STANDARD OPERATING PROCEDURE APPROVAL AND CHANGE FORM

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SEDIMENT SAMPLING

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SEDIMENT SAMPLING

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 material 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)

Sampling using an Ekman™ Dredge

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

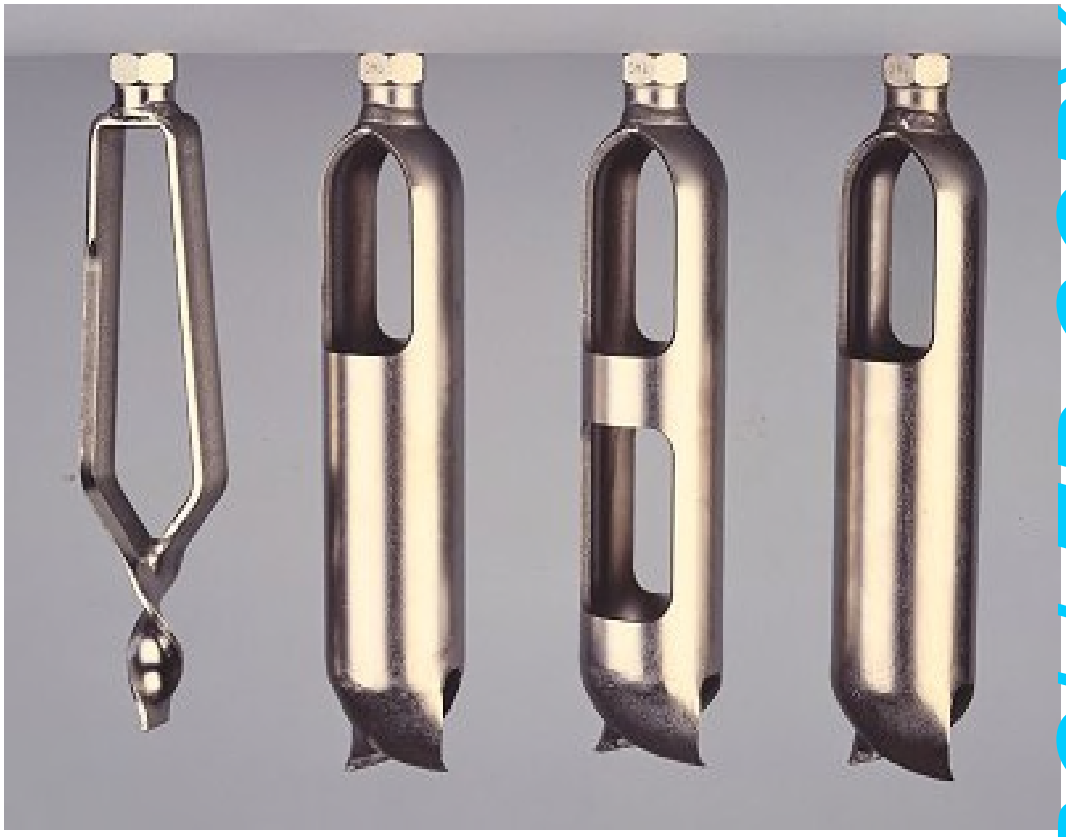

FIGURE 2 - Example of an Ekman™ Dredge

FIGURE 3 - Example of a Ponar™ Dredge

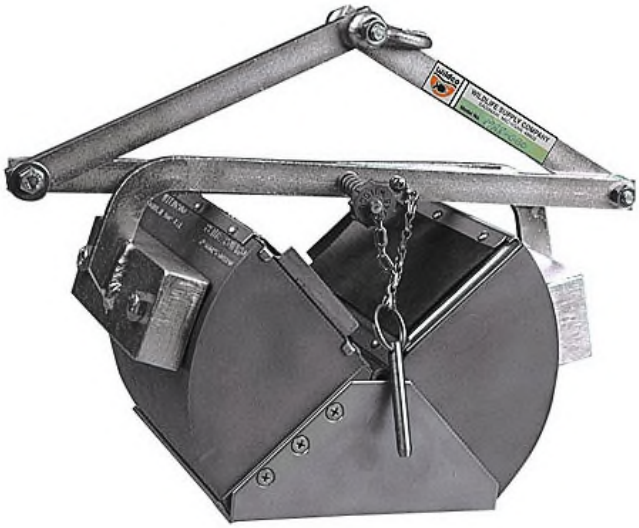

Figure 4 - Example of a Sampling Coring Device

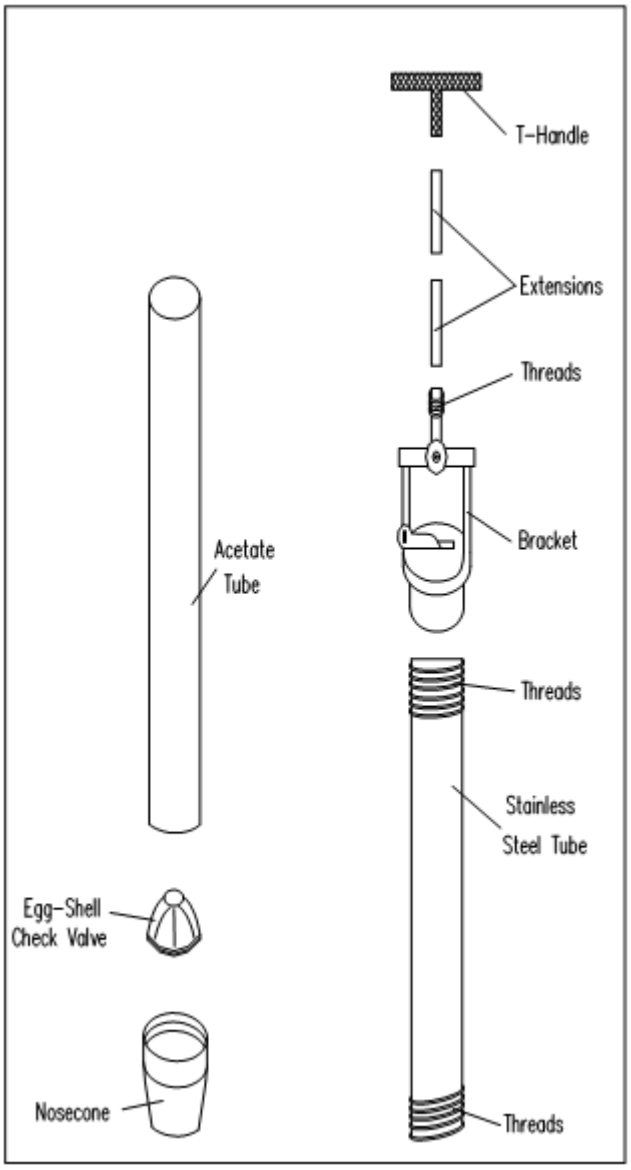

Figure 5 - Example of Vibracoring

Figure 6 - Example of an Encore Sampler

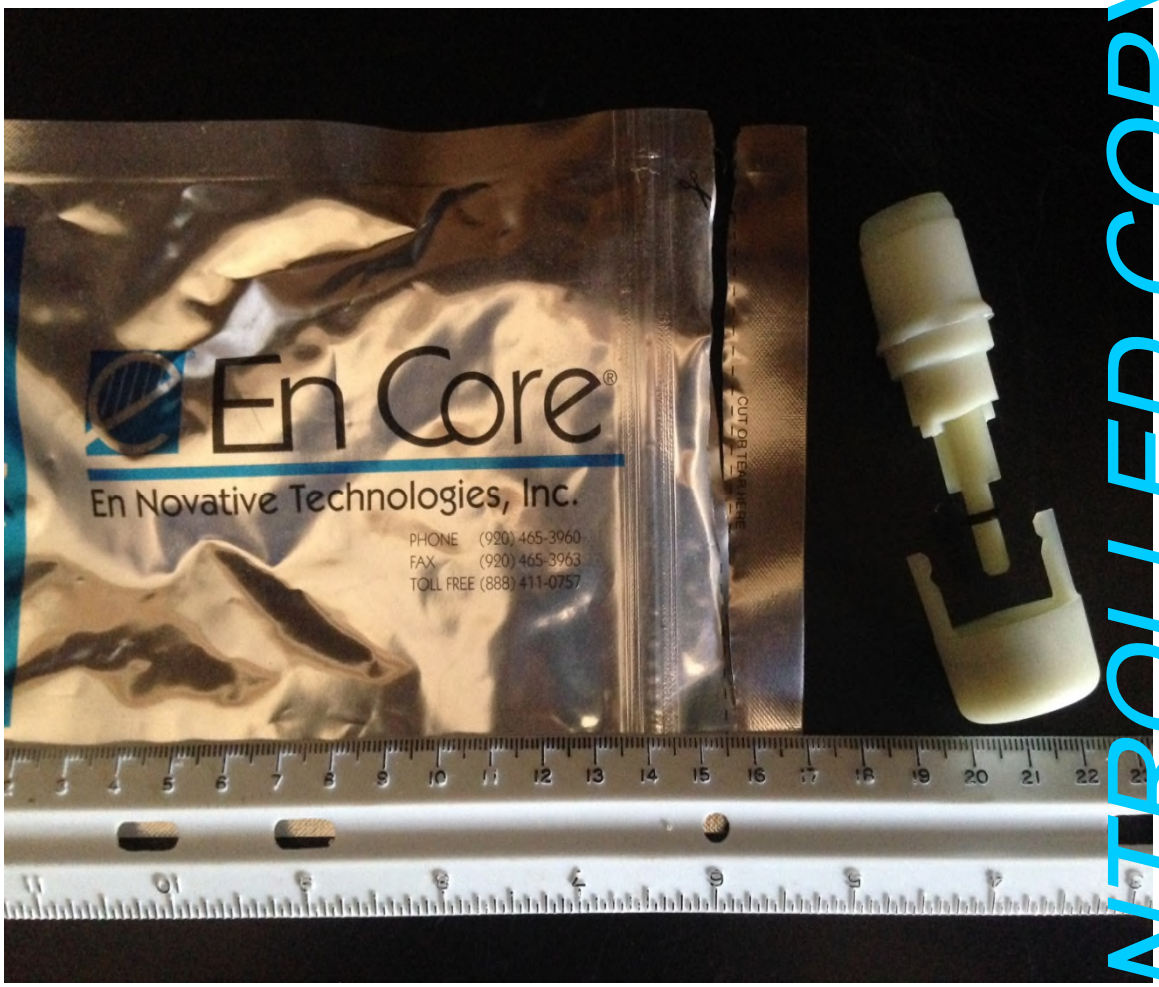

Figure 7 - Example of a Terracore Sampler