APPENDIX A

AMEC Standard Operating Procedures

EQUIPMENT DECONTAMINATION

1.0 PURPOSE

The standard operating procedure (SOP) describes methods of equipment decontamination for use during site activities.

2.0 SCOPE

These procedures shall be followed during decontamination of field equipment used to sample environmental media.

This procedure shall serve as professional guidance for AMEC Personnel. It is not intended to obviate the need for professional judgment that may arise in unforeseen circumstances. Deviations from this procedure in the planning or execution of activities must be approved by the Project Manager.

3.0 DEFINITIONS

None.

4.0 RESPONSIBILITIES

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

- 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 appropriate to the contaminants of concern
- The method for containing the residual contaminants and wash water from the decontamination process
- The use of a quality control measure to determine the effectiveness of the decontamination procedure

This subsection describes standards for decontamination, including the techniques to be used, frequency of decontamination, cleaning solutions, and effectiveness.

5.1 DECONTAMINATION AREA

An appropriate location for the decontamination area at a site shall be selected on the basis of the ability to control access to the area, the ability to control residual material removed from equipment, the need to store clean equipment, and the ability to restrict access to the area being investigated. The decontamination area shall be located an adequate distance away and upwind from potential contaminant sources to avoid contamination of clean equipment.

5.2 TYPES OF EQUIPMENT

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

5.3 Frequency of Equipment Decontamination

Down-hole drilling equipment and equipment used in monitoring well development and purging 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. When 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 decontaminating major equipment such as drill bits, augers, drill string, pump drop-pipe, etc., is 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, new and re-used soil sample liners, and hand tools. The decontamination procedure shall consist of the following: (1) wash with a non-phosphate detergent (alconox, liquinox, or other suitable detergent) and potable water solution, (2) rinse 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 equipment is very soiled.

Decontaminating submersible pumps requires additional effort 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 a relatively long (typically 4 feet) large diameter pipe (4-inch or greater) equipped with a bottom cap. The pipe shall be filled with the decontamination fluids, the pump placed within the capped pipe, and the pump operated while recirculating the fluids back into the pipe. The decontamination sequence shall include (1) detergent and potable water, (2) potable water rinse, (3) potable water rinse, and (4) deionized water rinse. 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 that must be considered. Decontamination water shall consist of distilled or deionized water. Steam-distilled water shall not be used in the decontamination process as this type of water usually contains elevated concentrations of metals. Decontamination solvents to be used during field activities will be specified in Work Plans or Quality Assurance Project Plans (QAPPs).

Equipment used 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 sample 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 that slopes toward a sump pit. If a concrete pad is impractical, planking can be used to construct solid flooring that is then covered by a nonporous surface and sloped toward a collection sump. If the decontamination area lacks a collection sump, plastic sheeting and blocks or other objects shall be used to create a bermed area for collection of equipment decontamination water. Items such as auger flights, which can be placed on metal stands 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 be stored in a separate location 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 in secured containers such as DOT-approved drums until their disposition is determined by laboratory analytical results. Containers shall be labeled in accordance with SOP, *IDW Management*.

5.6 Effectiveness of Decontamination Procedures

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

6.0 RECORDS

The decontamination process shall be described in the field logbook.

7.0 HEALTH AND SAFETY

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 decontamination areas. Generally the decontamination 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 are set up on a visqueen-lined bermed area. Separate spray bottles containing isopropyl alcohol (or alternative cleaning solvent as described in the Work Plan or Field Sampling Plan) and distilled water are used for final rinsing of equipment. Depending on the nature of the hazards and the site location, decontamination of heavy equipment such as augers, pump drop pipe, and vehicles may be accomplished using a variety of techniques.

Personnel responsible for equipment decontamination must wear the PPE specified in the site- specific Health and Safety Plan (HSP). Generally this includes at 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 be noted that air monitoring by the OHSC may result in an upgrade to the use of half-face respirators and cartridges in the decontamination 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 decontamination 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 decontamination area be raised 1 to 2 feet above ground level.

2. To avoid heat stress, over exertion, and exhaustion, it is a recommended that equipment decontamination be rotated among all site personnel.

3. Take necessary precautions when handling field sampling equipment.

8.0 REFERENCES

SOP, IDW Management

SOP, Field QC Samples (Water, Soil).

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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FIELD QC SAMPLES (WATER, SOIL)

1.0 PURPOSE

This standard operating procedure (SOP) describes the number and types of field Quality Control (QC) samples that will be collected during site field work.

2.0 SCOPE

This procedure applies to all site sample collection activities conducted.

This procedure shall serve as professional guidance for AMEC personnel. It is not intended to obviate the need for professional judgment that may arise in unforeseen circumstances. Deviations from this procedure in the planning or execution of activities must be approved by the Project Manager.

3.0 DEFINITIONS

3.1 Trip Blank

Trip blanks are samples that originate from ASTM Type II 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.

3.2 Equipment Rinsate Samples

An equipment rinsate (i.e., "decontamination rinsate," or "equipment blank") sample consists of analyte-free water that 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 field 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).

3.5 Reference Samples

Reference samples are samples taken from media similar to site media, but that are collected outside the zone of contamination, usually offsite.

3.6 Quality Control (QC) Levels

USEPA QC Level IV is appropriate to use for laboratory analysis for sites where cleanup decisions will be based on risk assessment; sites on or eligible for the National Priorities List (NPL) will also have laboratory analyses conducted at Level IV QC. Other QC levels may be appropriate for certain types of samples or analyses; criteria for selection of the appropriate QC level for individual projects and field work activities are discussed in SOP, *Data Validation Planning and Coordination*.

4.0 RESPONSIBILITIES

The Field Manager, the Project Manager, and Technical Director/QA 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); 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 1.

The use of performance evaluation (PE) samples is discussed in SOP, *Performance Evaluation Procedures*.

5.1 Trip Blanks

Trip blanks are prepared by the laboratory using organic-free water. They are sent by the laboratory to the field.

Trip blanks shall be placed in sample coolers by the laboratory 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 until 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 be analyzed for VOCs only (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 1

FIELD QC SAMPLES PER SAMPLING EVENT

Type of Sample	Level III		Level IV		Level V	
	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.

Source: Naval Energy and Environmental Support Activity (NEESA), 1988. Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program. NEESA 20.2-047B. June.

5.2 Equipment Rinsate Samples

Equipment rinsate samples are collected by pumping the source water over and/or through the decontaminated sampling equipment. This runoff water is collected into the sample containers directly, or with the use of a funnel if necessary. The source water may be poured by use of an electric or hand submersible pump by tipping the jug of water upside down, or by use of a stopcock and gravity.

One equipment rinsate sample shall be collected per day per sampling technique utilized that day (EPA 1986). 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.

5.3 Field Blanks

Field blanks are collected simply by pouring the source water into sample containers.

Field blanks, consisting of samples of the source water used as the final decontamination rinse water, 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 will be collected from adjacent locations or liners or water samples collected from the same well at the same time; these provide information on the entire sample measurement system, including sampling, analysis, and non-homogeneities of the media sampled. Alternatively, replicates may be collected. Replicates are collected at the same time (e.g., homogenized or split samples), and 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 consist only 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.

5.5 REFERENCE SAMPLES

Reference sampling is conducted to distinguish site-related contamination from naturally occurring or other non-site related levels of chemicals, i.e., to assess background levels. There are two types of background levels of chemicals:

- Naturally occurring levels, which are concentrations of chemicals present in the environment that have not been influenced by humans (e.g., iron, aluminum)

- Anthropogenic levels, which are concentrations of chemicals that are present in the environment due to human-made, non-site sources (e.g., industry, automobiles)

Reference samples will be collected for each medium sampled at a site. Site-specific conditions will dictate the number of reference samples necessary to characterize background concentrations of contaminants of concern. However, at least one reference sample from each medium will be collected during each sampling event at a site. The samples will be analyzed for all the analytes for which site samples of that medium are analyzed for. Background analysis, especially for metals, should be performed to assess the typical naturally occurring levels.

6.0 RECORDS

Records of the collection of field QC samples should be kept in the sample logbook by the methods discussed in SOP *Record Keeping, Sample Labeling, and Chain-of-Custody.*

7.0 HEALTH AND SAFETY

The site-specific Health and Safety Plan shall be followed when collecting or working with potentially hazardous environmental samples.

8.0 REFERENCES

EPA. 1987. Data Quality Objectives for Remedial Response Activities: Development Process

NEESA. 1988. Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program, NEESA 20.2-047B, June.

EPA. 1992. RCRA Technical Enforcement Guidance Document.

SOP, *Equipment Decontamination*

9.0 ATTACHMENTS

None.

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SAMPLE HANDLING, STORAGE, AND SHIPPING

1.0 PURPOSE

This standard operating procedure (SOP) sets forth the methods for use field personnel engaged in handling, storing, and transporting samples.

2.0 SCOPE

This procedure applies to all samples, and sample containers handled, stored, shipped, or otherwise transported during site activities. This procedure shall serve as professional guidance for AMEC personnel. It is not intended to obviate the need for professional judgment that may arise in unforeseen circumstances. Deviations 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 Manager is responsible for ensuring that all samples are shipped according to this procedure.

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

The Field Manager is responsible for ensuring that sample handling, storage, and transport activities conducted during all field sampling 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, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures*. 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 shall be placed in an insulated cooler with frozen gel packs (such as "blue ice") or ice in double, sealed self-sealing bags. Styrofoam pads shall be placed on the bottom and top (and optionally on the sides) of the inside of the cooler. 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. Prior to shipment, the ice or cold packs in the coolers shall 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 or on a schedule allowing the laboratory to meet holding times for analyses. The procedures for maintaining sample temperatures at 4°C, pertains to all field 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. Elements of these procedures are summarized below.

In Hawaii, soil sample shipments are typically brought to the courier at the airport where a United States Department of Agriculture (USDA) representative is contacted by the courier to make an inspection. Alternatively, AMEC has received approval from the USDA to ship soil samples, and has received a stamp that can be used to facilitate shipment. In this way, the USDA does not need to inspect each soil sample shipment. Water sample shipments do not need to be inspected by the USDA. Custody seals are to be placed on each container (see Section 5.1, *Handling and Storage*) to ensure proper chain-of-custody control in the event coolers are opened for inspection.

5.2.1 Hazardous Materials Shipment

Field personnel must state whether any sample is suspected to be a hazardous material. A sample should be assumed 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).

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. 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, other labeling and packing requirements must still be followed. A "Dangerous Goods in Excepted Quantities" label (Attachment 1) must be completed and attached to the associated shipping cooler (Attachment 2). Certain dangerous goods are not allowed on certain airlines in any quantity.

As stated in item 4 of Attachment 3, 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. Chain-of-custody seals will be placed on the coolers as discussed in SOP, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures*.

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

6.0 RECORDS

Records shall be maintained as required by implementing these procedures.

7.0 HEALTH AND SAFETY

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

2. Wear proper gloves, such as blue nitrile, latex, etc., as defined in the site-specific project Health and Safety Plan, when handling sample containers to avoid contacting any materials that may have spilled out of the sample containers.

8.0 REFERENCES

SOP, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures*

9.0 ATTACHMENTS

1. Label for Dangerous Goods in Excepted Quantities
2. Sample Cooler Marking Figure
3. SW-846 Preservative Exception

Attachment 1

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

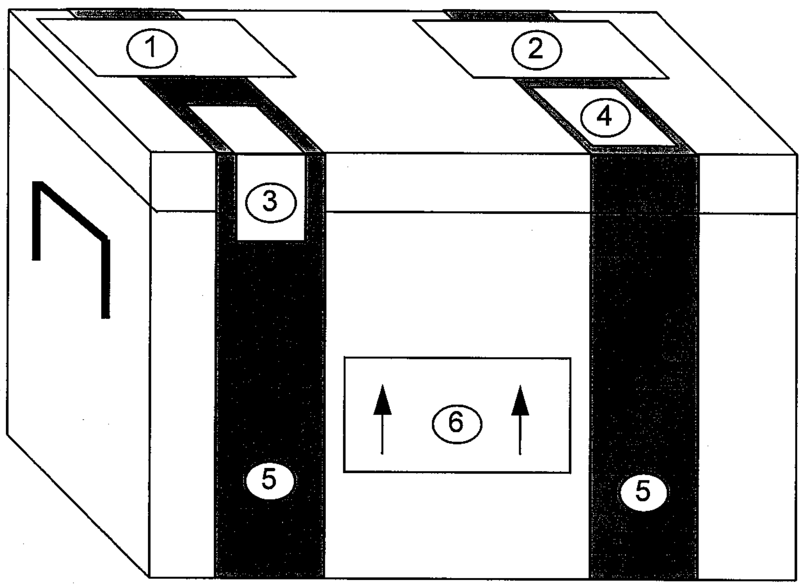
This package contains substance(s) in Class(es)
(check applicable box(es))

Class:	2	3	4	5	6	8	9
	o	o	o	o	o	o	o

and the applicable UN Numbers are:

Attachment 2

NON-HAZARDOUS MATERIAL COOLER MARKING FIGURE FOR SHIPMENT FROM OUTSIDE THE CONTINENTAL UNITED STATES



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

Attachment 3

PRESERVATIVE EXCEPTION

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

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

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

3. Sample preservation should be performed immediately upon sample collection. For composite samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then samples may be preserved by maintaining at 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 Mail, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. for the preservation requirements of Table 1, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentration of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or grater); 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.

IDW MANAGEMENT

1.0 PURPOSE

This standard operating procedure (SOP) describes the activities and responsibilities of AMEC Personnel with regard 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 investigation-derived waste (IDW) generated under the project. This SOP will also apply to personal protective equipment (PPE), sampling equipment, decontamination fluids, non-IDW trash, non-indigenous IDW, and hazardous waste generated during implementation of removal or remedial actions. The information presented will be used to prepare and implement Work Plans (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 Plans (DPs).

2.0 SCOPE

This document applies to all 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 under the project. It focuses on the requirements for minimizing, segregating, handling, labeling, storing, and inventorying IDW in the field. Certain drum inventory requirements related to the screening, sampling, classification, and disposal of IDW are also noted in this procedure.

This procedure is not intended to obviate the need for professional judgment that may arise in unspecified or unforeseen circumstances. Moreover, specific guidance from local regulatory agencies must be obtained and acted upon. Deviations from this procedure in planning or executing planned activities must be approved by the Project Manager and documented.

3.0 DEFINITIONS

3.1 Investigation-Derived Waste

Investigation-derived waste (IDW) consists of all materials generated during site investigation that may be contaminated with chemicals of concern. IDW may consist of many types of potentially contaminated materials, including but not limited to, 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, 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 Investigation-Derived Soil, Sludge, and Sediment

Investigation-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 drilling. 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.

Investigation-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.

Investigation-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. Monitoring well development methods are discussed in SOP, *Monitoring Well Development.*

Purge water consists of ground water that is removed from monitoring wells immediately prior to sampling. Well purging methods are discussed in SOP, *Monitoring Well Sampling*. Ground water derived during aquifer testing shall be addressed on a site-specific basis. Procedures for handling ground water generated during aquifer testing shall be included in the Work Plan or equivalent document.

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, rinse water and solvents used for the decontamination of non-consumable PPE, sampling equipment, and drilling equipment. Decontamination procedures are discussed in SOP, *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 and have 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 (1) it is listed as a hazardous waste in Chapter 40, Code of Federal Regulations (CFR), Parts 261.31 through 261.33; (2) it exhibits any of four hazardous characteristics: ignitability, corrosivity, reactivity, or toxicity (as determined using the Toxicity Characteristic Leachate Procedure [TCLP]); or, (3) 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 apply.

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 includes 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 not constitute land disposal (EPA 1992).

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 Managers are responsible for implementing this IDW procedure and for ensuring that all project field personnel follow it.

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 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
- Update and report changes to the IDW drum inventory

5.1 IDW MINIMIZATION

Field 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 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). For projects conducted in the Hawaiian Islands, it is recommended that soil IDW from borings and trenches less than 10 feet deep and not penetrating into a saturated layer be placed on polyethylene sheeting (e.g., Visqueen®) during excavation. 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, based upon the best professional judgment of the Field Manager, 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 of 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 of 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 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 of 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 of 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 disposed of accordingly (based upon the characteristics of the solvents as described in this SOP). Most other test kit materials should be considered non-IDW trash, and be disposed of as municipal waste.

5.2 Segregation of IDW by Matrix and Location

To facilitate subsequent IDW screening, sampling, classification and/or disposal, IDW shall generally 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% 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). In general, 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 logbook and reported in attachments to the quarterly drum inventory report (see SOP, *Logbooks* and Section 5.5). To avoid having mixed matrices 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.

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 of 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 Manager's best professional judgment, the visibly soiled PPE can be decontaminated and rendered nonhazardous, then the decontaminated PPE shall be double-bagged and disposed of 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 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 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, have a 55-gallon capacity, be completely painted or opaque, and 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.

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.

It is essential that all relevant information recorded on individual drum labels be repeated in the field notebook for later development of the drum inventory database (see Section 5.5 and SOP, *Logbooks*).

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 an 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 apply 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 of offsite (EPA 1991).

Drums shall be stored onsite within the AOC prior to disposal, except as directed by RCRA requirements for removal when professional judgment 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 and possible exposure to humans of the environment. 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 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 of.

6.0 RECORDS

The Project Manager is responsible for completing and updating the site-specific IDW drum inventory spreadsheet and submitting it as needed. After disposal, the actual means and/or location of disposal shall be indicated in tabular format with supporting narrative.

Field 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, *Logbooks*.

Upon receipt of analytical data from the investigation, an IDW Disposal Plan shall be prepared that will include the following:

- Criteria for selecting disposal options
- Possible disposal options
- A comparison between analytical data for each drum of IDW and the comparative criteria
- The disposal option selected for each drum of IDW

The IDW Disposal Plan must be approved by the generator, and in some cases, pertinent regulatory agencies. It must also be amended following each phase of field work. IDW disposal plans shall be prepared by the Project Manager and shall be in place prior to initiating field work.

7.0 HEALTH AND SAFETY

A site-specific health and safety plan shall be prepared by the Project Manager or their designee.

8.0 REFERENCES

Department of Transportation (DOT). 1990. Transporting Hazardous Materials (HM-181). December 21.

EPA. 1991. Management of Investigative-Derived Wastes During Site Inspections. U.S. Environmental Protection Agency/540/G-91/009. May.

EPA. 1992. Guide to Management of Investigative-Derived Wastes. Quick Reference Guide. U.S. Environmental Protection Agency: 9345.3-03FS. January.

Ogden, 1995. Disposal Plan for Management of Investigation-Derived Waster, Hawaii.

Ogden, 1994. Generic IDW Screening, Sampling, Analysis, and Disposal Plan.

9.0 ATTACHMENTS

None

LABORATORY QC SAMPLES (WATER, SOIL)

1.0 PURPOSE

This section sets forth the standard operating procedure (SOP) for identifying the number and type of laboratory Quality Control (QC) samples that will be. Laboratory QC analyses serve as a check on the precision and accuracy of analytical methods and instrumentation and potential contamination that may occur during laboratory sample preparation and analyses. Laboratory QC analyses include but are not limited to blank, duplicate, surrogate, blank spike, laboratory control sample, and matrix spike/ matrix spike duplicate analyses. These laboratory QC analyses are discussed in general below.

2.0 SCOPE

This procedure applies to all laboratory analytical activities conducted. This procedure shall serve as professional guidance for AMEC personnel. It is not intended to obviate the need for professional judgment that may arise in unforeseen circumstances. Deviations from this procedure in the planning or the execution of activities must be approved by the Project Manager.

3.0 DEFINITIONS

3.1 PRECISION

A measure of the agreement, i.e., reproducibility, among individual measurements of the same property, under prescribed similar conditions. Precision is measured by relative percent difference (RPD).

3.2 RELATIVE PERCENT DIFFERENCE (RPD)

A measure of precision which is based on the mean of two values from related analyses and is reported as an absolute value. It is calculated using the following formula:

$$RPD = | S-D | / [(S + D)/2] \times 100\%$$

where S = original sample result

D = duplicate sample result

3.3 Laboratory Blank

A clean sample provided by the laboratory that is analyzed to monitor contamination during laboratory analysis. Also called a method blank, reagent blank, or preparation blank. The same matrix must be used for the laboratory blank as for site samples.

3.4 Duplicate

A duplicate is a split sample that is analyzed to determine laboratory precision for a particular matrix.

3.5 Matrix Spike

A quality control sample where a known amount of analyte is added to a site sample, then analyzed, for the purpose of determining efficiency of recovery for that type of matrix.

3.6 Blank Spikes and Laboratory Control Samples

Blank spikes and laboratory control samples consist of reagent water or clean soil/sand that has been spiked with known amounts of specific analytes and is carried through the entire analytical procedure with the samples. The term blank spike is used in reference to organic analyses, whereas the laboratory control sample is used in reference to inorganic analyses; however, they are basically the same.

3.7 Surrogates

Surrogates are organic compounds that have similar characteristics and behavior as the target analytes but are either not naturally occurring (such as deuterated surrogates for gas chromatography/mass spectrometry (GC/MS) analyses) or are not expected to be naturally occurring in the analyzed samples. Surrogates are added to every blank, sample, matrix spike, matrix spike duplicate, and standard, and are used to evaluate analytical efficiency of the analytical method by measuring percent recovery. Surrogates are normally added prior to extraction to portions of samples that will be analyzed for all GC, GC/MS, and high-performance liquid chromatography (HPLC) methods.

3.8 Quality Control (QC) Levels

USEPA QC Level IV is appropriate to use for laboratory analysis for sites where cleanup decisions will be based on risk assessment; sites on or eligible for the National Priorities List (NPL) will also have laboratory analyses conducted at Level IV QC. Other QC levels may be appropriate for certain types of samples or analyses; criteria for selection of the appropriate QC level for individual projects and field work activities are discussed in SOP, *Data Validation Planning and Coordination*.

4.0 RESPONSIBILITIES

The Project QA Coördinators and the Laboratory Manager are responsible for identifying instances of non-compliance with this procedure and ensuring that future laboratory analytical activities are in compliance with it.

The Technical Director/QA is responsible for ensuring that sample analytical activities during all Projects are in compliance with this procedure.

5.0 PROCEDURES

Laboratory QC checks include all types of samples specified in the requested analytical methods, such as the analysis of laboratory blank, duplicate, and matrix spike samples. Types of QC samples are discussed in general below. The procedures presented below are minimum requirements; QC requirements of each analytical method must also be followed, and take precedence over this SOP.

5.1 Laboratory Blanks

Laboratory blank samples are analyzed to assess the degree to which laboratory contamination by reagent or method preparation may have affected sample analytical results. At a minimum, one laboratory blank will be analyzed per matrix per analytical method for each batch of at most 20 samples.

In evaluating the blank results, all blank data are reviewed to identify any compounds detected in the blanks. The laboratory shall be contacted to discuss detection of analytes in blank samples only in the event of unusual contamination, but not for common laboratory contaminants at low levels. The following compounds are considered to be common laboratory contaminants: acetone, methylene chloride, 2-butanone, and common phthalate esters. The data for samples analyzed during the same time period as the blank is then evaluated to identify the presence of any contaminants found in the blanks. The presence of the blank contaminants found in associated samples is then evaluated to avoid potential misinterpretation of actual sample constituents. Briefly, as discussed in the data validation SOPs, any analyte detected in both the sample and the associated blank is qualified as not detected if the sample concentration is less than 5 times the blank concentration (5x rule). For common laboratory contaminants (methylene chloride, acetone, toluene, 2-butanone, and common phthalate esters), a 10x rule applies.

5.2 Duplicates

Laboratory duplicates are analyzed to evaluate the reproducibility, or precision, of the analytical procedures for a given sample. Results of duplicate analyses are reported as the RPD, which is calculated by dividing the absolute value of the difference in concentration between the duplicate and original sample analyses by the arithmetic mean of their concentrations and multiplying the result by 100. One duplicate sample is analyzed for each batch of at most 20 samples analyzed of similar matrix. Duplicate analyses are normally performed on sample portions analyzed for inorganic constituents. For organic analyses, duplicate analyses are performed on matrix spike samples (see Section 5.3 of this procedure).

5.3 Matrix Spikes/Matrix Spike Duplicates

Matrix spike (MS) analyses are conducted by the laboratory to assess the accuracy of specific analytical methods and to provide information on the effect of the sample matrix on the analytical methodology. Spike analyses are performed by adding compounds of known concentration to a sample, an unspiked portion of which has previously been analyzed or is concurrently analyzed; spikes are representative target compounds for each analytical method performed. The spiked sample is reanalyzed and the original and the spiked sample results are compared. One matrix spike is analyzed for each batch of at most 20 samples of similar matrix. Since MS samples only provide information about the specific sample matrix used for the spike, MS analyses should be performed for each type of matrix collected.

For the matrix spike duplicate (MSD), a separate sample is separately spiked and analyzed. As discussed in Section 5.2, results of matrix spike duplicate analyses are reported the RPD, which is calculated by dividing the difference in concentration between the matrix spike duplicate and the matrix spike sample analyses by the arithmetic mean of their concentrations. One matrix spike duplicate analysis is required for at most each 20 samples of similar matrix.

5.4 Blank Spikes, Surrogates, and Laboratory Control Samples

Blank spikes, surrogates, and laboratory control samples are used to demonstrate that the laboratory process for sample preparation and analysis is under control.

Analytes selected for spiking of blank spikes and laboratory control samples are usually the same compounds used to spike MS/MSD samples and are representative target compounds.

At least two pesticides should be used as surrogates when pesticide analyses are being performed, and one polychlorinated biphenyl (PCB) when PCBs are analyzed. For wet chemistry methods, a single spike of an appropriate control for each method may be used for laboratory control sample analyses (i.e., cyanide, a control standard of sodium cyanide from a source other than that used for calibration may be spiked into water samples and analyzed with the water samples). For metals, at least three metals typically analyzed by inductively coupled plasma (ICP) must be monitored, and each element analyzed by graphite furnace atomic absorption and cold-vapor atomic absorption needs to be monitored. Blank spikes and laboratory control samples should be analyzed at a frequency of 1 per batch of at most 20 samples analyzed of similar matrix. Surrogates are required to be analyzed with all samples analyzed for volatile organics, base/neutral-acid extractables, and pesticides/PCBs.

6.0 RECORDS

Records of laboratory QC samples analyzed during Project activities will be maintained on laboratory bench sheets, raw data sheets, in the laboratory computerized data system, and on QC summary forms as requested. These QC summary forms will be provided in the laboratory analytical reports and laboratory data packages transmitted for each Project.

7.0 HEALTH AND SAFETY

Applicable to laboratory personnel only.

8.0 REFERENCES

NEESA. 1988. Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program. NEESA 20.2-047B. June.

NFESC. 1996. Navy Installation Restoration Laboratory Quality Assurance Guide. February.

SOP, *Data Validation Planning and Coordination*

9.0 ATTACHMENTS

None.

LOGBOOKS

1.0 PURPOSE

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

2.0 SCOPE

This document applies to all personnel involved with the use and control of logbooks and associated records pertaining to quality-related activities.

This procedure shall serve as professional guidance for the AMEC personnel. It is not intended to obviate the need for professional judgment that may arise in unforeseen circumstances. Deviations from this procedure in the planning or execution of activities must be approved by the Project Manager.

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, and well construction logs are data forms.

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 Manager is responsible for ensuring that the logbook is completed properly and daily.

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
- Descriptions of and rationale for approved deviations from the Work Plan or Field Sampling Plan
- Field instrumentation readings

- Personnel present
- Photograph references
- Sample locations
- Sample EPA number and sample identification, as described in SOP *Sample Naming*
- 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
- Subcontractors present
- 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 shall 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 of each logbook shall be performed 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 monthly. These reviews shall 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 Project requires submittal of photocopies of logbooks, this shall be performed as required. The field logbook shall be reviewed by the Project Manager on at least 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

SOP, *Sample Naming*

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 medium, container type, preservative, and the volume for each sample.
Time and Date	Record the time and date when the activity was performed (e.g., 0830/08/OCT/89). Use the 24-hour clock for recording the time and two digits for recording the day of the month and the year.
Analyses	Indicate the appropriate code for analyses to be performed on each sample, as specified in the 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 recording data and chronologies of events. The logbook author must include observations and descriptive notations, taking care to be objective and recording no opinions or subjective comments unless appropriate.

Recorded by

Include the signature of the individual responsible for the entries contained in the logbook and referenced forms.

Checked by

Include the signature of the individual who performs the review of the completed entries.

PERFORMANCE EVALUATION SAMPLES

1.0 PURPOSE

This section sets forth the standard operating procedure (SOP) for using performance evaluation (PE) samples on U.S. Navy PACDIV IRP sampling projects. PE samples are used to assess analytical accuracy in the laboratory during the time frame that project samples are analyzed, for a given method.

2.0 SCOPE

This procedure applies to all sample collection projects that have specified the use of PE samples. The use of PE samples is recommended for all medium and large projects, especially for laboratories that have not been used extensively or that have experienced quality control problems, and for particular analyses for which identification or assessment of magnitude (concentration) has been, or is expected to be, difficult.

3.0 DEFINITIONS

3.1 Performance Evaluation (PE) Sample

A PE sample is defined as a sample prepared by a vendor/supplier that contains a certified spiked concentration of a certain analyte(s). This sample is shipped to the analytical laboratory along with other site samples and analyzed. It should be double blind, i.e., the identity of the PE sample, analytes, and analyte concentrations are unknown to the laboratory. In order to serve as a double blind PR sample, it is important that the sample, to the extent practical, mimic actual field samples in terms of the number, type, and concentration of contaminants, and the sample matrix composition. Results reported by the laboratory for each analyte are compared to the certified concentrations supplied by the PE sample vendor, which measures the performance of the laboratory for that particular analytical method. PE samples are available for many analytes and at different concentrations. The water matrix is the most commonly used matrix for project-specific PE samples. Use of the soil matrix for PE samples is more difficult to interpret because of widely different soil types, which may affect contaminant extraction efficiency (unless soil from the site itself is effectively homogenized and spiked, and if field heterogeneity has been quantified. Non-native soils used for PE sample spiking would need to mimic site soil physical characteristics).

4.0 RESPONSIBILITIES

The Project Manager is responsible for deciding whether to include PE samples in the scope of work, while the laboratory coordinator and Project Manager are responsible for ordering the PE sample. Shipping the PE sample blind to the laboratory is the responsibility of the field sampling personnel and Field Manager. Interpretation of the analytical results associated with PE samples and implementing corrective actions associated with questionable results (if necessary) is the responsibility of the Project Manager or their designee.

5.0 PROCEDURES

PE samples shall be obtained from a vendor/supplier for the analyte(s) of interest. For example, if only a subset of analytes from an analytical category are suspected, the PE sample need only be spiked with these (e.g., benzene and trichloroethene from the volatile organic compounds analytical category may be the only compounds of concern for a specific project).

The concentration of interest shall also be specified. If site samples are expected to be at low concentrations, it is better to specify that a low concentration of the analytes be spiked into the PE sample. Generally, spikes at 2 to 3 times the reporting limit and near the regulatory action level (if any) are useful for water samples to verify the reporting limits provided by the laboratory, while spikes greater than 5 times the reporting limit are more useful for assessing the recovery of compounds that are expected to be present at a site. Soil PE samples are more difficult to interpret because of widely different soil types which may affect contaminant extraction efficiency (unless soil from the site itself is spiked), so these should be spiked with concentrations at least five times the reporting limit.

The PE samples shall be ordered from a qualified vendor far enough in advance that it can be prepared, then shipped to the field site a day or two prior to shipping it back to the laboratory along with other site samples. Care must be taken to ensure PE samples do not exceed their shelf time. It may be necessary to send the vendor sample containers that will be used for the project so that the laboratory cannot distinguish between sample containers and identify which sample is the PE sample. The vendor shall be responsible for adding the proper volume and type of preservative to each container. The PE samples shall be shipped overnight on ice and immediately placed in the sample stream. The date and time of the preparation of the PE samples are not evaluated.

The PE sample shall be labeled similarly to other field samples so that the laboratory cannot distinguish which sample is the PE sample. Sample naming, labeling, handling, and shipping are discussed in SOPs *IDW Management*; *Sampling Handling, Storage, and Shipping Procedures*. If it is necessary to send a PE sample to the laboratory in advance of field sampling (this is not normally recommended), enough volume must be provided for the laboratory to use as a matrix spike/matrix spike duplicate (MS/MSD) sample also.

PE samples shall be submitted to the laboratory and analyzed as close to the beginning of a project as possible (e.g., within the first week of a one to two month field sampling effort). This should allow sufficient time for the PE sample results to be evaluated, and appropriate corrective actions to be implemented. The evaluation should consist of comparing the analytical results for each compound to the corresponding certified concentrations supplied by the vendor. For water samples, the laboratory should be capable of identifying each of the compounds present in the PE sample and detecting these compounds at concentrations within the acceptable range specified by the vendor. Due to potential matrix interference problems associated with soil samples, it may be sufficient for the laboratory to simply identify the presence of a particular suite of analytes (i.e., the laboratory may not be capable of detecting the analytes within the acceptance criteria specified). The evaluation methodology for PE samples shall be documented into the project-specific planning documents (e.g., Work Plan, QAPP, etc.).

If the results reported by the laboratory are not found to be acceptable (i.e., the correct identity and concentration are not reported), appropriate corrective action shall be taken. Initially, the findings of the PE sample evaluation shall be submitted to the laboratory along with a request for an explanation for PE sample analysis failure. The analytical laboratory shall prepare a description of corrective actions, as necessary, that either have, or will be, taken to remedy the problem. If the laboratory cannot provide sufficient explanation for the problems, then another PE sample can be submitted for specific analysis for analytes of concern. The additional PE sample result will be used to verify that corrective action was taken. This will, of course, depend on whether the field sampling efforts are still occurring. Timely reporting of the PE results will be required, as well as early assessment of the PE sample results to ensure that additional PE samples can be submitted if problems are identified. If deemed necessary by the Project Manager, the laboratory can be audited to help confirm that they are capable of conducting the required analysis. Finally, if necessary, the laboratory can be suspended from conducting analysis for a particular method, or for the entire project.

6.0 RECORDS

Field sampling personnel shall label, package, and ship the PE sample similarly to other site samples. The certified value for each analyte and the acceptable range of results provided by the vendor/supplier shall be retained and used to compare to actual results reported. The results of the evaluation shall be included in the associated deliverable (e.g., Remedial Investigation Report, Remediation Verification Report, etc.).

7.0 HEALTH AND SAFETY

Field personnel shall follow the same health and safety procedures that apply to routine sample handling and shipping practices.

8.0 REFERENCES

None.

9.0 ATTACHMENTS

None.

RECORD KEEPING, SAMPLE LABELING, AND CHAIN-OF-CUSTODY PROCEDURES

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.

2.0 SCOPE

This procedure shall apply to all sample collection conducted. This procedure shall serve as professional guidance. It is not intended to obviate the need for professional judgment that may arise in unforeseen circumstances. Deviations from this procedure in the planning or the execution of activities must be approved by the Project Manager.

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 (COC)

Documentation of the process of custody control. Custody control includes possession of a sample from the time of its collection in the field to its receipt by the analytical laboratory, and through analysis and storage prior to disposal.

3.3 Laboratory Coordinator

The person for each Project who is the main point of contact with the Laboratory Project Manager. This may or may not be the Project QC Coordinator.

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 Manager is responsible for ensuring that all field personnel follow these procedures. The Technical Director/QA is responsible for verifying that the COC/Analytical Request Forms have been completed properly and match the sampling and analytical plan. The Projcect 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.

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 Technical Director/QA 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. The Technical Director/QA is also responsible for evaluating project compliance with these procedures, and is responsible for reviewing logbook entries, sample labeling, and chain-of-custody records to ensure that all are adequate to meet project requirements.

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, *Logbooks*.

5.2 Sample Labeling

A sample label with adhesive backing shall be affixed to each individual sample container. Clear tape shall 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/CLP sample number
- Date and time of collection
- Sampler's initials
- Matrix (optional)
- Sample preservatives (if applicable)
- 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. For water samples, a separate container is typically used for each separate test method, whereas with soil samples, all analyses are typically performed on the soil obtained from one sample container. In order to avoid lengthy lists on each container and confusion, soil sample containers typically don't list every analysis to be performed.

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
- 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
- Date and time that the sample/cooler was sealed.

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

Field personnel shall also log individual samples onto 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 copies of the completed COC forms to the reports containing the results of the analytical tests. An example COC form is provided in Attachment 2.

5.3.2 Laboratory Custody Procedures

The following are custody procedures to be followed by an independent laboratory receiving samples for chemical analysis; the procedures in their laboratory Quality Assurance Plan (LQAP) must follow these same procedures. A designated sample custodian shall take custody of all samples upon their arrival at the analytical laboratory. The custodian shall inspect all sample labels and COC forms to ensure that the information is consistent, and that each is properly completed. The custodian will also measure the temperature of the 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, except VOCs and purgeable TPH). The pH of these samples will be checked by the laboratory analyst after the sample aliquot has been removed from the vial for analysis.
- 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 and the Technical Director/QA shall be notified. All discrepancies will be documented in the field log book.

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

5.4 Completing Chain-of-Custody/Analytical Request Forms (Non-CLP)

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

Box 1 **Project Manager:** This name shall be the name that will appear on the report.

Project Name: Write it as it is to appear on the report.

Project Number: Write it 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.

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

Box 3 **Sample Disposal Instructions:** These instructions will be stated in the Basic Ordering Agreement (BOA) or each Project statement of work with each laboratory.

Shipment Method: State the method of shipment, e.g., hand carry; air courier via FED EX, AIR BORNE or DHL.

Comment: This area shall be used by the field team to communicate observations, potential hazards, or limitations that may have occurred in the field or additional information regarding analysis. For example: a specific metals list, explanation of Mod 8015, Mod 8015 + Kerosene, samples expected to contain high analyte concentrations.

Box 4 **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 identification 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., EPA QC Level III, IV, or V.

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.

Box 5 **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.

Box 6 **EPA Sample 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.

Description (sample identification): This name will be determined by the location and description of the sample. This sample identification should not be submitted to the laboratory, but should be left blank. If a computer COC version is used, the sample identification can be input but printed with this block black. A cross-referenced list of EPA number and sample identification must be maintained separately.

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 (Guam is 17 hours ahead of California during daylight savings time).

Lab Identification: This is for laboratory use only.

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

Box 8 **Analytical Parameters:** Enter the parameter by descriptor and the method number desired. 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 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.

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

Relinquished By: This space shall contain the signature of the person who turned over the custody of the samples to a second party other than an express mail carrier such as FEDEX, DHL or Air Borne Express.

Received By: Typically, this is signed by a representative of the receiving laboratory. Or, this signature could be from a field crew member who delivered 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): This space is for the final destination, e.g., at a subcontracted laboratory.

Box 10 **Lab Number and Questions:** This box is to be filled in by the laboratory only.

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

Box 12 **Total No. of Containers/row:** Sum the number of containers in that row.

Box 13 **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 Project 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.

5.5 Completing CLP Program Chain-of-Custody Forms

Specific CLP COC forms are required to allow the Contract Laboratory Analytical Services Support (CLASS) contractor and Region IX to track CLP Analytical Services (CLPAS). The CLP COC forms are also necessary to ensure that samples are transferred to the appropriate contract laboratory. This form is also important for accurately and concisely requesting analyses for each sample.

For CLP organic analytical services, copies of the COC forms are to be distributed as follows:

Blue (original) - to Quality Assurance Management Section (QAMS), Region IX

Pink (second) - to CLASS contractor

White (third) - to laboratory for return to Region IX

Yellow (fourth) - to laboratory for return to CLASS

Photocopy - for sampler's files

For CLP inorganic analytical services, copies of the COC forms are to be distributed as follows:

Green (original) - to Quality Assurance Management Section (QAMS), Region IX

Pink (second) - to CLASS contractor

White (third) - to laboratory for return to Region IX

Yellow (fourth) - to laboratory for return to CLASS

Photocopy - for sampler's files

Sample CLP COCs for organic samples and inorganic samples are provided as Attachments 4 and 5. The appropriate box numbers are identified and discussed below.

Case Documentation

Case No. **Enter Case Number** that has been assigned to the sampling event. CLPAS case numbers have the format "xxxxx".

HEADER INFORMATION

Box 1 **Project Code:** This code is assigned to the project by the Regional Sample Control Center (RSCC) coordinator EPA site managers.

Account Code: This is the account to be billed for sampling not conducted under the Superfund Program. Enter any Regional Information and the name of the program (e.g. RCRA) in the box titled "Non-Superfund Program".

Site Name: Enter the Site Name, City, State, and Spill ID. This information will not appear on the laboratory copies.

Box 2 **Regional Information**: Enter the Region Number, Sampling Company, and Sampler's Name.

Box 3 **Type of Activity:** Check the appropriate boxes that describe the sampling event:

Check the box which describes the Funding Lead

SF = Superfund
PRP = Potentially Responsible Party
ST = State
FED = Federal

Check the boxes which describe the sampling task

Pre-Remedial

PA = Preliminary Assessment
SSI = Screening Site Investigation
LSI = Listing Site Investigation

Remedial

RIFS = Remedial Investigation Feasibility Study

RD = Remedial Design

O&M = Operations and Maintenance

NPLD = National Priorities List

Removal

CLEM = Classic Emergency

REMA = Removal Assessment

REM = Removal

OIL = Oil Response

UST = Underground Storage Tank

Box 4 **Shipment Information:** State the date of shipment method of shipment, e.g., air courier via FED EX, AIR BORNE or DHL, and air bill number.

Box 5 **Shipment To:** Provide the laboratory name, address, and laboratory contact

SAMPLE DOCUMENTATION

CLP Sample Numbers: List CLP sample numbers as printed on the sample labels. CLPAS sample numbers should have the following format: YX001 for organic and MYX001 for inorganic samples.

Column A **Sample Description:** Enter the appropriate sample description code from Box 7.

Column B **Concentration:** Specify "L" for low and "M" for medium concentration samples. (For medium concentration samples, prior arrangements must have been made with the RSCC coordinator, CLASS, and the laboratories accepting the samples.)

Column C **Sample Type:** Enter the type of sample that was collected: "G" for grab or a discrete sample, and "C" for composite.

Column D **Preservative:** Enter the preservative used, as listed in Box 6. If "other" ("5" for organic and "7" for inorganic) is entered, specify the preservative used at the bottom of the "Sample Documentation" area.

Column E **CLPAS Analysis:** Check the appropriate box for each fraction to be analyzed. Low/medium concentration organic fractions include volatiles, semi-volatiles, and pesticides/PCBs. Low/medium concentration inorganic fractions include total metals, dissolved metals, and cyanide. If dissolved metals are requested, notation must be added to the form to indicate that the samples have been filtered in the field, and that digestion is required. (For each inorganic sample, either total metals or dissolved metals may be requested, but not both. Samples collected for total metals and dissolved metal analysis must be assigned separate/unique sample identification numbers.)

Column F **Regional Specific Tracking/Tag Numbers:** Region IX does not issue tracking/tag numbers. Instead, this column may be used for "special instructions" or to denote the number and type of containers used. If "special instructions" are used, provide a description at the bottom of the "sample documentation" area.

Column G **Station Location Number:** Enter the location for each sample collected.

Column H **Mo/Day/Year/Time:** Record the month, day, year and time (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).

Column I **Sampler's Initials:** The person who collection the sample must initial.

Column J **Corresponding CLP Organic/Inorganic Sample Number:** Enter the CLP organic/inorganic sample number corresponding to the sample collected.

Column K **Designated Field QC:** The column is NOT to be used to designate laboratory QC (MS/MSD) samples; information entered in this column will not appear on the laboratory copies. Enter the appropriate qualifier for

"Blind" field QC samples (ALL samples must have a qualifier).

"B" = Blind blanks may be further identified as trip blanks (T), field blanks (F), and equipment blanks (E). For example, B (E) designates a sample as an equipment blank.

"D" = Field duplicates do NOT include samples to be used as laboratory duplicates. The primary sample is identified with a "--", and the duplicate is designated with the letter "D" in column K. The station locations identification number (column G) should also identify the primary and duplicate samples.

"S" = Spiked field samples generated by field personnel

"PE" = Performance evaluation samples are spiked samples, but not field samples and are usually not prepared by field personnel.

"--" = This qualifier is used for all other samples not designated as blind field QC samples.

Box 8 **Shipment for Case Complete?:** For a specific case, the case is considered complete when ALL samples scheduled for shipment to the laboratory have been shipped.

Pagel of __: Enter the total number of CLP COC forms included in each cooler. The form accompanying each cooler must list only those samples contained in that cooler.

Sample used for a spike and/or duplicate: Enter the CLP sample number to identify the sample to be used by the laboratory for spike and/or duplicate analysis. This sample is also known as the laboratory QC sample (MS/MSD).

Additional sampler signatures: Include additional sampler signatures that are different from that provided in Box 2.

Chain of Custody Seal Number: Enter the number of the COC seal that was used to seal the cooler, if applicable.

6.0 RECORDS

The COC/analytical request form shall be faxed approximately 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. 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (EPA USWER Directive 9355 3-01).

USEPA, 1997. Instructions for Sample Shipping and Documentation, Quality Assurance Management Section USEPA Region 9.

USEPA. 1992. RCRA Ground Water Monitoring Technical Enforcement Guidance Document (TEGD).

USEPA. 1995 and as updated. Test Methods for Evaluating Solid Waste (SW-846), Third edition.

9.0 ATTACHMENTS

1. Chain-of-Custody Seal
2. Generic Chain-of-Custody/Analytical Request Form
3. Sample Completed Chain-of-Custody/Analytical Request Form
4. Sample CLP Chain-of-Custody Form for CLP organic analyses
5. Sample CLP Chain-of-Custody Form for CLP inorganic analyses

Attachment 1

CHAIN-OF-CUSTODY SEAL

<table>
<tr><td rowspan="3">[LABORATORY]</td><td>SAMPLE NO.</td><td>DATE</td><td>SEAL BROKEN BY</td></tr>
<tr><td colspan="2">SIGNATURE</td><td>DATE</td></tr>
<tr><td colspan="3">PRINT NAME AND TITLE (Inspector, Analyst or Technician</td></tr>
</table>

Attachment 2

GENERIC CHAIN-OF-CUSTODY/ANALYTICAL REQUEST FORM

Chain-of-Custody

Control Number: 94H0

Date ____ Page ____ of ____

CTO/DO Manager:	Bill To:	Sample Disposal
CTO/DO Name:	Company:	Shipment
CTO/DO Number:	Address:	Comments:
Deliver results to the address above or as stated in contract		
Cooler No:	# of containers:	
QC Level: TAT:	Preservatives:	

Sample ID (EPA ID)	Sample ID (Navy IRP Use Only)	Date Collected	Time Collected	Lab ID	Soil	Water	Other (drum, sludge, etc.)	Field Duplicate (MS/MSD)	TPH 8015B	CLP VOAs	CLP SVOAs	CLP Pesticides	CLP Metals	EPA 8080 (PCBs only)	EPA 8240	EPA 8270	Total Lead by EPA 6010				Extra Volume MS/MSD	HOLD	Total # of Containers
							TOTALS:																

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

Original (white), Lab Copy (yellow), Field Copy (pink)

Attachment 3

SAMPLE COMPLETED CHAIN-OF-CUSTODY/ ANALYTICAL REQUEST FORM

Chain-of-Custody

(11) Control Number: 96H0HC205

Date 9 / 3 / 96 Page 1 of 1

(1)

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

(2)

Bill To:	CLEAN/RAC Contractor
Company:	company name
Address:	Oahu, Hawaii

(3)

Sample Disposal	by lab
Shipment Method:	Express Courier
Comments:	PACDIV Level D, Measure Cooler Temperature at Lab

(6) Sample Data; (7) Matrix/QC; (8) Analyses; (12) Total # of Containers

Sample ID (EPA ID)	Sample ID (Navy IRP Use Only)	Date Collected	Time Collected	Lab ID	Soil	Water	Other (drum, sludge, etc.)	Field Duplicate (MS/MSD)	TPH 8015B	CLP VOAs	CLP SVOAs	CLP Pesticides	CLP Metals	EPA 8080 (PCBs only)	EPA 8240	EPA 8270	Total Lead by EPA 6010				Extra Volume MS/MSD	HOLD	Total # of Containers
(5) container # (water):									1	2	2	1	2	1							2		
Preservatives:									HCL	HCL			HNO3										
HC205		9/6/96	9:35		X				X	X	X	X	X	X									1
HC206		9/6/96	9:50		X				X	X	X	X	X	X									1
HC207		9/6/96	10:15		X				X	X	X	X	X	X									1
HC208		9/6/96	10:25		X				X	X	X	X	X	X									1
HC209		9/6/96	10:45		X				X	X	X	X	X	X									1
HC210		9/6/96	10:55			X		X		X													2
HC211		9/6/96	12:50			X			X	X	X	X	X	X									9
(13) TOTALS:									6	9	7	6	7	6									16

(9)

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

(10) For Lab Use

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

Original (white), Lab Copy (yellow), Field Copy (pink)

Attachment 4

SAMPLE CLP CHAIN-OF-CUSTODY FORM
FOR CLP ORGANIC ANALYSES

EPA — United States Environmental Protection Agency, Contract Laboratory Program Sample Management Office, PO Box 818 Alexandria, VA 22313, 703-557-2490 FTS 557-2490

Organi[illegible] raffic Report & Chain of Custody Record (For Organic CLP Analysis)

SAS No. (if applicable)

Case No. 17235

1) Project Code	SF
Account Code	
2) Region No.	9
Sampling Co.	Ace
4) Date Shipped	1-7-94
Carrier	Fed. Express
Regional Information	
Sampler (Name)	Gail Jones
Airbill Number	0912345678
Non-Superfund Program	
Sampler Signature	Gail Jones
5) Ship To	Alpha Lab, 123 Pine Ave, NY, NY 10001
ATTN:	John Doe
Site Name	Toxic Dump
City, State	Smallville CA
Site Spill ID	99
3) Type of Activity	Lead: SF ☒ PRP ☐ ST ☐ FED ☐; Pre-Remedial: PA ☐ SSI ☐ LSI ☐; Remedial: RIFS ☒ RD ☐ RA ☐ O&M ☐ NPLD ☐; Removal: CLEM ☐ REMA ☐ REM ☐ OIL ☐ UST ☐

6) Preservative (Enter in Column D): 1. HCl 2. HNO_3 3. $NaHSO_4$ 4. H_2SO_4 5. Other (Specify) 6. Ice only N. Not preserved

7) Sample Description (Enter in Column A): 1. Surface Water 2. Ground Water 3. Leachate 4. Rinsate 5. Soil/Sediment 6. Oil (High only) 7. Waste (High only) 8. Other (Specify)

CLP Sample Numbers (from labels)	A Enter # from Box 7	B Conc. Low Med High	C Sample Type: Comp./Grab	D Preservative from Box 6	E RAS Analysis: VOA	BNA	Pest/PCB	High only ARO/TOX	F Regional Specific Tracking Number or Tag Numbers	G Station Location Number	H Mo/Day/Year/Time Sample Collection	I Sampler Initials	J Corresp. CLP Inorg. Samp. No.	K Enter Appropriate Qualifier for Designated Field QC (B = Blank, S = Spike, D = Duplicate, PE = Perform. Eval., — = Not a QC Sample)
YJ126	2	L	G			X				MW-1	1-6-94 0900	GJ	MYG001	—
YJ127	2	L	G			X				MW-2	1-6-94 1000	GJ	MYG003	—
YJ128	2	L	G			X				MW-3	1-6-94 1100	GJ	MYG005	—

8) Shipment for Case complete? (Y/N): N — Page 1 of 2 — Sample used for a spike and/or duplicate: YJ127 — Additional Sampler Signatures — Chain of Custody Seal Number

CHAIN OF CUSTODY RECORD

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Gail Jones	1-7-94 1600	0912345678			
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	Is custody seal intact? Y/N/none

Split Samples ☐ Accepted ☐ Declined (Signature)

EPA Form 9110-2 (Rev. 5-91) Replaces EPA Form (2075-7), previous edition which may be used

Attachment 5

SAMPLE CLP CHAIN-OF-CUSTODY FORM FOR CLP INORGANIC ANALYSES

EPA — United States Environmental Protection Agency, Contract Laboratory Program Sample Management Office, PO Box 818 Alexandria, VA 22313, 703-557-2490 FTS 557-2490

Inorganic Traffic Report & Chain of Custody Record (For Inorganic CLP Analysis)

SAS No. (if applicable):
Case No.: 17235

1. Project Code: SF | Account Code: | 2. Region No.: 9 | Sampling Co.: Ace | 4. Date Shipped: 1-7-94 | Carrier: Fed. Express

Regional Information: | Sampler (Name): Gail Jones | Airbill Number: 0912345699

Non-Superfund Program: | Sampler Signature: Gail Jones | 5. Ship To: Beta Labs, Inc., 465 Maple Ave., Atlanta, GA 04507 | ATTN: Mary Smith

Site Name: Toxic Dump
City, State: Smallville CA | Site Spill ID: 99

3. Type of Activity — Lead: SF [X], PRP, ST, FED; Pre-Remedial: PA, SSI, LSI; Remedial: RIFS [X], RD, RA, O&M, NPLD; Removal: CLEM, REMA, REM, OIL, UST

6. Preservative (Enter in Column D): 1. HCl 2. HNO_3 3. NaOH 4. H_2SO_4 5. $K_2CR_2O_7$ 6. Ice only 7. Other (Specify) N. Not preserved

7. Sample Description (Enter in Column A): 1. Surface Water 2. Ground Water 3. Leachate 4. Rinsate 5. Soil/Sediment 6. Oil (High only) 7. Waste (High only) 8. Other (Specify)

CLP Sample Numbers (from labels)	A Enter # from Box 7	B Conc. Low Med High	C Sample Type: Comp./Grab	D Preservative from Box 6	E - RAS Analysis: Metals Total	Dissolved	Cyanide	Low Conc. only: Sulfide/Nitrate	Fluoride	High only: pH	Conductivity	F Regional Specific Tracking Number or Tag Numbers	G Station Location Number	H Mo/Day/Year/Time Sample Collection	I Sampler Initials	J Corresp. CLP Org. Samp. No.	K Enter Appropriate Qualifier for Designated Field QC (B = Blank, S = Spike, D = Duplicate, PE = Perform. Eval., — = Not a QC Sample)
MYG001	2	L	G	23	X		X						MW-1	1-6-94 0900	JB	YJ126	—
MYG002	2	L	G	2		X						A	MW-1	1-6-94 0915	JB	YJ126	—
MYG003	2	L	G	23	X		X						MW-2	1-6-94 1000	JB	YJ127	—
MYG004	2	L	G	2		X						A	MW-2	1-6-94 1015	JB	YJ127	—

A = Field Filtered, 0.45 micron
Digestion required for all dissolved samples

Shipment for Case complete? (Y/N): N | Page 1 of 1 | Sample used for a spike and/or duplicate: MYG003 + MYG004 | Additional Sampler Signatures: John Brown | Chain of Custody Seal Number:

CHAIN OF CUSTODY RECORD

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Gail Jones	1-7-94 1600	0912345699			
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	Is custody seal intact? Y/N/none

EPA Form (Rev. 8-91) Replaces EPA Form (2075-8), previous edition which may be used

Split Samples ☐ Accepted (Signature) ☐ Declined

SOIL AND ROCK CLASSIFICATION

1.0 PURPOSE

This section sets forth standard operating procedures (SOPs) for soil and rock classification to be used by AMEC personnel.

2.0 SCOPE

This document applies to all AMEC personnel involved with managing or participating in drilling and sampling activities who are responsible for soil and rock description.

This procedure shall serve as professional guidance for the AMEC personnel. It is not intended to obviate the need for professional judgment in unforeseen circumstances. Deviations from this procedure in the planning, or execution of 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 procedures are followed during projects conducted or supervised by a qualified individual. A qualified individual is defined as a person with a degree in geology, hydrogeology, soil science, or geotechnical/civil engineering with at least 1 year of experience in the classification of soils. Supervision is defined as onsite and continuous monitoring of the individual conducting soil classification.

The Field Manager is responsible for ensuring that all project field staff follow 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 in accordance with the USCS 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 qualified personnel are comparable. Site individuals describing soils as part of U.S. Navy 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 sites.

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

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

The USCS serves as a "shorthand" for classifying soil into 15 basic groups:

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)
SM1	Silty sand (>50% sand, >15% silt)
SC1	Clayey sand (>50% sand, >15% clay)
ML2	Inorganic, low plasticity silt (slow to rapid dilatancy, low toughness and plasticity)
CL2	Inorganic, low plasticity (lean) clay (no or slow dilatancy, medium toughness and plasticity)
MH2	Inorganic elastic silt (no to slow dilatancy, low to medium toughness and plasticity)
CH2	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 more than 50% poorly sorted 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 predominates) shall be added to the group name (e.g., clay with sand, CL; or silt with gravel, ML). If the soil is estimated to have 30% or more sand or gravel, or both, the words "sandy" or "gravely" (whichever predominates) shall be added to the group name (e.g., sandy clay, CL). If the percentage of sand is equal to the percent gravel, use "sandy."

Figure I defines the terminology of the USCS. Flow charts presented in Figures 2 and 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 classification, e.g., SC/CL, if the soil has been identified as having properties that do not distinctly place the soil into one group.

5.1.1 Estimation of Particle Size Distribution

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

1. Select a representative sample (approximately 1/2 of a 6-inch long by 2.5 inch diameter sample liner.)

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

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

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

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

6. Estimate percentages to the nearest 5%. If one of the components is present in a quantity considered less than 5%, indicate its presence by the term "trace".

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 Smaller 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
		GRAVELS 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 1

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

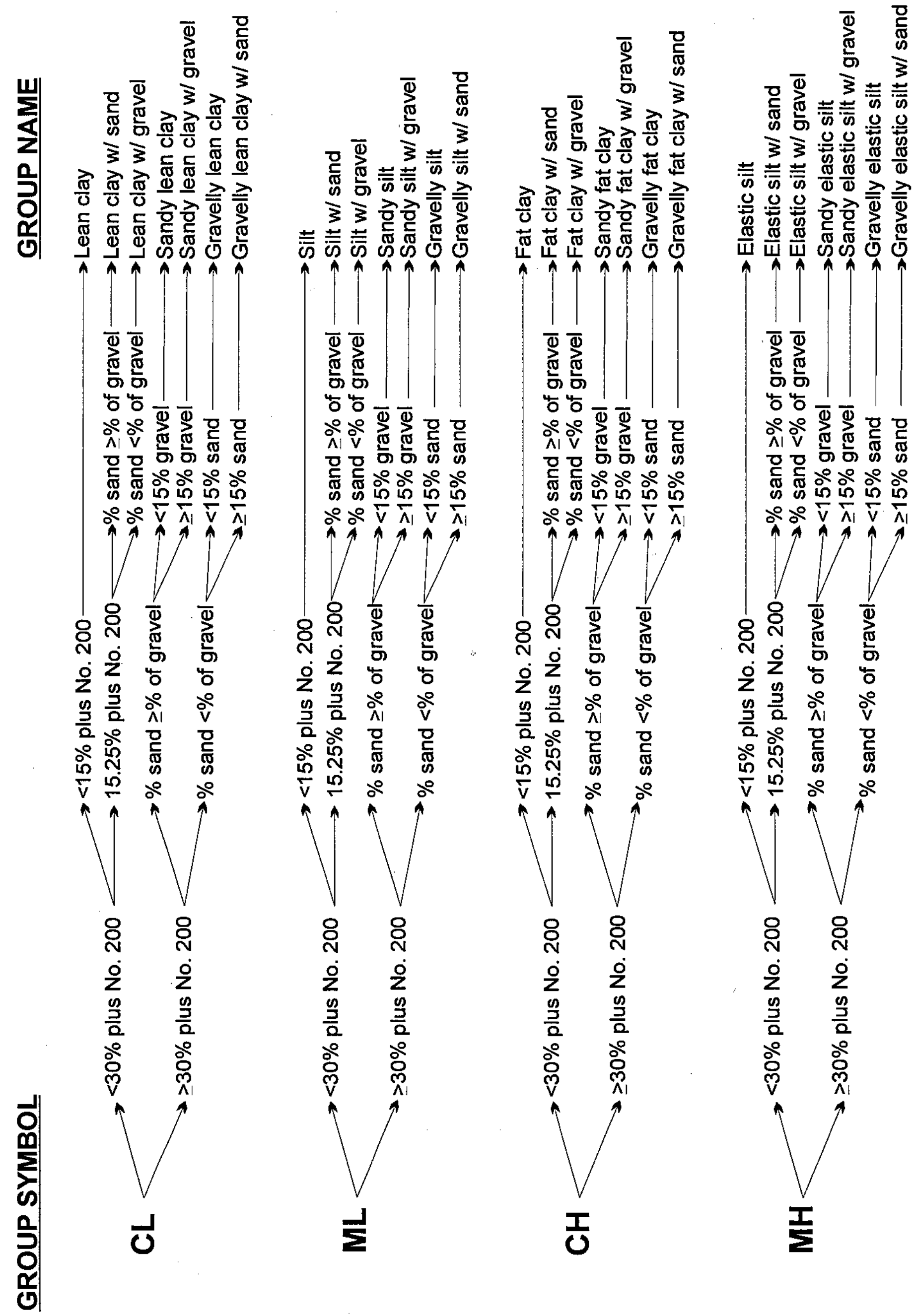


Figure 2

FLOW CHART FOR FINE GRAIN SOILS CLASSIFICATION

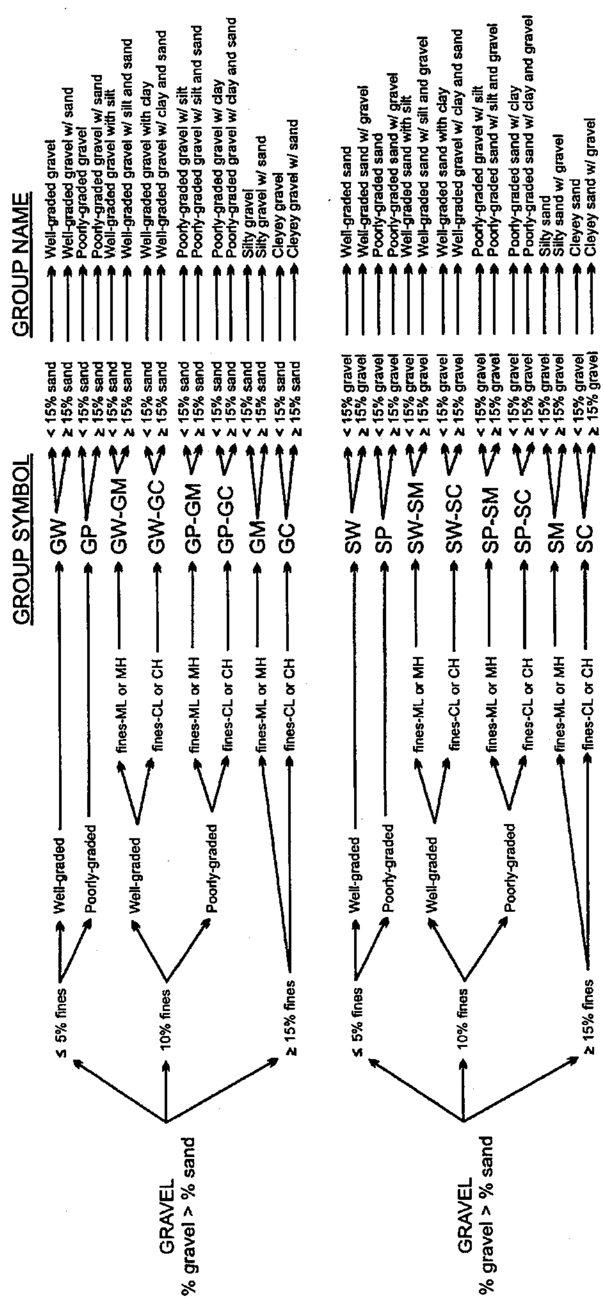


Figure 3

FLOW CHART FOR SOILS WITH GRAVEL

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

5.1.2 Soil Dilatancy, Toughness, and Plasticity

5.1.2.1 Dilatancy

To evaluate dilatancy, the following procedures shall be followed:

1. 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.

2. Smooth the soil ball in the palm of one hand with the blade of a knife or small spatula. Shake horizontally, striking the side of the hand vigorously against the other hand several times. Note the reaction of water appearing on the surface of the soil. Squeeze the sample by closing the hand or pinching the soil between the fingers, and note the reaction as none, slow, or rapid in accordance with the criteria in Table 1. The reaction is the speed with which water appears while shaking, and disappears while squeezing.

Table 1

CRITERIA FOR DESCRIBING DILATANCY

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

5.1.2.2 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 2.

Table 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.

5.1.2.3 Plasticity

The plasticity of a soil is defined by the ability of the soil to deform without cracking, the range of moisture content over which the soil remains in a plastic state, and the degree of cohesiveness at the plastic limit. The plasticity characteristic of clays and other cohesive materials 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 3.

Table 3

CRITERIA FOR DESCRIBING PLASTICITY

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

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;
- 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 4.

Table 4

SOIL MOISTURE CONTENT QUALIFIERS

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

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

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

5.1.5 In-place Conditions

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

5.1.5.1 Density/Consistency

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

The density or consistency of a soil is determined by observing the number of blows required to drive a 1 3/8-inch (35 mm) diameter split barrel sampler 18 inches using a drive hammer weighing 140 lbs (63.5 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 used in determining the soil density/consistency. The sum of the number of blows required for the second and third 6 inches of penetration is termed the "standard penetration resistance," or the "N-value." The observed number of blow counts must be corrected by an appropriate factor if a different type of sampling device (e.g., Modified California Sampler with liners) is used. For a 2 3/8-inch 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.
- 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 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 in Table 5.

Table 5

MEASURING SOIL DENSITY WITH A CALIFORNIA SAMPLER 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

Table I-E-5a

MEASURING SOIL DENSITY WITH A CALIFORNIA SAMPLER 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	2-4
Medium Stiff	4-8	4-9
Stiff	8-16	9-18
Very Stiff	16-32	18-36
Hard	>32	>36

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

Table 6

MEASURING SOIL CONSISTENCY WITH A HAND-HELD PENETROMETER

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:

Table 7

MEASURING SOIL CONSISTENCY USING THUMB PRESSURE

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

5.1.5.2 Cementation

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

- Quartz - siliceous;
- Chert - chert-cemented or chalcedonic;
- Opal - opaline;
- Carbonate - calcitic, dolomitic, sideritic (if in doubt, calcareous should be used);
- Iron oxides - hematitic, limonitic (if in doubt, ferruginous should be used);

Clay minerals - if the clay minerals are detrital or have formed by recrystallization of a previous clay matrix, they are not considered to be a cement. Only if they are chemical precipitates, filling previous pore space (usually in the form of accordion-like stacks or fringing radial crusts) should they be included as "kaolin-cemented," "chlorite-cemented," etc.

Miscellaneous minerals - pyritic, collophane-cemented, glauconite-cemented, gypsiferous, anhydrite-cemented, baritic, feldspar-cemented, etc.

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

Weak - friable, crumbles or breaks with handling or slight finger pressure;

Moderate - friable, crumbles or breaks with considerable finger pressure;

Strong - not friable, will not crumble or break with finger pressure.

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 - spherically shaped aggregates with faces that do not accommodate adjoining faces.

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

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

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

Lensed	-	inclusion of a small pocket of different 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 (determined by applying moderate pressure to sample using thumb and index finger)
Slickensided	-	fracture planes appear polished or glossy, sometimes striated (parallel grooves or scratches)

5.1.6 Development of Soil Description

Standard soil descriptions will be developed according to the following examples. There are three principal categories under which all soils can be classified. They 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 over 50% 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-SORTED SAND WITH SILT, medium- to coarse-grained, light olive gray, 5Y 6/2, saturated, loose, poorly sorted, subrounded clasts, SW/SM (minor silt with approximately 20% coarse-grained sand-sized shell fragments, and 80% medium-grained quartz sand, and 5% to 15% ML).

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, firm, 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.

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

5.2 Rock Classification

The purpose of rock classification is to thoroughly describe the physical and mineralogical characteristics of a specimen and to classify it according to an established system. The generalized rock classification system described below was developed for AMEC because, unlike the USCS for soils, there is no universally accepted rock classification system.. In some instances, a more detailed and thorough rock classification system may be appropriate. Any modifications to this classification system, or the use of an alternate classification system should be considered during preparation of the site WP and FSP. Any modifications to this classification system, or the use of another classification system, must be approved by both the Project Manager and the Technical Director/QA Program 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 must use the classification system described herein, or if necessary, another more detailed classification system. Use of a common classification system provides the most useful geologic database for all present and future subsurface investigations and remedial activities at Project sites.

In order to provide a more consistent rock classification between geologists, a rock classification template has been designated as shown in Figure 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 Classification group (i.e., metamorphic foliated)

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 4

ROCK CLASSIFICATION SYSTEM

- 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.)
- Rock Quality Designation (sum of all core pieces greater than two times the diameter of the core divided by the total length of the core run, expressed as a percentage) and
- Classification symbol (i.e., MF).

Example: Metamorphic foliated schist: Olive gray, 5Y, 3/2, Garnet 25%, Quartz 45%, Chlorite 15%, Tourmaline 15%, Fine-grained with Pegmatite garnet, highly foliated, slightly wavy, 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, *Soil Sampling*. Copies of this information shall be placed in the project files and reviewed by the Project Manager on a monthly basis at a minimum.

7.0 HEALTH AND SAFETY

Standard Health and Safety (H&S) practices should be observed according to the -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.

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

ASTM, 1990. Standard Practice for Description and Identification of Soils (Visual, Manual Procedure) Designation D 2488-90.

Birkeland, Peter W. 1984. Soils and Geomorphology. Oxford University Press.

Compton, Robert R. 1985. Geology in the Field. John Wiley & Sons, Inc.

Folk, Robert L. 1980. Petrology of Sedimentary Rocks.

Huang, Walter T. 1962. Petrology. McGraw-Hill Book Company.

McCarthy, David F. 1988. Essentials of Soil Mechanics and Foundations: Basic Geotechnics. Prentice Hall.

Munsell Soil Color Chart, 1990 Edition (Revised).

Pettijohn, F.J. 1957. Sedimentary Rocks. Harper, New York.

Rahn, Perry H. 1986. Engineering Geology. Elsevier Science Publishing Company, Inc.

SOP, *Soil Sampling*

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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SOIL SAMPLING

1.0 PURPOSE

This section sets forth the standard operating procedure (SOP) for soil sampling (surface samples, trench samples, and boring samples) to be used by AMEC personnel.

2.0 SCOPE

This procedure applies to all personnel involved with the managing or participating in drilling and soil sampling activities.

This procedure has been developed to serve as professional guidance for the AMEC personnel. However, it is not intended to obviate the need for professional judgment that may arise in unforeseen circumstances. Deviations from this procedure when planning or executing 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 sampling procedures are utilized during projects conducted or supervised by a qualified individual. 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 boring construction. A qualified individual for trenching, excavation (e.g., pit), 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, *Soil and Rock Classification*.

The Field Manager is responsible for ensuring that all project field staff follow 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 or trenching. 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 partly on the type of samples that can be collected when using various subsurface exploration techniques. These procedures are described in Section 5.2. In all cases, the equipment shall be inspected prior to commencement of drilling for signs of fluid leakage, which could introduce contaminants into the soil. If, at any time during subsurface exploration, fluid is observed leaking from the rig, operations shall cease and the leak shall 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, *IDW Management*).

5.1.2 Preparation of Site

Proper preparation of the site prior to the commencement of subsurface exploration is essential for smooth drilling operations. It is required to protect the health and safety of site personnel. First, the site shall be inspected to ensure that there are no overhead hazards that could affect subsurface exploration. Then, all subsurface sampling locations shall be assessed using geophysical methods. If possible, the area shall be excavated by hand to a depth of 2 to 3 feet before beginning drilling. If surface or shallow samples are required, it is suggested that the hand excavation be done as close to the actual subsurface exploration as possible. The location of the kill switch for the equipment shall be known to all members of the field crew and shall be readily accessible.

The equipment shall be situated upwind or side-wind of the borehole. The area surrounding, and in the vicinity of, the borehole shall be covered with plastic, including 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 designee the various areas.

5.1.3 Equipment Decontamination

To avoid cross-contamination, all sampling equipment utilized for borehole drilling and soil sampling that may potentially come into contact with environmental samples shall be thoroughly decontaminated as described in SOP, *Equipment Decontamination*. All sampling tools shall be decontaminated between each sampling event and between each borehole or trench. 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 be protected from contact with contaminated soils or other contaminated materials prior to sample collection. Equipment shall be kept on plastic or protected in another suitable fashion. After a borehole is completed, all augers and contaminated downhole equipment shall be stored on plastic sheeting.

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.

5.2 Soil Sample Collection Methods

Table 1 describes the characteristics of the sampling methods available for the drilling techniques frequently employed for conducting soil borings and monitoring well installation as described in SOP, *Monitoring Well Installation*. The split-spoon sampling method is 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.

Table 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

5.2.1 Split-spoon Samples

Split-spoon sampling is usually used in conjunction with the hollow-stem or solid-stem auger drilling method and can be used for sampling most unconsolidated and semi-consolidated sediments. It is less frequently used for air and mud rotary, and casing drive methods. It cannot normally 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 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 until the top of the desired sampling interval is reached. The drill bit is then withdrawn from the hollow-stem augers.

- 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 or stainless steel and are slightly smaller than the inner diameter of the sampler. If samples are to be analyzed for metals, it is recommended that stainless steel 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 attached either 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). The number of blows required to drive the sampler should be recorded at 6-inch intervals in the boring log because blow counts provide an indication of the density/compaction of the soils being sampled. The field geologist, hydrogeologist, or geotechnical engineer 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. Whether continuous or intermittent, the sample collected with this method is disturbed and cannot be used for certain geotechnical tests that require undisturbed samples.

- 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 liners containing the soil samples are immediately removed from the sampler. Generally, the lowermost liner 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, hydrogeologist, or geotechnical engineer shall observe the ends of the liner destined for analytical sampling and describe the physical nature of the sample (e.g., soil or rock type, grain size, color, moisture, etc., as indicated in SOP, *Soil and Rock Classification.*) The sample shall then be labeled according to SOP, *Record Keeping, Sample Labeling, and Chain-of-Custody*, and immediately placed on ice in a cooler as described in SOP, *Sample Handling, Storage, and Shipping Procedures*.

- The remaining liners collected from the sample, if any, 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 as described in Section 5.4.

- Lithologic logging of each sample shall be conducted in accordance with the methods outlined in SOP, *Soil and Rock Classification*, and entered into the boring log presented in Figure 1. In most instances, an additional liner full of material is available for this purpose. A check shall be made to ensure that the liners all contain similar material. If an extra liner full of material is not available, then logging will be accomplished by collecting the extra material present in the end of the sampler shoe. A comparison to the material visible at the end of the sample liner destined for laboratory analysis shall be made to ensure that the entire sample consists of similar material. If not, then

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 GR	SA	FI	COMMENTS

Figure 1
FIELD LOG OF BORING

- the different material is described to the extent possible by relating it to similar material previously encountered.

- If volatile organic compounds 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, *Equipment Decontamination.*

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

- Lithologic logging of each sample shall be conducted in accordance with the methods outlined in SOP, *Soil and Rock Classification.* If the sample is contained in a sleeve, the ends of the sample in the sleeve shall be observed to assess lithologic and stratigraphic characteristics.

- 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, *Equipment Decontamination.*

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 (i.e., particulate- and petroleum-free.) Distilled water may be added through the delivery system of the coring device by the driller, if necessary, provided that the drilling returns cannot be brought to the surface by air alone.

- 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.

- All sampling equipment must be decontaminated prior to each use according to the methods presented in SOP, *Equipment Decontamination*.

5.2.2 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 Type I or II cement with 3% to 5% 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.

5.2.3 Pit Sampling

Soil sampling locations within each trench or pit shall be chosen on the basis of visual inspection and any VOC screening results. Samples shall be collected from either the sidewalls or the bottom of the trenches/excavations. Soil sampling should be conducted outside the trench/excavation and personnel generally should not enter a trench or pit if there is any other means (e.g., backhoe buckets, hand augers, shovels, or equivalent) to perform the work. If entry is unavoidable, then a competent person shall first determine acceptable entry conditions including sloping, shoring, and air monitoring requirements, personal protective equipment, and inspections. In addition, the site-specific Health and

Safety Plan must be amended to include applicable requirements of 29 CFR 1910.146 and 29 CFR 1926 Subpart B.

5.3 Surface Sampling

All surface soil samples shall be accurately located on field maps in accordance with SOP, *Land Surveying*, and detailed soil classification descriptions completed in accordance with SOP, *Soil and Rock Classification* shall be recorded on the surface soil sampling log (Figure 2). 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 sampling surface soil 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 used 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 2). The soil classification shall include all the information outlined in SOP, *Soil and Rock Classification*.

Soil samples collected using a hand trowel are usually placed into pre-cleaned, wide-mouth glass jars. The jar is then sealed with a tight-fitting cap, labeled according to SOP, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures*, and placed on ice in a cooler in accordance with SOP, *Sample Handling, Storage, and Shipping Procedures*. All sampling equipment must be decontaminated prior to each use according to the methods presented in SOP, *Equipment Decontamination*.

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 (FEET)	DESCRIPTION	USCS SYMBOL	Est. % of G	Est. % of S	Est. % of F	COMMENTS

Figure 2
SURFACE AND SHALLOW SOIL SAMPLE LOG

Pre-cleaned 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, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures* and immediately placed on ice in a cooler as indicated in SOP, *Sample Handling, Storage, and Shipping Procedures*. To minimize possible cross-contamination, the SRA and sample liners shall be decontaminated prior to each use according to the procedures described in SOP, *Equipment Decontamination.*

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 excavations 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, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures* and immediately placed on ice in a cooler as indicated in SOP, *Sample Handling, Storage, and Shipping Procedures*.

All of the sampling equipment that comes into contact with the sample medium shall be decontaminated in accordance with the SOP, *Equipment Decontamination*. 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 liner (with the collected sample inside) is then removed from the ground and capped with Teflon® film and plastic end caps. The sample is labeled according to SOP and immediately placed on ice in a cooler. All liners shall be decontaminated prior to use, in accordance with SOP, *Equipment Decontamination*. Since the only equipment used are the sample liners themselves, this method helps to minimize the required amount of equipment decontamination.

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 model 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 VOCs 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 pre-cleaned glass jar, which is then sealed and agitated. The VOCs are allowed to volatilize into the headspace and equilibrate for 15 to 30 minutes. Next, the instrument probe is then inserted into the container to sample the headspace, and the instrument response is recorded in the field notebook and/or the field log.

6.0 RECORDS

Soil classification information collected during soil sampling should be documented in borehole, trench, and surface soil log forms. All log entries shall be made in indelible ink. Information concerning sampling activities shall be recorded on sample log forms or in the field logbook. All field logs shall be reviewed by the Project Manager or designee on at least a monthly basis. 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. For 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.

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

SOP, *IDW Management*

SOP, *Monitoring Well Installation*

SOP, *Soil and Rock Classification.*

SOP, *Equipment Decontamination*

SOP, *Land Surveying*

SOP, *Record Keeping, Sample Labeling, and Chain of Custody Procedures*, and

SOP, *Sample Handling, Storage, and Shipping Procedures*

9.0 ATTACHMENTS

None.

UTILITY CLEARANCE

1.0 PURPOSE

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

2.0 SCOPE

This SOP should be utilized to locate and identify the positions and types of underground utilities at sites where subsurface work is to be directed by AMEC personnel. It has been developed to serve as professional guidance for AMEC personnel. However, it is not intended to obviate the need for professional judgment that may arise in unforeseen circumstances. Deviations from these procedures while planning or executing planned activities must be approved by the Project Manager and documented.

3.0 DEFINITIONS

3.1 UTILITY

For this procedure a utility is defined as a manmade underground line or conduit, cable, pipe, vault or tank which is, or was, 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

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

4.0 RESPONSIBILITIES

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

The onsite Field Manager is responsible for planning utility clearance and for locating and marking underground utilities according to this SOP. 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 will include excavations, drilling, or any other subsurface investigative method that could damage 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 a preliminary, scaled site plan. The Project Manager shall be informed if utilities lie within close proximity to a proposed exploration or excavation location. The Project

Manager will determine if it is necessary to relocate proposed sampling or excavation locations.

Interviews with onsite and facility personnel familiar with the site shall be conducted to obtain additional information regarding the known and suspected locations of underground utilities. In addition, if appropriate, contact shall be made with local utility companies to request their help in locating underground lines. The dimensions, orientation, and depth of utilities other than those identified on the as-built plans shall be penciled in at their approximate locations on the preliminary plans. Type of utility, the personnel who provided the information, and the date the information was provided shall be entered into the field log.

During the pre-fieldwork interviewing process, the interviewer will determine which site personnel should be notified in the event of an incident involving damage to existing utilities. This information will be recorded in the field logbook with the corresponding telephone numbers and addresses.

5.3 Site Visit - Locate Utilities - Toning

Prior to the initiation of field activities, the field task manager or similarly qualified staff personnel shall visit the site and note existing structures and evidence of associated utilities, such as fire hydrants, irrigation systems, manhole and vault box covers, standpipes, telephone switch boxes, free-standing light poles, gas or electric meters, pavement cuts, and linear depression, should be noted. Notes of the actual site configuration shall be compared to the preliminary site plan. 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 Manager, 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, *Geophysical Testing Procedures*). 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 non-metallic cultural features are likely to be present at the site, other appropriate surface geophysical methods, such as Ground Penetrating Radar, should be used. Proposed exploration areas shall be cleared of all utilities in the immediate area where subsurface exploration is proposed. All anomalous areas should be clearly toned. All toned areas shall be clearly identified on the preliminary site plan. After toning, the site and plotting on the preliminary site plan all known or suspected buried utilities, the utility locator shall provide the Field Manager with a copy of the completed preliminary site plan. Alternatively, the Field Manager or designee shall document the results of the survey on the preliminary site plan.

Any anomalous areas detected and toned that are in close proximity to the exploration or excavation areas shall be reported to the Field Manager. The Field Manager shall determine the safe distance to maintain from the known or suspected utility. It may be necessary to relocate proposed exploration or excavation areas. If this is required, the field manager or a similarly qualified individual shall relocate them 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 plan. In some instances, such as in areas extremely congested with subsurface utilities, it may be necessary to dig by hand 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 Manager, the Project Manager and the subcontractor who is to conduct the subsurface exploration/excavation work. The site plan should be reviewed 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 HEALTH AND SAFETY

A site-specific Health and Safety Plan shall be adhered to by field and subcontractor personnel.

8.0 REFERENCES

Geophysical Testing Procedures

9.0 ATTACHMENTS

None.

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EPA

United States Environmental Protection Agency
Contract Laboratory Program Sample Management Office
PO Box 818 Alexandria, VA 22313
703-557-2490 FTS 557-2490

Organic Traffic Report & Chain of Custody Record

(For Organic CLP Analysis)

SAS No. (if applicable)

Case No. 17235

① Project Code	Account Code	② Region No.	Sampling Co.	④ Date Shipped	Carrier
SF		9	Ace	1-7-94	Fed. Express

Regional Information

Sampler (Name): Gail Jones

Airbill Number: 0912345678

Non-Superfund Program

Sampler Signature: Gail Jones

⑤ Ship To: Alpha Lab, 123 Pine Ave, NY, NY 10001

ATTN: John Doe

Site Name: Toxic Dump

City, State: Smallville CA

Site Spill ID: 99

③ Type of Activity: Lead: SF [X], PRP [ ], ST [ ], FED [ ]; Pre-Remedial: PA [ ], SSI [ ], LSI [ ]; Remedial: RIFS [X], RD [ ], RA [ ], O&M [ ], NPLD [ ]; Removal: CLEM [ ], REMA [ ], REM [ ], OIL [ ], UST [ ]

⑥ Preservative (Enter in Column D)
1. HCl
2. HNO3
3. $NaHSO_4$
4. H_2SO_4
5. Other (Specify)
6. Ice only
N. Not preserved

⑦ Sample Description (Enter in Column A)
1. Surface Water
2. Ground Water
3. Leachate
4. Rinsate
5. Soil/Sediment
6. Oil (High only)
7. Waste (High only)
8. Other (Specify)

CLP Sample Numbers (from labels)	A Enter # from Box 7	B Conc. Low Med High	C Sample Type: Comp./Grab	D Preservative from Box 6	E RAS Analysis: VOA	BNA	Pest/PCB	High only ARO/TOX	F Regional Specific Tracking Number or Tag Numbers	G Station Location Number	H Mo/Day/Year/Time Sample Collection	I Sampler Initials	J Corresp. CLP Inorg. Samp. No.	K Enter Appropriate Qualifier for Designated Field QC (B = Blank, S = Spike, D = Duplicate, PE = Perform. Eval., -- = Not a QC Sample)
YJ126	2	L	G			X				MW-1	1-6-94 0900	GJ	MYG001	—
YJ127	2	L	G			X				MW-2	1-6-94 1000	GJ	MYG003	—
YJ128	2	L	G			X				MW-3	1-6-94 1100	GJ	MYG005	—

⑧ Shipment for Case complete? (Y/N): N

Page 1 of 1

Sample used for a spike and/or duplicate: YJ127

Additional Sampler Signatures

Chain of Custody Seal Number

CHAIN OF CUSTODY RECORD

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Gail Jones	1-7-94 1600	0912345678			
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	Is custody seal intact? Y/N/none

Split Samples [ ] Accepted [ ] Declined (Signature)

EPA Form 9110-2 (Rev. 6-91) Replaces EPA Form (2075-7), previous edition which may be used

EPA United States Environmental Protection Agency
Contract Laboratory Program Sample Management Office
PO Box 818 Alexandria, VA 22313
703-557-2490 FTS 557-2490

Inorganic Traffic Report & Chain of Custody Record
(For Inorganic CLP Analysis)

SAS No. (If applicable):
Case No.: 17235

1. Project Code: SF
Account Code:
2. Region No.: 9
Sampling Co.: Ace
4. Date Shipped: 1-7-94
Carrier: Fed. Express
Regional Information:
Sampler (Name): Gail Jones
Airbill Number: 0912345699
Non-Superfund Program:
Sampler Signature: Gail Jones
5. Ship To: Beta Labs, Inc. 465 Maple Ave. Atlanta, GA 04507
ATTN: Mary Smith
Site Name: Toxic Dump
3. Type of Activity: Lead: SF [X] PRP [ ] ST [ ] FED [ ]; Pre-Remedial: PA [ ] SSI [ ] LSI [ ]; Remedial: RIFS [X] RD [ ] RA [ ] O&M [ ] NPLD [ ]; Removal: CLEM [ ] REMA [ ] REM [ ] OIL [ ] UST [ ]
City, State: Smallville CA
Site Spill ID: 99

6. Preservative (Enter in Column D)
1. HCl
2. HNO_3
3. NaOH
4. H_2SO_4
5. $K_2CR_2O_7$
6. Ice only
7. Other (Specify)
N. Not preserved

7. Sample Description (Enter in Column A)
1. Surface Water
2. Ground Water
3. Leachate
4. Rinsate
5. Soil/Sediment
6. Oil (High only)
7. Waste (High only)
8. Other (Specify)

CLP Sample Numbers (from labels)	A Enter # from Box 7	B Conc. Low Med High	C Sample Type: Comp./Grab	D Preservative from Box 6	E - RAS Analysis: Metals Total	Metals Dissolved	Cyanide	Low Conc. only: Nitrate/Nitrite	Low Conc. only: Fluoride	High only: pH	High only: Conductivity	F Regional Specific Tracking Number or Tag Numbers	G Station Location Number	H Mo/Day/Year/Time Sample Collection	I Sampler Initials	J Corresp. CLP Org. Samp. No.	K Enter Appropriate Qualifier for Designated Field QC (B = Blank, S = Spike, D = Duplicate, PE = Perform. Eval., — = Not a QC Sample)
MYG001	2	L	G	23	X		X						MW-1	1-6-94 0900	JB	YJ126	—
MYG002	2	L	G	2		X						A	MW-1	1-6-94 0915	JB	YJ126	—
MYG003	2	L	G	23	X		X						MW-2	1-6-94 1000	JB	YJ127	—
MYG004	2	L	G	2		X						A	MW-2	1-6-94 1015	JB	YJ127	—

A = Field Filtered, 0.45 micron
Digestion required for all dissolved samples

Shipment for Case complete? (Y/N): N
Page 1 of 1
Sample used for a spike and/or duplicate: MYG003 + MYG004
Additional Sampler Signatures: John Brown
Chain of Custody Seal Number:

CHAIN OF CUSTODY RECORD

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Gail Jones	1-7-94 1600	0912345699			
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	Is custody seal intact? Y/N/none

Split Samples [ ] Accepted [ ] Declined (Signature)

EPA Form (Rev. 8-91) Replaces EPA Form (2075-6), previous edition which may be used

EPA United States Environmental Protection Agency
Contract Laboratory Program Sample Management Office
PO Box 818 Alexandria, VA 22313
703-557-2490 FTS 557-2490

Inorganic Traffic Report & Chain of Custody Record
(For Inorganic CLP Analysis)

SAS No. (if applicable):

Case No. 17235

1. Project Code	Account Code	2. Region No.	Sampling Co.	4. Date Shipped	Carrier
SF		9	Ace	1-7-94	Fed. Express

Regional Information:

Sampler (Name): Gail Jones

Airbill Number: 0912345699

Non-Superfund Program:

Sampler Signature: Gail Jones

5. Ship To: Beta Labs, Inc. 455 Maple Ave. Atlanta, GA 04507
ATTN: Mary Smith

Site Name: Toxic Dump

City, State: Smallville CA

Site Spill ID: 99

3. Type of Activity: Lead: SF [X], PRP [ ], ST [ ], FED [ ]; Pre-Remedial: PA [ ], SSI [ ], LSI [ ]; Remedial: RIFS [X], RD [ ], RA [ ], O&M [ ], NPLD [ ]; Removal: CLEM [ ], REMA [ ], REM [ ], OIL [ ], UST [ ]

6. Preservative (Enter in Column D)
1. HCl
2. HNO_3
3. NaOH
4. H_2SO_4
5. $K_2Cr_2O_7$
6. Ice only
7. Other (Specify)
N. Not preserved

7. Sample Description (Enter in Column A)
1. Surface Water
2. Ground Water
3. Leachate
4. Rinsate
5. Soil/Sediment
6. Oil (High only)
7. Waste (High only)
8. Other (Specify)

CLP Sample Numbers (from labels)	A Enter # from Box 7	B Conc. Low Med High	C Sample Type: Comp./Grab	D Preservative from Box 6	E - RAS Analysis: Metals Total	Metals Dissolved	Cyanide	Low Conc. only: Nitrate/Nitrite	Fluoride	High only: pH	Conductivity	F Regional Specific Tracking Number or Tag Numbers	G Station Location Number	H Mo/Day/Year/Time Sample Collection	I Sampler Initials	J Corresp. CLP Org. Samp. No.	K Enter Appropriate Qualifier for Designated Field QC (B = Blank, S = Spike, D = Duplicate, PE = Perform. Eval., — = Not a QC Sample)
MYG001	2	L	G	23	X		X						MW-1	1-6-94 0900	JB	YJ126	—
MYG002	2	L	G	2		X						A	MW-1	1-6-94 0915	JB	YJ126	—
MYG003	2	L	G	23	X		X						MW-2	1-6-94 1000	JB	YJ127	—
MYG004	2	L	G	2		X						A	MW-2	1-6-94 1015	JB	YJ127	—

A = Field Filtered, 0.45 micron
Digestion required for all dissolved samples

Shipment for Case complete? (Y/N): N

Page 1 of 1

Sample used for a spike and/or duplicate: MYG003 + MYG004

Additional Sampler Signatures: John Brown

Chain of Custody Seal Number:

CHAIN OF CUSTODY RECORD

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Gail Jones	1-7-94 1600	0912345699			

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	Is custody seal intact? Y/N/none

Split Samples [ ] Accepted (Signature)
[ ] Declined

EPA Form 9110-1 (Rev. 5-91) Replaces EPA Form (2075-6), previous edition which may be used