# Attachment 3
# General and Per- and Polyfluoroalkyl Substances (PFAS) – Specific Field Standard Operating Procedures (SOPs)

# STANDARD OPERATING PROCEDURE APPROVAL AND CHANGE FORM

Scientific, Engineering, Response and Analytical Services
2890 Woodbridge Avenue Building 209 Annex
Edison New Jersey 08837-3679

## STANDARD OPERATING PROCEDURE

Title: Sample Receiving, Handling and Storage

Approval Date: 12/09/2015

| | |
|---|---|
| Effective Date: 12/09/2015 | SERAS SOP Number: 1008, Rev 2.1 |

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| Added Section 3.1.2 for sample acceptance/rejection criteria | 12/09/15 |
| Added Sample Receipt Report and Nonconformance Memo to Attachments | 12/09/15 |
| Added that freezer maintenance in the Biology lab is the responsibility of the Risk Maintenance Task Leader | 12/09/15 |
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# STANDARD OPERATING PROCEDURES

SOP: 1008
PAGE: 1 of 13
REV: 2.1
EFFECTIVE DATE: 12/09/15

# SAMPLE RECEIVING, HANDLING AND STORAGE

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CONTENTS

SUPERSEDES: SOP #1008; Revision 2.0; 12/07/12; U.S. EPA Contract EP-W-09-031

## 1.0 OBJECTIVE

The purpose of this Standard Operating Procedure (SOP) is to define routine procedures for sample receiving, logging and storing of samples submitted to the Environmental Response Team/Scientific, Engineering, Response and Analytical Services (ERT/SERAS) Laboratory for analysis.

## 2.0 APPLICABILITY

This SOP applies to all samples submitted to the ERT/SERAS Laboratory, whether the samples are to be subcontracted to or analyzed at the ERT/SERAS Laboratory.

## 3.0 DESCRIPTION

### 3.1 Sample Receiving

Sample receiving, log-in and custody procedures to be followed during regular working hours and after hours are described in this section.

### 3.1.1 Procedures during Regular Hours

1. The SERAS Task Leader (TL) will complete a Projected Work Assignment/Analytical Services Resource Requirements (PWA/ASRR) (Attachment 1, Appendix A) prior to initiation of field activities. The PWA provides a preliminary indication of the number of samples to be collected, matrix, and types of analyses requested, approximate field sampling dates and requested analytical data requirements for preliminary data and final analytical reports. This is subject to change due to unpredictable field events. The PWA will be transmitted to the PWA distribution list and the Work Assignment Manager (WAM) of the project to facilitate coordination of laboratory activities.

   During field activities, the TL will notify the Sample Receiving Technician (SRT) of the number of samples being shipped, the types of analyses requested, and when and how the samples are being shipped to the SERAS facility by directly calling the SRT, by leaving a detailed message on the SRT's voicemail (609)-865-9306 or sending the SRT an email. The SRT, in turn, will inform the Analytical Support Leader (ASL).

2. If shipped via commercial carrier, sample shipments will be received in the shipping/receiving area. The shipping/receiving clerk will notify the SRT that samples have arrived. The samples will be kept in the designated sample receiving area until the SRT is available. Alternatively, the SRT will receive directly any samples delivered to SERAS by returning sampling personnel. The TL will telephone the SRT to confirm the samples have arrived intact and complete.

3. The SRT will move the sample shipping containers to the sample receiving area where the containers will be opened under a hood and examined for physical integrity. The samples in the shipping container will be compared with those listed on the enclosed Chain of Custody (COC) record (Attachment 2, Appendix A). The SRT will measure and document the internal cooler temperature using a calibrated thermometer on the COC record, sign the "Received By" section along with the date and time received.

Any problems with the shipment will be addressed to the TL by the SRT.

4. For samples to be analyzed at SERAS, samples will be logged into the laboratory data system, Element, and given an Element tracking number. The Element sample number is indexed to each work order coming into the laboratory and will have the following format: Rymmxxx-ss where y is the last digit for the year, mm is the month, xxx is a sequential number assigned to each work order received for the month and ss is a sequential number assigned to each sample with the first sample on the COC typically assigned -01. Samples with multiple containers are given a letter designation, in alphabetical order, for each container. For example: Element number R208005-07 is interpreted as the year 2012, the month of August, the 5th work order received in August and sample 7 on COC record. The Element number is written on the sample labels affixed to the sample containers. A sample receiving report (Attachment 4, Appendix A) is filled out and stored in the SRT's files for each work order.

   After the samples have been logged into Element and labeled, the SRT will transfer custody of the samples to the laboratory. The samples will be delivered by the SRT to the appropriate laboratory along with the COC record. A representative from the appropriate laboratory will sign the COC record to acknowledge transfer of the samples. Additional copies of the COC record will be given to the SERAS Program Manager, Quality Assurance/Quality Control (QA/QC) Officer, ASL, TL, and QA/QC Group. The location of the samples is updated in Element to the receiving laboratory by the SRT.

   In the event of the receipt of samples with quick turn-around requirements, samples may be delivered directly to the laboratory prior to assignment of Element numbers and entry into the Element data base. The COC will be used to document the transfer of the samples to the laboratory. Element numbers will be assigned at the earliest possible time by the SRT, the sample labels will be updated and the laboratory will update the analytical records with the respective Element numbers.

   As each group is finished with the sample(s), they are transferred within the lab to any additional groups for analysis, as required. The COC is used to document the internal transfer of the sample to each group and the location of the sample is updated in Element.

   After the representatives from each group have signed the original COC acknowledging receipt and custody of the samples, the original COC is delivered to the QA/QC Group for incorporation into the final report.

   After samples are transferred to the various laboratory groups, the samples will be stored in the respective laboratory's sample storage refrigerators in preparation for analysis. After completion of all the required analyses, the SRT will regain custody of any remaining samples by having a representative from the laboratory group sign the COC record; thereby, relinquishing possession of the samples. The SRT will remove the relinquished samples from the laboratory's sample storage refrigerators and place them in the Sample Refrigeration Units (SRU) or the Risk Maintenance freezer (tissue samples), as appropriate, for storage or in preparation for disposal. The location of the sample needs to be updated in Element from the laboratory to the SRU or other appropriate area.

5. Samples transferred to an outside laboratory should be packed in separate shipping containers and shipped directly from the site to the outside laboratory. If the shipping container is received at the SERAS facility, and the COC record inside the cooler indicates that the entire shipment of samples is to be subcontracted, the SRT will take the shipping container to the sample receiving area. The SRT will open the shipping container under the hood and visually examine the samples for physical integrity. The number of samples in the shipping container will be compared with those listed on the COC record to verify the number of samples and types of analyses. The SRT will note the approximate internal cooler temperature on the COC, sign the "Received by" section with the date and time received. The SRT will then repack the samples, as outlined in SERAS SOP #2004, *Sample Packaging and Shipment*, add additional ice if necessary to maintain the temperature, and sign the COC record relinquishing custody of the samples. The shipping containers will be sealed as outlined in the above referenced SOP, and shipped to the subcontracted laboratory.

   When part of a shipment of samples arriving at the SERAS facility is to be subcontracted, all samples will first be logged into Element, as in step 4. The SRT will complete a new COC record for the samples to be subcontracted, sign the COC record relinquishing custody of the samples, and pack the samples as per SERAS SOP #2004, *Sample Packaging and Shipment* for shipping. The new COC record will reference the original COC record for traceability. The location of the samples in Element will be changed to "Other" and the SRT will make a note (in Element) where the samples were shipped.

   Samples returning from an outside laboratory will be treated the same as samples being sent in from the field. If the samples already have a work order #, the location of the samples needs to be updated in Element and the samples can be handled as per COC.

### 3.1.2 Sample Acceptance/Rejection Criteria

Samples received at SERAS will only be rejected at the request of the TL. If the TL is not available, their manager or the WAM can act as an alternate. Upon discovery of a nonconforming sample, the SRT will contact the TL (or alternate) and provide them details about the samples condition. The sample will be held until a resolution is provided by the TL (or alternate). The SRT will fill out a nonconformance memo (Attachment 3, Appendix A) providing details about the samples condition, reason for rejection, and resolution. The nonconformance memo will be turned into the SERAS QA/QC Officer. A copy of the nonconformance memo will be provided to the ASL and a copy will be retained by the SRT.

### 3.1.3 After Hours Procedures

1. If samples are to be delivered after hours and the SRT is not available, the TL or their designee will obtain the key for SRU No. 2 from the SRT or the Analytical Support Leader. SRU No. 2 has a locked inner door that prevents unauthorized access to

samples currently under custody.

2. Upon delivery, the TL or designee will place the sample shipping containers inside SRU No. 2.
3. At the beginning of the next work day, the TL or designee will inform the SRT that the shipping container has been placed inside the SRU. The SRT will follow the procedures detailed in section 3.1.1.

### 3.1.4 Potential Problems

1. Discrepancy in number of samples - If there is a discrepancy between the number of samples in the shipping container and those listed on the COC record, the SRT will note the discrepancy on the COC record and notify the TL. If the TL is unavailable, their immediate supervisor should be notified immediately. A non-conformance form must be filled out and submitted to the immediate supervisor.
2. Broken/damaged sample bottles - If any of the sample bottles received are broken, damaged or leaking, the SRT will note the problem on the COC record and notify the TL immediately. If the TL is unavailable, their immediate supervisor should be notified immediately. A non-conformance form must be filled out and submitted to the immediate supervisor.
3. Documentation errors - If there are any documentation errors, the SRT will note the problem on the COC record and notify the TL to initiate corrections. If the TL is unavailable, their immediate supervisor should be notified immediately. The SRT is not authorized to change or correct the COC record unless written authorization from the TL is received. The COC records will also be reviewed by the QA/QC Group during the verification process.

## 3.2 Sample Storage

Procedures for sample storage under routine and overload conditions are described in this section. Procedures for inventory are also outlined in this section.

### 3.2.1 Normal Conditions

All samples, except tissue samples, will be stored in the SRUs in labeled crates. Tissue samples will be stored in the freezer maintained by the risk maintenance group. Samples will be transferred to the appropriate laboratories for analysis by the SRT as described in section 3.1.1. After analysis is completed, custody of the samples will be transferred back to the SRT, and the samples stored in the SRU or as appropriate.

### 3.2.2 Overload Conditions

In the event that all the space in both of the SRUs is occupied, the samples will be stored in coolers or crates stacked on the floors of the SRUs. In the event that all floor space in the SRUs is occupied, the samples will be packed in ice, to maintain the temperature at ≤ 6ºC, and stored in coolers. The coolers will be stacked in the sample receiving area or in the laboratories. The temperature of the coolers will be maintained at ≤ 6°C by adding more ice as needed. A log will be maintained of the daily ice replenishment and maintenance check of the coolers. The log will be reviewed daily and initialed by the ASL.

NOTE: Samples that are to be analyzed for Volatile Organic Compounds (VOCs) will be stored separately from all other samples due to the potential for contamination.

3.2.3 Labeling, Storage and Maintenance of Samples

The SRT will maintain, in a bound logbook or electronic spreadsheet, a listing of location of all samples in the SRUs.

3.2.4 Emergency SRU and Freezer Malfunction Conditions

Refer to SERAS SOP #1009, *Operation of Sample Refrigeration Units*, in the event of malfunction of the SRU or freezers for emergency sample handling and alternate storage.

3.3 Sample Disposal

The inventory database will be reviewed monthly by the SRT. Samples may be returned to the site or designated for disposal as soon as the SERAS TL or ERT WAM determines that the samples are no longer needed. Samples will automatically be destined for disposal or returned to the site six months after collection unless requested to be held by the SERAS TL or EPA/ERT WAM.

Prior to designating samples for disposal, the SRT/Hazardous Waste Coordinator (HWC) must determine the extent of contamination of the samples. Samples analyzed by ERT/SERAS or a subcontracted laboratory will have analytical data available. Data may be accessed from preliminary data or final data, if available.

The analytical data are checked to ensure that the samples results correspond to the actual samples to be disposed. Many projects have identical sample numbers from one sampling event to the next. Care must be taken to verify the collection date and when possible, the location code. The samples can then be consolidated and the data summarized. Water samples are typically consolidated into 5-gallon jerry cans. The bottles are triple rinsed with a 10 percent (%) volume of water for a quantitative transfer. Additional rinses are performed if sediment or particulates remain in the original bottle. The pH of the consolidated water samples is recorded on the pail and the hazardous waste description form. Soil samples are typically kept in their original containers and packed into a 5-gallon open head polyethylene pail. The highest concentration of each constituent is noted on the hazardous waste description form. Consolidated samples destined for disposal are considered waste and are handled in accordance with SERAS SOP #1501, *Hazardous Waste Management*.

3.4 Sample Security

The sample receiving area and the walk-in SRUs will be locked at all times. The SRT and Analytical Support Leader are the only individuals who possess a key to the sample receiving area and SRUs. All transfer of samples in and out of the SRU or sample receiving area will be done by the SRT. In the event that the SRT is unavailable, his designee may perform the functions of the SRT.

Each individual is responsible for the security of samples transferred to their laboratory groups for analyses and alternate storage.

## 4.0 RESPONSIBILITIES

### 4.1 Sample Receiving Technician

The SRT is responsible for the following functions:

- Ensure that every sample is entered into Element according to the COC record, assigned an Element number, and delivered to the appropriate laboratory departments. Record the internal temperature of the sample shipping container on the COC record.

- Fill out the COC record and ship samples to an outside laboratory, if the samples are to be subcontracted and currently in the SRT's custody.

- Responsible for maintaining a record of all samples transferred to laboratories and retrieving samples when analysis is completed or alternate storage is no longer required.

- Ensure that the SRUs and the sample receiving area are locked and secure at all times when samples are present.

- Contact the ASL in the event of any observable malfunction of the SRUs.

- Maintain the dedicated logbook(s) for the SRUs and freezer temperatures (if the freezer is being used by SRT), the bound logbook for alternate storage of samples, documentation of all samples transferred to the laboratories for analysis or storage, and an inventory of samples in the SRUs.

- Inspect and maintain the cleanliness of the SRUs.

### 4.2 Task Leaders

Task Leaders are responsible for the following functions:

- Inform the SRT and ASL of anticipated sample(s) by filling out a PWA/ASRR, prior to initiation of field activities.

- Complete a COC record and notify the SRT of the total number of samples and types of analyses requested prior to shipping the samples, or the day before samples are scheduled to arrive at SERAS. Inform the SRT of any changes to the PWA. Notify the SRT if sample delivery is expected after hours.

- Contact the SRT after the shipment of samples to confirm sample receipt and condition.

### 4.3 Analytical Support Leader

The ASL is responsible for the following functions:

- Resolve any problems that arise as expeditiously as possible. Evaluate information from the SRT or laboratory personnel as to the nature and magnitude of any malfunctions, and initiate procedures for "alternate" storage as outlined in Section 3.2.3 of this SOP, if required.

- In the absence/unavailability of the SRT, security will be the responsibility of the ASL or designated individual.
- The ASL is responsible for expeditiously resolving problems, as they arise and for updating this SOP as necessary.

### 4.4 QA/QC Officer

The QA/QC Officer is responsible for the review of this SOP and for periodically checking the implementation of this SOP.

### 4.5 Laboratory Personnel

Samples will be handled only by personnel who have passed all requirements for working in the laboratory. Laboratory requirements include, but are not limited to, safe handling of hazardous materials in the laboratory; proper use of personal protective devices; fit testing and proper use of respiratory protection; location and use of laboratory safety equipment; safe handling of compressed gases; location and use of fire equipment; proper cleanup of spills; segregation and identification of hazardous wastes, Federal Hazard Communications Training (Right-To-Know) and chemical hygiene safety training established under OSHA Title 29 Code of Federal Regulations Part 1910 (29CFR1910).

The sample containers will be kept in a well ventilated area.

Latex gloves, safety glasses, steel-toed boots, laboratory coat and/or Tyvek overalls will be worn while handling samples and heavy containers.

## 5.0 APPENDICES

A – Attachments

APPENDIX A
Attachments
SOP #1008
December 2015

ATTACHMENT 1. SERAS Projected Work Assignment/Analytical Services Resource Requirements (PWA/ASRR)

WA #: SERAS-XXX
WA Name:
TL:
WAM:
Date:

ANALYTICAL WORK REQUESTED

| Number of Samples by Matrix | | | | | Analytical Schedule | | |
|---|---|---|---|---|---|---|---|
| Analysis | Soil | Water | Air | Shipment Date(s) | Laboratory Prelim(BD) | Laboratory Final (BD) | Validated Report (BD) |
| | | | | | | | |
| | | | | | | | |

Additional Requirements:

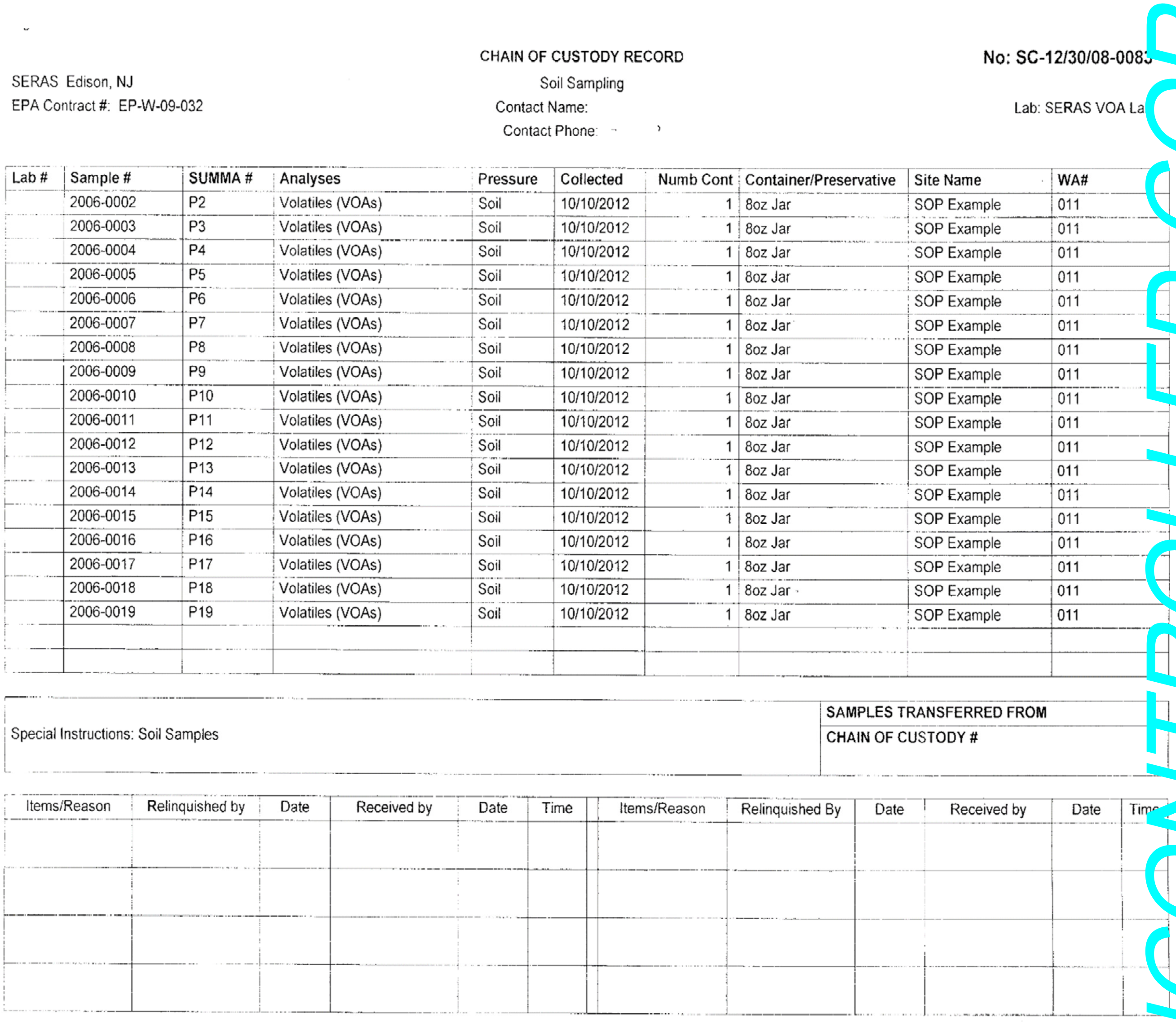
ANALYTICAL RESOURCE REQUIREMENTS

| Estimated Hours or Cost by Matrix or Function | | | | | |
|---|---|---|---|---|---|
| Analysis | Number of Samples | Water | Soil/ Sediment | Air | Data Validation/ Report Writing |
| | | | | | |
| | | | | | |

ANALYTICAL LABORATORIES (estimated cost or hours)

| Analysis | SERAS | Subcontract Laboratory |
|---|---|---|
| | | |
| | | |
| | | |

ATTACHMENT 2. Sample Chain of Custody Record



CHAIN OF CUSTODY RECORD

No: SC-12/30/08-0083

SERAS Edison, NJ
EPA Contract #: EP-W-09-032

Soil Sampling
Contact Name:
Contact Phone:

Lab: SERAS VOA La

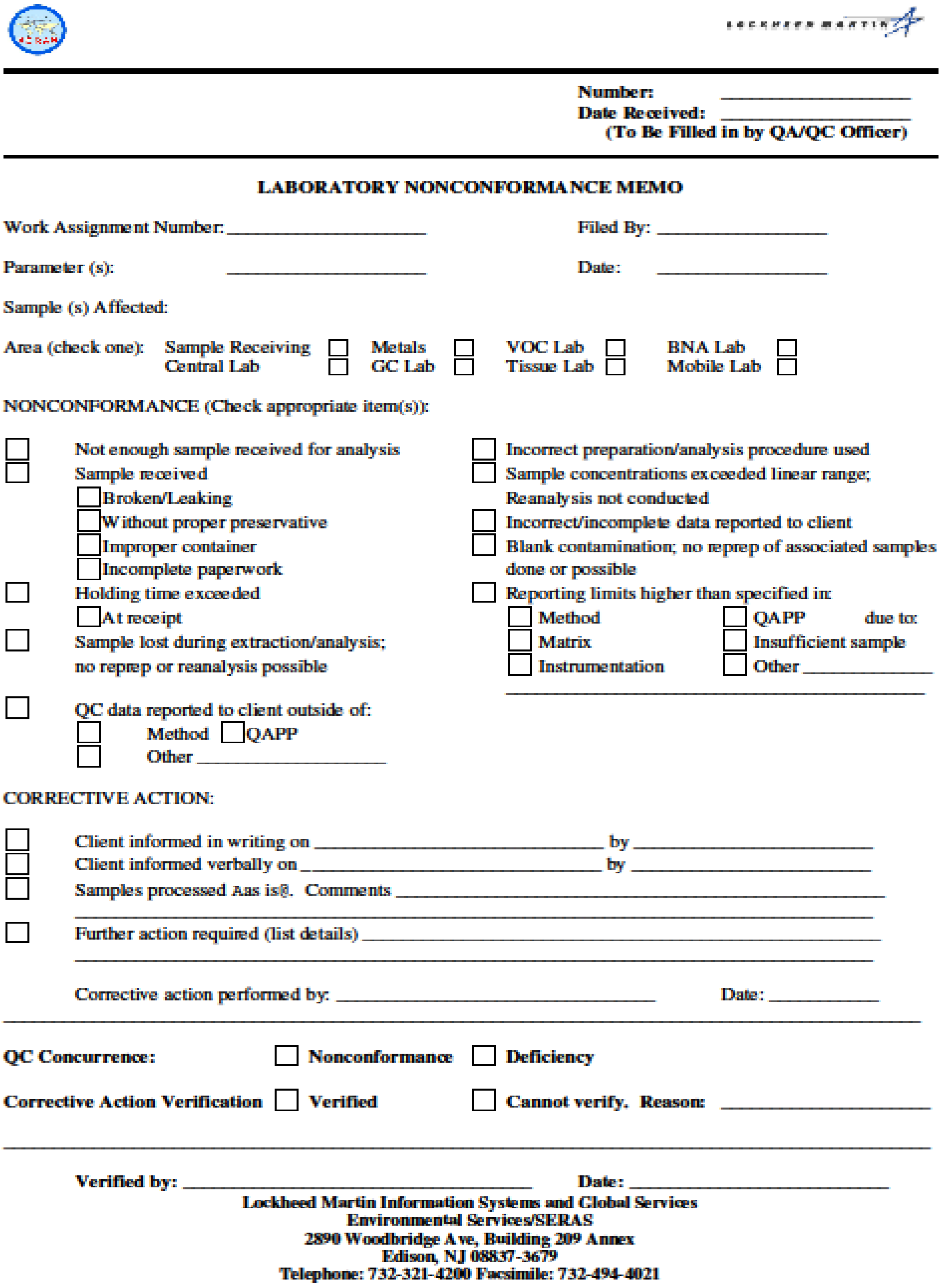
| Lab # | Sample # | SUMMA # | Analyses | Pressure | Collected | Numb Cont | Container/Preservative | Site Name | WA# |
|---|---|---|---|---|---|---|---|---|---|
| | 2006-0002 | P2 | Volatiles (VOAs) | Soil | 10/10/2012 | 1 | 8oz Jar | SOP Example | 011 |
| | 2006-0003 | P3 | Volatiles (VOAs) | Soil | 10/10/2012 | 1 | 8oz Jar | SOP Example | 011 |
| | 2006-0004 | P4 | Volatiles (VOAs) | Soil | 10/10/2012 | 1 | 8oz Jar | SOP Example | 011 |
| | 2006-0005 | P5 | Volatiles (VOAs) | Soil | 10/10/2012 | 1 | 8oz Jar | SOP Example | 011 |
| | 2006-0006 | P6 | Volatiles (VOAs) | Soil | 10/10/2012 | 1 | 8oz Jar | SOP Example | 011 |
| | 2006-0007 | P7 | Volatiles (VOAs) | Soil | 10/10/2012 | 1 | 8oz Jar | SOP Example | 011 |
| | 2006-0008 | P8 | Volatiles (VOAs) | Soil | 10/10/2012 | 1 | 8oz Jar | SOP Example | 011 |
| | 2006-0009 | P9 | Volatiles (VOAs) | Soil | 10/10/2012 | 1 | 8oz Jar | SOP Example | 011 |
| | 2006-0010 | P10 | Volatiles (VOAs) | Soil | 10/10/2012 | 1 | 8oz Jar | SOP Example | 011 |
| | 2006-0011 | P11 | Volatiles (VOAs) | Soil | 10/10/2012 | 1 | 8oz Jar | SOP Example | 011 |
| | 2006-0012 | P12 | Volatiles (VOAs) | Soil | 10/10/2012 | 1 | 8oz Jar | SOP Example | 011 |
| | 2006-0013 | P13 | Volatiles (VOAs) | Soil | 10/10/2012 | 1 | 8oz Jar | SOP Example | 011 |
| | 2006-0014 | P14 | Volatiles (VOAs) | Soil | 10/10/2012 | 1 | 8oz Jar | SOP Example | 011 |
| | 2006-0015 | P15 | Volatiles (VOAs) | Soil | 10/10/2012 | 1 | 8oz Jar | SOP Example | 011 |
| | 2006-0016 | P16 | Volatiles (VOAs) | Soil | 10/10/2012 | 1 | 8oz Jar | SOP Example | 011 |
| | 2006-0017 | P17 | Volatiles (VOAs) | Soil | 10/10/2012 | 1 | 8oz Jar | SOP Example | 011 |
| | 2006-0018 | P18 | Volatiles (VOAs) | Soil | 10/10/2012 | 1 | 8oz Jar | SOP Example | 011 |
| | 2006-0019 | P19 | Volatiles (VOAs) | Soil | 10/10/2012 | 1 | 8oz Jar | SOP Example | 011 |
| | | | | | | | | | |
| | | | | | | | | | |

Special Instructions: Soil Samples

SAMPLES TRANSFERRED FROM
CHAIN OF CUSTODY #

| Items/Reason | Relinquished by | Date | Received by | Date | Time | Items/Reason | Relinquished By | Date | Received by | Date | Tim |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

ATTACHMENT 3. Nonconformance Memo



Number: ____________________
Date Received: ____________________
(To Be Filled in by QA/QC Officer)

**LABORATORY NONCONFORMANCE MEMO**

Work Assignment Number: ____________________ Filed By: __________________

Parameter (s): ____________________ Date: __________________

Sample (s) Affected:

Area (check one): Sample Receiving ☐ Metals ☐ VOC Lab ☐ BNA Lab ☐
Central Lab ☐ GC Lab ☐ Tissue Lab ☐ Mobile Lab ☐

NONCONFORMANCE (Check appropriate item(s)):

- ☐ Not enough sample received for analysis
- ☐ Sample received
  - ☐ Broken/Leaking
  - ☐ Without proper preservative
  - ☐ Improper container
  - ☐ Incomplete paperwork
- ☐ Holding time exceeded
  - ☐ At receipt
- ☐ Sample lost during extraction/analysis; no reprep or reanalysis possible
- ☐ QC data reported to client outside of:
  - ☐ Method ☐ QAPP
  - ☐ Other __________________
- ☐ Incorrect preparation/analysis procedure used
- ☐ Sample concentrations exceeded linear range; Reanalysis not conducted
- ☐ Incorrect/incomplete data reported to client
- ☐ Blank contamination; no reprep of associated samples done or possible
- ☐ Reporting limits higher than specified in: due to:
  - ☐ Method ☐ QAPP
  - ☐ Matrix ☐ Insufficient sample
  - ☐ Instrumentation ☐ Other ____________
  - ________________________________________

CORRECTIVE ACTION:

- ☐ Client informed in writing on ____________________________ by ______________________
- ☐ Client informed verbally on ____________________________ by ______________________
- ☐ Samples processed Aas is@. Comments ______________________________________________
  ______________________________________________________________________
- ☐ Further action required (list details) _____________________________________________
  ______________________________________________________________________

Corrective action performed by: ______________________________ Date: ___________

______________________________________________________________________

**QC Concurrence:** ☐ **Nonconformance** ☐ **Deficiency**

**Corrective Action Verification** ☐ **Verified** ☐ **Cannot verify. Reason:** ____________________

______________________________________________________________________

**Verified by:** _________________________________ **Date:** ________________________

**Lockheed Martin Information Systems and Global Services**
**Environmental Services/SERAS**
**2890 Woodbridge Ave, Building 209 Annex**
**Edison, NJ 08837-3679**
**Telephone: 732-321-4200 Facsimile: 732-494-4021**

ATTACHMENT 4. Sample Receipt Report

| | |
|---|---|
| Date/Time Received: | **Shipping Container Details** |
| Received By: | Container ☐ of ☐ |
| Delivered By: Left in SRU#2 Walk-In Fed-Ex/UPS Other | **Remarks:** |
| Work Assignment #: | |
| Work Order #: | |

| **Receiving Criteria** | **Yes** | **No** | **Comments/Resolution** |
|---|---|---|---|
| 1. Outer shipping container intact? | | | |
| 2. Custody Seals Intact? | | | |
| 3. Shipping Papers/Information available? | | | |
| 4. Chain of Custody (COC) present? | | | |
| 5. COC properly filled out? | | | |
| 6. All samples received intact? | | | |
| 7. Samples packaged according to SOP 2004? | | | |
| 8. Custody is relinquished to SERAS Lab? | | | |
| 9. Received on Ice? Temperature at <6°C w/o freezing? | | | **Temp °C =** |
| 10. Sample labels and COC match? | | | |
| 11. Samples received within method specified hold time? | | | |
| 12. Volatiles free of headspace and in airtight container? | | | |
| 13. Was the proper sample container used? | | | |
| 14. Was a Trip Blank received with the shipment? | | | |
| 15. Is a PWA available? How was SRT notified of the shipment? | | | |
| 16. Does this require a non-conformance memo? | | | |

**Comments:**

# STANDARD OPERATING PROCEDURE APPROVAL AND CHANGE FORM

Scientific, Engineering, Response and Analytical Services
2890 Woodbridge Avenue Building 209 Annex
Edison New Jersey 08837-3679

## STANDARD OPERATING PROCEDURE

| | |
|---|---|
| Title: Chain of Custody Procedures | |
| Approval Date: 01/30/2016 | |
| Effective Date: 01/30/2016 | SERAS SOP Number 4005, Rev 2.0 |

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# CHAIN OF CUSTODY PROCEDURES

CONTENTS

CONTENTS (cont'd)

The SCRIBE Quick Start Guide Part 1 and the SCRIBE CLP User Guide are attached at the end of this document for reference and are not paginated as part of this SOP.

SUPERSEDES: SOP #4005; Revision 1.0; 10/31/01; U.S. EPA Contract 68-C99-223

## 1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to establish a procedure for the documentation and maintenance of sample custody. Chain of Custody (COC) is a legal term that refers to the ability to guarantee the identity and the integrity of the sample (or data) from collection through reporting of the test results. A sample is under custody if: (1) it is in a person's actual possession; (2) it is in your view, after being in your possession; or (3) it was in your possession and is now custody sealed; or (4) it is stored in a controlled area. Official custody of samples must be maintained from the time of collection to final deposition. In the case of litigation, the COC is evaluated to ensure that sample integrity was maintained from the time of sample collection to completion of analysis.

At SERAS, the COC records are utilized for tracking samples from the time of sample collection to receipt at the laboratory (whether internal at SERAS or an outside contract laboratory), analysis in the laboratory and through final deposition of the sample. The COC summarizes and identifies the samples. Integral components of the COC record include the field sample number and location from which the sample was collected, as well as the analyses requested. The COC should confirm or modify the arrangements previously made with the appropriate laboratory specified on the Projected Work Assignment/Analytical Services Resource Requirements (PWA/ASRR) form and the site-specific Uniform Federal Policy-Quality Assurance Project Plans (UFP-QAPPs). Analytical requirements should be discussed with the laboratory prior to initiation of field activities.

## 2.0 METHOD SUMMARY

The sampler is responsible for the care and custody of samples collected until they are transferred properly to a common carrier for shipment to the laboratory or until the samples are directly transferred to the laboratory performing the analyses. If a sample or a group of samples are not under direct control or observation of the individual responsible for the samples, the samples must be stored with the COC record in a container (e.g., cooler) in which, once closed, any unauthorized access would be clearly evident (i.e., a padlock, custody seal, or evidence tape is broken). Samples may be kept in a locked room or vehicle provided the cooler is secured as described above and sample integrity is not compromised. A copy or photocopy of this record should be retained by each individual who has signed it. Attaching custody seals to individual sample bottles is optional, but should be considered if the samples are of a sensitive nature or expected to be used in litigation.

### 2.1 SCRIBE Software

SCRIBE, a software program, is used to accomplish the requirements of this SOP. SCRIBE was developed by the United States Environmental Protection Agency (USEPA) Environmental Response Team (ERT) to assist in the process of managing environmental data. Relevant to this SOP, SCRIBE is used to generate sample numbers, labels for collected samples and a COC form for samples analyzed at the ERT/SERAS Laboratory or other SERAS-contracted laboratories.

### 2.2 Chain of Custody

COC records (Figures 1 through 4, Appendix A) must contain the project identifier (***do not use site name if samples are being sent to a contract laboratory***), work assignment number, Lockheed-Martin (LM) contact, phone number, sample number, sampling location, matrix, date collected, number of containers, container/preservative, and analyses requested for aqueous and solid matrices. Pump #, orifice #, stop pressure, total volume and other information required for the laboratory to provide results in the correct units on air sampling COC records. Columns such as sampling sub location and other available columns within Scribe may be also included on the COC record.

Sources of COC records include the contract laboratory and computer-generated forms created using sample management software such as SCRIBE or Forms2Lite, and as a last resort, preprinted blank forms from the Scientific, Engineering, Response and Analytical Services (SERAS) office. For samples to be sent to a Contract Laboratory Program (CLP) laboratory to be analyzed, CLP COC procedures should be followed and CLP-issued sample numbers should be used.

In addition to the required minimum fields mentioned above, for sorbent media air samples (tubes, cassettes, etc.), the volume of air collected should be indicated in one column and the media should be specified in the "Container/Preservative" column. Media lot numbers should be included in the comments section of the COC record. For air samples collected in SUMMA canisters, columns for the initial and final pressures and canister and orifice numbers should be included. For wipe samples, the area sampled should be indicated in a column called “Area Surface” or alternatively in the “Comments” section. For all samples, especially time-critical samples (samples with short holding times), the actual sample time should be indicated in one column.

For samples received at the ERT/SERAS Laboratory for analysis, ERT/SERAS Laboratory Sample Numbers (sequential numbers) are issued by the SERAS Sample Receiving Technician (SRT) for tracking purposes and are added to the COC record upon receipt and login of samples. One SERAS sample number is used for all sample containers sampled at one location for a specific matrix. Laboratories typically assign a Laboratory Information Management System (LIMS) number upon laboratory receipt of samples under COC, following their own protocols.

Transfer of sample custody is accomplished when each person (except common or commercial carriers) who has possession of the samples completes the "items/reason" column, signs the "relinquished by" section, and fills in the date. The "items/reason" column should specify the items (i.e., all above or a specific portion) and reason(s) (i.e., ship for analysis, deliver to laboratory, or archive) for transfer of the samples. The receiver (typically a representative of the laboratory performing the analysis) then signs the "Received by" section and fills in the date and time of receipt.

Custody of samples should not be transferred to commercial carriers (i.e., Federal Express) if the COC record is enclosed in the sample cooler and the opening is sealed with custody seals. Anyone signing the COC record should retain a photocopy of the SCRIBE-generated COC or the bottom copy of the SERAS preprinted COC for their files. The original COC record should be included in the final Analytical Report if the analysis is performed by the ERT/SERAS Laboratory. In the case of contracted laboratories, a copy of the signed COC will be included in the final Analytical Data Package submitted by the contract laboratory.

### 2.3 Sample Labeling

All sample containers must be labeled with a SCRIBE-generated sample identification label or pre-numbered label (Figures 5 and 6, Appendix A) that corresponds to a field data sheet, logbook or equivalent (SERAS SOP #2002, *Sample Documentation*). If SCRIBE-generated or pre-numbered labels are not available, handwritten labels that satisfy SOP #2002 and include sample number, sample location, and time and date of collection may be used. Each individual or discrete set of sample containers collected from a single location, matrix, or process must be given its own sample ID number.

Each discrete sampling location or matrix (i.e., surface water and sediment) must be labeled with separate sample numbers. For example, when collecting three samples at different depths from one borehole, three different sample numbers are required. Similarly, if three different air sampling media (i.e., charcoal, carbon, Tenax) are collected at one station, each media will be identified by a discrete sample number. Treatability samples from various treatment stages are also labeled as discrete samples.

For a particular sample with multiple analyses requiring multiple sample containers, each sample container must be labeled with the same sample ID number. This numbering scheme is applicable to all matrices except air and soil gas. If more labels are required than are available in the preprinted format, it is acceptable to hand-print additional labels for the same sample sequence. Replicate, duplicate, trip blank, field blank, equipment/rinsate blank, and Performance Evaluation (PE) samples are considered discrete samples. These samples are labeled, assigned a unique sample number, and listed on the COC record. Replicate, duplicate and PE samples should be submitted blind to the laboratory.

The only Quality Control (QC) samples given the same sample identification number as the field sample are the additional aliquots collected for Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples. If the TL chooses a particular sample for the MS/MSD, this is denoted in the MS/MSD column on the COC record

Specifically for air samples involving media, additional media are submitted to the laboratory for use as Blank Spike/Blank Spike Duplicate (BS/BSD) by notation in the "special instruction" section. Air samples require an extra set of blank tubes or filters to be enclosed along with the lot, field and trip blanks for BS/BSD analysis. Additional tubes may be required for calibration and/or desorption studies.

When samples are split with another agency, or are analyzed by two or more laboratories, samples should be segregated, packed, addressed, and shipped to the appropriate agency or laboratory. The split samples may be assigned the same sample number. A separate COC record must be prepared for each sample cooler and each agency or laboratory receiving samples. For samples sent to a CLP laboratory, CLP COC procedures should be followed.

Refer to SERAS SOP #1008, *Sample Receiving, Handling and Storage* to verify that the appropriate containers, number of bottles and preservatives are used.

## 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

This section is not applicable to this SOP.

## 4.0 INTERFERENCES AND POTENTIAL PROBLEMS

The COC record identifies which samples are present in the shipping containers and the types of analyses to be performed. Incomplete, illegible or erroneous information on the COC record can lead to miscommunication or misunderstanding by the receiving laboratory. A break in COC procedures will invalidate sample integrity.

## 5.0 EQUIPMENT/APPARATUS

- COC records
- Sample Labels
- Custody seals
- Cooler
- Re-sealable plastic bags

- Duct tape
- Clear tape
- Waterproof ink pen
- Computer with SCRIBE software and printer
- Sampling Worksheets and/or logbooks from which data are entered into Scribe

## 6.0 REAGENTS

This section is not applicable to this SOP.

## 7.0 PROCEDURES

### 7.1 SCRIBE-Generated Chain of Custody

SCRIBE is used to generate the COC record. Sample numbers, locations, matrix, date collected and analysis requested are input into Scribe, for the COC. A separate COC must be prepared for each shipping container. Abbreviations or notations used on one COC record should remain consistent on all COC prepared at the site.

- Project Identifier - Enter the Site Name or Project Name (WA Name) or any other identifier. Do not use the site name if the samples are being shipped to a contract laboratory. Instead, use of WA# or abbreviated form of the site name is recommended (e.g. Use LLC for Lower Ley Creek). Note: If using SCRIBE for sample management, the project name should be entered into the database. To avoid printing the project name on the COC record, select Report Setup. In the pop-up window for Report Setup, there is a section that reads "COC Report View." In this box, select "Lab Copy," this will replace the site name with the site number on the COC Record. Selecting "Region Copy" prints the site name on the COC Record. NOTE: "Region Copy" is typically the default setting.

- Project Number - Enter the Work Order No. SERASXXXXX (where XXXXX is the appropriate work assignment number). Be careful to include the correct project number since the site name may not be on the COC.

- LM Contact - Identify the Task Leader (TL) if analyses are to be performed by SERAS, or the SERAS Analytical Section subcontracting representative if samples are to be analyzed by an outside laboratory.

- Phone Number - Enter the phone number of the TL or the subcontracting representative. If not known at the time, enter 732-321-4200.

- SERAS # - This will be completed by the SRT upon receipt and login of samples at the ERT/SERAS Laboratory, and should be left blank (do not cross out) by the field personnel when preparing the COC. Any samples received by the SERAS SRT will be assigned a SERAS number. The number coding is RYMMBBB-XX, where R was the first letter of the previous contract, Y is the last digit of the year, MM is the month, BBB is the batch of the day and lastly XX is numerical sequence of the samples in the batch. NOTE: A batch can only have 99 samples. SERAS Sample Number R509002 means second batch of samples for September 2015. Each sample in the work order will be assigned a sequential number starting at -01. This applies to samples being analyzed at the ERT/SERAS Laboratory or being split at SERAS prior to being sent to a contract laboratory.

- Sample Number - Enter the sample number from the sample label attached to each sample container (i.e., 1002, 3002). If more than one sample container is collected for a particular analysis, it should be reflected in the total number of bottles. For example, three 40-mL vials preserved with 1:1 hydrochloric acid (HCl) are collected at a single location for volatile organic compound (VOC) analysis and all are labeled as sample number 4002. These vials would be listed on one line on the COC record as sample number 4002, 3 bottles indicated in the Number of Containers column and 1:1 HCl in the preservative column.

  **NOTE: Sample Numbers cannot begin with a zero. The results table when converted to an electronic deliverable data file (csv) does not recognize a zero and thus drops the zero.**

- Sampling Location - Enter the sampling location. This is typically the station name (i.e., MW-9, SG-22), address or some other identifier indicating where the sample was collected. Trip, rinsate, and field blanks are labeled as such.

- Sub Location: Occasionally the sampler will assign a sub location, (i.e., Sub location Basement or First Floor, Ambient, etc.).

- Analyses – List the type of analysis requested in this column. Standard abbreviations for analytical parameters are listed on Table 1, Appendix B. When collecting air, chip, wipe, or sweep samples record total sample volume collected or area sampled. The laboratory will not be able to report an accurate concentration without this information. These columns are automatically generated for the COC in SCRIBE, but may need to be user-selected to be printed on the COC. NOTE: CLP labs may have specific designation for analyses.

- Matrix - Enter the type of sample using the abbreviations listed below. When specifying a matrix not specifically listed below, include a description of the matrix in the "Special Instructions" section at the bottom of the COC record.

| | | | | | |
|---|---|---|---|---|---|
| SD - | Sediment | PW - | Potable Water | S - | Soil |
| DS - | Drum Solids | GW - | Groundwater | W - | Water |
| DL - | Drum Liquids | SW - | Surface Water | O - | Oil |
| X* - | Other | SL - | Sludge | A - | Air |
| AT - | Animal Tissue | PT - | Plant Tissue | PR - | Product |

* May be further identified as FT - fish tissue, MT - mammal tissue, WB - whole body, F - fillet, K - kidney, L - liver, etc. Any acronyms used must be defined on the COC record.

- Collected - Indicate the date and time when the sample was collected (mm/dd/yy) especially for those analyses that are time-sensitive (such as hexavalent chromium that has a 24-hour holding time for water samples). Use military time to document the sample collection time. For example, if a sample was collected at 10:05 pm, the time documented on the COC should read 22:05.

- Number of Containers - Indicate the number of sample bottles, size and preservatives (if applicable). Specify the container type if the container is other than glass. For glass containers, it is optional to indicate this information on the COC record. Enter any specific restrictions on the container; for example, if an amber bottle is used.

- Preservative – Indicate whether the sample is preserved or not and the type of preservative added to the sample.

- MS/MSD – Indicate whether an MS/MSD analysis is required or not.

Upon completion of the COC record, line out the unused area with an "X" and initials. If the samples are returning to the ERT/SERAS Laboratory, do not line out the SERAS # column that corresponds to the samples listed on the form, since this column will be completed by the ERT/SERAS SRT at a later date. This column may be lined out for samples being sent directly to a contract lab from the field.

Details of creating a COC using SCRIBE is shown in Appendix C, SCRIBE Quick Start Guide Part I. Generation of a CLP-compliant chain of custody is explained in Appendix D, SCRIBE CLP User Guide.

7.2 Pre-Printed Chain of Custody

Use of pre-printed COC forms is strongly discouraged. The preferred method for generation of COC records is by using SCRIBE.

The SERAS pre-printed COC has several columns similar to the Scribe COC record. They are SERAS #, Sample No., Sampling Location, Matrix, Date Collected, # of Bottles and Container/Preservative.

The last section of the COC has the header Analysis Requested. Under this section of the pre-printed COC Records, five columns are available to specify the analytical parameters required. The same standard abbreviations (Table 1, Appendix B) as discussed before apply here. The analysis requested should be noted on the top line of these columns and an X or ✓ mark used to designate the analysis requested for the sample containers listed. When collecting air, chip, wipe, or sweep samples, use a column in this section to record total sample volume collected or area sampled. The laboratory will not be able to report an accurate concentration without this information.

Upon completion of the COC record, line out the unused area with an "X" and initials. If the samples are returning to SERAS, do not line out the SERAS # column that corresponds to the samples listed on the form, since this column will be completed by the SERAS SRT at a later date. This column may be lined out for samples being sent directly to a subcontract lab from the field.

7.3. Special Instructions (applicable to both types of chain of custodies)

This section should be used to indicate any special analytical requirements or information that may be useful to the laboratory performing the analysis. This includes preliminary field screening data, special sample handling precautions, and certification requirements for certain labs. This section may specify special detection limit requirements, such as those for drinking water; special analytical methods other than regular methods, such as Method 524.2 for VOA; or special QA/QC requirements, such as no QA/QC required. Arrangements for special analytical requirements must be made in advance; the notation in this section serves as a reminder to those involved in the project.

The section may also be used to convey important information to the laboratory regarding the samples (e.g., "Samples 1001-1004 had elevated photoionization detector (PID) readings" or "XRF screening indicated lead levels in excess of 1000 ppm"). Information of this nature is extremely beneficial to the laboratory for determining worker protection and sample dilutions that may be necessary.

The COC should, if possible, receive a peer review prior to shipment of samples from the field. This review should include a comparison of the COC with the contents of the shipping container. Initials of the peer performing the review must appear in the "Special Instructions" section. The COC record must be completed thoroughly and correctly. A single cross out followed by the person's initials should be used in the event of an error.

7.4 Samples Transferred from Chain of Custody (applicable to both types of chain of custodies)

This section will be completed by the SRT if samples are transferred from the COC record completed in the field to another COC record for subcontract analysis or archiving.

7.5. Sign-Off (applicable to both types of chain of custodies)

- Items/Reason - Enter "all above" or the number of the sample bottles listed to indicate that all the items above are being transferred. The SRT must also indicate the reason for transfer (i.e., analysis, storage, etc.).
- Relinquished by - The individual relinquishing the samples signs their name. This may be field personnel, TL, the SERAS SRT, or the Analyst.
- Date - The individual relinquishing the samples enters the date of relinquishment (mm/dd/yy).
- Received by - This will be completed by the SERAS SRT or their designee if samples return to the SERAS facility, or the subcontract laboratory. For the SERAS laboratory, the lab analyst will also sign the COC indicating that the samples were received in the laboratory for analysis. This serves as internal chain of custody documentation. Sub-contract laboratories generally use an internal COC to document the transfer of the sample through the laboratory.
- Date - Recipient enters date of receipt (mm/dd/yy).
- Recipient enters time of day (military or am/pm designation).

Signatures for all sample transfers must be included on the COC. If the samples are hand-delivered to the laboratory, the TL or designee must wait for a sample receipt signature. This would be the case if samples are being delivered to the SERAS facility or subcontract laboratory for analysis.

**ALL SIGNATURES SHOULD BE LEGIBLE**

The original copy of the COC is enclosed in a re-sealable plastic bag and secured to the inside of the cooler lid. A copy of the COC should be retained for the TL's files. And an additional copy may be faxed or emailed to the SERAS SRT for confirmation of samples shipped to SERAS. If samples are shipped directly to a subcontract lab, the TL must fax or email a copy of the COC to the SERAS analytical subcontracting representative.

After packing and securing shipping coolers with duct tape, at least two custody seals must be placed across cooler openings. As long as the COCs are sealed inside the sample cooler and custody seals remain intact, commercial carriers are not required to sign off on the COC. Refer to SERAS SOP

#2004, *Sample Packing and Shipment* for specific protocols.

## 8.0 CALCULATIONS

This section is not applicable to this SOP.

## 9.0 QUALITY ASSURANCE/QUALITY CONTROL

1. All COC forms must be completed legibly and if not using Scribe, in permanent ink. Mistakes should be crossed out with a single line-through and initialed. If the number of cross-outs reduces legibility of the COC, a new COC record should be initiated.

2. Each COC record should, if possible, receive a peer review prior to shipment of samples from the field or from SERAS. Initials of the peer performing the review should appear in the "Special Instructions" section. This review must include a comparison of the COC with the contents of the shipping container. Peer review should ensure that the COC was filled out thoroughly and correctly and that the appropriate samples are in the shipping container.

3. Signatures for transfer of samples must be included on the COC. If the samples are hand-delivered to the laboratory, the TL or designee must wait for a sample receipt signature.

**ALL SIGNATURES SHOULD BE LEGIBLE**

## 10.0 DATA VALIDATION

Information provided on the COC is used to verify that all analyses were completed within acceptable holding times and that the analyses were performed as requested. In the case of air or wipe samples, the volume or area, on the COC is necessary to calculate final contaminant concentration. All COC records whether submitted to the ERT/SERAS laboratory, a contract laboratory or CLP will be checked during sample receipt and login.

## 11.0 HEALTH AND SAFETY

This section is not applicable to this SOP

## 12.0 REFERENCES

United States Environmental Protection Agency, Office of Emergency and Remedial Response, 1990. *Quality Assurance/Quality Control Guidance for Removal Activities - Sampling QA/QC Plan and Data Validation Procedures, (OSWER Directive 9360.4-01)*, EPA/540/G-90/004.

United States Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation, Contract Laboratory Program Guidance for Field Samplers, (OSWER Directive 9240.0-440), EPA 540-R-09-03, January 2011.

United States Environmental Protection Agency Environmental Response Team, ERT User Manual for SCRIBE CLP Sampling, August 29, 2013.
https://www.epaosc.org/sites/ScribeGIS/files/Scribe%20CLP%20User%20Guide.pdf

SCRIBE software website: https://www.epaosc.org/site/doc_list.aspx?site_id=ScribeGIS

SCRIBE User Manual Part 1 and Part 2 links:

https://www.epaosc.org/sites/ScribeGIS/files/Scribe%20Quick%20Start%20Guide%20Part%20I.pdf
https://www.epaosc.org/sites/ScribeGIS/files/Scribe%20Manual%20Part%20II.pdf

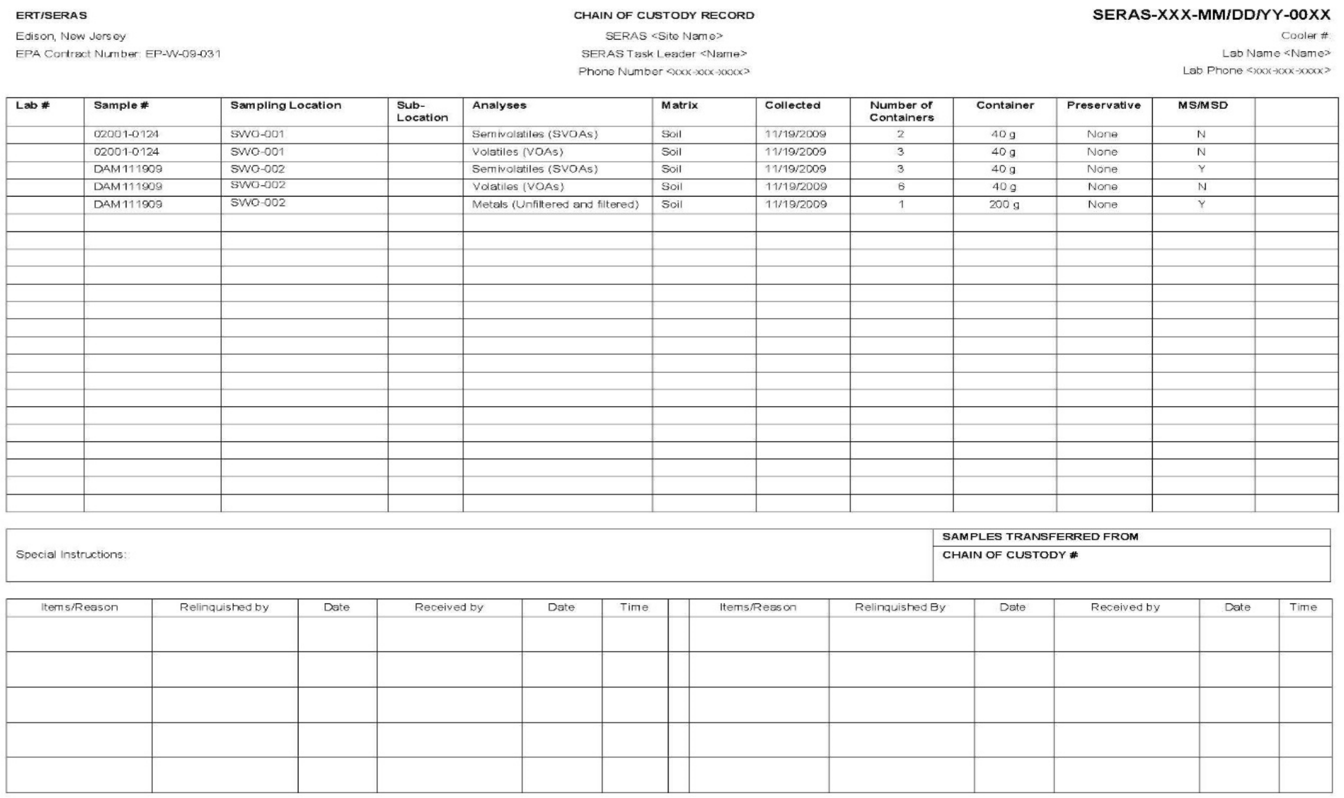
## 13.0 APPENDICES

A – Figures
B – Tables

The SCRIBE Quick Start Guide Part 1 and the SCRIBE CLP User Guide are attached at the end of this document for reference and are not paginated as part of this SOP.

APPENDIX A
Figures
SOP #4005
January 2016

FIGURE 1. Example of Completed Chain of Custody Record (Soil)



**ERT/SERAS**
Edison, New Jersey
EPA Contract Number: EP-W-09-031

**CHAIN OF CUSTODY RECORD**
SERAS <Site Name>
SERAS Task Leader <Name>
Phone Number <xxx-xxx-xxxx>

**SERAS-XXX-MM/DD/YY-00XX**
Cooler #:
Lab Name <Name>
Lab Phone <xxx-xxx-xxxx>

| Lab # | Sample # | Sampling Location | Sub-Location | Analyses | Matrix | Collected | Number of Containers | Container | Preservative | MS/MSD | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 02001-0124 | SWO-001 | | Semivolatiles (SVOAs) | Soil | 11/19/2009 | 2 | 40 g | None | N | |
| | 02001-0124 | SWO-001 | | Volatiles (VOAs) | Soil | 11/19/2009 | 3 | 40 g | None | N | |
| | DAM111909 | SWO-002 | | Semivolatiles (SVOAs) | Soil | 11/19/2009 | 3 | 40 g | None | Y | |
| | DAM111909 | SWO-002 | | Volatiles (VOAs) | Soil | 11/19/2009 | 6 | 40 g | None | N | |
| | DAM111909 | SWO-002 | | Metals (Unfiltered and filtered) | Soil | 11/19/2009 | 1 | 200 g | None | Y | |
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Special Instructions:

**SAMPLES TRANSFERRED FROM**
**CHAIN OF CUSTODY #**

| Items/Reason | Relinquished by | Date | Received by | Date | Time | | Items/Reason | Relinquished By | Date | Received by | Date | Time |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | |
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FIGURE 2. Example of Completed Chain of Custody Record (Water)

**ERT/SERAS**
Edison, New Jersey
EPA Contract Number: EP-W-09-031

**CHAIN OF CUSTODY RECORD**
SERAS <Site Name>
SERAS Task Leader <Name>
Phone Number <xxx-xxx-xxxx>

**SERAS-XXX-MM/DD/YY-00XX**
Cooler #:
Lab Name <Name>
Lab Phone <xxx-xxx-xxxx>

| Lab # | Sample # | Sampling Location | Sub-Location | Analyses | Matrix | Collected | Sample Time | Number of Containers | Container | Preservative | MS/MSD |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 02001-0124 | SWO-001 | | Semivolatiles (SVOAs) | Water | 11/19/2009 | 16:00 | 2 | 1L Amber | None | |
| | 02001-0124 | SWO-001 | | Volatiles (VOAs) | Water | 11/19/2009 | 16:00 | 3 | 40 ml VOA | None | |
| | DAM111909 | Underflow Dam | | Semivolatiles (SVOAs) | Surface Water | 11/19/2009 | 15:50 | 3 | 1 liter | None | Y |
| | DAM111909 | Underflow Dam | | Volatiles (VOAs) | Surface Water | 11/19/2009 | 15:50 | 6 | 40 ml VOA | None | Y |
| | DAM111909 | Underflow Dam | | Metals (Unfiltered and filtered) | Surface Water | 11/19/2009 | 15:50 | 1 | 1 L poly | HNO3 pH<2 | Y |
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|---|---|
| Special Instructions: | **SAMPLES TRANSFERRED FROM**<br>**CHAIN OF CUSTODY #** |

| Items/Reason | Relinquished by | Date | Received by | Date | Time | | Items/Reason | Relinquished By | Date | Received by | Date | Time |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | |
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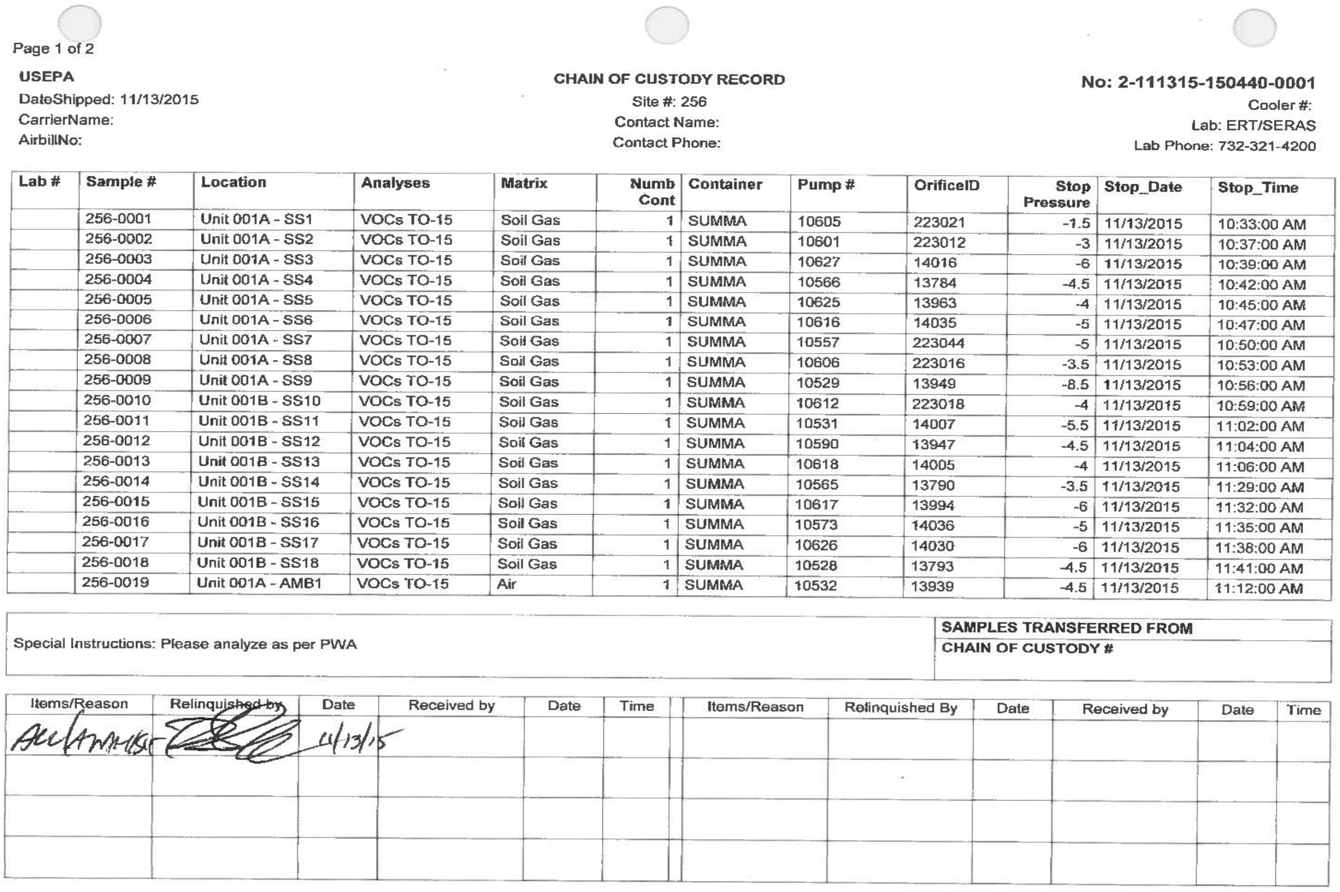
FIGURE 3. Example of Completed Chain of Custody Record (Air)



Page 1 of 2

**USEPA**
DateShipped: 11/13/2015
CarrierName:
AirbillNo:

**CHAIN OF CUSTODY RECORD**
Site #: 256
Contact Name:
Contact Phone:

**No: 2-111315-150440-0001**
Cooler #:
Lab: ERT/SERAS
Lab Phone: 732-321-4200

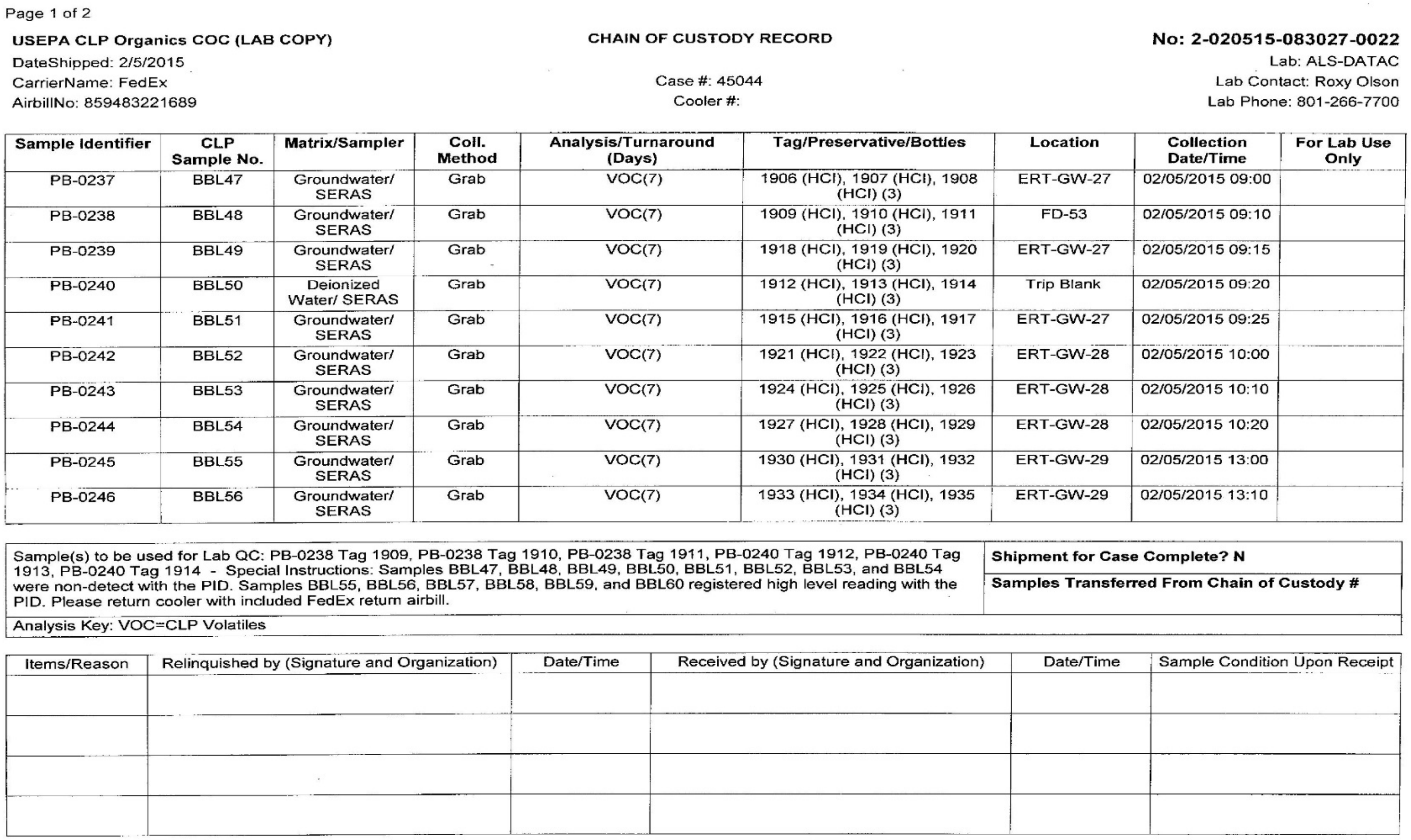
| Lab # | Sample # | Location | Analyses | Matrix | Numb Cont | Container | Pump # | OrificeID | Stop Pressure | Stop_Date | Stop_Time |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 256-0001 | Unit 001A - SS1 | VOCs TO-15 | Soil Gas | 1 | SUMMA | 10605 | 223021 | -1.5 | 11/13/2015 | 10:33:00 AM |
| | 256-0002 | Unit 001A - SS2 | VOCs TO-15 | Soil Gas | 1 | SUMMA | 10601 | 223012 | -3 | 11/13/2015 | 10:37:00 AM |
| | 256-0003 | Unit 001A - SS3 | VOCs TO-15 | Soil Gas | 1 | SUMMA | 10627 | 14016 | -6 | 11/13/2015 | 10:39:00 AM |
| | 256-0004 | Unit 001A - SS4 | VOCs TO-15 | Soil Gas | 1 | SUMMA | 10566 | 13784 | -4.5 | 11/13/2015 | 10:42:00 AM |
| | 256-0005 | Unit 001A - SS5 | VOCs TO-15 | Soil Gas | 1 | SUMMA | 10625 | 13963 | -4 | 11/13/2015 | 10:45:00 AM |
| | 256-0006 | Unit 001A - SS6 | VOCs TO-15 | Soil Gas | 1 | SUMMA | 10616 | 14035 | -5 | 11/13/2015 | 10:47:00 AM |
| | 256-0007 | Unit 001A - SS7 | VOCs TO-15 | Soil Gas | 1 | SUMMA | 10557 | 223044 | -5 | 11/13/2015 | 10:50:00 AM |
| | 256-0008 | Unit 001A - SS8 | VOCs TO-15 | Soil Gas | 1 | SUMMA | 10606 | 223016 | -3.5 | 11/13/2015 | 10:53:00 AM |
| | 256-0009 | Unit 001A - SS9 | VOCs TO-15 | Soil Gas | 1 | SUMMA | 10529 | 13949 | -8.5 | 11/13/2015 | 10:56:00 AM |
| | 256-0010 | Unit 001B - SS10 | VOCs TO-15 | Soil Gas | 1 | SUMMA | 10612 | 223018 | -4 | 11/13/2015 | 10:59:00 AM |
| | 256-0011 | Unit 001B - SS11 | VOCs TO-15 | Soil Gas | 1 | SUMMA | 10531 | 14007 | -5.5 | 11/13/2015 | 11:02:00 AM |
| | 256-0012 | Unit 001B - SS12 | VOCs TO-15 | Soil Gas | 1 | SUMMA | 10590 | 13947 | -4.5 | 11/13/2015 | 11:04:00 AM |
| | 256-0013 | Unit 001B - SS13 | VOCs TO-15 | Soil Gas | 1 | SUMMA | 10618 | 14005 | -4 | 11/13/2015 | 11:06:00 AM |
| | 256-0014 | Unit 001B - SS14 | VOCs TO-15 | Soil Gas | 1 | SUMMA | 10565 | 13790 | -3.5 | 11/13/2015 | 11:29:00 AM |
| | 256-0015 | Unit 001B - SS15 | VOCs TO-15 | Soil Gas | 1 | SUMMA | 10617 | 13994 | -6 | 11/13/2015 | 11:32:00 AM |
| | 256-0016 | Unit 001B - SS16 | VOCs TO-15 | Soil Gas | 1 | SUMMA | 10573 | 14036 | -5 | 11/13/2015 | 11:35:00 AM |
| | 256-0017 | Unit 001B - SS17 | VOCs TO-15 | Soil Gas | 1 | SUMMA | 10626 | 14030 | -6 | 11/13/2015 | 11:38:00 AM |
| | 256-0018 | Unit 001B - SS18 | VOCs TO-15 | Soil Gas | 1 | SUMMA | 10528 | 13793 | -4.5 | 11/13/2015 | 11:41:00 AM |
| | 256-0019 | Unit 001A - AMB1 | VOCs TO-15 | Air | 1 | SUMMA | 10532 | 13939 | -4.5 | 11/13/2015 | 11:12:00 AM |

Special Instructions: Please analyze as per PWA

**SAMPLES TRANSFERRED FROM**
**CHAIN OF CUSTODY #**

| Items/Reason | Relinquished by | Date | Received by | Date | Time | Items/Reason | Relinquished By | Date | Received by | Date | Time |
|---|---|---|---|---|---|---|---|---|---|---|---|
| All/Analysis | | 11/13/15 | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

FIGURE 4. Example CLP Chain of Custody



Page 1 of 2

**USEPA CLP Organics COC (LAB COPY)**
DateShipped: 2/5/2015
CarrierName: FedEx
AirbillNo: 859483221689

CHAIN OF CUSTODY RECORD

Case #: 45044
Cooler #:

**No: 2-020515-083027-0022**
Lab: ALS-DATAC
Lab Contact: Roxy Olson
Lab Phone: 801-266-7700

| Sample Identifier | CLP Sample No. | Matrix/Sampler | Coll. Method | Analysis/Turnaround (Days) | Tag/Preservative/Bottles | Location | Collection Date/Time | For Lab Use Only |
|---|---|---|---|---|---|---|---|---|
| PB-0237 | BBL47 | Groundwater/ SERAS | Grab | VOC(7) | 1906 (HCl), 1907 (HCl), 1908 (HCl) (3) | ERT-GW-27 | 02/05/2015 09:00 | |
| PB-0238 | BBL48 | Groundwater/ SERAS | Grab | VOC(7) | 1909 (HCl), 1910 (HCl), 1911 (HCl) (3) | FD-53 | 02/05/2015 09:10 | |
| PB-0239 | BBL49 | Groundwater/ SERAS | Grab | VOC(7) | 1918 (HCl), 1919 (HCl), 1920 (HCl) (3) | ERT-GW-27 | 02/05/2015 09:15 | |
| PB-0240 | BBL50 | Deionized Water/ SERAS | Grab | VOC(7) | 1912 (HCl), 1913 (HCl), 1914 (HCl) (3) | Trip Blank | 02/05/2015 09:20 | |
| PB-0241 | BBL51 | Groundwater/ SERAS | Grab | VOC(7) | 1915 (HCl), 1916 (HCl), 1917 (HCl) (3) | ERT-GW-27 | 02/05/2015 09:25 | |
| PB-0242 | BBL52 | Groundwater/ SERAS | Grab | VOC(7) | 1921 (HCl), 1922 (HCl), 1923 (HCl) (3) | ERT-GW-28 | 02/05/2015 10:00 | |
| PB-0243 | BBL53 | Groundwater/ SERAS | Grab | VOC(7) | 1924 (HCl), 1925 (HCl), 1926 (HCl) (3) | ERT-GW-28 | 02/05/2015 10:10 | |
| PB-0244 | BBL54 | Groundwater/ SERAS | Grab | VOC(7) | 1927 (HCl), 1928 (HCl), 1929 (HCl) (3) | ERT-GW-28 | 02/05/2015 10:20 | |
| PB-0245 | BBL55 | Groundwater/ SERAS | Grab | VOC(7) | 1930 (HCl), 1931 (HCl), 1932 (HCl) (3) | ERT-GW-29 | 02/05/2015 13:00 | |
| PB-0246 | BBL56 | Groundwater/ SERAS | Grab | VOC(7) | 1933 (HCl), 1934 (HCl), 1935 (HCl) (3) | ERT-GW-29 | 02/05/2015 13:10 | |

Sample(s) to be used for Lab QC: PB-0238 Tag 1909, PB-0238 Tag 1910, PB-0238 Tag 1911, PB-0240 Tag 1912, PB-0240 Tag 1913, PB-0240 Tag 1914 - Special Instructions: Samples BBL47, BBL48, BBL49, BBL50, BBL51, BBL52, BBL53, and BBL54 were non-detect with the PID. Samples BBL55, BBL56, BBL57, BBL58, BBL59, and BBL60 registered high level reading with the PID. Please return cooler with included FedEx return airbill.

**Shipment for Case Complete? N**

**Samples Transferred From Chain of Custody #**

Analysis Key: VOC=CLP Volatiles

| Items/Reason | Relinquished by (Signature and Organization) | Date/Time | Received by (Signature and Organization) | Date/Time | Sample Condition Upon Receipt |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

FIGURE 5. Example of SCRIBE Generated Sample Labels

**Sample # 01001**
**Tag: A**
Date: 9/9/2010
Location: Location 1
Analyses: TO-15+TIC+Landfill Gas
Preservation:

**Sample # 01002**
**Tag: A**
Date: 9/9/2010
Location: Location 2
Analyses: TO-15+TIC+Landfill Gas
Preservation:

**Sample # 01003**
**Tag: A**
Date: 9/10/2010
Location: Location 3
Analyses: TO-15+TIC+Landfill Gas
Preservation:

**Sample # 01004**
**Tag: A**
Date: 9/10/2010
Location: Location 2
Analyses: TO-15+TIC+Landfill Gas
Preservation:

**Sample # 01005**
**Tag: A**
Date: 9/10/2010
Location: Location 3
Analyses: PAHs
Preservation: Wet ice

**Sample # 01006**
**Tag: A**
Date: 9/10/2010
Location: Field Blank
Analyses: PAHs
Preservation: Wet ice

FIGURE 6. Pre-Numbered Sample Container Labels

SERAS, EDISON NJ
(732) 321-4200 SAMPLE NO. 00351
EPA CONTRACT EP-W-09-031
SITE NAME DATE
VOL OF AIR TIME
ANALYSIS REQUEST: REMARKS:

SERAS, EDISON NJ
(732) 321-4200 SAMPLE NO. 00352
EPA CONTRACT EP-W-09-031
SITE NAME DATE
VOL OF AIR TIME
ANALYSIS REQUEST: REMARKS:

00351
00351
00352
00352

SERAS, EDISON NJ
(732) 321-4200 SAMPLE NO. 00353
EPA CONTRACT EP-W-09-031
SITE NAME DATE
VOL OF AIR TIME
ANALYSIS REQUEST: REMARKS:

SERAS, EDISON NJ
(732) 321-4200 SAMPLE NO. 00354
EPA CONTRACT EP-W-09-031
SITE NAME DATE
VOL OF AIR TIME
ANALYSIS REQUEST: REMARKS:

00353
00353
00354
00354

SERAS, EDISON NJ
(732) 321-4200 SAMPLE NO. 00355
EPA CONTRACT EP-W-09-031
SITE NAME DATE
VOL OF AIR TIME
ANALYSIS REQUEST: REMARKS:

SERAS, EDISON NJ
(732) 321-4200 SAMPLE NO. 00356
EPA CONTRACT EP-W-09-031
SITE NAME DATE
VOL OF AIR TIME
ANALYSIS REQUEST: REMARKS:

00355
00355
00356
00356

SERAS, EDISON NJ
(732) 321-4200 SAMPLE NO. 00357
EPA CONTRACT EP-W-09-031
SITE NAME DATE
VOL OF AIR TIME
ANALYSIS REQUEST: REMARKS:

SERAS, EDISON NJ
(732) 321-4200 SAMPLE NO. 00358
EPA CONTRACT EP-W-09-031
SITE NAME DATE
VOL OF AIR TIME
ANALYSIS REQUEST: REMARKS:

00357
00357
00358
00358

SERAS, EDISON NJ
(732) 321-4200 SAMPLE NO. 00359
EPA CONTRACT EP-W-09-031
SITE NAME DATE
VOL OF AIR TIME
ANALYSIS REQUEST: REMARKS:

SERAS, EDISON NJ
(732) 321-4200 SAMPLE NO. 00360
EPA CONTRACT EP-W-09-031
SITE NAME DATE
VOL OF AIR TIME
ANALYSIS REQUEST: REMARKS:

00359
00359
00360
00360

APPENDIX B
Tables
SOP #4005
January 2016

TABLE 1: Standard Abbreviations for Analysis

| Abbreviation | Analysis |
|---|---|
| VOA(1) | Volatile Organic Analysis |
| SVOA(1) | Semivolatile Organic Analysis |
| PAH | Polycyclic Aromatic Hydrocarbons |
| Pest/PCB(1) | Pesticides and PCBs |
| Pest(1) | Pesticides only |
| PCB(1) | PCBs only |
| HERB(1) | Herbicides only |
| TAL Metals(1) | Target Analyte List Metals |
| RCRA Metals | As, Ba, Cd, Cr, Pb, Hg, Se, Ag |
| CN | Total Cyanide |
| PHENOL | Total Phenol |
| PCDD/PCDF | Total Dioxins/Furans (17 congeners) |
| DIOXIN/FURANS | Total Dioxins and Total Furans |
| PCB (209) | PCB Congeners |
| TCLP-VOA | Toxicity Characteristic Leaching Procedure Volatiles only (10 compounds) |
| TCLP-SVOA | Toxicity Characteristic Leaching Procedure – Base Neutral/ Acid Extractables only (13 compounds) |
| TCLP-PEST | Toxicity Characteristic Leaching Procedure – Pesticides only (6 compounds) |
| TCLP METALS | Toxicity Characteristic Leaching Procedure – Metals only (8 compounds) |
| TCLP-HERB | Toxicity Characteristic Leaching Procedure – Herbicides only (2 compounds) |
| TPH | Total Petroleum Hydrocarbons |
| TO-15 VOC | Volatile Organic Compounds by EPA TO-15 |
| $Cl^-$ | Chloride |
| $NO_3$ | Nitrate |
| $NO_3/NO_2$ | Nitrate/Nitrite |
| $SO_4$ | Sulfate |
| $HS^-$ | Sulfide |
| TOC | Total Organic Carbon |

.NOTE: The list above only contains typical examples and is not inclusive of every parameter that may be analyzed.

# STANDARD OPERATING PROCEDURE APPROVAL AND CHANGE FORM

Scientific, Engineering, Response and Analytical Services
2890 Woodbridge Avenue Building 209 Annex
Edison New Jersey 08837-3679

## STANDARD OPERATING PROCEDURE

Title: Sediment Sampling

Approval Date: 07/31/2016

Effective Date: 07/31/2016

SERAS SOP Number: 2016, Rev 1.0

### Authors

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Title SERAS Environmental Scientist (Biologist)

Signature

Date 7/31/16

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Date

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Date 7/31/16

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Signature

Date 7/31/16

The top row of this table shows the most recent changes to the controlled document. For previous revision history information, archived versions of this document are maintained by the SERAS QA/QC Officer on the SERAS local area network (LAN).

| History | Effective Date |
|---|---|
| Complete Rewrite | 07/31/2016 |
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CONTENTS

SUPERCEDES: SOP #2016, Rev. 0.0, 11/02/01, U.S. EPA Contract 68-C99-223

## 1.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes general and specific procedures to be used by Scientific, Engineering, Response and Analytical Services (SERAS) personnel when collecting representative sediment samples. For the purposes of this SOP, sediment is defined as organic or inorganic material that is broken down by the processes of weathering and erosion and deposited/transported by the action of water. Some examples of sediments include: weathered rock, naturally occurring organic material, and secretions from organisms (e.g. Calcite). The methodologies discussed in this SOP are applicable to the sampling of sediment located adjacent to and underneath the surface of water bodies. Sediment samples are most typically collected to determine the following:

- chemical analysis
- contaminant toxicity
- bioassays
- the presence of benthic biota
- delineate the type, extent and concentration of contamination/impact
- to identify contaminant migration pathways and sources
- disposal of contaminants
- grain size distribution of contamination
- depositional environment/ambient conditions
- sediment type

A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The sampler needs to ensure the methods used are adequate to satisfy the data quality objectives listed in the site-specific QAPP

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations or other procedural limitations. In all instances, the procedures employed must be documented on a Field Change Form and attached to the QAPP. These changes must be documented in the final deliverable.

## 2.0 METHOD SUMMARY

Various techniques, methods and equipment have been developed for the collection of sediment samples and their use is subject to site conditions and project goals. Sediment samples may be collected using a variety of methods and equipment, depending on the depth of the aqueous layer, the portion of the sediment profile required (surface vs. subsurface), the type of sample required (disturbed vs. undisturbed), contaminants present, sediment type, and analyses required.

Sediment is collected from beneath an aqueous layer either directly, using a hand-held device such as a scoop, trowel, or auger, or indirectly, using a remotely activated device such as an Ekman or Ponar dredge. Following collection, sediment is transferred from the sampling device to a sample containers of appropriate size and construction for the analysis (es) requested. If composite sampling techniques are employed, multiple grabs are placed into a container constructed of an inert material (e.g. stainless steel bowl, aluminum pan, or re-sealable plastic bag), homogenized, and transferred to the sample container(s) appropriate for the analysis (es) requested. The homogenization procedure should not be used if the sample analysis includes volatile organic compounds (VOCs). In this case, sediment, or multiple grabs of sediment, should be transferred directly from the sample collection device or homogenization container to the sample container.

Cores may also be collected directly into an acetate or polyvinyl chloride (PVC) sleeve that serves as the sample container for undisturbed samples.

## 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Chemical preservation of solids is generally not recommended. Cooling to less than or equal to (≤) 6 degrees Celsius ($^{O}$C) is usually the best approach, supplemented by the appropriate holding time for the analyses requested.

Wide-mouth glass containers with Teflon lined caps are utilized for sediment samples. The sample volume is a function of the analytical requirements and will be specified in the QAPP.

The amount of sample collected, along with the proper sample container type (i.e. glass, plastic), chemical preservation, and storage requirements are dependent upon the matrix sampled and analysis performed. For further information, refer to the SERAS SOP #2003, *Sample Storage, Preservation and Handling*, and/or the QAPP. Preservation of sediment samples is dependent on the analytical method chosen for analysis. Use of sodium bisulfate for VOCs creates low pH conditions that may deteriorate certain target compounds. Samples preserved with methanol can only be analyzed by the medium level method; thereby, elevating reporting limits (RLs).

Additional Quality Assurance/Quality Control (QA/QC) samples should be collected as outlined in the QAPP for each specific site. Further information on QA/QC Samples can be found in SERAS SOP #2005, *Quality Assurance/Quality Control Samples*.

Samples are packed and shipped in accordance with SERAS SOP #2004, *Sample Packing and Shipping*.

## 4.0 INTERFERENCES AND POTENTIAL PROBLEMS

Sediments occur in a wide variety of environments such as streams, wetlands, rivers, lakes and oceans. Some of these environments can be difficult and possibly hazardous to sample. It is common to find materials that may be too large to sample such as cobbles and gravel. In addition, dense clays, silts and organic material may also be found. The appropriate sampling equipment must be assigned, prior to field work, for the collection of the materials anticipated to be encountered.

When working in areas deeper than wading depth, a vessel would be required. SERAS maintains a wide range of vessels (from small zodiacs, pontoon boat for inland projects to a 41-survey vessel capable of working in the open ocean). Appropriate health and safety measures must be applied to the collection methods chosen.

The potential of introducing contamination by a sampling device or technique poses a limitation in sediment sampling. Sometimes, the material that sample containers are made of can interfere with the contaminants that a sample will be analyzed for (i.e. plastics absorb pesticides, metal devices may corrode, etc.). When selecting the samples bottles, consider the contaminants of concern which are to be analyzed.

Substrate particle size and organic matter content are a direct consequence of the physical characteristics of a water body and the watershed. Contaminants are more likely to be concentrated in sediment typified by fine particle size and high organic matter. This type of sediment is most likely to be collected from depositional zones. In contrast, coarse sediment with low organic matter does not typically concentrate contaminants and are generally found in erosional zones. The selection of a sampling location can, therefore, greatly influence the analytical results and should be justified and discussed in the QAPP.

Sediments may contain very light particulate matter. For undisturbed samples, all efforts must be made to protect these light sediments from being lost during sampling due to current, agitation, or other methods. Care must be taken when decanting standing water from a sediment sample to minimize the loss of these fine particulates.

## 5.0 EQUIPMENT/APPARATUS

The equipment required for collection of sediment samples mainly depends on the environment where the sampling is going to take place and the contaminants that are being analyzed. In general, the equipment listed below may be required to perform sediment sampling:

- Maps/Navigational charts
- Personal protective equipment (PPE)
- Compass
- Global positioning system (GPS) receiver
- Tape measure
- Survey stakes, flags, buoys and anchors
- Digital camera
- Bucket, plastic or stainless steel
- Sample bottles
- Ziploc® plastic bags of various sizes
- Field logbook/Sampling data sheets
- Sample labels
- COC records
- Custody seals
- Cooler(s)
- Wet ice
- Decontamination equipment and supplies
- Scoops (plastic or stainless steel)
- Trowels (plastic or stainless steel)
- Bucket auger, with T-handle and extensions
- Tube auger, with T-handle and extensions
- Pipe wrenches
- "T" handle for Volatile Organic Compound (VOC) sampling and "T" handle for sampling with auger bucket/tube
- Ekman™ dredge
- Ponar™ dredge
- Van Veen Sampler or Young-Modified Van Veen Sampler
- Nylon™ rope line or steel cable
- Winch
- Power drill
- Photo-Ionization Detector (PID)/Flame-Ionization Detector (FID)
- Tools and toolbox, multi-use
- SCUBA/dive gear

- Laptop computer with Scribe™ software
- Portable printer
- Printer paper
- Power strip (s)
- Extension cords
- Vessel
- Hacksaw
- En Core®/Terra Core® samplers
- Trash bags
- Coring device
- Acetate/Polycarbonate/PVC sleeves
- Cutting shoes
- Core catchers
- Hook blade razor knife
- Geoprobe® liner cutting tool
- Hip and chest waders
- Over boots
- Ice
- Bowls, stainless steel, for homogenizing sample

## 6.0 REAGENTS

Decontamination solutions are specified in the SERAS SOP #2006, *Sampling Equipment Decontamination*. In addition, these solutions are included in the site-specific Health and Safety Plan (HASP).

## 7.0 PROCEDURES

### 7.1 Preparation

1. Determine the project objectives and extent of the sampling event.

2. Perform a general site survey prior to commencement of field activities, in accordance with the site-specific HASP.

3. Prepare schedules, coordinate with staff and subcontractors, and communicate with the regulatory agency.

4. Determine the type of equipment and supplies required based on the site characteristics and project objectives.

5. Identify, obtain and calibrate the required air monitoring equipment (e.g. PID/FID), if required by the health and safety plan (HASP).

6. Confirm that the sampling equipment is working and ready to use.

7. Decontaminate all non-dedicated sampling equipment in accordance with SERAS SOP #2006, *Sampling Equipment Decontamination*.

8. Identify and mark all potential sampling locations with stakes, flags, and/or buoys, if appropriate. A GPS may be used to identify preselected sampling locations or to record sampling locations. When selecting sampling locations, consider the site's specific physical characteristics including, but not limited to, water flow, topography, depth of the overlying aqueous layer, sediment type, contaminant source, and the extent and nature of contamination. In addition, consider on-site access and property boundaries.

## 7.2 Sample Collection

The selection of a sampling device is mainly contingent upon the:

- physical characteristics of the sediment to be sampled,
- type of sample needed,
- analytical parameters to be studied,
- amount of sediment needed,
- contaminant(s) contained in the sediment,
- depth of water above the sampling location, and
- possible interferences or contamination introduced by the sampling device.

If analysis of sediment from a discrete depth or location is desired, sediment is transferred directly from the sampling device to a labeled sample container(s) of appropriate size and construction for the analysis (es) requested. Transfer is accomplished with a stainless steel or plastic lab spoon or equivalent.

If composite sampling techniques or multiple grabs are employed, equal portions of sediment from each location or collocation are deposited into a decontaminated stainless steel, plastic, aluminum pan or other appropriate container (e.g., Teflon). The sediment is homogenized thoroughly to obtain a mixture representative of the area sampled. The composite sediment sample is transferred to a labeled container(s) of appropriate size and construction for the analysis (es) requested. Transfer of sediment is accomplished with a stainless steel or plastic lab spoon or equivalent. Samples for VOC analysis must be transferred directly from the sample collection device or pooled from multiple areas in the homogenization container prior to mixing. This is done to minimize the loss of contaminant due to volatilization during homogenization.

All non-dedicated sampling devices should be decontaminated prior to use, then wrapped in aluminum foil. The sampling device should remain wrapped until needed. Dedicated sampling devices should be used for each sample. Disposable sampling devices for sediment are generally impractical due to cost and the large number of sediment samples which may be required. Sampling devices should be cleaned in the field using the decontamination procedure described in (SERAS) SOP #2006, *Sampling Equipment Decontamination*.

Once samples have been collected, the following procedures must be followed:

1. Transfer the sample(s) into suitable, labeled sample containers specific for the analyses to be performed.
2. Preserve the sample, if appropriate, or use pre-preserved sample bottles. Do not overfill bottles if they are pre-preserved.

3. Cap the container securely, place in a resealable plastic bag, and cool to ≤)6ºC, if required by the analytical method.
4. Record all pertinent data in the site logbook and/or on field data sheets.
5. Enter all sampling information into Scribe.
6. Generate a Chain of Custody (COC) record, place inside a plastic sleeve and tape to the top of the inside of the cooler.
7. Attach custody seals to cooler prior to shipment.

## 7.3 Surface Sediment Sampling Methods and Operational Instructions

The main purpose of sediment sampling is to collect a sample of a deposited material. In performing this task, proper sampling equipment and precautions are required to be taken. Several techniques have been developed to sample sediment material from different surface water environments. In general, the main techniques are sampling with scoops, bucket/tube augers, coring devices and mechanical grabs.

Scoops cause the greatest degree of sediment disturbance. Cores and mechanical grabs cause the least disturbance in the water-sediment interface. The main sediment sampling procedures are discussed below.

### 7.3.1 Sampling Surface Sediment with a Scoop/Trowel

In shallow, slow moving water representative surficial sediment samples may be collected with plastic or stainless steel scoops or trowels.

1. Collect the desired thickness and volume of sediment from the marked sampling location causing minimal disturbance of the water-sediment interface with a scoop.

2. Place the sample into a homogenization container or a specified sampling bottle. (If sampling for VOCs, do not homogenize; transfer the sample directly into the container). See section 7.3.8 for more information on collecting VOC samples.

3. Label the sample bottle and store in a cooler with wet ice.

### 7.3.2 Sampling Surface Sediment with a Bucket/Tube Auger

In shallow water, representative surficial sediment samples may be collected with a bucket or tube auger. Bucket and tube augers are sampling devices that consist of a bucket or tube with a series of extensions and a handle in the shape of the letter “T” (commonly known as “T” handle). Refer to Figure 1, Appendix A)

1. Attach the bucket/tube auger to the required length of extensions and attach the "T" handle to the upper extension.

2. If the study objectives and characteristics of the sediment or water body warrant, an acetate sleeve may be inserted into the tube auger prior to sampling.

3. Insert the bucket/tube auger onto the sediment at a 90° vertical angle.

4. Begin sampling by rotating the auger into the sediment with downward pressure until the desired depth is reached.

5. Slowly retrieve the auger containing the sample. The auger should be examined to determine if significant amounts of sediment are lost due to the thin, wet nature of some sediments. If significant losses have occurred, an alternate method of sampling should be performed, such as coring.

6. Carefully decant the surface water contained in the auger.

7. Collect VOC samples directly from the bucket/tube auger using methods discussed in section 7.8.3.

8. Place the sediment sample in a container to homogenize, and then transfer the sediment sample into the appropriate sample bottle.

9. Label the sample bottle and store in a cooler with wet ice.

7.3.3 Sampling Deep Sediment with a Bucket/Tube Auger

In some instances Bucket/Tube Augers may also be used to collected subsurface sediment samples in a dry creek bed. Typically this method is not practical due to difficulties keeping boreholes open to desired depth.

1. Attach the auger bucket/tube to the required length of extensions and attach the "T" handle to the upper extension.

2. If using a tube auger, insert an acetate sleeve prior to sampling.

3. Insert the bucket/tube auger into the sediment at a 90° vertical angle.

4. Rotate the auger into the sediment with downward pressure until the desired depth is reached.

5. Begin augering while periodically removing any accumulated sediment (i.e. cuttings) from the auger bucket/tube. The cuttings should be temporarily stored on plastic sheeting at a distance of at least two (2) feet from the sampling area, to prevent cross-contamination.

6. After reaching the upper range of the desired depth, carefully retrieve the bucket/tube auger from the boring.

7. Advance the auger down the borehole carefully avoiding contact with the borehole sides to prevent cross-contamination. Gradually push down the auger into the sediment sampling location to reach the desired depth.

8. Retrieve the auger from the borehole.

9. Carefully decant the surface water contained in the auger.

10. Collect VOC samples directly from the bucket/tube auger using methods discussed in section 7.8.3.

11. Place the sediment sample in a homogenization container, homogenize, and then transfer into the appropriate sample bottle.

12. Label the sample bottle and store in a cooler with wet ice.

13. Dispose the cuttings in accordance with the site-specific QAPP.

### 7.3.4 Surface Sediment Sampling with a Mechanical Dredge

The Ekman, Van Veen, and the Ponar™ dredges are recommended for sampling in deeper water (water that is too deep to use scoops or augers) or for when relatively large amounts of sediments are required. In general, dredges are devices with jaws that are forced shut by weights, level arms, springs, cables or cords. The Ekman™ dredge is mainly used to sample fine sediments (e.g. mud, silt, and other soft and unconsolidated materials) whereas the Ponar™ dredges can be used to sample a wider range of grain sizes (clay to small gravel). Listed below are the assembly and operation instructions for both devices (Figures 2 and 3, Appendix A)

<u>Sampling using an Ekman™ Dredge</u>

1. Attach a dredge head to the bracket on the base of the extension pole with machine bolts.

2. Engage the jaws in a way that they are in the open position by placing trip cables over the release studs. Ensure that the hinged doors on the top of the dredge open freely to grab a sample.

3. Lower the dredge above the sampling location and hold.

4. Using the extension pole, push the dredge head into the sediments to the desired depth.

5. Trigger the jaw by depressing the button on the upper end of the extension pole.

6. Raise the sampler and slowly decant the water contained in the device through the top opening of the sampler.

7. Open the dredge jaws and place the sediment into a container for homogenization or directly into appropriate sample containers.

8. Label the sample bottle and store in a cooler with wet ice.

Sampling using a Ponar™ or Van Veen Dredge

**NOTE: Special care should be taken when using these types of dredges. The steel arms act in such a way as to cause significant pinch hazards.**

1. Attach a nylon rope (at least ¼″) or a steel cable (at least ⅛″) to the ring located on top of the dredge.

2. Arrange the dredge with the jaws in the open position, setting the trip bar or spring pin so the sampler remains open when lifted from the top.

3. Slowly lower the sampler to just above the sediment surface and drop the sampler into the sediment.

4. Raise the dredge to the surface and slowly decant the water through the screens on top of the dredge.

5. Open the dredge jaws and place the sediment into a container for homogenization or directly into appropriate sample containers.

6. Label the sample container and store in a cooler with wet ice.

7.3.5 Sampling Sediment with a Coring Device

This method is ideal for collecting intact sediment core samples. By utilizing this technique the original layering of the sediment deposited will be preserved. In general, core samplers are elongated tubes composed of an acetate sleeve, a "T" handle, a core catcher, drive hammer and a cutting shoe (Figure 4, Appendix A).

1. Assemble the coring device and insert a PVC sleeve into the sampling tube.

2. Insert the core catcher, if needed, into the lower end of the sampling tube with the convex surface positioned inside the acetate sleeve.

3. Screw the cutting shoe onto the lower end of the sampling tube, securing the acetate sleeve and core catcher.

4. Attach the sampling device to the required length of extensions; then attach the "T" handle or the drive hammer onto the upper extension.

5. Place the sampler 90° over the location to be sampled.

6. If the "T" handle is used, place downward pressure on the device until the desired depth is reached. After the desired depth is reached, slowly retrieve the sampler from the sediment. Some samplers may be equipped with a ball valve at the top of the core to aid in retrieving wetter samples. This valve should be closed before retrieving the sampler from the bottom.

7. Carefully remove the coring device from the water sampling location.

8. Unscrew the cutting shoe and remove the core catcher.

9. Slide the PVC sleeve out of the bottom of the sampler tube. Decant surface water, using care to retain the fine sediment fraction. The sample may be left in the PVC sleeve, collected directly from the sleeve, or placed in a container for homogenization prior to transferring to sample containers. Cores should always be stored in an upright position until the overlying water has been drained, the PVC cores cut to remove any overlying air spaces, and capped on both ends. To drain the overlying water, the PVC core should cut at various levels starting near the top of the core and proceeding to just above the top of the sediments. Water should drained at a rate slow enough to minimize turbulence and disturbance to the sediment. Indicate on the PVC tube the orientation of the sediment core using a waterproof marker.

10. Label the sample and store in a cooler with wet ice.

7.3.6 Diver-Assisted Sediment Sampling

For sampling in deep water environments where dredge methods cannot be used or core samples are required, a diver-assisted sediment sampling may be utilized. This technique may be used in biological and chemically-contaminated environments at depths up to 130 feet sea water (fsw) and is performed by trained EPA-certified scientific divers. All divers performing these activities are required to adhere to the SERAS SOP # 3019, *Dive Operation Safety*. Divers collecting sediment samples should have experience with equipment/methodology required to collect sediment.

1. Prepare two teams: a surface team (surface support) and a dive team (sampling team). The dive team will sample all locations and will remain in constant communication and supported by the surface team.

2. The surface control team will provide the diver team with an acetate or polyvinyl chloride (PVC) sampling tube, and two plastic end caps. A metal cap and a sledge hammer may be used in stiffer sediments to achieve the required sample depth.

3. The diver(s) will move to the sampling location.

4. Once at the sampling location, the diver(s) communicate to the surface team; the depth of water and the site/sediment conditions.

5. The diver(s) will manually advance the sample tube into the sediment or place the metal cap on top of the sleeve and hammer the sleeve vertically into the sediment until the desired depth is reached.

6. Remove the metal cap from the top of the core (if used) and replace with an end cap.

7. The core will then be slowly pulled from the sediment. The diver should reach under the sediment and place a bottom cap on the core as soon as possible.

8. The diver will carry core vertically to the surface and give it to a member of the surface support team.

9. The surface support team will secure the end caps to the core with duct tape and document the sample location, sample depth and sample orientation (top of core/bottom of core). Cores are then transported and stored in an upright position.

10. The sample may be left in the sleeve, sampled directly from the core, or placed in a container for homogenization or compositing. Cores should always be stored in an upright position until the overlying water has been drained.

11. If intact cores are to be used for analysis or transported off the site, they should be cut and recapped after removing all overlying water/air space in the core. To drain the overlying water, the acetate core should cut at various levels starting near the top of the core and proceeding to just above the top of the sediment. Water should be drained at a rate slow enough to minimize water turbulence and disturbance to the sediment. After the water has been drained from the core, the core should be cut at the top of the sediment and recapped.

11. Label the sample and store in a cooler with wet ice.

### 7.3.7 Vibracore Sampling

When sampling in deep water or where significant sample volume or depth are required, Vibracoring techniques may be used. Use of the Vibracore obtains sediment samples by vibrating a metal core barrel into the sediment. Penetration success is dependent upon the lithology of the formation.

Vibracores are generally composed of a stainless steel tube, detachable metal-cutting nose, stainless steel core catcher and the Vibracore drilling head. In general, Vibracores are operated by a team of two or more people from a vessel or on a structure extending over the water surface. Vibracoring should be conducted in accordance with subcontractor's SOPs and industry methodology standards.

Vibracoring uses vibration to achieve penetration into the sediments. If undisturbed cores are required, alternate sampling methods should be evaluated (Figure 5, Appendix A).

1. After allowing the sediments in the core to settle, all standing water should be drained from the core by cutting small holes above the sediment line. Water should be drained slowly so as not to re-entrain fine sediments.

2. Put the core sleeve on the soil identification table.

3. Use a Vibracore™ sleeve cutting tool (electric sheet metal cutter) and cut the full length of the sleeve. Then position the cutting tool roughly 4 inches to the left or right of the first cut and cut the entire length of the sleeve again.

4. Separate the sample core into the pre-determined sampling intervals.

5. Screen the sample core with the appropriate air monitoring device and record all readings in a site log book.

6. Perform soil identification/description activities.

7. Collect Terra Core samples for VOC's first. Then, transfer the remainder of the interval to a mixing bowl and homogenize.

8. Transfer the samples into the appropriately labeled sample containers and then store in a cooler with wet ice to maintain a temperature of ≤6°C.

7.3.8 Volatile Organic Compound Sampling

7.3.8.1 En Core® Sampler Method

The En Core® sampler is designed to collect sediment samples to be analyzed for VOC's. The En Core® sampler is comprised of an inert composite polymer (coring body) and a stainless steel "T" handle. This method reduces the open-air handling of soil samples in the field, minimizing the loss of VOCs. The following procedures are used for collecting sediment samples using an En Core® sampler (Figure 6, Appendix A).

1. Assemble the coring body, plunger rod and "T" handle.

2. Turn the "T" handle with the T-up and the coring body down and push the sampler into the sediment until the coring body is completely full (o-ring on sampler seen in the bottom hole of the sampler for 5 grams, and the top hole of the sampler for 25 grams) with minimal disturbance of the sample. Remove the sampler from the sediment.

3. Cap the coring body while it is still on the "T" handle. Push the cap over the flat area of the ridge. Ensure that the cap is seated properly to seal the sampler. Push cap to lock arm in place. Rotate the cap 90 degrees ensuring the cap is locked.

4. Remove the capped sampler by depressing the locking lever on the "T" handle while twisting and pulling the sampler from the "T" handle.

5. Using the hole located on the En Core® "T" handle, insert the core plunger, twist and lock the plunger of the core body.

6. Attach the label to the coring body cap, place it back into the En Core® sample bag and seal the bag.

7. This process will be conducted a total of three times for each field sample, six times for a sample and a field duplicate and nine times for a sample that has been chosen for the Matrix Spike/Matrix Spike Duplicate (MS/MSD) as outlined in the UFP-QAPP.

8. Store the sample in a cooler with wet ice at ≤6°C.

9. Decontaminate the En Core® "T" handle according to SERAS SOP #2006, *Sampling Equipment Decontamination*.

7.3.8.2 Terra Core® Sampler Method

A Terra Core® sampler is a single-use device designed to collect sediment samples to be analyzed for VOCs. The Terra Core® sampler is made of an inert composite polymer and reduces the open-air handling of sediment samples in the field. The following procedures are used for collecting sediment samples using a Terra Core® sampler (Figure 7, Appendix A).

1. Assemble the Terra Core® sampler by inserting the plunger portion into the "T" handle. Snap the plunger into the sampler.

2. Push the Terra Core® sampler into the sediment, ensuring that the Terra Core® sampler is completely full with sediment. Remove sampler from the sediment.

3. Unclip the plunger, rotate 90° and push the sample out of the sampler into a pre-weighted 40-milliliter (mL) vial containing a stirring bar. Refer to the analytical method if preservation is required. Label sample and store on wet ice.

4. This process will be conducted 3 times for the collection of a sample, 6 times for a duplicate and 9 times for an MS/MSD as outlined in the UFP-QAPP.

## 8.0 CALCULATIONS

This section is not applicable to this SOP.

## 9.0 QUALITY ASSURANCE/QUALITY CONTROL

Specific QA/QC activities that apply to the implementation of these procedures will be listed in the Quality Assurance Project Plan QAPP prepared for the applicable sampling event. The following general QA procedures will also apply:

1. All sample collection data, including sample collection methods, times of collection, analyses required, and decontamination procedures (if any) must be documented on site logbooks.

2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer or instrument-specific SOPs, unless otherwise specified in the QAPP. Equipment check out and calibration is necessary prior to purging and sampling and must be done according to the instruction manuals supplied by the manufacturer.

3. Each field sampler's level of competency must be documented for each type of equipment used.

## 10.0 DATA VALIDATION

Data verification (completeness checks) must be conducted to ensure that all data inputs are present for ensuring the availability of sufficient information. These data are essential to providing an accurate and complete final deliverable. The SERAS Task Leader (TL) is responsible for completing the UFP-QAPP verification checklist for each project.

## 11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, Occupational Safety and Health Administration (OSHA) and SERAS health and safety guidelines. More specifically, depending upon the site specific contaminants, various protective programs must be implemented prior to sampling the first well. The site's health and safety plan (HASP) should be reviewed with specific emphasis placed on the protection program planned for the well sampling tasks. Standard safe operating practices should be followed such as minimizing contact with potential contaminants in both the vapor phase and liquid matrix through the use of respirators and other PPE.

When conducting sediment sampling activities, physical hazards must be identified and adequate precautions are required to be taken to prevent any hazards. If sampling is conducted from a shore or bank adjacent to a water body, the sampler should be alert for bank collapse. The person performing the sampling should be on a lifeline and wearing the appropriate PPE [including a personal flotation device (PFD)]. If sampling from a vessel, samplers are required to take all appropriate protective measures and wear a PFD or mustang suit. Further information on personal protective equipment can be found in SERAS SOP # 3016, *Personal Protective Equipment Program*.

All diver assisted sampling should also follow SERAS SOP# 3019, *Diver Operation Safety*. Any sampling that is being conducted from a vessel should follow both safety and operation requirements.

## 12.0 REFERENCES

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## 13.0 APPENDICES

A - Figures

APPENDIX A
Figures
SETAS SOP #2016
July 2016

FIGURE 1 - Example of Sampling Augers

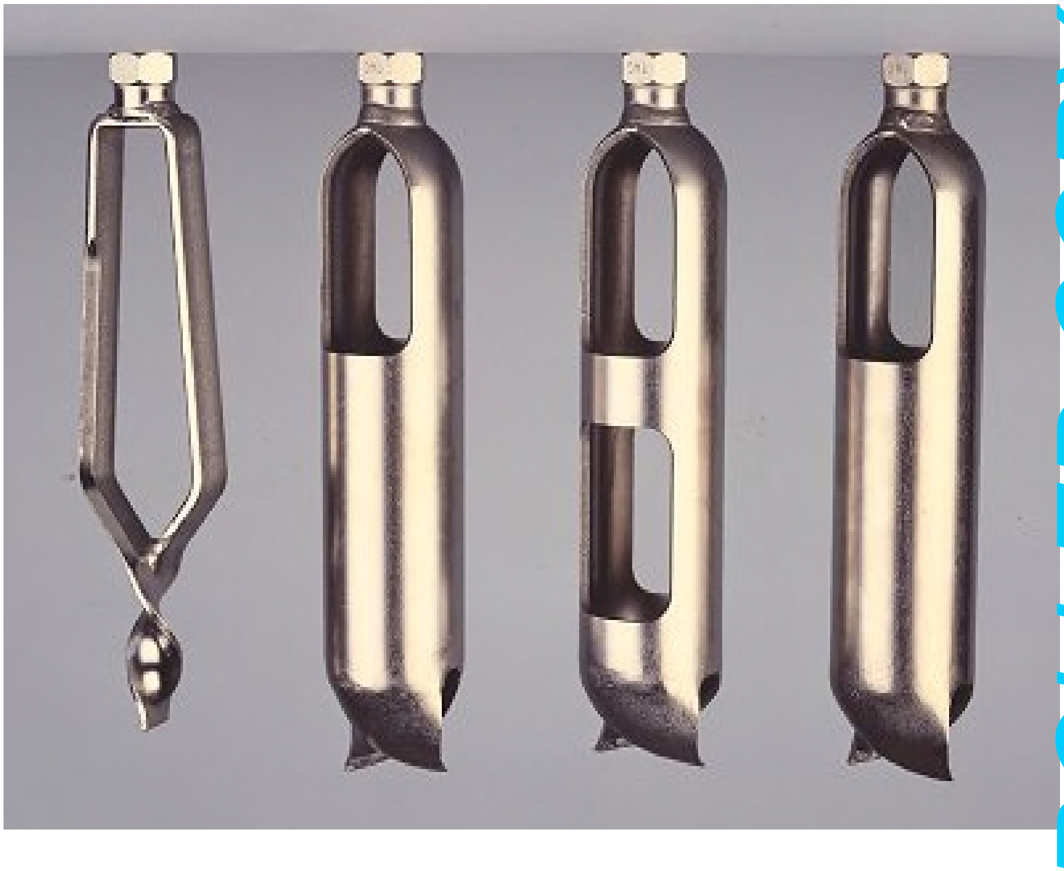

FIGURE 2 - Example of an Ekman™ Dredge

FIGURE 3 - Example of a Ponar™ Dredge

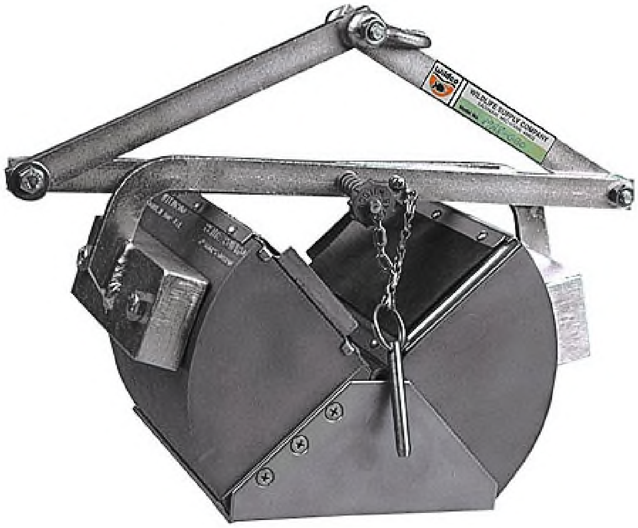

Figure 4 - Example of a Sampling Coring Device

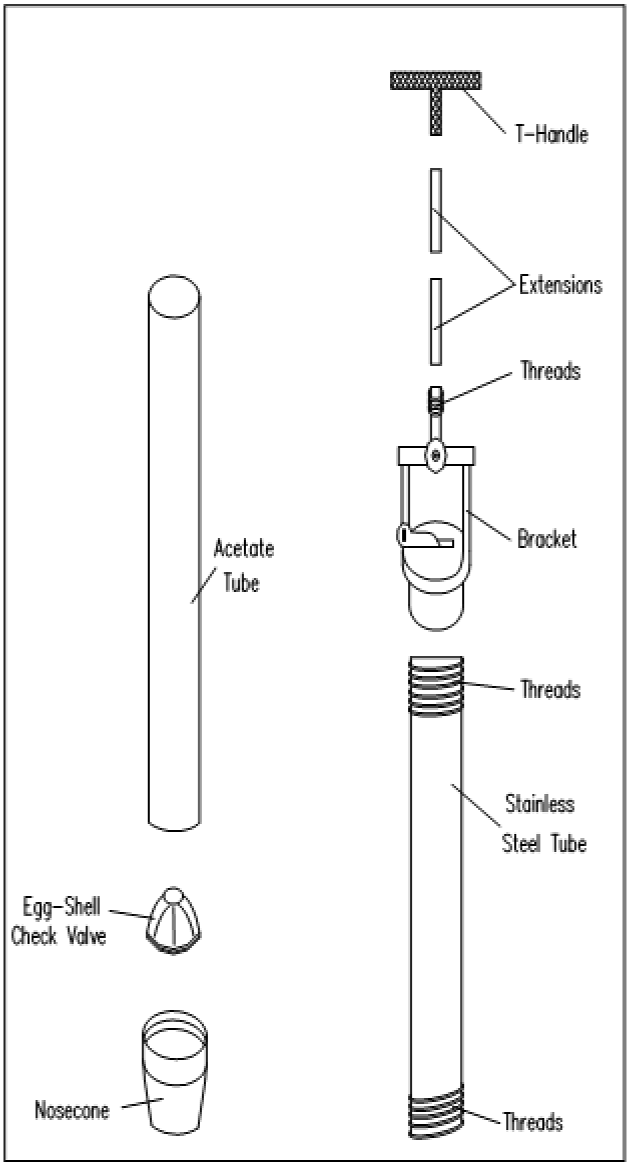

Figure 5 - Example of Vibracoring

Figure 6 - Example of an Encore Sampler

Figure 7 - Example of a Terracore Sampler

# STANDARD OPERATING PROCEDURE APPROVAL AND CHANGE FORM

Scientific, Engineering, Response and Analytical Services
2890 Woodbridge Avenue Building 209 Annex
Edison New Jersey 08837-3679

## STANDARD OPERATING PROCEDURE

Title: Surface Water Sampling

Approval Date: 07/31/2016

Effective Date: 07/31/2016

SERAS SOP Number: 2013, Rev 1.0

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The top row of this table shows the most recent changes to the controlled document. For previous revision history information, archived versions of this document are maintained by the SERAS QA/QC Officer on the SERAS local area network (LAN).

| History | Effective Date |
|---|---|
| Editorial changes | 07/31/16 |
| Added UFP QAPP preparation language to Section 1.0; training records for documenting competency to Section 9.0; data verification text to Section 10.0 | 07/31/16 |
| Rewrite of Section 3.0 | 07/31/16 |
| Added text discussing selection of samplers based on composition; and the impact of floating debris on dip samplers and of currents when using Kemmerer bottles, to Section 4.0 | 07/31/16 |
| Added field rinsing discussion to Section 7.1 | 07/31/16 |
| Rewrite of Section 7.2 | 07/31/16 |
| Deleted discussion of Van Doren and Bacon Bomb samplers from SOP | 07/31/16 |
| Rewrite of sections 7.3.2 Dip Sampler and 7.3.3 Direct Method | 07/31/16 |
| | |
| | |

CONTENTS

SUPERSEDES: SOP #2013; Revision 0.0; 02/15/02; U.S. EPA Contract 68-C99-223

## 1.0 SCOPE AND APPLICATION

This standard operating procedure (SOP) is applicable to the collection of representative surface water samples from streams, rivers, lakes, ponds, lagoons, and surface impoundments. It includes samples collected from depth, as well as samples collected from the surface.

A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The sampler needs to ensure that the methods used are adequate to satisfy the data quality objectives listed in the QAPP for a particular site.

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations or other procedural limitations. In all instances, the procedures employed must be documented on a Field Change Form and attached to the QAPP. These changes must be documented in the final deliverable

## 2.0 METHOD SUMMARY

Sampling situations vary widely due to varying water depths, velocity, sampling intervals, etc.; therefore, no universal sampling procedure can be recommended. However, surface water sampling is generally accomplished through the use of one of the following samplers or techniques:

- Kemmerer bottle
- Dip sampler
- Direct method (collecting water samples directly into the sample container)

These samplers and sampling techniques will result in the collection of representative samples from the majority of surface waters and impoundments encountered.

## 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

The amount of sample collected, along with the proper sample container type (i.e. glass, plastic), chemical preservation, and storage requirements are dependent upon the matrix sampled and analysis performed. For further information, refer to the Scientific Engineering Response and Analytical Services (SERAS) SOP #2003, *Sample Storage, Preservation and Handling*.

Whenever possible, dedicated sampling devices should be used. However, if sampling with re-usable (non-dedicated) equipment, equipment will need to be decontaminated. Refer to SERAS SOP #2006, *Sampling Equipment Decontamination*, for proper procedures.

Once samples have been collected, the following procedures should be followed:

1. Transfer the sample(s) into suitable, labeled sample containers specific for the analyses to be performed.
2. If appropriate, preserve the sample, or use pre-preserved sample bottles. Do not overfill bottles if they are pre-preserved.
3. Cap the container securely, place in a resealable plastic bag, and cool to less than or equal to (≤) 6 degrees Centigrade ($^{o}$C).
4. Record all pertinent data in the site logbook and/or on field data sheets.
5. Complete the Chain of Custody (COC) record.

6. Attach custody seals to cooler prior to shipment.
7. Decontaminate all non-dedicated sampling equipment prior to the collection of additional samples.

## 4.0 INTERFERENCES AND POTENTIAL PROBLEMS

Cross contamination problems can be eliminated or minimized through the use of dedicated or disposable sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Refer to SERAS SOP #2006, *Sampling Equipment Decontamination*, for proper procedures.

The appropriate sampling device must be of a proper composition. Selection of samplers constructed of glass, stainless steel, polyvinyl chloride (PVC) or polytetrafluoroethylene (PTFE) commonly referred to as Teflon®, should be based upon the suspected contaminants and the analyses to be performed

Improper sample collection can involve using contaminated equipment, disturbance of the stream or impoundment substrate, and sampling in an obviously disturbed or non-representative area.

Following proper decontamination procedures, minimizing disturbance of the sample site, and careful selection of sampling locations will eliminate these problems. Proper timing for the collection of samples must be taken into consideration due to tidal influences and low or fast-flowing streams or rivers.

Dip samplers may collect floating debris which may skew sample results.

Collection at a non-representative depth may result when using a Kemmerer bottle in a current, due to inaccurate depth measurements.

## 5.0 EQUIPMENT/APPARATUS

Equipment needed for collection, preservation and handling of surface water samples may include (depending on technique chosen):

- Kemmerer bottles
- Line and messengers
- Dip sampler
- Peristaltic pump
- Tygon tubing
- Polyethylene (PE) or PTFE tubing
- 0.45 micron (µm) filters
- Sample bottles
- Preservation reagents
- pH paper
- Resealable plastic bags
- Ice
- Coolers
- Inert packing material
- Sample labels
- Printer
- Chain of Custody records
- Custody seals

- Field data sheets
- Decontamination equipment/supplies
- Maps/plot plan
- Personal protective equipment (PPE)
- Compass
- Tape measure
- Survey stakes, flags, or buoys and anchors
- Vessel
- Global Positioning System (GPS) unit
- Camera
- Logbook/waterproof pen
- Paper towels
- Water quality meter

## 6.0 REAGENTS

Reagents are utilized for preservation of samples and for decontamination of sampling equipment. The preservatives depend on the analysis to be performed and are summarized in SERAS SOP #2003, *Sample Storage, Preservation and Handling.* Decontamination solutions are specified in SERAS SOP #2006, *Sampling Equipment Decontamination.*

## 7.0 PROCEDURES

### 7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and the type and amount of equipment and supplies needed.
2. Obtain the necessary sampling and monitoring equipment.
3. Decontaminate or pre-clean equipment, and ensure that it is in working order.
4. Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate.
5. Use stakes, flags, or buoys to identify and mark all sampling locations identified by GPS data. If required, the proposed locations may be adjusted based on site access, property boundaries, and obstructions.
6. Field Rinsing - Once field work has begun, and before samples are collected, the sample-wetted portions of most of the collection and processing equipment require a field rinse with native water. Field rinsing helps to condition, or equilibrate, sampling equipment to the sample environment. Rinsing also serves to ensure that all cleaning-solution residues have been removed. **Note –** Do not field rinse pre-preserved bottles or when collecting volatile organic compounds (VOCs).

### 7.2 Representative Sampling Considerations

In order to collect a representative sample, the hydrology and characteristics of a stream, river, pond, lake or impoundment should be determined prior to sampling. This will aid in determining the presence of separate phases or layers in lagoons or impoundments, flow patterns in streams, and appropriate sample locations and depths. Location of sampling will depend on project goals and conditions. For example, in a stream or river the sample should be collected at a location where the velocity is sufficient to prevent deposition of solids and should have relatively uniform flow. In moving water, the sampler must always stand downstream of the collected sample. Care must be taken to avoid introducing re-suspended sediment into the sample, particularly in small stagnant ponds. Recent storm events may dilute contamination or bring contaminants from upstream sources and should be taken into consideration when collecting samples. In addition, present or recent storm events will alter water quality data. Storm event data should be recorded in logbooks to help evaluate the data.

7.2.1 Water Quality Data

Water quality data, including pH, conductivity, oxygen reductions potential (ORP), and dissolved oxygen (DO) may be collected in ponds, lakes and impoundments to determine if stratification is present. Measurement intervals will depend on many factors (i.e. total depth, location access, site conditions, etc). A determination will be made prior to collecting any water quality data as to depth(s) and frequency of measurements. These measurement intervals should be as consistent as possible throughout the sampling event. Depth intervals should be documented in the QAPP, any changes should be documented in a field logbook. Refer to SERAS SOP # 2041, *Operation of the Water Quality Multi-Parameter Meters*, for more information on how to collect the necessary water quality data.

7.2.2 Sampling Methods

Factors that contribute to the selection of a sampling method are:

- Width, depth, flow and accessibility of the location being sampled
- Whether the sample will be collected onshore or offshore

Kemmerer bottles (Figure 1, Appendix A) may be used in most situations where site access is from a boat or structure, such as a bridge or pier, and where samples at specific depths are required.

Dip samplers (Figure 2, Appendix A) are useful in situations where a sample is to be recovered from an outfall pipe or along a lagoon bank where direct access to the sample point is not feasible.

The direct method may be utilized to collect water samples from streams, rivers, lakes, and other surface waters directly into the sample container(s).

## 7.3 Sample Collection

7.3.1 Kemmerer Bottle

Sampling procedures for a Kemmerer Bottle are as follows:

1. Use a properly decontaminated Kemmerer bottle. Set the sampling device so that the upper and lower stoppers are pulled away from the body, allowing the surface water to enter tube.
2. Lower the pre-set sampling device to the predetermined depth. Avoid disturbance of the bottom.
3. When the Kemmerer bottle is at the required depth, send the weighted messenger

down the suspension line to close the sampling device.

4. Retrieve the sampler and discharge the first 10-20 milliliters (mL) from the drain to clear potential contamination from the valve. Fill sample containers for VOC samples first as these samples should not be composited. This procedure may be repeated if additional sample volume is needed to fulfill analytical requirements. Subsequent grabs may be composited or transferred directly to appropriate sample containers.

### 7.3.2 Dip Sampler

Sampling procedures for a Dip Sampler are as follows:

1. If necessary, assemble the device in accordance with the manufacturer's instructions.
2. Extend the device to the sample location and collect the sample by dipping the sampler into the water.
3. Retrieve the sampler and transfer the sample to the appropriate sample container(s).

### 7.3.3 Direct Method

For streams, rivers, lakes, and other surface waters, the direct method may be utilized to collect water samples directly into the sample container(s). Health and safety considerations must be addressed when sampling lagoons or other impoundments where specific conditions may exist that warrant the use of additional safety equipment. These issues must be addressed in the site-specific Health and Safety Plan (HASP).

Using adequate protective clothing for wading or boats, access the sampling station from a downstream location, walking upstream so as to not disturb sediments and suspending them into the water column. Collect water quality information for the sampling location and record in the site log book or field data sheets. For shallow stream stations, collect the sample under the water surface while pointing the sample container upstream; the container must be upstream of the collector. Avoid disturbing the substrate. For lakes and other impoundments, collect the sample under the water surface while avoiding surface debris and boat wake. Pre-preserved sample bottles cannot be used for this sampling method.

Surface water samples may also be collected directly by using a peristaltic pump with PE or PTFE lined tubing. This method is also used when collecting filtered samples.

## 8.0 CALCULATIONS

This section is not applicable to this SOP.

## 9.0 QUALITY ASSURANCE/QUALITY CONTROL

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

1. All data must be documented on field data sheets or in site logbooks.
2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Calibration of equipment must occur prior to sampling/operation and must be documented in the site log book or field data sheets.
3. To avoid the incidental inclusion of disturbed sediment in the sample, multiple surface water samples should be collected from a downstream to upstream direction and upstream of any activity that may disturb the sediment (i.e., wading).
4. While collecting surface water using the direct method, the sample container should be opened below the surface to avoid the collection of floating debris.
5. Water quality data (pH, specific conductivity, ORP, temperature, and DO) may be collected to detect the presence of stratified layers or other site-specific characteristics that would affect the sample.
6. The competency of field personnel must be demonstrated and documented.

Additional Quality Assurance/Quality Control (QA/QC) Samples should be collected as outlined in the QAPP for each specific site. Further information on QA/QC Samples can be located in SERAS SOP #2005, *Quality Assurance/Quality Control Samples*.

## 10.0 DATA VALIDATION

Data verification/completeness checks must be conducted to ensure project-specific quality objectives have been met as defined in the corresponding UFP-QAPP. The SERAS Task Leader is responsible for completing the UFP-QAPP verification checklist for each project.

## 11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, Occupational Health and Safety Administration (OSHA) and/or corporate health and safety procedures.

When sampling lagoons or surface impoundments containing known or suspected hazardous substances, adequate health and safety and boating precautions must be taken to ensure the safety of sampling personnel. Refer to SERAS SOP #3023, *Boat Safety* and SERAS SOP #3016, *Personal Protective Equipment Program*.

## 12.0 REFERENCES

Wilde, F.D., D.B. Radtke, J. Gibs and R.T. Iwatsubo. 1998. National Field Manual for the Collection of Water-Quality Data - Selection of Equipment for Water Sampling. U.S. Geological Survey Techniques of Water - Resources Investigations, Book 9, Chap. A2, variously paged.

U.S. Environmental Protection Agency. 1984. Characterization of Hazardous Waste Sites - A Methods Manual: Volume II. Available Sampling Methods, Second Edition. EPA/600/4-84-076.

## 13.0 APPENDICES

A - Figures

APPENDIX A
Figures
SOP #2013
July 2016

FIGURE 1. Kemmerer Bottle

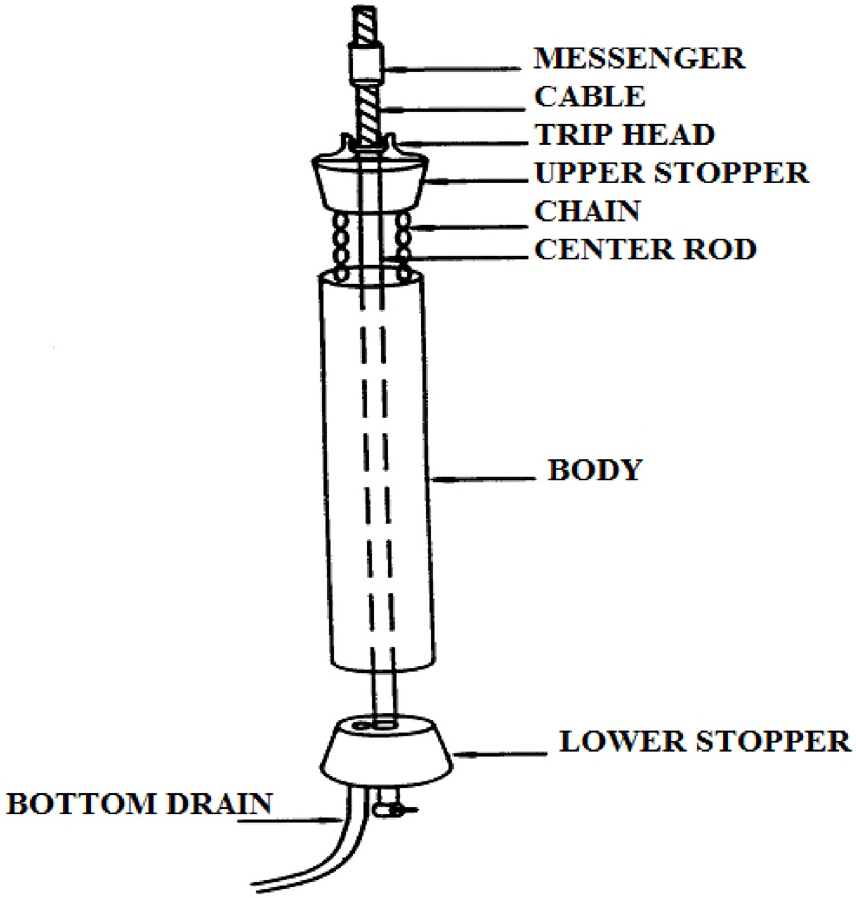


FIGURE 2. Dip Sampler

# STANDARD OPERATING PROCEDURES

SOP: ERT-PROC-2001-20
PAGE: 1 of 9
REV: 1.0
EFFECTIVE DATE: 10/19/20

# GENERAL FIELD SAMPLING GUIDELINES

CONTENTS

*The policies and procedures established in this document are intended solely for the guidance of OLEM employees of the U.S. Environmental Protection Agency (EPA). They are not intended and cannot be relied upon to create any rights, substantive or procedural, enforceable by any party in litigation with the United States. EPA reserves the right to act at variance with these policies and procedures, and to change them at any time without public notice. EPA strongly encourages all readers to verify the validity of the information contained in this document by consulting the most recent Code of Federal Regulations (CFR) and updated guidance documents.*

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

## 1.0 OBJECTIVE

The objective of this standard operating procedure (SOP) is to describe the general field sampling techniques and guidelines that will assist in planning, choosing sampling strategies and sampling locations, and frequency of Quality Control (QC) samples for proper assessment of site characteristics. The ultimate goal is to ensure data quality during field collection activities.

A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The sampler needs to ensure the methods used are adequate to satisfy the data quality objectives (DQOs).

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations or other procedural limitations. In all instances, the procedures employed must be documented on a Field Change Form and attached to the QAPP. These changes must be documented in the final deliverable.

## 2.0 APPLICABILITY

This SOP applies to the collection of aqueous and non-aqueous samples for subsequent laboratory analysis to determine the presence, type, and extent of contamination at a site.

## 3.0 DESCRIPTION

Representative sampling ensures that a sample or a group of samples accurately reflect the target population from which the sample(s) are intended to draw conclusions about. Depending on the contaminant of concern and matrix, several environmental and logistical variables may contribute to uncertainty in sampling design, which may affect the representativeness of the samples and subsequent measurements. Environmental variability can occur due to non-uniform distribution of the pollutant due to topographic, meteorological and hydrogeological factors, changes in species, and dispersion of contaminants and flow rates. Logistical variables including restricted or limited access to areas for sampling due to health and safety concerns, physical obstructions, or inability to obtain access agreements may affect the spatial representativeness of the sampling design and/or preclude samples from being collected in areas of interest.

Determining the sampling approach depends on what is known about the site from prior sampling (if any) and the site history, variation of the contaminant concentrations throughout a site, potential migration pathways, and human and environmental receptors. The objectives of an investigation determine the appropriate sampling design.

The frequency of sampling and the specific sample locations that are required must be defined in the site-specific QAPP.

### 3.1 Planning Stage

The objectives of an investigation are established and documented in the site-specific QAPP. The technical approach including the media/matrix to be sampled, sampling equipment to be used, sampling design and rationale, and SOPs or descriptions of the procedure to be implemented are included in the QAPP. Refer to the matrix-specific SOPs for sampling techniques which include the equipment required for sampling.

During the planning stage, the DQOs will be determined. In turn, the project's DQOs will determine the need for screening data or definitive data. Screening data supports an intermediate or preliminary decision but eventually is supported by definitive data before the project is complete (i.e., placement of monitor wells, estimation of extent of contamination). Definitive data is suitable for final decision making, has defined precision and accuracy requirements and is legally defensible (i.e., risk assessments, site closures).

## 3.2. Sampling Design

A sample design specifies the number of samples to be collected for each matrix of concern, the measurements which will be conducted on those samples, where the samples will be collected (downstream of the contaminant release, along a grid, etc.) and how the samples will be collected (discrete or composite samples, seasonally, etc.). The DQOs for a Site assist in selecting the appropriate sampling design for the population of concern (e.g., lead concentrations in residential soil, contaminant uptake in plants, polychlorinated biphenyl [PCB] levels in a specific reach of a river). Other factors may include logistical, measurement and budgetary constraints, such as accessibility to the sampling area, analytical instrument sensitivity or manpower availability. EPA QA/G-5S, *Guidance on Choosing a Sampling Design for Environmental Data Collection*, provides detailed guidance on the selection of a representative sampling design.

There are two main categories of environmental sampling designs:

1. Judgmental, also known as biased or targeted sampling; and
2. Probability-based sampling, which includes, but is not limited to, simple random, systematic, ranked set, stratified and cluster sampling.

Judgmental sampling is based on expert/technical knowledge of the site, known contaminant pathways and the chemical/physical processes associated with the contaminants of concern (COCs). It can be less expensive than probability-based sampling as it is typically quicker to implement. It is often used to target sampling in areas where there have been known chemical spills or visible staining of the matrix of concern. Because it is based on professional judgment, the reliability and precision of the results cannot be quantified using statistical assessments. The interpretation of the sampling results is dependent on personal interpretation.

Although probabilistic sampling is often more costly in time and implementation, this type of design allows for the assessment of the uncertainty associated with the sampling results and provides reproducible results, if performed accurately. Probability-based sampling includes a random/unbiased component for locating samples. Inferential statistics can be used to extend the measured results of the sampling efforts to the larger population of concern and statistical limits can be computed assessing the variability of the measurements. Probabilistic sampling is used when DQOs include the need to obtain the mean or median concentration across an area of concern, establish variability of the COC(s), perform trend analyses, determine the probability of exceeding an actionable level, locate hot spot(s) within a designated area, compare reference and on-site COCs, and establish background levels of COCs. There are many more applications of probabilistic-sampling. Simple random, systematic and stratified random sampling are the most commonly applied sampling designs in assessing environmental sites.

### 3.2.1 Judgmental Sampling

Judgmental sampling is the subjective selection of sampling locations based on the professional judgment of the field team. This method is useful to locate and to identify potential sources of contamination when there is reliable historical and physical knowledge about a relatively small feature or condition. It may not be representative of the full site and is used to document worst case scenarios. For example, groundwater sampling points are typically chosen based on professional judgment, whether permanently installed wells or temporary well points. Judgmental sampling may also be implemented at a site when there are schedule and budget limitations, or to determine if there are contaminant "hotspots" that require further investigation using an extensive probability-based sampling design. For example, judgmental sampling may be used to identify multiple areas of contaminated soil, and a subsequent probability-based sampling design can be used to fully delineate the extent of the contaminated soil in each area within a specified level of uncertainty.

### 3.2.2 Simple Random Sampling

In simple random sampling, sample locations are selected randomly. For example, random pairs of coordinates could be selected from an area where soil sampling is planned. The simple random sampling approach is applied when there are many sample locations and the concentrations are assumed to be homogeneous across a site with respect to the parameter(s) that are going to be analyzed or monitored for. Simple random sampling can also be used to select an initial sample location in a systematic and stratified sampling design.

### 3.2.3 Systematic Sampling

Systematic grid sampling involves the collection of samples at fixed intervals when the contamination is assumed to be randomly distributed. A random point is chosen as the origin for the placement of the grid. A grid is constructed over a site and samples are collected from the nodes (where the grid lines intersect). Depending on the number of samples that are required to be collected, the distance between the sampling locations can be adjusted. The representativeness of the sampling may be improved by shortening the distance between sample locations.

Systematic random sampling is used for estimating contaminant concentrations within grid cells. Instead of sampling at each node, a random location is chosen within each grid cell. The systematic grid and random sampling approaches are useful for delineating the extent of contamination, documenting the attainment of clean-up goals, and evaluating and determining treatment and disposal options.

Transect sampling involves one or more transect lines established across the site. Samples are collected at systematic intervals along the transect lines. The number of samples to be collected and the length of the transect line determines the spacing between the sampling points. This type of sampling design is useful for delineating the extent of contamination at a particular site, for documenting the attainment of clean-up goals, and for evaluating and determining treatment and disposal options.

### 3.2.4 Stratified Sampling

Stratified sampling involves separating a site with heterogenous conditions into multiple homogenous strata. It is useful when a heterogeneous population or area can be broken down into regions with less variability within the boundaries of a stratum then between the strata. Professional judgement, historical information, site observations, exposure to ecological and human receptors, soil type, fate and transport mechanisms, and other site-specific factors can be used to separate a sampling area into multiple strata. Additionally, strata can be defined based on the decisions that will be made. Sampling locations can be selected from each stratum using professional judgment, random sampling, or systematic sampling. Using a systematic sampling design within each stratum, with varying sample densities between different strata, ensures that areas of the site thought to have higher variability in contaminant concentrations and/or thought to be within the boundaries of uncertainty surrounding decision levels are sampled at a higher spatial resolution. This method still maintains a representative and unbiased sample design within each stratum.

## 3.3 Sampling Techniques

Sampling is the selection of a representative portion of a larger population or body (i.e. target population). The primary objective of all sampling activities is to characterize a site accurately in a way that the impact on human health and the environment can be evaluated appropriately.

### 3.3.1 Sample Collection Techniques

Sample collection techniques may be either grab or composite. A grab sample is a discrete aliquot representative of a specific location at a given time and collected all at once from one location. The representativeness of such samples is defined by the nature of the materials that are sampled. Samples collected for volatile organic compounds (VOCs) are always grab samples and are never homogenized. Composite samples are non-discrete samples composed of more than one specific aliquot collected at selected sampling locations. Composite samples must be homogenized by mixing prior to putting the sample into containers. Composite samples can, in certain instances, be used as an alternative to analyzing a number of individual grab samples and calculating an average value. Incremental sampling conducted over a grid is a special case of composite sampling and is detailed in U.S. EPA Environmental Response Team (ERT) SOP, *Incremental Soil Sampling*. Choice of collecting discrete or composite samples is based on project's DQOs.

### 3.3.2 Homogenization

Mixing of soil and sediment samples is critical to obtain a representative sample. An adequate volume/weight of sample is collected and placed in a stainless steel or Teflon® container, and is thoroughly mixed using a spatula or spoon made of an inert material. Once the sample is thoroughly mixed the sample is placed into sample containers specific for an analysis. Avoid the use of equipment made of plastic or polyvinyl chloride (PVC) when sampling for organic compounds when the reporting limit (RL) is in the parts per billion (ppb) or parts per trillion (ppt) ranges. Refer to ERT SOP, *Soil Sampling*, for more details on homogenization.

### 3.3.3 Filtration

In-line filters are used specifically for collecting groundwater samples for dissolved metals analysis and for filtering large volumes of turbid groundwater. Groundwater samples collected for VOCs are typically not filtered due to potential VOC losses. Filtering groundwater is performed to remove silt particulates from samples to prevent interference with the laboratory analysis. The filters used in groundwater sampling are either cartridge type filters inserted into a reusable housing, or are self-contained and disposable. Filter chambers are usually made of polypropylene housing an inert filtering material that removes particles larger than 0.45 micrometers (µm). Refer to ERT SOP, *Groundwater Well Sampling* and ERT SOP, *Surface Water Sampling*, for more details on filtration techniques.

### 3.4 Quality Assurance /Quality Control Samples

QA/QC samples provide an evaluation of both the laboratory's and the field sampling team's performance. Including QA/QC samples in a sampling design allows for identifying and measuring sources of error potentially introduced from the time of sample collection through analysis. The most common QA/QC samples collected in the field are collocated field duplicates, field replicates, equipment blanks and field blanks. Trip blanks are typically added for each matrix in each cooler used to ship VOC samples and are prepared prior to going into the field preferably by the laboratory that will be performing the analyses. Extra volume/mass is collected for a matrix spike/matrix spike duplicate (MS/MSD) at a frequency of 5 percent (%; one in 20 samples). Spiking is performed in the laboratory. For additional information or other QA/QC samples pertinent to sample analysis, refer to ERT SOP, *Quality Assurance/Quality Control Samples*.

Collocated field duplicates may be collected based on site objectives and used to measure variability and precision associated with the sampling process including sample heterogeneity, sampling methodology, and analytical procedures. Field replicates are field samples obtained from one location, homogenized, and divided into separate containers. This is useful for determining whether the sample has been homogenized properly. Equipment blanks (also known as rinsate blanks) are typically collected at a rate of one per day. The equipment blank is used to evaluate the relative cleanliness and the decontamination methods of non-dedicated equipment. Refer to ERT SOP, *Sampling Equipment Decontamination,* for more details regarding decontaminating non-dedicated equipment.

### 3.5 Sample Containers, Preservation, Storage and Holding Times

The amount of sample to be collected, the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix sampled and the analyses to be conducted. This information is provided in ERT SOP, *Sample Storage, Preservation, and Handling*. Field personnel need to be cognizant of any short holding times that warrant immediate shipment/transfer to the laboratory.

### 3.6 Documentation

Field conditions and site activities must be documented. Scribe will be used to document sample information and generate chain of custody records. Other field measurements not typically entered into Scribe will be documented in a site-specific logbook or in a personal logbook. All sample documentation will be maintained in accordance with ERT SOP, *Sample Documentation* and ERT SOP, *Chain of Custody Procedures.*

## 4.0 RESPONSIBILITIES

### 4.1 ERT Work Assignment Manager

The ERT WAM is responsible for providing technical expertise and technical direction to the contractor, preparing task orders/work assignments, reviewing deliverables, interacting with the Regional customers and monitoring the financial and administrative management of the project.

### 4.2 ERT Quality Control Coordinator

The ERT Quality Coordinator provides quality assurance oversight for all projects and implements/maintains the ERT Quality Assurance Program.

### 4.3 ERT Contractor Task Leaders

Task Leaders (TLs) are responsible for the overall management of the project. Task Leader responsibilities include ensuring that field personnel are well informed of the sampling requirements for a specific project and that SOP and QA/QC procedures stated in the site-specific QAPP are adhered to, issuing a Field Change Form that documents any changes to sampling activities after the QAPP has been approved and maintaining sample documentation.

### 4.4 ERT Contractor Field Personnel

Field personnel are responsible for reading the QAPP prior to site activities and performing sample collection activities as written. They are responsible for notifying the TL of deviations from sample collection protocols which occurred during the execution of sampling activities. Field staff will collect samples and prepare documentation in accordance with ERT SOP, *Sample Documentation*. In addition, field personnel are responsible for reading and conforming to the approved site-specific Health and Safety Plan (HASP).

### 4.5 ERT Contractor QA/QC Officer

The contractor's QA/QC Officer is responsible for reviewing this SOP and ensuring that the information in this SOP is updated on a timely basis. Compliance to this SOP may be monitored by either conducting a field audit or reviewing deliverables prepared by the contractor's TL.

### 4.6 ERT Contractor Health and Safety Officer

Based on OSHA requirements, a site-specific health and safety plan (HASP) must be prepared for response operations under the Hazardous Waste Operations and Emergency Response (HAZWOPER) standard, 29 CFR 1910.120. Field personnel working for EPA's ERT should consult the Emergency Responder Health and Safety Manual currently located at https://response.epa.gov/_HealthSafetyManual/manual-index.htm for the development of the HASP, required personal protective equipment (PPE) and respiratory protection.

The contractor's Health and Safety Officer (HSO) is responsible for ensuring that a HASP has been written and approved prior to field activities. Additionally, the contractor's HSO is responsible for ensuring that the contractor's site personnel H&S training and that their medical monitoring is current.

## 5.0 REFERENCES

U.S. EPA. 2006. Guidance on Systematic Planning using the Data Quality Objectives Process (QA/G-4), EPA/240/B-06/001, February 2006.

U.S. EPA. 2002. Guidance on Choosing a Sampling Design for Environmental Data Collection (QA/G-5S), EPA/240/R-02/005, December 2002.

## 6.0 APPENDICES

This section is not applicable to this SOP.

# GROUNDWATER WELL SAMPLING

## CONTENTS

CONTENTS (cont.)

*The policies and procedures established in this document are intended solely for the guidance of OLEM employees of the U.S. Environmental Protection Agency (EPA). They are not intended and cannot be relied upon to create any rights, substantive or procedural, enforceable by any party in litigation with the United States. EPA reserves the right to act at variance with these policies and procedures, and to change them at any time without public notice. EPA strongly encourages all readers to verify the validity of the information contained in this document by consulting the most recent Code of Federal Regulations (CFR) and updated guidance documents.*

## 1.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) provides general information on how to collect groundwater samples from monitor wells and other wells for field screening or laboratory analysis. The procedures in this SOP are designed for sampling in conjunction with analysis of the most common groundwater contaminants, i.e. volatile and semi-volatile organic compounds (VOCs and SVOCs), pesticides, herbicides, polychlorinated biphenyls (PCBs) and metals including cyanide. A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The sampler needs to ensure the methods used are adequate to satisfy the data quality objectives listed in the site specific QAPP (Environmental Response Team [ERT] SOP, *Preparation of Quality Assurance Project Plans (QAPPs) Using Uniform Federal Policy Format*).

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations or other procedural limitations. In all instances, the procedures employed must be documented on a Field Change Form and attached to the QAPP. These changes must be documented in the final deliverable.

## 2.0 METHOD SUMMARY

Three methods are generally accepted to collect a groundwater sample from a well for field screening or laboratory analysis: high-flow sampling, low-flow sampling and no-purge sampling. Historically, a high-flow purging method has been used for groundwater sampling. In the mid-1990s, low-flow (low stress) purging and sampling evolved using low pumping rates. No-purge sampling devices, which began to appear in the late 1990s and early 2000s, enabled collecting a sample without the pumping or purging of groundwater prior to sampling.

### 2.1 High-Flow Purging and Sampling

An adequate purge is normally achieved using this method by removing three well volumes of standing groundwater at relatively high flow rates prior to sampling while recording the pumping rate, discharge volume, water level and routine groundwater parameters over time. Routine groundwater parameters may include pH, specific electrical conductance, turbidity, temperature, dissolved oxygen and oxidation-reduction potential (ORP). It is assumed that stabilization of the groundwater measurements indicates the purge water is representative of ambient water from the underlying aquifer. Groundwater quality parameters are generally considered stabilized after three consecutive sets of readings do not vary by more than 10 percent (%). The time between readings (typically 5 to 10 minutes) should be chosen to ensure enough data have been collected to document the stability of parameters. If the calculated purge volume is large, measurements taken every 15 minutes may be adequate. If the field parameters do not stabilize after three well volumes have been removed, a decision to continue purging or to collect a sample should be made by the ERT Work Assignment Manager (WAM).

### 2.2 Low-Flow Purging and Sampling

This method minimizes the purge water volume removed, the water level drawdown, and the turbidity and aeration of the groundwater by using low purging and sampling rates, generally less than 1 liter per minute (lpm) or 0.26 gallon per minute (gpm). The pump intake is set within the zone of highest contaminant concentration or flux in the screened interval, if known. Otherwise, it is placed at the midpoint of the screened interval or open borehole. The water level in the well is maintained near the static level (within 0.3-foot) during purging and sampling. Water quality parameters (pH, specific electrical conductance, temperature, turbidity, dissolved oxygen and ORP) are monitored for stability during purging to indicate when sampling may commence. It is assumed that vertical flow within the well is not occurring.

### 2.3 FLUTe Well Sampling

A FLUTe well consists of a downhole liner with multiple sampling ports. Once installed the sampling system is used to purge and sample the well. The sampling system consists of a manifold, valves, tubing and a nitrogen cylinder. The process involves attaching a nitrogen supply line from the manifold to a downhole airline (U-line) to the desired port. The nitrogen supply line from the manifold is now attached to the nitrogen cylinder. The nitrogen fills the U-line at a specific pressure, flushing purge water from the sample port. This port will then be purged dry then allowed to recharge for 5 to 10 minutes (dependent upon recharge) then purging again. This process will be repeated at least three times. Once the purging has been completed a waiting period of 10 to 15 minutes will be observed and the sample can then be collected through the sample/purge line. This procedure will be applied to all sampling ports until completion.

Note: Refer to the FLUTe well installation specifications for the exact nitrogen pressure (PSI) rating. Purging and sampling the well at the wrong PSI may damage the well.

### 2.4 No-Purge Discrete Sampling

Passive sampling techniques do not involve purging or pumping of the well before collection of a groundwater sample. A discrete sample is collected at a specific location in the well using a grab, diffusion, or adsorption device. These samplers are typically placed in the well and allowed to equilibrate during a deployment period before a sample is collected. Well water within the screened or open interval is assumed to be in equilibrium with the aquifer water and it is also assumed that there is no vertical flow of groundwater in the well.

## 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

The analytical method specifies the type of bottle, preservative, holding time and filtering requirements for a groundwater sample. Samples should be collected, when possible, directly from the sampling device into appropriate sample containers. Check that a Teflon liner is present inside the cap of the sample container, if required. Attach a sample identification label. Record all pertinent data in a site-specific logbook. A chain of custody (COC) record will be generated using Scribe.

The samples should be placed in a cooler and maintained at less than or equal (≤) to 6 degrees Celsius ($^{O}$C) and protected from sunlight. Ideally, samples should be shipped within 24 hours of collection. If large numbers of samples are being collected, shipments may occur on a regular basis after consulting the analytical laboratory where the samples will be shipped for analysis. In all circumstances, samples need to be shipped and analyzed before the holding time expires.

Due to the trace levels at which VOCs are detectable, potential of cross-contamination and the introduction of contaminants must be avoided. Treatment of the sample with sodium thiosulfate preservative is required only if there is residual chlorine in the water that could cause free radical chlorination and change the identity of the original contaminants. This preservative should not be used if there is no chlorine in the water. Quality assurance/quality control (QA/QC) samples are incorporated into the shipment package to provide a check for cross-contamination. Samples for the analysis SVOC, pesticides, herbicides and PCBs do not normally require preservation. Samples for the analysis of VOCs typically require preservation with hydrochloric acid prior to shipment to the laboratory. Groundwater samples collected for metals and cyanide analyses are required to be adjusted with nitric acid to a pH of less than (<) 2 and sodium hydroxide to a pH of greater than (>) 12, respectively. In the event a geo-unit has undergone chemical treatment efforts should be taken to neutralize the treatment chemical within the sample container (e.g., Ascorbic Acid for Sodium Persulfate). For further details refer to ERT SOP, *Sample Storage, Preservation and Handling*.

## 4.0 INTERFERENCES AND POTENTIAL PROBLEMS

### 4.1 Effects Caused by Well Installation and Development

The main goal of most well sampling is to obtain a sample that represents the groundwater in a specific location in an aquifer. Improperly installed (i.e. faulty filter pack or poorly grouted seal) or inadequately developed wells may not provide representative groundwater samples. Installation and development logs for the wells to be sampled should be reviewed prior to mobilizing to the field. Newly installed wells should generally not be sampled until at least 24 hours after development.

### 4.2 Effects Caused by Change in Sample Environment

In-situ groundwater is usually under different conditions of aeration/oxidation, pressure, gas content and temperature than those found at the ground surface. Therefore, the chemical composition of the groundwater may change between the time of collection and the time of analysis. It may be difficult to avoid some of those changes. However, proper sample collection and preparation procedures should be used to minimize chemical changes in groundwater samples.

### 4.3 Presence of Immiscible Fluids

The presence of a floating or sinking organic layer in a well may require re-evaluation of the sampling design. Wells containing Light Non-Aqueous Phase Liquid (LNAPL) are generally not sampled for dissolved concentrations of VOCs and SVOCs (i.e. usually petroleum-derived products). LNAPL can usually be detected on top of the water column in a well using an interface probe, clear bailer or steel tape with color-gauge water finding paste. Wells containing dense non-aqueous phase liquid (DNAPL) are often sampled for VOCs, SVOCs, or PCBs. DNAPL can be detected at the bottom of the water column in a well using an interface probe or clear bailer.

## 5.0 EQUIPMENT/APPARATUS

All equipment used in groundwater purging and sampling must be constructed of materials that do not introduce contaminants or alter the contaminants being investigated. The devices used in groundwater purging and sampling of wells for a variety of contaminants are listed in Table 1, Appendix A, in Figures 1 through 10, Appendix B and discussed below.

## 5.1 Bailers

Bailers are best suited to sampling shallow or small diameter wells. Other devices may be more appropriate for deep, larger diameter wells that require removal of large volumes of water. Bailers are generally not recommended for the collection of groundwater samples. Bailers consist of a rigid length of tube, with a ball check-valve at the bottom (standard bailer) or top and bottom (point-source bailer). The four most common types of bailers are made of poly-vinyl chloride (PVC), polyethylene, Teflon and stainless steel. A non-reactive line is used to lower and raise the bailer in the well.

Advantages:

- No power source needed
- Portable
- Inexpensive
- Dedicated, the potential of cross-contamination is minimal
- Readily available
- Simple method for removing small volumes of purge water
- Does not subject the sample to pressure extremes

Disadvantages:

- Time-consuming to purge large volumes of groundwater from well
- The valve at the bottom of the bailer often leaks; thus, the potential exists to lose part of the sample
- Bailing may disturb the water column causing changes to the field parameters to be measured
- May result in aeration of the groundwater and stripping of VOCs and SVOCs from the sample

## 5.2 No Purge Samplers

No purge or passive samplers make it possible to collect groundwater samples without pumping or purging a well. These samplers are lowered to a desired depth within the screened interval or open borehole. Most of these samplers can be stacked to obtain samples at a series of depths. They can provide reproducible and accurate data, if correctly used for sampling. There are three main categories of no purge samplers currently available, they include:

1. Grab-type samplers provide an instantaneous representation of analyte concentrations within the discrete interval to which they are lowered. These are activated by pulling up, using an up and down motion, or triggering at the surface. These samplers cannot all be used to collect groundwater samples for every type of chemical analysis; therefore, the manufacturer’s instructions should be consulted to determine if the target analyte can be sampled with a specific device. Sampler capacities range from 40 milliliters (mL) to over 4 liters (L) but may not provide a sufficient volume of water to enable testing for all chemicals of concern during a single deployment. Some of these samplers are designed to be left in the well for an equilibration period prior to sampling. This period allows the natural conditions to be re-established following any disturbances caused by deploying the sampler down well through the water column.

Some common grab-type samplers include:

- HydraSleev
- Snap Sampler
- Discrete Interval Sampler (DIS)
- Kemmerer Sampler

2. Diffusion-equilibrium samplers rely on diffusion of the analytes to attain equilibrium between the sampler and the groundwater. Equilibration times vary from several days to a few weeks depending on the type of sampler, conditions in the well, transmissivity of the aquifer or natural flushing rate of the well, and properties of the contaminant (ITRC, 2006). The minimum recommended time between deploying and retrieving these samplers is generally two weeks. Typically, the samples contain time-averaged concentrations from the last few days of the deployment period.

   Some common diffusion-equilibrium-type samplers include:
   - Regenerated-Cellulose Dialysis Membrane Sampler (RCDMS)
   - Nylon-Screen Passive Diffusion Sampler (NSPDS)
   - Polyethylene Diffusion Bag Sampler (PDB)
   - Rigid Porous Polyethylene Sampler (RPPS)

### 5.3 FLUTe Well Sampling System

The FLUTe sampling system consists of a manifold, valves, tubing and a nitrogen cylinder. The manifold consists of multiple valves and is a connection point for the nitrogen supply line and downhole airline or (U-line). A water level indicator will be deployed down the water line or (Tag Line) to ensure the groundwater is at the appropriate depth and to ensure the FLUTe liner is intact. Once the water level measurements have been recorded, the sampling process may begin.

Note: Refer to the FLUTe well installation specifications for the exact nitrogen pressure (PSI) setting. Purging and sampling the well at the wrong PSI may damage the well.

Advantages:

- The FLUTe system allows the installation of multiple wells or sampling intervals within one well. In theory, it's more cost effective as only one well has to be installed as opposed to the sampling of multiple wells.
- Sampling is relatively quick as there is very little volume to purge.

Disadvantages:

- Specialized equipment and supplies are required for the well sampling

### 5.4 Positive Displacement Pumps

Three types of positive displacement pumps typically used for purging and sampling of groundwater wells are bladder, gear-drive, and centrifugal. Positive displacement pumps designed for groundwater monitoring are constructed of non-sorptive materials (stainless steel, Viton and Teflon). Heat dissipated by submersible pump motors (i.e. gear-drive and centrifugal) may increase the sample temperature, causing loss of dissolved VOCs and precipitation of dissolved metals (Nielsen and Nielsen, 2006). Some positive displacement pumps can be easily disassembled for cleaning. However, decontamination of certain centrifugal pumps may be difficult and labor intensive as they contain a number of intricate parts.

Bladder pumps consist of the housing, bladder assembly and intake screen/filter. The housing and intake screen are constructed of stainless steel or PVC, while the replaceable bladder cartridge is made of Teflon or low-density polyethylene (LDPE). Air supply and discharge lines extend to the pump from the surface. Compressed air (typically nitrogen or ultra-zero air) is alternately applied to the supply line using a pump controller at the surface. The on/off cycles of compressed air squeeze the bladder to displace water out of the pump toward the surface then exhaust to allow the bladder to refill. Water enters the pump under hydrostatic pressure through an inlet check valve at the bottom of the pump. A check valve above the bladder prevents back flow into the pump from the discharge line. Bladder pumps can be either portable if the wells are shallow or dedicated if the wells are deep. Portable bladder pumps are limited to a depth of approximately 200 feet; whereas, dedicated bladder pumps are limited to a depth of approximately 1000 feet. Bladder pumps can be used to purge and sample groundwater wells for any type of analyte.

Gear-drive pumps use an electric motor to rotate two meshing gears (a drive gear and an idler made of Teflon). The gears trap and move the water upward from the pump inlet to the discharge line. They can be powered using 12, 24 and 36 volt direct current (VDC) batteries or 110 and 220 volt alternating current (VAC) with an inverter. Fultz Pumps, Inc. makes two models (SP-300 and SP-400) of gear-drive pumps for groundwater monitoring with a lift capability of up to approximately 200 feet. A controller allows the pump flow rate to be adjusted at the surface.

Centrifugal pumps use electric motors to spin or rotate an impeller or series of impellers, which creates centrifugal force, and develops the pressure to move water through the discharge line to the surface. These pumps are available in both variable-speed and fixed-speed configurations. A variable-frequency drive (VFD) controller at the surface enables the discharge rate to be adjusted for the pump. Common models of VFD centrifugal pumps are the Grundfos® Redi-Flo2 and Redi-Flo4. They have maximum operating depths of approximately 300 and 525 feet, respectively. Flow control for fixed-speed centrifugal pumps is accomplished using a throttling valve in the discharge line at the surface.

Submersible pumps generally use an electric power source. Centrifugal submersible pumps can run off a 12-VDC rechargeable battery, or a 110 or 220-VAC power supply. Most progressive cavity submersible pumps are powered by a 12-VDC battery. Gasoline used to power electrical generators is a potential source of contamination and should be kept well away from purging and sampling equipment. Submersible pumps are available for monitoring wells of various depths and diameters.

Advantages:

- Small diameter pumps are portable and easily transported from well to well
- Relatively low to high pumping rates are possible
- Very reliable and priming is not required
- Mainly constructed of relatively inert materials

Disadvantages:

- Power or compressed air source needed
- Submersible pump might degas the sample
- Deep wells may require pumps that are heavy and cumbersome to use
- Relatively expensive
- Sediment in water may clog intake screen or impellers
- Must be decontaminated between wells
- Because pumping pulls water from the more permeable zones, contaminant contributions from lower permeability zones may be masked in the samples
- Pumping causes mixing which may destroy in-well stratification of contaminant concentrations that could exist and be vital to the investigation

### 5.5 Suction Pumps

Suction pumps include peristaltic and diaphragm pumps. Peristaltic pumps can be used to purge small diameter wells (two inches or less) and should only be used to sample for inorganic contaminants. Diaphragm pumps are rarely used for the purging or sampling of monitoring wells and are omitted from further discussion. Suction pumps are limited to use in wells with a depth to groundwater of less than approximately 25 feet.

The peristaltic pump is a low volume pump that uses rollers to squeeze flexible tubing (e.g., ⅜-or ¼-inch inner diameter [ID] medical grade silastic) thereby creating suction. It is required that Teflon or Teflon-lined polyethylene tubing, e.g. ⅜- or ¼-inch outside diameter (OD) be connected to the pump when sampling for VOCs, SVOCs, and PCBs. Polyethylene tubing may be used when collecting samples for metals analyses. The tubing can be dedicated to a well for long-term monitoring or should otherwise be discarded. Peristaltic pumps require a power source that is either 12 VDC or 110 VAC.

Advantages:

- Portable, inexpensive, and readily available
- Operates from either 110 VAC or 12 VDC
- Variable flow rate, easily controlled
- Dedicated or new tubing used at each well thus minimizing the chances of cross-contamination

Disadvantages:

- Restricted to wells where water levels are within 25 feet of the ground surface
- Vacuum can cause loss of dissolved gasses and volatile organics
- Generally suitable for only small diameter shallow wells
- Maximum flow rate of some types (e.g. peristaltic pumps) limited to approximately 1.0-Lpm

### 5.6 Inertial Pumps

The simplest inertial pump consists of a foot valve connected to semi-rigid tubing. These pump systems are available in six sizes from 6 millimeters (mm) to 25-mm OD. Foot valves are usually made of Delrin, Teflon or stainless steel and are self-tapping directly onto the tubing. The tubing commonly used in the inertial pumps is low-density polyethylene for shallow wells and high-density polyethylene, Teflon-lined polyethylene, or Teflon for intermediate and deep wells. Tubing may either be decontaminated or discarded after use or dedicated to the well.

These pumps are most appropriate to use when wells are too deep to bail by hand, too shallow or too small in diameter to warrant the use of a submersible pump, or the water table is deeper than the limit for suction. After the pump is installed in the well, rapid upstrokes and down-strokes lift the water in the tubing. Inertial pumps can be hand operated for depths shallower than approximately 45 feet or motor driven using an actuator for depths deeper than approximately 45 feet. Optimal performance of most inertial pump systems is obtained at depths less than approximately 135 feet.

Advantages:

- Portable, inexpensive, reliable, and readily available
- Offers a rapid method for purging relatively small diameter and shallow to intermediate depth wells
- Easily operated and decontaminated

Disadvantages:

- Produces agitation that could cause turbid groundwater inside the well
- May cause VOC loss from the groundwater due to agitation
- Limited to field screening or sampling narrow-diameter temporary wells
- Restricted to depths of less than approximately 135 feet
- May be time consuming to purge wells with these pumps
- Gas-driven actuator is heavy and fuel fumes may cause sample contamination

### 5.7 Field Equipment Checklist

#### 5.7.1 General

- Water level indicator/sensor
- Transducer
- Keys for well lock(s)
- Monitoring equipment with a flame ionization detector (FID) or photo-ionization detector (PID)
- Logbook
- Calculator
- Sample labels
- COC records and custody seals
- Sample containers
- Engineer's rule
- Sharp knife (with locking blade)
- Tool box containing: screwdrivers, pliers, hacksaw, hammer, flashlight, etc.
- Leather work gloves
- Surgical gloves
- Personal Protective Equipment (PPE)
- Five gallon bucket(s)

- Plastic sheeting
- Shipping containers
- Packing materials
- Bolt cutters
- Ziploc plastic bags
- Decontamination solutions (e.g. Liqui-Nox)
- Potable water
- Aluminum foil
- Sprayers
- Preservatives, if needed
- Distilled water
- Fire extinguisher (if using a generator as a power source)
- In-line filters, 0.45 microns (µm) (typically used for sampling of dissolved metals only)
- Flow cell
- Water quality meter (e.g. Horiba or YSI)
- Permanent markers
- Duct tape, clear tape and packaging materials
- Paper towels
- 55-gallon drum(s) for storage of purged groundwater
- First aid kit
- Laptop computer with SCRIBE software
- Portable printer
- Printer paper and labels
- Power strip
- Extension cords

5.7.2 Bailers

- Bailers of appropriate size and construction material
- Nonreactive line

5.7.3 No-Purge Samplers

- Appropriate sampler
- Sample bottles, depending on the type of sampler
- Trigger line and trigger mechanism, depending on the type of sampler

5.7.4 FLUTe Well Sampling System

- Nitrogen cylinder
- FLUTe sampling manifold
- Tubing
- 5 gallon buckets (for purge water)

- Water level indicator (Solinst Model 102)

5.7.5 Positive Displacement Pumps

- Pump(s) and controller(s), depending on the type of pump used
- Generator (120 or 240 volts) or 12-volt power source, depending on the type of pump used
- Compressed air supply, depending on the type of pump used
- Extension cord(s)
- Polyethylene, Teflon or silicone tubing
- Hose clamps
- Safety cable
- Tool box containing: pipe wrenches, wire strippers, electrical tape, heat shrink wrap or tubing, hose connectors, etc.
- Teflon tape
- Winch, pulley or hoist for large submersible pumps (2-inch diameter or greater)
- Gasoline container and gasoline
- Flow meter and gate valve
- Plumbing components (nipples, reducers, plastic pipe connectors)
- Control box

5.7.6 Inertial Pumps

- Pump assembly (foot valve and tubing)
- Gas-driven actuator, if required

5.7.7 Suction Pumps

- Small diameter Teflon or polyethylene tubing (e.g. ⅜-inch OD or ¼-inch ID)
- Roll of small diameter silicone tubing (e.g. ⅜-inch OD or ¼-inch ID )
- 110 VAC generator or 12 VDC power source

## 6.0 REAGENTS

Reagents are used for preservation of samples, calibration of water quality meters and for decontamination of sampling equipment. Nevertheless, samples should be cooled to $\leq 4^{O}$C and protected from sunlight in order to minimize degradation and any potential reaction due to the light sensitivity of the sample. Refer to ERT SOP, *Sample Storage, Preservation, and Handling*, *Sampling Equipment Decontamination* and *Operation of the Water Quality Multi-Parameter Meters* for reagents required for each specific type of application.

## 7.0 PROCEDURES

### 7.1 Office Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed and the types and amount of equipment and supplies needed (e.g. well diameter and depth of wells to be sampled).

2. Obtain the necessary monitoring and sampling equipment appropriate to the type of contaminant(s) being investigated. Availability of preservatives, packing material, sample labels and shipping coolers.

3. Decontaminate all equipment prior to use, ensure that equipment is in working order and ready to use.

4. Identify all sampling locations and secure correct well-lock keys.

### 7.2 Field Preparation

1. Mobilize from the least contaminated well to the most contaminated well, if known, to minimize the risk of cross-contamination.

2. Lay plastic sheeting around the well to minimize contamination of sampling equipment from soil and materials that might be adjacent to the well.

3. Remove the lock on the well cap, note the location, note the time of day, note the date and record the information in the site logbook.

4. Remove the well cap (allow 3 to 5 seconds to prevent exposure of vapors).

5. Screen the headspace of the well with an appropriate air monitoring instrument such as a FID or PID to determine the potential presence of VOCs. Record the FID or the PID readings in the site logbook.

6. Measure the distance from the water surface to the referenced measuring point and record it in the site logbook. A reference point may be the top of the outer protective casing, the top of riser pipe, the ground surface, or the top of a concrete pad. Document the reference point used in the Site logbook. If floating organics are present, the water level and depth to the floating product can be measured with an interface probe operated in accordance with ERT SOP, *Water Level Measurements*.

7. Measure the total depth of the well and record the information in the site logbook and/or on a field data sheet.

8. Calculate the volume of water in the well and the volume to be purged using the calculations in Section 8.0, *Calculations*.

9. Select the appropriate purging and sampling equipment.

## 7.3 Purging and/or Sampling

After field preparation is completed, the purging and sampling of a groundwater well is generally performed using high or low flow methods. Wells that cannot be purged at a low flow rate (approximately 100 milliliters per minute [mL/min]) without going to dryness or contain insufficient water to enable purging should be considered for no-purge sampling. The objective is to conduct consistent and representative sampling of the groundwater wells. The same methods should be used each time the wells are purged and sampled, unless a different method would improve the data quality. Applicable sampling equipment for various contaminants of concern is presented in Table 1 of Appendix A.

### 7.3.1 High-Flow Purging and Sampling

A representative sample is collected after a known volume of groundwater (usually three well volumes) is pumped at a relatively high flow rate (at or below rates used for development) from the well or the water quality parameters have stabilized. Water quality parameters that can be measured during purging include temperature, electrical conductance, pH, oxidation-reduction potential and turbidity. The volume of water to be purged can be determined as described in Section 8.0 *Calculations* of this SOP. Groundwater quality parameters are generally considered stabilized after three consecutive sets of readings do not vary more than 10%.

The time between readings is based on the purge rate and cumulative volume but is typically 5 to 10 minutes or when every half volume (after the initial well volume) is purged. The well should be purged enough to remove the stagnant water but not enough to induce flow from other areas. Sampling should be performed immediately after purging. Samples for VOCs are collected first when sampling for more than one set of parameters, followed in order by samples for SVOCs, PCBs, and inorganic analyses. Positive displacement and suction lift pumps are recommended for high flow purging and sampling; whereas, the use of bailers and inertial pumps is discouraged. The total volume purged, purge method, purge rate, and the start and end times of purging, water quality parameter readings and sample collection time are recorded in the site’s logbook. The static water level and depth to water at the end of purging should also be recorded in the site’s logbook.

### 7.3.2 Low-Flow Purging and Sampling

During low flow purging, the pumping rate is adjusted (typically between 100 and 500 mL/min) to minimize or stabilize the drawdown to within 0.3 foot of the static water level. Both the drawdown and water quality parameters (pH, electrical conductivity, temperature, dissolved oxygen, oxidation-reduction potential and turbidity) are monitored during the purging according to ERT SOP, *Operation of the Water Quality Multi-Parameter Meters*. The water quality parameters are measured in a flow cell. Measurements are typically made every five minutes or after each flow cell volume has been purged.

A sample is collected after the parameters fall within the ranges listed below for three consecutive readings:

| | |
|---|---|
| Water level drawdown | <0.3 foot |
| pH | ± 0.1 unit |
| Electrical conductance | ± 3% |
| Temperature | ± 3% |
| Dissolved oxygen | ± 3% |
| Turbidity | ± 10% for values greater than 1 nephelometric turbidity unit (NTU) |
| Oxidation-Reduction Potential | ± 10 millivolts |

Other ranges may apply for some of the parameters listed above depending on the State or Federal guidance that may need to be adopted for evaluating their stabilization. If the parameters have not stabilized after two hours of purging; a) continue purging until stabilization is attained and collect the sample, b) stop purging, do not collect the sample, and record attempts to reach stabilization in the site's logbook, and c) stop purging, collect the sample, and record attempts to reach stabilization in the site's logbook.

Low flow purging and sampling is best performed using positive displacement pumps and in some instances may be conducted using peristaltic pumps when only inorganic parameters are targeted.

7.3.3 No-Purge Discrete Sampling

Passive samplers provide a discrete sample from the screened portion or open interval of a groundwater well without pumping or purging. The sampler must be completely submerged and should be installed at the same depth during each monitoring event for data consistency and comparability. If historical information indicates that contamination in the well is not stratified, a single deployment depth should be selected, and sampler placement at the middle of the screen or open interval may be appropriate. Several samplers can also be deployed at different depths in the well to conduct vertical profiling. These samplers collect a limited sample volume; therefore, the manufacturer should be consulted to ensure the device will provide enough water volume to conduct the required analysis and any QA/QC that may be required in the QAPP. Diffusion and adsorption samplers may require several days or weeks of deployment before a representative sample can be collected; whereas, some grab-type samplers may not require an equilibration period prior to sampling.

7.3.4 FLUTe Well Sampling Procedures

Gather and organize all of the sampling equipment and supplies; manifold, tubing, water level indicator and 5 gallon buckets.

Attach the manifold to the down-hole airline or (U-line). Attach the nitrogen supply line from the cylinder to the block. Once everything is securely attached turn on the nitrogen supply. Attach the sample tubing to the sample port directly adjacent to the U-line. Turn the valve on the manifold to the on position allowing the nitrogen to flow down the U-line. Sample purge water will now flow up and out of the sample port tubing line. Continue to purge until the line runs dry. Allow 5 to 10 minutes to recover and repeat this procedure 2 more times. After the purging process has been completed, allow another 5 to 10 minutes for the port to recover; then sample.

This procedure will be applied to all sample ports until all have been sampled.

Note: Refer to the FLUTe well installation specifications for the exact nitrogen pressure (PSI) setting. Purging and sampling the well at the wrong PSI may damage the well.

7.3.5 General Operating Procedure for Purging and Sampling

The general procedures for devices most commonly used for purging and sampling are:

No-Purge Devices

Consult the manufacturer's instructions for the deployment and retrieval of the applicable no-purge device selected for monitoring.

Positive Displacement Pumps and Suction Pumps

The following steps describe the use of positive displacement pumps in purging and sampling a well:

1. Determine the volume of water to be purged as described in Section 8.0, *Calculations,* of this SOP if conducting high-flow purging and sampling.

2. Lay plastic sheeting around the well to prevent contamination of pumps, hoses or lines with soil or other foreign materials.

3. Assemble pump, hoses and safety cable, and lower the pump into the well. Make sure the pump is set in the screened interval.

4. Attach a flow meter to the outlet hose to measure the volume of water purged or measure it with a container of known volume. If a meter is unavailable a five-gallon bucket may be used along with a stop watch.

5. Use a ground fault circuit interrupter (GFCI) or ground the generator to avoid possible electric shock.

6. Attach the power supply for submersible pumps or compressed gas cylinder or compressor for bladder pumps, and purge the well until the specified volume of water has been removed (or until field parameters, such as temperature, pH and conductivity have stabilized). Do not allow the pump to run dry. If the pumping rate exceeds the well recharge rate, reduce the pumping rate.

7. Collect the sample, starting with VOCs and dispose of the purge water as specified in ERT SOP, *Investigation-Derived Waste Management*.

8. Cap the sample container tightly and place the pre-labeled sample container into a cooler. Use a water proof marker is for labeling or a Scribe-generated Label.

9. Replace the well cap and decontaminate the pump.

10. Log the collection time, sampling method, and analyses required for all samples in the site logbook.

11. Package samples and complete necessary paperwork.

## 7.4 Filtering

Samples collected for dissolved metals analysis require filtration. Groundwater is primarily filtered to exclude silt and other particulates from the samples that would interfere with the laboratory analysis. In-line filters are used specifically for the preparation of groundwater samples for dissolved metals analysis, and for filtering large volumes of turbid groundwater. An in-line filter can be used with a peristaltic pump to transfer the sample from the original sample bottle, through the filter, and into a new sample container. The filter must be replaced between sampling locations.

The filters used in groundwater sampling are self-contained and disposable. Disposable filters are preferred and often used to reduce cross-contamination of groundwater samples. Disposable filter chambers are constructed of polypropylene material, with an inert filtering material within the housing. Disposable filters have barb or national pipe thread (NPT) fittings on the inlet and outlet sides of the housing to connect to 3/8-inch or 5/8-inch tubing.

## 7.5 Special Considerations for VOC Sampling

The proper collection of a sample for VOC analysis requires minimal disturbance of the sample to limit volatilization. Sample retrieval equipment suitable for the collection of VOCs is:

- Positive displacement bladder pumps
- Some submersible pumps
- No-purge samplers

Field conditions and other constraints will limit the choice of certain systems. The concern must be to collect a valid sample that has been subjected to the least amount of turbulence possible.

The following procedures are required to be used:

1. Open the vial, set cap in a clean place, and collect the sample. When collecting duplicate samples; collect both samples at the same time.

2. Fill the vial to almost overflowing. Do not rinse the vial, or let it excessively overflow. It needs to have a convex meniscus on the top of the vial before securing the cap.

3. Check that the cap has not been contaminated and place the cap directly over the top and screw down firmly. Do not over tighten the cap.

4. Invert the vial and tap gently. Observe vial for at least 10 seconds. If an air bubble appears, unscrew the cap and pop the bubble or refill with more sample then re-seal. Do not collect a sample with air trapped in the vial.

5. The holding time for unpreserved samples to be analyzed for VOCs is 7 or 14 days for preserved samples. Samples should be shipped or delivered to the laboratory as fast as practical in order to allow the laboratory time to analyze the samples within the holding time. Ensure that the samples are stored at $\leq 4^{O}C$ during transport but do not allow them to freeze. The most readily available method of cooling is to use ice packed in double-sealed plastic bags (e.g. Ziploc bags).

## 8.0 CALCULATIONS

To calculate the volume of a well, use the following equation:

$$\text{Well Volume (gallons)} = \pi r^2 hk$$

where:

$\pi$ = 3.14
r = radius of monitor well (feet)
h = height of the water column (feet). (This may be determined by subtracting the: depth to water from the total depth of the well as measured from the same reference point).
k = conversion factor, 7.48 gallons per cubic foot (gal/$ft^3$)

The inner diameter of most monitoring wells is typically 2 to 4 inches. If the inner diameter of the monitoring well is known, standard conversion factors can be used to simplify the equation above.

The volume, in gallons per linear foot, for various standard monitoring well diameters can be calculated as follows:

$$\text{Volume (gal/ft.)} = \pi r^2 k$$

OR

$$\text{Volume} = 23.5 r^2$$

where:

$\pi$ = 3.14
r = radius of well (feet)
k = conversion factor (7.48 gal/$ft^3$)

For a 2-inch diameter well, the volume, in gallons per linear foot, can be calculated as follows:

$$\begin{aligned}\text{Volume/linear ft.} &= \pi r^2 k \\ &= 3.14 \times (1/12)^2 \times (7.48\ \text{gal/ft}^3) \\ &= 0.163\ \text{gal/ft}\end{aligned}$$

The well radius must be in feet to be able to use the equation.

The conversion factors (***f***) for the most common diameter monitor wells are as follows:

| Well diameter-inches | 2 | 3 | 4 | 6 |
|---|---|---|---|---|
| Volume (gal/ft.) | 0.1631 | 0.3670 | 0.6528 | 1.4680 |

If you use the conversion factors than the equation is modified as follows:

$$\text{Well Volume} = hf$$

where:

$h$ = height of water column (feet)
$f$ = conversion factor

## 9.0 QUALITY ASSURANCE/QUALITY CONTROL

Specific QA/QC activities that apply to the implementation of these procedures will be listed in the Quality Assurance Project Plan prepared for the applicable sampling event. The following general QA procedures will also apply:

1. All sample collection data, including purge methods and time, sample collection methods, times of collection, analyses required, and decontamination procedures (if any) must be documented.

2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer or instrument-specific SOPs, unless otherwise specified in the QAPP. Equipment check-out and calibration is necessary prior to purging and sampling and must be done according to the instruction manuals supplied by the manufacturer.

3. The collection of rinsate (equipment, field) blanks is recommended to evaluate the potential for cross-contamination from non-dedicated purging and/or sampling equipment. The determination of how many field (rinsate, equipment) blanks to be collected is dependent on the project's data quality objectives.

4. Trip blanks are required if analytical parameters include VOCs.

5. Records must be maintained, documenting the training of the operators that use instrumentation and equipment for the collection of environmental information.

## 10.0 DATA VALIDATION

Data verification (completeness checks) must be conducted to ensure that all data inputs are present for ensuring the availability of sufficient information. This may include but is not limited to: location information, water quality parameter measurements, purging start and end times, water levels, depth to groundwater measurements, purge method and total volume pumped. These data are essential to providing an accurate and complete final deliverable. The contractor's Task Leader (TL) is responsible for completing the UFP-QAPP verification checklist for each project.

## 11.0 HEALTH AND SAFETY

Based on Occupational Safety and Health Administration (OSHA) requirements, a site-specific health and safety plan (HASP) must be prepared for response operations under the Hazardous Waste Operations and Emergency Response (HAZWOPER) standard, 29 CFR 1910.120. Field personnel working for EPA's ERT should consult the Emergency Responder Health and Safety Manual currently located at https://response.epa.gov/_HealthSafetyManual/manual-index.htm for the development of the HASP, required PPE and respiratory protection.

When working around VOCs:

1. Avoid breathing volatile constituents venting from the well.
2. Check the well head-space with a FID/PID prior to sampling.
3. If monitoring results indicate organic concentration above the action level, it may be necessary to conduct sampling activities in Level C protection. At a minimum, skin protection will be afforded by disposable protective clothing.

Physical hazards associated with well sampling:

1. Lifting injuries associated with pump and bailers retrieval; moving equipment.
2. Use of pocket knives for cutting discharge hose.
3. Heat/cold stress as a result of exposure to extreme temperatures in protective clothing.
4. Slip, trip, fall conditions as a result of pump discharge.
5. Restricted mobility due to the wearing of protective clothing.
6. Electrical shock associated with use of submersible pumps is possible. Use a GFCI or a copper grounding stake to avoid this problem.

## 12.0 REFERENCES

Interstate Technology Regulatory Council (ITRC), 2006, Technology *Overview of Passive Sampler Technologies*, Prepared by the ITRC Diffusion Sampler Team, 94 pp.

Nielsen, D.M., and Nielsen, G.L., 2006, Ground-Water Sampling, In: Nielsen, D.M. (ed.), *Practical Handbook of Environmental Site Characterization and Ground-Water Monitoring*, 2nd Edition, Taylor and Francis, Boca Raton, Florida, pp. 959-1112.

U. S. Environmental Protection Agency, Region 9 Laboratory, Richmond, CA, 09/2004, Field Sampling Guidelines, Document #1220, "*Groundwater Well Sampling*".

ASTM Method D4468-01 "*Standard Guide for Sampling Ground-Water Monitoring Wells*", ASTM 2013.

## 13.0 APPENDICES

A - Table
B - Figures

APPENDIX A
Tables
SOP: ERT-PROC-2007-20
June 2020

**TABLE 1. Acceptable Purging and Sampling Equipment for Contaminants of Concern**

| Equipment | VOC | SVOC | PCB | Pesticides/Herbicides | Metals Plus Cyanide |
|---|---|---|---|---|---|
| Bailer | X | X | X | X | X |
| Peristaltic/Centrifugal Pump | X | X | 3 | 3 | 3 |
| Submersible Pump | 3 | 1 | 1 | 1 | 1 |
| Bladder Pump | 1 | 1 | 1 | 1 | 1 |
| Inertial Pump | X | X | X | X | X |
| Diffusion Sampler | 1 | 3 | X | X | X |
| Adsorption Sampler | 2 | 2 | 2 | 2 | X |
| Grab Sampler | 2 | 2 | 2 | 2 | 2 |

X – Not recommended for definitive data
1 – Recommended method
2 – Useful with limitations
3 – Better methods exists

APPENDIX B
Figures
SOP: ERT-PROC-2007-20
June 2020

FIGURE 1. Bailer

FIGURE 2. Grab-type Sampler

FIGURE 3. Diffusion-Equilibrium Sampler

FIGURE 4. Bladder Pump

FIGURE 5. Gear-Driven Pump

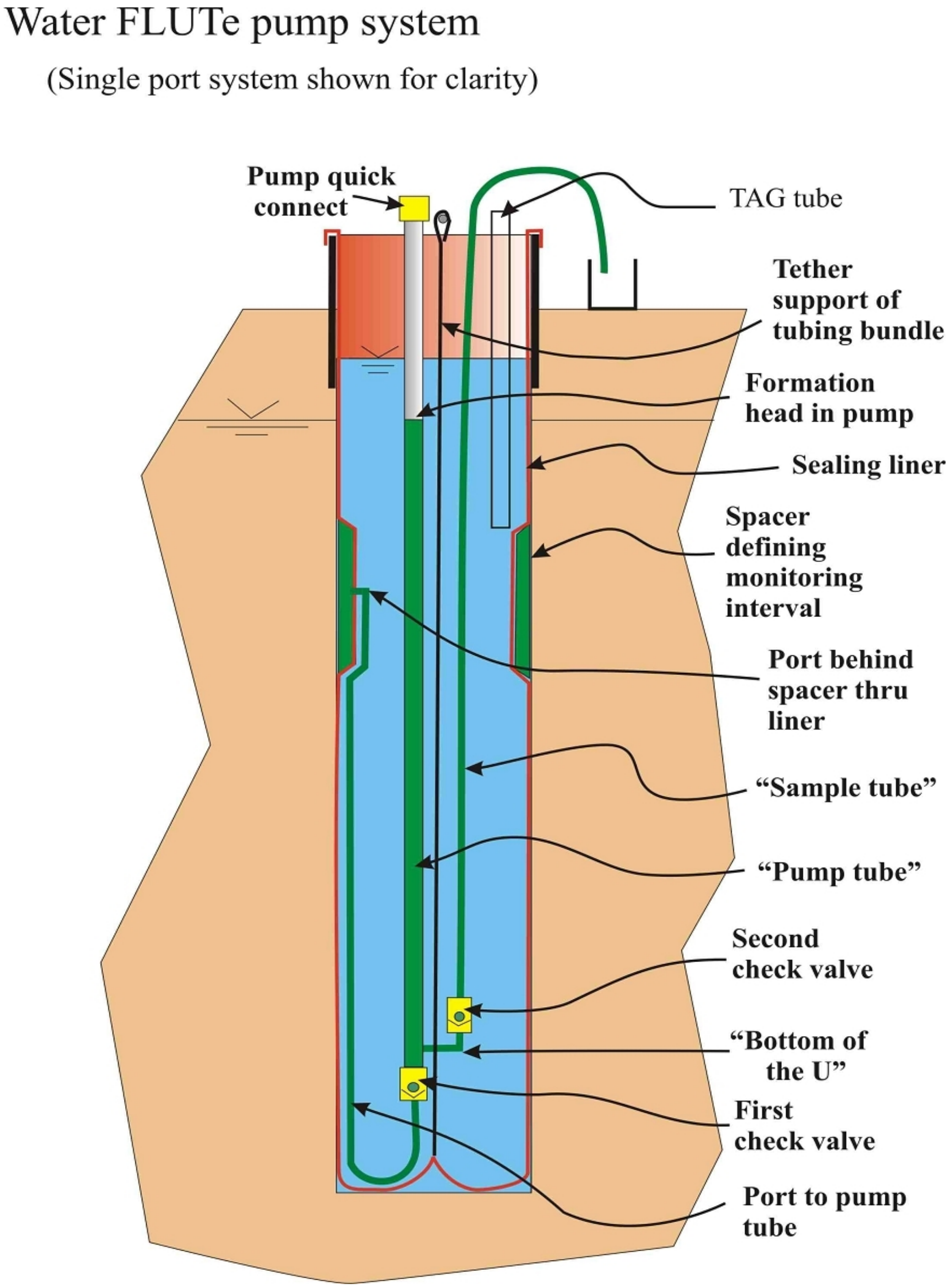
FIGURE 6. Centrifugal Pump

FIGURE 7. Peristaltic Pump

FIGURE 8. Diaphragm Pump

FIGURE 9. Foot-Valve Pump

FIGURE 10. FLUTe Well System



# INVESTIGATION-DERIVED WASTE MANAGEMENT

CONTENTS

## 1.0 OBJECTIVE

The objective of this standard operating procedure (SOP) is to provide general reference information on the management of investigation-derived waste (IDW) generated during Environmental response Team (ERT) site investigations.

A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The anticipated approach and procedures for IDW management will be detailed in the approved QAPP for the site investigation.

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations or other procedural limitations. In all instances, the procedures employed must be documented on a Field Change Form and attached to the QAPP. These changes must be documented in the final deliverable.

## 2.0 APPLICABILITY

This SOP is applicable only if the U.S.EPA On-Scene Coordinator (OSC), Remedial Project Manager (RPM), or other Regional Manager does not have procedures in place for IDW management. Prior to site activities, the ERT contractor's Task Leader (TL) determines if the OSC, RPM, or other Regional Manager has procedures in place for IDW management. This should be done by contacting the ERT Work Assignment Manager (WAM). If it is determined that procedures are not in place, then the contractor's TL should evaluate IDW handling and management options based on:

- Site contaminants and their concentrations, and total projected volume of IDW
- Media potentially affected (e.g., groundwater, soil) by management options
- Location of the nearest population(s) and likelihood and/or degree of site access
- Potential exposure to workers
- Potential environmental impacts

Every effort must be made to ensure the selection of investigation method(s) minimizes the generation of IDW, contact with contaminants, and cost of disposal. It is important that the TL share information about site contaminants and expected IDW with the contractor's Health and Safety Officer (HSO) and Hazardous Waste Coordinator well in advance of site startup. This will better ensure that the upfront work can be done to minimize and dispose of IDW efficiently and in compliance with applicable regulations. Efforts made to characterize IDW will be consistent with the scope and purpose of the site investigation.

## 3.0 DESCRIPTION

### 3.1 Regulatory Background and Options for Managing IDW

#### 3.1.1 Regulatory References

This SOP provides information that is based on the rules, regulations, and guidance documents summarized in Table 1 of Appendix A.

#### 3.1.2 IDW Management Options

The National Oil and Hazardous Substances Contingency Plan (NCP) requires that management of IDW generated during site investigations complies with all applicable or relevant and appropriate requirements (ARARs) to the extent practicable unless a waiver is granted. Potentially applicable provisions for IDW management at Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites are listed in the following ARARs: the Resource Conservation and Recovery Act (RCRA), Safe Drinking Water Act (SDWA), Clean Air Act (CAA), Toxic Substances Control Act (TSCA), Clean Water Act (CWA), and other state laws.

Typical options for handling IDW include immediate disposal or interim management at the end of which the IDW is either: (1) returned to its source or (2) treated, disposed, or stored elsewhere. The contractor's TL in conjunction with the ERT WAM is required to select options for IDW management that are protective of human health and the environment and comply with or waive the ARARs. The most important general elements of managing IDW are as follows:

- Leaving a site in no worse condition than existed prior to the investigation
- Removing those wastes that pose an immediate threat to human health or the environment
- Leaving on site those wastes that do not require off-site disposal or long-term above-ground containerization
- Complying with federal and state ARARs to the extent practicable (OERR, 1991)
- Planning and coordination for IDW management
- Minimizing the quantity of wastes generated

The specific elements of the approach are as follows:

- Characterizing IDW through the use of existing information (manifests, Safety Data Sheets (SDSs), previous test results, knowledge of the waste generation process, and other relevant records) and best professional judgment.
- Delineating an area of concern (AOC) unit for leaving RCRA hazardous soil cuttings within the unit.
- Containerizing RCRA hazardous groundwater, decontamination fluids, personal protective equipment (PPE), and disposable sampling equipment (if generated in excess of 100 kilograms [kg]/month) and disposing of it at RCRA Subtitle C facilities.
- Leaving on site RCRA nonhazardous soil cuttings, groundwater, and decontamination fluids preferably without containerization and testing.

The U.S. EPA does not recommend the removal of wastes from all sites and, in particular, from those sites where IDW does not pose any immediate threat to human health or the environment.

Based on this information and the guidelines included in the following sections, the ERT contractor's TL should include a plan for handling IDW in the QAPP. Any deviations from or modifications to the plan due to unexpected or unforeseen field conditions must be documented using a field change form and noted in the site logbook.

## 3.2 Characterization of IDW

### 3.2.1 Types of IDW

IDW can be divided into investigation-derived environmental media, debris, and other materials. The U.S. EPA uses the term environmental media to describe soil, sediment, surface water, and groundwater or a mixture of such materials (61 Federal Register 18780, 18783; April 29, 1996). Environmental media are not inherently waste but contaminated environmental media becomes a waste if it cannot be returned to its source. The definition of environmental debris found in 40 Code of Federal Regulations (CFR) 268.2(g) and includes: solid material, particles that exceed 60 millimeters (mm), and materials intended for disposal. IDW may therefore include, but is not limited to, the following items:

<u>Media</u>

- Soil
- Sediment
- Bedrock
- Surface water
- Drill cuttings
- Purge water
- Development water

<u>Debris</u>

- Concrete, asphalt, building materials, etc.
- Slag
- Used glassware
- Clean trash
- PPE
- Decontamination equipment (buckets, brushes, clothing, tools, etc.)
- Field analytics waste (immunoassay, chlor-n-oil, chlor-n-soil, HACH kits, sample extracts, etc.)
- Dedicated/expendable equipment (bailers, fitters, hose, buckets, x-ray fluorescence [XRF] cups, etc.)

<u>Other Materials</u>

- Sludge
- Drum solids
- Biological tissue
- Drilling fluids
- Fluid and sludge from the dewatering of drilling mud
- Decontamination fluids

### 3.2.2 Hazardous IDW

To handle IDW properly, the ERT contractor's TL must know whether it contains CERCLA hazardous substances as defined under Section 101(14) and whether those substances are RCRA hazardous wastes or contaminants regulated under other statutes such as TSCA, CWA, CAA, and SDWA. The complete list of CERCLA hazardous substances is found at 40 CFR 302.4. To handle IDW in compliance with regulations, reasonable efforts should be made to characterize it. However, these efforts should be consistent with the scope and purpose of the site investigation.

Contaminated environmental media is not solid waste (i.e. because it was in place and not discarded), cannot be considered RCRA hazardous waste (i.e., because it is not solid waste), but is subject to regulation under RCRA Subtitle C when it contains hazardous waste. The "contained-in" policy requires environmental media to be managed as hazardous waste when it is mixed with listed hazardous constituents (F-, K-, P-, or U-codes identified under 40 CFR 261.31 to 261.33) at concentrations above health-based levels or is mixed with enough hazardous constituents that it exhibits one of four hazardous characteristics (ignitability, corrosivity, reactivity, or toxicity) based on comparison of analytical results to limits established in 40 CFR 261.21 to 261.24. Once the characteristic is eliminated (i.e., through treatment), the environmental media is no longer considered to contain hazardous waste and be subject to RCRA regulations. A formal "contained-out determination" is not required because the determination can be easily made through analytical testing. However, in the case of environmental media that are no longer contaminated by high concentrations of a listed hazardous waste, EPA recommends that the Regions or authorized states make the "contained-out determination" using site-specific health-based standards. Environmental media that contained listed hazardous waste when first generated (i.e., removed from the ground) remain subject to Land Disposal Restriction (LDR) regulations known as Universal Treatment Standards (UTS) following an approved "contained out determination", except under certain circumstances.

The "contained-in" policy also applies to debris contaminated with RCRA-listed hazardous waste (51 Federal Register 37225, August 18, 1992), which must be handled as hazardous material until it no longer contains hazardous waste at concentrations above health-based levels [40 CFR 261.3(f)(2)]. Hazardous contaminated debris are also subject to LDR standards. Hazardous debris treated to comply with those standards would no longer be subject to RCRA regulation if the debris does not exhibit any hazardous waste characteristics. Agency action is not required; a "contained-out determination" is automatic.

A combination of solid IDW, such as sludge or drum solids, and listed or characteristic waste is considered a mixture under the "mixture rule". Mixtures of solid IDW and listed wastes are RCRA hazardous wastes under 40 CFR 261.3(a)2(iv).

### 3.2.3 Polychlorinated Biphenyl-Containing IDW

Management of IDW contaminated with polychlorinated biphenyls (PCBs) involves compliance with the requirements for PCB remediation waste as specified in the TSCA PCB regulations at 40 CFR 761.50(b)(3) and 761.61. However, PCBs mixed with RCRA hazardous waste become RCRA regulated material. Waste materials containing PCBs as the result of a spill, an intentional or accidental release or uncontrolled discharges of PCBs or other unauthorized disposal of PCBs is called PCB remediation waste which is managed at its "as-found" PCB concentration. Most of the PCB remediation waste encountered during site investigations consists of "bulk PCB remediation waste" (including, but not limited to, existing piles of soil, in-situ soil, sediments, dredged materials, muds, PCB sewage sludge, and industrial sludge) or “liquid PCBs” (homogeneous, flowable material containing PCBs and no more than 0.5 percent (%) by weight non-dissolved material).

3.2.4 Asbestos-Containing IDW

Asbestos-containing IDW is most likely to be derived from building, landfill, or fill materials during Superfund site investigations. However, soil and rock may also contain naturally-occurring asbestos (NOA) at some sites. Asbestos-containing material (ACM) as defined in the National Emission Standards for Asbestos, found in Subpart M of the National Emission Standards for Hazardous Air Pollutants (NESHAP), 40 CFR Part 61, consists of: Category I and Category II nonfriable ACM containing greater than 1% asbestos as analyzed using polarizing light microscopy (PLM). Office of Solid Waste and Emergency Response (OSWER) Directive 9345.4-05 (Clarifying Cleanup Goals and Identification of New Assessment Tools for Evaluating Asbestos at Superfund Cleanups, EPA, August 2004) indicated that the 1% definition may not be reliable for assessing potential human health hazards from asbestos-contaminated soils at Superfund sites and that a risk-based, site-specific action level is generally more appropriate. Furthermore, OSWER Directive 9200.0-68 (Framework for Investigating Asbestos-Contaminated Superfund Sites, EPA, September 2008) indicated that accurate quantification is very difficult when the asbestos content of soil is less than 1% PLM and that the results should be interpreted semi-quantitatively.

U.S. EPA does not classify ACM as hazardous waste under RCRA; however, it can be designated a hazardous waste if it is located in a state that regulates asbestos (e.g., California classifies ACM as hazardous waste if it is friable [i.e., can be reduced to powder or dust under hand pressure when dry] and contains 1% or more asbestos). State solid waste regulations generally have asbestos handling and disposal requirements and the states determine which landfills can accept ACM. If the landfills accept regulated ACM (i.e., friable ACM; Category I nonfriable ACM that have become or will become friable or have been subject to grinding, cutting, abrading or burning; or Category II nonfriable ACM that have a high probability of becoming or that have become crumbled, pulverized, or reduced to powder due to work practices used during the course of demolition or renovation), they must comply with Asbestos NESHAP requirements.

3.2.5 Non-Hazardous IDW

Non-hazardous IDW is waste that does not meet the EPA’s definition of hazardous waste.

Even if the IDW does not contain RCRA hazardous waste, the ERT contractor’s TL should determine whether the IDW contains other CERCLA hazardous substances. CERCLA hazardous substances include, in addition to RCRA hazardous wastes, substances, elements, compounds, solutions, or mixtures designated as hazardous or toxic under CERCLA itself or under the authority of other laws such as TSCA, CWA, CAA, and SDWA. Therefore, even if RCRA is not applicable, one of these statutes may be.

## 3.3 Management of IDW

### 3.3.1 Waste Minimization

The ERT contractor's TL will obtain input from their HSO and Hazardous Waste Coordinator to support selection of site investigation methods that minimize the generation of IDW, particularly TSCA or RCRA hazardous wastes. The site investigation team should limit contact with contaminants and use drilling and decontamination methods (such as steam cleaning) that minimize PPE, disposable equipment, decontamination fluids, and soil cuttings. In particular, the inspection team should minimize the amounts of solvents used for decontamination or eliminate solvents altogether. Minimizing the amount of wastes generated reduces the number of IDW handling problems and costs of disposal.

### 3.3.2 Types, Hazards, and Quantities of IDW

Extensive testing of the IDW is not warranted in most cases; instead, the nature of the wastes should be assessed by applying professional judgment, using readily available information about the site (such as Safety Data Sheets, manifests, storage reports, process descriptions, preliminary assessments, and results of earlier studies), as well as direct observation of the wastes for discoloration, odor, or other indicators of contamination. Similarly, RCRA procedures for determining whether a waste exhibits RCRA hazardous characteristics do not require testing if the decision can be made by applying knowledge of the characteristic in light of the materials or process used. In most instances, a determination may be made based on available information and professional judgment. This does not mean that IDW can be assumed to be nonhazardous unless clearly proven otherwise. Given the limited information available, the ERT contractor's TL, in conjunction with the ERT WAM, must determine whether it more likely than not that the wastes are hazardous.

To handle IDW properly, the contractor's TL must determine the types (such as soil cuttings, groundwater, decontamination fluids, PPE, or disposable equipment), characteristics (whether RCRA hazardous or containing other CERCLA hazardous substances), and quantities of anticipated wastes. As discussed previously, testing will generally not be required to characterize IDW if available information indicates that it does not likely contain hazardous waste or hazardous constituents.

Upon determining the types of anticipated IDW, the contractor's TL should determine IDW characteristics, in particular whether it is expected to be RCRA hazardous or to contain high concentrations of PCBs. For RCRA hazardous IDW (listed or characteristic), the contractor's TL should determine whether it poses an increased hazard to human health and the environment relative to conditions that existed prior to the site investigation. Field analytical screening results, if available, may be helpful indicators of IDW characteristics. However, the contractor's TL must remember that these are not RCRA tests and that the test results usually do not identify RCRA hazardous wastes. The contractor's TL must also determine the exact properties of RCRA nonhazardous IDW to select an appropriate disposal facility when the off-site disposal is required.

Upon determining the type and characteristics of IDW to be generated, the ERT contractor's TL must assess the anticipated quantities of waste. This should be done based on past experience with site investigations of similar scope.

### 3.3.3 On-Site IDW Handling Options

In planning the scope of work, the ERT contractor's TL must decide if IDW can be left on site or if it must be disposed off-site. Handling of RCRA hazardous IDW and IDW with high PCB concentrations (greater than 50 parts per million [ppm]) may involve either moving the IDW within an AOC unit, or containerization, storage, testing, treatment, and off-site disposal. It is preferable to leave both RCRA hazardous and nonhazardous IDW on site within an AOC unit whenever it complies with regulations, does not pose any immediate threat to human health and the environment, or there is not a high probability of serious community concerns. The contractor's TL must determine procedures for handling IDW on site in conjunction with the WAM.

**RCRA Nonhazardous IDW**

If IDW are RCRA nonhazardous soil or water, they should be left on site unless other circumstances, such as state ARARs or a high probability of serious community concerns, require off-site disposal. RCRA hazardous soil also may be left on site. The on-site handling options available when IDW are RCRA nonhazardous are listed below.

For soil cuttings:

1. Spread around the well.
2. Put back into the boring.
3. Put into a pit within the AOC.
4. Dispose of at the site's operating treatment/disposal unit (TDU).

For groundwater:

1. Pour onto ground next to well to allow infiltration.
2. Dispose of at the site's TDU.

For decontamination fluids:

1. Pour onto ground (from containers) to allow infiltration
2. Dispose of at the site's TDU.

For decontaminated PPE and disposable equipment:

1. Double bag and deposit the bags on the site or in a U.S. EPA dumpster, or in any municipal landfill.
2. Dispose at the site's TDU if available.

**RCRA Hazardous IDW**

If IDW are considered RCRA nonhazardous due to lack of information on the waste hazard, the ERT contractor's TL should have an alternate plan for handling IDW if field conditions indicate that these wastes are hazardous. In such a case, there should be an adequate number of containers available for collecting groundwater, decontamination water, soil cuttings, etc.

If IDW consists of RCRA hazardous soils that pose no immediate threat to human health and the environment, plan on leaving it on site within a delineated AOC unit. However, one must also consider the proximity of residents and workers in the surrounding area and use best professional judgment to make these decisions. Planning for leaving RCRA hazardous waste on site involves:

- Delineating the AOC unit.
- Determining pit locations close to the borings within the AOC unit for waste burial.
- Covering hazardous IDW in the pits with surficial soil.
- Not containerizing and testing wastes designated to be left on site.

Another alternative for handling RCRA hazardous soil is disposal in a TDU located on the same property as the AOC under investigation. If the TDU is outside the AOC, it must comply with the off-site policy. If any decontamination fluids are generated which are RCRA hazardous wastes, they should be disposed off-site in compliance with the off-site policy or in compliance with the conditionally exempt small quantity generator exemption. Small quantities (i.e., no more than 100 kg/month) of decontamination fluids may be containerized prior to delivery to a hazardous waste facility.

### 3.3.4 Options Available for Off-Site Disposal of IDW

IDW should be disposed of off-site in the following situations:

- When identified as RCRA hazardous water
- When identified as RCRA hazardous soil that may pose a substantial risk if left at the site
- When identified as RCRA hazardous PPE and disposable equipment
- If leaving them on site would create increased risks at the site

RCRA nonhazardous wastes could be disposed off-site at appropriate RCRA nonhazardous facilities that are in compliance with CERCLA section 121(d)(3) and off-site policy when it is necessary to comply with legally enforceable requirements such as state ARARs that preclude on-site disposal. IDW designated for off-site disposal must be properly containerized, tested, and stored before pick up and disposal. Decontaminated PPE and disposable equipment should be double-bagged if sent to an off-site dumpster or municipal landfill.

Planning for off-site disposal should include the following guidelines:

- Informing the WAM that containerized IDW may be temporarily stored on site while awaiting pick up for off-site disposal
- Initiating the procurement process for IDW testing, pick up and disposal
- Coordinating IDW testing and pick-up activities
- Preparing adequate numbers and types of containers. Drums should be used for collecting small amounts of IDW. Larger amounts of soil and water can be contained in Baker tanks, poly tanks, and bins. PPE and disposable equipment should be double-bagged for disposal at a municipal landfill or collected in drums for disposal at a hazardous waste facility.
- Designating a storage area (either within the site's existing storage facility, existing

fenced area, or within a temporary fence constructed for the site investigation). No humans, children in particular, may have access to the storage area.

All IDW shipped off site, whether RCRA hazardous or not, must go to facilities that comply with the RCRA disposal policy, and the ERT contractor's TL, in conjunction with their Purchasing Department, must verify that the facilities operate in accordance with this policy.

### 3.4 Equipment/Apparatus

Equipment, materials, and supplies needed for containerizing IDW are generally selected based on waste characteristics or constituents. Other considerations include the case of decontaminating or disposing of the equipment. Most equipment and supplies can be easily procured. For example, 5-gallon buckets, plastic bags, etc. can help segregate contaminated materials. Contaminated liquid can be stored temporarily in metal or plastic cans or drums.

#### 3.4.1 Waste Disposal

- Trash bags
- Trash containers
- 55-gallon drums or 5-gallon pails
- Metal/plastic buckets/containers for storage and disposal of decontamination solutions

#### 3.4.2 Decontamination Equipment

- Drop cloths of plastic or other suitable materials
- Large galvanized tubs
- Wash solutions
- Rinse solutions
- Long-handled, soft-bristled brushes
- Paper or cloth towels
- Metal or plastic cans or drums
- Soap or wash solution

## 4.0 RESPONSIBILITIES

### 4.1 ERT Work Assignment Manager

The ERT WAM is responsible for providing technical expertise and technical direction to the contractor, preparing task orders/work assignments, reviewing deliverables, interacting with the Regional customers and monitoring the financial and administrative management of the project.

### 4.2 ERT Contractor's Task Leader

The contractor's TL becomes familiar with the available site history, sampling process and the waste(s) generated before and during field activities. Ensures proper storage/containerization of IDW so it is protected from the elements, covered except for when waste is added, and accessible by equipment needed to remove it. Takes samples of waste(s) for analysis if needed. Provides a physical description of the waste(s) and works closely with the hazardous waste coordinator to complete waste profiles. They share site history, known contaminants, information about likely IDWs with their HSO and Hazardous Waste Coordinator well in advance of site mobilization. This would not apply to emergency responses with rapid start-up.

### 4.3 ERT Contractor's Health and Safety Officer

The contractor's HSO works with the contractor's TL and Hazardous Waste Coordinator to ensure that IDW management is compliant with applicable regulations. The HSO works with the TL to convene meetings as necessary to ensure necessary parties participate and that necessary investigation and planning are conducted in advance of field work to determine proper disposition of IDWs.

### 4.4 ERT Contractor's Hazardous Waste Coordinator

Obtains the federal hazardous waste generator identification number from the ERT WAM if needed. Contracts a reputable waste disposal service, completes waste profiles, and schedules waste removal. Requests additional analysis if required. Complies with Off-Site Rule 40 CFR 300.440. Reviews all paperwork for accuracy prior to signature by the ERT WAM. Maintains documentation in an organized file for all IDW removed. Provides ERT WAM with copies of manifests, Off-Site Rule communications and waste profiles.

## 5.0 REFERENCES

U.S. EPA, Management of Investigation-Derived Wastes During Site Inspections, Office of Emergency and Remedial Response Directive 9345.3-02, May 1991.

U.S. EPA, Guide to Management of Investigation Derived Wastes, Office of Solid Waste and Emergency Response Memorandum 9345.3.03FS, January 1992.

Code of Federal Regulations, Title 40, Part 261, Section 23, Section 11 (a) (3), and Section 24 (a) (b).

CFR Proposed Criteria: 51 FR 21685, June 30, 1986 and 51 FR 21450, May 20, 1992.

## 6.0 APPENDICES

This section is not applicable to this SOP.

CONTENTS

## 1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide guidance for determining the depth to water in a well using an electronic water level indicator. In this SOP, wells are defined as monitoring wells, piezometers, temporary well points, and potable wells. Permanent wells should be surveyed such that wells can be located and water elevations can be determined. At sites where there are multiple wells, a complete round of water level measurements should be collected site-wide prior to commencement of activities that will affect groundwater levels.

Groundwater level measurements are used to:

- Construct water table/potentiometric surface maps,
- Identify the groundwater drawdown and recovery during an aquifer test,
- Document variations in water level,
- Provide a baseline measurement to convert the height of the water column above an installed transducer to water level elevations, and
- Determine groundwater volume in wells prior to purging.

A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The sampler needs to ensure that the methods used are adequate to satisfy the data quality objectives listed in the UFP-QAPP for a particular site.

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations or other procedural limitations. In all such instances, the procedures employed must be documented on a Field Change Form and attached to the UFP-QAPP. These changes must be documented in the final deliverable.

## 2.0 METHOD SUMMARY

A permanent survey mark should be placed on the top of the riser pipe or casing as a reference point for groundwater level measurements. If the lip of the riser pipe is not flat, a notch can be made on the polyvinyl chloride (PVC) riser and used as the reference point. Alternatively, the reference point may be located on the top of the outer protective casing (if present). If using a measurement reference point, it must be documented in a site-specific logbook or on a field data sheet (Figure 1, Appendix A). All field personnel must be informed of the measurement reference point used to ensure the collection of consistent data.

NOTE: If data are recorded in the ERT contractor's sampler's personal logbook, the pages must be photocopied and retained in the contractor's project files.

Before measurements are made, water levels in piezometers and monitor wells should be allowed to stabilize for a minimum of 24 hours after well construction and development. In low yield situations, recovery of water levels to static equilibrium may take longer. All measurements should be recorded to one hundredth (0.01) of a foot. When possible, measurements should be taken from the least to the most contaminated borehole, well, or piezometer.

Open the well and if necessary determine the presence of volatile organic compounds (VOCs) with an appropriate air monitoring instrument. For electrical sounders, ground the measuring equipment if required, and then lower the water level probe into the well until the water surface is reached, as indicated by a tone or meter deflection. Once at least three consistent water level measurements have been obtained, the water level should be recorded on a field datasheet and/or in field logbook and the water level probe should be removed from the well. All caps and well covers should be closed and any the water level meter should be decontaminated as necessary.

NOTE: If a separate phase product is present, a product/water interface probe is required for the measurement of product thickness and water level.

## 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

This section is not applicable to this SOP.

## 4.0 INTERFERENCES AND POTENTIAL PROBLEMS

- Cascading water, particularly in open-hole or rock wells and especially during aquifer pumping tests, may interfere with the water level measurement.
- Some older types of meters are only marked at 5-foot intervals. Only water level indicator marked in 0.01 foot increments should be used for taking water level measurements.
- Oil or other product on or in the water column can insulate the contacts of the probe of a meter and give false readings. For accurate water level measurements in wells, containing separate phase product, a special product/water level indicator is required.
- Tapes (electrical or surveyor) may have damaged or missing sections, or may be spliced inaccurately. Always examine the tape for continuity and completeness.

## 5.0 EQUIPMENT/APPARATUS

- Electric water level indicator, marked in increments of 0.01-foot
- Spare batteries
- Appropriate air monitoring equipment [photoionization detector (PID) and/or flame ionization detector (FID)]
- Product/water interface probe
- Site logbook and field data sheets
- Decontamination supplies
- Paper towels and trash bags

## 6.0 REAGENTS

No chemical reagents are used in this procedure; however, decontamination solutions may be necessary. If decontamination of equipment is required, refer to ERT SOP, *Sampling Equipment Decontamination* and the approved site-specific UFP-QAPP.

## 7.0 PROCEDURES

### 7.1 Preparation

If historical records are available, they should be reviewed to determine which wells are likely to be contaminated. Historical records may also indicate the presence of VOCs in the headspace, light non-aqueous phase liquid (LNAPL) or dense non-aqueous phase liquid (DNAPL). Water levels across a site should be measured from the least contaminated to the most contaminated well to prevent cross-contamination.

All equipment should be inspected to ensure that they are in working order and clean. Both the speaker and indicator light on an electronic water level indicator should activate when the probe enters water. If the contaminant of concern includes the possibility of an LNAPL, an interface probe that indicates the top of the LNAPL and the interface with the groundwater should be checked also at this time.

All wells should be surveyed by a licensed surveyor; however, a relative survey can be used in most applications of water levels. The surveyor shall mark the top of casing (TOC) at the point that it was surveyed. Information on the well, including survey data, total depth and screened interval, should be available and brought to the site. When water level measurements are made in support of groundwater sampling, the log sheet included in ERT SOP, *Groundwater Well Sampling* should be used for documentation. For other uses, document measurements on an appropriate log sheet or logbook.

### 7.2 Liquid Level Determination

1. Open the well by removing the well cover and well cap and record the well identification (ID) number in the site log book.

2. If indicated in the Health and Safety Plan (HASP), the headspace of the well should be assessed using a PID and/or FID.

3. Identify the TOC as marked by the surveyor. If the well has not been surveyed, establish a reference point on the casing using a permanent mark or notch, and document its location in the site log book (ASTM 2001). Measure the height of the mark relative to the well pad and record.

4. Turn on the water level indicator and set the sensitivity to middle of the range (e.g., 5 or 6 on a Durham Geo Slope Indicator).

5. Lower the probe of the electronic water level indicator into the well until an audible tone and a light indicates contact had been made with the water.

6. Raise and lower the probe until the interface is identified by the tone terminating when the probe is raised slightly.

7. Determine the distance from the water surface to the TOC by holding the graduated tape against the reference mark and read the distance to the nearest 0.01 of a foot. Repeat until a consistent and repeatable measurement is made. If water is suspected to be clinging to the probe, a gentle shake will remove the water.

8. If LNAPL presence is suspected, use an interface probe in a similar fashion as described above, noting the difference in tones for the top of the LNAPL and interface with the water.

9. Measure the depth to LNAPL in the same manner as with the water level indicator noting the steady tone and light indicating that the probe is in a non-conducting liquid. Water is indicated by an intermittent tone and light.

10. To determine the LNAPL–water interface, repeat the process except raising the probe from the water layer up into the LNAPL. Raising the probe prevents LNAPL from coating the probe obscuring the interface (Solinst, 1998). DNAPL occurs below the water level, and the interface is detected when the intermittent tone and light becomes a steady tone and light.

11. Document the depths of all interfaces detected in the site logbook.

12. Remove the probe from the well. Replace the well cap and secure the wellhead cover in place.

13. Decontaminate the equipment by washing thoroughly with a non-abrasive mild detergent with warm (not hot) water and a soft cloth (Solinst, 1998) as necessary.

In the site-specific logbook and/or on a field data sheet (Appendix A, Figure 1) record the well ID, latitude/longitude (if available), date, time of day, participating field personnel, all fluid measurements, any PID or FID results, and any physical changes at the well (e.g. erosion or cracks in the protective concrete pad).

## 8.0 CALCULATIONS

Groundwater elevations can be determined for surveyed wells using the equation:

$$E_w = E - D \qquad \text{(Equation 1)}$$

Where:

$E_W$ = Elevation of the groundwater relative to the survey datum
$E$ = Elevation of the TOC as marked by the surveyor
$D$ = Depth to water

To calculate the volume of the well, first the height of the water column must be determined. The height of the water column may be available from site records or can be determined by sounding the well, which is a measure of the total depth of the well from the TOC. Subtracting the depth to the water from the total depth provides the height of the water column in the well. Well volume in gallons is then determined by:

$$\text{Well Volume (gallons)} = \pi r^2 hk \qquad \text{(Equation 2)}$$

Where:

$\pi$ = 3.14
$r$ = inside radius of monitoring well (feet)
$h$ = height of the water column (feet)
$k$ = conversion factor, 7.48 gallons per cubic foot (gal/ft$^3$)

In cases where LNAPL is present, the weight of the LNAPL on the water column affects the water elevation. The corrected water elevation is calculated by:

(LNAPL thickness)(LNAPL density) + water elevation = corrected water elevation

For purposes of approximation, specific gravity of LNAPL of 0.8 can be used when the density is not known.

## 9.0 QUALITY ASSURANCE/QUALITY CONTROL

The following general quality assurance/quality control (QA/QC) procedures apply:

1. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the UFP-QAPP.

2. Each well must be tested a minimum of three times to compare results. Results should agree within 0.02 of a foot. Consistent failure of consecutive readings to agree suggests that levels are changing because of tidal influences or the well is hydraulically connected to a near-by pumping well.

## 10.0 DATA VALIDATION

Data verification (completeness checks) must be conducted to ensure that all data inputs are present for ensuring the availability of sufficient information. These data are essential to providing an accurate and complete final deliverable. The contractor’s Task Leader (TL) is responsible for completing the UFP-QAPP verification checklist for each project. The data generated will be reviewed and processed by the contractor’s TL prior to distribution.

## 11.0 HEALTH AND SAFETY

Based on Occupational Safety and Health Administration (OSHA) requirements, a site-specific health and safety plan (HASP) must be prepared for response operations under the Hazardous Waste Operations and Emergency Response (HAZWOPER) standard, 29 CFR 1910.120. Field personnel working for EPA's Environmental Response Team (ERT) should consult the Emergency Responder Health and Safety Manual currently located at https://response.epa.gov/_HealthSafetyManual/manual-index.htm for the development of the HASP, required personal protective equipment (PPE) and respiratory protection.

## 12.0 REFERENCES

American Society for Testing and Materials (ASTM) International. 1987 (Reapproved 2001). *Standard Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)*. Designation: D 4750-87 (Reapproved 2001).

Durham Geo Slope Indicator, Inc. *Water Level Indicator Instructions*.

Solinst. 1998. *Interface Meter Operation Instructions*.

U.S. Geological Survey (USGS), 2010. GWPD 4 – Measuring water levels by use of an electric tape. Version 2010.1. Groundwater Technical Procedures of the USGS.

## 13.0 APPENDICES

A – Example Field Data Sheet

APPENDIX A
Example Field Data Sheet
SOP: ERT-PROC-2043-20
February 2020

FIGURE 1. EXAMPLE FIELD DATA SHEET

PAGE __ OF_

SITE NAME: ____________________ LOGGER NAME: ____________________

SITE LOCATION: ____________________ ERT WAM: ____________________

LOG DATE: ____________________ WA# ____________________

| Time | Well I.D. | Latitude | Longitude | Elevation of well (TOC) | Depth to bottom of well (feet) | Depth to water (feet) | Depth to product (feet), if any | Product type/ Product thickness | COMMENTS (pH, temperature, specific conductance, weather conditions) |
|---|---|---|---|---|---|---|---|---|---|
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TOC = Top of casing

NOTES:

MEASUREMENT REFERENCE POINT FROM______GROUND SURFACE OR______TOP OF CASING

Weather Conditions: Temperature (°F/°C):___________

Rain: Heavy: ____Medium:____ Light:____

Barometric Pressure: ____

Other significant observations:

## CONTENTS

## 1.0 OBJECTIVE

The objective of this Standard Operating Procedure (SOP) is to define the procedures required for preparing and maintaining documentation that provides the details of field sampling activities. The sample documentation discussed in this procedure includes Site Logbooks, Field Data Worksheets, Analytical Logbooks, Labels, Chain of Custody records and custody seals.

A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The sampler needs to ensure that the methods used are adequate to satisfy the data quality objectives listed in the QAPP for a particular site.

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations or other procedural limitations. In all instances, the procedures employed must be documented on a Field Change Form and attached to the QAPP. These changes must be documented in the final deliverable.

## 2.0 APPLICABILITY

This SOP is applicable to all field activities which involve the collection of samples and/or the generation of environmental measurements and data associated with sample collection. It is applicable to both traditional (handwritten) and electronic records as those acquired through equipment that denotes sample locations (e.g. global positioning system [GPS]) or equipment that measures conditions at the time of sample collection (e.g. data logger).

Scientific recordkeeping accurately records and preserves data, provides a usable and comprehensive reference for clients and coworkers, enables continuation or replication of work and preserves all data describing the work for scientific and legal purposes.

## 3.0 DESCRIPTION

### 3.1 General

Accurate sample documentation is essential for proper site evaluation. A clear traceable paper trail must follow each sample from its point of origin to the final client deliverable. It is important that specific procedures be adopted so that the desired degree of accuracy and completeness is achieved.

All sample documents must be completed accurately and completely. Each line, table or checkbox present on any field datasheet must be completed. If there is some reason why certain areas of portions of a field datasheet are not used, field personnel are required to cross out those sections and initial and date. Any hardcopy corrections or revisions must be made by crossing out the incorrect entry and initialing and dating the error.

### 3.2 Sample/Measurement Documentation

Field sample documentation must be sufficient so that an accurate account of field operations can be reconstructed in the writer’s absence. Site activity may be documented in a site logbook or on field datasheets. There is the potential, especially on Superfund sites, for these records to be used as legal evidence. All site logbooks, field datasheets, data acquired electronically by U.S. EPA Environmental Response Team [ERT] and ERT contractor personnel and Scribe databases are official records. Upon completion of the sampling event, all sample information that can be imported must also be entered into the site-specific Scribe database.

### 3.2.1 Site Logbook

The site logbook is essentially a descriptive notebook detailing site activities and observations. All entries should be dated and signed by the individual(s) making the entries. Site logbooks should contain at a minimum, the following information:

- Site name and location on inside and outside cover
- Name of person to whom the logbook was assigned
- Date and location of field work
- Times (military times preferred, or reference AM or PM)
- Names and addresses of field contacts
- Site sketches and/or photographic references
- Weather conditions
- Sample descriptions, locations, times taken, identification numbers
- Chain of Custody information, shipping paper identification number, recipient address and phone number, etc.
- Field observations and discussion
- Field measurements (i.e. pH, temperature, surface water flow rates, etc.)
- Instructions issued by the Work Assignment Manager
- Field activities by all contractor personnel on site

Entries may be made in site logbooks by any ERT or ERT contractor personnel on site and should detail the activities of all personnel involved in the field operations. Each entry should be signed by the person making the entry and should relate to previous entries or have sufficient background detail. The sequence of site activities should be clear to a reader who was not at the site. Various types of logbooks available are shown in Figure 1, Appendix A.

When a site logbook is completed and no longer needed for site documentation, or after a project is finished, the site logbook must be returned to the ERT contractor's Central Files for archiving. If the site logbook is transmitted to ERT, documentation of the transmittal and a copy of the notes from the logbook must be prepared and maintained in the Central Files.

### 3.2.2 Field Data Worksheets

Field data worksheets, specific to a sampling or measurement/monitoring task, may be used to record all information pertinent to sampling efforts. Field data worksheets are pre-printed to document specific data related to sample collection or field measurement/monitoring data. Required fields typically include Site Name, Project Number (Work Assignment Number [#]), Sampler(s), ERT Work Assignment Manager (WAM), the ERT contractor's Task Leader, Date, Sample #, sample location information, collection information, measurement/monitoring data including type of device used for collection/measurement activities, any calibrations performed, flow rate, etc. and analytical requirements. Examples of Field Data Worksheets include: Air Sampling Worksheets, SUMMA Sampling Worksheets, Boring Logs, Slug Test Data Sheets, etc. All sample data documented on Field Data Worksheets will be transferred to the site-specific Scribe database, as fields allow. Field Datasheets/Worksheets will be archived in the ERT contractor's Central Files and are typically appended to the final client deliverable.

Examples of field datasheets/worksheets can be found in Figures 2 through 5, Appendix A.

## 3.3 Analytical Documentation

Analytical data, including sample analysis or field analytical measurements, must be documented so that the sequence of laboratory activities will be clear to a reader who was not involved in the analysis. These measurements are recorded in an analytical logbook. Analytical logbooks will be issued for, but are not limited to: documenting analysis by a particular lab (stationary, mobile, Trace Atmospheric Gas Analyzer [TAGA]) or instrument; recording sample preparation and extraction procedures; recording temperature readings, and; documenting bench-scale and treatability studies.

Entries must detail the analytical activities of laboratory personnel. Each entry must be signed and dated by the analyst making the entry and must relate to previous entries or have sufficient background detail. Upon completion of an analytical logbook, the logbook must be returned to the ERT contractor's Quality Assurance/Quality Control (QA/QC) Officer for archival or remain in the laboratory for reference.

## 3.4 Sample Labels

Sample labels are attached to environmental samples and are used to document sample information including the sample location, sample number, sample date/time, sample volume (air samples) and analyses. Sample labels may be generated by Scribe or pre-numbered sample labels may be used. If pre-numbered labels are used, the Scribe database must be updated to include all sample information. If a Contract Laboratory Program (CLP) laboratory will be analyzing the sample(s), the sample label(s) must include unique preassigned CLP number(s). ERT SOP, *Scribe Use in Field Operations* should be consulted for more detail on the use of Scribe.

### 3.4.1 Scribe Generated Sample Labels

Sample labels are generated by the Scribe software for inclusion on the sample containers. The label contents can be tailored to suit the needs of the project and the laboratory where the samples will be analyzed. Scribe generated labels (Figures 6 and 7, Appendix A) are used for all types of samples.

If duplicates or blanks are collected at a sampling location, the sample sets must be treated as being unique from the original sample and labeled with different and unique sample identification numbers. The Scribe database should be used to document sample duplicates and link to the original sample. When collecting samples for parameters which require extra volume for matrix spike/matrix spike duplicate (MS/MSD) analysis, the original sample container(s) and the MS/MSD containers are labeled with the same sample identification number. Required volumes for MS/MSD analysis for typical parameters are specified in each site specific QAPP.

### 3.4.2 Pre-Numbered Sample Labels

Logistically, there may be circumstances where Scribe cannot be used to effectively generate labels to fulfill the demands of a project. This may be due to lack of computing or printing resources, the need to pre-label sample containers (i.e. tracking high and low volume activity based sampling [ABS] cassettes), or time-sensitive constraints. At the discretion of the Task Leader, pre-numbered sample labels may be used to meet sample documentation needs.

The pre-numbered sample label for SUMMA canister sampling (Figure 3, Appendix A) consists of three parts. The largest part includes the project name, the contract number, the sample identification number, and space for the following information: the site name, sample volume, date, time, requested analysis, and remarks. Other parts include two additional sample labels with only the sample identification number.

When a sample is collected, the largest part of the sample label is completed and affixed to the sample container in the manner described by the appropriate ERT air sampling SOP. The two remaining sample number labels can be used to label additional sample containers comprising that sample or to identify sample number on the Field Data Sheet or Logbook.

Although pre-numbered labels may be used to meet project demands, all data must be entered into the Scribe database.

### 3.5 Chain of Custody

A Chain of Custody (COC) record (Figure 9, Appendix A) must be maintained from the time a sample is collected to its final deposition so that the entire path and life of a sample can be tracked. Chain of Custody (COC) is a legal term that refers to the ability to guarantee the identity and the integrity of the sample (or data) from collection through reporting of the test results. A sample is under custody if: (1) it is in a person's actual possession; (2) it is in your view, after being in your possession; or (3) it was in your possession and is now custody sealed; or (4) it is stored in a controlled area.

In the case of litigation, the COC is evaluated to ensure that sample integrity was maintained from the time of sample collection to completion of analysis. The COC should be generated by the TL or their designee using Scribe software. Scribe is required for generating COC records. Refer to ERT SOP, *Chain of Custody Procedures*. In instances where a Scribe COC can't be generated in the field due situations such as emergency response, working remotely without power or computer problems, a preprinted blank COC record may be used as a last resort (Figure 10, Appendix A).

### 3.6 Custody Seals

Custody Seals (Figure 11, Appendix A) demonstrate that a sample container has not been opened or tampered with during transport or storage. Two seals should be affixed in such a manner that the shipping container cannot be opened without breaking the seal. The person in direct possession of the samples shall sign and date the seal at the time of its application. In some circumstances, usually for CLP procedures, it may also require that each individual sample container be sealed with a custody seal.

## 4.0 RESPONSIBILITIES

### 4.1 ERT Work Assignment Manager

The ERT Work Assignment Manager (WAM) is responsible for providing technical expertise and technical direction to the contractor, preparing task orders/work assignments, reviewing deliverables, interacting with the Regional customers and monitoring the financial and administrative management of the project.

### 4.2 ERT Quality Coordinator

The ERT Quality Coordinator provides QA oversight for all projects and implements/maintains the ERT Quality Assurance Program.

### 4.3 ERT Contractor Task Leaders and Field Staff

The ERT contractor TLs and field staff are responsible for preparing and maintaining sample documentation in accordance with this SOP.

### 4.4 ERT Contractor Management

The ERT contractor's management are responsible for ensuring implementation of the procedures outlined in this SOP.

### 4.5 ERT Contractor QA/QC Officer

The ERT contractor's QA/QC Officer is responsible for ensuring compliance with this SOP by auditing reports prepared by contractor personnel and notifying contractor management personnel on an annual basis to review and revise this SOP.

## 5.0 REFERENCES

U.S. EPA, *for Documenting Environmental Information in Logbooks*, accessed at https://www.epa.gov/quality/procedure-documenting-environmental-information-logbooks (July 2020).

## 6.0 APPENDIX

A - Figures

# APPENDIX A
Figures
SOP: ERT-PROC-2002-20
October 2020

FIGURE 1. Example Site Logbooks

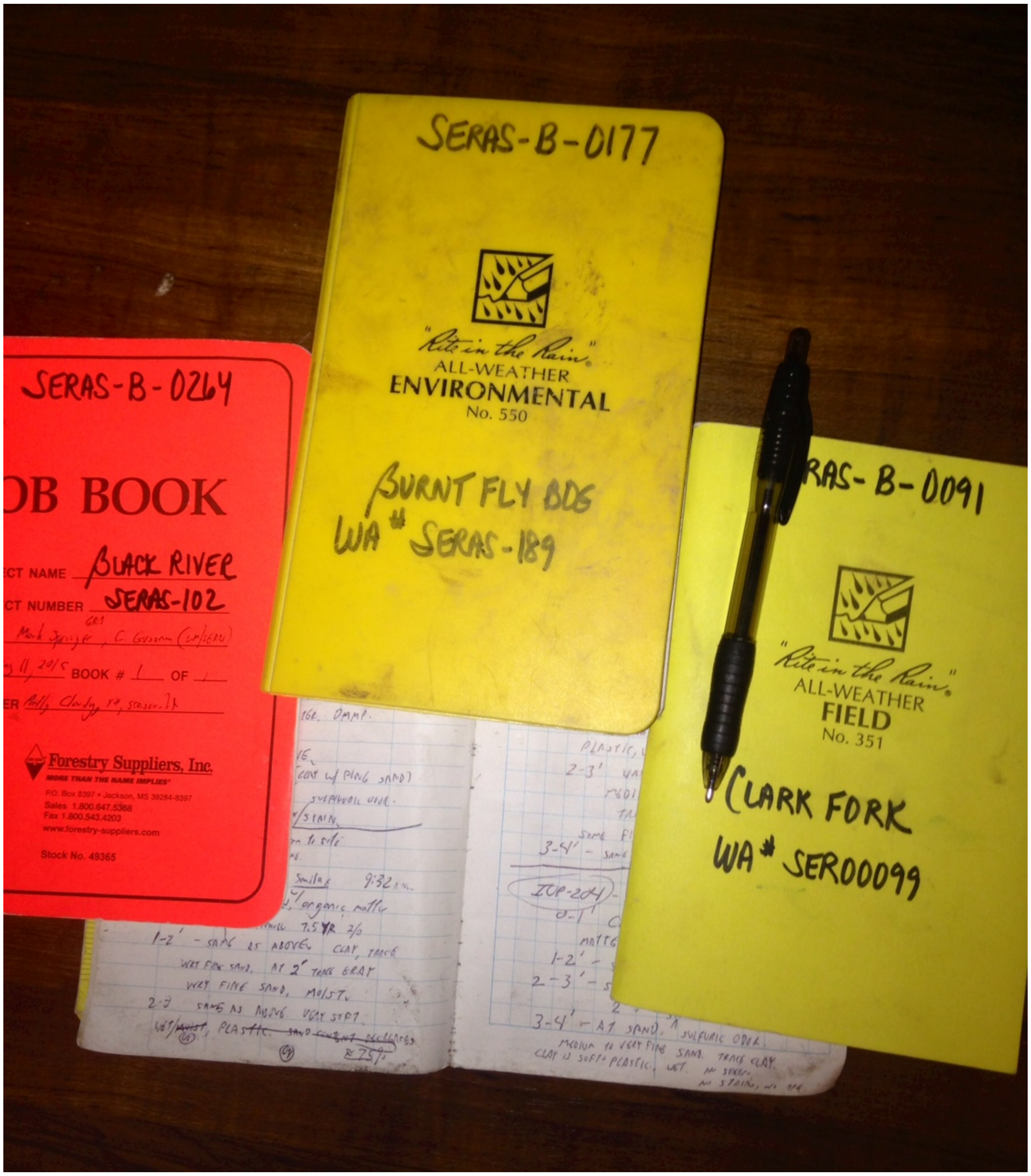
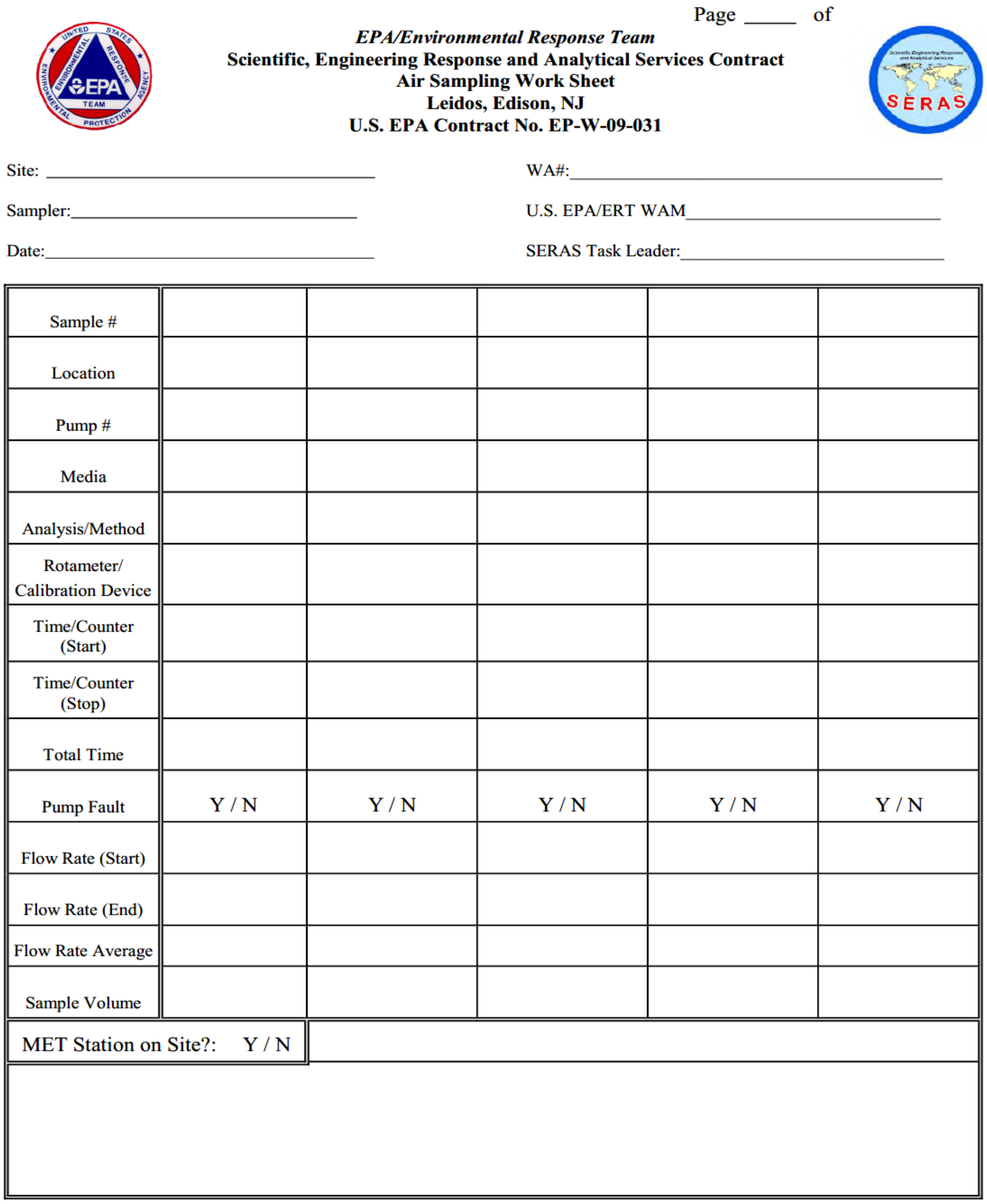


FIGURE 2. Air Sampling Worksheet



Page _____ of

***EPA/Environmental Response Team***
**Scientific, Engineering Response and Analytical Services Contract**
**Air Sampling Work Sheet**
**Leidos, Edison, NJ**
**U.S. EPA Contract No. EP-W-09-031**

Site: ______________________________

WA#:______________________________

Sampler:___________________________

U.S. EPA/ERT WAM___________________

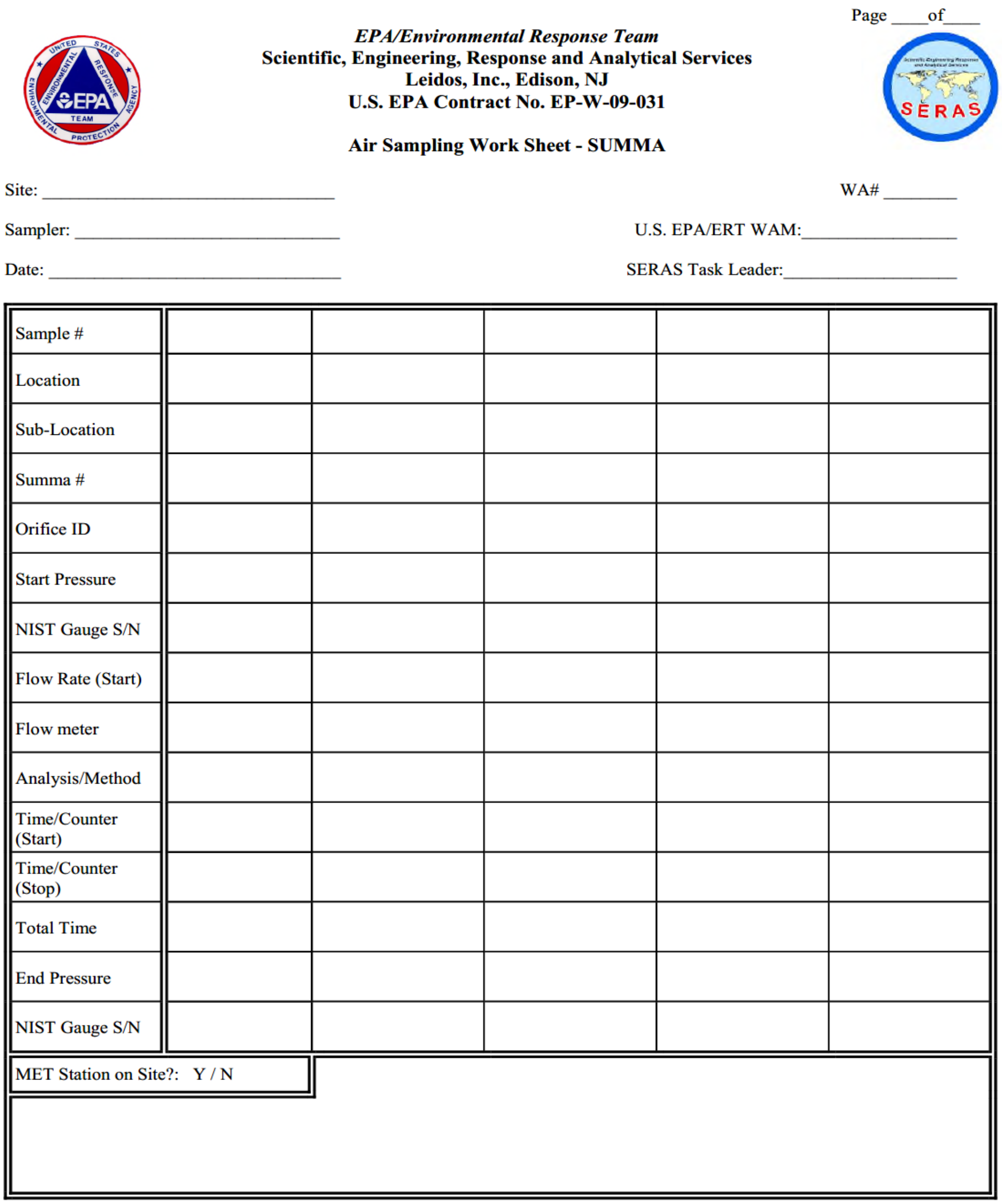
Date:______________________________

SERAS Task Leader:__________________

| | | | | | |
|---|---|---|---|---|---|
| Sample # | | | | | |
| Location | | | | | |
| Pump # | | | | | |
| Media | | | | | |
| Analysis/Method | | | | | |
| Rotameter/ Calibration Device | | | | | |
| Time/Counter (Start) | | | | | |
| Time/Counter (Stop) | | | | | |
| Total Time | | | | | |
| Pump Fault | Y / N | Y / N | Y / N | Y / N | Y / N |
| Flow Rate (Start) | | | | | |
| Flow Rate (End) | | | | | |
| Flow Rate Average | | | | | |
| Sample Volume | | | | | |

MET Station on Site?: Y / N

FIGURE 3. SUMMA Sampling Work Sheet



Page ____of____

*EPA/Environmental Response Team*
**Scientific, Engineering, Response and Analytical Services**
**Leidos, Inc., Edison, NJ**
**U.S. EPA Contract No. EP-W-09-031**

**Air Sampling Work Sheet - SUMMA**

Site: ______________________________ WA# ________

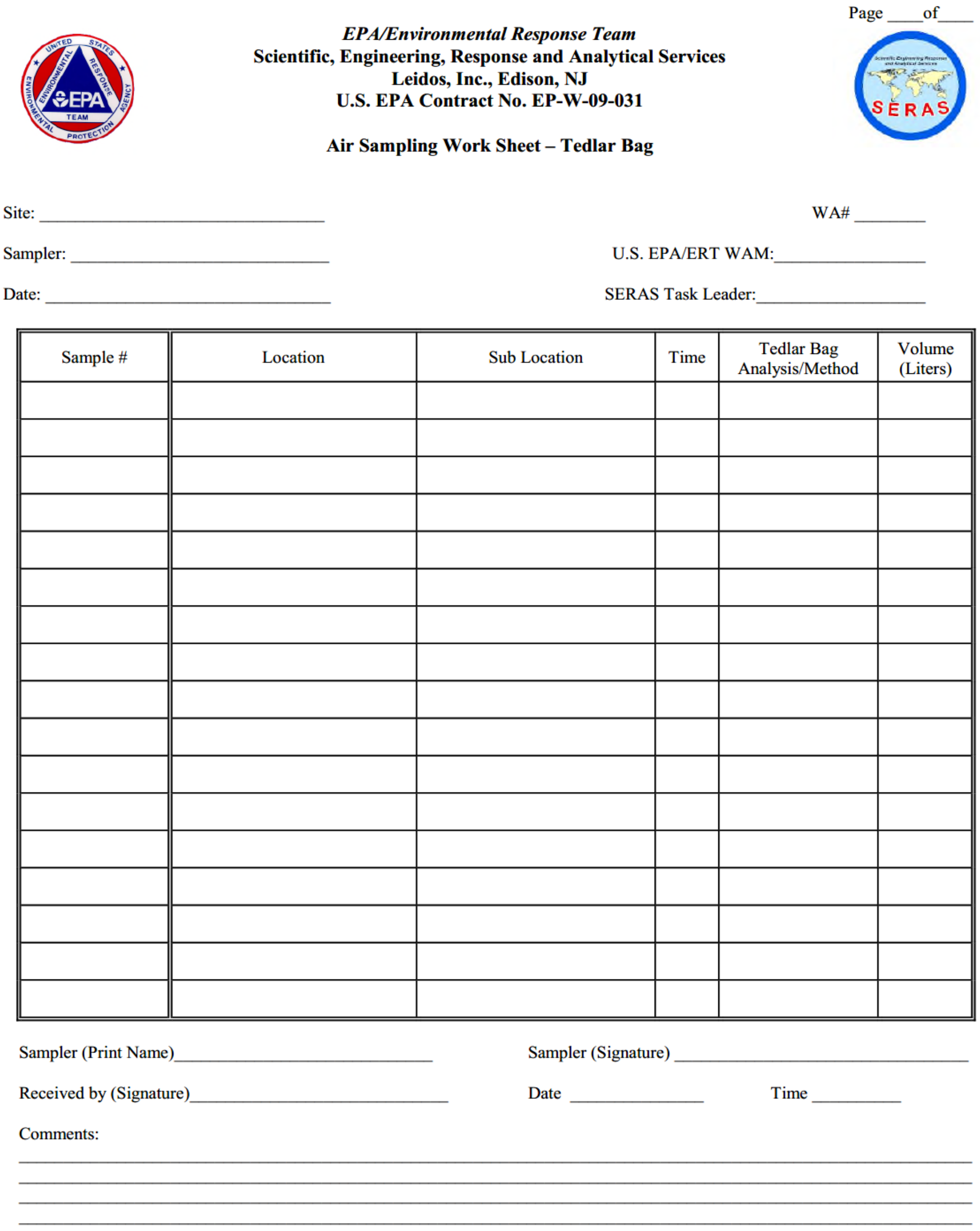
Sampler: ___________________________ U.S. EPA/ERT WAM:________________

Date: ______________________________ SERAS Task Leader:__________________

| | | | | | |
|---|---|---|---|---|---|
| Sample # | | | | | |
| Location | | | | | |
| Sub-Location | | | | | |
| Summa # | | | | | |
| Orifice ID | | | | | |
| Start Pressure | | | | | |
| NIST Gauge S/N | | | | | |
| Flow Rate (Start) | | | | | |
| Flow meter | | | | | |
| Analysis/Method | | | | | |
| Time/Counter (Start) | | | | | |
| Time/Counter (Stop) | | | | | |
| Total Time | | | | | |
| End Pressure | | | | | |
| NIST Gauge S/N | | | | | |

MET Station on Site?: Y / N

FIGURE 4. Tedlar Bag Sampling Worksheet



Page ____of____

*EPA/Environmental Response Team*
**Scientific, Engineering, Response and Analytical Services**
**Leidos, Inc., Edison, NJ**
**U.S. EPA Contract No. EP-W-09-031**

**Air Sampling Work Sheet – Tedlar Bag**

Site: ________________________________ WA# ________

Sampler: _____________________________ U.S. EPA/ERT WAM:________________

Date: ________________________________ SERAS Task Leader:__________________

| Sample # | Location | Sub Location | Time | Tedlar Bag Analysis/Method | Volume (Liters) |
|---|---|---|---|---|---|
| | | | | | |
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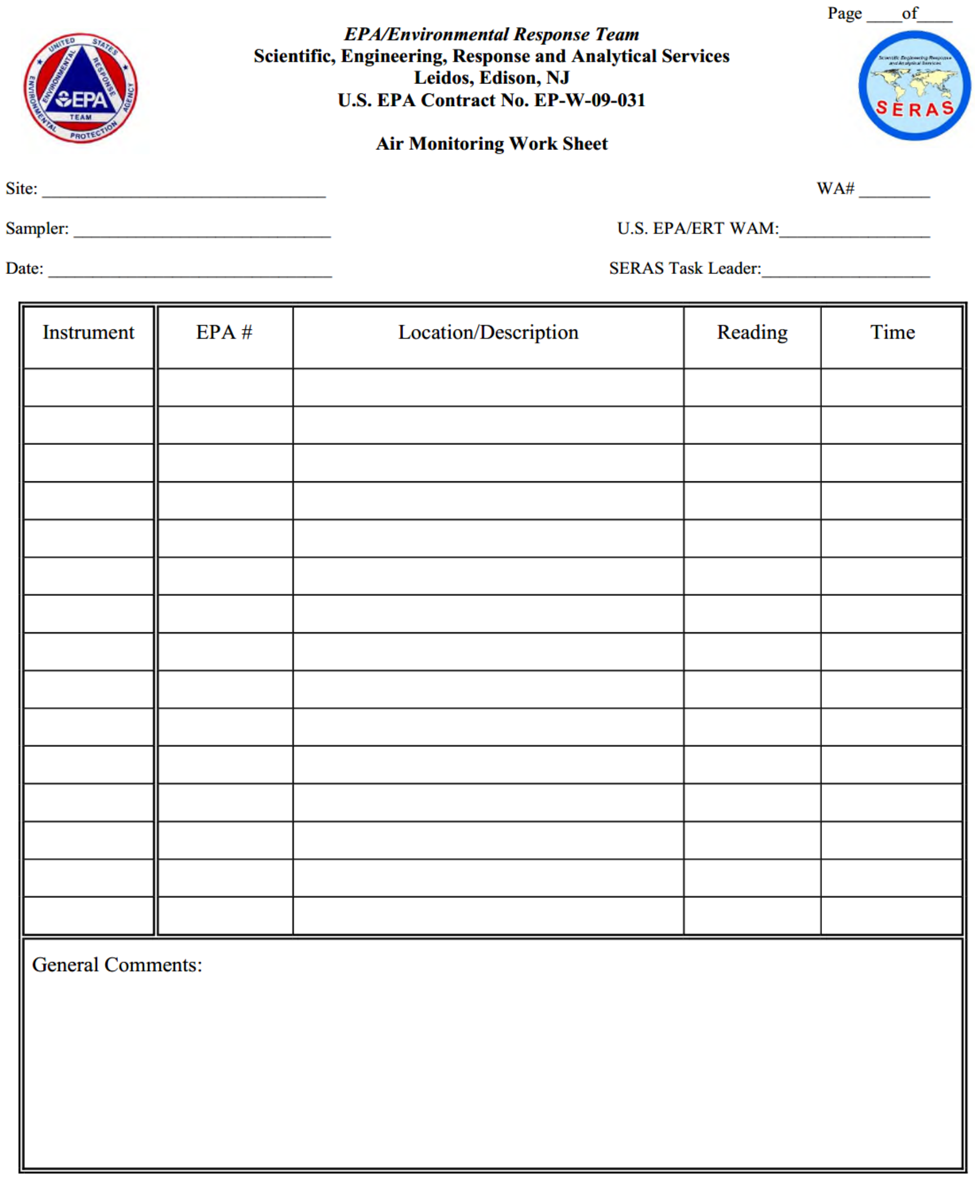
Sampler (Print Name)____________________________ Sampler (Signature) ________________________________

Received by (Signature)____________________________ Date _______________ Time __________

Comments:
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________

FIGURE 5. Air Monitoring Worksheet



Page ____of____

***EPA/Environmental Response Team***
**Scientific, Engineering, Response and Analytical Services**
**Leidos, Edison, NJ**
**U.S. EPA Contract No. EP-W-09-031**

**Air Monitoring Work Sheet**

Site: ________________________________ WA# ________

Sampler: _____________________________ U.S. EPA/ERT WAM:________________

Date: ________________________________ SERAS Task Leader:___________________

| Instrument | EPA # | Location/Description | Reading | Time |
|---|---|---|---|---|
| | | | | |
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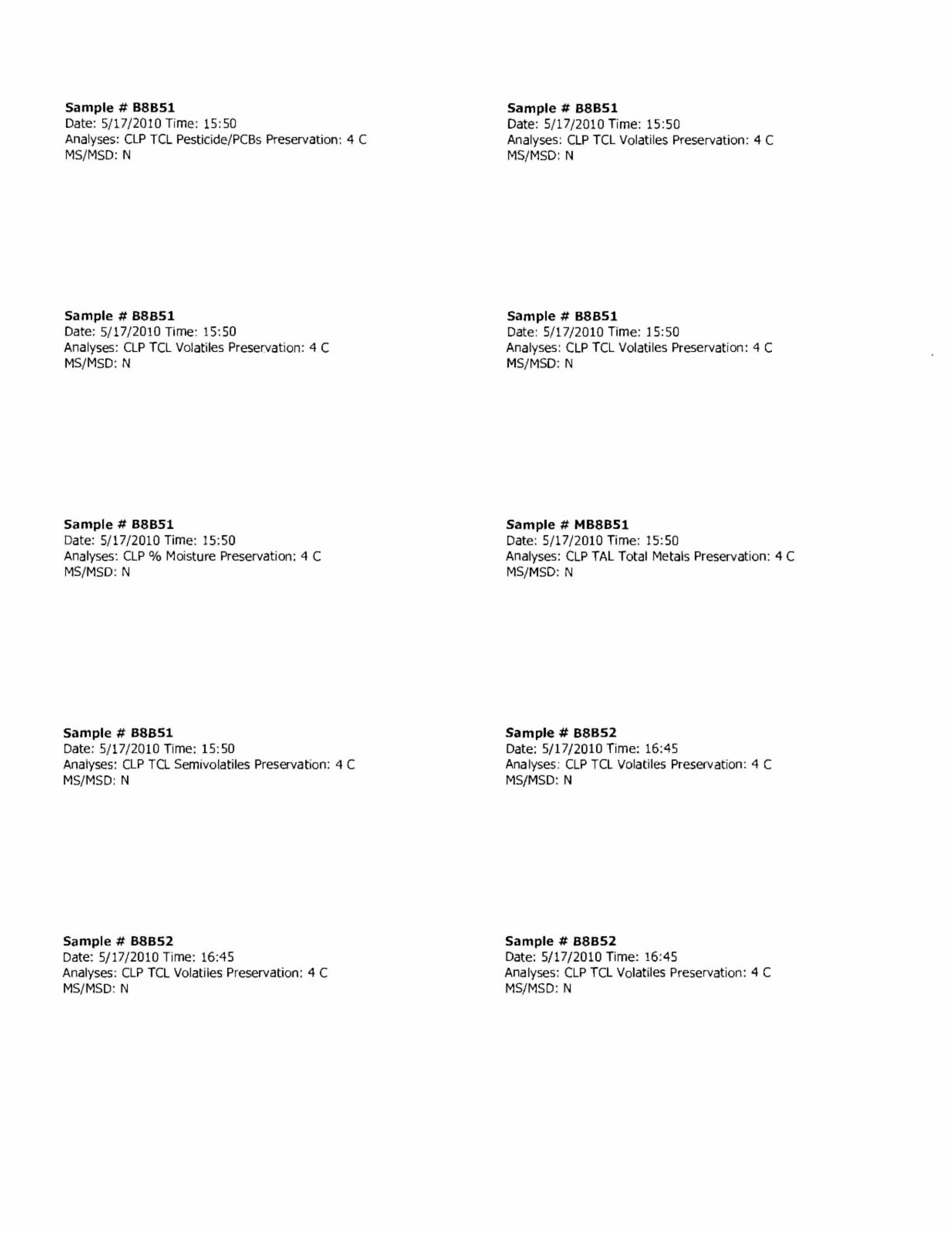
General Comments:

FIGURE 6. Example Scribe-Generated Sample Labels



**Sample # B8B51**
Date: 5/17/2010 Time: 15:50
Analyses: CLP TCL Pesticide/PCBs Preservation: 4 C
MS/MSD: N

**Sample # B8B51**
Date: 5/17/2010 Time: 15:50
Analyses: CLP TCL Volatiles Preservation: 4 C
MS/MSD: N

**Sample # B8B51**
Date: 5/17/2010 Time: 15:50
Analyses: CLP TCL Volatiles Preservation: 4 C
MS/MSD: N

**Sample # B8B51**
Date: 5/17/2010 Time: 15:50
Analyses: CLP TCL Volatiles Preservation: 4 C
MS/MSD: N

**Sample # B8B51**
Date: 5/17/2010 Time: 15:50
Analyses: CLP % Moisture Preservation: 4 C
MS/MSD: N

**Sample # MB8B51**
Date: 5/17/2010 Time: 15:50
Analyses: CLP TAL Total Metals Preservation: 4 C
MS/MSD: N

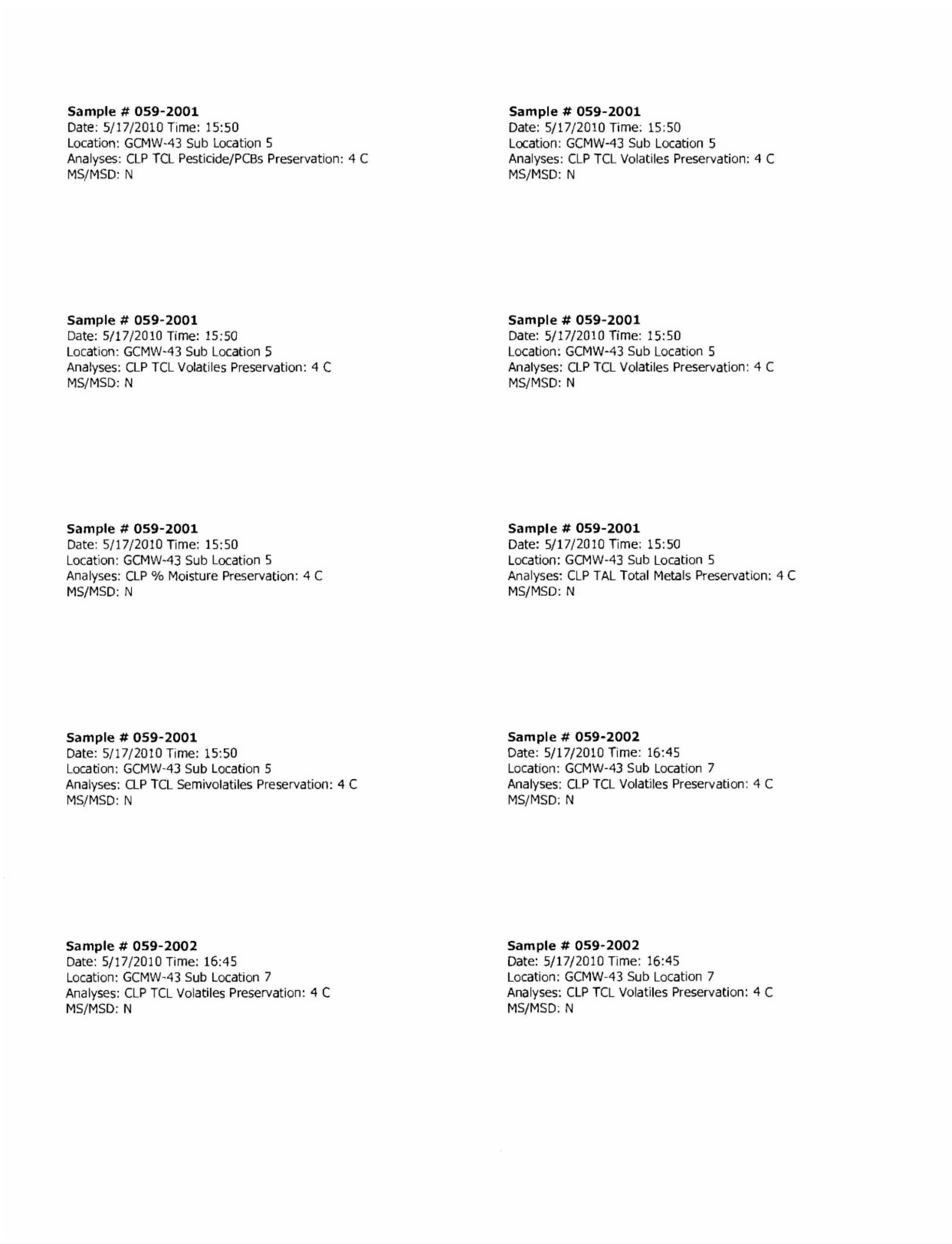
**Sample # B8B51**
Date: 5/17/2010 Time: 15:50
Analyses: CLP TCL Semivolatiles Preservation: 4 C
MS/MSD: N

**Sample # B8B52**
Date: 5/17/2010 Time: 16:45
Analyses: CLP TCL Volatiles Preservation: 4 C
MS/MSD: N

**Sample # B8B52**
Date: 5/17/2010 Time: 16:45
Analyses: CLP TCL Volatiles Preservation: 4 C
MS/MSD: N

**Sample # B8B52**
Date: 5/17/2010 Time: 16:45
Analyses: CLP TCL Volatiles Preservation: 4 C
MS/MSD: N

FIGURE 7. Example Scribe-Generated Sample Labels



**Sample # 059-2001**
Date: 5/17/2010 Time: 15:50
Location: GCMW-43 Sub Location 5
Analyses: CLP TCL Pesticide/PCBs Preservation: 4 C
MS/MSD: N

**Sample # 059-2001**
Date: 5/17/2010 Time: 15:50
Location: GCMW-43 Sub Location 5
Analyses: CLP TCL Volatiles Preservation: 4 C
MS/MSD: N

**Sample # 059-2001**
Date: 5/17/2010 Time: 15:50
Location: GCMW-43 Sub Location 5
Analyses: CLP TCL Volatiles Preservation: 4 C
MS/MSD: N

**Sample # 059-2001**
Date: 5/17/2010 Time: 15:50
Location: GCMW-43 Sub Location 5
Analyses: CLP TCL Volatiles Preservation: 4 C
MS/MSD: N

**Sample # 059-2001**
Date: 5/17/2010 Time: 15:50
Location: GCMW-43 Sub Location 5
Analyses: CLP % Moisture Preservation: 4 C
MS/MSD: N

**Sample # 059-2001**
Date: 5/17/2010 Time: 15:50
Location: GCMW-43 Sub Location 5
Analyses: CLP TAL Total Metals Preservation: 4 C
MS/MSD: N

**Sample # 059-2001**
Date: 5/17/2010 Time: 15:50
Location: GCMW-43 Sub Location 5
Analyses: CLP TCL Semivolatiles Preservation: 4 C
MS/MSD: N

**Sample # 059-2002**
Date: 5/17/2010 Time: 16:45
Location: GCMW-43 Sub Location 7
Analyses: CLP TCL Volatiles Preservation: 4 C
MS/MSD: N

**Sample # 059-2002**
Date: 5/17/2010 Time: 16:45
Location: GCMW-43 Sub Location 7
Analyses: CLP TCL Volatiles Preservation: 4 C
MS/MSD: N

**Sample # 059-2002**
Date: 5/17/2010 Time: 16:45
Location: GCMW-43 Sub Location 7
Analyses: CLP TCL Volatiles Preservation: 4 C
MS/MSD: N

FIGURE 8. Pre-Numbered SUMMA Label

**SERAS, EDISON NJ**
(732) 321-4200 SAMPLE NO. 00351
EPA CONTRACT EP-W-09-031
SITE NAME DATE
VOL OF AIR TIME
ANALYSIS REQUEST: REMARKS:

**SERAS, EDISON NJ**
(732) 321-4200 SAMPLE NO. 00352
EPA CONTRACT EP-W-09-031
SITE NAME DATE
VOL OF AIR TIME
ANALYSIS REQUEST: REMARKS:

00351
00351
00352
00352

**SERAS, EDISON NJ**
(732) 321-4200 SAMPLE NO. 00353
EPA CONTRACT EP-W-09-031
SITE NAME DATE
VOL OF AIR TIME
ANALYSIS REQUEST: REMARKS:

**SERAS, EDISON NJ**
(732) 321-4200 SAMPLE NO. 00354
EPA CONTRACT EP-W-09-031
SITE NAME DATE
VOL OF AIR TIME
ANALYSIS REQUEST: REMARKS:

00353
00353
00354
00354

**SERAS, EDISON NJ**
(732) 321-4200 SAMPLE NO. 00355
EPA CONTRACT EP-W-09-031
SITE NAME DATE
VOL OF AIR TIME
ANALYSIS REQUEST: REMARKS:

**SERAS, EDISON NJ**
(732) 321-4200 SAMPLE NO. 00356
EPA CONTRACT EP-W-09-031
SITE NAME DATE
VOL OF AIR TIME
ANALYSIS REQUEST: REMARKS:

00355
00355
00356
00356

**SERAS, EDISON NJ**
(732) 321-4200 SAMPLE NO. 00357
EPA CONTRACT EP-W-09-031
SITE NAME DATE
VOL OF AIR TIME
ANALYSIS REQUEST: REMARKS:

**SERAS, EDISON NJ**
(732) 321-4200 SAMPLE NO. 00358
EPA CONTRACT EP-W-09-031
SITE NAME DATE
VOL OF AIR TIME
ANALYSIS REQUEST: REMARKS:

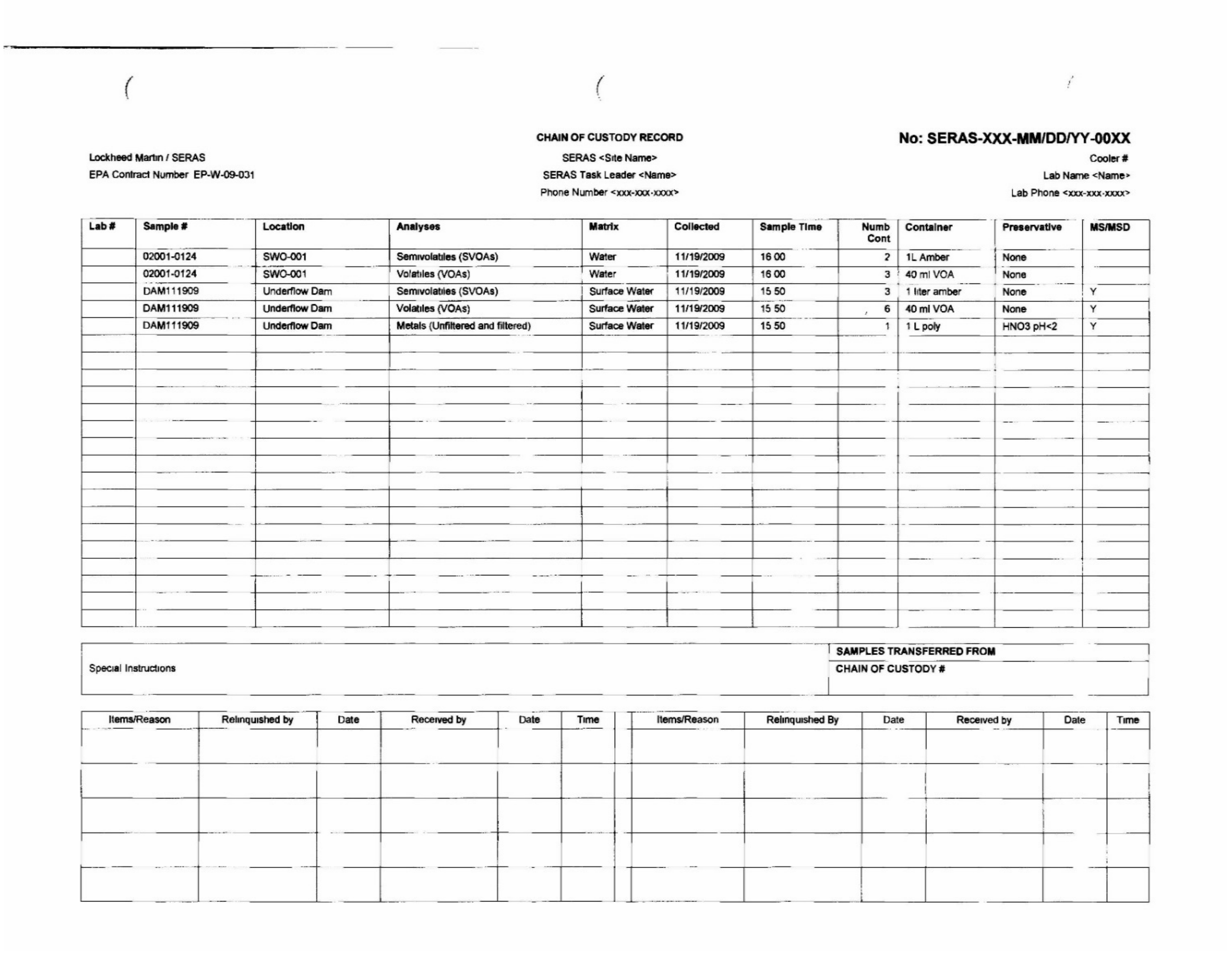
00357
00357
00358
00358

**SERAS, EDISON NJ**
(732) 321-4200 SAMPLE NO. 00359
EPA CONTRACT EP-W-09-031
SITE NAME DATE
VOL OF AIR TIME
ANALYSIS REQUEST: REMARKS:

**SERAS, EDISON NJ**
(732) 321-4200 SAMPLE NO. 00360
EPA CONTRACT EP-W-09-031
SITE NAME DATE
VOL OF AIR TIME
ANALYSIS REQUEST: REMARKS:

00359
00359
00360
00360

FIGURE 9. Chain of Custody Record (SCRIBE)



Lockheed Martin / SERAS
EPA Contract Number EP-W-09-031

**CHAIN OF CUSTODY RECORD**
SERAS <Site Name>
SERAS Task Leader <Name>
Phone Number <xxx-xxx-xxxx>

**No: SERAS-XXX-MM/DD/YY-00XX**
Cooler #
Lab Name <Name>
Lab Phone <xxx-xxx-xxxx>

| Lab # | Sample # | Location | Analyses | Matrix | Collected | Sample Time | Numb Cont | Container | Preservative | MS/MSD |
|---|---|---|---|---|---|---|---|---|---|---|
|  | 02001-0124 | SWO-001 | Semivolatiles (SVOAs) | Water | 11/19/2009 | 16 00 | 2 | 1L Amber | None |  |
|  | 02001-0124 | SWO-001 | Volatiles (VOAs) | Water | 11/19/2009 | 16 00 | 3 | 40 ml VOA | None |  |
|  | DAM111909 | Underflow Dam | Semivolatiles (SVOAs) | Surface Water | 11/19/2009 | 15 50 | 3 | 1 liter amber | None | Y |
|  | DAM111909 | Underflow Dam | Volatiles (VOAs) | Surface Water | 11/19/2009 | 15 50 | 6 | 40 ml VOA | None | Y |
|  | DAM111909 | Underflow Dam | Metals (Unfiltered and filtered) | Surface Water | 11/19/2009 | 15 50 | 1 | 1 L poly | HNO3 pH<2 | Y |
|  |  |  |  |  |  |  |  |  |  |  |
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Special Instructions

SAMPLES TRANSFERRED FROM
CHAIN OF CUSTODY #

| Items/Reason | Relinquished by | Date | Received by | Date | Time | Items/Reason | Relinquished By | Date | Received by | Date | Time |
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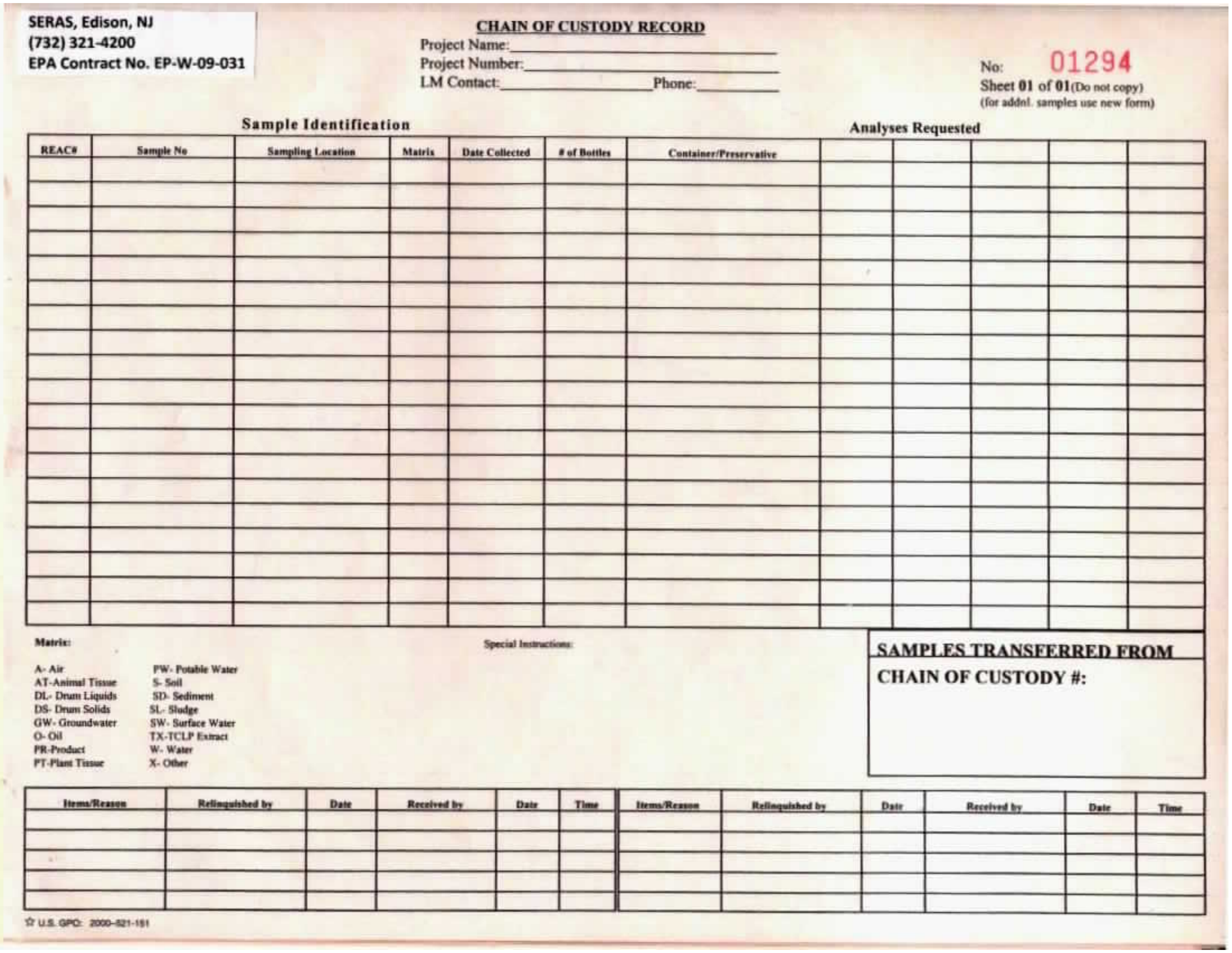

FIGURE 10. Generic Chain of Custody Record

**SERAS, Edison, NJ**
**(732) 321-4200**
**EPA Contract No. EP-W-09-031**

**CHAIN OF CUSTODY RECORD**

Project Name:____________________
Project Number:____________________
LM Contact:____________ Phone:________

No: 01294
Sheet **01** of **01** (Do not copy)
(for addnl. samples use new form)

**Sample Identification** | **Analyses Requested**

| REAC# | Sample No | Sampling Location | Matrix | Date Collected | # of Bottles | Container/Preservative | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
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**Matrix:**

| | |
|---|---|
| A- Air | PW- Potable Water |
| AT-Animal Tissue | S- Soil |
| DL- Drum Liquids | SD- Sediment |
| DS- Drum Solids | SL- Sludge |
| GW- Groundwater | SW- Surface Water |
| O- Oil | TX-TCLP Extract |
| PR-Product | W- Water |
| PT-Plant Tissue | X- Other |

**Special Instructions:**

**SAMPLES TRANSFERRED FROM**
**CHAIN OF CUSTODY #:**

| Items/Reason | Relinquished by | Date | Received by | Date | Time | Items/Reason | Relinquished by | Date | Received by | Date | Time |
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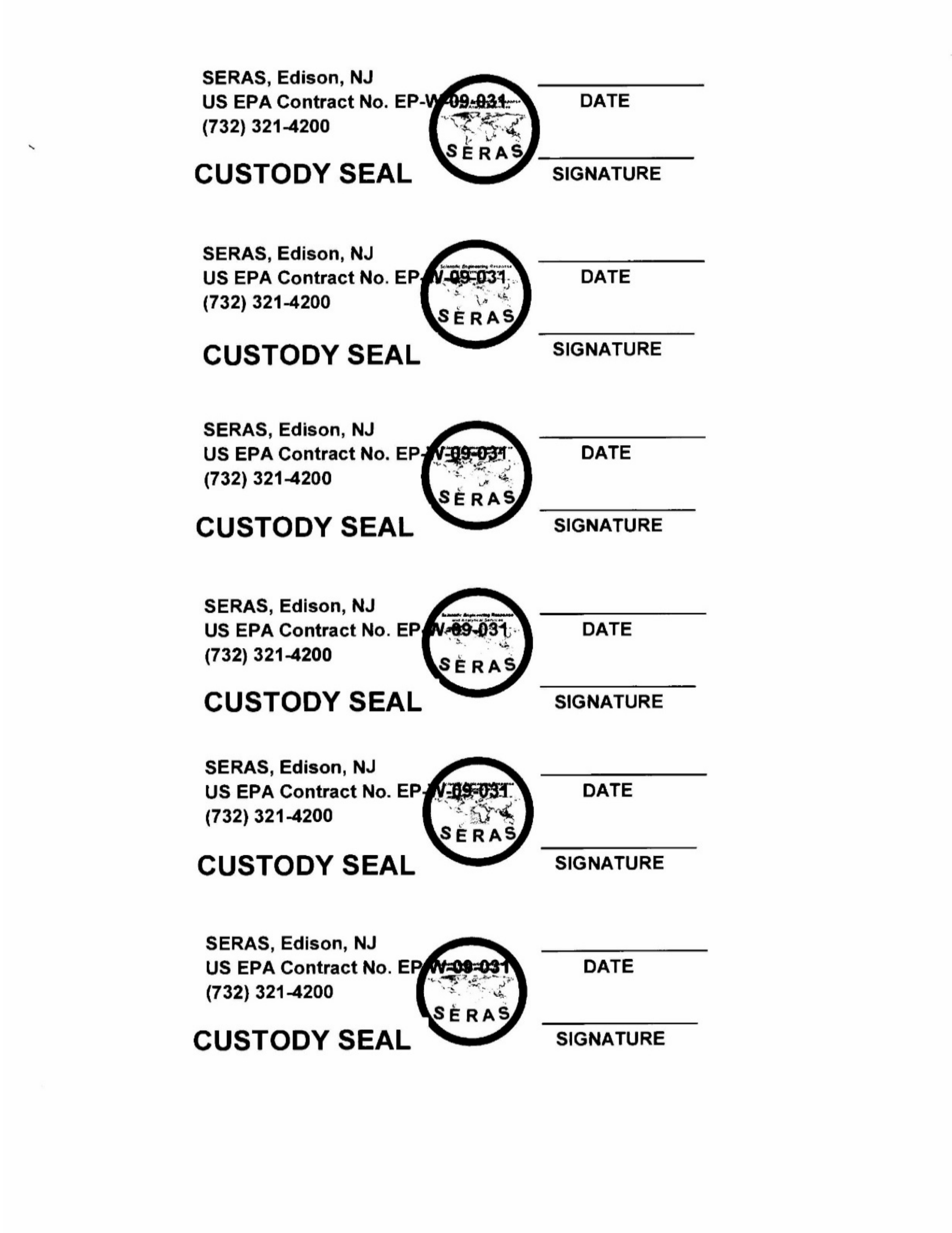
☆ U.S. GPO: 2000-521-151

FIGURE 11. Custody Seals



SERAS, Edison, NJ
US EPA Contract No. EP-W-09-031
(732) 321-4200
**CUSTODY SEAL**
DATE
SIGNATURE

SERAS, Edison, NJ
US EPA Contract No. EP-W-09-031
(732) 321-4200
**CUSTODY SEAL**
DATE
SIGNATURE

SERAS, Edison, NJ
US EPA Contract No. EP-W-09-031
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US EPA Contract No. EP-W-09-031
(732) 321-4200
**CUSTODY SEAL**
DATE
SIGNATURE

## CONTENTS

CONTENTS (cont'd)

## 1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to describe the methods for preventing or limiting cross-contamination of samples due to inappropriate or inadequate equipment decontamination and to provide general guidelines for developing decontamination procedures for sampling equipment to be used during environmental investigations as per 29 Code of Federal Regulations (CFR) 1910.120. This SOP does not address personnel decontamination.

A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The sampler needs to ensure the methods used are adequate to satisfy the data quality objectives (DQOs).

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations or other procedural limitations. In all instances, the procedures employed must be documented on a Field Change Form and attached to the QAPP. These changes must be documented in the final deliverable.

## 2.0 METHOD SUMMARY

Removing or neutralizing contaminants from equipment minimizes the possibility of sample cross contamination, reduces or eliminates transfer of contaminants to clean areas, and prevents the mixing of incompatible substances. Some equipment may have specific decontamination procedures that do not follow this SOP. Refer to the user manual for each piece of equipment before utilizing this SOP.

Gross contamination can be removed by physical decontamination procedures. These abrasive and non-abrasive methods include the use of brushes and high and low pressure water cleaning.

The first step is the physical removal of gross contamination on sampling equipment which may include steam or a high pressure water wash. The second step is a soap and water wash that removes the remainder of visible material and residual oils and grease. The third step involves a potable water rinse to remove any detergent, followed by a distilled/deionized water rinse.

For the removal of metals, an acid rinse with a 10% nitric acid solution is used prior to the final distilled/deionized water rinse. For the removal of organics, pesticide grade acetone, methanol or hexane, depending on the specific contaminant of concern, will be applied prior to the final distilled/deionized rinse. Acetone is typically chosen because it is excellent at removing organics, miscible in water, and not a target analyte on the Priority Pollutant List. If acetone is known to be a contaminant of concern or if Target Compound List analysis (which includes acetone) is to be performed, another solvent such as methanol will need to be substituted.

Hexane should be used when the contaminant of concern is polychlorinated biphenyls (PCBs) or in oily media. The solvent must be allowed to evaporate completely and then a final distilled/deionized water rinse is performed. This rinse removes any residual traces of the solvent.

A generalized decontamination procedure is:

1. Physical removal
2. Non-phosphate detergent wash with potable water
3. Potable water rinse
4. Solvent rinse (acetone, hexane, etc.)
5. Air dry
6. 10% nitric acid solution rinse

7. Distilled/deionized water rinse
8. Air dry

In instances in which sampling equipment is being used to collect samples for biological pathogens, the acid is replaced with a 10% bleach solution. Modifications to the standard procedure are required to be documented in the site-specific QAPP, field log book and subsequent reports. All decontamination water is replaced daily at a minimum. If at any point throughout the day the water becomes too dirty, then it is no longer suitable for cleaning and is required to be replaced. All sampling equipment must be decontaminated before collecting samples on-site and after use of each piece of sampling equipment.

Waste materials generated from the decontamination processes are referred to as Investigation-Derived Waste (IDW). Management of this waste should be in coordination with Environmental Response Team (ERT) SOP, *Investigation-Derived Waste Management.*

## 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

The amount of sample collected, along with the proper sample container type (i.e. glass, plastic), chemical preservation, and storage requirements are dependent upon the matrix sampled and analysis performed. For further information, refer to ERT SOP, *Sample Storage, Preservation and Handling*.

Sample collection and analysis of decontamination waste generated on-site may be required prior to disposal of decontamination liquids and solids. This should be determined prior to initiation of site activities or as soon as possible thereafter. For more information on handling of IDW, refer to ERT SOP, *Investigation-Derived Waste Management*.

## 4.0 INTERFERENCES AND POTENTIAL PROBLEMS

Acetone is an excellent solvent since it is miscible with water; however, if volatile organic compounds (VOCs) are to be analyzed, the use of an alternate solvent (methanol, hexane) should be considered since acetone is a compound on the Target Compound List (TCL).

The use of deionized (distilled if only option) water is required for decontamination of sampling equipment. In addition, that water is required to be lab certified, analyte free (specifically for the contaminants of concern). The deionized water must be secured prior to field activities as it is not commonly found local to the site.

The use of solvents and acids on sensitive sampling equipment may cause damage. It is important to avoid damaging the equipment. If acids or solvents are utilized, follow health and safety, and waste disposal guidelines.

When decontaminating equipment when temperatures are below freezing, water will freeze in pump spray hoses lines, tanks and in buckets/pails, etc. Additionally, equipment will require longer drying times.
Do not store sampling equipment or reagents used for decontamination near gasoline or any exhaust emissions. Improperly cleaned and prepared sampling equipment can lead to misinterpretation of analytical data due to cross contamination.
Make sure that the decontamination station is set up as not to compromise a clean environment.

## 5.0 EQUIPMENT/APPARATUS

Decontamination equipment is selected based on the type of equipment to be cleaned and anticipated contaminants to be removed. For example, soft-bristle scrub brushes or long-handled bottle brushes are used to remove contaminants. Large galvanized wash tubs, stock tanks, buckets, or children's wading pools hold wash and rinse solutions. Large plastic garbage cans or other similar containers lined with plastic bags help segregate contaminated equipment. Drums are used to store liquid and solid site derived waste.

The following standard materials and equipment are recommended for decontamination activities:

5.1 Decontamination Tools/Supplies

- Long and short handled brushes
- Bottle brushes, composed of nonmetallic material such as nylon
- Plastic sheeting
- Paper towels
- Plastic or galvanized tubs or buckets
- Pressurized sprayers filled with potable water
- Spray bottles
- Aluminum foil
- Pressure washer
- Garden hose
- Electrical cords
- Work lights (if working in the dark)
- Generator (if using a submersible pump or lights)
- Water tank
- Sump pump

5.2 Health and Safety Equipment

The use of personal protective equipment (PPE), (i.e. safety glasses or splash shield, Tyvek® suits, nitrile gloves, aprons or coveralls, steel toe boots, etc.), is required. Refer to the site-specific Health and Safety Plan (HASP) for site-specific requirements.

5.3 Waste Disposal

- Trash bags
- 55-gallon drums (open and closed top types)
- Metal/plastic buckets/containers for storage and disposal of decontamination solutions

## 6.0 REAGENTS

Table 1 (Appendix A) lists solvents recommended for the elimination of particular chemicals. In general, solvents typically utilized during the decontamination process are:

- 10% Nitric Acid ($HNO_3$), typically used for inorganic compounds such as metals
- Acetone (pesticide grade)
- Hexane (pesticide grade)
- Methanol (pesticide grade)
- Deionized/Distilled Water that meets ASTM Type II specifications
- Non-Phosphate Detergent
- Potable Water

## 7.0 PROCEDURES

A decontamination area should be set up prior to sampling. Weather conditions (i.e. hot, cold, rain, snow, etc.) play an important role in the decontamination process. In hot, cold, rainy or snowy conditions, a tent or canopy may be erected around and over the decontamination area. In cold environments, the decontamination may need to occur inside a building or portable heaters may be needed to warm the area under the tent or canopy. In addition, in cold environments the potable and deionized water may freeze. Plan accordingly and consider your working conditions prior to field sampling activities

A decontamination plan needs to be implemented and includes:

- The number, location, and layout of decontamination stations
- Decontamination equipment
- Selection of appropriate decontamination methods
- Methods of disposal of all investigative derived waste (i.e. PPE, solid and liquid waste, etc.)
- Work practices that minimize contact with potential contaminants.
- Protection procedures for monitoring and sampling equipment (i.e. covering with plastic, etc.)
- Considerations related to weather conditions
- The use of disposable and dedicated sampling equipment, when possible

### 7.1 Decontamination Methods

All samples and equipment removed from site must be decontaminated, removing all contamination that may have adhered to the equipment. Various decontamination methods remove contaminants by washing with water and another physical cleaning action. In addition, solvents and/or acids may be used to decontaminate the equipment.

Physical decontamination methods are grouped into two categories, abrasive and non-abrasive methods, and are listed below:

#### 7.1.1 Abrasive Cleaning Methods

Abrasive cleaning methods work by rubbing and wearing away the top layer of the surface containing the contaminant. It involves the use of metal or nylon brushes. The amount and type of contaminants removed will vary with the brush type, length of time brushed, degree of brush contact, degree of contamination, nature of the contaminant and surface being cleaned.

#### 7.1.2 Non-Abrasive Cleaning Methods

Non-abrasive cleaning methods work by forcing the contaminant off a surface with water pressure (i.e. sprayer or pressure washer).

Low-Pressure Water

This method consists of a pressure sprayer filled with water. The user pumps air into the sprayer tank to create pressure. The water is then discharged through a slender nozzle and hose, cleaning the equipment. Scrubbing with a brush is typically used in conjunction with this method.

High-Pressure Water

This method consists of the use of a pressure washer. The operator controls the directional nozzle which is attached to a high-pressure hose. Operating pressure usually ranges from 400 – 600 pounds per square inch (PSI). Scrubbing with large brushes can be used to aid in the decontamination process.

Rinsing

Contaminants and any remaining solvents and/or acids are removed by thorough rinsing. The rinsing is done either by the use of a sprayer or a pressure washer depending on the equipment being cleaned.

Damp Cloth Removal

In some instances, due to sensitive, non-waterproof equipment or due to the unlikelihood of equipment being contaminated, it is not necessary to conduct an extensive decontamination procedure. For example, air sampling pumps attached to a fence, placed on a drum, or equipment protected by plastic or some other material are not likely to become heavily contaminated.

A damp cloth is used to wipe off any contaminants which may have adhered to equipment through airborne contaminants or from surfaces upon which the equipment was set. The use of a different cleaning cloth for each piece of equipment is required. Upon completion, dispose of all cloths with the site derived waste.

## 7.2 Field Sampling Equipment Decontamination Procedures

### 7.2.1 Decontamination Setup

Set up the decontamination area by laying out a section of plastic sheeting large enough for the type and amount of equipment to be decontaminated and for the equipment drop and equipment air drying areas.

Stage brushes, pressure sprayers, spray bottles (w/appropriate solvents, acids and deionized water), 5-gallon buckets, plastic/galvanized wash tubs, pressure washer (if required) and detergent. Figure 1 (Appendix B) shows the decontamination area overall layout. Section 7.2.2 discusses the decontamination procedures depending on the contaminants of concern for a Site.

Stage the appropriate amount and type of sample bottles and a cooler, for the collection of rinsate samples. For specific rinsate sample information, refer to ERT SOP, *Quality Assurance/Quality Control Samples.*

### 7.2.2 Decontamination Procedures

There are various stations of the cleaning process in which the equipment move through that are designed to remove all visible contamination. Stations 1 and 2 are designed to remove all visible contamination. Additional stations after 1 and 2 remove materials that require dissolution and a final rinse. Once the equipment has passed through all stations, it is laid out to air dry.

Decontamination Process for Metals

**Station 1** - Place the sampling equipment into the soapy water solution and thoroughly scrub with brushes or pressure washer. When there is no visible residue remaining, transfer to Station 2.

**Station 2** - Rinse the equipment in the bucket/tub with potable water. Then remove from the bucket/tub and rinse with the pressure sprayer. When satisfied with the cleanliness of the sampling equipment, transfer to Station 3.

**Station 3** - Apply the acid solution and air dry on the plastic sheeting, behind Station 3. Once equipment has fully dried, transfer to Station 4.

**Station 4** - Rinse the equipment with the pressure sprayer filled with deionized water. When satisfied the rinsing process is complete, transfer to the equipment drying area. After drying, the equipment should be wrapped in aluminum foil to prevent contamination of the equipment.

Decontamination Process for Organics

**Station 1** - Place the sampling equipment into the soapy water solution and thoroughly scrub with brushes. When there is no visible residue remaining, transfer to Station 2

**Station 2** - Rinse the equipment in the bucket/tub with potable water. Then remove from the bucket/tub and rinse with the pressure sprayer. When satisfied with the cleanliness of the sampling equipment, transfer to Station 3.

**Station 3** - Apply the appropriate solvent or solvents and air dry on the plastic sheeting, behind Station 3. Once equipment has fully dried, transfer to Station 4.

**Station 4** - Rinse the equipment with the pressure sprayer filled with deionized water. When satisfied the rinsing process is complete, transfer to the equipment drying area.

Decontamination process for Metals and Organics

**Station 1** - Place the sampling equipment into the soapy water solution and thoroughly scrub with brushes. When there is no visible residue remaining, transfer to Station 2.

**Station 2** - Rinse the equipment in the bucket/tub with potable water. Then remove from the bucket/tub and rinse with the pressure sprayer. When satisfied with the cleanliness of the sampling equipment, transfer to Station 3.

**Station 3** - Apply the acid solution and transfer to Station 4.

**Station 4** - Rinse the equipment with the pressure sprayer filled with deionized water. When satisfied the rinsing process is complete, transfer to Station 5.

**Station 5**- Apply the solvent or solvents and air dry on the plastic sheeting behind Station 5. Once equipment has fully dried, transfer to Station 6.

<u>**Station 6**</u> - Rinse the equipment with the pressure sprayer filled with deionized water. When satisfied the rinsing process is complete, transfer to the equipment drying area. After drying, the equipment should be wrapped in aluminum foil to prevent contamination of the equipment.

7.2.3 Post Decontamination Procedures

1. Fill out the appropriate labels for the all the various wastes and affix the labels to the drums and/or containers.
2. Clean up the entire work area. Collect solid waste (i.e. nitrile gloves, plastic sheeting, etc.) and store in an appropriate Department of Transportation (DOT) certified drum.
3. Return any remaining unused solvents or acid solutions to their respective labeled containers and properly store.
4. Transfer potable water rinse waste into an appropriate DOT certified drum or container.
5. Transfer the solvent and acid solution rinse water waste into the appropriately labeled DOT certified drums or containers.
6. Using a pressure sprayer, rinse the basins/buckets.
7. Transfer liquid generated from this process into the potable water rinse waste container.
8. Transfer the decontamination brushes into the solid waste container.
9. Empty the pressure sprayer filled with potable water onto the ground.
10. Return all equipment into their carrying cases or shipping containers.
11. Make arrangements for the pickup of all liquid and solid waste.

For further information on waste disposal, refer to ERT SOP, *Investigation-Derived Waste Management*.

7.3 Decontamination of Earth Moving Equipment/Drilling Equipment and Accessories

The decontamination of earth moving and/or drilling equipment and their accessories will require the use of a pressure washer. In addition, an on-site water supply will need to be available. If an on-site water supply is not available, a water tank along with a pump, hoses and a generator will be required. Finally, a designated area on-site needs to be designated as a decontamination area. Some sites already have a concrete pad set-up for this very purpose. If this is not the case, work with the ERT Work Assignment Manager (WAM) to assign a location for these activities to take place on-site.

An area for decontamination can be built with 4x4 lumber or hay bales, heavy-duty plastic sheeting and a sump pump. The area will need to extend at least 4 feet beyond the outer dimensions of the equipment being cleaned. Either slope the decontamination area down to one corner or dig a small hole about 2 feet by 2 feet square and about 2 feet deep to allow for the collection of the decontamination water. Cover the decontamination area with plastic sheeting, wrapping the sides around and under the 4 x 4 lumber or bales of hay. If equipment being decontaminated includes equipment with tracks that might tear through the plastic sheeting, appropriate surfaces need to be included for the equipment to drive on. Finally, place a sump pump into this area and periodically empty the water as necessary, into the appropriately labeled liquid waste drum.

7.3.1 Decontamination Set-up Procedures

1. Move the equipment into the decontamination area.

2. Stage all the decontamination equipment and supplies (i.e. Pressure Washer, Hoses, PPE, etc.)

3. Connect all hoses and fill the pressure washer with fuel.

4. Dress out in the appropriate PPE (refer to the site-specific HASP).

At a minimum, Tyvek®, safety glasses/goggles, steel toe boots, and nitrile gloves must be worn. If handling any equipment (i.e. drill rods, etc.) work gloves must also be worn to prevent possible injury. For site specific requirements refer to the site-specific HASP.

7.3.2 Decontamination Cleaning Procedures

1. Physically remove as much of the visible material as possible from the heavy equipment after use and prior to steam cleaning. If contaminated material is suspected as determined by visual observations, instrument readings, or other means, collect material in an appropriate waste container.

2. Place the heavy equipment on the decontamination pad in the decontamination area. Verify the decontamination pad has no leaks and the sump pump is functioning properly before beginning the decontamination process.

3. Power on the pressure washer and begin cleaning from the top to the bottom. Thoroughly clean parts of the heavy machinery that come into contact with visible material (such as tires, bucket, augers, drill rods, tracks and the back and underneath of the drill rig). Scrub areas with excessive dirt/debris with large bristle brushes. A flat head shovel can be used to aide in the removal of the dirt/debris. Continue cleaning until all visible contamination has been removed. If required, apply solvents and/or acid solutions, rinse with deionized/distilled water and then let air dry.

The use of solvents and/or acid solutions will depend on site specific conditions. Check with the site-specific HASP for further guidance.

7.3.3 Post Decontamination Procedures

1. Fill out the appropriate labels for the all the various wastes and affix the labels to the drums and/or containers.

2. Transfer potable water rinse waste into an appropriate DOT certified drum or container. Transfer water from the decontamination pad to the liquid waste drums using a sump pump.

3. Collect and transfer solid waste (i.e. nitrile gloves, plastic sheeting, etc.) to a DOT-certified drum or container.

4. Transfer the solvent and acid solution rinse water waste into the appropriately labeled DOT-certified drums or containers.

5. Make arrangements for the pickup of all liquid and solid waste.

For further information on waste disposal, refer to ERT SOP, *Investigation Derived Waste Management*.

## 8.0 CALCULATIONS

This section is not applicable to this SOP.

## 9.0 QUALITY ASSURANCE/QUALITY CONTROL

Documentation of the decontamination process including date, time and personnel that conducted the decontamination activities must be recorded in a field logbook. Record manufacturer and lot numbers of the reagents used for the decontamination procedures.

A rinsate blank is a specific type of quality control sample associated with the field decontamination process. This sample will provide information on the effectiveness of the decontamination process employed in the field. Rinsate blanks are samples obtained by pouring analyte free deionized water over previously decontaminated sampling equipment, testing for residual contamination. The blank water is then collected in sample containers, processed, shipped and analyzed. The rinsate blank is used to assess possible cross-contamination caused by improper decontamination procedures. The most common frequency of collection is one rinsate blank per day per type of sampling device, to meet definitive data objectives. For further information for each analysis, refer to ERT SOP, *Quality Assurance/Quality Control Samples*.

For information on sample container types and preservation, refer to ERT SOP, *Sample Storage, Preservation and Handling*.

If sampling equipment requires the use of Teflon® or polyethylene tubing, it must be disposed of into the on-site waste container and replaced with clean tubing before additional sampling occurs.

Records must be maintained documenting the training of the operators that use equipment for the collection of environmental information.

## 10.0 DATA VALIDATION

Data verification (completeness checks) must be conducted to ensure that all data inputs are present for ensuring the availability of sufficient information. These data are essential to providing an accurate and complete final deliverable. Results of quality control samples will be evaluated for possible cross-contamination of improperly or inadequately decontaminated sampling equipment. This data will be utilized to quantify the sample results in accordance with the project's data quality objectives. The ERT contractor’s Task Leader (TL) is responsible for completing the UFP-QAPP verification checklist for each project.

## 11.0 HEALTH AND SAFETY

Based on Occupational Safety and Health Administration (OSHA) requirements, a site-specific health and safety plan (HASP) must be prepared for response operations under the Hazardous Waste Operations and Emergency Response (HAZWOPER) standard, 29 CFR 1910.120. Field personnel working for EPA's ERT should consult the Emergency Responder Health and Safety Manual currently located at https://response.epa.gov/_HealthSafetyManual/manual-index.htm for the development of the HASP, required PPE and respiratory protection.

The decontamination process can pose hazards under certain circumstances. Hazardous substances may be incompatible with decontamination materials. For example, the decontamination solution may react with contaminants to produce heat, explosion, or toxic products. Also, vapors from decontamination solutions may pose a direct health hazard to workers by inhalation, contact, fire, or explosion.

The decontamination solutions must be determined to be acceptable before their use. Decontamination materials may degrade protective clothing or equipment and some solvents can permeate protective clothing. If decontamination materials pose a health hazard, measures are to be taken to protect personnel. Alternatively, substitutions can be made to eliminate the hazard. The choice of respiratory protection based on contaminants of concern from the site may not be appropriate for solvents used in the decontamination process. Material generated from decontamination activities requires proper handling, storage, and disposal. PPE may be required for these activities.

Safety data sheets (SDS) are required for all decontamination solvents or solutions as required by the Hazard Communication Standard (i.e. acetone, alcohol, etc.).

## 12.0 REFERENCES

Field Sampling Procedures Manual, New Jersey Department of Environmental Protection, August 2005.

Compendium of Superfund Field Operations Methods, EPA 540/p-87/001.

The Field Branches Quality System and Technical Procedures – Field Equipment Cleaning and Decontamination, USEPA Region IV Science and Ecosystem Support Division, November 2007.

Guidelines for the Selection of Chemical Protective Clothing, Volume 1, Third Edition, American Conference of Governmental Industrial Hygienists, Inc., February 1987.

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH/OSHA/USCG/EPA, October 1985.

## 13.0 APPENDICES

A – Tables
B - Figures

APPENDIX A
Tables
SOP: ERT-PROC-2006-20
October 2020

TABLE 1. Soluble Contaminants and Recommended Solvent Rinse

| SOLVENT[1] | EXAMPLES OF SOLVENTS | SOLUBLE CONTAMINANTS |
|---|---|---|
| Water | Deionized water<br>Potable water | Low-chain hydrocarbons<br>Inorganic compounds<br>Salts<br>Some organic acids and other polar compounds |
| Dilute Acids | Nitric acid<br>Acetic acid<br>Boric acid | Basic (caustic) compounds (e.g., amines and hydrazines) and inorganic compounds. |
| Dilute Bases | Sodium bicarbonate | Acidic compounds<br>Phenol<br>Thiols<br>Some nitro and sulfonic compounds |
| Organic Solvents [2] | Acetone<br>Alcohols<br>Ketones<br>Aromatics<br>Alkanes (e.g., hexane)<br>Common petroleum products (i.e. fuel, oil, kerosene) | Nonpolar compounds (e.g., some organic compounds) |
| Organic Solvent[2] | Hexane | PCBs |

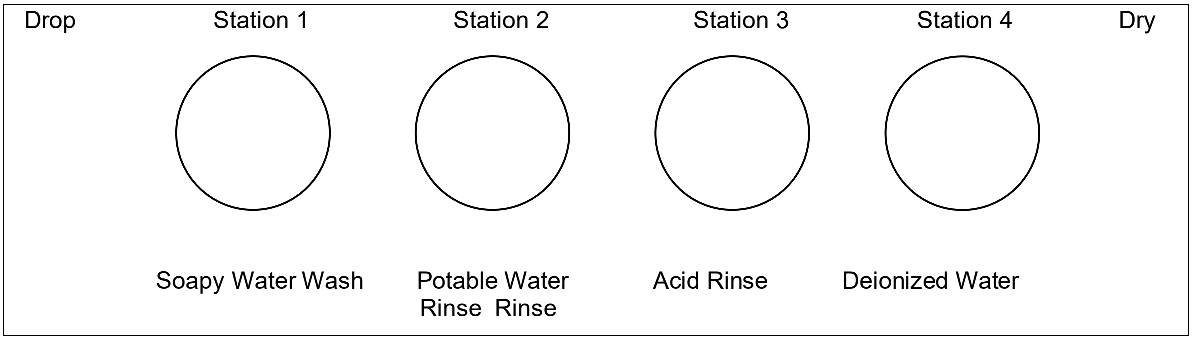
(1) - Safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard

(2) - WARNING: Some organic solvents can permeate and/or degrade protective clothing

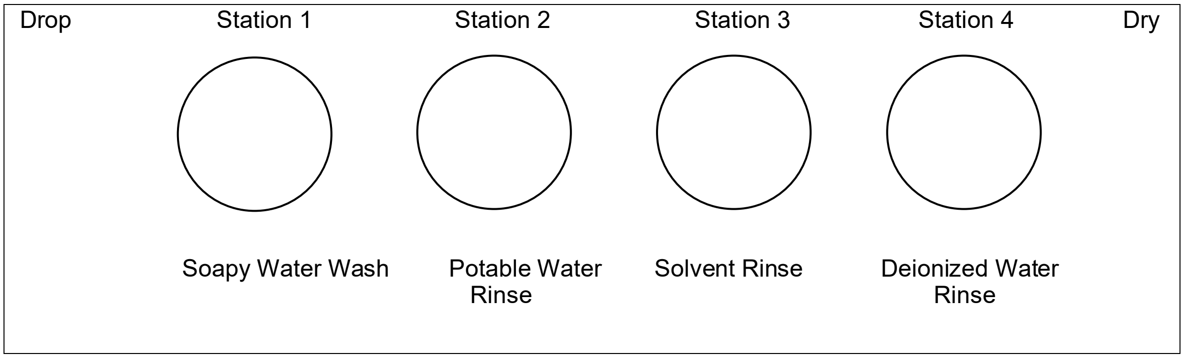
APPENDIX B
Figures
SOP: ERT-PROC-2006-20
October 2020

FIGURE 1. Sampling Equipment Decontamination Area

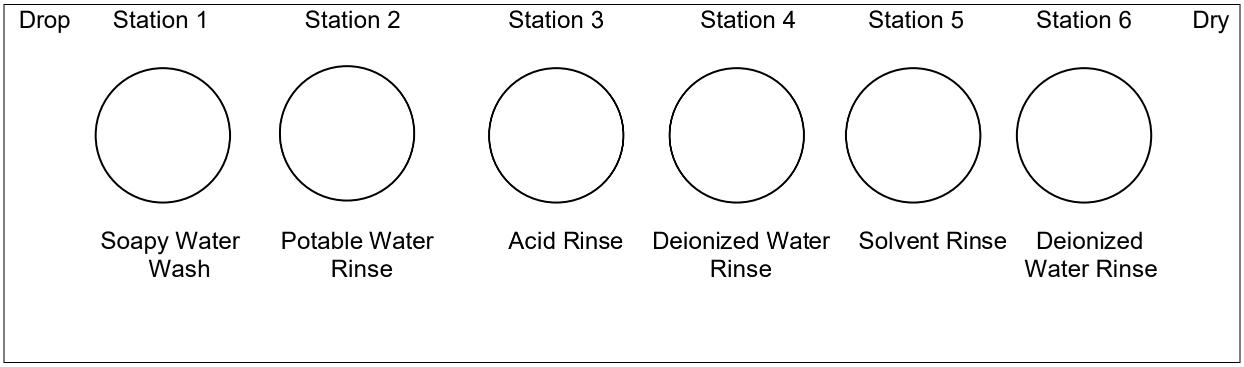
Configuration for the Removal of Metals



Configuration for the Removal of Organics



Configuration for the Removal of Metals and Organics



# STANDARD OPERATING PROCEDURES

SOP: ERT-PROC-2004-20
PAGE: 1 of 17
REV: 1.1
EFFECTIVE DATE: 10/19/20

# SAMPLE PACKING AND SHIPPING

## CONTENTS

*The policies and procedures established in this document are intended solely for the guidance of OLEM employees of the U.S. Environmental Protection Agency (EPA). They are not intended and cannot be relied upon to create any rights, substantive or procedural, enforceable by any party in litigation with the United States. EPA reserves the right to act at variance with these policies and procedures, and to change them at any time without public notice. EPA strongly encourages all readers to verify the validity of the information contained in this document by consulting the most recent Code of Federal Regulations (CFR) and updated guidance documents.*

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

## 1.0 OBJECTIVE

The objective of this standard operating procedure (SOP) is to summarize the requirements for packing and shipping of environmental samples by the United States Environmental Protection Agency (U.S. EPA) Environmental Response Team's (ERT) contractor personnel on behalf of the ERT.

## 2.0 APPLICABILITY

This SOP is applicable to ERT contractor personnel for packing and shipping l hazardous and non-hazardous environmental samples on behalf of U.S. EPA.

## 3.0 DESCRIPTION

### 3.1 General

Environmental samples collected by ERT contractor personnel are shipped to the ERT Laboratory, U.S. EPA Regional laboratories, U.S. EPA Contract Laboratory Program (CLP) laboratories or other laboratories contracted by ERT or their contractor for analysis. The samples are required to be transported in a manner that will ensure their integrity, guard them from leakage/breakage, and will protect the health and safety (H&S) of the shipping and receiving personnel. Regulations for packing and shipping of environmental samples by all forms of transportation (land, sea, and air) are regulated and enforced by the U.S. Department of Transportation (U.S. DOT) and published in the Code of Federal Regulations (CFR) Title 49: *Transportation*. All sample shipments, regardless of the form of transportation, must always be in compliance with 49 CFR.

Due to holding time limitations, most environmental samples are shipped by commercial air carrier (e.g., Federal Express). The International Air Transport Association (IATA) regulates the shipping of dangerous goods and publishes the IATA Dangerous Goods Regulations (DGR) manual annually. The IATA DGR is a globally-accepted field source reference for shipping hazardous materials by commercial air carriers and includes all federal regulations along with country-specific and carrier-specific regulations. All air shipments made by ERT contractor personnel must be in accordance with the IATA DGR. The IATA Hazard Class Definitions can be found in Appendix A,

### 3.2 Shipment of Environmental Samples and Hazardous Samples

Prior to shipment, the ERT contractor's Task Leader (TL) must determine if the samples contain hazardous material (also referred to as dangerous goods). Dangerous goods are defined as substances or materials, which have been determined by the U.S. DOT, to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce [Refer to 49 CFR 171.8].

Generally, environmental samples collected from matrices such as air, surface water, soils or sediments are classified as non-hazardous environmental samples; whereas samples collected from drums, storage tanks (above ground and underground), contaminated ponds, impoundments, lagoons, pools, and leachate from hazardous waste sites (e.g. landfills) can potentially be classified as hazardous samples.

3.3 APHIS-Regulated Soils

Regardless of whether collected soil is deemed to be non-hazardous environmental samples or hazardous samples, the samples need to be evaluated to determine whether they are U.S. Department of Agriculture, Animal and Plant Health Inspection Service (APHIS) regulated soil samples. Soil samples from all foreign countries, all U.S. territories (i.e., Puerto Rico, United States Virgin Islands (USVI) and North Mariana Islands), Hawaii, and parts of the United States fall under federal quarantine as authorized under 7 CFR 301. To determine if there are regulated soils in a specific sample area, refer to the following link to retrieve contact information for State Plant Health Directors (SPHDs):

https://www.aphis.usda.gov/aphis/ourfocus/planthealth/ppq-program-overview/sphd

Because designations of regulated soil areas are updated frequently by the USDA APHIS, obtaining recent information is critical. Soils from these regulated areas may contain bacteria, viruses, fungi, nematodes, invertebrates or seeds of undesirable plant species that could be harmful to U.S. agriculture or natural resources. The movement of these soils within the continental U.S. is regulated under 7 CFR 330.300.

When soils consist of organic materials containing unidentifiable material of biological origin, the USDA classifies the soil as a mixture of inorganic and organic materials. This classification includes most soil samples, but generally exempts sediment samples, geologic samples, drilling core samples or soil samples consisting purely of inorganic material such as pure sand or rock.

In addition to other packaging requirements specified in section 3.5, when shipping APHIS-regulated soils, the samples must be shipped in a securely closed, watertight or leak-proof container (e.g., vial, glass jar, etc.) contained in a secondary durable watertight or leak-proof container (e.g., self-sealing plastic bag). Both the primary and secondary container must be capable of containing soil independently. A copy of the APHIS Soil Permit should be included with the chain-of-custody (COC) record inside the sample container. An APHIS Soil Permit Label (Figure 1, Appendix B) must be attached to the outside of the package. Prior to shipping the soil samples, the laboratory must be informed the samples are APHIS-regulated samples and that they are being shipped from a quarantined area. This is done to ensure the laboratory is capable of handling quarantined soil samples and so adequate precautions are followed by the laboratory during handling, analysis and disposal of the samples.

3.4 Sample Storage

Samples are collected in labeled containers, jars or bags and documented according to ERT SOP, *Sample Documentation*. Sample containers, jars or bags should be wiped clean and are required to be closed tightly before they are stored. Samples are required to be stored, preserved, and handled according to ERT SOP, *Sample Storage, Preservation and Handling*.

3.5 Sample Packaging

Sample packaging is dependent upon the sample matrices being shipped as specified below:

- Soil, sediment, water and air samples collected on tube media are shipped in durable intact insulated sample coolers

- Biological samples may be shipped in secure jars or resealable plastic bags depending on the nature of the sample and the analyses needed. For example, small crayfish may be placed in small glass jars but a large fish filet may need to be shipped in a large resealable plastic bag.
- SUMMA canisters are shipped in metal SUMMA canister boxes.
- Cassette media are shipped in sample coolers or cardboard boxes.
- Tedlar bags should not be shipped, but hand delivered whenever possible, due to issues with pressure changes that may impact the samples during air transportation. If Tedlar bags are to be shipped, the bags should not be filled more than 70 percent (%) to allow for atmospheric expansion (ERT SOP, *Tedlar® Bag Sampling)*.
- When shipping hazardous samples, the inner and outer packing must be compliant with specifications listed in IATA DGR.
- When shipping non-hazardous samples with dry ice, the container must be vented and a dry ice label affixed to the container.

Additional packaging is needed for certain types of samples as specified below:

- Potentially breakable (e.g., glass) sample containers must be placed in a re-sealable plastic bags to contain any breakage or spillover of sample. Small bubble wrap bags, specifically made for holding glass sample jars and tubes, are readily available, convenient, and effective.
- Tedlar bag media must be placed inside an opaque bag, to prevent degradation.
- Cassettes and tube media for air samples must be placed inside of a Whirl Pak® bag to maintain integrity.

Prior to placing samples in an intact insulated sample cooler, the cooler should be lined with a garbage bag or drum liner. As needed, bubble wrap or other inert packing material may be used to protect glass or potentially breakable sample containers during shipping. Once all the samples have been placed in the cooler, the garbage bag/liner should be sealed with duct tape to ensure that if the contents were to get damaged during shipping the garbage bag/liner would contain the spill.

A COC record is required to accompany all samples. The COC is placed in a waterproof zip-top bag and taped to the inside of the lid of the outer packaging so it is easily located upon opening the shipment. If shipping samples from outside the contiguous United States or areas within the United States under Federal, state or local quarantine, an APHIS soil permit must be included with the COC (see Section 3.3).

Sample coolers are required to be closed and sealed with duct or strapping tape. A minimum of two custody seals must be placed across the shipping container/cooler's opening following ERT SOP, *Chain of Custody Procedures*. All custody seals and labels (see section 3.7) are secured in place on the cooler with clear tape. Duct tape on the outside of the shipping container should also be covered with clear packing tape prior to shipping.

### 3.6 Sample Temperature Maintenance

Many samples, depending on the analysis, are required to be maintained at a temperature less than or equal to (≤) 6 degrees Celsius (°C) from time of collection through shipment. Some samples must be frozen following collection and maintained frozen through the shipping process. For detailed information on sample storage requirements, see ERT SOP, *Sample Storage, Preservation, and Handling*.

Wet ice, Blue Ice® or dry ice is typically used to maintain appropriate sample temperatures during shipment. The quantity of ice will vary depending on the time of year and the length of time the samples will be in transit. If wet ice is used for temperature maintenance during shipment, it should be double bagged to prevent leakage. When shipping samples immediately after collection or during hot weather, an ice bath may be needed to chill the samples prior to packing and shipment. Blue Ice® may be used in place of wet ice for shipping samples with extended transit times. Temperature blanks are included with the samples in the shipping containers when requested by the laboratory conducting the analysis.

Dry ice is used primarily for shipping biological samples. When shipping with dry ice, it is recommended that the cooler is vented by leaving the drain on the side of the cooler open.

## 3.7 Package Documentation and Labeling

When shipping with a commercial carrier such as Federal Express, an airbill must be completely and accurately completed and included with each sample cooler (Figure 2, Appendix B). The airbill must include a name and phone number for both the sender and recipient. All shipments are required to have address labels including the name and addresses of the shipper and recipient (laboratory). In addition, samples that contain APHIS-regulated soils (see Section 3.3) must have APHIS Soil Permit Labels attached to the outside of the sample cooler (Figure 1, Appendix B).

For convenience, FedEx on-line shipping tools are also available to prepare an Air Waybill, get rates and transit times, schedule a pick-up and receive automated status notifications about your shipment at http://www.fedex.com/gy/ebusiness/shipping.html

### 3.7.1. Non-Hazardous Environmental Samples

All sample coolers containing non-hazardous environmental samples must include “Environmental Sample” labels (Figure 3, Appendix B) on the outside of the cooler.

### 3.7.2 Hazardous Samples (Dangerous Goods)

The TL or their designee is required to determine the composition of the sample for shipping purposes [such as asbestos containing materials (ACMs), polychlorinated biphenyls (PCBs), etc.]. If the hazardous material/sample materials are not listed, the TL has to determine the most appropriate hazard class and packing group (PG) applicable. The applicable hazard class and PG is dependent on the physical and chemical properties of the environmental hazardous samples. Definitions of the hazard classes specified by the IATA DGR are included in Appendix A.

For hazardous samples, the appropriate hazard class label(s) (Figure 4, Appendix B) must be included on the outside of the sample cooler as designed in the IATA DGR manual. A computer-generated Shipper’s Declaration for Dangerous Goods (Figure 5, Appendix B) form must be filled out completely and accurately and provided to the shipper at the time of shipment.

## 3.8 Sample Shipment

Samples are sent Priority Overnight using a commercial shipping carrier (e.g. Federal Express), picked up by a laboratory courier, or hand-delivered to the laboratory. For samples being delivered to the ERT Laboratory, coordination with the ERT contractor’s Sample Receiving Technician is required prior to shipping samples. For samples being shipped to an outside laboratory (CLP, U.S. EPA or subcontracted), the laboratory should be informed of the shipment by either the CLP Sample Coordinator, the TL, or the ERT contractor’s Analytical Subcontracting Representative along with a delivery date and any appropriate shipper tracking numbers.

## 3.9 Equipment and Materials

- United Nations (UN) approved inner and outer shipping containers for dangerous goods
- Intact insulated sample coolers for non-hazardous environmental samples
- SUMMA cases
- Bubble Wrap, Bubble Bags or other inert cushioning material
- Airbills
- Custody seals
- “Environmental Samples” Labels
- Hazard Class Labels
- Copies of valid APHIS Soil Permits and labels
- Typewritten “Shipper’s Declaration for Dangerous Goods”
- COCs
- Wet ice/Blue Ice/Dry Ice
- Garbage Bags or Drum Liners
- Plastic Resealable Bags
- Dark colored bags
- Whirl-Pak®
- Duct or strapping tape
- Clear tape
- Nitrile and work gloves
- Paper towels

## 3.10 Training Requirements

According to 40 CFR Parts 171-177, all personnel responsible for packing and shipping samples must be trained. Training for all ERT contractor personnel hired after November 15, 1992, is required to be completed within the first 90 days of their employment. ERT contractor personnel who have been re-assigned to perform shipping/receiving tasks are required to complete training within 90 days after their new job responsibilities have been assigned. ERT contractor personnel hired after November 15, 1992, may perform sample packing and shipping functions prior to the completion of training with the supervision by the ERT contractor’s Shipping and Receiving Coordinator or other trained personnel. All personnel potentially involved with shipping of regulated soils must take Soil Permitting training on an annual basis.

According to U.S. DOT 40 CFR 171-177, hazardous shipping training must be taken once every three years; however, IATA specifies training once every two years. ERT contractor personnel potentially involved with shipping of hazardous samples must take Hazardous Materials (HM)-181 training every two years.

## 4.0 RESPONSIBILITIES

### 4.1 ERT Work Assignment Manager

The ERT Work Assignment Manager (WAM) is responsible for providing technical expertise and technical direction to the contractor, preparing task orders/work assignments, reviewing deliverables, interacting with the Regional customers and monitoring the financial and administrative management of the project.

### 4.2 ERT Quality Coordinator

The ERT Quality Coordinator provides quality assurance oversight for all projects and implements/maintains the ERT Quality Assurance Program.

### 4.3 ERT Contractor Health and Safety Officer

The ERT contractor's Health and Safety Officer (HSO) or their designee is responsible for providing packing and shipping training to ERT contractor employees.

### 4.4 ERT Contractor Quality Assurance/Quality Control Officer

The ERT contractor's Quality Assurance/Quality Control (QA/QC) Officer is responsible for approving any updates to this SOP, informing contractor personnel when the SOP has been updated and where the document is located. The QA/QC Officer may conduct audits to determine if contractor personnel are in compliance with this SOP.

### 4.5 ERT Contractor Task Leaders and Field Staff

ERT contractor TLs and field staff are responsible for packing and shipping samples in accordance with IATA *Dangerous Goods Regulations* and guidelines outlined in this SOP, and must attend training once every two years.

### 4.6 ERT Contractor Shipping and Receiving Coordinator

The ERT contractor's Shipping and Receiving Coordinator is responsible for providing appropriate packing and shipping information as requested by the contractor's TL and field staff.

### 4.7 ERT Contractor Program Manager

The ERT contractor's Program Manager or their designee is responsible for the implementation of the guidelines outlined in this SOP and ensuring the timely update of this SOP.

## 5.0 REFERENCES

Code of Federal Regulations. *Domestic Quarantine Notices*: 7 CFR Part 301.

Code of Federal Regulations. *Soil from Foreign Countries or Territories or Possessions:* 7 CFR 330.300.

Code of Federal Regulations. *Hazardous Materials Regulations (DOT):* 40 CFR 171-177.

Code of Federal Regulations. *Transportation:* 49 CFR.

International Air Transport Association. 2016. Dangerous Goods Regulations, 57th Edition. Montreal, Quebec, Canada.

## 6.0 APPENDICES

A - IATA Hazard Class Definitions
B – Figures

# APPENDIX A
# IATA Hazard Class Definitions
SOP: ERT-PROC-2004-20
October 2020

## IATA Hazard Class Definitions

Dangerous goods are defined as articles or substances which are capable of posing a risk to health, safety property or the environment and which are shown in the list of dangerous goods according to IATA Regulations. In addition, Dangerous Goods are defined as those goods which meet the criteria of one or more of nine UN hazard classes and, where applicable, to one of three UN Packing Groups. The nine classes relate to the "type of hazard" whereas the packing groups relate to the applicable "degree of danger" within the class. Some hazard classes are further subdivided into hazard divisions due to the wide scope of a class. The division number does not imply a hazard level.

Class 1 – Explosives

| | |
|---|---|
| Division 1.1 | Articles and substances having a mass explosion hazard |
| Division 1.2 | Articles and substances having a projection hazard, but not a mass explosion hazard |
| Division 1.3 | Articles and substances having a fire hazard, a minor blast hazard, and/or a minor projection hazard, but not a mass explosion hazard |
| Division 1.4 | Articles and substances presenting no significant hazard |
| Division 1.5 | Very insensitive articles and substances having a mass explosion hazard |
| Division 1.6 | Extremely insensitive articles and substances which do not have a mass explosion hazard |

Class 2 – Gases

| | |
|---|---|
| Division 2.1 | Flammable gas |
| Division 2.2 | Non-flammable, non-toxic gas |
| Division 2.3 | Toxic gas |

Class 3 - Flammable Liquids

Class 4 - Flammable Solids, Substance Liable to Spontaneous Combustion, Substance Which, in Contact with Water, Emit Flammable Gases

| | |
|---|---|
| Division 4.1 | Flammable Solids, self-reactive substances and solid desensitized explosives |
| Division 4.2 | Substances liable to spontaneous combust |
| Division 4.3 | Substances which, in contact with water, emit flammable gases |

Class 5 - Oxidizing Substances and Organic Peroxides

| | |
|---|---|
| Division 5.1 | Oxidizer |
| Division 5.2 | Organic peroxides |

Class 6 – Toxic and Infectious Substances

| | |
|---|---|
| Division 6.1 | Toxic Substances |
| Division 6.2 | Infectious Substances |

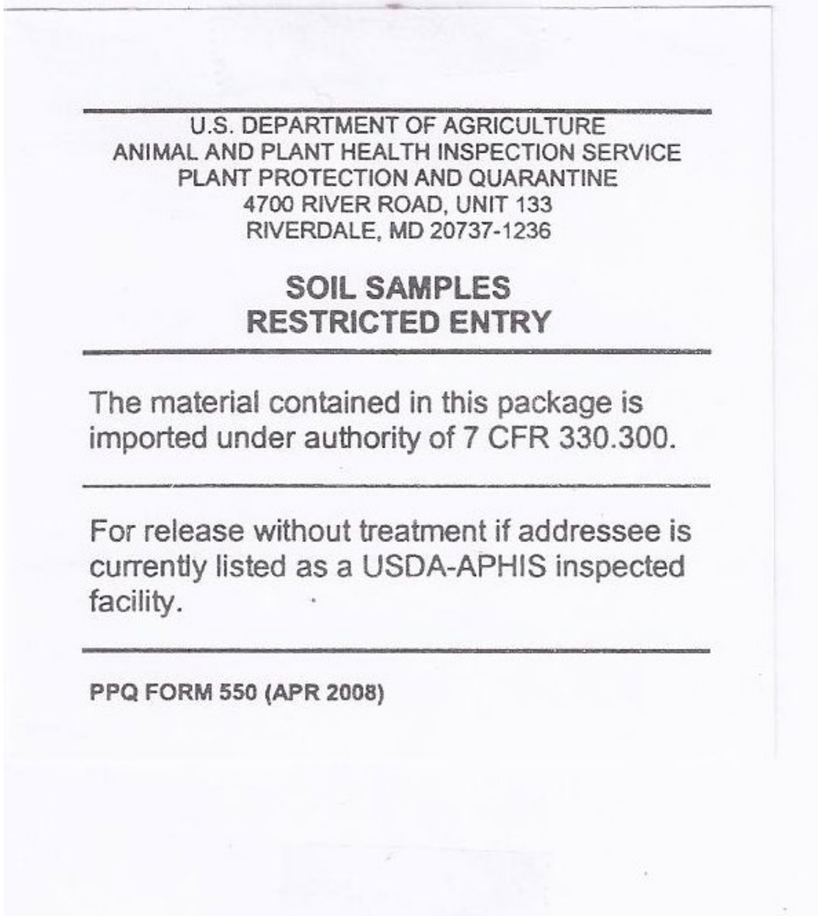
Class 7 - Radioactive Material

Class 8 - Corrosives

Class 9 - Miscellaneous Dangerous Goods

# APPENDIX B
Figures
SOP: ERT-PROC-2004-20
October 2020

FIGURE 1. Example of APHIS Soil Permit Label



U.S. DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
PLANT PROTECTION AND QUARANTINE
4700 RIVER ROAD, UNIT 133
RIVERDALE, MD 20737-1236

**SOIL SAMPLES**
**RESTRICTED ENTRY**

The material contained in this package is imported under authority of 7 CFR 330.300.

For release without treatment if addressee is currently listed as a USDA-APHIS inspected facility.

**PPQ FORM 550 (APR 2008)**

FIGURE 2. Example of an Airbill

**FedEx.** USA Airbill

Tracking Number 4799499202

SNA12

**Sender's Copy**

**1 From (please print)**

Date 1 99-99-99 Sender's FedEx Account Number 214616289

Sender's Name 2 Your Department/Name Phone 3 ( 309 )438-XXXX(Your #)

Dept/Floor/Suite/Room

Company Lockheed Martin /SERAS

Address 2890 Woodbridge Avenue

City Edison State NJ Zip 08837

**2** Your Internal Billing Reference Information (Optional) (First 24 characters will appear on invoice) 5 SERXXX

**3 To (please print)**

Recipient's Name 4 Reggie Redbird Phone ( 555 )555-2473

Dept/Floor/Suite/Room Suite 2001

Company Redbird, Inc.

Address 123 State St

(To "HOLD" at FedEx location, print FedEx address here) (We Cannot Deliver to P.O. Boxes or P.O. Zip Codes)

City Normal State IL Zip 61761

**For HOLD at FedEx Location check here**
☐ Hold Weekday (Not available with FedEx First Overnight)
☐ Hold Saturday (Not available at all locations) (Not available with FedEx First Overnight or FedEx Standard Overnight)

**For Saturday Delivery check here**
☐ (Extra Charge. Not available to all locations) (Not available with FedEx First Overnight or FedEx Standard Overnight)

6 Select Service Requested

**4a Express Package Service** *Packages under 150 lbs.* Delivery commitment may be later in some areas.
☐ FedEx Priority Overnight (Next business morning)
☐ FedEx Standard Overnight (Next business afternoon)
☐ FedEx 2Day* (Second business day)
☐
☐ NEW FedEx First Overnight (Earliest next business morning delivery to select locations) (Higher rates apply)

* FedEx Letter Rate not available. Minimum charge: One pound FedEx 2Day rate.

**4b Express Freight Service** *Packages over 150 lbs.* Delivery commitment may be later in some areas.
☐ FedEx Overnight Freight (Next business day service for any distance)
☐ FedEx 2Day Freight (Second business day service for any distance)
☐ FedEx Express Saver Freight (Up to 3 business-day service based upon distance)

(Call for delivery schedule. See back for detailed descriptions of freight products.)

**5 Packaging** ☐ FedEx Letter ☐ FedEx Pak ☐ FedEx Box ☐ FedEx Tube ☐ Other Pkg.
Declared value limit $500

**6 Special Handling**
Does this shipment contain dangerous goods? ☐ Yes (As per attached Shipper's Declaration) ☐ Yes (Shipper's Declaration not required)
☐ Dry Ice Dry Ice, 9, UN 1845 III ______ x ______ kg. 904 (Dangerous Goods Shipper's Declaration not required)
CA ☐ Cargo Aircraft Only

**7 Payment**
Bill to: ☐ Sender (Account no. in section 1 will be billed) ☐ Recipient ☐ Third Party ☐ Credit Card ☐ Cash/Check
(Enter FedEx account no. or Credit Card no. below)

FedEx Account No.
Credit Card No. Exp. Date

| Total Packages | Total Weight | Total Declared Value* | Total Charges |
|---|---|---|---|
| | | $ .00 | $ |

*When declaring a value higher than $100 per shipment, you pay an additional charge. See SERVICE CONDITIONS, DECLARED VALUE AND LIMIT OF LIABILITY section for further information.

**8 Release Signature** Sign to authorize delivery without obtaining signature.

Your signature authorizes Federal Express to deliver this shipment without obtaining a signature and agrees to indemnify and hold harmless Federal Express from any resulting claims.

272

**Service Conditions, Declared Value, and Limit of Liability** – By using this Airbill, you agree to the service conditions in our current Service Guide or U.S. Government Service Guide. Both are available on request. SEE BACK OF SENDER'S COPY OF THIS AIRBILL FOR INFORMATION AND ADDITIONAL TERMS. We will not be responsible for any claim in excess of $100 per package whether the result of loss, damage, or delay, non-delivery, misdelivery, or misinformation, unless you declare a higher value, pay an additional charge, and document your actual loss in a timely manner. Your right to recover from us for any loss includes intrinsic value of the package, loss of sales, interest, profit, attorney's fees, costs, and other forms of damage, whether direct, incidental, consequential, or special, and is limited to the greater of $100 or the declared value but cannot exceed actual documented loss. The maximum declared value for any FedEx Letter and FedEx Pak is $500. Federal Express may, upon your request, and with some limitations, refund all transportation charges paid. See the FedEx Service Guide for further details.

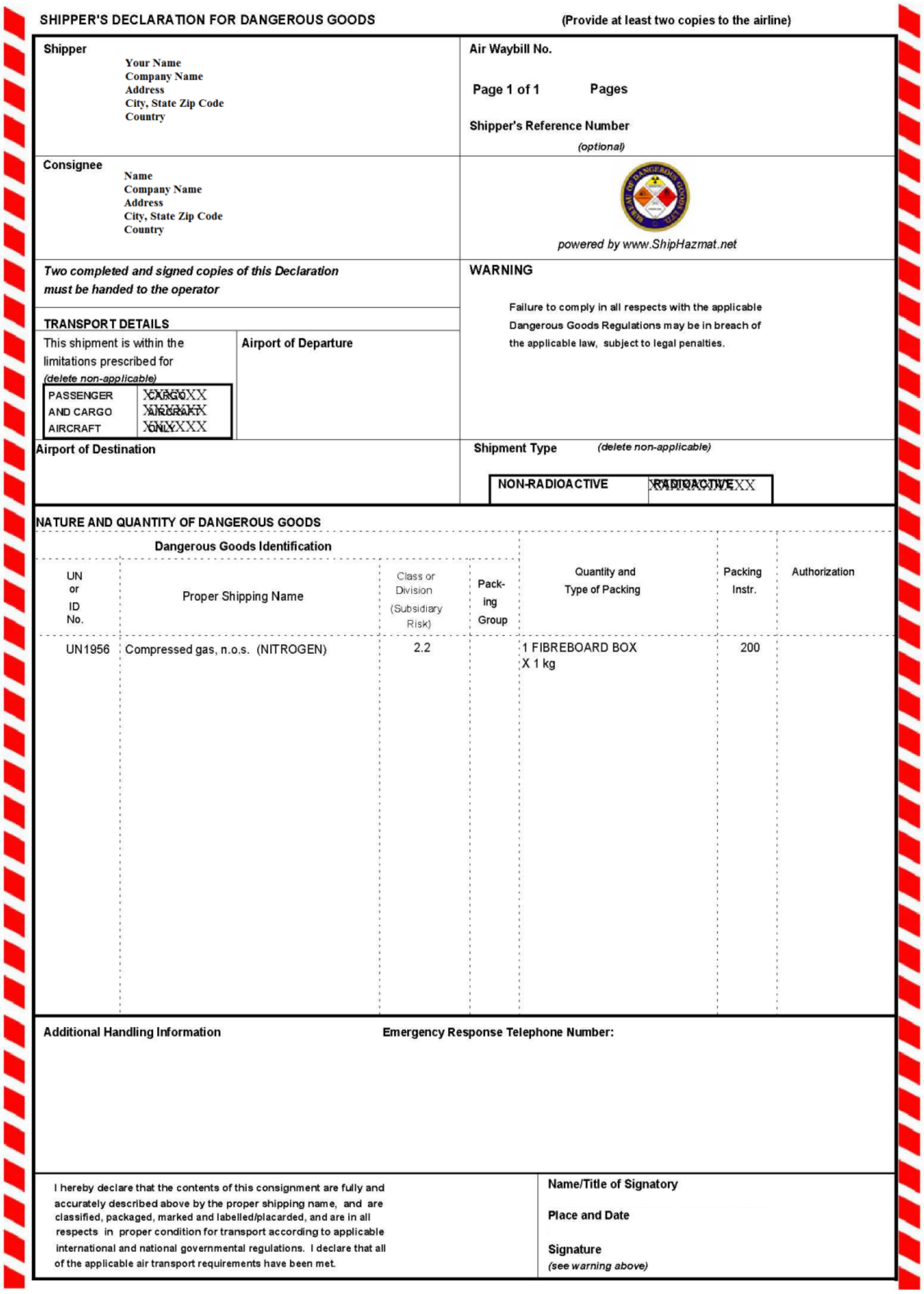
**Questions?**
**Call 1-800-Go-FedEx** (1-800-463-3339)

*The World On Time*

FIGURE 3. Environmental Samples Label

FIGURE 4. Hazard Class Labels

FIGURE 5. Example of Shipper's Declaration for Dangerous Goods



**SHIPPER'S DECLARATION FOR DANGEROUS GOODS** **(Provide at least two copies to the airline)**

**Shipper**
Your Name
Company Name
Address
City, State Zip Code
Country

**Air Waybill No.**

**Page 1 of 1 Pages**

**Shipper's Reference Number**
*(optional)*

**Consignee**
Name
Company Name
Address
City, State Zip Code
Country

*powered by www.ShipHazmat.net*

***Two completed and signed copies of this Declaration must be handed to the operator***

**WARNING**

Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties.

**TRANSPORT DETAILS**

This shipment is within the limitations prescribed for *(delete non-applicable)*

| | |
|---|---|
| PASSENGER AND CARGO AIRCRAFT | ~~CARGO AIRCRAFT ONLY~~ |

**Airport of Departure**

**Airport of Destination**

**Shipment Type** *(delete non-applicable)*

| | |
|---|---|
| NON-RADIOACTIVE | ~~RADIOACTIVE~~ |

**NATURE AND QUANTITY OF DANGEROUS GOODS**

| Dangerous Goods Identification | | | | | | |
|---|---|---|---|---|---|---|
| UN or ID No. | Proper Shipping Name | Class or Division (Subsidiary Risk) | Pack-ing Group | Quantity and Type of Packing | Packing Instr. | Authorization |
| UN1956 | Compressed gas, n.o.s. (NITROGEN) | 2.2 | | 1 FIBREBOARD BOX X 1 kg | 200 | |

**Additional Handling Information**

**Emergency Response Telephone Number:**

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. I declare that all of the applicable air transport requirements have been met.

**Name/Title of Signatory**

**Place and Date**

**Signature**
*(see warning above)*

# OPERATION OF THE WATER QUALITY MULTI-PARAMETER METERS

CONTENTS

*The policies and procedures established in this document are intended solely for the guidance of OLEM employees of the U.S. Environmental Protection Agency (EPA). They are not intended and cannot be relied upon to create any rights, substantive or procedural, enforceable by any party in litigation with the United States. EPA reserves the right to act at variance with these policies and procedures, and to change them at any time without public notice. EPA strongly encourages all readers to verify the validity of the information contained in this document by consulting the most recent Code of Federal Regulations (CFR) and updated guidance documents.*

## 1.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the procedures for assembly, calibration, usage and post-use verification of Multi-parameter Water Quality Meters. This SOP specifically covers the YSI® 650 MDS data logger with YSI 6920 sonde, which houses all the different sensors, and the Horiba® U-52, two of the typical units used by U.S. Environmental Protection Agency (EPA) Environmental Response Team (ERT) contractor personnel. These units consist of two pieces, the data logger and the sonde. These instruments are used to collect representative water quality data. The parameters that may be quantified include: temperature in degrees Celsius (ºC), pH in standard units, dissolved oxygen (DO) in milligrams per liter (mg/L), conductivity in microsiemens per centimeter (µS/cm), turbidity in nephelometric turbidity units (NTU) and oxidation/reduction potential (ORP) in millivolts (mV). Always refer to each unit's operating manual for complete operating instructions. Due to the nature of this equipment and its use under different environmental conditions, data obtained will be considered screening data.

A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The sampler needs to ensure that the methods used are adequate to satisfy the data quality objectives (DQOs) listed in the QAPP for a particular site.

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations or other procedural limitations. In all instances, the procedures employed must be documented on a Field Change Form and attached to the QAPP. These changes must be documented in the final deliverable.

## 2.0 METHOD SUMMARY

The multi-parameter water quality meters are used to obtain physical characteristics of both surface water and groundwater. Measurements can be collected by submerging the probe directly into the water, inserting the probe into a water sample, or through a flow cell. The instrument is calibrated prior to data collection and verified immediately following use in the field. Water quality measurements are transferred from the digital display into an equipment or site logbook or field datasheet. For further information refer to ERT SOP, *Logbook Documentation.* Data may be logged electronically for later download.

## 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

When handling the data logger, it should be kept dry. Both the data logger and sonde should be protected from being damaged during routine fieldwork. Data loggers must be disconnected from the sonde before being stored. Sonde sensors must be stored with approximately 1/2 inch of tap water or pH 7 solution in the calibration and/or storage cup so that the sensors can remain moist without being immersed in liquid. The storage vessel must be sealed to minimize evaporation. The data logger and sonde must be stored at temperatures between -10 and 30ºC with a relative humidity of under 80 percent (%), free from condensation. Additionally, the meter must be stored in areas void of dust, strong vibrations, or corrosive gases. The meters should not be stored in areas of extreme or fluctuating temperatures such as near air conditioners, direct sunlight, or in an area with strong wind.

## 4.0 INTERFERENCES AND POTENTIAL PROBLEMS

Prior to field mobilization, the batteries of the unit should be checked and replaced or recharged as necessary. Batteries without sufficient charge may result in inaccurate measurements. If any parameter begins to drift during field measurements, consult the unit's operation manual or contact the manufacturer.

It is important to complete the instrument calibration and post-use verification procedures as soon as possible, at or near the sampling location or site base station. Changes in barometric pressure, altitude, or ambient air temperature will affect the accuracy of the instrument.

Where possible, work in a shaded area as the readout may become obscured by bright sunlight. If the display is left in direct sunlight, the screen will become unreadable. Prolonged exposure to sunlight may damage the display.

If moisture gets inside the data logging unit, the unit may become inoperable.

Contaminated calibration solutions and/or air bubbles on the optical surface of the probe can lead to calibration errors when measuring turbidity. Negative turbidity readings may occur of clean water samples if the probe was not cleaned properly when last returned from the field and then recalibrated. Suspended particles in water may cause the turbidity readings to fluctuate.

## 5.0 EQUIPMENT/APPARATUS

The following equipment is necessary for field operation:

- Water Quality Meter (data logger, sonde and connection cable)
- Storage/calibration cup
- Flow-through cell (optional based on sample type)
- Logbook
- Soft paper wipes
- Two gallon bucket (or similar)

The following equipment is necessary for calibration:

- Altimeter/barometer, calibrated in accordance with manufacturer's recommendations
- Scissors or pocket knife (for trimming DO membrane)
- National Institute of Standards and Technology (NIST) traceable thermometer (glass, -1 to 51°C)
- Ring stand
- Clamp

## 6.0 REAGENTS

The following reagents are required for proper calibration:

- Deionized or distilled water, for use as a "0" NTU turbidity standard, rinsing calibration cups and determining DO
- Potassium Chloride (KCl) Solution for replacement of DO membrane
- NIST-traceable pH buffer solutions, (4.00, 7.00, and 10.00 standard units [S.U.]), for the YSI
- NIST-traceable turbidity standard solutions, 100 NTU or 126 NTU standards – based on specific sonde, for the YSI
- NIST-traceable conductivity standard solution, 0.9 to 9.9 millisiemens per centimeter (mS/cm) standard
- NIST-traceable ORP powder, for the YSI and Horiba
- Multi-parameter calibration solution, for the Horiba U-52
- Sodium Sulfite powder for zero DO calibration.

# 7.0 PROCEDURES

## 7.1 Assembly

The three major components of multi-parameter water quality meters are the data logger, data cable and sonde, which houses the probes. To assemble, first connect the data cable to the sonde by aligning the key on the data cable male connector to the slot in the sonde's connector head. Then connect the other end of the data cable to the data logger without forcing the pins into the connector. The meter is now ready for calibration.

## 7.2 Calibration

Calibration and/or verification and inspection of the water quality meter should be performed on a daily basis when in the field to adjust for changing field conditions.

The inspection and calibration of the water quality meters includes:

- Testing and calibration of probes
- Inspection and cleaning of seal areas
- Replacement of damaged O-rings
- Replacement of membranes and electrolytes, as needed
- Battery check or replacement
- Documentation of calibration and maintenance in equipment or site logbook

Refer to each unit's operation manual prior to calibration as calibration procedures vary. A multi-parameter solution can be used to calibrate the Horiba U-52 for pH, conductivity, turbidity, and dissolved oxygen or individual solutions can be used, also referred to as auto-calibration. See the Horiba U series manual for more information on auto calibration. The YSI uses individual solutions to calibrate the various sensors. For further information, follow sections 7.2.1 through 7.2.6 listed below.

### 7.2.1 Temperature Verification

Verification of the temperature sensor, the sensor is inserted into a bucket filled with water of a known temperature by using the NIST-traceable thermometer. Wait five minutes to allow the sensor probe and NIST-traceable thermometer to stabilize. Document the reading in the equipment or site logbook. Verification should be performed annually. If the displayed temperature is greater than (>) ±5°C from the reference thermometer, the unit should be returned to the manufacturer.

### 7.2.2 Dissolved Oxygen Calibration

Dissolved Oxygen (DO) is calibrated differently by the YSI and the Horiba instruments. For complete step by step details, refer to each unit's specific user manuals. The DO calibration should be performed every two months when not in normal use to verify that the probe is operational. During field use the calibration must be made daily to adjust for atmospheric and other changes that can alter DO readings.

YSI

The DO probe is calibrated using either the Winkler titration method of an aqueous solution or the Percent Saturation method in air. The latter method avoids the use of additional chemicals and hardware and is summarized here. Consult the YSI *User Manual* for a detailed description of both methods.

Prior to DO calibration, determine the local barometric pressure in millimeters of mercury (mm Hg) with a calibrated altimeter/ barometer. The YSI meter will prompt the user to enter the barometric pressure. Place approximately three milliliters (mL) of water, or a damp sponge, in the bottom of the calibration cup. Place the probe end of the sonde into the cup, being careful not to submerge either the DO or temperature probe into the water. Ensure the DO probe is vented to the atmosphere by engaging only one or two threads into the calibration cup. Wait approximately 10 to 15 minutes for the air in the calibration cup to become saturated with water vapor and for the temperature to stabilize. The DO calibration procedure will also automatically calibrate the probe in milligrams/liter (mg/L). Document in the equipment or site logbook the barometric pressure and whether or not, the sensor calibrated.

Horiba

The DO calibration requires a two-point calibration. The first is a zero calibration using deionized water or tap water. The second point uses a mixture of 50 grams (g) of sodium sulfite to 1000 milliliters (mL) of water. DO concentrations are reported in mg/L and are temperature dependent. Refer to the chart in the Horiba user manual, which lists DO concentrations at a standard range of temperatures. Further information on preparing the proper span calibration can be found in the Horiba user manual. Document the whether or not the sensor calibrated in the equipment or site logbook.

### 7.2.3 Conductivity Calibration

For units manufactured by both YSI and Horiba, rinse the calibration cup and probes with deionized or distilled water followed by a small amount of the conductivity solution. Fill the calibration cup with a conductivity standard between 0.9 mS/cm and 9.99 mS/cm and then immerse the probe end of the sonde into the solution until past the vent hole. Allow the temperature to equilibrate and conductivity readings to stabilize for at least one minute before proceeding. Enter the theoretical calibration value used during calibration (e.g., 10 mS/cm) into the unit.

Following calibration, rinse the sonde in tap or deionized/distilled water. If the sensor fails to calibrate it may need to be replaced. For the complete step-by-step process and for troubleshooting, refer to the specific unit's operation manual. Document in the equipment or site logbook the concentration of conductivity solution used, its lot number and expiration date, and whether or not the sensor calibrated.

### 7.2.4 pH Calibration

Calibration procedures for pH are similar for the YSI and the Horiba instruments. For complete step-by-step details, refer to each unit's specific user manuals. A two-point calibration is performed within a specific calibration range, either the 4-7 range or the 7-

10 range. Before beginning the two-point calibration procedure, the anticipated pH to be measured should be known.  or either calibration range, record the calibration solutions used, their lot numbers and expiration dates in the equipment or site logbook.

Two-Point Calibration: Range 4 – 7

Rinse the calibration cup and sonde with deionized or distilled water. Fill the cup above the pH probe with the pH 7 buffer solution. Enter the actual pH value based on the calibration temperature. Document the pH value on the meter once the reading has stabilized. Rinse the cup with deionized or distilled water. Fill the cup with pH 4 buffer solution. Again enter the actual pH value based on the calibration temperature. Document the pH value on the meter once the reading has stabilized. Remove the sonde and rinse both the cup and the sonde with deionized or distilled water. The pH sensor is now calibrated and ready for use.

If the sensor fails to calibrate, the probe may need to be replaced. For troubleshooting, refer to the meter’s operation manual.

Two-Point Calibration: Range 7 – 10

Rinse the calibration cup and sonde with deionized or distilled water. Fill the cup above the pH probe with the pH 7 buffer solution. Enter the actual pH value based on the calibration temperature. Document the pH value on the meter once the reading has stabilized. Rinse the cup with deionized or distilled water. Fill the cup with pH 10 buffer solution. Again enter the actual pH value based on the calibration temperature. Document the pH value on the meter once the reading has stabilized. Remove the sonde and rinse both the cup and the sonde with deionized or distilled water. The pH sensor is now calibrated and ready for use.

If the sensor fails to calibrate, the probe may need to be replaced. For troubleshooting, refer to the meter’s operation manual.

### 7.2.5 Turbidity Calibration

YSI

A two-point calibration is performed to calibrate the turbidity sensor. First, rinse the calibration cup with deionized or distilled water. Fill the cup with 0 NTU distilled or deionized water past the turbidity probe. Agitate the sonde making sure no air bubbles adhere to the probe. Once calibrated, rinse the calibration cup with deionized or distilled water. Rinse the cup with a small amount of the 100 or 126 NTU turbidity standard, depending on which sensor is installed. Fill the cup above the turbidity probe with the 100 or 126 NTU turbidity standard. Agitate the sonde, making sure no air bubbles adhere to the probe. Once the reading has stabilized, confirm the calibration. The unit is now calibrated and ready for use.

If the sensor fails to calibrate, the probe may need to be replaced. For specific step-by-step instructions and troubleshooting, follow the each unit’s operation manual. In the equipment or site logbook, record the calibration solutions used, their lot numbers and expiration dates along with whether or not the sensor calibrated in the field equipment or site logbook.

Horiba

Turbidity is divided into three measurement ranges: 0.0 to 9.9 NTU, 10 to 100 NTU, and over 100 NTU. Calibration procedures are dependent on the range(s) of the water to be measured. For most field applications, only the 0.0 to 9.9 NTU range is necessary, which requires a two-point calibration (one zero point and one span calibration). The first standard is 0 NTU deionized or distilled water. Fill the cup with the 0 NTU distilled or deionized water past the turbidity probe. Agitate the sonde, making sure no air bubbles adhere to the probe. Once calibrated, rinse the calibration cup with deionized or distilled water followed by a small amount of the reference standard solution.

For calibration within the 0.0 to 9.9 NTU range, a known concentration of solution must be within the 0.0 to 9.9 NTU range. Instructions on the preparation of the 8.0 NTU standard solution is found in the Horiba operation manual. Also found in the operation manual are calibration procedures for other calibration ranges and multiple point calibrations. In the site logbook, record the lot and expiration dates of the turbidity standards used.

#### 7.2.6 Oxidation-Reduction Potential Calibration

Horiba

First prepare the ORP calibration solution by agitating 250 mL of deionized water with one bag of ORP standard powder. For further details on preparing the solution, refer to the Horiba user manual. Rinse the calibration cup and sensor with deionized or distilled water, followed by a small amount of the ORP solution. Fill the calibration cup with ORP solution until just above the ORP sensor. Agitate the sonde, making sure no air bubbles adhere to the probe. Do not leave the ORP standard solution in the open air for more than an hour; doing so will require that the solution be discarded and replaced with fresh solution.

If sensor fails to calibrate, the probe may need to be replaced. For specific step by step instructions and troubleshooting, follow the each unit’s operation manual.

YSI

There is no calibration of the ORP sensor for the YSI meter; however, the ORP sensor should be verified that it is functioning correctly. Using a 3682 Zobell solution, readings should be between 221 and 241 mV at normal ambient temperature. If the reading is outside of this range, then it should be returned to the manufacturer for service.

### 7.3 Field Measurements

#### 7.3.1 Submersion

For collecting measurements directly from a water body, remove the storage cup and thread on the weighted guard, then immerse the probe. Use a rope or string to lower and raise the probe into the water. Never use the data cable to lower and raise the sonde into and out of water as this may damage the cable. Allow several minutes for the readings to stabilize to ensure accurate readings. Record the parameter values in a site logbook. When measurements are complete, remove the weighted guard and replace the storage cup.

### 7.3.2 Sample Cup

The sample cup may be used to make measurements of grab samples. Fill the cup approximately ¼ full of the water to be sampled, agitate and discard the water. Then, fill the cup until it's nearly full, with the probe sensors completely covered. After allowing time for the values to stabilize, record the parameter values in a site logbook.

### 7.3.3 Flow-Through Cell

The flow-through cell is used to collect multi-parameter measurements while purging a groundwater monitoring well during low-flow sampling. Prior to collecting measurements, the first couple minutes of purging must be done outside of the flow-through cell to prevent sediments from entering the cell. This will help prevent possible false turbidity readings. The pumping rate must be adjusted so that no air bubbles are present. Measurements can be made at periodic intervals either manually or by programming the data logger. Parameter values are then recorded in a site logbook.

## 7.4 Post-Use Verification

Follow the same procedures for initial calibration, except for the adjustment of parameter values. Instead, record the readings for each parameter and document in a logbook. Post-verification ensures the reliability of the field measurements by demonstrating that the instrument calibration did not drift during the monitoring period. Any significant deviations (+/- 10%) in the calibration status of the instrument should be incorporated into the final interpretation of the water quality data.

## 7.5 Decontamination

The following steps should be followed to decontaminate the unit after each field mobilization:

1. Clean the entire sonde and the data cable with a cloth and mild liquid detergent solution and then rinse with deionized or distilled water. If necessary, a soft brush or cotton swab may be used to clean between the probes. Repeat this step as many times as necessary to remove all visible contamination.

2. Add deionized or distilled water to the storage cup and fasten to the sonde.

3. Agitate the instrument gently to further remove any contaminants or detergent.

4. Wipe the pH probe with lens cleaner or a cotton swab. Do not use abrasive cloths to wipe the probe.

5. Repeat Steps 2 through 4 until the probes are clean. **Do not use acetone, organic solvents, nitric acid or harsh detergents to clean the instrument**. Once the unit is decontaminated, it is ready for calibration or storage. If calibrating, refer to Section 7.2 for calibration instructions. If storing the unit, refer to Section 3.0.
6. Due to limitations on decontamination methods, no samples should be collected directly from the water quality parameter device. Once the sample stream has achieved steady state conditions required for sampling, the water quality device must be removed prior to sampling.

### 7.6 Maintenance

Maintenance schedules are followed as outlined by manufacturers' guidelines. The replacement of probes should be done by a qualified individual. See each unit's operation manual for maintenance schedules.

## 8.0 CALCULATIONS

This section is not applicable to this SOP.

## 9.0 QUALITY ASSURANCE/QUALITY CONTROL

Specific quality assurance/quality control (QA/QC) activities that apply to the implementation of these procedures will be listed in the QAPP prepared for the applicable monitoring event. The following general QC procedures will also apply:

- Equipment will be calibrated prior to field use and post-verified after field use as per Sections 7.2 and 7.4.
- All data must be documented in equipment or site logbooks as per ERT SOP, *Logbook Documentation.*
- Record the manufacturer lot numbers and expiration dates of all calibration standards used in the instrument logbook. Ensure all standards and solutions are not expired.
- The units are inspected quarterly in the equipment logbook to ensure they are functioning properly. This will allow the user time to find and replace defective probes or components before going into the field. If units are rented, a copy of the preventive maintenance and calibration done by the environmental rental company will be requested. Renting the unit does not reduce the number of QC checks that need to be performed.
- Records must be maintained, documenting the training of the operators that use the instrumentation and equipment for the collection of environmental information.

## 10.0 DATA VALIDATION

Results of the post-verification checks will be evaluated for instrument drift. This information will be used to qualify the environmental sample results according to the project's data quality objectives. There is no formal data validation procedure.

Data verification (completeness checks) must be conducted to ensure that all data inputs are present for ensuring the availability of sufficient information. This may include but is not limited to: location information, water quality parameter measurements, purging start and end times, water levels, depth to groundwater measurements, purge method and total volume pumped. These data are essential to providing an accurate and complete final deliverable. The Environmental Response Team (ERT) contractor's Task Leader is responsible for completing the UFP-QAPP verification checklist for each project.

## 11.0 HEALTH AND SAFETY

Based on Occupational Safety and Health Administration (OSHA) requirements, a site-specific health and safety plan (HASP) must be prepared for response operations under the Hazardous Waste Operations and Emergency Response (HAZWOPER) standard, 29 CFR 1910.120. Field personnel working for EPA's ERT should consult the Emergency Responder Health and Safety Manual currently located at https://response.epa.gov/_HealthSafetyManual/manual-index.htm for the development of the HASP, required personal protective equipment (PPE) and respiratory protection.

## 12.0 REFERENCES

Horiba, Ltd. April 2009. Multi Water Quality Checker U-50 Series Instruction Manual. Website access, April 22, 2015.

YSI Incorporated. November 2011. 6-Series Multiparameter Water Quality Sondes, Revision J. Website access, April 22, 2015.

## 13.0 APPENDICES

A – Water Quality Meter Figures

# APPENDIX A
Water Quality Meter Figures
SOP: ERT-PROC-2041-21
January 2021

FIGURE 1.Water Quality Meters

Example of the YSI 650 MDS data logger and 6920V2 sonde

Example of the Horiba U-52 Water Quality Meter