# STANDARD OPERATING PROCEDURE FOR THE COLLECTION OF CHEMICAL AND BIOLOGICAL AMBIENT WATER SAMPLES

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**Table of Contents**


| Section | Subject | Page |
|---|---|---|
| 1. | Scope and Application | 4 |
| 2. | Summary of Method | 4 |
| 3. | Definitions | 4 |
| 4. | Health and Safety Warnings | 5 |
| 5. | Interferences | 6 |
| 6. | Personnel Qualifications | 6 |
| 7. | Equipment and Supplies | 7 |
| 8. | Pre-sample Collection | 7 |
| 9. | Sample Collection | 8 |
| | 9.1.0 Sample Collection From a Boat | 8 |
| | 9.2.0 Sample Collection Using Waders | 9 |
| | 9.3.0 Sample Collection From the Shore | 10 |
| | 9.4.0 Sample Collection Using a Bucket | 10 |
| | 9.5.0 Sample Collection at Depth | 12 |
| | 9.6.0 Sample Collection - Depth integrated | 13 |
| 10. | Sample Handling, Preservation, and Storage | 14 |
| 11. | Chain of Custody | 15 |
| 12. | Data and Record Management | 16 |
| 13. | Quality Control/Quality Assurance and Decontamination | 16 |
| 14. | Waste Management and Pollution Prevention | 16 |
| 15. | References | 17 |

**1.0 Scope & Application:**

This Standard Operating Procedure is applicable to the collection of representative chemical and biological samples from lakes, ponds and streams.

**2.0 Summary of Method:**

This SOP describes the procedure for the collection of representative water samples from: a boat, using waders, from shore, using a bucket, at depth and through the water column (depth integrated). This method assumes that the sampling parameters (pollutants) are uniformly distribute in the water column. This SOP does not include sample parameters that require specific methods such as ambient metals collection and certain biological and chemical samples. It also doesn't address flow proportioned sampling.

**3.0 Definitions:**

3.1 Bottle Blank: Analyte-free water is collected into a sample container, of the same lot number as the containers used for the environmental samples. This sample evaluates contamination introduced from the sample container(s) from a common lot.

3.2 Equipment/Rinse/Rinsate Blanks: A sample that is collected by pouring over or running analyte-free water through the sample collection equipment after decontamination and before sample collection. The sample is collected in the appropriate sample container with the proper preservative, identical to the samples. This sample evaluates background contamination resulting from the field equipment, sampling procedure, sample container, preservative, and shipment.

3.3 Field Blank: In the field, analyte-free water is collected into a sample container with preservatives. The sample containers are the same lot used for the environmental samples. This evaluates contamination introduced from the sample container(s) with applicable preservatives. Field blanks are not used for volatile samples.

3.4 Filter Blank: In the field, analyte-free water is passed through a filter and collected into in the appropriate sample container. The filter blank is then preserved. This procedure is identical to the sample collection.

3.5 Shipping Container Temperature Blank: A water sample that is transported to the laboratory to measure the temperature of the samples in the cooler.

3.6 Trip Blanks: A sample collected at the laboratory using analyte free water in the appropriate sample container with the proper preservative, taken out to the field, and returned to the laboratory for analysis without being opened. Trip blanks are generally for volatile organic compounds, low level metals, and gasoline range hydrocarbon samples. Trip blanks are used to assess contamination introduced during sample transport.

3.7 Field Replicates/Duplicates: Two or more samples collected at the same sampling location. Field replicates should be samples collected side by side or by collecting one sample and immediately collecting the second sample. Field replicates represent the precision of the whole method, site heterogeneity, field sampling and the laboratory analysis.

3.8 Field Split Samples: Two or more representative sub-samples taken from one environmental sample in the field. Prior to splitting, the environmental sample is homogenized to correct for sample heterogeneity that would adversely impact data comparability. Field split samples are usually analyzed by different laboratories (intra-laboratory comparison) or by the same laboratory (intra-laboratory comparison). Field splits are used to assess sample handling procedures from field to laboratory and laboratory's comparability.

3.9 Laboratory Quality Samples: Additional samples will be collected for the laboratory's quality control: matrix spike, matrix spike duplicate, laboratory duplicates, etc.

3.10 Proficiency Testing (PT)/Performance Evaluation Sample (PES): A sample, the composition of which is unknown to the laboratory or analyst, provided to the analyst or laboratory to assess the capability to produce results within acceptable criteria. This is optional depending on the data quality objectives.

**4.0 Health and Safety Warnings:**

4.1 All proper personal protection clothing and equipment must be worn.

4.2 All sampling involving hazardous material or hazardous conditions (i.e sampling material, sample preservatives) must be performed with at least two people.

4.3 When working with potentially hazardous materials or situations, follow EPA, OSHA, and site specific health or safety procedures. If a site has a known hazardous chemical is present on site, review all chemical data including exposure guidelines and Material Data Safety Sheets (MSDS) before visiting the site.

4.4 When sampling lagoons or surface impoundments, the sampling team member(s) collecting the sample should not get too close of the edge of the impoundment, where bank failure may cause them to lose their balance.

4.5 Follow the OEME Boat Safety SOP (see reference) when conducting sampling from a boat.

4.6 When preserving samples all proper personal protection clothing and equipment is to be worn. At a minimal this will includes closed toed shoes, safety glasses and impervious gloves. Clean water and baking soda should be available for rinsing and neutralizing acids.

4.7 When working with potential hazardous chemicals or biological agents, avoid inhalation, skin contact, eye contact or ingestion. If skin contact occurs remove contaminated clothing immediately. Wash the affected areas thoroughly with large amounts of water and soap and water. If available consult the Material Data Safety Sheets (MSDS) for prompt action, and in all cases seek medical attention immediately. If inhalation, eye contact or ingestion occurs, consult the Material Data Safety Sheets (MSDS) for prompt action, and in all cases seek medical attention immediately.

4.8 When sample handling is complete wash your hands thoroughly**.**

**5.0 Interferences:**

5.1 Interference may result from using contaminated equipment, solvents, reagents, sample container, or sampling in a disturbed area.

5.2 Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. Clean and decontaminate all sampling equipment prior to use. Follow the appropriate cleaning procedure for the parameters being sampled.

5.3 All sampling equipment must be routinely demonstrated to be free from contaminants under the conditions of the analysis by running equipment blanks.

**6.0 Personnel Qualifications:**

6.1 All field samplers working at Superfund sites are required to take a 40 hour health and safety training course and the required annual refresher course prior to engaging in any field activities.

6.2 The field samplers should be pre-trained in all sampling equipment and procedures by an experienced sampler before initiating the sampling procedure.

6.3 All personnel shall be responsible for complying with all quality assurance/quality control requirements that pertain to their organizational/technical function.

**7.0 Equipment and Supplies:**

7.1 Sampling collection equipment (Kemmerer bottle, bacon bomb sampler, dip sampler, sampling pole, sampling bucket and/or bailer)

7.2 Chest waders with belt, hip boots

7.3 Boat

7.4 Appropriate clean impervious gloves

7.5 Sample preservation equipment (preservatives, pH paper, pipets, baking soda, safety glasses, DI water)

7.6 Pre-cleaned sampling bottles (Refer to 40 CFR Part 136.3 (e) Table II, the laboratory's request form or the analytical method for the proper preservative, bottle type and size.

7.7 Zip lock plastic bags

7.8 Coolers with ice

7.9 Phosphate free soap solution, distilled water, cleaning brush and other necessary equipment and reagents for decontaminating sampling equipment

7.10 Site logbooks, indelible marker, waterproof pen, field data sheets, chain of custody forms and sample tags

**8.0 Pre-sample Collection:**

8.1 Determine the number of samples (including QC samples) specified in QAPP. Refer to section 3.0 for QC sample definitions. Determine the sample locations, analytical sampling parameters, the sampling methods to be employed, and which equipment and supplies are needed.

8.2 Obtain the necessary sampling equipment.

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

8.4 Prepare a schedule and coordinate with the staff, clients, laboratory and regulatory agencies.

8.5 If possible, perform a general site survey prior to the site entry in accordance with the health and safety plan and QAPP.

8.6 Use GPS, topo maps, stakes, flags, or buoys to identify and mark all sampling locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

**9.0 Sample Collection**

When collecting samples, the field location should be recorded using Global Positioning System (GPS). The date and time of sample collection, field measurements and ambient conditions must be recorded. Water chemistry measurements should be made after sample collection is complete unless the measurements can be made in a way that will not contaminate or influence the samples (i.e, if there is a strong flow). Refer to the YSI Sondes SOP (see reference) for measuring water chemistry in the field.

**9.1.0 Sample Collection From a Boat**

9.1.1 Approach the sampling point from a downstream or down-wind position and then motor slowly toward the sampling point. The motor should be turned off prior to reaching the sampling location and the boat allowed to coast a short distance to the anchoring point to prevent sampling of water affected by motor exhaust.

9.1.2 Allow the boat to come to a complete stop and lower the anchor slowly to prevent bottom sediments from being disturbed. Do not drop or toss the anchor overboard. If there is no wind or current you may not need to anchor.

9.1.3 Allow the boat to drift into anchored position before beginning sampling.

9.1.4 Prepare the sample bottles. If not already done, label the sample bottles with at least, the sample number, with a permanent marker or waterproof sticker.

9.1.5 The member of the team who will be doing sampling will don new “powder free” polyethylene, PVC, or nitrile gloves.

9.1.6 Remove sample container cap. Plunge container quickly though water surface to avoid surface scum. If there is significant surface scum, record this in the field notes and use a swirling motion to clear it before plunging the bottle. The sampler will submerge the container 0.1 to 0.2 meters (4 to 8 inches) and allow the container to fill. Bacteriological samples must have air space in the top of the sample container.

9.1.7 Bring bottle up and immediately cap container.

9.1.8 An alternative to this method is to submerge capped container to 0.1 to 0.2 meters and then remove cap, allowing container to fill, then recapping at the same depth

**9.2.0 Sample Collection Using Waders**

9.2.1 Don waders with belt

9.2.2 Prepare the sample bottles. If not already done, label the sample bottles with at least, the sample number using a permanent marker or waterproof sticker.

9.2.3 Where there is flow or current, always approach the sampling location slowly from the downstream.

9.2.4 Once you have reached the sampling location allow the water to return to a pre-disturbed condition.

9.2.5 The member of the team who will be doing sampling will don new "powder free" polyethylene, PVC, or nitrile gloves.

9.2.6 Remove sample container cap. Reaching up stream or up-current plunge the container quickly though water surface to avoid surface scum. If there is significant surface scum, record this in the field notes and use a swirling motion to clear it before plunging the bottle. The sampler will submerge the container 0.1 to 0.2 meters (4 to 8 inches) and allow the container to fill. Avoid contacting the sample bottle with the bottom or adjacent rocks and stream debris. If the water depth is less than 0.1 meters sample the water at mid depth. Bacteriological samples must have a small amount of air space in the top of the sample container for mixing in the laboratory.

9.2.7 Bring bottle up and immediately cap container.

9.2.8 An alternative to this method is to submerge capped container to 0.1 to 0.2 meters and then remove cap, allowing container to fill, then recapping at the same depth

### 9.3.0 Sample Collection From the Shore

9.3.1 Prepare the sample bottles. If not already done, label the sample bottles with at least, the sample number using a permanent marker or waterproof sticker.

9.3.2 Identify the proper sampling location that will be sampled with out entering the water.

9.3.3 Where there is flow or current always approach the sampling location slowly from downstream or down wind.

9.3.4 The member of the team who will be doing sampling will don new "powder free" polyethylene, PVC, or nitrile gloves.

9.3.5 Remove sample container cap. Reaching up stream or up-current plunge the container quickly though water surface to avoid surface scum. If there is significant surface scum, record this in the field notes and use a swirling motion to clear it before plunging the bottle. The sampler will submerge the container 0.1 to 0.2 meters (4 to 8 inches) and allow the container to fill. Avoid contacting the sample bottle with the bottom, stream bank, adjacent rocks and stream debris. If the water depth is less than 0.1 meters, sample the water at mid depth. Bacteriological samples must have a small amount of air space in the top of the sample container for mixing in the laboratory.

9.3.6 Bring bottle up and immediately cap container.

9.3.7 An alternative to this method is to submerge capped container to 0.1 to 0.2 meters and then remove cap, allowing container to fill, then recapping at the same depth

### 9.4 Sample Collection Using a Bucket

This method may not be used for oil and grease analysis and may only be used for bacteria analysis if the bucket has been adequately sterilized and maintained sterile. For bacteria the bucket should not be pre-rinsed and a new sterile bucket is required at each site. The analytes of concern will dictate the type of bucket that is used and therefore the proper decontamination procedure. At a minimum this would be with a phosphate free soap and rinsed three times with distilled water.

9.4.1 Prepare the sample bottles. If not already done, label the sample bottles with at least the sample number using a permanent marker or waterproof sticker.

9.4.2 Identify the proper sampling location that will be sampled without entering the water.

9.4.3 Where there is flow or current always sample on the upstream side of the bridge or structure.

9.4.4 The member of the team who will be doing sampling will don new "powder free" polyethylene, PVC, or nitrile gloves.

9.4.5 Locate the pre-cleaned bucket and rope.

9.4.6 Lower the bucket slowly to the water. To prevent particles or bridge material from entering the bucket, do not allow the rope or the bucket to touch the bridge structure.

9.4.7 Allow the bucket to fill at least 1/3 of the way full and raise the bucket slowly so that it does not contact anything on the way up. Coil the rope in your hand or on a cleaned surface (i.e. a clean plastic bag). This is performed to prevent particles from gathering on the rope and eventually dropping in the bucket.

9.4.8 Once the bucket has been raised, swirl the water in the bucket so it has contacted all inside surfaces. Empty the bucket so that it doesn't disturb the water to be sampled.

9.4.9 Lower the bucket slowly to the water. To prevent particles or bridge material from entering the bucket, do not allow the rope or the bucket to touch the bridge structure.

9.4.10 Allow the bucket to fill to provide enough volume to fill all sample containers. Raise the bucket slowly so that it does not contact anything on the way up. Coil the rope in your hand or on a cleaned surface (i.e. a clean plastic bag). This is performed to prevent particles from gathering on the rope and eventually dropping in the bucket. If material falls in the bucket on the way up, empty the bucket and go to 9.4.8

9.4.11 Once the bucket is raised uncap all sampling containers

9.4.12 Swirl the water in the bucket so it is well mixed.

9.4.13 Fill up all sampling containers 1/3 full

9.4.14 Swirl the water in the bucket so it is well mixed

9.4.15 Fill up all sampling container to 2/3 full

9.4.16 Swirl the water in the bucket so it is well mixed

9.4.17 All sampling containers are to be filled unless otherwise specified. If more sample volume is required go to 9.4.10. and continue to fill the sample bottles 1/3 at a time.

9.4.18 Between each stations wash the bucket with a phosphate free soap and rinse three times with distilled water. To prevent contamination, do not store the rope in the bucket.

**9.5 Sample Collection at Depth**

This method may not be used for bacteria analysis unless the depth-sampler has been adequately sterilized and maintained sterile. For bacteria a new sterile depth-sampler is required at each site. The depth-sampler should be cleaned properly for the particular analysis required. At a minimum this would be with a phosphate free soap and rinsed three times with distilled water.

9.5.1 Prepare the sample bottles. If not already done, label the sample bottles with at a minimum, the sample number using a permanent marker or waterproof sticker.

9.5.2 Identify the proper sampling location that may be sampled without entering the water.

9.5.3 Where there is flow or current alway sample on the upstream side of the bridge, structure or boat. If sampling from a boat follow the procedure in 9.1.1-9.1.3

9.5.4 The member of the team who will be doing sampling will don new “powder free” polyethylene, PVC, or nitrile gloves.

9.5.5 Locate the pre-cleaned depth-sampler.

9.5.6 Lower the depth-sampler slowly to the desired depth.

9.5.7 Move the sampling rope several time side to side, to allow the water at depth to enter the sampler.

9.5.8 Drop the messenger to trigger the depth-sampler.

9.5.9 Raised the depth-sampler.

9.5.10 Remove the caps from all sample bottles

9.5.11 Shake or swirl the water in the depth-sampler

9.5.12 Fill up all sampling containers 1/3 full

9.5.13 Shake or swirl the water in the depth-sampler

9.5.14 Fill up all sampling container to 2/3 full

9.5.15 Shake or swirl the water in the depth-sampler

9.5.16 All sampling containers are to be filled unless otherwise specified.. If more sample volume is required go to 9.5.6. and continue to fill the sample bottles 1/3 at a time.

9.5.17 Between each stations wash the depth-sampler with a phosphate free soap and rinse three times with distilled water.

**9.6 Sample Collection - Depth integrated**

This method refers to collecting depth integrated samples using a 3 foot bailer. This method may not be used for bacteria analysis unless the bailer has been adequately sterilized and maintained sterile. For bacteria, a new sterile bailer is required at each site and know pre-rinsing can be performed. The bailer should be cleaned properly for the particular analysis required. At a minimum this would be with a phosphate free soap and rinsed three times with distilled water.

9.6.1 Prepare the sample bottles. If not already done, label the sample bottles with at a minimum, the sample number using a permanent marker or waterproof sticker.

9.6.2 Identify the proper sampling location that may be sampled without entering the water.

9.6.3 Where there is flow or current alway sample on the upstream side of the bridge, structure or boat. If sampling from a boat follow the procedure in 9.1.1-9.1.3

9.6.4 The member of the team who will be doing sampling will don new “powder free” polyethylene, PVC, or nitrile gloves.

9.6.5 Locate the pre-cleaned Teflon bailer.

9.6.6 Lower the bailer slowly until the top of bailer is at the water's surface (3 feet).

9.6.7 Raise the bailer.

9.6.8 Empty the bailer so that it doesn't disturb the water to be sampled (At least 5 feet away from the sample collection location).

9.6.9 Lower the bailer slowly until the top of bailer is at the water's surface (3 feet).

9.6.10 Raise the bailer.

9.6.11 Remove the caps from all sample bottles

9.6.12 Mix the water in the bailer by putting you gloved finger of the top of the bailer and turning it upside down and then right-side up 3 times.

9.6.13 Fill up all sampling containers 1/3 full (if there is only one sample container fill it all at once).

9.6.14 Mix the water in the bailer by turning it upside down and then right-side up once.

9.6.15 Fill up all sampling container to 2/3 full

9.6.16 Mix the water in the bailer by turning it upside down and then right-side up once.

9.6.17 All sampling containers are to be filled unless otherwise specified**.** If more sample volume is required go to 9.6.10 and continue to fill the sample bottles 1/3 at a time.

9.6.18 Between each stations wash the bailer with a phosphate free soap and rinse three times with distilled water.

## 10.0 Sample Handling, Preservation, and Storage

10.1 Don safety glasses, appropriate impervious gloves and other necessary safety equipment. Have neutralizing agent and rinse water readily available.

10.2 Preserve the sample or use pre-preserved sample bottles, when appropriate. Refer to 40 CFR Part 136.3 (e) Table II, the laboratory's request form or the analytical method for the proper preservative and amount.

10.3 Use a clean pipet (for each preservative) to deliver the necessary amount of preservative for each sample. Avoid contacting the pipet with the sample. Add preservative in small increments and test; too much preservative may mask analytical results. After preservation is complete dispose of the pipet by rinsing it and placing it in the trash.

10.4 Cap the sample and shake it to mix the preservative with the sample.

10.5 When a specific pH level is required. Check to the pH by pouring a small amount of sample from the container over the pH paper. To avoid contamination do not put the pH paper in the sample bottle. If the required pH has not been achieved add additional preservative by following the procedures in 10.3.

10.6 Once the sample has been preserved properly, cap the container, use a custody seal if the sample is for enforcement and then place the container in a zip-lock plastic bag (optional).

10.7 Load all the sample containers into cooler(s) ensuring that the bottles are in the ice but not totally immersed in water.

10.8 Record all pertinent data in the site logbook and on the field data sheet. At a minimum this should include date, time, station number, sampling number and sample conditions.

**11.0 Chain of Custody**

11.1 Follow the Sample Control Procedures, chain-of-custody Standard Operating Procedures.

11.2 At a minimum enter the following information on the Chain of Custody form: sampling date, sampling time, station number, sample numbers, project name, number of containers per station/sample number, type of analyses, type of sample (composite or grab), and samplers signatures.

11.3 Chain of custody forms should stay with the samples at all times. When samples are not in custody of the sampler or designated person (who signs the form) they should be maintained under lock and key.

11.3 Attach the custody seals to the cooler prior to shipment if for investigation or shipment to another laboratory.

**12.0 Data and Records Management:**

12.1 All data and information shall be recorded in a hardbound book or on a data sheet. Follow the Field Data Management SOP.

12.2 The chain of custody form is signed over to the laboratory. A copy is kept with the sampling records.

12.3 The sampling data is stored at US EPA - NE, 11 Technology Dr, North Chelmsford, MA for at least 5 years.

**13.0 Quality Control/Quality Assurance and Decontamination:**

13.1 Representative samples are required. The sampler will evaluate the site specific conditions to assure the sample will be representative.

13.2 All sampling equipment must be completely decontaminated prior to and after use.

13.3 Between each stations sampling equipment (i.e buckets, depth sampler and depth integrated sampler) shall be washed with a phosphate free soap and rinsed three times with distilled water. If sampling vertical profiles at the same station, sampling equipment will not be washed unless deemed necessary by the project data quality objectives.

13.4 All field QC sample requirements in the QAPP must be followed. These may involve trip blanks, equipment blanks, field duplicates and the collection of extra samples for the laboratory's quality control.

**14.0 Waste Management and Pollution Prevention:**

14.1 During field sampling and analysis events there may be hazardous waste produced from the sample collection. The waste must be handled and disposed of in accordance with federal, state, and municipal regulations. Dispose of the site specific hazardous waste produced where the work was performed, if the operating site has proper disposal available. If there is no disposal that meets regulatory requirements, the waste must be transported back to EPA-NE and transferred to the hazardous waste manager for disposal. The sample volume should be minimized to reduce unnecessary waste.

**15.0 References:**

15.1 U.S. EPA, Office of Environmental Measurement and Evaluation, January 1998, Revision 2. Safe Boating Standard Operating Procedures. EPA-RG 1-OEME/BOAT

15.2 U.S. EPA, Office of Environmental Measurement and Evaluation, 4/23/02, Revision 0. Standard Operating Procedures for calibration and field measurement procedures for the YSI model 6- series Sondes (Including: temperature, pH, specific conductance, turbidity, and dissolved oxygen. YSI Sondes

15.3 U.S. EPA, Office of Environmental Measurement and Evaluation, August 1996, Revision 1. Sample Control Procedures, chain-of-custody.

15.4 U.S. EPA 40 CFR Part 136.3 (e) Table II