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LANL Order Reference

RCRA Sampling Procedures Handbook

U.S. Environmental Protection Agency, Region 6, 1997

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Table 7-4
General Decontamination Solutions

Contamination	Cleaning Solution	Rinses
Inorganic	Nonphosphate detergent soap mixture	tapwater - Type II reagent grade water
Organic	Nonphosphate detergent	Tap water rinse - distilled water

preservative contamination, atmospheric contamination; variability in the samples; and incomplete homogenation. The most commonly used QC samples and their function are listed below.

Field duplicate - Homogenized aliquots of a single sample, field duplicates are used to assess the quality of sampling methods and sample handling. Field duplicates may also be used to check laboratory procedures. One field duplicate sample per matrix should be collected for every 10 samples collected.

Co-located sample - Soil/sediment samples which are collected from the same location or adjacent to each other to provide data on variability of the contaminants in soils/sediments. One co-located sample per matrix should be taken for every 10 samples collected. This type of sample is usually optional in preliminary sampling events conducted to establish releases. It may be more applicable in detailed studies such as an RFI, CDE, or in site characterization studies as part of closure plan preparation.

Equipment rinsate blank - Often referred to as an equipment blank, an equipment rinsate blank is a sample of the last decontamination liquid poured over equipment. It measures the efficiency of the decontamination process. Equipment rinsate blank samples should be collected before a sample collection vessel will be used or when sampling equipment is decontaminated and reused in the field. When possible this sample should be collected after the most contaminated sample location in order to provide a worst case scenario. The equipment rinsate blank should be taken from any non-dedicated equipment used in the sampling process, including pumps used for sampling, interface probes, mixing bowls, sampling scoops, split-spoon samplers, etc. Equipment rinsate blanks should be collected at a rate of 1 blank per every 10 samples collected or one per day.

Trip blank - A sample of laboratory-grade distilled water poured into a sample container in the lab which follows the sample containers, coolers and samples throughout the field event. It measures the amount of volatile contaminants, if any, that absorb through the container while in the field. The trip blank sample should be sent to the lab at the end of the sampling event.

Field Blank - This sample is similar to the trip blank except that it is prepared in the field with laboratory grade distilled water and is prepared exactly as all other samples in the field. Field blanks are used to determine whether site conditions are contributing to contamination levels. Field blanks are typically necessary in windy sampling conditions when blowing dust is a problem. Field blanks are also useful in situations where there are numerous air releases from a facility which may bias sample analytical results.

In some cases where extensive soil sampling is being conducted, soil blanks may be required. Soil blanks can be prepared from washed silica sand and submitted to the laboratory to evaluate potential contamination at the lab and from containers. In order for the soil blanks to be valid, two other soil blanks of the same sand should be sent to two independent laboratories for analysis in order to obtain base fine data to compare to the on-site soil blank.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples - A sample collected that is three times the normal volume that is required for a specific chemical analysis. The purpose of this sample is discussed in Section 7.4.2 of this handbook. One MS/MSD sample per matrix should be collected for every 20 samples collected.

Background samples - A sample taken from media characteristic of the facility site, but outside the zone of contamination. Literature and monitoring data should be reviewed to determine background conditions.

Table 7-5 provides guidelines for collecting field quality control samples.

Table 7-5
Guidelines for Recommended Quality Control Samples for Field Sampling Programs

Media	Field Duplicate	Co-located	Equipment Rinsate Blank	Trip Blank	Field Blank	MS/MSD	Background
Aqueous	one in ten	one in ten	one prior to sampling and then after each decon event	one per sampling event	one per day	one in twenty	minimum of two per sampling event
Soil/ Sediment	one in ten	one in ten	one prior to sampling and then after each decon event	not required	one per day	one in twenty	minimum of two per sampling event
Air	one in ten	one in ten	one prior to sampling and then after each decon event	not required	not available	one in twenty	minimum of two per sampling event
Source Material	one in ten	one in ten	one prior to sampling and then after each decon event	one per sampling event if source is liquid	not usually required	one in twenty	not required

Source: U.S. Environmental Protection Agency, 1987; "Data Quality Objectives for Remedial Response Activities, Development Process"; EPA/540/G-87/003; Office of Emergency and Remedial Response and Office of Waste Programs Enforcement; Washington DC; March 1987.

7.4.2 Laboratory QA/QC Program

Laboratory QA/QC samples are a measure of instrument and laboratory performance. They provide data that is necessary to determine the quality of sample analyses. All samples analyzed by the CLP require specific laboratory QA/QC, which is always implemented. If a non-CLP laboratory is to be utilized, specific detail regarding a laboratory QA/QC program should be clarified. The following is a brief discussion of the commonly used QA/QC samples.

Method blank reagent blank - Laboratory grade water or clean soil, if available, analyzed along with the samples. It provides a measure of interferences introduced by laboratory practices. One method blank per ten samples is required.

Duplicate samples - A sample aliquot from a sample. Measures the precision of analysis in terms of relative percent difference (RPD).

Matrix Spike (MS) samples - Measures performance of method used relative to sample matrix.

Matrix Spike Duplicate (MSD) samples - A duplicate sample from a matrix spike sample. Measures the precision of analysis in terms of relative percent difference (RPD).

Method Spike - Laboratory grade water spiked with the analyte of interest to monitor accuracy of analysis of laboratory performance of methods.

Performance Sample - Quarterly or biannual performance evaluation of EPA or National Bureau of Standard, (NBS) submitted for evaluation of laboratory performance.

7.5 Sampling Handling

Handling of a sample after its collection and prior to its analysis is an important aspect of any sampling effort. Procedures followed during this phase of sampling may be critical in determining the quality of the analytical data subsequently obtained, and must be carefully specified in the sampling plan. Samples must first be containerized using properly selected and cleaned containers, and may require filtration and/or preservation prior to shipping. Containers must be properly packaged for shipping and transported to the lab. Special procedures may be required, depending on the hazardous nature of the sample.

Proper chain of custody controls must be followed during collection and shipment of samples. Special QA/QC procedures are also required during sample collection and shipment.

Improper sample handling or choice of containers may cause problems, including loss of volatiles or changes within the sample. Improper choice of containers may cause the container to react with the sample, thus creating analytical errors or even the destruction of the container with subsequent loss of the sample. Containers may contribute contaminants to samples through leaching or surface desorption from container walls, or deplete concentrations of sample constituents through adsorption. Improper transfer of sample to the container may also result in loss of volatile constituents or other changes in quality.

The sampling plan should specify the type of sample containers to be used to collect samples; the method of transferring the sample to the container; and the procedures which will be used to ensure that sample containers are free of contaminants prior to use.

7.5.1 Sample Containers

The most important factors to consider when choosing containers for hazardous material samples are compatibility of the container with the sample; resistance to breakage; required sample volume; and, that the containers are properly cleaned before use so that other contaminants are not introduced into the sample. Containers must not melt, leach, rupture, or leak as a result of chemical reactions with the constituents of a sample. Thus, it is important to have some idea of the composition of the sample before the containers are selected (EPA, 1986). Sample containers may be ordered from commercial container vendors. These containers must be prepared in accordance with defined cleaning procedures and strict quality control analysis requirements to meet the contaminant-free specifications required for laboratory analyses. Figure 7-1 illustrates the types of containers, amounts, and specific matrix for different constituents that are available. Figure 7-2, from the Sampler's Guide to the CLP (EPA, 1990b) shows the required container usage and sample amounts for CLP laboratories.

7.5.2 Sample Preservation & Filtration

Some samples, such as water samples for dissolved metals analysis may require immediate filtration in the field. Other samples can be filtered at a later time in the laboratory. The specific analytical methods should

Figure 7-1
Sample Container Types

CONTAINER TYPE	DESCRIPTION	USED FOR SAMPLE TYPE
A	80-oz. amber glass bottle with teflon-lined black phenolic cap	Extractable Organics
B	40-ml glass vial with teflon backed silicon septum cap	Volatile Organics
C	1-L high density polyethylene bottle with poly-lined, white poly cap	Metals, Cyanide & Sulfide
D	120-ml glass vial with teflon lined, white poly cap	Volatile Organics (Soil)
E	16-oz. wide-mouthed glass jar with teflon-lined, black poly cap	Ext. Organics & Metals in Soils & Med/High
F	Water	Ext. Organics & Metals in Soils & Med/High
G	8-oz. wide-mouthed glass jar with teflon-lined, black poly cap Water	Ext. Organics & Metals in Soils & Med/High
H	4-oz. wide-mouth glass jar with teflon-lined, black poly cap Water	Extractable Organics
K	1-L amber glass bottle with teflon lined, black poly cap	Extractable Organics
L	4-L amber glass bottle with teflon-lined, black phenolic cap	Metals, Cyanide & Sulfide
	500-ml high-density polyethylene bottle with poly-fined, baked poly cap	

Figure 7-2
CLP Laboratory Required Container Usage and Sample Amounts

Inorganics

Sample Matrix	Concentration	Fraction	Volume	Container Type
Water	Low	Total Metals and Cyanide	1 L	C, H, or L
		Dissolved Metals	1 L	C or L
	Medium	Total Metals and Cyanide	1 • L	C or L
		Dissolved Metals	1 • L	C or L
Soil/Sediment	Low/Medium	Total Metals and Cyanide	6 oz	F or G

Organics

Sample Matrix	Concentration	Fraction	Volume	Container Type
Water	Low	VOAs	80 m•L	B
		SVs	2 • L	A, K, or H
		Pesticides/ Aroclors	2 • L	A, K, or H
Soil/Sediment	Low/Medium	VOAs	240 m•	D
		SVs	3 oz	F or G
		Pesticides/ Aroclors	3 oz	F or G

be consulted to determine when to filter. Care must be taken to filter a sample immediately in the field, if it is required, so that the sample integrity is not compromised. For groundwater samples, in order to compare metals concentrations to drinking water standards, samples should not be filtered.

Sample filtration is a judgement call to be made by the field team leader dependent upon the use of the data and the turbidity of the water sample. Many low level samples require preservation by refrigeration or addition of chemical reagents. This slows any physical, chemical, and biological changes likely to occur to the sample over time. As presented earlier, Table 5-4 lists some preservative types and recommended sample preservation requirements. Some Regions may vary in the types of chemical reagents required for preserving samples, and should be consulted for any variances. Medium and high level unknown samples are not usually preserved.

7.5.3. Sample Size Required

The size of the sample to be collected in the field is dependent upon the size of the sample required by the laboratory to perform the analysis. The sample description on Figure 7-2 lists some general guidance on sample size. For specific sample sizes, the sample is referred to SW-846. For the most part, sample sizes listed in Figure 7-2 are considerably more than required by the laboratory, although additional sample quantity assists the laboratory in performing repeat analysis if required and archiving samples for future verification analysis.

7.5.4 Sample Documentation

Numerous sample identification documents are used to maintain identification and chain-of-custody of all samples collected, and to control sample disposition. These documents include: sample identification tags, chain-of-custody forms, CLP traffic report forms and labels, custody seals, and shipping forms.

Sample Tags and/or Labels. Each sample is identified by a sample tag or label with a unique sample number recorded on the tag/label. Each Region should be consulted regarding variances in labeling requirements.

Generally, the information to be recorded on the tag/label includes: project code, station number, date, time, sample number, station

location, sampler(s), tag number, remarks, and analysis. Appendix E presents an example sample tag and step-by-step instructions on how to fill out the tag.

If a label or tag is not available, the same information should be recorded on the container with waterproof ink. At a minimum, the tag or label should contain the name of the collector, date and time of collection, place of collection, and sample number. Sample labels which are affixed to the container should be secured with clear tape to prevent loss.

Custody Seals - When samples are shipped to the laboratory, containers must be secured with EPA custody seals. Custody seals (see Appendix E), or evidence tape, are placed over or around the lid of the container. However, some regions prohibit the use of tape. The custody seals should be signed and dated by the individual relinquishing custody of the samples. Two seals must be placed on each shipping container (cooler), one at the front and one at the back.

Chain-of-Custody/Traffic Report and Labels - A required part of any sampling and analytical program is the integrity of the sample from collection to data reporting. "Chain-of-Custody" documentation results in the ability to trace the possession and handling of samples from the time of collection, through analysis and final disposition. All samples must be accompanied by a chain-of-custody form. Appendix E presents example chain-of-custody forms and step-by-step instruction to completing the form. The information recorded on this form includes: project number, project name sampler(s) station number and location, date, time, composite sample, number of containers, remarks, relinquish/received signatures, date, and time.

Combination chain-of-custody/traffic report forms (see Appendix E) are used for samples shipped to CLP laboratories for organic and inorganic analyses.

The preprinted numbered adhesive sample labels must be secured to sample containers by the sampler, and protected from water and solvents with clear tape. Chain-of-custody/traffic report forms should be completed (with waterproof ink) in accordance with the instruction sheet provided in Appendix E.

The chain-of-custody/traffic report original (white copy) should be sent to the Sample Management Office (SMO) by the CSCC. The first (pink) copy should be retained by the Sample Leader for field records. The second and third copies (white and yellow) should be sent with the

shipment to the laboratory (address to be provided by the SMO).

Receipt for Samples - A facility should be given a receipt for the samples collected during the sampling event. A copy of the chain-of-custody may be given as such a receipt, although many Regions require the use of a Receipt for Samples form (See Appendix E). (The facility representative must also have the opportunity, if required, to obtain splits of the samples.)

7.5.4 Procedures for Packing

Procedures for Packing Low Concentration Level Samples - Samples collected during the sampling activities containing low concentrations (less that 10 ppm) of inorganic and organic chemical compounds in groundwater, surface water, sediments and soil are considered to be environmental samples. Procedures for packing these samples for shipment will be as follows:

- Determine maximum weight allowed per package from shipper.
- Secure sample bottle lids with custody seals. At the same time, ensure that the sample labels are secured to the container with clear plastic tape.
- The labels must appear on the bottles to be sent to the laboratory.
- Place about three inches of inert cushioning material, such as styrofoam or vermiculite, in bottom of cooler, or install a cooler liner.
- Samples should be placed inside a large plastic bag inside the ice coolers.
- Place containers in cooler in such a way that they do not touch.
- Pack bottles in inert cushioning material.
- Fill cooler with either inert cushioning material, foam, or vermiculite and blue ice (as available) if sample cooling is required. If wet ice is used, it should be double bagged.
- Tape cooler drain shut.
- Place paperwork in a clear plastic bag and tape to inside of cooler lid (be sure to sign appropriate documents).
- For hand delivered shipments, attach custody seals to front and back, otherwise, see below.

If shipping via commercial carrier, the following additional packaging procedures should be followed:

- Complete shipping form for carrier and retain as part of permanent documentation.
- After acceptance by the shipper, wrap strapping tape around cooler at two locations, to secure cooler in case of latch failure during shipment. Do not cover labels.
- Place laboratory address on top of cooler.
- Put "this side up" labels on at least two sides and "fragile" labels on at least two sides.
- Affix custody seals on front right and back left of cooler. Cover seals with wide, clear tape.

Procedures for Packing Medium to High Concentration Level Samples - Medium concentration sample containers should be placed in metal paint cans, sealed with clips before packaging in cooler. All Traffic Report and sample tag numbers will be placed on the outside of the can as well as the inside. Appropriate DOT shipping labels (e.g., Dangerous Goods Identification) should be placed on each can and cooler. A restricted airbill (Figure 7-4) should be completed and a copy be retained for the project file.

7.6 Data Validation

Data validation procedures are a set of checks applied at appropriate levels to verify data quality. Data validation includes the comparison of actual performance parameters of an analytical method, with requirements established for that particular method. Criteria normally established for data validation includes limits on operational parameters, such as GC conditions; calibration data; special checks unique to each measurement; statistical tests, such as for outliers; and, manual checks, such as hand calculations. These limits should be defined so as to ensure a high probability of detecting any invalid data. The limits are generally specified in the laboratory contract or in the documentation for the analytical procedure itself.

Internal data validation is normally performed by the laboratory which is conducting the analysis. However, it is frequently performed by an external source using the quality control data provided with the analytical data by the lab. Internal data validation procedures are formalized in the functional guidelines for evaluating organic and inorganic analyses, which are designed to permit structured data review. The CLP statement of work for organic and inorganic analyses

laboratory can be contracted. If a decision is made to go outside the CLP, the RSCC can still be helpful in choosing a qualified laboratory. The laboratory is procured using a standard bidding process. The laboratories chosen to receive the invitation for bids (IFB) are usually approved by the EPA Regional QA representative. The desired analytical protocol is specified in the IFB and conforms closely to CLP or other EPA-approved methods. IFBs are sent to at least three laboratories. The RSCC can provide technical assistance in making the final selection, which must be approved by the EPA Headquarters Project Officer and/or Contracting Officer prior to the work beginning, unless contractor support is being utilized.

9.3 Requesting Sample Containers, Sample Documentation

9.3.1 Sample Containers

In addition to coordinating CLP analyses, the RSCC is also the regional contact for sample containers. The RSCC authorized requester should be asked to identify and order the necessary sample containers from a commercial vendor. These containers should be prepared in accordance with defined cleaning procedures and strict quality control analysis requirements to meet the contaminant-free specification required for CLP analyses. Some non-CLP laboratories provide their own containers and preservatives as part of their service.

9.3.2 Sample Documentation

Sample identification and tracking documents must also be obtained for the samples. The documents routinely needed are:

- sample identification tags;
- sample traffic reports;
- chain-of-custody records;
- receipt-for-samples forms;
- custody seals; and,
- field notebooks.

Sample identification tags (see Appendix E) are fitted out and attached to each sample when it is taken. Traffic reports (see Appendix E) are used by the CLP with a number assigned to individual samples for tracking. Because samples collected could be used in litigation, chain-of-custody records (Appendix E) are kept to trace possession of the samples from collection to introduction as legal evidence. Custody seals (Appendix E) are used to ensure that samples are not tampered with during shipment. Section 3007(a)(2) of RCRA provides that EPA

minimize their creation. The immaculate Tyvek can be disposed of with more confidence than the suit unnecessarily stained by rubbing against every barrel on site. Minimization of contamination contributes to safety, by minimizing the likelihood of exposure.

For RCRA facilities, means of disposing of contaminated suits and equipment should be in place. If these are inadequate at the site, it may be necessary to package and ship these materials to a RCRA-approved off-site facility. At all times, the samplers should follow all required RCRA and/or CERCLA requirements.

- Field Documentation - Log Books/Photographs

Field notebooks are maintained to record significant events, observations, and measurements taken during investigation. They are intended to provided sufficient data and observations to enable participants to reconstruct events that occurred, and to refresh the memory of field personnel called to testify during legal proceedings. In legal proceedings, field notes are admissible as evidence. As legal documents, field notes need to be factual, detailed, and objective. All entries should be dated and signed by the author.

In taking photographs, a log is kept detailing the date, time, subject, frame number, roll number, photographer, and witness for each picture. The photographer should keep in mind that a photograph can document more than the immediate subject. In photographing sample bottles to document custody seals for example, the photographer may also be documenting sample color, number of phases, sample identification, the dead bug floating in the sample, etc. Also, photography can be used to describe relationships. A shot of a drum standing under a tree, a closer shot showing the label on the drum, and a shot of the fine print on the label can convey practically the same information to the reader of a subsequent report, as being at the sampling event.

9.7 Exit the Site - Sample Shipment

Samples from hazardous waste sites being shipped to a laboratory are covered by the Transportation Safety Act of 1974. Regulations

governing such shipments are detailed in:

- Title 49 CFR
  - Parts 100 - 177 - Shipper Requirements and Hazardous Material Table
  - Parts 178 - 199 - Packaging Specifications
- Title 40 CFR
  - Part 262.20 - Hazardous Waste Manifest
- International Civil Aviation Regulations (ICAO)
  - Technical Instructions for the Safe Transport of Dangerous Goods by Air
- International Air Transport Association (IATA)
  - Dangerous Goods Regulations
- Tariff BOE-6000-D (reprint of 49 CFR with updates)
  - Low concentration samples are defined as environmental samples and are packaged as follows:

Commercial shippers, such as Federal Express, have hazardous materials sections which can provide the necessary restricted airbills (Figure 8-5), labels and assistance in determining the proper packaging. Improperly declared or labelled packages are likely to be refused by the carrier. Also, the penalties for improper shipment of hazardous materials can be quite severe; a fine of $25,000 and five years imprisonment may be imposed for each violation. Therefore, the shipper must be very careful to comply with the regulations. Medium and high concentration samples are defined as hazardous and require packaging also as presented in Section 7.5.

9.8 Reporting Requirements

9.8.1 Trip Reports

Often, laboratory results from samples will not be available for several weeks to months after the sampling trip. The trip report serves to clearly record the events in a timely fashion. As with all trip reports for various activities, the trip report for a sampling event should address the following fundamental elements:

- What was the purpose of the sampling trip?

- Where did the sampling take place?
- When was the sampling performed?
- Who were the site contacts: Witnesses to the sampling?
- What samples were taken? From where, exactly? What were they to be analyzed for?
- How, exactly, was sampling performed?
- What were site conditions? Did site conditions impact the sampling?
- What kind of field monitoring for health and safety was done?

The trip report should include available maps of the site and surrounding area, and of sample locations. As discussed earlier, photographs taken during sampling should be adequately formatted to serve as guides to sample locations, and to illustrate sampling techniques used.

9.8.2 Draft and Final Sampling Reports

Once analytical results are received and evaluated, a sampling report is prepared. This report, somewhat more formal than a trip report, has a specific format which may vary between Regions. It should address the various areas of sampling and analysis which may be questioned during litigation. The sampling report typically includes:

- An introduction briefly addressing site description and history and objectives of the sampling.
- A description of the sampling program design and its rationale.
- A discussion of the sampling mission including:
  - Dates performed;
  - Number of samples taken;
  - Locations of samples; and
  - Analyses requested.
- A discussion of quality assurance/quality control measures used in the sampling:
  - Proper sampling procedures used;
  - Proper sample containers;
  - Proper chain-of-custody forms and seals; and
  - Correct packaging of samples.
- Summary of analytical results.
- Summary of laboratory data validation.

Due to the complexity of the issues addressed, the sampling report may require internal review and revision prior to its final release.

ERT Method

WATER LEVEL MEASUREMENT

1.0 SCOPE AND APPLICATION

1.1 The purpose of this Standard Operating Procedure (SOP) is to set guidelines for the determination of the depth to water and floating chemical product (i.e., gasoline, kerosene) in an open borehole, cased borehole, monitoring well or piezometer.

1.2 Generally, water level measurements taken in boreholes, piezometers, or monitoring wells are used to construct water table or potentiometric surface maps and to determine flow direction as well as many other aquifer characteristics. Therefore, all water level measurements at a given site should be collected within a 24-hour period with a great deal of accuracy. Certain situations may necessitate that all water level measurements be taken within a shorter time interval. These situations may include:

- The magnitude of the observed changes between wells appears too large;
- Atmospheric pressure changes;
- Aquifers which are tidally influenced;
- Aquifers affected by river stage, impoundments, and/or unlined ditches;
- Aquifers stressed by intermittent pumping of production wells;
- Aquifers being actively recharged due to precipitation event; and
- Occurrence of pumping.

1.3 These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent on site conditions, equipment limitations or limitations imposed by the procedure or other procedure limitations. In all instances, the ultimate procedures employed should be documented and associated with the final report.

1.4 Mention of trade names or commercial products does not constitute US EPA endorsement or recommendation for use.

2.0 SUMMARY OF METHOD

2.1 A survey mark should be placed on the casing for use as a reference point for measurement. Generally, the reference point is made at the top of casing or "stickup", but often the lip of the riser pipe is not flat. Another measuring reference should be located on the grout apron. The measuring point should be documented in the site logbook and on the groundwater level data form. Every attempt should be made to notify future field personnel of such reference point in order to ensure comparable data and measurements.

2.2 Prior to measurement, water levels in piezometers and monitoring wells should be allo[illegible]ns stabilize for a minimum of 24 hours after well construction and development. In low yield [illegible]ons, recovery may take longer. All measurements should be made to an accuracy of 0.01 feet. In general, working with decontaminated equipment, proceed from least to most contaminated wells. Where many wells are to be sampled (i.e., greater than ten), measurements may be taken in a systematic manner to ensure efficiency and accuracy. Open the well and monitor headspace with the appropriate monitoring

Clean all equipment entering well by the following decontamination procedure:

Triple rinse equipment with deionized water;

Wash equipment with an Alconox solution which is followed by a deionized water rinse;

Rinse with an approved solvent (e.g., methanol, isopropyl alcohol, acetone) as per the work plan, if organic contamination is suspected; and

Place equipment on clean surface such as a teflon or polyethylene sheet.

Remove locking well cap, note well ID, time of day, elevation (top of casing) and date in site logbook or an appropriate groundwater level data form.

Remove well casing cap.

If required by site-specific condition, monitor headspace of well with a photoionization detector (PID) or flame ionization detector (FID) to determine presence of volatile organic compounds, and record in site logbook.

Lower electric water level measuring device or equivalent (i.e., permanently installed transducers or airline) into the well until water surface is encountered.

Measure the distance from the water surface to the reference measuring point on the well casing or protective barrier post and record in the site logbook. In addition, note that the water level measurement was from the top of the steel casing, the top of the PVC riser pipe, the ground surface, or some other position on the well head.

The groundwater level data forms should be completed.

Measure total depth of well (at least twice to confirm measurement) and record in site logbook or on groundwater level data form.

Remove all downhole equipment, replace well casing cap and locking steel caps.

Rinse all downhole equipment and store for transport to next well. Decontaminate all equipment as outlined in Step 3 above.

Note any physical changes, such as erosion or cracks in protective concrete pad or variation in total depth of well, in field logbook and on groundwater level data form.

5.3 Calculations

5.3.1 To determine groundwater elevation above mean sea level, use the following equation:

$$E_w = E - D$$

where: E_w = Elevation of water above mean sea level (ft) or local datum;
E = Elevation above sea level or local datum at point of measurement (ft); and

instrument to determine the presence of volatile organic compounds. Lower water level measurement device into well until water surface or bottom of casing at least twice is encountered.

2.3 Measure distance from water surface to reference point on well casing at least twice and record in site logbook and/or groundwater level data form. Remove all downhole equipment, decontaminate as necessary, and replace casing cap. Note that if floating hydrocarbon product is present, a special dual liquid water level indicator is required.

3.0 INTERFERENCES

3.1 The chalk used on steel tape may contaminate the well.

3.2 Cascading water may obscure the water mark or cause it to be inaccurate.

3.3 Many types of electric sounders use metal indicators at five-foot intervals around a conducting wire. These intervals should be checked with a surveyor's tape (preferably with units divided in hundredths of a foot) to insure accuracy.

3.4 If there is oil present on the water, it can insulate the contacts of the probe on an electric sounder or give false readings due to thickness of the oil. It is recommended to determine the thickness and density of the oil layer in order to determine the correct water level. A special liquid water level indicator is required.

3.5 Turbulence in the well and/or cascading water can make water level determination difficult with either an electric sounder or steel tape.

3.6 An airline measures drawdown during pumping. It is only accurate to 0.5 foot unless it is calibrated for various drawdowns.

4.0 APPARATUS AND MATERIALS

There are a number of devices which can be used to measure water levels. The device must be capable of attaining an accuracy of 0.01 feet, and calibrated on a regular basis.

5.0 PROCEDURES

5.1 Preparation

Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies needed. Decontaminate or pre-clean equipment, and ensure that it is in working order.

5.2 Procedures

Make sure water level measuring equipment is in good operating condition.

If possible and when applicable, start at those wells that are least contaminated and proceed to those wells that are most contaminated.

D = Depth to water (ft).

6.0 QUALITY CONTROL

All data must be documented on standard chain of custody forms, field data sheets, groundwater level data forms, or within personal/site logbooks.

All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

Each well should be tested at least twice in order to compare results.

7.0 REFERENCES

1. U.S. Environmental Protection Agency, 1986. RCRA Groundwater Monitoring Technical Enforcement Guidance Document, pp. 207.

2. U.S. Environmental Protection Agency, 1987, A Compendium of Superfund Field Operations Methods. EPA/540/p-87/001 Office of Emergency and Remedial Response Washington, D.C. 20460.

ERT Method

GROUNDWATER WELL SAMPLING

1.0 SCOPE AND APPLICATION

The objective of this standard operating procedure (SOP) is to provide general reference information sampling of ground water wells. This guideline is primarily concerned with the collection of water samples from the saturated zone of the subsurface. Every effort must be made to ensure that the sample is representative of the particular zone of water being sampled. These procedures are designed to be used in conjunction with analyses for the most common types of ground water contaminants (e.g., volatile and semi-volatile organic compounds, pesticides, metals, biological parameters).

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure or other procedure limitations. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (EPA) endorsement or recommendation for use.

2.0 SUMMARY OF METHOD

Prior to sampling a monitor well, the well must be purged to remove water that may have been stagnant in the well, and to introduce fresh groundwater into the well for sampling. This may be achieved with one of a number of instruments. The most common of these are the bailer, submersible pump, non-contact gas bladder pump, inertia pump and suction pump. At a minimum, three wellvolumes should be purged, if possible. Equipment must be decontaminated prior to use and between wells. Once purging is completed and the correct laboratory-cleaned sample containers have been prepared, sampling may proceed. Sampling may be conducted with any of the above instruments, and need not be the same as the device used for purging. Care should be taken when choosing the sampling device as some will affect the integrity of the sample. Sampling equipment must also be decontaminated. Sampling should occur in a progression from the least to most contaminated well, if this information is known.

3.0 INTERFERENCES

3.1 General

The primary goal in performing ground water sampling is to obtain a representative sample of the ground water body. Analysis can be compromised by field personnel in two primary ways: (1) taking an unrepresentative sample, or (2) by incorrect handling of the sample. There are numerous ways of introducing foreign contaminant into a sample, and these must be avoided by following strict sampling procedures and utilizing trained field personnel.

3.2 Purging

In a nonpumping well, there will be little or no vertical mixing of the water, and stratification will occur. The well water in the screened section will mix with the ground water due to normal flow patterns, but the well water

above the screened section will remain isolated, become stagnant, and may lack the contaminants representative of the ground water. Persons sampling should realize that stagnant water may contain foreign material inadvertently or deliberately introduced from the surface, resulting in an unrepresentative sample. To safeguard against collecting nonrepresentative stagnant water, the following guidelines and techniques should be adhered to during sampling:

- As a general rule, all monitor wells should be pumped or bailed prior to sampling. Purge water should be containerized on site or handled as specified in the site specific project plan. Evacuation of a minimum of one volume of water in the well casing, and preferably three to five volumes, is recommended for a representative sample. In a high-yielding ground water formation and where there is no stagnant water in the well above the screened section, evacuation prior to sample withdrawal is not as critical. However, in all cases where the monitoring data is to be used for enforcement actions, evacuation is recommended;

- When purging with a pump (not a bailer), the pump should be set at the screened interval, or if the well is an open-rock well, it should be set at the same depth the sample will be collected. When sampling a screened well, the sample should also be collected from the same depth the pump was set at;

- The well should be sampled as soon as possible after purging;

- Analytical parameters typically dictate whether the sample should be collected through the purging device, or through a separate sampling instrument;

- For wells that can be pumped or bailed to dryness with the equipment being used, the well should be evacuated and allowed to recover prior to sample withdrawal. If the recovery rate is fairly rapid and time allows, evacuation of more than one volume of water is preferred. If recovery is slow, sample the well upon recovery after one evacuation; and

- A non-representative sample can also result from excessive pre-pumping of the monitoring well. Stratification of the leachate concentration in the ground water formation may occur, or heavier-than-water compounds may sink to the lower portions of the aquifer. Excessive pumping can dilute or increase the contaminant concentrations from what is representative of the sampling point of interest.

3.3 Materials

Materials of construction for samplers and evacuation equipment (bladders, pump, bailers, tubing, etc.) should be limited to stainless steel, Teflon, and glass in areas where concentrations are expected to be at or near the detection limit. The tendency of organics to leach into and out of many materials make the selection of materials critical for trace analyses. The use of plastics, such as PVC or polyethylene, should be avoided when analyzing for organics. However, PVC may be used for evacuation equipment as it will not come in contact with the sample, and in highly contaminated wells, disposable equipment (i.e., polypropylene bailers) may be appropriate to avoid cross-contamination.

Table 1 discusess the advantage and disadvantages of certain equipment.

Draw a predetermined volume of sample onto the sorbent tube (may require closing the syringe valve, emptying the syringe and then repeating the procedure, depending upon the syringe capacity and volume of sample required).

After sampling, remove the tube from the sampling train with gloves or a clean cloth. **DO NOT LABEL OR WRITE ON THE TENAX/CMS TUBE.**

Place the sorbent tube in a conditioned stainless steel tube holder or culture tube. Culture tube caps should be sealed with Teflon tape.

7.4.3 Sample Labeling:

Each sample tube container (not tube) must be labeled with the site name, sample station number, date sampled, and volume sampled.

Chain of custody sheets must accompany all samples to the laboratory.

7.4.4 Quality Assurance:

Before field use, a QA check should be performed on each batch of sorbent tubes by analyzing a tube by thermal desorption/cryogenic trapping GC/MS.

At least one blank sample must be submitted with each set of samples collected at a site. This trip blank must be treated the same as the sample tubes except no sample will be drawn through the tube.

Sample tubes should be stored out of UV light (i.e., sunlight) and kept on ice until analysis.

Samples should be taken in duplicate, when possible.

7.5 Summa Canister Sampling

Follow step 7.2.1 to evacuate well volume. If HNU analysis was performed prior to taking a sample, evacuation is not necessary.

Attach a certified clean, evacuated 6-liter Summa canister via the 1/4" Teflon tubing.

Open valve on Summa canister. The soil gas sample is drawn into the canister by pressure equilibration. The approximate sampling time for a 6 liter canister is 20 minutes.

Site name, sample location, number, and date must be recorded on a chain of custody form and on a blank tag attached to the canister.

7.6 Calculations

Field Screening Instruments: Instrument readings are usually read directly from the meter. In some cases, the background level at the soil gas station may be subtracted from the reading.

replacing the nut on the 1/6" (Tedlar bag) side. A 1/4" I.D. silicone O-ring replaces the ferrules in the nut on the 1/4" (sorbent tube) side of the union.

The adapter attaching the sampling syringe to the sorbent tube consists of a reducing union (1/4" to 1/16" O.D. -- Swagelok Cat. # SS-400-6-ILV or equivalent) with a 1/4" I.D. silicone O-ring replacing the ferrules in the nut on the 1/4" (sorbent tube) side and the needle of a luer-lock syringe needle inserted into the 1/16" side. (Held in place with a 1/16" ferrule.) The luer-lock end of the needle can be attached to the sampling syringe. It is useful to have a luer-lock on/off valve situated between the syringe and the needle.

Two-stage glass sampling cartridge (1/4" O.D. x 1/8" I.D. x 5 1/8") contained in a flame-sealed tube (Manufacturer: Supelco Custom Tenax/Spherocarb Tubes) containing two sorbent sections retained by glass wool:

Front section: 150 mg of Tenax-GC
Back section: 150 mg of CMS (Carbonized Molecular Sieve)

Sorbent tubes may also be prepared in the lab and stored in either Teflon capped culture tubes or stainless steel tube containers. Sorbent tubes stored in this manner should not be kept more than two weeks without reconditioning. (See "Standard Operating Procedure for Tenax/CMS Sorbent Tube Preparation").

Teflon-capped culture tubes or stainless steel tube containers for sorbent tube storage. These containers should be conditioned by baking at 120 degrees C for at least two hours. The culture tubes should contain a glass wool plug to prevent sorbent tube breakage during transport. Reconditioning of the containers should occur between uses or after extended periods of disuse (i.e., two weeks or more).

Nylon gloves or lint-free cloth. (Hewlett Packard Part # 8650-0030 or equivalent.)

Sample Collection:

Handle sorbent tubes with care, using nylon gloves (or other lint-free material) to avoid contamination.

Immediately before sampling, break one end of the sealed tube and remove the Tenax cartridge. For in-house prepared tubes, remove cartridge from its container.

Connect the valve on the Tedlar bag to the sorbent tube adapter. Connect the sorbent tube to the sorbent tube adapter with the Tenax (white granular) side of the tube facing the Tedlar bag.

Connect the sampling syringe assembly to the CMS (black) side of the sorbent tube. Fittings on the adapters should be finer-tight.

Open the valve on the Tedlar bag.

Open the on/off valve of the sampling syringe.

Each cooler containing samples should also contain one Tedlar bag of ultra-zero grade air, acting as a field blank. The field blank should accompany the samples in the field (while being collected) and when they are delivered for analysis. A fresh blank must be provided to be placed in the empty cooler pending additional sample collection. One new field blank per cooler of samples is required. A chain of custody sheet must accompany each cooler of samples and should include the blank that is dedicated to that group of samples.

8.6 Trip Standards

Each cooler containing samples should contain a Tedlar bag of standard gas to calibrate the analytical instruments (Photovac GC, etc.). This trip standard will be used to determine any changes in concentrations of the target compounds during the course of the sampling day (e.g., migration through the sample bag, degradation, or adsorption). A fresh trip standard must be provided and placed in each cooler pending additional sample collection. A chain of custody sheet should accompany each cooler of samples and should include the trip standard that is dedicated to that group of samples.

8.7 Tedlar Bag Check

Prior to use, one bag should be removed from each lot (case of 100) of Tedlar bags to be used for sampling and checked for possible contamination as follows: the test bag should be filled with ultra-zero grade air; a sample should be drawn from the bag and analyzed via Photovac GC or whatever method is to be used for sample analysis. This procedure will ensure sample container cleanliness prior to the start of the sampling effort.

8.8 Summa Canister Check

From each lot of four cleaned Summa canisters, one is to be removed for a GC/MS certification check. If the canister passes certification, then it is re-evacuated and all four canisters from that lot are available for sampling.

If the chosen canister is contaminated, then the entire lot of four Summas must be recleaned, and a single canister is re-analyzed by GC/MS for certification.

8.9 Options

Duplicate Samples: A minimum of 5% of all samples should be collected in duplicate (i.e., if a total of 100 samples are to be collected, five samples should be duplicated.) In choosing which samples to duplicate, the following criteria applies: if, after filling the first Tedlar bag and evacuating the well for 15 seconds, the second HNU (or other field monitoring device being used) reading matches or is close to (within 50%) the first reading, a duplicate sample may be taken.

Spikes: A Tedlar bag spike and Tenax tube spike may be desirable in situations where high concentrations of contaminants other than the target compounds are found to exist (landfills, etc.). The additional level of QA/QC attained by this practice can be useful in determining the effects of interferences caused by these non-target compounds. Summa canisters containing samples are not spiked.

9.0 REFERENCES

- Metal detector or magnetometer, for detecting underground utilities/pipes/drums (1 per sampling team).
- Photovac GC, for field-lab analysis of bagged samples.
- Summa canisters (plus their shipping cases) for sample, storage and transportation.

4.2 Power Hammer Method

- Bosch demolition hammer.
- 1/2" O.D. steel probes, extensions, and points.
- Dedicated aluminum sampling points.
- Teflon tubing, 1/4".
- "Quick Connect" fittings to connect sampling probe tubing, monitoring instruments, and Gilian pumps to appropriate fittings on vacuum box.
- Modeling clay.
- Vacuum box for drawing a vacuum around Tedlar bag for sample collection (1 per sampling team).
- Gilian pump Model HFS113A adjusted to approximately 3.0 L/min (1 to 2 per sample team).
- 1/4" Teflon tubing, 2 ft to 3 ft lengths, for replacement of contaminated sample line.
- Tedlar bags, 1.0 L, at least 1 bag per sample point.
- Soil Gas Sampling labels, field data sheets, logbook, etc.
- HNU Model P1101, or other field air monitoring devices, (1 per sampling team).
- Ice chest, for carrying equipment and for protection of samples (2 per sampling team).
- Metal detector or magnetometer, for detecting underground utilities/pipes/drums (1 per sampling team).
- Photovac GC, for field-lab analysis of bagged samples.
- Summa canisters (plus their shipping cases) for sample, storage and transportation.
- Generator with extension cords.
- High lift jack assembly for removing probes.

5.0 REAGENTS

HNU Systems Inc. Calibration Gas for HNU Model P1101, and/or calibration gas for other field air monitoring devices.

Deionized organic-free water, for decontamination.

Methanol, HPLC grade, for decontamination.

Ultra-zero grade compressed air, for field blanks.

Standard gas preparations for Photovac GC calibration and Tedlar bag spikes.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

Tedlar Bags: Soil gas samples are generally contained in 1.0-L Tedlar bags. Bagged samples are best stored in coolers to protect the bags from any damage that may occur in the field or in transit. In addition, coolers insure the integrity of the samples by keeping them at a cool temperature and out of direct sunlight. Samples should be analyzed as soon as possible, preferably within 24 - 48 hours.

After evacuation, the monitoring instrument(s) is connected to the probe using a Teflon connector. When the reading is stable, or peaks, the reading is recorded.

Of course, readings may be above or below the range set on the field instruments. The range may be reset, or the response recorded as a greater than or less than figure. Recharge rate of the well with soil gas must be considered when resampling at a different range setting.

7.3 Tedlar Bag Sampling

Follow step 7.2.1 to evacuate well volume. If air monitoring instrument screening was performed prior to sample taking, evacuation is not necessary.

Use the vacuum box and sampling train (Figure 1) to take the sample. The sampling train is designed to minimize the introduction of contaminants and losses due to adsorption. All wetted parts are either Teflon or stainless steel. The vacuum is drawn indirectly to avoid contamination from sample pumps.

The Tedlar bag is placed inside the vacuum box, and attached to the sampling port. The sample probe is attached to the sampling port via Teflon tubing and a "Quick Connect" fitting.

A vacuum is drawn around the outside of the bag, using a Gilian pump connected to the vacuum box evacuation port, via Tygon tubing and a "Quick Connect" fitting. The vacuum causes the bag to inflate, drawing the sample.

Break the vacuum by removing the Tygon line from the pump. Remove the bagged sample from the box and close valve. Label bag, record data on data sheets or in logbooks. Record the date, time, sample location ID, and the HNU, or other instruments reading(s) on sample bag label. CAUTION: Labels should not be pasted directly onto the bags, nor should bags be labeled directly using a marker or pen. Inks and adhesive may diffuse through the bag material, contaminating the sample. Place labels on the edge of the bags, or tie the labels to the metal eyelets provided on the bags. Markers with inks containing volatile organics (i.e., permanent ink markers) should not be used.

7.4 Tenax Tube Sampling

Samples collected in Tedlar bags may be sorbed onto Tenax tubes for further analysis by GC/MS.

Additional Apparatus:

Syringe with a luer-lock tip capable of drawing a soil gas or air sample from a Tedlar bag onto a Tenax/CMS sorbent tube. The syringe capacity is dependent upon the volume of sample begin drawn onto the sorbent tube.

Adapters for fitting the sorbent tube between the Tedlar bag and the sampling syringe. The adapter attaching the Tedlar bag to the sorbent tube consists of a reducing union (1/4" to 1/16" O.D. -- Swagelok cat. # SS-400-6-ILV or equivalent) with a length of 1/4" O.D. Teflon tubing

Tenax Tubes: Bagged samples can also be drawn onto Tenax or other sorbent tubes to undergo lab GC/MS analysis. If Tenax tubes are to be utilized, special care must be taken to avoid contamination. Handling of the tubes should be kept to a minimum and only while wearing nylon or other lint-free gloves. After sampling, each tube should be stored in a clean, sealed culture tube; the ends packed with clean glass wool to protect the sorbent tube from breakage. The culture tubes should be kept cool and wrapped in aluminum foil to prevent any photodegradation of samples (see Section 7.4.).

Summa Canisters: The Summa canisters used for soil gas sampling have a 6 liter sample capacity and are certified clean by GC/MS analysis before being utilized in the field. After sampling is completed, they are stored and shipped in travel cases.

7.0 PROCEDURES

7.1 Soil Gas Well Installation

Initially a hole slightly deeper than the desired depth is made. For sampling up to 5 feet, a 5-ft single piston slam bar is used. For deeper depths, a piston slam bar with threaded 4-foot-long extensions can be used. Other techniques can be used, so long as holes are of narrow diameter and no contamination is introduced.

After the hole is made, the slam bar is carefully withdrawn to prevent collapse of the walls of the hole. The soil gas probe is then inserted.

It is necessary to prevent plugging of the probe, especially for deeper holes. A metal wire or cable, slightly longer than the probe, is placed in the probe prior to inserting into the hole. The probe is inserted to full depth, then pulled up three to six inches, then cleared by moving the cable up and down. The cable is removed before sampling.

The top of the sample hole is sealed at the surface against ambient air infiltration by using modeling clay molded around the probe at the surface of the hole.

If conditions preclude hand installation of the soil gas wells, the power driven system may be employed. The generator powered demolition hammer is used to drive the probe to the desired depth (up to 12' may be attained with extensions). The probe is pulled up 1-3 inches if the retractable point is used. No clay is needed to seal the hole. After sampling, the probe is retrieved using the high lift jack assembly.

If semi-permanent soil gas wells are required, the dedicated aluminum probe points are used. These points are inserted into the bottom of the power driven probe and attached to the Teflon tubing. The probe is inserted as in step 5. When the probe is removed, the point and Teflon tube remain in the hole, which may be sealed by backfilling with sand, bentonite, or soil.

7.2 Screening with Field Instruments

The well volume must be evacuated prior to sampling. Connect the Gilian pump, adjusted to 3.0 L/min, to the sample probe using a section of Teflon tubing as a connector. The pump is turned on, and a vacuum is pulled through the probe for approximately 15 seconds. Longer time is required for sample wells of greater depths.

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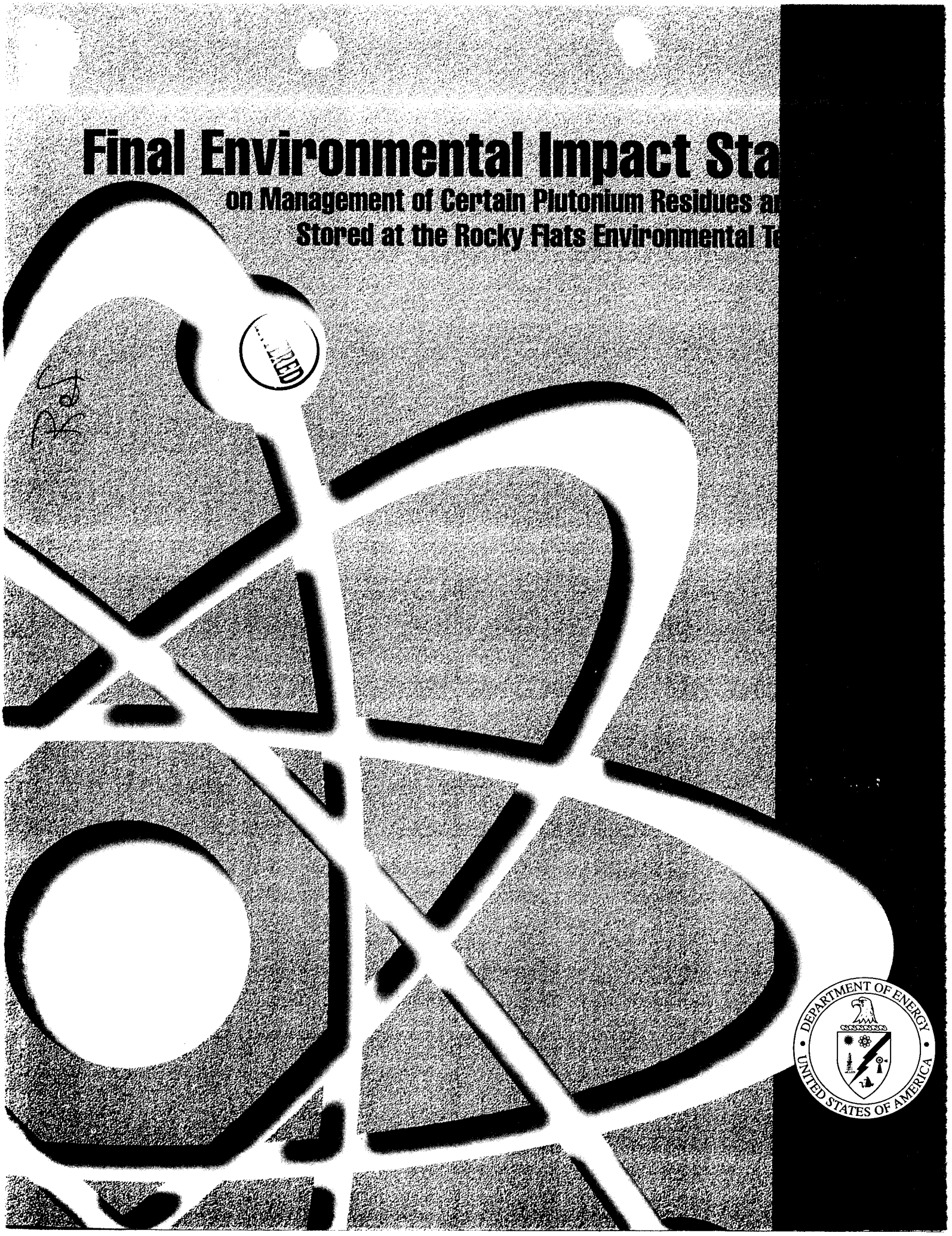

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Pit Disassembly and Conversion Demonstration Environmental Assessment and Research and Development Activities

1998
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Preapproval Review

May 1998

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