LITERATURE REVIEW AND REPORT

SURFACE-SEDIMENT SAMPLING TECHNOLOGIES

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NOTICE

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ABSTRACT

A literature review was conducted to identify available surface sediment sampling technologies with an ability to collect undisturbed sediments to depths of up to 1 meter below the water sediment interface. This survey was conducted using published literature and references, Environmental Protection Agency reports, professional sources, journal articles, internet web sites, sales brochures, and other sources as identified. For each piece of sampling equipment or sampling tool identified during the literature search, the following information was collected: general description of the equipment or tool, including its size, shape, weight, and composition; manufacturer's name, address, phone number, and email; a picture of the equipment or tool; the general mechanism of operation; sample volume collected; chemical and physical compatibility concerns; labor requirements; cost; and other requirements such as electrical power or specialized training.

Sampling methodologies included in this investigation are grab or core types of sampling devices, as these types are most typically used in collecting surface sediments. In this review, 40 samplers were identified that included 13 grab samplers and 27 core samplers. Grab samplers included in the review are the Ponar, Birge-Ekman, Van Veen, Peterson, Mud Snapper, Scoopfish, Shipek, Smith-McIntyre, and others. Core samplers included in the review are the piston, splitcore, box, Vibracore, Mackereth, Ballchek, Craib, Gomex, Phleger, and others. These technologies were identified through contacts with centers of contaminated sediments expertise and included in the study. Vendors were solicited to provide required information for the report.

All information collected in the literature search phase is maintained in an Access® database. Pictures of equipment will be maintained in digital PDF or JPEG file formats in a sediment sampler picture file directory associated with the database. Information contained in the database is provided in the Appendix to this report.

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1.0 INTRODUCTION

This surface sediment sampling technologies report was prepared for the U.S. Environmental Protection Agency's (EPA) Office of Research and Development (ORD), National Exposure Research Laboratory (NERL), Environmental Sciences Division (ESD), Characterization and Monitoring Branch (CMB) in Las Vegas, Nevada. EPA NERL's ESD conducts research programs on environmental exposures to ecological and human receptors, as well as develops methods for characterizing chemical and physical stressors. ESD also conducts analytical chemistry research and applies advanced monitoring technology to issues involving surface and subsurface contamination. CMB develops, evaluates, applies, and validates technologies and approaches for cost-effective monitoring and assessment of surface and subsurface environments. The Branch's research and technical support address questions about monitoring for site characterization, pollution prevention, the detection and assessment of contaminants, and decision support systems for site characterization and the evaluation of exposure. The goal of this study was to conduct a literature review to identify available surface sediment sampling technologies. For the purposes of this investigation, surface sediment is defined as any depth of sediment up to 1 meter from the overlying water/sediment interface.

The surface sediment sampling technologies study was initiated as a result of findings from a study conducted by the Committee on Remediation of PCB-Contaminated Sediments, which was established by the National Research Council (NRC). The findings of this study identified the need for the ability to collect undisturbed surface sediment samples. NRC published a report in 2001 titled "A Risk-Management Strategy for PCB-Contaminated Sediment," which discussed the findings of this study in more detail (NRC 2001). EPA's Environmental Monitoring and Assessment Program and the National Oceanic and Atmospheric Administration (NOAA) National Status and Trends Program are also interested in surface sediment sampling technologies because their studies focus on the characterization of recent environmental impacts to lakes, estuaries, and coastal waters (EPA 2001).

Tetra Tech EM Inc. (Tetra Tech) prepared this report to summarize the results of the surface sediment sampling technologies literature review that will be used by EPA and others in identifying and developing or modifying a sediment sampling device or tool for collecting an undisturbed surface sediment sample. Specifically, Tetra Tech was responsible for the following: (1) conducting a survey using published literature and references, EPA reports, professional sources, journal articles, internet web sites, and other sources as identified; (2) collecting and reviewing accessible information for each sampling tool or device, including a general description of the equipment or tool, manufacturer information, a picture of the equipment or tool, general mechanism of operation, sample volume collected, compatibility concerns, labor requirements, cost, and other requirements such as electrical power or specialized training; and (3) development of a database in Microsoft Access® format to compile information attained during the literature review.

This section describes the background, purpose, and need for the study. Section 2.0 provides considerations for selection of sediment sampling equipment. Section 3.0 discusses the two most commonly used types of sediment sampling devices, grab and core samplers, which are typically used to assess surficial sediment characteristics. Section 4.0 provides a summary and status of the sediment sampling technologies study. Section 5.0 provides a list of references. The appendix includes a description of each sediment sampling device or tool attained during the literature review and included in the database.

2.0 SURFACE-SEDIMENT SAMPLER LITERATURE SEARCH

This survey was conducted using published literature and references, EPA and U.S. Geological Survey (USGS) reports and documents, professional sources, journal articles, internet web sites, and sales catalogs in order to identify sediment samplers. For each piece of sampling equipment or sampling tool identified during the literature search, Tetra Tech collected the following information: general description of the equipment or tool, including its size, shape, weight, and composition; manufacturer's name, address, phone number, and email; a picture of the equipment or tool; the general mechanism of operation; sample volume collected; chemical and physical compatibility concerns; labor requirement; cost; and other requirements such as electrical power or specialized training. Sampling device vendors were contacted whenever possible to confirm literature search findings and to request additional information needed to complete data gaps.

Candidate samplers identified in the literature review were evaluated to determine whether they possessed sufficiently unique characteristics in order to classify as a new sampler or a different model under an existing classified sampler. Of the 85 sediment samplers identified in the literature review, there were 40 unique classified samplers that included 13 grab samplers and 27 core samplers.

All information collected in the literature search was maintained in an ACCESS database. Pictures of equipment will be maintained in digital PDF or JPEG file format as a bound object within a sediment sampler picture file directory associated with the database.

The database maintains each of the 40 unique sediment sampler types in a separate record. Different identified models of a classified sampler are presented in a single record. Details of a specific sampler are presented in a specially designed screen that contains sampler data property fields as wella s feature fields that discuss general description, operation, chemical and physical compatibility, and training and other requirements. A section that presents the manufacturer information and cost data is at the bottom of the screen. A JPEG file icon is embedded in this screen in order to permit a call up of a sampler picture file by placement of the cursor and clicking on the mouse. The screen also provides the ability to change to a printer friendly format in order to download a hard copy of sampler data records.

The database possesses a search function table that appears upon opening the database. The database can be searched according to sampler category (cor or grab) or type. Searchable core samplers include the gravity, box, piston, manual push, mechanical push, and mechanical oscillation devices. Searchable grab samplers include the small dredge, clamshell bucket, mechanical trap, and manual trap devices. Starting with a general idea of a type of sampler, a user of the database can display specific records of samplers that correspond to the input sampler type.

3.0 SELECTING DEVICES OR TOOLS FOR SEDIMENT SAMPLE COLLECTION

Selection of the appropriate sediment sampling device or tool must first be determined based on the data quality objectives for the project. No individual sediment sampler is appropriate for every objective and environmental setting. More than one sampling approach may be required for an investigation involving an assessment of the horizontal and vertical distribution of sediment contaminants of concern or benthos. Studies indicate that most samplers were designed primarily for collection of sediments for benthos or particle-size analysis and generally are inadequate for collecting undisturbed samples for chemical and mineralogical analysis. Studies have also shown that most sediment sampling equipment is not designed for collecting samples from the water/sediment interface (USGS 1997). Considerations for selecting a sampler for sediment collection are discussed in more detail below.

When selecting the sediment sampling equipment, consideration must be given to the safety of the field team, which may involve accessibility to the sampling site and sampling platform. Accessibility to the sampling area is an important factor in selection of the sampling equipment. When working in remote areas, considerations may include a boat, plane, helicopter, bridge, ice, scuba, wading, or a cable way. Other considerations may include the weight of equipment to be transported and the lifting capacity of winch, boom, crane, A-frame, or other support equipment that can be safely operated from a platform where sampling will take place (EPA 2001).

Limitations of sampling equipment are another factor that needs to be evaluated and may include physical disturbance of sediments, retention of fine-grained sediments, penetration depth, and limitations due to the physical character of the sediment type, such as particle size and degree of consolidation. Studies have shown that most sediment samplers are capable of recovering relatively undisturbed samples in soft, fine-grained sediments, but few can sample consolidated sediments consisting primarily of sand, gravel, firm clay, or till (EPA 2001).

For most studies, the upper 10 to 15 centimeters is typically the desired depth of penetration because most benthic organisms are found in this horizon. To limit physical disturbance and loss of fines during sampling of this upper horizon, a minimum penetration depth of 6 to 8 centimeters is recommended, but 10 to 15 centimeters is preferred. If contaminated sediment is being linked to organism exposure, sampling of specific sediment layers may be required. The feeding habits of the organisms of concern should be considered because some organisms feed at shallow depths and others feed at deeper intervals (EPA 2001).

Samples of specific sediment layers can provide information on the horizontal distribution of the contaminants of concern for the most recently deposited material. This information can be used to map the distribution of contaminants of concern across a body of water. A column of sediment, including the surficial and underlying layers, can be used to document historical changes in vertical distribution of contaminants of concern by characterizing the sediment quality with depth. This information can also be used to correlate organism exposure to specific sediment layers (EPA 2001).

The physical character of the cross-sectional area to be sampled will also be a determining factor in selecting the proper sediment sampler. These physical characters include slope, bathymetry, flow velocity, sampling depth, and size and areal distribution of physically different sediment types across the body of water to be sampled (EPA 2001; USGS 1997).

Sample volume may be a consideration when selecting a sampler because the required volume of sediment is typically dependent on the number and type of benthos and/or chemical sample analyses (EPA 2001). If the sample is collected for chemical analysis, compatibility concerns with the sampler construction materials will also need to be evaluated. Sampler construction materials can leach or be eroded during sample retrieval, which can impact results of sample analysis (USGS 1997).

4.0 SEDIMENT SAMPLERS

Three main types of sediment sampling devices are available: grab samplers, core samplers, and dredge samplers. Grab samplers are most commonly used to collect surface sediment in the determination of horizontal sediment characteristics. Core samplers are used to sample thick sediment deposits or for the collection of sediment profiles to determine the vertical distribution of sediment characteristics or to characterize the sediment column. Dredge samplers are used primarily for collection of benthos (EPA 2001).

Dredge samplers provide inadequate control of sample location, volume, and depth (USGS 1997), cause disruption of sediment and pore water integrity (EPA 2001), as well as a loss of fine-grained sediments (EPA 2001). For these reasons, dredge samplers are not typically used for collecting surface sediments; therefore, only the grab and core samplers are recommended for collecting surface sediments, and are considered in this evaluation. Tetra Tech identified 40 different grab and core sediment samplers during the literature review for this study. A description of each identified sampler is provided in the Surface Sediment Sampler Database, which is provided in the appendix to this report. Grab and core samplers are discussed in more detail below.

Grab Samplers

Grab samplers are used to collect information on horizontal surface distribution of sediments. Grab samplers typically consist of a set of jaws, which shut when lowered to the surface of the sediment or contain a bucket, and rotates into the bottom when reaching the sediment surface. These samplers are easy to handle and operate and can be used in a range of substrata (EPA 2001). Tetra Tech identified 13 grab samplers during the literature review for this study that are presented in the database in the appendix. Table 3-1 lists some general characteristics of select grab samplers. For additional information about the samplers listed in the table or other samplers identified in this study, the sampler database is provided in the appendix.

TABLE 3-1
GENERAL CHARACTERISTICS OF SELECT GRAB SAMPLERS*

Database Record Number	Sampler	Sampler Construction Material	Sampler Dimensions	Sampler Weight (Kg)	Penetration Depth	Sample Volume (L)	Application
2 of 40	Birge-Ekman	Stainless steel	15.2 x 15.2 cm - 30.5 x 30.5 x 30.5 cm	6.8 - 9.1	10 – 30 cm	3.4 - 16	A box-style sediment sampler which includes a messenger-operated release device; overlapping cover plates, loosely hinged at the top of the box, permit an outflow of water during descent, and close tightly to prevent wash out of sediment during ascent.
21 of 40	Ponar	Stainless steel and neoprene rubber	15.2 x 15.2 cm - 22.9 x 22.9 cm	10.0 - 23	10 cm	1- 8.2	The device is used in fresh- and saltwater to collect samples of hard sediments such as sand, gravel, consolidated material, or clay. The sampler is designed for penetrating deep into the substrate.
3 of 40	Van Veen	Stainless steel; neoprene straps; zinc-plated chain	35 x 70 x 100 cm	14.0 - 120	30 cm	8 - 75	The device can be used in surging or rough seas without premature closure; designed to descend vertically through strong underwater currents and collects samples without excessively disturbing the sediment.
22 of 40	Petersen	Zinc-plated heavy steel	30.5 x 30.5 cm	5 - 61.2	30 cm	9.45 – 9.89	The device is used in freshwater for collecting sediment samples from sandy, gravel, or clay substrates; vent holes permit water to flow through while the grab is being lowered, minimizing diagonal movement as well as reducing the frontal shock wave generated by descent.

TABLE 3-1
GENERAL CHARACTERISTICS OF SELECT GRAB SAMPLERS* (CONTINUED)

Database Record Number	Sampler	Sampler Construction Material	Sampler Dimensions	Sampler Weight (Kg)	Penetration Depth	Sample Volume (L)	Application
31 of 40	Smith-McIntyre	Stainless steel	70 x 70 x 60 cm	40 -100	30 cm	10 - 20	The device automatically collects a sediment sample upon contact with the substrate and can be used for sampling in either shallow or deep waters.
23 of 40	Shipek	Stainless steel; cast alloy steel	10.2 x 15.2 x 15.2 cm	5 - 61.2	10 cm	0.5 - 3	Sampler is designed to collect unconsolidated sediments from deep lakes and near offshore.

Notes:

*Adapted from USGS 1997.

Kg Kilogram
L Liter
cm Centimeter

Grab samplers are commonly used when the following general factors apply:

- Large volumes of sediment are needed for analysis

- Consolidated, large-grained sediments are expected to be encountered in substrate
- Large surface area of surficial sediment is needed
- Still water to very low current (small grab samplers) and mild to moderate current (large grab samplers)

The Van Veen, Ponar, Petersen, and Birge-Ekman devices are the most commonly used grab samplers because they are effective in most types of substrate and can be used in a variety of environments including lakes, rivers, estuaries, and marine waters. However, the Birge-Ekman is limited to sampling unconsolidated, soft sediments. The Van Veen is selected for several estuarine monitoring programs because it (1) can sample most types of substrate, (2) is less susceptible to blockage and loss of sample, (3) is less susceptible to forming bow waves during descent, and (4) provides high sample integrity compared to other grab samplers (EPA 2001).

Grab samplers have varying penetration depths depending on the size, shape, and underlying substrate. Large capacity grab samplers, including the Smith-McIntyre, Hammond, large Birge-Ekman, Van Veen, Nemag Valstar, and Petersen devices, can collect samples from a depth of 30 centimeters. Smaller grab samplers including the Scoopfish, Mud Snapper, small Birge-Ekman, standard and petite Ponar, and Shipek devices can collect samples from a depth of 10 centimeters. Grab sampler volumes can range from 0.5 liters to 95 liters.

Grab samplers are susceptible to washout of fine-grained sediments and dispersion of material in front of the bow wave created by the sampler during descent. This washout can significantly impact chemical or benthos sample analysis, since some organisms can detect the pressure wave of the approaching sampler. The Ponar, Van Veen, and Ted-Young modified Vgrab samplers are equipped with mesh screens and rubber flaps to cover the jaws to allow water to pass through the sampler during descent. This feature reduces disturbance from bow waves at the water/sediment interface and washout of sediment samples during ascent (EPA 2001).

Core Samplers

Core samplers are used to collect vertical profiles of the sediment. This information can be used to characterize geologic conditions in substrate and document historical changes in vertical distribution of contaminants of concern with depth. Core samplers typically use weights or piston devices to drive a hollow tube into the sediment surface, where a core of sediment is retrieved. The core samplers generally consist of a removable core liner, which fits into the core barrel and retains the sediment sample. Most core samplers can be used with different liner materials, including polyvinyl chloride (PVC), brass, Lexan®, or stainless steel. Compatibility of sample liner material with intended sample analysis should be determined prior to use. Tetra Tech identified 29 core samplers during the literature review for this study. Table 3-2 provides general characteristics of a representative selection of core samplers. For additional information about the samplers listed in the table or other samplers identified in this study, the sampler database is provided in the appendix.

Core samplers are commonly used when the following general factors apply:

- Characterization of contamination in deeper sediments is needed
- Documentation of historical changes in vertical distribution of contaminants is needed
- Reduced oxygen exposure needed for sample analysis
- Soft, fine-grained sediments are expected to be encountered in substrate

These samplers come in various designs, lengths, and diameters and are generally described as hand-held, gravity, vibracore, box, or piston-core samplers. Most core samplers, with the exception of the hand-held core samplers, require the use of a winch or crane depending on the size and weight of the sampler (EPA 2001). Some commonly used hand-held core samplers include the Russian-Type Borer, Ogeechee, and KC Hand-Operated Sediment Corer. These samplers can be used in a wide range of sediment types including soft- to fine- and medium-grained sediments, semi-compacted material, as well as peat and plant roots in shallow bodies of water (EPA 2001).

TABLE 3-2
GENERAL CHARACTERISTICS OF SELECT CORE SAMPLERS*

Database Record Number	Sampler	Sampler Construction Material	Sampler Dimensions	Sampler Weight (Kg)	Penetration Depth	Sample Volume (L)	Application
7 of 40	Russian-Type Borer	Stainless steel	5 cm O.D. x 50 cm in length - 7.5 cm O.D. x 75 cm in length	Unavailable	1 meter	1 – 3.3	Device is manually driven, chambered-type, side-filling core sampler designed to collect discrete, relatively uncompressed sediment samples.
37 of 40	Ogeechee	Stainless steel core tube; stainless steel or Lexan® nose piece; stainless steel or plastic core catcher	50.8 cm x 5 cm x 243.8 cm x 5 cm	4.5 - 27.2	243.8 cm	5	The sampler is effective for firm or sandy sediments and can be used in fast-moving water up to 4.5 m (15 feet) deep with the use of an extension handle.
33 of 40	Kajak-Brinkhurst	Stainless steel	50.8 x 5 cm - 76.2 x 5 cm	5.9 - 21.8	70 cm	1.37 – 1.5	Designed to collect sediment samples from ocean floors and large deep lakes in most substrates.
34 of 40	Phleger	Stainless steel	50.8 x 3.6 cm	8 - 15	50 cm	0.48 – 0.65	Consists of a weighted hollow tube that is used to penetrate the bottom sediment layers so that the deposition of sediments can be studied.
9 or 40	Piston	Stainless steel frame and core tube; Lexan® or stainless steel nose piece; stainless steel or plastic core catcher	1.5 x 0.5 m – 2 x 0.5 m	11.3 - 1,174.8	3 – 20 m	5 - 40	The Piston provides pressure for greater sample retention and can collect sediment samples up to 20 m deep.
18 of 40	Vibracore	Stainless steel	102 cm - 5 cm - 1270 x 7.6 cm	45.4 - 136.1	3 – 13 m	1.35 – 37.7	Designed to collect sediment samples from lakes, bays, and estuaries; constructed of stainless steel and can be powered by a portable generator.

TABLE 3-2
GENERAL CHARACTERISTICS OF SELECT CORE SAMPLERS* (CONTINUED)

Database Record Number	Sampler	Sampler Construction Material	Sampler Dimensions	Sampler Weight (Kg)	Penetration Depth	Sample Volume (L)	Application
38 of 40	Boomerang	Stainless steel	203.2 x 29.8 x 8.1 cm	74.8	1 m	3.52	A free-falling sampler designed to collect sediment cores without the use of cable connections and can be dropped overboard from small or large boats without winch or deck equipment with minimal sediment disturbance.
36 of 40	Alpine	Stainless steel	182.9 x 41.1 cm	110 - 155	2 m	1.92 - 3	Sampler has interchangeable core barrels that allow for different penetration depths. Can collect samples in soft, fine-grained semi-consolidated sediments.

Notes:

*Adapted from USGS 1997.

Kg Kilogram

L Liter

O.D. Outside diameter

cm Centimeter

m Meters

Gravity core samplers are typically used in loosely consolidated, soft- to fine-grained sediments and can collect core samples up to 3 meters long (EPA 2001). Commonly used gravity samplers include the KC Sediment Trap, Slide-Hammer Corer, Kajak-Brinkhurst Corer, Phleger, Benthos, Alpine, Boomerang Corer, and Ballchek Corer. These samplers are usually deployed using a winch that suspends the sampler about 5 meters above the sediment to be sampled and allowed to free fall, penetrating the sediment and forcing the material into the sample liner. Some gravity core samplers, such as the Ballchek Corer, are equipped with stabilizing fins to provide balance and stability during corer descent.

Vibracorers are the most commonly used core samplers because they can retrieve deep core samples in most types of sediment. Vibracore samplers have an electrically powered vibrating head, which vibrates vertically along the axis of the sampler to penetrate the sediment. The core barrel and liner are inserted into the head of the vibrator and the entire assembly is lowered into the water. A vibracore sampler can penetrate compact sediments and collect core samples up to 10 meters long depending on the horsepower of the vibrating head and weight of the sampler. Larger vibracore samplers require the use of a large boat to maintain balance and provide adequate lift to break the head of the corer out of the sediment for sample retrieval (EPA 2001).

Box core samplers are designed to collect samples of mud, silt, and other soft sediments from lakes, riverine, and lagoon environments. Box core samplers consist of a box that is equipped with a frame to add stability during sampling penetration. Box core samplers come in various sizes and are typically constructed of stainless steel, aluminum, PVC, or fiberglass. Box core samplers are generally used for water/sediment interface studies or when large volumes of sediment need to be collected from the depth profile. Due to the size of box core samplers, most are deployed from a boat or other vessel that has a large deck or platform, using a winch or crane with a large lifting capacity (EPA 2001).

Piston-core samplers can collect samples from shallow streams to ocean floors and large lakes up to 20 meters deep. The piston-core sampler comes in a variety of designs and sizes that basically consist of a cylinder with a piston that is pushed into the streambed. As the cylinder is pushed into the sediment, the piston is retracted, which creates a suction holding the sediment sample in the cylinder. Piston-core samplers can be used in most sediment types and can recover relatively undisturbed sediment cores in deep waters (EPA 2001).

5.0 SUMMARY OF FINDINGS

A variety of samplers are available for sampling surficial sediments, and sampler selection should be based primarily on the data quality objectives established for the project. Other factors to consider may include, but are not limited to, accessibility of sampling area, weight of equipment, type of substrate, sample depth, sample volume, and potential for physical disturbances of substrate. Grab and core samplers are the preferred samplers for use during most surficial sediment sampling projects, however, dredge samplers are acceptable for collecting sediment samples for benthos analysis. Grab samplers are used when large volumes of sediment are required and where accuracy of surficial sediment sampling depths is not critical. Core samplers are recommended for use when accurate surficial sediment sampling depths are important, vertical profiles are needed to assess quality of sediment at depth, and it is important to maintain an oxygen-free environment.

In the consideration of water depth as a factor during sediment sampling, for circumstances where the water level is less than 4 meters and under low tide conditions, samplers that may be selected include the Birge-Ekman, Petite Ponar, Van Veen, or Petersen. If water depth is greater than 4 meters, samplers such as the Ponar or the Van Veen can be selected. In a limited sampling area it may not be possible to launch devices off of a boat, or the ability of a boat-launched sampler to reach subsurface may be limited, so it may be more appropriate to use a manually operated device, with diver assistance as required in collection of the sample.

Sediment properties must also be considered in the selection of a sampler. Soft sediments can be sampled with any of the variety of the clamshell bucket style of grab samplers. Compacted sediments, on the other hand, may require additional force to bear on the sediment bed for sample collection, such as that provided by the weight of a Smith-McIntyre sampler. The nature and properties of sediment should be considered during sample planning.

In the sampling of sediments to depths that are less than 10 centimeters, the Birge-Ekman, Ponar, and Shipek devices are able to provide appropriate sample collection. For sampling of sediment that is up to 30 centimeters in depth, the Smith-McIntyre, Van Veen, or Petersen devices might instead by considered for use since these samplers possess a wider bucket and heavier frame to collect the lower portion depth level.

The required volume of collected sediment is also an important factor in selection of sampling devices for a specific sampling objective. In collecting sediment sample volumes that are less than 3 liters, the mini Birge-Ekman, Petite Ponar, and mini-Shipek samplers can be used. If sample volume requirements are at least 3 liters and up to 10 liters in volume, the Birge-Ekman, Ponar, or Petersen samplers that possess larger buckets can be used. If more than 10 liters of sample is required, the Van Veen or Smith-McIntyre samplers should be considered for use as these types of samplers have the weight to bear into the sediment and a larger bucket to collect the sediment sample.

Of the variety of sediment samplers available for collecting surficial sediments, most of the innovative technological progress has been focused on the following: (1) construction materials that are more durable and compatible, and facilitate deployment; (2) accuracy and discreteness of sample depth; (3) sample volume; (4) ability to sample various types of substrate; and (5) ability to minimize physical disturbance and retain fines. Several vendors offer different options for currently available surficial sediment samplers. Extensive information is available about most of the surficial sediment samplers identified during this study, including sampler use, construction materials, effectiveness, size, penetration depth, sample volume, costs, and advantages and disadvantages of each sampler.

This study was conducted by EPA to determine if technologies are currently available that can or have the potential to collect undisturbed surface sediments. Grab samplers are designed to collect horizontal surface distribution of sediments. However, surface samples collected using this type of sampler are perturbed during the sampling process from the water column bow wave induced by descent of the sampling device. As a result of this perturbation, fine grain particulates in the surface sediment are washed out from the sample that is collected. Core samplers, while primarily focused on collection of vertical profiles, may be useful in collecting surficial sediment; however, in the sample collection process, disturbance will also occur from washout of fine grains caused by the water column bow wave induced by descent of the sampling device. Sediment being collected in the core will also be subjected to compression and consolidation.

The ability to collect and analyze an undisturbed sediment layer at the water-sediment interface that is 0.5 to 1.0 centimeters in thickness will provide better information for contaminated sediment impact on water column and biota risk assessment. To accomplish this sample collection requirement, it will be necessary to develop new or modified sampling technologies. The successful technology will be the one that eliminates or minimizes the deployment bow wave impact on the water column which results in washing out of fine grain sediments during grab sample collection. This will require development of grab sampling technology that is hydrodynamically designed or deployed to eliminate or minimize the effect. New technology must also be successful at eliminating consolidation and compaction that occurs in core sampling. This will require the development of a core sampling technology that eliminates or minimizes the impact of the core wall on the sediment that causes the compression. The new or modified sampler focused on these areas will provide a more accurate representative sample for evaluation which in turn will provide better information for risk assessment investigations.

6.0 REFERENCES

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APPENDIX
SURFACE SEDIMENT SAMPLER DATABASE
(40 Tabs)