook may be completed in a spreadsheet, although the data transfer step introduces more chances for mistakes, requires more thorough verification, and repeated work.

5.2 COC LOGBOOK STRUCTURE

The structure of the COC Logbook is outlined in this section. Most of the COC Logbook database fields will be necessary for all sampling projects, except for the analytical methods field which will vary for each project. The field type and maximum character size requirements shall be set in advance by the database manager and Project Manager.

In general, the COC Logbook will contain information sample by sample. These fields include EPA number, sample identification, internal laboratory tracking number, SDG number, matrix, Unified Soil Classification System (USCS) soil type, functional area within a site, date sampled, analytical methods requested, x and y coordinates, depth below ground surface, and field QC samples associated with each sample. Attachment 2 describes common fields used in the COC Logbook.

In general, each field must contain no more than eight characters. A header must be provided for each field. The analytical method name must be consistent between the COC Logbook and the laboratory statement of work; the laboratory must use the same names in all electronic data deliverables. The order of fields entered into the database does not matter because sorting and querying can be performed by using the field header.

In the analytical methods fields, the following designations shall be used:

X = analysis requested and ultimately analyzed
A = analysis added after the original COC was submitted

D = analysis was deleted after original COC was submitted (e.g., not enough sample volume was received)

L = sample was lost during transport or laboratory preparation and analysis could not be performed

E = extra result provided by the laboratory although it was not requested

6.0 RECORDS

The COC Logbook is the record that will be created. It typically will be created in the database, but may alternatively be created in a spreadsheet and then loaded into the database. A table can be printed to include in the project report to serve as a list of which samples were analyzed for which analyses.

7.0 HEALTH AND SAFETY

Not applicable.

8.0 REFERENCES

None.

9.0 ATTACHMENTS

Attachment 1 - Common COC Logbook Fields
Attachment 2 - Example COC Logbook table printout

ATTACHMENT 1

COMMON COC LOGBOOK FIELDS

(refer to Attachment 2 for example printout)

EPA NO. = 5-character unique identification assigned by field personnel, used for tracking in the laboratory and in the environmental database

OGDEN ID = Sample identification 9-character name assigned by field personnel to give meaning to each sample

LAB_SAMPLE_NO = Internal laboratory tracking number assigned by the laboratory personnel for internal tracking purposes

MATRIX = e.g., W = water, S = soil, A = air

UNIT = Functional area within a site - e.g., source area(s), downstream areas, upstream reference areas, receptor locations

COOLER ID = cooler identification for tracking of shipments

DATE_SAMP = Date sampled as recorded on the COC

TEMP_C = Temperature - temperature measured and reported by the laboratory upon sample receipt. This corresponds to each cooler.

DATE_SHIPPED = date shipped from site, used for tracking shipments only (optional)

DATE_RECD = date received by the laboratory (optional)

SDG = Sample Delivery Group (SDG) number assigned by the laboratory or CTO personnel for each batch of not more than 20 samples

QC = identifies which sample was sent with a larger volume and used as a laboratory matrix spike/matrix spike duplicate (MS/MSD) Analytical methods requested - will contain one field for each analytical method used for each project. e.g., OLM01.8V = volatile organics by the CLP method, 7196 = hexavalent chromium analysis by EPA Method 7196, etc. Part C of the laboratory Basic Ordering Agreement (BOA) contains identifiers for most common laboratory methods.

HOLD = whether a sample was requested to be held and not analyzed

NOTE = add notes

ER_REF = equipment rinsate field QC samples associated with each sample

FB_REF = field blank field QC samples associated with each sample

TB_REF = trip blank field QC samples associated with each sample

USCS_TYPE = United States Soil Conservation Service (USCS) soil type - used to assess geological conditions

LATITUDE = y coordinate, or easting, or distance from a fixed point, used for plotting data on maps

LONGITUDE = x coordinate, or northing, or distance from a fixed point, used for plotting data on maps

DEPTH = Depth below ground surface (bgs), or z coordinate

ATTACHMENT 2

EXAMPLE COC LOGBOOK TABLE PRINTOUT

EPA NO	OGDEN ID	LAB SAMPLE NO	MTX	DEPTH	X	Y	FUNCTIONAL AREA	USCS SOIL TYPE	DATE SAMPLED	TEMP C	DATE SHIPPED	DATE REC'D
DB160	BFBS03S01	9306S066-002	S	2.50	130.395.99	151.881.06	N-UST	SW	6/9/93	5	6/10/93	6/11/93
DB161	BFBS03S03	9306S066-003	S	5.50	130.395.99	151.881.06	N-UST	SW	6/9/93	5	6/10/93	6/11/93
DB165	BFBS04D01	9306S085-003	S	4.50	130.450.76	151.891.16	N-UST	SW	6/11/93	2	6/12/93	6/14/93
DB167	BFBS04G01	9306S085-005	S	14.00	130.450.76	151.891.16	N-UST	SM	6/11/93	2	6/12/93	6/14/93
DB164	BFBS04S01	9306S085-002	S	3.00	130.450.76	151.891.16	N-UST	SW	6/11/93	2	6/12/93	6/14/93
DB166	BFBS04S02	9306S085-004	S	8.00	130.450.76	151.891.16	N-UST	SW	6/11/93	2	6/12/93	6/14/93
DB173	BFBS05S02	9306S118-002	S	4.50	130.417.68	151.862.71	N-UST	SW	6/15/93	5	6/16/93	6/17/93
DB174	BFBS05S03	9306S118-003	S	5.50	130.417.68	151.862.71	N-UST	SW	6/15/93	5	6/16/93	6/17/93
DB189	BFBS05S04	9306S151-002	S	9.00	130.417.68	151.862.71	N-UST	SC	6/17/93	13	6/18/93	6/21/93
DB157	BFBS06G01	9306S048-004	S	18.00	130.430.79	151.811.86	N-UST	SW	6/7/93	6	6/8/93	6/9/93
DB155	BFBS06S02	9306S048-002	S	4.00	130.430.79	151.811.86	N-UST	GW	6/7/93	6	6/8/93	6/9/93
DB156	BFBS06S05	9306S048-003	S	8.50	130.430.79	151.811.86	N-UST	SW	6/7/93	6	6/8/93	6/9/93
DB213	BFBS07D01	9306S253-003	S	2.50	131.173.43	150.484.02	S-Looped Road	SW	6/28/93	5	6/29/93	6/30/93
DB214	BFBS07G01	9306S253-004	S	6.50	131.173.43	150.484.02	S-Looped Road	GW	6/28/93	5	6/29/93	6/30/93
DB232	BFBS07G02	9307S413-006	S	37.00	131.173.43	150.484.02	S-Looped Road	GC	7/16/93	15	7/17/93	7/20/93
DB212	BFBS07S01	9306S253-002	S	2.50	131.173.43	150.484.02	S-Looped Road	SW	6/28/93	5	6/29/93	6/30/93
DB215	BFBS07S02	9306S253-005	S	8.50	131.173.43	150.484.02	S-Looped Road	CL	6/28/93	5	6/29/93	6/30/93
DB204	BFBS08G01	9306S196-004	S	13.00	131.232.55	150.481.16	S-Looped Road	SP	6/21/93	10	6/22/93	6/24/93
DB202	BFBS08S01	9307S288-009	S	2.50	131.232.55	150.481.16	S-Looped Road	SW	6/30/93	9	7/1/93	7/2/93
DB203	BFBS08S04	9306S196-003	S	8.50	131.232.55	150.481.16	S-Looped Road	ML	6/21/93	10	6/22/93	6/24/93
DB206	BFBS09G01	9306S196-006	S	4.50	131.373.33	150.464.87	S-Looped Road	GW	6/21/93	10	6/22/93	6/24/93
DB205	BFBS09S01	9306S196-005	S	2.50	131.373.33	150.464.87	S-Looped Road	GW	6/21/93	10	6/22/93	6/24/93
DB207	BFBS09S02	9306S196-007	S	6.50	131.373.33	150.464.87	S-Looped Road	GW	6/21/93	10	6/22/93	6/24/93
DB197	BFBS10D01	9306S152-004	S	5.00	131.236.51	150.445.90	S-Looped Road	SW	6/18/93	7	6/19/93	6/21/93
DB198	BFBS10G01	9306S152-005	S	7.00	131.236.51	150.445.90	S-Looped Road	SW	6/18/93	7	6/19/93	6/21/93
DB196	BFBS10S01	9306S152-003	S	4.00	131.236.51	150.445.90	S-Looped Road	SW	6/18/93	7	6/19/93	6/21/93
DB199	BFBS10S02	9306S152-006	S	9.00	131.236.51	150.445.90	S-Looped Road	SW	6/18/93	7	6/19/93	6/21/93
DB192	BFBS11G01	9306S151-005	S	16.00	131.239.00	150.398.59	S-Looped Road	GM	6/17/93	13	6/18/93	6/21/93
DB190	BFBS11S02	9306S151-003	S	4.50	131.239.00	150.398.59	S-Looped Road	GW	6/17/93	13	6/18/93	6/21/93
DB191	BFBS11S03	9306S151-004	S	8.50	131.239.00	150.398.59	S-Looped Road	SW	6/17/93	13	6/18/93	6/21/93
DB176	BFBS12G01	9306S118-005	S	4.50	130.477.34	151.839.54	N-UST	SW	6/15/93	5	6/16/93	6/17/93
DB175	BFBS12S01	9306S118-004	S	1.50	130.477.34	151.839.54	N-UST	SW	6/15/93	5	6/16/93	6/17/93
DB171	BFBS13G01	9306S085-009	S	8.50	130.422.75	151.906.20	N-UST	SM	6/11/93	2	6/12/93	6/14/93
DB170	BFBS13S01	9306S085-008	S	4.50	130.422.75	151.906.20	N-UST	SW	6/11/93	2	6/12/93	6/14/93
DB183	BFBS14D01	9306S132-006	S	4.50	130.156.10	150.478.91	S-Concrete Pad	SW	6/16/93	3	6/17/93	6/18/93
DB182	BFBS14S01	9306S132-005	S	3.00	130.156.10	150.478.91	S-Concrete Pad	SW	6/16/93	3	6/17/93	6/18/93
DB184	BFBS14S02	9306S132-007	S	5.50	130.156.10	150.478.91	S-Concrete Pad	SW	6/16/93	3	6/17/93	6/18/93
DB181	BFBS15G01	9306S132-004	S	7.00	130.268.34	150.496.59	S-Concrete Pad	GC	6/16/93	3	6/17/93	6/18/93
DB179	BFBS15S01	9306S132-002	S	2.50	130.268.34	150.496.59	S-Concrete Pad	GC	6/16/93	3	6/17/93	6/18/93
DB180	BFBS15S02	9306S132-003	S	5.00	130.268.34	150.496.59	S-Concrete Pad	GC	6/16/93	3	6/17/93	6/18/93
DB185	BFBS16S01	9306S132-008	S	3.00	130.383.29	150.575.29	S-Concrete Pad	SW	6/16/93	3	6/17/93	6/18/93
DB186	BFBS16S02	9306S132-009	S	5.00	130.383.29	150.575.29	S-Concrete Pad	SW	6/16/93	3	6/17/93	6/18/93
DC058	PSBS02G01	9307S272-004	S	8.50	132.004.65	151.213.04	Background	SW	6/29/93	6	6/30/93	7/1/93
DC056	PSBS02S02	9307S272-002	S	4.50	132.004.65	151.213.04	Background	GW	6/29/93	6	6/30/93	7/1/93
DC057	PSBS02S03	9307S272-003	S	6.50	132.004.65	151.213.04	Background	GW	6/29/93	6	6/30/93	7/1/93
DC028	PSBS03D03	9306S196-012	S	7.00	132.124.75	151.183.40	Leach Field NE	GW	6/22/93	8	6/23/93	6/24/93
DC029	PSBS03G01	9306S196-013	S	14.00	132.124.75	151.183.40	Leach Field NE	LS	6/22/93	8	6/23/93	6/24/93
DC026	PSBS03S01	9306S196-010	S	3.00	132.124.75	151.183.40	Leach Field NE	SW	6/22/93	8	6/23/93	6/24/93
DC027	PSBS03S03	9306S196-011	S	7.00	132.124.75	151.183.40	Leach Field NE	GW	6/22/93	8	6/23/93	6/24/93
DC062	PSBS04G01	9307S272-008	S	8.50	132.072.14	151.164.31	Leach Field N	GM	6/29/93	6	6/30/93	7/1/93
DC060	PSBS04S02	9307S272-006	S	4.50	132.072.14	151.164.31	Leach Field N	GW	6/29/93	6	6/30/93	7/1/93
DC061	PSBS04S03	9307S272-007	S	6.50	132.072.14	151.164.31	Leach Field N	GM	6/29/93	6	6/30/93	7/1/93
DC047	PSBS05G01	9306S229-012	S	7.50	132.066.68	151.149.17	Leach Field	GW	6/25/93	4	6/26/93	6/28/93
DC048	PSBS05G02	9306S230-001	S	10.00	132.066.68	151.149.17	Leach Field	GM	6/25/93	4	6/26/93	6/28/93
DC045	PSBS05S01	9306S229-010	S	3.50	132.066.68	151.149.17	Leach Field	GW	6/25/93	2	6/26/93	6/28/93
DC046	PSBS05S02	9306S229-011	S	5.50	132.066.68	151.149.17	Leach Field	GW	6/25/93	2	6/26/93	6/28/93
DC053	PSBS06G01	9306S253-008	S	12.00	132.077.93	151.143.50	Leach Field	SW	6/28/93	5	6/29/93	6/30/93
DC075	PSBS06G02	9307S346-001	S	41.00	132.077.93	151.143.50	Leach Field	GC	7/9/93		7/10/93	7/12/93
DC051	PSBS06S02	9306S253-006	S	4.50	132.077.93	151.143.50	Leach Field	GW	6/28/93	5	6/29/93	6/30/93
DC052	PSBS06S03	9306S253-007	S	6.50	132.077.93	151.143.50	Leach Field	GW	6/28/93	5	6/29/93	6/30/93
DC033	PSBS07G01	9306S207-003	S	4.50	132.131.01	151.126.37	Leach Field SE	SW	6/23/93	4	6/24/93	6/25/93
DC032	PSBS07S01	9306S207-002	S	2.50	132.131.01	151.126.37	Leach Field SE	SW	6/23/93	4	6/24/93	6/25/93
DC034	PSBS07S02	9306S207-004	S	6.50	132.131.01	151.126.37	Leach Field SE	SW	6/23/93	4	6/24/93	6/25/93
DC038	PSBS08D02	9306S229-003	S	4.50	132.087.05	151.100.22	Leach Field SE	GW/W	6/24/93	17	6/25/93	6/28/93

ATTACHMENT 2 (CONTINUED)
EXAMPLE COC LOGBOOK TABLE PRINTOUT

SDG	QC	VOA	SVOA	PEST / PCB	EPA 8310	CAL LUFT 8015M	CLP MET A	CLP MET B	7196	218.6	RFW# 16S-51	9060	OPb	EPA 504	CN	GEN MIN	9040	HOLD	ER REF	FB REF	TB REF
DB154		X		X	X	X	X		X		X		X	X					E26	F07	T27
DB154		X		X	X	X	X		X		X		X	X					E26	F07	T27
DB154		X		X	X	X	X		X		X		X	X					E27	F07	T28
DB154												X							E27	F07	T28
DB154		X		X	X	X	X		X		X		X	X					E27	F07	T28
DB154		X		X	X	X	X		X		X		X	X					E27	F07	T28
DB172		X	X	X	X	X	X		X		X		X	X					E27	F07	T28
DB172		X		X	X	X	X		X		X		X	X			X		E28	F08	T29
DB172		X		X	X	X	X		X		X		X	X					E28	F08	T29
DB154												X							E30	F08	T31
DB154		X		X	X	X	X		X		X		X	X					E25	F07	T26
DB154		X		X	X	X	X		X		X		X	X					E25	F07	T26
DC048	X	X		X	X	X	X		X		X								E25	F07	T26
DC048												X							E37	F10	T38
DB225												X							E37	F10	T38
DC048		X		X	X	X	X		X		X								E43	F12	T44
DC048		X		X	X	X	X		X		X								E37	F10	T38
DB194												X							E37	F10	T38
DC063		X		X	X	X	X		A		X						X		E32	F09	T33
DB194	X	X	X	X	X	X	X		X		X								E32	F09	T33
DB194												X							E32	F09	T33
DB194		X	X	X	X	X	X		X		X						X		E32	F09	T33
DB194		X		X	X	X	X		X		X								E32	F09	T33
DB194		X		X	X	X	X		X		X								E32	F09	T33
DB194												X							E31	F08	T32
DB194		X		X	X	X	X		X		X								E31	F08	T32
DB194		X	X	X	X	X	X		X		X								E31	F08	T32
DB172												X							E31	F08	T32
DB172	X	X		X	X	X	X		X		X								E30	F08	T31
DB172		X		X	X	X	X		X		X								E30	F08	T31
DB172												X							E30	F08	T31
DB172		X		X	X	X	X		X		X		X	X					E28	F08	T29
DB154												X							E28	F08	T29
DB154	X	X		X	X	X	X		X		X		X	X					E27	F07	T28
DB172		X		X	X	X	X		X		X								E27	F07	T28
DB172		X		X	X	X	X		X		X								E29	F08	T30
DB172		X		X	X	X	X		X		X								E29	F08	T30
DB172												X							E29	F08	T30
DB172		X		X	X	X	X		X		X								E29	F08	T30
DB172		X		X	X	X	X		X		X								E29	F08	T30
DB172		X		X	X	X	X		X		X								E29	F08	T30
DB172		X		X	X	X	X		X		X								E29	F08	T30
DC048												X					D		E29	F08	T30
DC048		X						X	X						X		X		E38	F10	T39
DC048		X						X	X						X		X		E38	F10	T39
DB194		X						X	X						X		X		E38	F10	T39
DB194												X							E33	F09	T34
DB194		X						X	X						X		X		E33	F09	T34
DB194		X						X	X						X		X		E33	F09	T34
DC048												X							E33	F09	T34
DC048		X						X	X						X		X		E38	F10	T39
DC048		X						X	X						X		X		E38	F10	T39
DC030												X							E38	F10	T39
DC048												X							E36	F09	T37
DC030		X						X	X						X		X		E36	F09	T37
DC030		X						X	X						X		X		E36	F09	T37
DC048												X							E36	F09	T37
DC075	X											X							E37	F10	T38
DC048		X						X	X						X		X		E41	F11	
DC048		X						X	X						X		X		E37	F10	T38
DC030												X							E37	F10	T38
DC030	X	X						X	X						X		X		E34	F09	T35
DC030		X						X	X						X		X		E34	F09	T35
DC030		X						X	X						X		X		E34	F09	T35
																			E35	F09	T36

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DATA MANAGEMENT PROGRAM

1.0 PURPOSE

The Data Management Plan (DM-Plan) is a written document that establishes data management requirements and expectations for a project. The purpose for the DM-Plan is to ensure the requirements and expectations are identified, understood, and fully accomplished.

2.0 SCOPE

The DM-Plan applies to all projects requiring electronic data management. The DM-Plan will cover the complete environmental data management life cycle. This includes each of the following steps:

- Sample Collection
- Results Generation
- Data Validation
- Data Automation
- Data Analysis
- Data Archival

The focus of the DM-Plan is on the actual data. The DM-Plan will identify what data is expected and when it will be available. Also, the procedures for processing the data will be stated. Finally, the anticipated reporting requirements and data deliverables will be identified. As professional guidance for specific activities, this procedure is not intended to obviate the need for professional judgement to accommodate unforeseen circumstances. Deviance from this procedure in planning or in the execution of planned activities must be approved by management personnel and documented.

3.0 DEFINITIONS

Data Base Management System (DBMS): The computer software that manages the data stored within data base files.

Data Base Administrator (DBA): The individual responsible for maintaining the overall integrity of the data bases for the entire field program. He ensures the data and the DBMS software are both effectively maintained.

Information Systems (IS): Ogden Department responsible for providing data management and other computer support services.

Project Data Manager: The individual assigned to be the key liaison between the environmental personnel and IS. Unless otherwise delegated, the Project Manager maintains this responsibility.

4.0 RESPONSIBILITIES

The Project Manager ensures the DM-Plan is developed. The DBA ensures the technical feasibility of effectively carrying-out the DM-Plan.

The Project Manager will initiate the data management plan and will maintain the responsibility to ensure the plan is developed prior to the collection, processing, or analysis of any project related data. The DBA will ensure that technical assistance and example DM-Plans are provided if and when they are needed. Once complete, the DM-Plan will be reviewed by the Project Manager and the DBA. If acceptable, the Project Manager and the DBA will indicate their acceptance by authorizing the plan with their signatures.

5.0 PROCEDURE

The Project Manager initiates the DM-Plan by notifying the DBA that their project will utilize electronic data management services. The Project Manager then begins to write the plan and identify their data management requirements and expectations for their project. The DM-Plan must address the following:

PROJECT SCOPE: A general statement of the type of data management services that will be required to effectively conduct the project.

SCHEDULING: Scheduling will identify when project tasks are to begin, their duration, and planned completion dates. Emphasis is placed on when the data will be made available to IS for entry into the DBMS.

DATA ASSESSMENT: The types and quantities of data that will be collected for a project need to be identified in the DM-Plan. This would include the number of sampling locations, the types of data that will be collected and generated (water levels, geotechnical, air, hydrogeologic, etc.), the analytical procedures that will be used, and the nomenclature used in identifying locations and their samples; this includes QA/QC samples.

DATA SOURCES: The sources or originators of the data need to be identified (i.e., laboratories, field personnel, on-line data bases, etc.). The format in which the data is expected must also be identified. This will reduce the risk of data be invalid due to omission, incompatibility, or unavailability due to time constraints.

DATA USAGE: Methods of data analysis must be stated in the DM-Plan. This includes anticipated usage of any computer software.

PROJECT PERSONNEL: Key personnel involved with project data should be named in the DM-Plan. The Project Manager will maintain the responsibility of Project Data Manager. If the Project Manager has delegated another person to be the Project Data Manager, this must be stated in the DM-Plan.

Additional information deemed appropriate for the DM-Plan should also be included. References to other documents that provide information necessary to the DM-Plan can be incorporated by reference and provided to the DBA.

6.0 RECORDS

Records will be maintained as required by implementing procedures.

7.0 REFERENCES

None.

8.0 ATTACHMENTS

None.

ATTACHMENT 4

BELL CANYON SAMPLING
QUALITY ASSURANCE PROJECT PLAN (QAPP)

BELL CANYON SAMPLING
QUALITY ASSURANCE PROJECT PLAN

This Quality Assurance Project Plan (QAPP) describes the quality assurance/quality control (QA/QC) procedures that will be used during the sampling activities for the Bell Canyon Residence Soil Sampling activities. The QAPP has been developed in conjunction with the Bell Canyon Soil Sampling Work Plan and the Health and Safety Plan (HSP). This QAPP is provided as Attachment 4 to the Bell Canyon Soil Sampling Work Plan. The Bell Canyon HSP is provided as Attachment 2 to the Bell Canyon Work Plan.

A4.1 Sampling Project Description

Bell Canyon is located south of the Rocketdyne Santa Susana Field Laboratory (SSFL). A description of sampling activities and location of the samples is included in the Bell Canyon Sampling Work Plan.

Approximately 27 soil and/or sediment samples will be collected during Bell Canyon sampling activities. Samples will be analyzed for chemicals and radionuclides using the laboratory methods listed in Table A4-1.

A4.2 QAPP Purpose and Scope

This QAPP describes QA/QC procedures applicable for radionuclide sampling and analysis activities to be performed as part of the Bell Canyon activities. QA/QC procedures that will be followed for the chemical sampling and analysis activities included in the Bell Canyon work plan are described in the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) QAPP (September 1996) and the RFI QAPP Addendum (May 1998). The RFI QAPP and QAPP Addendum are provided as Attachments 1 and 2 to this document.

Project organization and responsibilities for the Bell Canyon sampling are those specified in the RFI QAPP and RFI QAPP Addendum.

A4.3 QA Objectives for Measurement of Radionuclide Data

The overall quality assurance objectives for this project are to develop and implement procedures to obtain and evaluate the sampling data to meet the data quality objectives (DQOs) for the project. DQOs are qualitative and quantitative statements about the types, quantities, and quality of the data to be collected as part of the Bell Canyon sampling. The overall list of analytical methods to be performed as part of the Bell Canyon sampling is provided in Table A4-1. Specific detail regarding the radionuclide analytical methods is provided in Table A4-2.

The quantitative DQOs for the measurement of analytical methodologies are based on quantitation limits, precision , accuracy, and completeness. Analytical DQOs for estimated quantitation limits are provided in Table A4-3 and for precision and accuracy in Table A4-4. The completeness goal is ninety percent for all analyses and analytes.

The qualitative DQOs include the representativeness and comparability of the data. Representativeness is a measure of how closely the measured results reflect the actual concentration of the chemical in the sample and how well the data represent the site. Comparability is a measure of the confidence with which one data set can be compared to another.

A4.4 Sampling Procedures

Details of the sampling procedures to be used for the Bell Canyon activities are specified in the Bell Canyon Work Plan and in the RFI Field Standard Operating Procedures (Attachment 3 to the Bell Canyon Soil Sampling Work Plan).

Sample containers, preservation, and holding times for radionuclide samples collected during the Bell Canyon project are provided in Table A4-5.

Laboratory QC requirements are discussed in Section A4.9. Field QC samples for radionuclide analysis will be collected during the Bell Canyon sampling program. The field QC samples will include a field equipment blank, a field blank, and a co-located field duplicate.

A field equipment blank sample is collected by passing laboratory- or vendor-supplied water through decontaminated sample collection equipment into an appropriate sample container for analysis. Field equipment blank results are used to evaluate the effectiveness of the decontamination procedures to address the issue of possible cross contamination. One field equipment blank will be collected for each sampling event (one sampling event scheduled) and will be analyzed for the same analyses as the other site soil samples. A field blank sample is an analysis of the same laboratory- or vendor-supplied water used for the equipment blank. The field blank sample results are used to ensure that analytes of concern are not present in the decontamination water. One field blank sample will be collected during the Bell Canyon sampling. A field duplicate is a soil sample collected from the same location and at the same time as the original sample. The co-located field duplicate results are used to evaluate the field variability and laboratory performance. One co-located duplicate sample will be collected per analytical method for every 20 samples collected.

A4.5 Sample Custody

Radionuclide sample custody procedures are the same as custody procedures specified for chemical sample analysis (see the RFI QAPP and QAPP Addendum attached). All radionuclide samples will be collected using standard chain-of-custody (COC) protocols.

Bell Canyon sampling will follow the naming conventions specified for the RFI with the following additions:

EPA sample IDs:	RH	Offsite Laboratories (radionuclide/chemical)
Ogden Sample IDs:	BC	Bell Canyon Samples

A4.6 Calibration Procedures and Frequency

Calibration procedures and frequency of field instruments for the Bell Canyon sampling program will follow those specified in the RFI QAPP and QAPP Addendum.

A4.7 Analytical Procedures

Radionuclide analytical testing for the Bell Canyon sampling program will be provided by Thermo NUtec, located in Richmond, California. The selection of Thermo NUtec to perform the radionuclide analyses was based on the ability of the laboratory to perform those analytical methods specified for this project and the acceptability of the laboratory's QA program. Thermo NUtec is a California-certified laboratory for those methods requiring certification.

U.S. Environmental Protection Agency (EPA) protocols will be followed by the laboratory for all methods with the exception of thorium and plutonium analyses. Thorium and plutonium analyses do not have specified EPA methods; Thermo NUtec will be following Eastern Environmental Radiation Facility (EERF) Radiochemistry methods for these analytes.

Estimated quantitation limits for the radionuclide analytes are listed in Table A4-3. Laboratory quality control procedures should be those of the specified methods. Section A4.9 contains a discussion of some of the quality control checks, while Section A4.3 discusses QA Objectives.

Radionuclide analyses will have a 14-day turnaround time for preliminary results.

A4.8 Data Reduction, Validation, and Reporting

Radionuclide data will be reduced by the laboratory as provided in the Laboratory Quality Assurance Plan (LQAP).

Radionuclide data validation evaluates the data for compliance with the method and then determines the data usability and validity. The process consists of checking calculations and records, evaluating QC samples, and qualifying the data set.

Radionuclide analytical data reports will typically include a narrative, copies of the COCs, copies of all analytical forms, all sample analytical results, calibration results, and laboratory QC sample results. Analytical results will be reported in picoCuries/gram (pCi/g) or picoCuries/liter (pCi/L). The laboratory will provide analytical results for all samples, duplicate sample, field blanks, field equipment blanks to project personnel for review. Reporting requirements will be those specified in the RFI QAPP.

A4.9 Additional QAPP Requirements

Additional QAPP requirements for the Bell Canyon sampling program include:

- Internal Quality Control Checks
- Preventive Maintenance
- Assessing Data Quality Objectives
- Performance and System Audits
- Corrective Actions
- QA reports

Specifications provided in the RFI QAPP and QAPP Addendum will be followed for these QAPP requirements with the following exception: a Performance Evaluation (PE) sample will not be submitted to the radionuclide laboratory because Ogden is not licensed to receive known radioactive materials and the laboratory already participates in single-blind performance studies. PE sample results for chemical analyses at the subcontracting laboratories has been performed as part of the RFI (see RFI QAPP and QAPP Addendum).

Table A4-1 (Page 1 of 1)

SAMPLE ANALYTICAL SUITE

Laboratory Analytical Method	Types of Chemicals/Radionuclides
Method 8021	Volatile organic compounds
Method 8015M	Total Petroleum Hydrocarbons
Method 8270 SIM	Semi-volatile organic compounds (selected ions, low detection limits)
Method 8270	Semi-volatile organic compounds (standard ions list and detection limits)
Methods 6010/7000	Metals
Method 7196	Hexavalent chromium
Method 9045	pH
Method 340.2	Fluoride
Method 300	Chloride, nitrate
None Established (a)	Perchlorate
ASTM D19	Formaldehyde
Method 8080	Polychlorinated biphenyls
Method 1613B	Dioxin and furan compounds
Method 8330	Ordnance compounds
Method 901.1	Gamma-emitting radionuclides (including cesium-137 and cobalt-60)
Method 905	Strontium-90 radionuclide
Method 906	Tritium radionuclide
Method 907	Plutonium radionuclides
Method 908	Thorium and uranium radionuclides

(a) No formal regulatory-approved method for perchlorate analysis exists although the Department of Health Services has reviewed the procedures performed. The laboratory is following a analytical procedure similar to Method 300.

Table A4-2 (Page 1 of 1)

RADIONUCLIDE ANALYTICAL METHODS

Analytical Category	Analysis EPA Method No.	Analysis Method	Method Reference	Preparation No.	Preparation Method
Soil and Field QC Water					
Radionuclides	901.1	Spectroscopy	EPA Methods with some modifications	901.1	Dissolution
	905 modified			905 modified	
	908 modified			908 modified	
	EERF 00-04			EERF 00-04	
	EERF 00-07			EERF 00-07	
	906 modified	Liquid scintillation		906 modified	

EPA = Environmental Protection Agency
EERF = Eastern Environmental Radiation FacilityRadiochemistry Procedures Manual

Table A4-3 (Page 1 of 1)

ANALYTICAL DATA QUALITY OBJECTIVES FOR RADIONUCLIDE DETECTION LIMITS

Analytical Category	Analyte	Estimated Quantitation Limit[(a)] (mg/kg)
Soil		
Gamma Radionuclides (901.1)	Barium-140	0.02[(b)]
	Berylium-7	0.07[(b)]
	Cerium-141	0.01[(b)]
	Cerium-144	0.03[(b)]
	Cesium-134	0.44[(b)]
	Cesium-137	0.01[(b)]
	Cobalt-58	0.01[(b)]
	Cobalt-60	0.01[(b)]
	Iodine-131	0.01[(b)]
	Iron-59	0.03[(b)]
	Manganese-54	0.01[(b)]
	Potassium-40	0.12[(b)]
	Radium-226	0.02[(b)]
	Ruthenium-103	0.15[(b)]
	Ruthenium-106	0.76[(b)]
	Thorium-228	0.03[(b)]
	Zirconium-95	0.02[(b)]
	Zinc-65	0.02[(b)]
Strontium-90 (905M)	Strontium-90	1 pCi/g
Tritium (906M)	Tritium	0.5 pCi/g
Plutonium (EERF 00-04)	Plutonium	0.05 pCi/g
Uranium (908M)	Uranium	0.05 pCi/g
Thorium (EERF 00-07)	Thorium	0.05 pCi/g
Field QC Soil Samples	Analytes as above	As above
Field QC Water Samples	Analytes as above	See Method Reference

(a) Sample EQLs are highly matrix dependent. The EQLs listed here are provided for guidance and may not always be achievable. EQLs are listed for soil/sediment based on wet-weight, but normally data are reported on a dry-weight basis; therefore, actual EQLs will be higher based on the percent moisture in each sample (EPA 1992).

(b) Estimated quantiation limits are based on a 750g sample counted for approximately 400 minutes.

EQL = Estimated Quantitation Limit
EERF = Eastern Environmental Radiation Facility Radiochemistry Procedures Manual

Table A4-4 (Page 1 of 1)

ANALYTICAL DATA QUALITY OBJECTIVES FOR RADIONUCLIDE ACCURACY AND PRECISION

Analytical Category and Parameters	Method Number and Reference[a]	BS/LCS Accuracy Criteria[b] Water	BS/LCS Accuracy Criteria[b] Soil	Precision Criteria (Maximum RPD) Water	Precision Criteria (Maximum RPD) Soil
Radiochemistry					
Gamma radionuclides Cesium-137 (and/or Cobalt-60)	EPA 901.1 modified for soil	80-120	NA	(c)	(d)
Strontium-90	EPA 905 modified for soils	80-120	NA	(c)	(d)
Tritium	EPA 906 modified for soils	80-120	NA	(c)	(d)
Plutonium	EERF 00-04	80-120	NA	(c)	(d)
Uranium	EPA 908 modified for soils	80-120	NA	(c)	(d)
Thorium	EERF 00-07	80-120	NA	(c)	(d)

Notes:

(a) Method references are provided in Table A4-3.

(b) BS/LCS represents Blank Spike/Laboratory Control Sample.

(c) The blank results are compared to the minimum detectable activity (MDA) of the blank analysis. The control limits are defined at +2 times the MDA.

(d) If both duplicate and original sample results are less than or equal to two times their respective MDA's then no relative percent difference (RPD) is calculated and the duplicate result is acceptable. If the results ± their respective 2σ absolute errors overlap, then the duplicate sample result is acceptable and an RPD is calculated.

EPA - Environmental Protection Agency
EERF - Eastern Environmental Radiation Facility Radiochemistry Procedures Manual
NA indicates that the criteria are Not Applicable to this particular compound.

Table A4-5 (Page 1 of 1)

RADIONUCLIDE SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Matrix	Analytical Parameter	Method	Container	Sample Volume/Weight[a]	Preservative	Holding Time[b]
Soil	Gamma radionuclides	EPA 901.1	HDPE	1 kg[a]	none	180 days
	Strontium-90	EPA 905M	HDPE	1 g[a]	none	180 days
	Tritium	EPA 906M	GLASS	20 g[a]	none	180 days
	Plutonium	EERF 00-04	HDPE	1 g[a]	none	180 days
	Uranium	EPA 908M	HDPE	1 g[a]	none	180 days
	Thorium	EERF 00-07	HDPE	1 g[a]	none	180 days
Field QC Water	Gamma radionuclides	EPA 901.1	HDPE	1 L[a]	none	180 days
	Strontium-90	EPA 905M	HDPE	1 L[a]	none	180 days
	Tritium	EPA 906M	GLASS	125 ml[a]	none	180 days
	Plutonium	EERF 00-04	HDPE	1 L[a]	none	180 days
	Uranium	EPA 908M	HDPE	1 L[a]	none	180 days
	Thorium	EERF 00-07	HDPE	1 L[a]	none	180 days

(a) One soil sample container containing approximately 1000 g will suffice for all analyses.

(b) Half-life varies for radiochemistry compounds so holding time set by laboratory for consistency.

EPA = Environmental Protection Agency
HDPE = High density polyethylene
QC = Quality Control

BELL CANYON SAMPLING

QUALITY ASSURANCE PROJECT PLAN

ATTACHMENT 1

(copy of the RFI Quality Assurance Project Plan, September 1996)

APPENDIX G
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LIST OF TABLES*

LIST OF FIGURES*

* Tables and figures are located in numerical order at the end of each section.

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LIST OF ACRONYMS

AA	Atomic Absorption
AOC	Area of Concern
APTF	Advanced Propulsion Test Facility
ASAP	As Soon As Possible
ASTM	American Society for Testing and Materials
BS	Blank Spike
C	Celsius
CA	California
CFR	Code of Regulations
CLP	Contract Laboratory Program
COC	Chain-of-custody
CRDL	Contract Required Detection Limit
CRQL	Contract Required Quantification Limit
DCA	Dichloroethane
DHS	Department of Health Services
DMP	Data Management Plan
DOE	Department of Energy
DQO	Data Quality Objectives
DTSC	Department of Toxic Substances Control
ECL	Engineering Chemistry Lab
EDD	Electronic Data Deliverable
ELCD	Electrolytic Conductivity Detector
EPA	Environmental Protection Agency
EQL	Estimated Quantitation Limit
ETEC	Energy Technology Engineering Center
FID	Flame Ionization Detector
G	Glass
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
HCl	Hydrochloric Acid
HMX	High Melting Explosive
HNO_3	Nitric Acid
HPLC	High Performance Liquid Chromatography
HSP	Health and Safety Plan

ICP	Inductively Coupled Argon Plasma Spectroscopy
ID	Identification
IRFNA	Inhibited Red Fuming Nitric Acid
K_d	Soil Partitioning Coefficient
Kg	Kilogram
L	Liter
LCS	Laboratory Control Sample
LOX	Liquid Oxygen
LQAP	Laboratory Quality Assurance
LQAP	Laboratory Quality Assurance Plan
LUFT	Leaking Underground Fuel Tank
mg	Milligram
MMH	Monomethyl Hydrazine
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NA	Not Applicable
NASA	National Aeronautics and Space Administration
NDMA	N-Nitrosodimethylamine
NERI	Northeast Research Institute
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NTO	Nitrogen Tetroxide
OSWER	Office of Solid Waste Emergency Response
oz	Ounce
P	Polyethylene
PAHs	Polynuclear Aromatic Hydrocarbons
PCDD	Polychlorinated dibenzodioxin
PCDF	Polychlorinated dibenzofuran
PCE	Perchloroethylene
PE	Performance Evaluation
PID	Photo Ionization Detector
QAMS	Quality Assurance Management Section
QAOs	Quality Assurance Objectives
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act

RDX	Royal Demolition Explosive
REP	Replicate
RFI	RCRA Facility Investigation
RFP	Request for Proposal
RPD	Relative Percent Difference
RWQCB	Regional Water Quality Control Board
SAIC	Science Applications International Corporation
SIM	Selective Ion Monitoring
SOP	Standard Operating Procedure
SPA	Storable Propellant Area
SS	Stainless Steel
SSFL	Santa Susanna Field Laboratory
STL	System Test Laboratory
SVE	Soil Vapor Extraction
SVOCs	Semivolatile Organic Compounds
SW-846	Test Methods for Evaluating Solid Waste: Physical and Chemical Methods
SWMU	Solid Waste Management Unit
TBD	To Be Decided
TCA	Trichloroethane
TCE	Trichloroethylene
TD	Thermal Desorption
TEG	Transglobal Environmental Geochemistry
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TRPH	Total Recoverable Petroleum Hydrocarbons
VOA	Volatile Organic Analytes
VOCs	Volatile Organic Compounds
µg	Micrograms

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SECTION G.1
PROJECT DESCRIPTION AND OBJECTIVES

This Quality Assurance Project Plan (QAPP) describes the quality assurance/quality control (QA/QC) procedures that will be used during data collection and sampling activities for the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) sites of the Rocketdyne Santa Susana Field Laboratory (SSFL) in Ventura County, California. The RFI activities include soil sampling and analysis, as well as passive and active soil gas sampling and analysis. The QAPP was developed in conjunction with the RFI work plan addendum, Data Management Plan (DMP) (Appendix D), and the Health and Safety Plan (HSP) (Appendix E). The RFI is being performed in accordance with the RCRA Corrective Action Requirements specified in three Hazardous Waste Facility Permits issued to Rockwell by the California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC).

This QAPP was originally drafted by ICF Kaiser in 1993 and has been modified by Ogden. The major changes include the addition of passive soil gas sampling and analysis, active soil gas sampling and analysis, use of field test kits for soil samples, use of an onsite mobile laboratory for certain analyses, and several procedural changes.

QA/QC procedures in this document govern aspects of the data collection and analytical efforts and are designed to produce technical data of an acceptable and known quality that meet the established objectives of the RFI. This QAPP has been prepared using the following guidelines:

- U.S. EPA, *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*, QAMS-005/80, 1983.

- U.S. EPA, *RFI Guidance*, OSWER Directive 9502.00-6C, July 1, 1987.

- U.S. EPA Region IX, *Guidance for Preparing Quality Assurance Project Plans for Superfund Remedial Projects*, 1989.

The following sections summarize the RFI project description and objectives. The SSFL facility is described in the work plan addendum.

G.1.1 PROJECT DESCRIPTION

A number of separate Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) have been identified at SSFL that require further evaluation under the RFI program (ICF 1993a-c). Table 1-2 lists the RFI SWMUs and AOCs by area. Descriptions of these SWMUs and AOCs, as well as summaries of existing site investigation data for the vadose zone soils at the SWMUs and AOCs, are presented in the work plan addendum. During the RFI, selected SWMUs and AOCs will be investigated to assess the extent of potentially hazardous chemicals in the vadose zone soils. The rationale for selection of sites for inclusion in the RFI is presented in the Current Conditions Report and the work plan addendum.

The types of wastes, potential chemicals introduced, analytical categories, and analysis method numbers are summarized in Table G.1-1. The RFI work plan addendum defines the applicable methods, procedures, and protocols for the proposed sampling events. Each sampling task will adhere to the QA requirements set forth in this QAPP and may include more stringent measures as deemed appropriate to meet task goals.

G.1.2 PROJECT OBJECTIVES

The overall objectives of the RFI are to (1) characterize the quantity and extent of chemicals in vadose zone soils that may pose a risk, and (2) collect data of sufficient quality to be used for a quantitative risk assessment. These objectives are supported by ensuring that measurement data acquired are of the quality necessary to adequately assess releases that may have occurred in the environment, so that the data then can be accurately used to evaluate the need for corrective measures. Strict QA/QC requirements have been developed and will be employed throughout the duration of the RFI to attain these project goals. Project objectives and the scope of work are discussed in more detail in Section 1 of the work plan addendum.

Significant changes to this QAPP will be reviewed and approved by Rocketdyne personnel and will be submitted in addendum form to the appropriate regulatory agencies before any action is taken.

SECTION G.2
PROJECT ORGANIZATION AND RESPONSIBILITY

The RFI at the SSFL facility will be carried out by Rocketdyne contractors as well as by Rocketdyne personnel. The responsibilities of the key individuals or their designees are described in Section 8 of the work plan addendum. Specifically for this QAPP, the following roles are described:

- QA/QC Manager - Nicholas P. Rottunda

  The QA/QC Manager will be responsible for the direction of the QA program during all sampling and analysis activities for the investigation and for reviewing data collection activities and assuring that they adhere to the QAPP. The QA/QC Manager will prepare the QAPP for management review and approval and will be responsible for determining the acceptability of any changes to the established QAPP.

- Data Management Officer - Chris Hein

  The Data Management Officer will establish and maintain a database for data collected during the project.

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SECTION G.3
QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall quality assurance objectives (QAOs) for this project are to develop and implement procedures to obtain and evaluate the data that can be used to satisfy the data quality objectives (DQOs) of the project and associated data uses. DQOs are qualitative and quantitative statements about the types, quantities, and quality of the data to be collected in the RFI. The rationale for the types of data are addressed in the RFI work plan addendum. The overall list of analytical methods to be performed at the RFI sites is contained in Table G.3-1; a discussion of these methods is included in Section G.7.

The quantitative DQOs for the measurement of analytical methodologies are based on detection limits, precision, accuracy, and completeness. The definition of each term is provided below.

- Quantitation Limit: The detection limit that the laboratory should be able to confidently achieve and report. The quantitation limit for each sample may be elevated owing to matrix interferences, moisture, or the presence of other analytes.

- Precision: The measurement of agreement of a set of replicate results without comparison to an assumed or known value. Precision is a measure of reproducibility and may be expressed as the relative percent difference (RPD) of duplicate/replicates (REP) analyses:

$$\text{RPD} = \frac{(\text{REP 1} - \text{REP 2})}{(\text{REP 1} + \text{REP 2}) \times 0.5} \times 100\%$$

  RPDs will be calculated for laboratory duplicates, matrix spike/matrix spike duplicates (MS/MSDs), and field duplicates.

- Accuracy: The degree of agreement between a known, or true, value and a measured value. The accuracy of a result is affected by both systematic and random errors. Accuracy may be represented by the following equation:

$$\text{Accuracy} = \frac{\text{Measured Value}}{\text{True Value}} \times 100\%$$

Accuracy will be measured by spiking a known concentration of a known analyte at a known concentration (true value) into site samples, then measuring the recovery (measured value). This applies to blank spikes, matrix spikes, and surrogates.

- Completeness: A measure of acceptable analytical data obtained compared to the ideally expected amount of data to be obtained. It is expressed as the percentage of samples analyzed for which acceptable analytical data are generated. Data that are rejected are counted against the completeness goal; data that are considered estimated concentrations or undetected are counted as acceptable data.

Quantitative DQOs for estimated quantitation limits are provided in Table G.3-2 and for precision and accuracy in Table G.3-3. The completeness goal is 90 percent for all analyses and analytes, although the analytes with the lowest action limits are the most critical.

Qualitative DQOs include the representativeness and comparability of the data. Representativeness is a measure of how closely the measured results reflect the actual concentration of the chemical constituent in the matrix sampled and how well these data represent the site. Representativeness is established by selecting procedures that will produce results that accurately, precisely, and reliably depict the measured matrix and conditions. The representativeness of a result is associated with the development and implementation of proper field and laboratory protocols for sample collection, handling, and documentation. Data representativeness will be attained through the proper design of the sampling program, including background samples, which will make certain that sample locations and the number of samples chosen will sufficiently describe the site.

Comparability expresses the confidence with which one data set can be compared to another. The analytical parameters, sample locations, and depths targeted during this event have been selected such that they will be comparable to previously collected data. Comparability of the data will be maintained, using established procedures for sampling activities and laboratory analytical methods, to provide uniformity in analysis and reporting criteria. Data results will be reported in appropriate units consistent with existing site data and applicable regulatory levels. PAH results from field test kits and the laboratory measure essentially the same analytes. VOC data from passive and active soil gas and from soil sample analysis in the laboratory measure also essentially the same analytes.

Field screening and onsite mobile laboratory data will be used to make sampling decisions in the field; mobile onsite laboratory and offsite fixed laboratory data will be used in the quantitative risk assessment.

The standard analytical methods listed in Tables G.3-1 and G.3-2 are contained in EPA's *Test Methods for Evaluating Solid Waste: Physical and Chemical Methods* (SW–846), 3rd Edition, as updated in 1992; EPA's *Methods for Chemical Analysis of Water and Wastes*, Revised March 1983; California Water Resources Control Board's *Leaking Underground Fuel Tank (LUFT) Manual: Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure*. The QA/QC procedures found in SW–846 and some stricter criteria from the EPA Contract Laboratory Program (CLP) or EPA Data Validation Functional Guidelines will apply for the listed parameters. Specific QA/QC methodology for soil vapor sampling and analysis is presented separately in the active soil vapor sampling standard operating procedures (SOPs), provided in Appendix D.

Table G.3-4 summarizes the chemical analyses for each type of field activity and for each analytical category. Mobile onsite and fixed offsite laboratory subcontractors have not been selected at this time.

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SECTION G.4
SAMPLING PROCEDURES

Details of the sampling procedures to be implemented during the RFI (including techniques for sample site selection, sample collection procedures, and specific sampling programs) are presented in the RFI work plan addendum and field SOPs (Appendix D).

G.4.1 SAMPLE CONTAINERS, PRESERVATION, STORAGE, AND HOLDING TIMES

Soil gas and soil samples will be collected in containers listed in Table G.4-1. Typically, at least three soil samples will be collected at each proposed sampling depth: one for onsite laboratory analysis, one for offsite laboratory analysis, and one for logging soil parameters. At selected sampling locations, a fourth container must be collected and sent to the geotechnical laboratory. Table G.4-1 lists the types of analyses and containers required, approximate sample volume or weight required, preservative required, and holding time required that will govern the sample handling procedures.

G.4.2 QUALITY CONTROL SAMPLES

Laboratory QC requirements are discussed in the analytical methods and in Section G.9.

Field QC samples will be collected during active soil vapor and soil sampling, then analyzed to evaluate environmental measurements and aid in the review, interpretation, and validation of analytical data. These QC samples include various types of blanks and field replicates. Passive soil gas sampling will not require the use of field QC samples.

G.4.2.1 Active Soil Gas Sampling

The active soil gas SOP is presented in Appendix D. Los Angeles Regional Water Quality Control Board regulatory guidance will be followed (also provided in Appendix D). In summary, the following field QC samples will be analyzed.

Field duplicate: A field duplicate is a soil gas sample that is collected from the same location and at the same time as (or immediately following) an original sample. The field duplicate results are used to evaluate field variability and laboratory performance. One duplicate soil gas sample will be collected at the rate of one duplicate for every 20 samples, with at least one field duplicate per day.

Representative chemical source site sample: If available, a representative chemical source will be sampled and analyzed to establish method confidence.

Field blank: A field blank, consisting of atmospheric air, will be analyzed at least daily.

G.4.2.2 Soil Sampling

Field QC samples to be collected during the soil sampling efforts will include field equipment blanks, field blanks, and field duplicates. Blanks will be a water matrix, as described below. Field test kits will only be used for field duplicate QC samples.

Field equipment blank: A field equipment blank is collected by passing laboratory- or vendor-supplied water through decontaminated sampling collection equipment into an appropriate sample container for analysis. Field equipment blank results are used to evaluate the effectiveness of decontamination procedures to address the issue of possible cross contamination. One field equipment blank will be collected for each soil sampling event, for each soil sampling technique, and will be analyzed for the same analyses as the other site soil samples. If field work lasts for several weeks with only weekend breaks, only one field equipment blank sample need be collected and analyzed.

Field blank: The same laboratory- or vendor-supplied water used for the equipment blank should be analyzed once to ensure that the analytes of concern are not present in this source water (especially of concern for naturally occurring metals).

Trip blank: Trip blanks are samples used to identify possible contamination during sample handling and transport to the fixed laboratory. The samples will be prepared in the laboratory using organic-free water. They will then be shipped with the sample containers to the field, stored with the field samples, and returned to the offsite, fixed laboratory for analysis. One pair of trip blanks will accompany each cooler containing VOC samples and will only be analyzed for VOCs. These samples should be labeled in a manner similar to normal site samples and submitted to the laboratory blind.

Trip banks will not be used for onsite mobile laboratory soil sample analysis because samples will generally begin to be analyzed within minutes or hours.

Field duplicate: A field duplicate is a soil sample collected from the same location and at the same time as an original sample. The field duplicate results are used to evaluate field variability and laboratory performance. One duplicate soil sample will be collected per analytical method for every 20 samples collected. The field duplicate samples will be assigned unique identification numbers but will not be identified as duplicates to the laboratory.

G.4.3 SAMPLE REPRESENTATIVENESS

Data obtained during the RFI should accurately represent the actual site conditions. Obtaining representative data requires strict adherence to the procedures for sample collection and analysis that are presented in this QAPP. In addition, the samples that are to be analyzed must be carefully selected so as to be representative of the site location or process that is being sampled. The details on the types, locations, and number of samples to be collected are presented in the RFI work plan addendum. The following guidelines govern representativeness of the samples:

- Where sample composition may vary with location, e.g., for sampling in specific SWMUs or AOCs, a sufficient number of samples will be collected so that the area of interest can be adequately described.

- In some cases, composite samples may be taken to represent the average of several individual samples. Whenever possible, however, individual samples are preferred to composite samples.

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SECTION G.5
SAMPLE CUSTODY

Detailed log entries, identification, and chain-of-custody (COC) procedures will be used to document the acceptability of the data generated. To reduce the possibility of error, the number of personnel assuming custody of the sample will be minimized.

Onsite sampling data will be controlled and entered on appropriate forms. Personnel involved in the COC procedures and transfer of samples will be trained on the purpose of the activity and procedures prior to implementation.

G.5.1 FIELD SAMPLE CUSTODY

Sample documentation and custody procedures will include the completion of sample labels and COC forms for all samples analyzed onsite and offsite. The COC forms also typically serve as the analytical request form.

Soil samples collected during the field investigations will be labeled with a partially pre-printed label. An example of a sample label to be used during the RFI is presented as Figure G.5-1. Each sample will be assigned a unique identification number. These identification numbers will be used consistently in field log books, other field records, and on COC documentation. Each label will contain the following information:

- unique five-character EPA number,
- project name (only necessary for samples sent offsite for analysis),
- time and date of collection, and
- analyses requested (optional if the COC form contains this information).

A COC form will accompany the samples from collection of the field samples through submittal of samples to the laboratory. The COC will trace and document the path of each individual sample by means of a unique COC identification number. The following information will be included on the COC:

- project name
- sampling date and time
- sample identification

- total number of sample containers
- type of container
- preservative (if any)
- number of samples collected
- type of analysis required
- special instructions (if any)
- signatures indicating sample relinquishment and receipt

An example of the COC form to be used during this project is presented in Figure G.5-2.

COC forms to accompany the soil samples during shipment to the offsite analytical laboratory will be placed in a sealed plastic bag and taped to the inside of the shipping container. Soil gas samples will be transferred by the sampling team to an onsite mobile laboratory upon collection; a COC form will be maintained to document the requested analyses and receipt of each sample. To document the transfer of samples from field personnel to the laboratory, a representative of the laboratory will sign the accompanying COC, and a copy of the signed form will be submitted with the laboratory data. Samples will likely be shipped offsite by overnight courier to the laboratory.

G.5.2 SAMPLE NAMING

Sample naming is discussed below for soil, field testing, passive soil gas, and active soil gas samples.

Soil Samples

Two sample names will be used for each soil sample, an EPA number for laboratory tracking and another for sample identification.

The EPA number must be unique and will be five characters long, which is small enough to fit laboratory computer software requirements. For example, the following sequence may be used:

RA001,
RA002,
RA003, etc.

The first two letters will designate the type of field activity:

RA	Passive Soil Gas
RB	Active Soil Gas
RC	Field Test-kit Analyses
RD	Soil Mobile Laboratory
RE	Offsite Fixed Laboratory

The sample identification (ID) will be nine characters long and will contain meaningful designations that can be used to sort and query data in the database.

The following format will be used for the sample identification:

aabbccdee

Where,

aa	Two-letter acronym designating a specific RFI site
bb	Type of sample and matrix (see Table G.5-1 for possible sample types and matrix)
cc	Location number (e.g., 01, 02, 03) such as boring location
d	Field quality control type (see Table G.5-2 for possible types)
ee	Chronological sample number from a particular sampling location (e.g., 01, 02, 03)

Table G.5-3 lists "aa" designations that will be used for each site.

The following examples illustrate the sample naming scheme:

	Site	Sample ID	EPA Number
Second soil sample from first boring	Rocketdyne Happy Valley	HVBS01S02	RD001
Duplicate of previous sample	Rocketdyne Happy Valley	HVBS01D02	RD002
Same sample for offsite laboratory analysis	Rocketdyne Happy Valley	HVBS01S02	RE003
Third active soil gas sample from fourth boring	NASA Alfa Area	AASG04S03	RB001
First passive soil gas sample from second location	DOE BLD. 56 Landfill	BLPG02S01	RA001
First equipment blank field QC water sample	Rocketdyne Happy Valley	HVQW01E01	RE001
First field blank field QC water sample	NASA Bravo Test Area	BVQW01F01	RE002
Fifth sample for field test-kit analysis from 12th boring	Rocketdyne Instrument Lab	ILBS12V05	RC001
First PE sample	Rocketdyne CTL-III	CLQS01P01	RD004

The laboratory will only see the five-character EPA number, while field sampling personnel will record the nine-character sample ID on a cross-reference chart and use this sample ID in the database to sort and query data per site, matrix, and so forth.

Depth of sample collection for each sample will be recorded in the field notebook.

Other Samples

Field test-kit sample naming will follow the format discussed above. A soil sample from the same location for field test-kit analysis and mobile laboratory analysis will have the same sample ID but a different EPA number.

Passive and active soil gas sample naming will follow the format discussed in Section G.5.2.

G.5.3 FIELD DOCUMENTATION

Information pertinent to the collection of a sample will be maintained in a bound field logbook. All entries will be made in indelible ink, and corrections will be made by drawing a line through the error and initialing the correction. The following information will be included for each sample collected:

- SWMU or AOC location number
- field sample identification number
- matrix sampled
- sample depth
- sampling date and time
- method of sampling
- preservation techniques (if applicable)
- sampling observations (if applicable)
- results of field measurements (if applicable)

Information regarding the sample that is included on the sample label will be compared for consistency with that noted in the field logbook prior to shipment of samples to the laboratory.

G.5.4 LABORATORY CUSTODY PROCEDURES

Receipt, storage, and tracking of samples submitted to the offsite laboratory will be conducted according to strict protocol to prevent sample contamination or loss and to prevent the production of invalid laboratory data as a result of sample deterioration or tampering. Onsite mobile laboratory sample custody will follow similar procedures, although some of the steps discussed below may be eliminated because it is onsite.

G.5.4.1 Sample Handling

Upon receipt of the samples, the laboratory custodian will sign the airbill or other shipping documentation (if any) and will verify that the information on the sample labels matches that on the COC form. The custodian will then inspect each sample to see that it is in an appropriate container, properly preserved, in good condition (i.e., no leaks, shipping damage, etc.), and that there is sufficient volume to perform the requested analyses. After verifying that the records match the physical samples, the laboratory custodian will sign the COC form. Any discrepancy will be noted in the laboratory's incoming log book and resolved before the sample is assigned for analysis.

G.5.4.2 Sample Identification

The custodian will assign a unique sample number to each sample to track it from storage through the laboratory system until the analytical process is completed and the sample is discarded. The samples will be analyzed in laboratory batches not to exceed 20 samples.

G.5.4.3 Sample Custody Records

Once the samples have been received by the laboratory, the custodian and/or laboratory personnel will maintain a laboratory logbook that clearly documents the following information:

- sample preparation techniques (e.g., extraction)
- instrument methods
- experimental conditions such as use of specific reagents, temperatures, reaction times, instrument settings
- results of analysis of QC samples
- time and date of analysis
- name of analyst

damage, etc.), and that there is sufficient volume to perform the requested analyses. After verifying that the records match the physical samples, the laboratory custodian will sign the COC form. Any discrepancy will be noted in the laboratory's incoming log book and resolved before the sample is assigned for analysis.

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- experimental conditions such as use of specific reagents, temperatures, reaction times, instrument settings
- results of analysis of QC samples
- time and date of analysis
- name of analyst

SECTION G.6
CALIBRATION PROCEDURES AND FREQUENCY

G.6.1 FIELD INSTRUMENTS

Field instruments will be calibrated on a routine basis according to the procedures, frequency of calibration, and use of calibration standards specified by the instruments' manufacturers. Field team members familiar with the field calibration and operations of the equipment will maintain proficiency and perform the prescribed calibration procedures. Field test-kit calibration will follow manufacturer specifications.

G.6.2 LABORATORY INSTRUMENTS

The calibration procedures and frequency of calibration of laboratory equipment used by the analytical laboratory will follow the specification of the laboratory's QA manual (laboratory to be determined). The calibration procedures and frequency of calibration for the equipment will, minimumally, follow the specifications of 40 CFR, Part 136, Appendix A, and SW-846 (latest version).

Calibration criteria for each sampling event, beyond those required by the analytical methods, may be specified in site sampling and analysis plans. Calibration records will be maintained by the analytical laboratories.

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SECTION G.7
ANALYTICAL PROCEDURES

The choice of the analytical laboratory to perform the chemical analyses for soil samples will be based on the ability of the laboratory to perform a particular analytical method and the acceptability of the laboratory's QA program. All soil and water analyses will be performed by laboratories certified for those analyses by the California Department of Health Services (DHS). Soil or water analyses not certified by DHS will be performed by laboratories certified for other organic or inorganic tests. Active soil vapor analyses will be performed by a mobile laboratory certified for soil and water analyses (there is no DHS certification for soil vapor analytical laboratories).

G.7.1 ANALYTICAL METHODS

Specific laboratory methods that will be used are listed in Table G.3-1. Details of these procedures are present within the appropriate standard method document (e.g., SW-846, ASTM, and so forth). Details regarding each method, such as lists of analytes, quantitation limits, and precision and accuracy goals, are provided in Tables G.3-1, G.3-2, and G.3-3, respectively. Laboratory-established reporting limits for each method and a QA Plan will be provided after final selection of the laboratory (or laboratories), and the laboratory will comply with the reporting requirements.

The analytical methods for passive and active soil gas analysis are different from each other and from the analytical methods used for soil samples. The methods and QA procedures for soil vapor analysis are presented in Appendices D and F.

The RFI work plan addendum specifies parameters and analyses for specific sampling events. All parameters specified by the analytical methods will be reported. Freon 113 (1,1,2-trichlorotrifluoroethane), Freon 11 (trichlorofluoromethane), acetone and methyl ethyl ketone as well as other VOCs previously detected, will be added to the Method 8010 VOC analyte list for active soil gas samples. Other compounds may be added to some of the methods if those compounds are judged to be of concern.

Three areas of the RFI analytical program require further discussion: analytical methods, selected analytes, and laboratory selection. These are discussed below.

Analytical Methods

EPA Method 8270 Selective Ion Monitoring (SIM) is a modified method designed to reach lower detection limits by focusing on specific analytes of concern, unlike the regular Method 8270, which can detect over 65 semivolatile analytes. SIM is a procedure contained in the NOAA Status and Trends method for PAH analysis, as well as a procedure in polychlorinated dibenzodioxin (PCDD) and polychlorinated dibenzofuran (PCDF) analyses by EPA Methods 8280 and 8290. Method 8270SIM will be used to focus on 16 PAHs and NDMA at selected sites. Hydrazine compounds may be analyzed by ion chromnotography if NDMA is detected above field aciton levels.

Method 8015 modified (8015M) is a California LUFT method modification of EPA Method 8015. The preparation method proposed is extraction, rather than purge and trap, owing to the nature of the fuels used at the sites. The fuels used, RP-1 and JP-4, are both similar to kerosene. Their chromatogram pattern overlaps somewhat with gasoline (lighter) and diesel fuel (heavier), but the majority falls between gasoline and diesel. Purge and trap would be recommended if gasoline were the main fuel of concern and if the spills or leaks were more recent.

For soil and soil gas samples analyzed by the mobile laboratory, GC methods are recommended over the GC/MS method for VOCs. Therefore, EPA Methods 8010 (chlorinated VOCs) and 8020 (aromatic VOCs) are recommended over EPA Method 8240. Several reasons for selecting these methods are listed below.

- GC offers lower detection limits than GC/MS.
- Many analytes have been previously detected at the sites, so firmer confirmation by GC/MS is not as critical.
- GC/MS instrumentation is less stable in the field than in a fixed laboratory.
- Many more mobile laboratories are equipped to perform and are experienced with GC methods compared to GC/MS methods. Requiring GC/MS would reduce the number of qualified laboratories and force them to use methods they are not as familiar with.

Analyte Selection

The 17 Title 22 metals will be analyzed for in the RFI samples. They are arsenic, chromium, antimony, barium, beryllium, cadmium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc. Trace Inductively Coupled Argon Plasma Spectroscopy (ICP) will be used to analyze for these metals; cold vapor atomic absorption (CAA) will be used for analysis of mercury.

In addition, some analytes will not be analyzed for in soil samples. Isopropanol will not be analyzed because of its limited prevalence as a previously detected analyte at SSFL, its low toxicity, and because it will be used as an equipment decontamination rinse liquid during field sampling.

Laboratory Selection

To ensure data quality, the following QC measures will be performed:

- Approximately 5 to 10 percent of samples analyzed for VOCs and/or TPH by the onsite mobile laboratory will be confirmed in a fixed offsite laboratory.

- A PE sample will be sent to the mobile laboratory to monitor its ability to identify analytes correctly and report concentrations accurately as discussed in Section G.9.

- A 1-day audit by a chemist will be performed as discussed in Section G.12.

The onsite mobile laboratory, rather than an offsite fixed laboratory, will be used to analyze for VOCs for two reasons:

- Quick analysis allows in-the-field decisions to be made regarding the extent of concentrations, allowing site characterization to proceed more quickly and efficiently.

- Quick analysis, typically beginning within minutes of sample collection, reduces the amount of VOCs that might be lost to the atmosphere during overnight transport to an offsite laboratory.

According to EPA, "field methods can produce legally defensible data if appropriate method QC is available and if documentation is adequate" (EPA 1992).

G.7.2 QUANTITATION LIMITS

The estimated quantitation limits for each method and analyte are listed in Table G.3-2.

G.7.3 QUALITY CONTROL REQUIREMENTS

Quality control procedures should follow those of the specified method. Section 9 contains a discussion of some quality control checks, while Section 3 contains QA Objectives.

G.7.4 TURNAROUND TIMES

Field test kit, active soil gas, and mobile laboratory soil sample analysis will typically have same-day turnaround times. Passive soil gas sample results will be delivered within 14 days. Offsite laboratory analysis turnaround times will be between 5 and 14 working days. Requested turnaround times will depend on the analytical methods, field investigation schedule, and laboratory capabilities.

G.7.5 SUBCONTRACTORS FOR ANALYSIS

Each analytical subcontractor will be selected based on qualifications, ability to meet turnaround times, and cost. They will be selected after requests for proposals (RFPs) are tendered. The most likely subcontractor(s) are listed for each activity below.

Passive Soil Gas

Two suppliers are currently known; each supplier of the sampling materials also performs the analyses. Quadrel Services and W. L. Gore and Associate, Inc., are the two known suppliers who will submit proposals, and one will be selected. Additional information regarding these suppliers is included in Appendix F.

Active Soil Gas

It is likely that Transglobal Environmental Geochemistry (TEG) will perform active soil gas sampling and analysis in a mobile laboratory onsite because it will likely perform the direct-push drilling activities.

Field Test Kits

Ogden personnel will perform the field test-kit analyses onsite. The supplier of the field test kits will be Ensys, Ohmicron, or other suppliers whose Method 4035 PAH test kits have been EPA approved. Additional information regarding these suppliers is included in Appendix F.

Mobile Laboratory

TEG or another subcontractor who is DHS certified will be selected. If special Los Angeles Regional Water Quality Control Board (RWQCB) requirements exist and must be met, a laboratory acceptable to the Los Angeles RWQCB will be selected.

Offsite Fixed Laboratory

This subcontractor must be DHS approved for each analysis, unless approval does not specifically exist (e.g., fluoride, 8270SIM). A laboratory that is familiar with 8270SIM will be selected.

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SECTION G.8
DATA REDUCTION, VALIDATION, AND REPORTING

Details regarding data management for the RFI are addressed in the DMP (Appendix D). The objective of the DMP is to describe the organization and procedures that are used to document that the chemical and other analytical and nonanalytical data generated as part of the RFI are efficiently collected, accurately transmitted, and carefully stored for future reference. The emphasis of the DMP is to effectively manage the data to produce relevant and useful descriptions in reports generated for internal and external purposes.

G.8.1 DATA REDUCTION

Data will be reduced by the mobile and offsite laboratory as discussed in Section G.3 and the Laboratory Quality Assurance Plan (LQAP), and by project personnel as discussed in Section 4.3.2 of the work plan addendum. Accuracy and precision QC calculations will follow formulas presented in Section G.3. Reduced data will generally be reported as presented in Section G.8.3.

G.8.2 DATA VALIDATION

Data validation activities for passive soil gas, active soil gas, field test kits, and soil samples analyzed by a laboratory are discussed below.

Passive Soil Gas

Because these data will be used for screening, strict data validation activities are not required. A chemist will review the QC data and sample results data for any outliers and for reasonableness of results.

Active Soil Gas

At least several sample results will be reviewed by a chemist to ensure that identification and quantitation of chemicals is being performed correctly. The chemist will either receive fax copies of data, including chromatograms, for review, or will conduct an onsite visit.

Field Test Kits

Field test kit results for soil samples will be compared to laboratory results to make sure that a good correlation exists. A certain number of false positives are expected, while false negatives are expected to be minimal, based on manufacturer specifications.

Soil Samples

Verification of analytical data is performed through routine reviews that will include checking results for errors in computer entry, data transmission, and transcription during the processing of the data.

The data validation process entails evaluating soil sample data for compliance with the method acceptance criteria and then determining the data usability and validity. The process consists of checking calculations and records, evaluating QC sample results, and qualifying the data set. Data that are outside the upper and lower bounds for acceptance will be qualified and reported to the QA/QC Manager. The QA/QC Manager will assess the need for repeat sampling or analysis.

One of the first data packages received from the offsite laboratory used for selected soil analyses will be validated following EPA data validation functional guidelines (EPA 1985a, b) for Level IV. The remainder of the soil sample data will be validated for the following items:

- sample management (collection techniques, sample containers, preservation, handling, transport, chain-of-custody, holding times);
- method blank sample results;
- blank spike and laboratory control sample results;
- surrogate recoveries, if applicable;
- matrix spike/matrix duplicate recoveries and precision; and
- field QA/QC sample results.

For full data validation on selected samples, the following items will also be validated:

- GC/MS tuning, if a GC/MS is used;
- calibration data;

- internal standards performance;
- interference check sample results for inorganic analyses; and
- raw data.

The following data qualifiers will be applied, following EPA guidance:

U	Undetected
J	Estimated Concentration
N	Uncertainty of Analyte Identity
R	Rejected, unusable data point

Data qualified as rejected, "R," will not be used in the risk assessment, while other data may be.

G.8.3 DATA REPORTING

Data reporting for each activity is discussed below.

Passive Soil Gas

Reports will be submitted from the supplier on hard copy (paper) deliverables. These data will be manually entered into the computer database for use.

Active Soil Gas

Same-day results will be available onsite for project personnel to use to make decisions about additional depths or lateral extent of sampling. These results will be available either on hard copy, on a computer screen, or both. QC data and chromatograms will be made available at a later time after field work has been completed, but mobile laboratory personnel will verbally notify project personnel each day if any significant QC problems have been identified. Results will be manually entered into the computer database after field work has been completed.

Field Test Kits

Results will be recorded on log forms, then later entered manually into the computer database.

Mobile Laboratory Soil Analyses

Same-day results will be available onsite for project personnel to use to make decisions about additional depths or lateral extent of sampling. These results will be available either on hard copy, on a computer screen, or both. QC data and chromatograms will be made available at a later time after field work has been completed, but mobile laboratory personnel will verbally notify project personnel each day if any significant QC problems have been identified. Results will be manually entered into the computer database after field work has been completed.

Offsite Fixed Laboratory Soil Analyses

The analytical laboratory reports for the data to be validated will typically include a narrative, copies of the COCs, copies of the analytical forms, all sample analytical results, tune results and mass spectra, calibration results, mass spectra and chromatograms for each sample, calculated recoveries for all QC samples, method duplicate or duplicate spike and method blank results, method quantitation limits for all parameters, dilutions, calibration ranges, and raw data for analyses, as appropriate. Analytical results will be reported in micrograms per kilogram (µg/kg) for soil organic analytes (except for total petroleum hydrocarbons [TPH] and total organic carbon [TOC], which will be in milligrams per kilogram [mg/kg]), and in mg/kg for inorganic parameters. The data deliverables packages from the soil gas mobile laboratory may differ from those provided by the offsite fixed laboratory.

The laboratory will provide analytical results for all samples, duplicate samples, field blanks, equipment blanks, trip blanks (if any), and spiked samples (if any) to project personnel for review. One copy of the analytical results will be sent to the Data Management Officer. The Data Management Officer will process the data and deliver the processed data and the original laboratory reports to the QA/QC Manager. The QA/QC Manager will review the results and report the findings to the Project Manager as soon as possible.

Electronic data deliverables (EDDs) will be received from the fixed laboratory in Ogden 794 Format. EDDs will eliminate the need for manual entry of data into the computer database.

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SECTION G.9
INTERNAL QUALITY CONTROL CHECKS

Internal QC checks will be performed for field sampling activities and laboratory activities. As appropriate, the following internal QC samples will be analyzed to aid in establishing the consistency and validity of the sample data.

G.9.1 FIELD ACTIVITY QUALITY CONTROL

Internal QC checks of sampling and analytical procedures and of the potential for cross contamination will be performed by submittal and evaluation of field QC samples, including equipment blanks, field blanks, and field duplicates. The definitions and use of each field QC sample are included in Section G.4.2.

G.9.2 LABORATORY QUALITY CONTROL

Laboratory QC samples will be used to assess the desired precision, accuracy, completeness, and comparability of the data. QC samples that are to be used in the laboratory for soil analysis are described below. Mobile laboratory QC samples for soil gas analysis are described in the active soil gas SOP in Appendix D. Method blanks and laboratory control samples are used to monitor the performance of the instrument and the laboratory's performance of the analytical method. Surrogate spikes, sample matrix spikes, sample matrix spike duplicates, and duplicates are used to assess the effects of a sample matrix on the analytical data as well as the laboratory's performance of the analytical method. Spikes will not typically be used for passive or active soil gas samples. Passive soil gas and field test-kit analysis QC procedures will follow supplier recommendations.

G.9.2.1 Active Soil Gas Sample Analysis

The following laboratory QC measures will be implemented for active soil gas sample analysis:

<u>Initial calibration standards</u>: An initial calibration with at least three different concentrations of the standard will be run as described in Appendix D.

Daily midpoint calibration check: Calibration will be checked daily with a midpoint concentration at the start of each day as described in Appendix D.

Laboratory control sample: An LCS, different from calibration standards, will be run as described in Appendix D.

Confirmation: Analyte confirmation using a second column and surrogate analytes is not required but may be used, as described in Appendix D.

G.9.2.2 Soil Sample Analysis

The following QC measures will be implemented for soil sample analysis:

Method blanks: Method blanks consist of analyte-free water processed in the same manner as the samples within a batch, using identical reagents and solvents. Method blanks serve to measure contamination associated with laboratory storage, preparation, or instrumentation. The criteria for method blank acceptance are provided on a method-by-method basis. No detections of analytes are desired; if there are detections, this indicates sample cross contamination and associated samples will be qualified during the data validation process.

Laboratory control samples (LCSs): LCSs, or blank spikes, and blank spike duplicates are independently prepared standards with known quantities of analytes that are analyzed by the laboratory to verify the analytical procedure and instrument calibration. LCSs are subjected to the sample preparation or extraction procedure and analyzed as samples.

LCS results are compared to control limits that have been established for each of the compounds being monitored. Initially, EPA-established control limits or laboratory historical data are used to set the control limits. Control limits are recalculated periodically as sufficient LCS data become available. Control limits for LCS results can be based on the historical average recovery in the blank spike, plus or minus three standard deviation units. Results that fall within the control limits are judged to be in control. Spikes that fall outside of precision and/or accuracy acceptance criteria are judged to be out of control and indicate either a matrix interference or a problem with the standard analytical procedure. Once an analytical laboratory is selected, these criteria will be available and will replace those listed in Table G.3-3.

Internal standards: Internal standards are measured quantities of certain compounds added to a sample or the sample extract after preparation or extraction of the sample. Internal standards are used in an internal standard calibration method to correct for analytical method effects such as capillary column injection losses, purging losses, or viscosity effects.

Interference check sample (ICP analyses only): This solution contains both interfering and analyte elements of known concentrations and is used to verify background and interelement correction factors. The sample is run at the beginning and end of each batch.

Surrogate spikes: Surrogate spikes are used for most organic methods. Surrogates are compounds similar to the analytes of interest but are not commonly found in environmental samples. The surrogates are added to samples to monitor the effect of the matrix on the accuracy of the analysis. Surrogate spikes are utilized to assess the recovery of the method and to determine any systematic sample preparation or extraction problem. Results are reported in terms of percent recovery. Surrogate recovery percentage goals for the analytical methods to be used during the RFI are listed in Table G.3-3.

Sample MS/MSD: For each analytical batch of up to 20 samples, a sample is selected that represents the matrix in the batch. This sample is divided into two separate portions that are spiked in duplicate by adding known amounts of analytes to the sample. The matrix spike and matrix spike duplicate are subjected to the sample preparation or extraction procedure and analyzed as samples. The spike recovery measures the effects of interferences in the sample matrix and reflects the accuracy of the determination. The results will be expressed as percent recovery of the spiked compounds and the RFD between the spike and spike duplicate results.

Duplicates: Certain analytes are not amenable to spike additions. For these analytes, samples are run in duplicate. The duplicate sample is subjected to the same preparation and analytical scheme as the original sample. The precision of a given analysis is reported as the RFD between the duplicates. For metals, duplicates and matrix spikes will be analyzed, but not matrix spike duplicates.

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SECTION G.10
PREVENTIVE MAINTENANCE

G.10.1 FIELD EQUIPMENT

Field equipment will be subject to a routine maintenance program in accordance with the manufacturer's specifications. Equipment will be cleaned and checked for integrity after each use. If defects are observed, necessary repairs will be performed before the item of equipment is used again. Equipment parts with a limited life (such as batteries, membranes, and some electronic components) will be checked periodically, and replaced or recharged as necessary, according to the manufacturer's specifications.

Each piece of field equipment will have its own log sheet containing the equipment identification number, date of use, information on maintenance procedures, and date of last maintenance (and type of maintenance). Because most equipment is used on an irregular, as-needed basis, equipment will be properly stored when not in use.

G.10.2 LABORATORY EQUIPMENT

Laboratory instrument checks and maintenance will be documented in instrument logbooks at the instrument location. The logs typically contain date, name of analyst, instrument malfunction (if any), and corrective or preventive maintenance performed. The appropriate spare parts to keep the instruments functioning on a regular basis are usually kept in laboratory inventory but will be readily available from the manufacturer, if necessary.

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SECTION G.11
ASSESSING DATA QUALITY OBJECTIVES

The following sections describe how the field and laboratory QC aspects will be assessed.

G.11.1 FIELD

The impact of field activities on data quality relates primarily to sampling technique and sample point location and postcollection sample handling procedures. Use of SOPs will minimize problems and audits, as described in Section G.12, and will provide the principal means of assessing the conformance of field personnel to SOPs set forth in the RFI work plan addendum. Periodic QC checks will be made to evaluate whether sample documentation procedures adhere to those stated in the DMP (Appendix D), to ensure that field equipment calibration sheets are on file, and to check for transcription errors on labels and/or COCs. Observed problems may lead to data qualifications during data validation activities as discussed in Section G.8. A summary of any problems will be described in the text of the report.

G.11.2 LABORATORY

Data will be validated as described in Section G.8. An overall data quality assessment summary will be provided in the text of the report.

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SECTION G.12
PERFORMANCE AND SYSTEMS AUDITS

The primary objective of performance and systems audits is to document that the established QA/QC procedures are properly implemented. Qualified personnel will perform the various tasks.

G.12.1 PERFORMANCE AUDITS

Performance audits are day-to-day evaluations of data quality produced by a particular activity or function. Performance audits will be conducted weekly by the field manager, and at least once by the QA/QC manager or designee. These performance audits will consist of real-time observation and review of field sampling, sample handling, and documentation. Any problems or deviations from SOPs or this QAPP will be documented and provided to the QA/QC manager and the project manager.

Internal laboratory performance audits will be performed as described in the laboratory's QA manual and SOP manual.

In addition, performance audits of the contracted laboratories will be conducted by use of a PE sample. This PE sample is supplied by a vendor for selected analytes and at certified concentrations. The purpose of this performance audit is to verify that the contracted laboratories are correctly identifying and quantifying analytes of interest.

For the offsite laboratory, a PE sample containing certified concentrations of certain PAHs will be submitted for analysis. Results reported by the laboratory will be compared to the certified concentrations to assess accuracy. A PE sample containing NDMA will also be supplied if it can be obtained from a vendor. For the mobile laboratory, a soil PE sample for chlorinated and aromatic VOCs and TPH will be used.

G.12.2 SYSTEMS AUDITS

Systems audits are an independent evaluation of components of the measurement systems and are done for proper systems selection and use. A systems audit will be conducted at least once during the field program by a senior technical person, the QA/QC manager, or designee. Such an audit will address both field and laboratory activities and will include a review of:

- personnel qualifications
- sampling equipment
- decontamination
- documentation
- sampling, testing, and analytical methodologies and techniques
- adherence to Standard Operating Procedures
- adherence to the Work Plan and Quality Assurance Project Plan

Audit findings will be discussed immediately with the Field Manager and other appropriate site personnel, then submitted in writing to the Project Manager, typically within 14 days of completion. Each report will indicate whether performance and systems operations are satisfactory. In the event inadequacies are identified, corrective measures will be undertaken as outlined in Section 13.

A 1-day performance audit of the mobile laboratory will likely be performed by a qualified chemist. Adherence to analytical methods and QA/QC procedures will be assessed. Any deficiencies will be documented and corrected immediately. A brief report of the audit findings will be prepared and provided to the QA/QC Manager and Project Manager.

SECTION G.13
CORRECTIVE ACTIONS

The following procedures have been established to provide that conditions adverse to quality, such as malfunctions, deficiencies, deviation, and errors, are promptly investigated, documented, evaluated, and corrected. Nonconforming conditions can include but are not limited to the following:

- laboratory or field data are incomplete;
- improper calculation, methodology or technique was used, or instrument malfunction occurred;
- DQOs for precision, accuracy, and completeness are not achieved;
- specific requirements of the method or standard operating procedures not met; and
- performance and systems audits indicate a deficiency, as discussed in Section 12.

An example corrective action form is included as Figure G.13-1. When a significant nonconforming condition is noted at the site or laboratory, the cause of the condition will be evaluated, and corrective action will be taken to preclude recurrence. Condition identification, cause, reference documents, and corrective actions planned will be documented and reported to the Project Manager, QA/QC Manager, and subcontractor management (if applicable), at a minimum. Implementation of corrective action will be verified by documented follow-up to the QA/QC Manager. All project personnel have the responsibility to promptly identify, solicit approved corrective action, and report nonconforming conditions. Project management and staff, as well as laboratory groups, must monitor ongoing work performance in the normal course of daily responsibilities.

When identifying the nonconforming conditions, a request is directed to the manager in charge of the item or activity requiring correction or modification. The individual to whom the request is addressed returns the response (including signature and date) promptly to the QA/QC Manager after stating the cause of the conditions and the corrective action to be taken. The QA/QC Manager confirms the adequacy of the intended corrective action, verifies implementation of the corrective action, and maintains the log of requests issued and the responses. Upon verification of implementation of the corrective action, the QA/QC Manager will close out the request and distribute copies to the Project Manager and appropriate task managers/personnel. Original requests will be maintained in the project files.

Items, activities, or documents that do not conform to QA/QC requirements will be documented. Corrective actions will be identified via audit findings sheets attached to the audit report. Audit findings will be logged, maintained, and controlled by the QA/QC Manager. However, corrective action and verification of implementation of accepted corrective action(s) will involve the Project Manager as well as the QA/QC Manager.

SECTION G.14

QUALITY ASSURANCE REPORTS TO MANAGEMENT

Reports from the QA/QC Manager to the Ogden Project Manager will typically address the following:

- overview of activities and significant events related to QA/QC;
- summary of audit results (Section G.12);
- review of corrective action request status (Section G.13);
- summary of laboratory QA/QC reports, via a summary of data validation reports;
- summary of significant changes to SOPs, the work plan addendum, and the QAPP; and
- recommendations.

Reports will be submitted to the Project Manager as necessary. Once the QA reports have been reviewed by the Project Manager, a summary report will be prepared for the Rocketdyne Project Manager.

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Table G.1-1

ANALYTICAL CATEGORIES FOR POTENTIAL CHEMICALS AND WASTES

Waste Source	Potential Chemicals Introduced	Analytical Category	EPA Analytical Method Number
Laboratories	Solvents(a)	VOCs	8010/8020(b)
	Alcohols, Ketones	(c)	(c)
	Formaldehyde	Carbonyl Compounds	8315A
Rocket Testing Fuels/Solvents	RP-1 (high grade kerosene)	TPH	8015M
	JP-4 (gasoline and diesel)	TPH	8015M
	Solvents(a)	VOCs	8010/8020(b)
	monomethyl hydrazine (MMH)	(c)	
	hydrazine derivatives	(c)	
	N-nitrosodimethylamine (NDMA)	SVOCs	8270SIM(d)
	Liquid Hydrogen	(c)	
	Combustion products	PAHs	8270SIM
Sludges	Waste Oil	TPH	8015M
	Metals	Metals	6010, 7196, 7470/7471
Oxidizers	Nitrogen tetroxide (NTO)	Nitrates	(c)
	Inhibited Red Fuming Nitric Acid (IRFNA)	Nitrates	(c)
	Fluorine compounds	Total Fluoride	340.2
	RDX, HMX	Ordnance	8330
Caustic Solutions	Potassium Hydroxide	pH	9045
	Sodium Hydroxide	pH	9045
Reactive metals	Metals, primarily sodium	Metals	6010, 7196
Thermal Treatment/ Incineration	Metals	Metals	6010, 7196
	Combustion Products	PAHs	8270SIM
		Dioxins/Furans	8290

Table G.1-1 (Page 2 of 2)

ANALYTICAL CATEGORIES FOR POTENTIAL CHEMICALS AND WASTES

(a) Primary chlorinated solvents detected at the site include TCE, TCA, Freon-113, methylene chloride, PCE, DCA, and Freon-11.
(b) Passive soil gas samples will be analyzed by a TD-GC/MS method.
(c) Will not be analyzed for because of instability in the environment and/or low toxicity.
(d) Additional hydrazine compounds may be analyzed by USEPA Method 8270SIM if NDMA concentrations above its action level are detected.

8270SIM = USEPA Method 8270 with Selected Ion Monitoring
8015M = USEPA Method 8015 Modified
VOCs = Volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
PAHs = Polynuclear Aromatic Hydrocarbon Compounds
SVOCs = Semivolatile Organic Compounds
HMX = High Melting Explosive
RDX = Royal Demolition Explosive

Table G.3-1

ANALYTICAL METHODS

Analytical Category	Analysis EPA Method No.	Analysis Method	Method Reference	Preparation No.	Preparation Method
Passive Soil Gas					
VOCs and Light PAHs	NA	TD-GC/MS	(c)	NA	Thermal desorption
Active Soil Gas					
Chlorinated VOCs	8010(a)	GC-ELCD	EPA SW-846	NA or 5030	Direct injection or purge and trap
Aromatic VOCs	8020(a)	GC-PID	EPA SW-846	NA or 5030	Direct injection or purge and trap
Soil Test Kits					
PAH	4035	Immunoassay	EPA SW-846	4035	Extraction, filtration
Soil and Field QC Water					
Chlorinated VOCs	8010(a)	GC-ELCD	EPA SW-846	5030	Purge and trap
Aromatic VOCs	8020(a)	GC-PID	EPA SW-846	5030	Purge and trap
VOCs	8260	GC/MS	EPASW-846	5030	Purge and trap
PAHs, NDMA,(e)	8270SIM(b)	GC/MS with SIM	EPA SW-846 with modification	3540/3550 (soil) 3510/3520 (water)	soxhlet/sonication (soil) separatory funnel/liquid-liquid (water)
Carbonyl Compounds	8315A	HPLC	EPA SW-846	3540/3550 (soil) 3510/3520 (water)	soxhlet/sonication (soil) separatory funnel/liquid-liquid (water)

Table G.3-1 (Page 2 of 3)

ANALYTICAL METHODS

Analytical Category	Analysis EPA Method No.	Analysis Method	Method Reference	Preparation No.	Preparation Method
Dioxin/Furans	8290	GC/MS	EPA SW-846	3540/3550 (soil) 3510/3520 (water)	soxhlet/sonication (soil) separatory funnel/liquid-liquid (water)
Ordnances	8330	HPLC	EPA SW-846	3540/3550 (soil) 3510/3520 (water)	soxhlet/sonication (soil) separatory funnel/liquid-liquid (water)
TPH	8015M	GC-FID	CA LUFT Manual	CA LUFT	Purge and trap, and/or extraction
Metals (17 Title 22)	6010/7470/7471	Trace ICP	EPA SW-846	3050	Acid Digestion
Hexavalent Chromium	7196	Colorimetric	EPA SW-846	3060	Reaction
Total Fluoride	340.2 modified for soil	Electrode	EPA-600/4-79-020	NA	(d)
pH	9040 water/9045 soil	Electrode	EPA SW-846	9040 water/9045 soil	None/Mix with water

Note: Refer to Table G.3-4 for which analyses will be performed with field test kits in an onsite mobile laboratory and in an offsite fixed laboratory.

Note: A subset of these methods listed will be used for analyzing samples from each site, depending on suspected site contaminants and analytes previously detected. See Table G.1-1 and the work plan addendum for more details.

(a) EPA Method 8021 may be used instead; it is similar to Methods 8010 and 8020 combined because it uses GC-ELCD and GC-PID in series.

(b) Selected Ion Monitoring is part of EPA Methods 8280 and 8290, as well as National Oceanic and Atmospheric Administration (NOAA) Status and Trends methods for analysis of PAHs at low detection limits (NOAA 1993).

(c) Nonstandard method. Two vendors, NERI and W. L. Gore and Associates, use a similar method (see Appendix E).

(d) Standard methods for fluoride in soil do not exist. The method for water analysis will be modified, possibly using a water extraction. This preparation method will be selected after discussions with the analytical laboratory once it is selected.

(e) PAHs and NDMA will be analyzed for only at sites where these were previously detected or are expected.

(f) Method 8260 will be used in the fixed laboratory for confirming percntage of Method 8010 and 8020 results from the onsite mobile laboratory.

Table G.3-1 (Page 3 of 3)

ANALYTICAL METHODS

NA - Not applicable
VOCs - Volatile Organic Compounds
PAHs - Polynuclear Aromatic Hydrocarbons
TD - Thermal Desorption
GC/MS - Gas Chromatography/Mass Spectrometry
EPA - Environmental Protection Agency
SW-846 - Test Method for Evaluating Solid Waste (EPA 1995)
LUFT - Leaking Underground Fuel Tank
TPH - Total Petroleum Hydrocarbons
CA - California
8015M - 8015 Modified
FID - Flame Ionization Detector
PID - Photo Ionization Detector
NDMA - N-Nitrosodimethylamine
QC - Quality Control
ELCD - Electrolytic Conductivity Detector
SIM - Selected Ion Monitoring

Table G.3-2

ANALYTICAL DATA QUALITY OBJECTIVES FOR DETECTION LIMITS

Analytical Category	Analyte	Estimated Quantitation Limit(a,b) (mg/kg)	Field Action Level(c) (mg/kg)
VOCs by Passive Soil Gas	See Appendices D and F	presence or absence	presence(d)
VOCs and Light PAHs (TD-GC/MS)			
VOCs by Active Soil Gas	See Appendices D and F		
Chlorinated VOCs (8010)	See Appendix F	1 µg/L(e)	(d)
Aromatic VOCs (8020)	See Appendix F	1 µg/L(e)	(d)
Soil			
PAH Test Kits (4035)	Polynuclear Aromatic Hydrocarbons	1 mg/kg	1 mg/kg
VOCs (f) (8260 and 8010/8020)	2-Chloroethyl vinyl ether	0.005	(g)
	1,1-Dichloroethane	0.005	1.81
	1,1-Dichloroethene	0.005	0.01
	1,2-Dibromo-3-chloropropane	0.005	(g)
	1,2-Dichlorobenzene	0.005	630
	1,2-Dichloroethane	0.005	0.2
	1,3-Dichlorobenzene	0.005	891
	1,4-Dichlorobenzene	0.005	1.93
	1,1,1-Trichloroethane	0.005	7
	1,1,2-Trichloroethane	0.005	0.1
	1,1,2-Trichlorotrifluoroethane (Freon 113)(h)	0.005	40.8
	1,1,1,2-Trichloroethane	0.005	5.9
	1,1,2,2-Tetrachloroethane	0.005	0.569
	Acetone	0.005	341
	Benzene	0.005	0.168
	Bromodichloromethane	0.005	(g)
	Bromoform	0.005	(g)
	Bromomethane	0.005	(g)
	Carbon tetrachloride	0.005	0.407
	Chlorobenzene	0.005	19.1
	Chloroethane	0.005	(g)
	Chloroform	0.005	0.64
	Chloromethane	0.005	(g)
	Chlorotrifluoroethylene	0.005	40.8
	Chlorofluoroethylene	0.005	40.8

Table G.3-2 (Page 2 of 4)

ANALYTICAL DATA QUALITY OBJECTIVES FOR DETECTION LIMITS

Analytical Category	Analyte	Estimated Quantitation Limit(a,b) (mg/kg)	Field Action Level(c) (mg/kg)
	Chlorotrifluoroethane	0.005	40.8
	cis-1,2-Dichloroethene	0.005	0.05
	Dichlorodifluoromethane (Freon 12)	0.005	11.7
	Ethylbenzene	0.005	670
	Methyl Ethyl Ketone	0.005	400
	Methylene chloride	0.005	1.9
	Xylene (Total)	0.005	300
	Tetrachloroethene	0.005	0.3
	Toluene	0.005	392
	Trimethylbenzene	0.005	300
	trans-1,2-Dichloroethene	0.005	0.15
	trans-1,3-Dichloropropene	0.005	(g)
	Trichloroethene	0.005	0.19
	Trichlorofluoromethane (Freon 11)(h)	0.005	(g)
	Vinyl chloride	0.005	0.0011
SVOCs (8270SIM)	Acenaphthylene	0.005	(g)
	Acenaphthene	0.005	1,030
	Anthracene	0.005	(g)
	Benzo(a)anthracene	0.005	(g)
	Benzo(b)fluoranthene	0.005	(g)
	Benzo(k)fluoranthene	0.005	0.114
	Benzo(g,h,i)perylene	0.005	938
	Benzo(a)pyrene	0.005	0.0114
	Chrysene	0.005	11.4
	Dibenz(a,h)anthracene	0.005	(g)
	Fluoranthene	0.005	1,250
	Fluorene	0.005	(g)
	Indeno(1,2,3-cd)pyrene	0.005	0.114
	Naphthalene	0.005	616
	Phenanthrene	0.005	938
	Pyrene	0.005	938
	bis(2-ethylhexyl)phthalate	0.005	22.1
	di-n-butylphthalate	0.005	3,910
	diethylphthalate	0.005	31,200
	N-nitrosodimethylamine (NDMA)(i)	0.05	0.00364
	N-nitrosodiphenylamine	0.05	37.9
Ion Chromatography	Dimethyl hydrazine	0.05	0.0714
	Hydrazine	0.05	0.0302
	Monomethyl hydrazine	0.05	0.00034
Ordnance (8330)	Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine (HMX)	0.13	1,520
	Hexahydro-1,3,5,-Trinitro-1,3,5-Triazine (RDX)	0.13	0.51

Table G.3-2 (Page 3 of 4)

ANALYTICAL DATA QUALITY OBJECTIVES FOR DETECTION LIMITS

Analytical Category	Analyte	Estimated Quantitation Limit[a,b] (mg/kg)	Field Action Level[c] (mg/kg)
Carbonyl Compound (8315)	Formaldehyde	2.0	7,800
Dioxins/Furans (8290)	2,3,7,8-TCDD	3.0 x 10^{-6}	1.05 x 10^{-6}
	1,2,3,7,8-PeCDD	6.0 x 10^{-6}	2.10 x 10^{-6}
	2,3,4,7,8-PeCDF	6.0 x 10^{-6}	2.10 x 10^{-6}
	1,2,3,7,8-PeCDF	6.0 x 10^{-6}	2.10 x 10^{-5}
	1,2,3,4,7,8-HxCDF	6.0 x 10^{-6}	1.05 x 10^{-5}
	1,2,3,6,7,8-HxCDF	6.0 x 10^{-6}	1.05 x 10^{-5}
	1,2,3,7,8,9--HxCDF	6.0 x 10^{-6}	1.05 x 10^{-5}
	2,3,4,6,7,8-HxCDF	6.0 x 10^{-6}	1.05 x 10^{-5}
	1,2,3,4,7,8-HxCDD	6.0 x 10^{-6}	1.05 x 10^{-5}
	1,2,3,6,7,8-HxCDD	6.0 x 10^{-6}	1.05 x 10^{-5}
	1,2,3,7,8,9-HxCDD	6.0 x 10^{-6}	1.05 x 10^{-5}
	1,2,3,4,6,7,8-HpCDD	2.60 x 10^{-5}	1.05 x 10^{-4}
	1,2,3,4,7,8,9-HpCDF	6.0 x 10^{-6}	1.05 x 10^{-4}
	1,2,3,4,6,7,8-HpCDF	6.0 x 10^{-6}	1.05 x 10^{-4}
	OCDF	6.0 x 10^{-5}	1.05 x 10^{-3}
	OCDD	6.0 x 10^{-5}	1.05 x 10^{-3}
TPH (8015M)	Gas/diesel/lube oil	5	100
Metals (6010/7000)	Antimony	3.0	8.7
	Arsenic	2.0	8.4
	Barium	0.5	162
	Berylium	0.5	0.9
	Cadmium	0.5	6.4
	Chromium (Total)	2.0	37.1
	Cobalt	1.0	18.4
	Copper	1.0	68.6
	Lead	1.5	19.9
	Mercury	0.2	0.3
	Molybdenum	1.0	5.2
	Nickel	1.0	64.6
	Selenium	1.0	0.84
	Silver	1.0	1.1
	Thallium	1.0	Detection Limit
	Vanadium	0.5	57.1
	Zinc	2.0	370
Hexavalent Chromium (7196)	Hexavalent Chromium	0.03	0.389
Fluoride (340.2)	Total Fluoride	100	4,260

Table G.3-2 (Page 4 of 4)

ANALYTICAL DATA QUALITY OBJECTIVES FOR DETECTION LIMITS

Analytical Category	Analyte	Estimated Quantitation Limit[(a,b)] (mg/kg)	Field Action Level[(c)] (mg/kg)
Nitrate (300)	Total Nitrate//Nitrite	0.01	113,500[(j)]
Chloride (300)	Total Chloride	0.5	(k)
pH (9045)	pH	0.1 units	(k)
Field QC Soil Samples for Confirmation	(c)	0.005	See 8010, 8020
Field QC Water Samples	Same as for soil	See Method Reference	Detection[(m)]

EQL - Estimated Quantitation Limit

(a) Sample EQLs are highly matrix dependent. The EQLs listed here are provided for guidance and may not always be achievable. EQLs are listed for soil/sediment based on wet-weight, but normally data are reported on a dry-weight basis; therefore, actual EQLs will be higher based on the percent moisture in each sample (EPA 1992).

(b) Estimated quantitation limit is different for different laboratories. Once a laboratory is selected for this project, its MDL studies and Laboratory Quality Assurance Plan (LQAP) will be used to identify the estimated quantitation limit for each analyte.

(c) See Section 2 and Appendix B of the work plan addendum.

(d) No field action level established. Additional sampling based on indication of elevated concentrations, generally 100 µg/L total VOCs.

(e) For each analyte 50 µg/L if direct injection.

(f) GC measurements for Method 8010/8020 are generally more sensitive than the GC/MS measurements for Method 8260.

(g) FAL not calculated for field program. If detected, the FAL of a similar compound will be used for screening soil sample results.

(h) These analytes are not typically detected by this method but will be added to the analyte list if possible.

(i) N-nitrosodimethylamine (NDMA) is not a typical target analyte but will be specially requested for analysis. A small sample of NDMA or rocket fuel containing NDMA will be required as a standard for the laboratory. Other hydrazine compounds will only be analyzed if possible when concentrations of NDMA above the action level are detected.

(j) FAL for nitrate

(k) No FAL determined for field program (see Section 2 and Appendix B).

(l) Analysis for field QC samples will include all methods requested for the field program.

(m) Any field QC water sample detections will be used to validate data (Section G.8).

Table G.3-3

ANALYTICAL DATA QUALITY OBJECTIVES FOR ACCURACY AND PRECISION, MOBILE AND FIXED LABORATORY FOR SOIL AND WATER SAMPLES

Analytical Category and Parameters	Method Number and Reference(a)	MS/MSD or Surrogate Accuracy Criteria(b) (% Recovery)		BS/LCS Accuracy Criteria(c)		Precision Criteria (Maximum RPD)	
		Water	Soil	Water	Soil	Water	Soil
Volatile Organic Compounds	EPA SW-846 Methods 8010, 8020, 8260	Source: EPA SW-846		Source: (d)		Source: EPA SW-846	
Benzene(g)		76-127	66-142	70-130	70-130	11	21
Chlorobenzene(g, h)		75-130	60-133	70-130	70-130	13	21
1,1-Dichloroethene(h)		61-145	59-172	70-130	70-130	14	22
Toluene(g)		76-125	59-139	70-130	70-130	13	21
Trichloroethene(h)		71-120	62-137	70-130	70-130	14	24
Surrogates:		Source: EPA CLP Limit					
Bromofluorobenzene		86-115	59-113	NA	NA	NA	NA
1,2-Dichloroethane-d_4		76-114	70-121	NA	NA	NA	NA
Toluene-d_8		88-110	84-138	NA	NA	NA	NA
Polynuclear Aromatic Hydrocarbons, NDMA	EPA SW-846 8270SIM	Source: (d)		Source: (d)		Source: (d)	
Acenaphthene		70-130	60-140	80-120	60-140	30	40
Pyrene		70-130	60-140	80-120	60-140	30	40
Surrogate (e):							
Acenephthene-d_{10}		70-130	60-140	NA	NA	NA	NA
Total Petroleum Hydrocarbons	CA-LUFT, Modified 8015	Source: (d) 70-130	60-140	Source: (d) 80-120	60-140	Source: (d) 30	40

Table G.3-3 (Page 2 of 4)

ANALYTICAL DATA QUALITY OBJECTIVES FOR ACCURACY AND PRECISION, MOBILE AND FIXED LABORATORY FOR SOIL AND WATER SAMPLES

Analytical Category and Parameters	Method Number and Reference[(a)]	MS/MSD or Surrogate Accuracy Criteria[(b)] (% Recovery) Water	Soil	BS/LCS Accuracy Criteria[(c)] Water	Soil	Precision Criteria (Maximum RPD) Water	Soil
Surrogate[(e)]:							
Orthoterphenyl[(e)]		70-130[(d)]	60-140[(d)]	NA		NA	
<u>Ordnances</u>	EPA SW-846 8330						
HMX		Source: 50-150	50-150	50-150	50-150	30	30
RDX							
Surrogate: 1,2-Dinitrotoluene		60-140	23-140	NA	NA		
<u>Carbonyl Compounds</u>	EPA SW-846 8315A						
Formaldehyde		60-140	60-140	60-140	60-140	30	30
Surrogate: Butanal		35-114	23-120	N/A	N/A		
<u>Metals</u>	EPA SW-846	Source: EPA CLP Limit		Source: EPA CLP Limit		Source: EPA CLP Limit	
Aluminum	6010	75-125	75-125	80-120	80-120	20[(f)]	35[(f)]
Antimony	6010	75-125	75-125	80-120	80-120	20[(f)]	35[(f)]
Arsenic	7060	75-125	75-125	80-120	80-120	20[(f)]	35[(f)]
Barium	6010	75-125	75-125	80-120	80-120	20[(f)]	35[(f)]
Berylium	6010	75-125	75-125	80-120	80-120	20[(f)]	35[(f)]
Cadmium	6010	75-125	75-125	80-120	80-120	20[(f)]	35[(f)]
Chromium (Total)	6010	75-125	75-125	80-120	80-120	20[(f)]	35[(f)]

Table G.3-3 (Page 3 of 4)

ANALYTICAL DATA QUALITY OBJECTIVES FOR ACCURACY AND PRECISION, MOBILE AND FIXED LABORATORY FOR SOIL AND WATER SAMPLES

Analytical Category and Parameters	Method Number and Reference(a)	MS/MSD or Surrogate Accuracy Criteria(b) (% Recovery)		BS/LCS Accuracy Criteria(c)		Precision Criteria (Maximum RPD)	
		Water	Soil	Water	Soil	Water	Soil
Cobalt	6010	75-125	75-125	80-120	80-120	20(f)	35(f)
Copper	6010	75-125	75-125	80-120	80-120	20(f)	35(f)
Lead	6010	75-125	75-125	80-120	80-120	20(f)	35(f)
Mercury	7470/7471	75-125	75-125	80-120	80-120	20(f)	35(f)
Molybdenum	6010	75-125	75-125	80-120	80-120	20(f)	35(f)
Nickel	6010	75-125	75-125	80-120	80-120	20(f)	35(f)
Selenium	6010	75-125	75-125	80-120	80-120	20(f)	35(f)
Silver	6010	75-125	75-125	80-120	80-120	20(f)	35(f)
Thallium	6010	75-125	75-125	80-120	80-120	20(f)	35(f)
Vanadium	6010	75-125	75-125	80-120	80-120	20(f)	35(f)
Zinc	6010	75-125	75-125	80-120	80-120	20(f)	35(f)
<u>Fluoride</u>	EPA 340.2 modified for soil	75-125	75-125	NA	NA	20(f)	35(f)
Nitrate/Nitrite	EPA 300 modified for soil	75-125	75-125	N/A	N/A		
Chloride	EPA 300 modified for soil		75-125	N/A	N/A		

Table G.3-3 (Page 4 of 4)

ANALYTICAL DATA QUALITY OBJECTIVES FOR ACCURACY AND PRECISION, MOBILE AND FIXED LABORATORY FOR SOIL AND WATER SAMPLES

Notes:

(a) Method references are provided in Table G.3-1.

(b) MS/MSD represents Matrix Spike/Matrix Spike Duplicate. For metals and general chemistry, a matrix spike and sample duplicate will be analyzed instead of MS/MSD. Because the only water samples analyzed are field QC samples, MS/MSDs need not be performed for the water matrix.

(c) BS/LCS represents Blank Spike/Laboratory Control Sample. No CLP or method criteria exist for many organic tests, so laboratory limits will be used once a laboratoy is selected.

(d) The criteria presented will be revised after procurement of an analytical laboratory to support this investigation.

(e) When analytical laboratory is selected for the project, alternative surrogate(s) may be proposed and used.

(f) The maximum relative percent difference (RPD) provided applies only to cases where all duplicate sample values are greater than 5 times the CRDL. A maximum control limit of + or - CRDL for water samples will be used when at least one duplicate sample value is less than 5 times the CRDL.

(g) For 8010 and 8260.

(h) For 8020 and 8260.

NA indicates that the criteria are Not Applicable to this particular compound.

Note: Active soil gas, passive soil gas, and field test-kit analyses are not covered by this table. Active soil gas procedures are discussed in Appendix F. Passive soil gas data will not, for the most part, be used quantitatively. Field test-kit procedures are discussed in Appendix D and F. QC requirements for these matrices and tests are not as strict because they are screening analyses.

Table G-3.4

ANALYTICAL PROGRAM SUMMARY

Sampling Activity	Laboratory Analyses	Analytical Method	Onsite Analysis	Offsite Analysis (a)
Passive Soil Vapor	VOCs, light-weight SVOCs	TD-GC/MS	x	
Active Soil Vapor	VOCs	8010/8020, modified for vapor	x	
Soil Sampling	VOCs	8010/8020 and 8260	x	x
	SVOCs	8270SIM		x
	PAHs	4035 (Field Test Kit)	x	
	TPH	8015M	x	x
	Carbonyl Compounds (b)	8315A		x
	Ordnance	8330		x
	Total fluoride	340.2		x
	Nitrate/Nitrite and chloride	300.0		x
	PCDDs/PCDFs	8290		x
	Metals	6010, 7470, 7471, and 7196 (c)		x
	pH	9045		x
PE Samples	(d)	(d)	x	x

Notes:

(a) Selected soil samples will be analyzed at an offsite laboratory for QA/QC purposes
(b) Formaldehyde is the only compound proposed in this analytical category
(c) 17 Title 22 metals and hexavalent chromium
(d) PE soil samples for VOCs and TPH will be analyzed at the onsite laboratory, all other compounds will have QA/QC performed at the offsite laboratory.

VOCs = Volatile organic compounds
SVOCs = Semivolatile organic compounds
TPH = Total petroleum hydrocarbons
PAHs = Polynuclear aromatic hydrocarbons
PCDDs = Polychlorinated dibenzo-p-dioxins
PCDFs = Polychlorinated dibenzofurans
PE = Performance evaluation

Table G.4-1

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Matrix	Analytical Parameter	Method	Container	Sample Volume/Weight[a]	Preservative	Holding Time
Passive Soil Gas	VOCs, light PAHs	TD-GC/MS	Absorbent material in glass container	2 wires or cords	None	14 days
Active Soil Gas	VOCs	EPA 8010, 8020	Syringe	20 ml	None	4 hours[d]
Soil	PAH	draft EPA 4035	Brass or SS tubes or glass jars	4 oz[f]	None	2 days[d]
	VOCs	EPA 8010, 8020	Brass or SS tubes	4 oz[e]	Cool to 4°C	14 days
	PAHs, NDMA	EPA 8270SIM	Brass or SS tubes	4 oz[f]	Cool to 4°C	14 days or 7 days for extraction and 40 days for analysis
	VOCs	EPA 8260	Brass or SS tubes	[f]	Cool to 4°C	14 days
	Dioxins/Furans	EPA 8290	Brass or SS tubes	4 oz[f]	Cool to 4°C	30 days for extraction and 45 days for analysis
	Ordnance	EPA 8330	Brass or SS tubes	4 oz[f]	Cool to 4°C	14 days or 7 days for extraction and 40 days for analysis
	Carbonyl	EPA 8315A	Brass or SS tubes	4 oz[f]	Cool to 4°C	72 hours for extraction and derivitization; 72 hours for analysis
	TPH	Modified 8015	Brass or SS tubes	4 oz[e]	Cool to 4°C	14 days
	Metals	EPA 6010	SS rings	4 oz[f]	Cool to 4°C	6 months
	Hexavalent Chromium	EPA 7196	SS rings	4 oz[f]	Cool to 4°C	28 days
	Fluoride	EPA 340.2	Brass or SS tubes	8 oz[f]	Cool to 4°C	28 days
	Nitrite/Nitrate	EPA 300				28 days
	Chloride	EPA 300				28 days
	pH	EPA 150.1	Brass or SS tubes	4 oz[f]	Cool to 4°C	ASAP
	Total Organic Carbon	EPA 415.1 or Walkley Black	Brass or SS tubes	8 oz[f]	Cool to 4°C	28 days
Geotechnical Soil Samples	Soil Moisture Content	ASTM D2216	Brass or SS tubes	8 oz[g]	None	None
	Bulk Density	ASTM D2937	Brass or SS tubes	8 oz[g]	None	None
	Soil Porosity	Calculated[b]	Brass or SS tubes	8 oz[g]	None	None

Table G.4-1 (Page 2 of 3)

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Matrix	Analytical Parameter	Method	Container	Sample Volume/Weight(a)	Preservative	Holding Time
	Specific Gravity	ASTM D854 and C127	Brass or SS tubes	8 oz(g)	None	None
	Soil Partitioning Coefficient (K_d)	Nonstandard(c)	Brass or SS tubes	8 oz(g)	Cool to 4°C	None
Field QC Water	VOCs	EPA 8260	VOA vials with septum	2 x 40 ml	HC1, Cool to 4°C	14 days if preserved, 7 days if unpreserved
	PAHs, NDMA	EPA 8270SIM	G amber	1 L	Cool to 4°C	7 days for extraction and 40 days for analysis
	Dioxins/Furans	EPA 8290	G	1 L	Cool to 4°C	30 days for extraction and 45 days for analysis
	Ordnance	EPA 8330	G	1 L	Cool to 4°C	7 days for extraction and 40 days for analysis
	Carbonyl Compounds	EPA 8315A	G	1 L	Cool to 4°C	72 hours for extraction and derivitization 72 hours for analysis
	TPH	8015M	G amber	1 L	HCl or H_2SO_4	14 days
	Metals	EPA 6010	P,G	1 L	HNO_3 to pH<2	6 months
	Hexavalent Chromium	EPA 7196	P,G	1 L	TBP	24 hours
	Fluoride	EPA 340.2	P	1 L	Cool to 4°C	28 days
	Nitrate/Nitrite	EPA 300	P	250 ml	Cool 4°C, pH<2 H_2SO_4	28 days
	Chloride	EPA 300	P	125 ml	Cool 4°C	28 days
	pH	EPA 150.1	P,G	40 ml	Cool to 4°C	ASAP
	Total Organic Carbon	EPA 415.1 or Walkley Black	P,G	1 L	Cool to 4°C	28 days

---

(a) The laboratory may specify a larger or smaller volume at the beginning of the project. The volume listed above is a recommended minimum.

(b) Soil porosity calculated with the equation: Total Porosity = 1 - (Dry Density)/(Specific Gravity)

(c) Pavlostathis, S.G. and J. Kendrick. 1991. "Desorptive Behavior of Trichloroethylene in Contaminated Soil" in Environmental Science and Technology. 25, 274-279.

(d) Will be analyzed immediately when possible.

(e) One soil sample container will suffice for all analyses performed in the mobile laboratory.

Table G.4-1 (Page 3 of 3)

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Matrix	Analytical Parameter	Method	Container	Sample Volume/Weight[(a)]	Preservative	Holding Time

[(f)] One soil sample container likely will suffice for all analyses performed by the offsite laboratory.

[(g)] Two or more containers likely will be required for the suite of geotechnical analyses.

[(h)] Glass Teflon-lined wide-mouth jars may be substituted only if necessary; sample disturbance must be minimized.

EPA - Environmental Protection Agency
NA - Not Applicable
NDMA - N-Nitrosodimethylamine
PAHs - Polynuclear Aromatic Hydrocarbon Compounds
SIM - Selected Ion Monitoring
SS - Stainless Steel
TPH - Total Petroleum Hydrocarbon
VOCs - Volatile Organic Compounds
P = Polyethylene
G = Glass

Table G.4-1 (Page 3 of 3)

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

(f) One soil sample container likely will suffice for all analyses performed by the offsite laboratory.
(g) Two or more containers likely will be required for the suite of geotechnical analyses.
(h) Glass Teflon-lined wide-mouth jars may be substituted only if necessary; sample disturbance must be minimized.

EPA - Environmental Protection Agency
NA - Not Applicable
NDMA - N-Nitrosodimethylamine
PAHs - Polynuclear Aromatic Hydrocarbon Compounds
SIM - Selected Ion Monitoring
SS - Stainless Steel
TPH - Total Petroleum Hydrocarbon
VOCs - Volatile Organic Compounds
P = Polyethylene
G = Glass

Table G.5-1
SAMPLE TYPE AND MATRIX

Code	Sample Type	Matrix
BS	Boring	Soil
QS	Field QC	Soil
QW	Field QC	Water
SG	Soil Gas (active)	Gas
PG	Soil Gas (passive)	Gas
QG	Field QC	Gas

Table G.5-2
FIELD QC TYPE DESIGNATIONS

S	normal Sample	(all nonfield QC samples)
D	Duplicate	(collocate, e.g., adjacent liners)
R	Replicate	(homogenized or otherwise considered homogeneous)
E	Equipment rinsate	
F	Field blank	
T	Trip blank	
P	Performance Evaluation (PE)	
G	Geotechnical	
V	Field Test	(e.g., immunoassay test kit)

Table G.5-3
SAMPLE ID DESIGNATIONS FOR EACH SITE

"aa" of 9-character Sample ID	Area	PRP	SWMU or AOC Number	SWMU or AOC Name
IL	Area I	Rocketdyne	SWMU 4.3 SWMU 4.4	Instrument Lab, Building 324 Equipment Lab, Building 301
CL	Area I	Rocketdyne	SWMU 4.7	CTL-III Pond
AF	Area I	Rocketdyne	SWMU 4.9	APTF
LF	Area I	Rocketdyne	SWMU 4.12	LETF Area
CN	Area I	Rocketdyne	SWMU 4.14	Canyon Area
BA	Area I	Rocketdyne	SWMU 4.15 AOC	Bowl Test Area Ponds Building 901 Leach field
R1	Area I	Rocketdyne	SWMU 4.16	R1 Pond
PP	Area I	Rocketdyne	SWMU 4.17	Perimeter Pond
HV	Area I	Rocketdyne	AOC	Happy Valley
EV	Area II	NASA	SWMU 5.2	Building 206, ELV Final Assembly
DB 9/10/97 B~~V~~U	Area II	NASA	SWMU 5.5/AOC	B204 USTs
AP	Area II	NASA	SWMU 5.6	Ash Pile
AA	Area II	NASA	SWMU 5.9 SWMU 5.10 SWMU 5.11	Alfa Test Area Alfa Test Area Tanks Alfa Skim and Retention Ponds
BV	Area II	NASA	SWMU 5.13 SWMU 5.15	Bravo Test Area Bravo Skim Ponds
CA	Area II	NASA	SWMU 5.18, 5.19	Coca Test Area
DA	Area II	NASA	SWMU 5.23	Delta Test Area
R2	Area II	NASA	SWMU 5.26	R2 Ponds
SP	Area II	NASA	AOC	Storable Propellant Area (SPA)

Table G.5-3 (Page 2 of 2)
SAMPLE ID DESIGNATIONS FOR EACH SITE

"aa" of 9-character Sample ID	Area	PRP	SWMU or AOC Number	SWMU or AOC Name
BT	Area II	NASA	AOC	Building 515 STP
LX	Area II	NASA	SWMU 4.5	LOX Plant Former Waste Oil Sump and Clarifier
EC	Area III	Rocketdyne	SWMU 6.1, 6.3/AOC	Equipment Chemistry Lab (ECL) Area, Building 270
CF	Area III	Rocketdyne	SWMU 6.4	Compound A Facility
SL	Area III	Rocketdyne	SWMU 6.5	STL-IV Test Area and Ozonator Tank
SN	Area III	Rocketdyne	SWMU 6.8	Silvernale Reservoir
EL	Area III	Rocketdyne	SWMU 6.9	EEL Area
BL	Area IV	DOE	SWMU 7.1	Building 056 Landfill
OC	Area IV	DOE	SWMU 7.4	Old Conservation Yard
HL	Area IV	DOE	SWMU 7.7	Rockwell International Hot Lab
NC	Area IV	DOE	SWMU 7.8	New Conservation Yard
CG	Area IV	DOE	SWMU 7.10	Former Coal Classification PDU
BG				Onsite Background
BZ				Buffer Zone

SECTION G.15
REFERENCES

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OGDEN

5510 MOREHOUSE DRIVE
SAN DIEGO, CA 92121
(619) 458-9044

Chain of Custody

Control Number: *COC*
Date / / Page 1 of 1

Project Manager:	Dixie Hambrick
Project Name:	Rockeydyne
Project Number:	31315 0001
Deliver results to the address above or as stated in contract	

Bill To:	Mark Deffley
Company:	Ogden Environmental
Address:	5510 Morehouse Drive, San Diego, CA 92121

Sample Disposal Instructions:
Shipment Method:
Comment:
ANIONS = NITRITE/NITRATE, CHLORIDE, FLOURIDE

Cooler No:	
QC Level:	**TAT:**

Sample Data

Sample ID	Description (for Ogden use only)		Date Collected	Time Collected	Lab ID

Matrix

Soil	Water	Soil Gas	Absorbent Mat

Preservatives	4°C	4°C HCL	4°C HCL	4°C HNO_3	4°C	4°C	4°C	4°C	4°C	4°C	4°C										
	EPA 8315 Carbonyls	EPA 8260 VOCs	TPH 8015M	17 Metals (Title 22)	PAHs 8270 SIM	NDMA 8270 SIM	9040/9045 pH	Dioxins/Furans 8290	Ordnance 8330	Hex Chrome 7196	Anions									Extra Volume MS/MSD	HOLD

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

For Lab Use

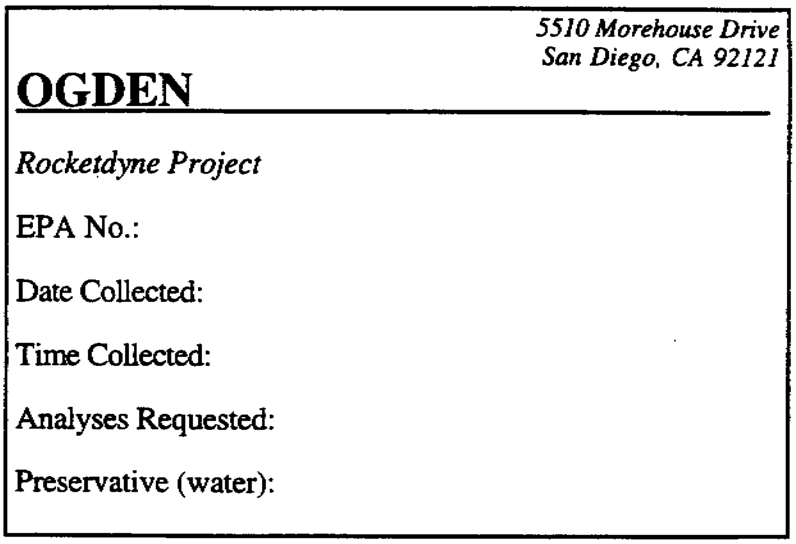
Lab Number:

Do COC match samples: Y or N
Broken container: Y or N
Received within holding time: Y or N
COC seal intact: Y or N
Any other problems: Y or N
If any YES, Ogden contacted: Y or N
Date contacted: ___ / ___ / ___
Temperature °C

1 Original, 2 Lab Copy, 3 Field Copy

REV: 1

Figure G.5-2 Example Chain-of-Custody Form



5510 Morehouse Drive
San Diego, CA 92121

OGDEN

Rocketdyne Project

EPA No.:

Date Collected:

Time Collected:

Analyses Requested:

Preservative (water):

Figure G.5-1
Example Sample Label

CORRECTIVE ACTION FORM

Project: Rocketdyne SSFL

To: ____________________

Nonconforming Condition:

Signed: ________________________________ Date: __________

cc: QA/QC Manager
Project Manager

RESPONSE

Cause:

Corrective Action Taken:

Signed: ________________________________ Date: __________

QA/QC Manager Approval:

Signed: ________________________________ Date: __________

QA/QC Manager Verification:

Signed: ________________________________ Date: __________

cc: Originator
Responder
Project Manager

Figure G.13-1

BELL CANYON SAMPLING

QUALITY ASSURANCE PROJECT PLAN

ATTACHMENT 2

(copy of the RFI Quality Assurance Project Plan Addendum, May 1998)

This addendum details additional analytical methods not included in the RCRA Facility Investigation (RFI) Quality Assurance Project Plan (QAPP) dated September 1996. It provides updated sample identifiers applicable to additional sites being investigated as part of the RFI. Also, it identifies a new QA/QC manager for the RFI sampling activities.

Columbia Analytical Services (CAS), Canoga Park, CA is the primary laboratory providing analytical services for all sampling efforts. Selected analyses are being performed at the CAS laboratories in Santa Clara, CA (perchlorates) and Kelso, WA (formaldehyde and tributyltin). Specialized analyses are subcontracted by CAS to Triangle Laboratories and Alta Laboratories (dioxins and furan analysis), Paragon (ordnance analysis) and Lockheed Analytical Services (hydrazine analysis). Onsite mobile lab analyses (EPA Methods 8015M and 8021) are provided by InterPhase/CAS mobile laboratory services. Confirmation sampling analysis for the mobile laboratory testing is performed by Centrum Laboratories using EPA Methods 8260 and 8015M.

Changes identified in this QAPP Addendum are the laboratory specific QA/QC criteria provided by CAS. Specifically, the Analytical Methods, the Quantitation Limits (QLs), and the Blank Spike (BS)/ Laboratory Control Sample (LCS) recovery limits have been updated where applicable. The attached tables are revised from the original QAPP to reflect these changes. Based on this review, the indicated acceptance criteria will meet the objectives of the project as described in the QAPP. CAS (Canoga Park, Santa Clara, and Kelso) Triangle, Alta, and Lockheed are ELAP certified laboratories. EPA or standard protocols are followed by the laboratories. Perchlorate is analyzed using ion chromatography (SM 300.0-modified) methodology. The Department of Health Services (DHS) has reviewed and found the CAS protocols acceptable for this method.

Specific Revisions/Additions

QA/QC Manager (effective 1/97):

Elizabeth Wessling

The Sample ID Format requires the following additions:

EPA Sample IDs:	RV, RR	Soil Vapor Laboratory
	RD, RM	Soil Mobile Laboratory
	RF, RS	Offsite Fixed Laboratory
	RG, RP	Offsite Geotechnical Laboratory

Refer to Section G.5.2, Appendix G (RFI Work Plan Addendum) for specific sample naming conventions.

The following additions are made for Site Identifiers:

Ogden Sample IDs:	CTL-V	Area I AOC	CT
	CDFF	Area II AOC	CD
	ABFF	Area II AOC	AB
	STP Pond	Area III AOC	ST
	SRE Pond	Area III AOC	SR
	Bldg. 5, PDU	SWMU 7.8	PU

Refer to Table ES-1, RFI Work Plan Addendum, Volume I for other specific RFI site identifiers.

Attachments: Revised Tables G.1-1, G.3-1, G.3-2, G.3-3, G.3-4, G.4

Table G.3-2 (Page 1 of 7)

ANALYTICAL DATA QUALITY OBJECTIVES FOR DETECTION LIMITS

Analytical Category	Analyte	Estimated Quantitation Limit[(a)] (mg/kg)	Field Action Level[(b)] (mg/kg)
VOCs by Active Soil Gas	See Appendices D and F		
Chlorinated VOCs (8260)	See Appendix F	1 µg/L[(d)]	(c)
Aromatic VOCs (8260)	See Appendix F	1 µg/L[(d)]	(c)
Soil			
PAH Test Kits (4035)	Polynuclear Aromatic Hydrocarbons	1 mg/kg	1 mg/kg
VOCs [(e)] (8260 and 8021)	2-Chloroethyl vinyl ether	0.005	(f)
	1,1-Dichloroethane	0.005	1.81
	1,1-Dichloroethene	0.005	0.01
	1,2-Dibromo-3-chloropropane	0.005	(f)
	1,2-Dichlorobenzene	0.005	630
	1,2-Dichloroethane	0.005	0.2
	1,3-Dichlorobenzene	0.005	891
	1,4-Dichlorobenzene	0.005	1.93
	1,1,1-Trichloroethane	0.005	7
	1,1,2-Trichloroethane	0.005	0.1
	1,1,2-Trichlorotrifluoroethane (Freon 113)[(g)]	0.005	40.8
	1,1,1,2-Trichloroethane	0.005	5.9
	1,1,2,2-Tetrachloroethane	0.005	0.569
	Acetone	0.005	341
	Benzene	0.005	0.168
	Bromodichloromethane	0.005	(f)
	Bromoform	0.005	(f)
	Bromomethane	0.005	(f)
	Carbon tetrachloride	0.005	0.407
	Chlorobenzene	0.005	19.1
	Chloroethane	0.005	(f)
	Chloroform	0.005	0.64
	Chloromethane	0.005	(f)
	Chlorotrifluoroethylene	0.005	40.8
	Chlorofluoroethylene	0.005	40.8
	Chlorotrifluoroethane	0.005	40.8

Table G.3-2 (Page 2 of 7)

ANALYTICAL DATA QUALITY OBJECTIVES FOR DETECTION LIMITS

Analytical Category	Analyte	Estimated Quantitation Limit[a] (mg/kg)	Field Action Level[b] (mg/kg)
	cis-1,2-Dichloroethene	0.005	0.05
	Dichlorodifluoromethane (Freon 12)	0.005	11.7
	Ethylbenzene	0.005	670
	Methyl Ethyl Ketone	0.005	400
	Methylene chloride	0.005	1.9
	Xylene (Total)	0.005	300
	Tetrachloroethene	0.005	0.3
	Toluene	0.005	392
	Trimethylbenzene	0.005	300
	trans-1,2-Dichloroethene	0.005	0.15
	trans-1,3-Dichloropropene	0.005	(f)
	Trichloroethene	0.005	0.19
	Trichlorofluoromethane (Freon 11)[g]	0.005	(f)
	Vinyl chloride	0.005	0.0011
SVOCs (8270SIM)	Acenaphthylene	0.005	(f)
	Acenaphthene	0.005	1,030
	Anthracene	0.005	(f)
	Benzo(a)anthracene	0.005	(f)
	Benzo(b)fluoranthene	0.005	(f)
	Benzo(k)fluoranthene	0.005	0.114
	Benzo(g,h,i)perylene	0.005	938
	Benzo(a)pyrene	0.005	0.0114
	Chrysene	0.005	11.4
	Dibenz(a,h)anthracene	0.005	(f)
	Fluoranthene	0.005	1,250
	Fluorene	0.005	(f)
	Indeno(1,2,3-cd)pyrene	0.005	0.114
	Naphthalene	0.005	616
	Phenanthrene	0.005	938
	Pyrene	0.005	938
	bis(2-ethylhexyl)phthalate	0.005	22.1
	di-n-butylphthalate	0.005	3,910
	diethylphthalate	0.005	31,200
	N-nitrosodimethylamine (NDMA)[h]	0.05	0.00364
	N-nitrosodiphenylamine	0.05	37.9
SVOCs(8270)[m]	1,2,4-Trichlorobenzene	0.30	(j)
	1,2-Dichlorobenzene	0.30	(j)
	1,3-Dichlorobenzene	0.30	891

Table G.3-2 (Page 3 of 7)

ANALYTICAL DATA QUALITY OBJECTIVES FOR DETECTION LIMITS

Analytical Category	Analyte	Estimated Quantitation Limit[(a)] (mg/kg)	Field Action Level[(b)] (mg/kg)
	1,4-Dichlorobenzene	0.30	1.93
	2,4,5-Trichlorophenol	0.30	(j)
	2,4,6-Trichlorophenol	0.30	(j)
	2,4-Dichlorophenol	0.30	(j)
	2,4-Dimethylphenol	0.30	(j)
	2,4-Dinitrophenol	0.30	(j)
	2,4-Dinitrotoluene	0.30	(j)
	2,6-Dinitrotoluene	0.30	(j)
	2-Chloronaphthalene	0.30	(j)
	2-Chlorophenol	0.30	(j)
	2-Methylnaphthalene	0.30	(j)
	2-Methylphenol	0.30	(j)
	2-Nitroaniline	0.30	(j)
	2-Nitrophenol	0.30	(j)
	3,3'-Dichlorobenzidine	0.30	(j)
	3- and 4-Methylphenol Coelution	0.30	(j)
	3-Nitroaniline	0.30	(j)
	4,6-Dinitro-2-methylphenol	0.30	(j)
	4-Bromophenyl phenyl ether	0.30	(j)
	4-Chloro-3-methylphenol	0.30	(j)
	4-Chloroaniline	0.30	(j)
	4-Chlorophenyl phenyl ether	0.30	(j)
	4-Nitroaniline	0.30	(j)
	4-Nitrophenol	0.30	(j)
	Acenaphthene	0.30	1,030
	Acenaphthylene	0.30	(f)
	Anthracene	0.30	(f)
	Benz(a)anthracene	0.30	(f)
	Benzo(a)pyrene	0.30	0.0114
	Benzo(b)fluoranthene	0.30	(f)
	Benzo(g,h,i)perylene	0.30	938
	Benzo(k)fluoranthene	0.30	0.114
	Benzoic acid	0.30	(j)
	Benzyl alcohol	0.30	(j)
	Butyl benzyl phthalate	0.30	(j)
	Carbazole	0.30	(j)
	Chrysene	0.30	11.4

Table G.3-2 (Page 4 of 7)

ANALYTICAL DATA QUALITY OBJECTIVES FOR DETECTION LIMITS

Analytical Category	Analyte	Estimated Quantitation Limit[a] (mg/kg)	Field Action Level[b] (mg/kg)
	Di-n-butyl phthalate	0.30	3,910
	Di-n-octyl phthalate	0.30	(j)
	Dibenz(a,h)anthracene	0.30	(j)
	Dibenzofuran	0.30	(j)
	Diethylphthalate	0.30	31,200
	Dimethyl phthalate	0.30	(f)
	Fluoranthene	0.30	1,250
	Fluorene	0.30	(f)
	Hexachlorobenzene	0.30	(j)
	Hexachlorobutadiene	0.30	(j)
	Hexachlorocyclopentadiene	0.30	(j)
	Hexachloroethane	0.30	(j)
	Indeno(1,2,3-cd)pyrene	0.30	0.114
	Isophorone	0.30	(j)
	N-Nitrosodi-n-propylamine	0.30	(f)
	N-Nitrosodiphenylamine	0.30	37.9
	Naphthalene	0.30	616
	Nitrobenzene	0.30	(j)
	Pentachlorophenol	0.30	(j)
	Phenanthrene	0.30	938
	Phenol	0.30	(j)
	Pyrene	0.30	938
	bis(2-Chloroethoxy)methane	0.30	(j)
	bis(2-Chloroethyl)ether	0.30	(j)
	bis(2-Chloroisopropyl) ether	0.30	(j)
	bis(2-Ethylhexyl)phthalate	0.30	22.1
PCBs (8080)	Aroclor-1016	0.01	(j)
	Aroclor-1221	0.01	(j)
	Aroclor-1231	0.01	(j)
	Aroclor-1242	0.01	(j)
	Aroclor-1248	0.01	(j)
	Aroclor-1254	0.01	(j)
	Aroclor-1260	0.01	(j)
Dioxins/Furans (8290, 1613B)	1,2,3,7,8-PeCDD	6.0×10^{-6}	2.10×10^{-6}
	2,3,4,7,8-PeCDF	6.0×10^{-6}	2.10×10^{-6}
	1,2,3,7,8-PeCDF	6.0×10^{-6}	2.10×10^{-5}

Table G.3-2 (Page 5 of 7)

ANALYTICAL DATA QUALITY OBJECTIVES FOR DETECTION LIMITS

Analytical Category	Analyte	Estimated Quantitation Limit(a) (mg/kg)	Field Action Level(b) (mg/kg)
	1,2,3,4,7,8-HxCDF	6.0×10^{-6}	1.05×10^{-5}
	1,2,3,6,7,8-HxCDF	6.0×10^{-6}	1.05×10^{-5}
	1,2,3,7,8,9--HxCDF	6.0×10^{-6}	1.05×10^{-5}
	2,3,4,6,7,8-HxCDF	6.0×10^{-6}	1.05×10^{-5}
	1,2,3,4,7,8-HxCDD	6.0×10^{-6}	1.05×10^{-5}
	1,2,3,6,7,8-HxCDD	6.0×10^{-6}	1.05×10^{-5}
	1,2,3,7,8,9-HxCDD	6.0×10^{-6}	1.05×10^{-5}
	1,2,3,4,6,7,8-HpCDD	2.60×10^{-5}	1.05×10^{-4}
	1,2,3,4,7,8,9-HpCDF	6.0×10^{-6}	1.05×10^{-4}
	1,2,3,4,6,7,8-HpCDF	6.0×10^{-6}	1.05×10^{-4}
	OCDF	6.0×10^{-5}	1.05×10^{-3}
	OCDD	6.0×10^{-5}	1.05×10^{-3}
TPH (8015M)	Gas/diesel/lube oil	5	100
Metals (6010/7000)	Aluminum		(j)
	Antimony	3.0	8.7
	Arsenic	2.0	8.4
	Barium	0.5	162
	Berylium	0.5	0.9
	Boron		(j)
	Cadmium	0.5	6.4
	Chromium (Total)	2.0	37.1
	Cobalt	1.0	18.4
	Copper	1.0	68.6
	Lead	1.5	19.9
	Mercury	0.2	0.3
	Molybdenum	1.0	5.2
	Nickel	1.0	64.6
	Selenium	1.0	0.84
	Silver	1.0	1.1
	Thallium	1.0	Detection Limit
	Vanadium	0.5	57.1
	Zinc	2.0	370
Hexavalent Chromium (7196)	Hexavalent Chromium	0.03	0.389

Table G.3-2 (Page 6 of 7)

ANALYTICAL DATA QUALITY OBJECTIVES FOR DETECTION LIMITS

Analytical Category	Analyte	Estimated Quantitation Limit[a] (mg/kg)	Field Action Level[b] (mg/kg)
Fluoride (340.2)	Total Fluoride	100	4,260
Nitrate (300)	Total Nitrate//Nitrite	0.01	113,500[i]
Perchlorates (300)	Perchlorate	0.01	(j)
Chloride (300)	Total Chloride	0.5	(j)
Tributyltin (Krone- et al. 1988)	Tributyltin	0.001	(j)
pH (9045)	pH	0.1 units	(j)
Field QC Soil Samples	(b)	0.005	8260
Field QC Water Samples	Same as for soil	See Method Reference	Detection[l]

EQL - Estimated Quantitation Limit

(a) Sample EQLs are highly matrix dependent. The EQLs listed here are provided for guidance and may not always be achievable. EQLs are listed for soil/sediment based on wet-weight, but normally data are reported on a dry-weight basis; therefore, actual EQLs will be higher based on the percent moisture in each sample (EPA 1992).

(b) See Section 2 and Appendix B of the work plan addendum.

(c) No field action level established. Additional sampling based on indication of elevated concentrations, generally 100 µg/L total VOCs.

(d) For each analyte 50 µg/L if direct injection.

(e) GC measurements for Method 8021 are generally more sensitive than the GC/MS measurements for Method 8260.

(f) FAL not calculated for field program. If detected, the FAL of a similar compound will be used for screening soil sample results.

(g) These analytes are not typically detected by this method but will be added to the analyte list if possible.

(h) N-nitrosodimethylamine (NDMA) is not a typical target analyte but will be specially requested for analysis. A small sample of NDMA or rocket fuel containing NDMA will be required as a standard for the laboratory. Other hydrazine compounds will only be analyzed if possible when concentrations of NDMA above the action level are detected.

(i) FAL for nitrate

Table G.3-2 (Page 7 of 7)

ANALYTICAL DATA QUALITY OBJECTIVES FOR DETECTION LIMITS

(j) No FAL determined for field program; additional sampling basd on levels detected and discussion with DTSC.
(k) Analysis for field QC samples will include all methods requested for the field program.
(l) Any field QC water sample detections will be used to validate data (Section G.8).
(m) EPA Method 8270 may be used in locations where additional semi-volatile compounds are potential contaminants, or in selected circumstances where Method 8270SIM results indicate compound interference.

Table G.3-4 (Page 1 of 2)

ANALYTICAL PROGRAM SUMMARY

Sampling Activity	Laboratory Analyses	Analytical Method	Onsite Analysis	Offsite Analysis (a)
Active Soil Vapor	VOCs	8260, modified for vapor	x	
Soil Sampling	VOCs	8021 and 8260	x	x
	SVOCs	8270SIM, 8270[b]		x
	PCBs	8080		x
	PAHs	4035 (Field Test Kit)	x	
	TPH	8015M	x	x
	Carbonyl Compounds[c]	ASTMD19		x
	Dioxins/Furans	8290, 1613B		x
	Ordnance	8330		x
	Total fluoride	340.2		x
	Perchlorates	300M		x
	Hydrazines	300M		x
	Nitrate/Nitrite and chloride	300.0		x
	Metals	6010, 7470, 7471, and 7196[d]		x
	pH	9045		x
PE Samples	(e)	(e)	x	x

Table G.3-4 (Page 2 of 2)

ANALYTICAL PROGRAM SUMMARY

Notes:

(a) Selected soil samples will be analyzed at an offsite laboratory
(b) Method 8270 used only in those locations where additional semi-volatile compounds are potential contaminants, or in selected circumstances where Method 8270SIM results indicate compound interference.
(c) Formaldehyde is the only compound proposed in this analytical category
(d) 17 Title 22 metals and hexavalent chromium
(e) PE soil samples for VOCs and TPH will be analyzed at the onsite laboratory, all other compounds will have QA/QC performed at the offsite laboratory.

ASTMD19 = American Society for Testing and Materials Method D19
VOCs = Volatile organic compounds
SVOCs = Semivolatile organic compounds
TPH = Total petroleum hydrocarbons
PAHs = Polynuclear aromatic hydrocarbons
PE = Performance evaluation
EPA = Environmental Protection Agency
PCBs = Polychlorinated biphenyls

Table G.4-1 (Page 1 of 4)

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Matrix	Analytical Parameter	Method	Container	Sample Volume/Weight(a)	Preservative	Holding Time
Passive Soil Gas	VOCs, light PAHs	TD-GC/MS	Absorbent material in glass container	2 wires or cords	None	14 days
Active Soil Gas	VOCs	EPA 8260 modified for soil	Glass bulb	200 ml	None	4 hours(d)
Soil	PAH (test kits)	draft EPA 4035	Brass or SS tubes or glass jars	4 oz(f)	None	2 days(d)
	VOCs	EPA 8260, 8021	Brass or SS tubes	4 oz(e)	Cool to 4°C	14 days
	PAHs, NDMA	EPA 8270SIM	Brass or SS tubes	4 oz(f)	Cool to 4°C	14 days for extraction and 40 days for analysis
	SVOC	EPA 8270	Brass or SS tubes	4 oz(f)	Cool to 4°C	14 days for extraction and 40 days for analysis
	PCBs	EPA 8080	Brass or SS tubes	4 oz(f)	Cool to 4°C	14 days for extraction and 40 days for analysis
	Dioxins/Furans	EPA 8290, 1613B	Brass or SS tubes	4 oz(f)	Cool to 4°C	30 days for extraction and 45 days for analysis
	Ordnance	EPA 8330	Brass or SS tubes	4 oz(f)	Cool to 4°C	14 days for extraction and 40 days for analysis
	Carbonyl	ASTMD19	Brass or SS tubes	4 oz(f)	Cool to 4°C	72 hours for extraction and derivitization; 72 hours for analysis
	TPH	EPA 8015M	Brass or SS tubes	4 oz(e)	Cool to 4°C	14 days
	Metals	EPA 6010	SS tubes	4 oz(f)	Cool to 4°C	6 months
	Hexavalent Chromium	EPA 7196	SS tubes	4 oz(f)	Cool to 4°C	28 days
	Fluoride	EPA 340.2	Brass or SS tubes	8 oz(f)	Cool to 4°C	28 days
	Nitrite/Nitrate	EPA 300	Brass or SS tubes	8 oz(f)	Cool to 4°C	28 days
	Chloride	EPA 300	Brass or SS tubes	8 oz(f)	Cool to 4°C	28 days
	Perchlorates	EPA 300	Brass or SS tubes	8 oz(f)	Cool to 4°C	28 days

Table G.4-1 (Page 2 of 4)

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Matrix	Analytical Parameter	Method	Container	Sample Volume/Weight[(a)]	Preservative	Holding Time
	Hydrazines	EPA 300	Brass or SS tubes	8 oz(f)	Cool to 4°C	28 days
	pH	EPA 150.1	Brass or SS tubes	4 oz(f)	Cool to 4°C	ASAP
	Total Organic Carbon	EPA 415.1 or Walkley Black	Brass or SS tubes	8 oz(f)	Cool to 4°C	28 days
	Tributyltin	Krone, et al. 1988	Brass or SS tubes	4 oz	none	28 days
Geotechnical Soil Samples	Soil Moisture Content	ASTM D2216	Brass or SS tubes	8 oz(g)	None	None
	Bulk Density	ASTM D2937	Brass or SS tubes	8 oz(g)	None	None
	Soil Porosity	Calculated(b)	Brass or SS tubes	8 oz(g)	None	None
	Specific Gravity	ASTM D854 and C127	Brass or SS tubes	8 oz(g)	None	None
	Soil Partitioning Coefficient (K_d)	Nonstandard(c)	Brass or SS tubes	8 oz(g)	Cool to 4°C	None
Field QC Water	VOCs	EPA 8260, 8021	VOA vials with septum	2 x 40 ml	HC1, Cool to 4°C	14 days if preserved, 7 days if unpreserved
	PAHs, NDMA	EPA 8270SIM	G amber	1 L	Cool to 4°C	7 days for extraction and 40 days for analysis
	PCBs	EPA 8080	G amber	1 L	Cool to 4°C	7 days for extraction and 40 days for analysis
	Dioxins/Furans	EPA 8290, 1613B	G	1 L	Cool to 4°C	30 days for extraction and 45 days for analysis
	Ordnance	EPA 8330	G	1 L	Cool to 4°C	7 days for extraction and 40 days for analysis
	Carbonyl Compounds	ASTMD19	G	1 L	Cool to 4°C	72 hours for extraction and derivitization 72 hours for analysis
	TPH	8015M	G amber	1 L	HCl or H_2SO_4	14 days

Table G.4-1 (Page 3 of 4)

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

Matrix	Analytical Parameter	Method	Container	Sample Volume/Weight[(a)]	Preservative	Holding Time
	Metals	EPA 6010	P,G	1 L	HNO_3 to pH<2	6 months
	Hexavalent Chromium	EPA 7196	P,G	1 L	TBP	24 hours
	Fluoride	EPA 340.2	P	1 L	Cool to 4°C	28 days
	Nitrate/Nitrite	EPA 300	P	250 ml	Cool 4°C, pH<2 H_2SO_4	28 days
	Chloride	EPA 300	P	125 ml	Cool to 4°C	28 days
	Perchlorates	EPA 300	P	125 ml	Cool to 4°C	28 days
	Hydrazines	EPA 300	P	1 L	Cool to 4°C	28 days
	pH	EPA 150.1	P,G	40 ml	Cool to 4°C	ASAP
	Total Organic Carbon	EPA 415.1 or Walkley Black	P,G	1 L	Cool to 4°C	28 days
	Tributyltin	Krone, et al. 1988	P	4 oz	none	28 days

Table G.4-1 (Page 4 of 4)

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

(a) The laboratory may specify a larger or smaller volume at the beginning of the project. The volume listed above is a recommended minimum.

(b) Soil porosity calculated with the equation: Total Porosity = 1 - (Dry Density)/(Specific Gravity)

(c) Pavlostathis, S.G. and J. Kendrick. 1991. "Desorptive Behavior of Trichloroethylene in Contaminated Soil" in Environmental Science and Technology. 25, 274-279.

(d) Will be analyzed immediately when possible.

(e) One soil sample container will suffice for all analyses performed in the mobile laboratory.

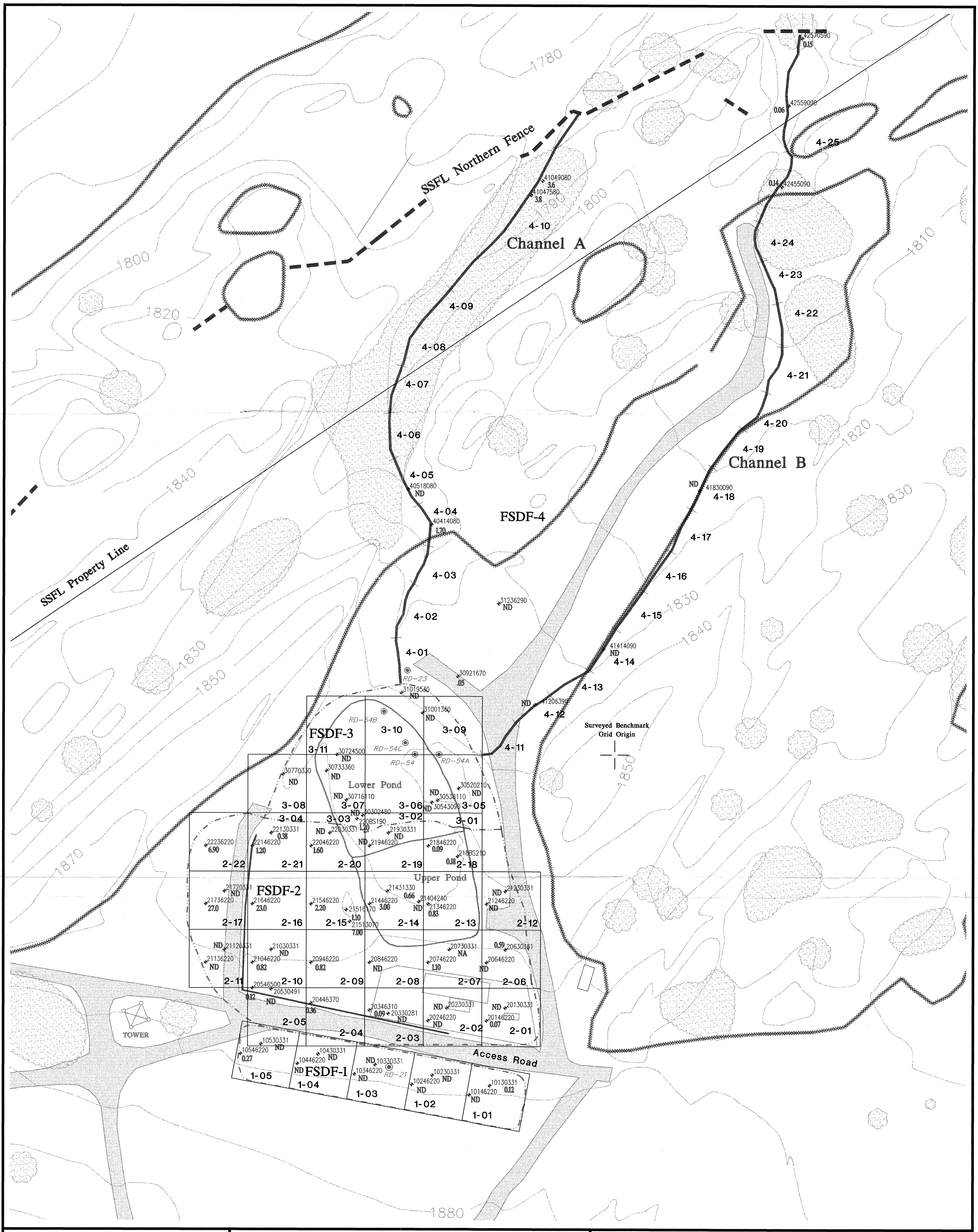
(f) One soil sample container likely will suffice for all analyses performed by the offsite laboratory.

(g) Two or more containers likely will be required for the suite of geotechnical analyses.

(h) Glass Teflon-lined wide-mouth jars may be substituted only if necessary; sample disturbance must be minimized.

(i) One soil sample container containing approximately 1000 g will suffice for all analyses performed by the offsite laboratory.

8270SIM - EPA Method 8270 with selected ion monitoring
EPA - Environmental Protection Agency
NA - Not Applicable
NDMA - N-Nitrosodimethylamine
PAHs - Polynuclear Aromatic Hydrocarbon Compounds
SIM - Selected Ion Monitoring
SS - Stainless Steel
TPH - Total Petroleum Hydrocarbon
VOCs - Volatile Organic Compounds
P = Polyethylene
G = Glass
HDPE = High density polyethylene



41414090	Sample Location Number
3-01	FSDF Grid Block Number
◉	Groundwater Monitoring Wells
6.9	PCB Concentration (mg/kg)
	Tree
	Ditches
— · · — · · —	FSDF Area Boundaries
——	Pond Boundaries
▬ ▬ ▬	Fences
	Bedrock Outcrop

N

0 20' 40'

1" = 40 feet

N:\PRJ\46289\RSK\FIG_2-4

Former Sodium Disposal Facility
Rocketdyne
Santa Susana Field Laboratory

Figure 2-4
FSDF Detail Map
PCB Concentration Map

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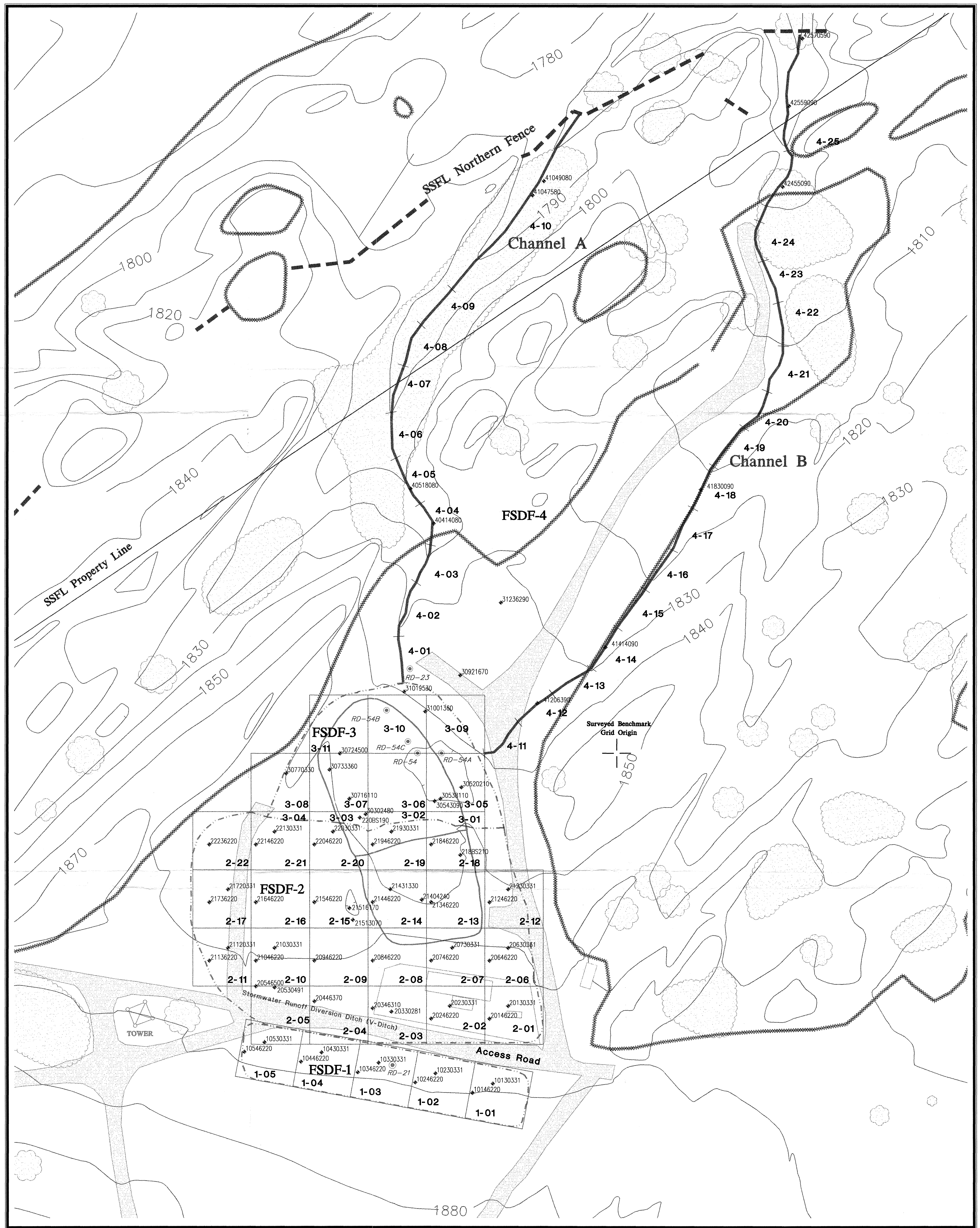

Former Sodium Disposal Facility
Rocketdyne
Santa Susana Field Laboratory

Figure 2-1
FSDF Study Area Boundaries with Sampling Grids and Sample Locations

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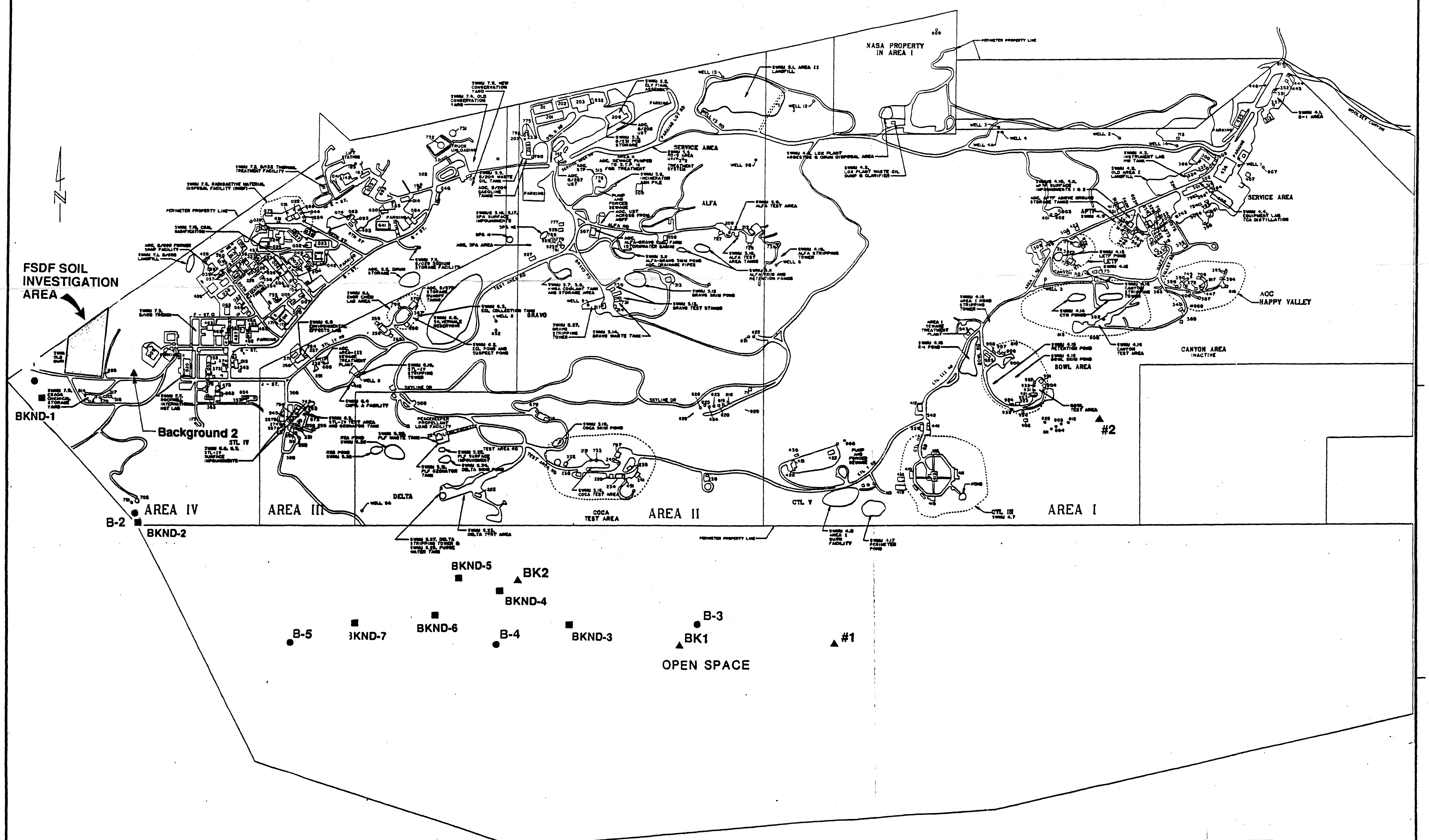
41830090 Sample Location Number
3-01 FSDF Grid Block Number
Groundwater Monitoring Wells
Ditches
Tree
FSDF Area Boundaries
Pond Boundaries
Fences
Bedrock Outcrop

N

0 20' 40'
1" = 40 feet

SANTA SUSANA FIELD LABORATORY



LEGEND	
BK1 ▲	Background soil sample collected in June 1993
#1 ▲	Background soil sample collected in July 1993
B-1 ●	Background soil sample collected in December 1994
BKND-1 ■	Background soil sample locations collected in July 1995

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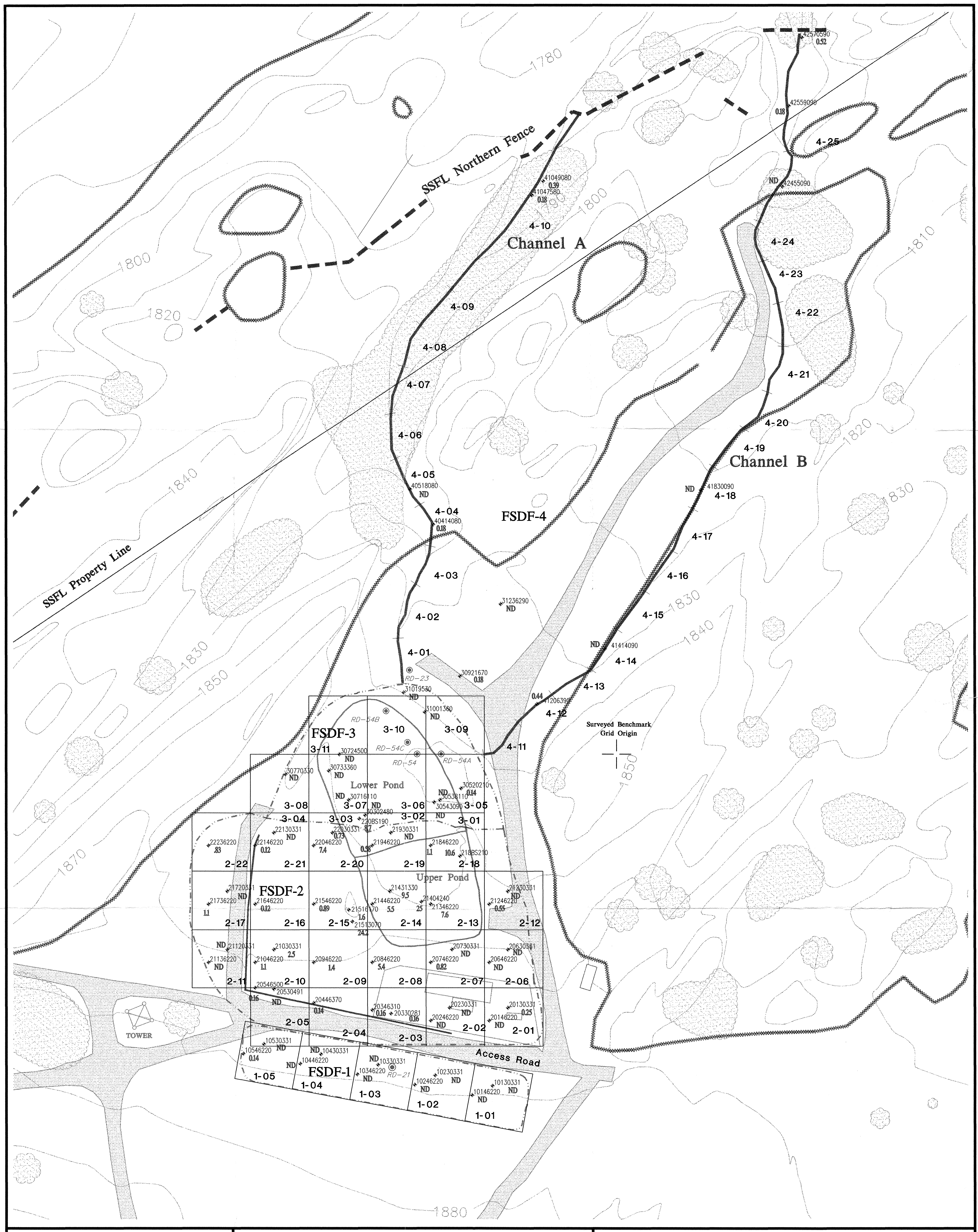
Figure 2-2
Rockeldyne
Santa Susana Field Laboratory
Onsite Background Soil
Sampling Locations

FILENAME: F:\ART\PORT-SRP.DRW DATE: 06.16.95



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Rocketdyne
Santa Susana Field Laboratory

Figure 2-3
FSDF Detail Map
Mercury Concentration Map

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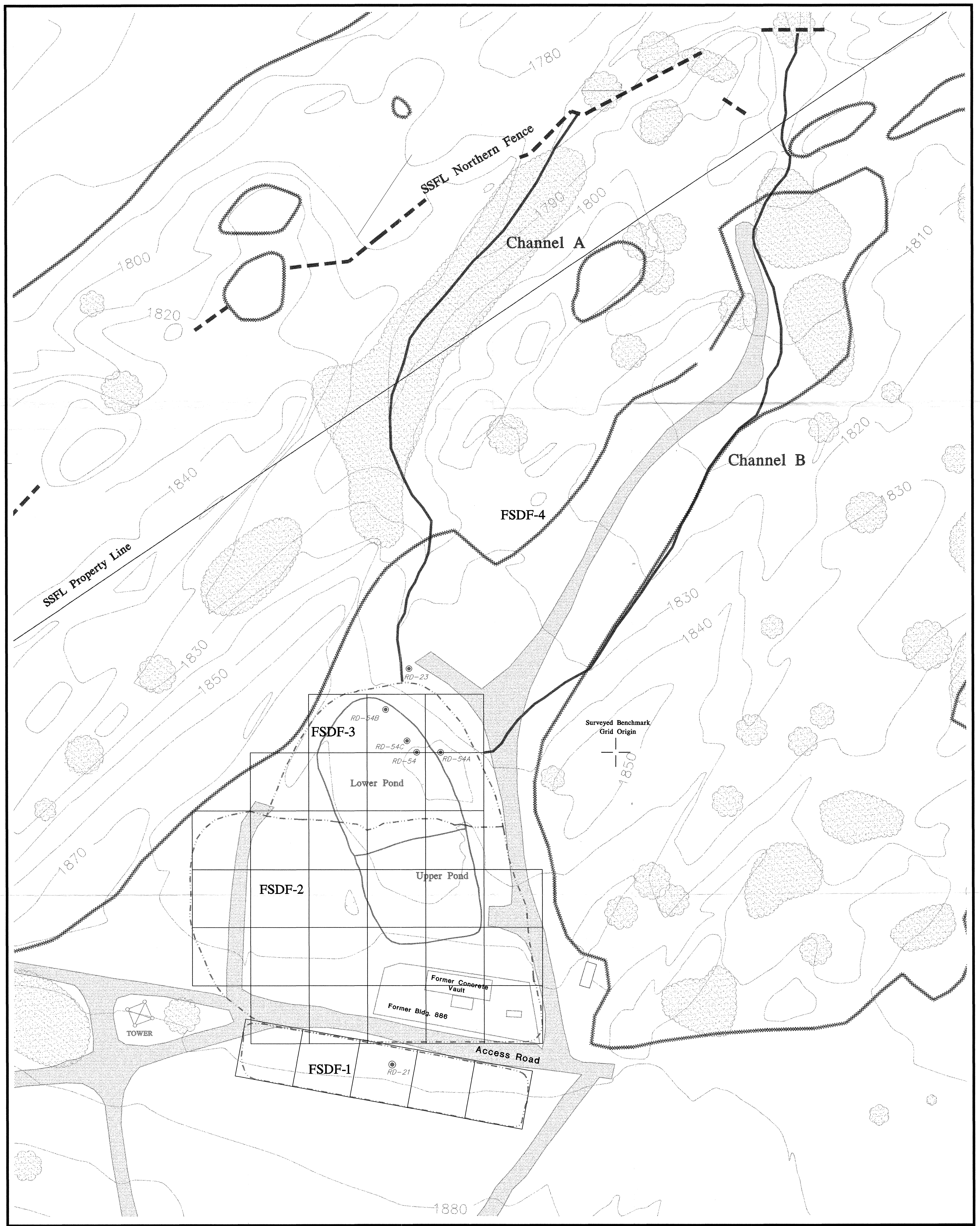

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Figure 1-3

FSDS Study Area Boundaries
with Sample Location Grids

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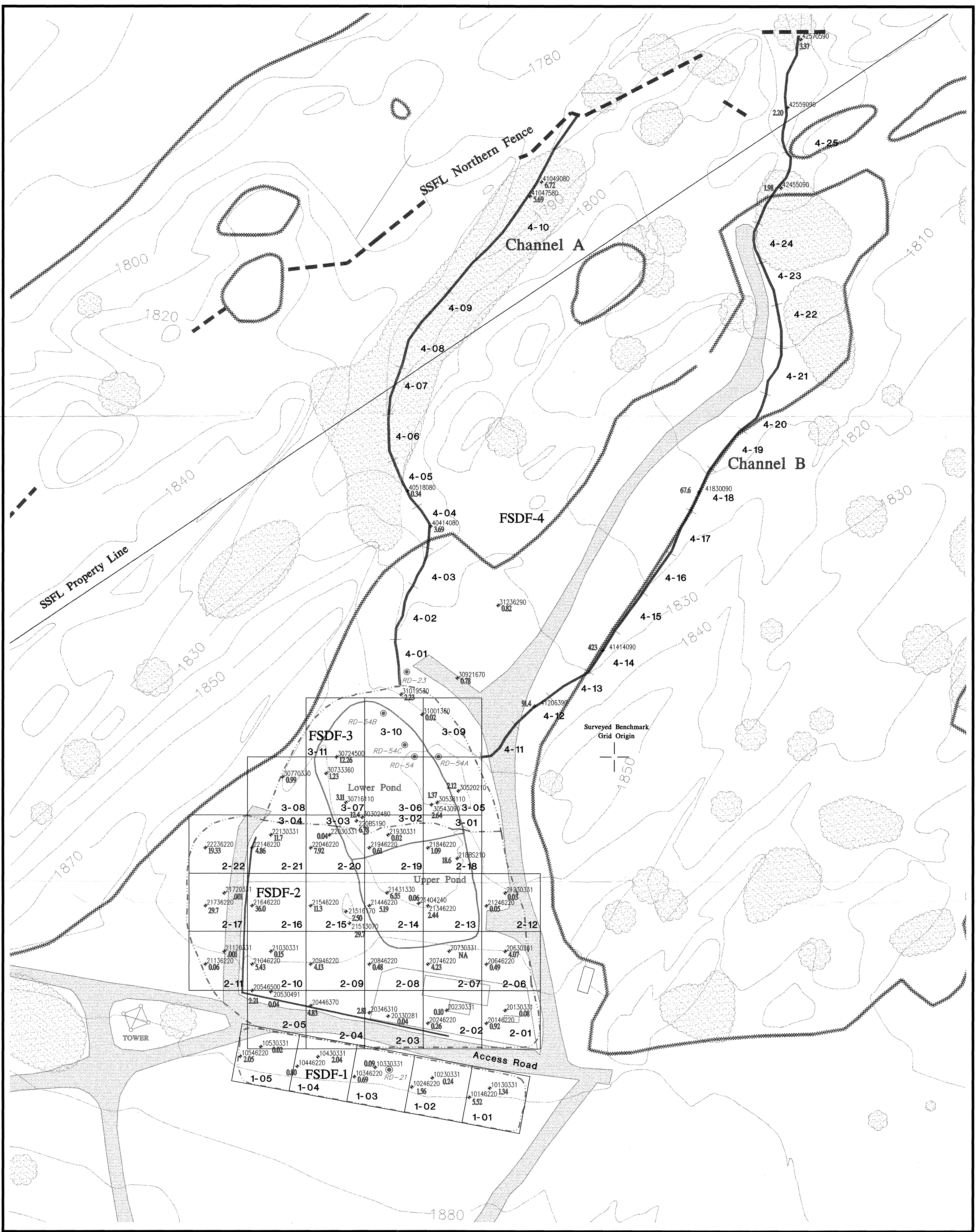

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Figure 2-5
FSDF Detail Map
Total TCDD-TEQ

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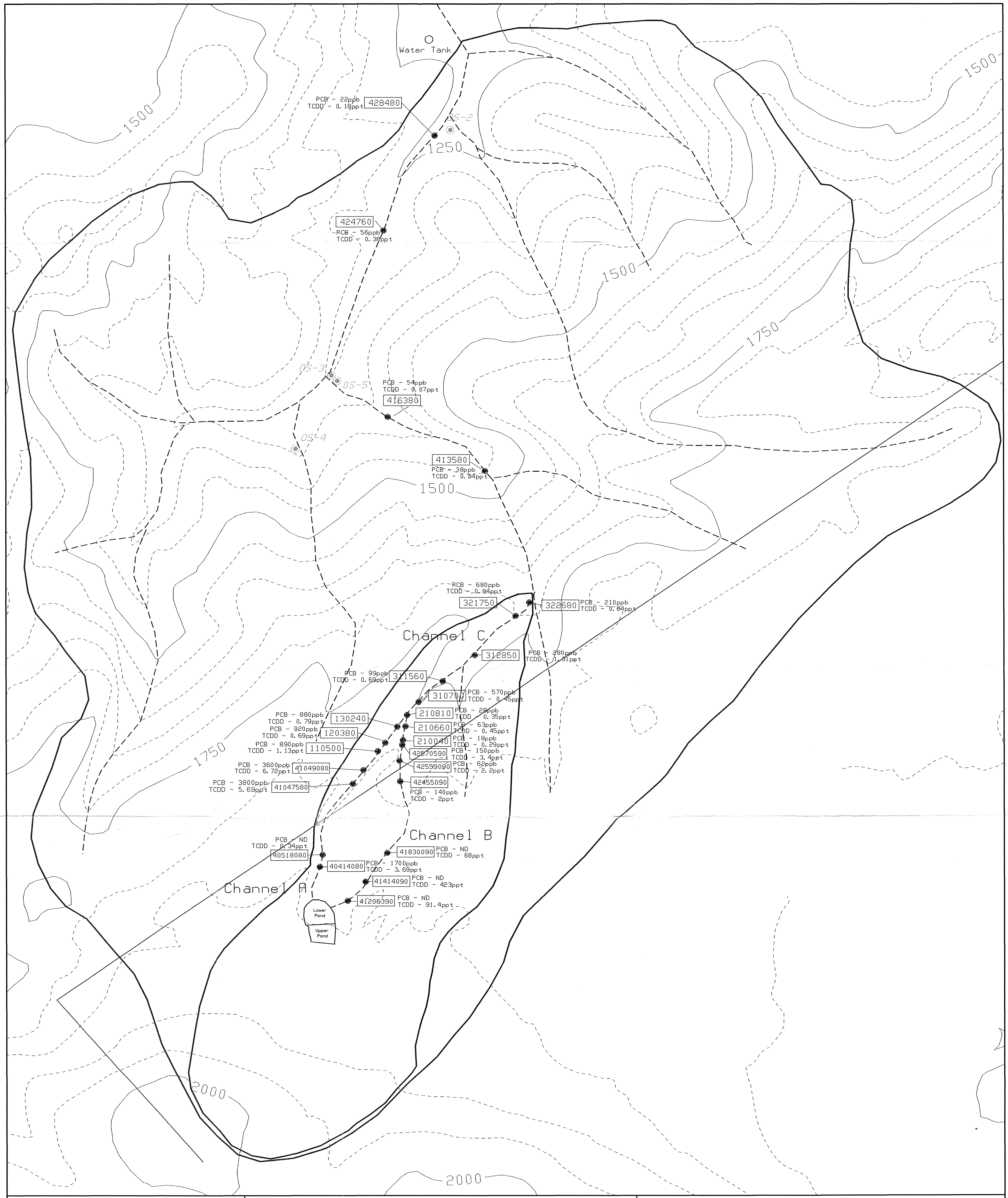

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Figure 2-6
Watershed Area
Chemical Concentrations in Sediment

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——— Watershed and Sub-Watershed Boundaries
- - - - - Drainage Path
● 41830090 PCB - 64ppb Approximate Sample Location Sample Value
——— SSFL Property Line

TCDD	2,3,7,8-TCDD Toxic Equivalents
PCB	Polychlorinated Biphenyls
ppb	Parts Per Billion
ppt	Parts Per Trillion

Scale: 1″ = 200′