STANDARD OPERATING PROCEDURE

4230.19A

Soil Sampling at Lead-Contaminated Residential Sites

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A. PURPOSE AND APPLICABILITY

The purpose of this Standard Operating Procedure (SOP) is to describe the procedures for the collection of representative surface soil samples at lead-contaminated residential sites as described in the Superfund Lead-Contaminated Residential Sites Handbook (Handbook, 2003). The sampling depths are specific to investigations for this type of site. Analysis of soil samples may determine whether concentrations of specific pollutants (e.g., lead, barium, cadmium, cobalt, copper, mercury, nickel and zinc) exceed established action levels, or if the concentrations of pollutants present a risk to public health, welfare, or the environment.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the actual procedures used should be documented and described in an appropriate site report.

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

B. SUMMARY OF METHOD

Soil samples may be collected using a variety of methods and equipment depending on the depth of the desired sample, the type of sample required (disturbed vs. undisturbed), and the soil type. Surface soils may be easily sampled using a spade, trowel, and scoop.

The major category of sites where sampling will be performed includes, but is not limited to active/former lead mining, milling and smelter sites, areas impacted by mining, milling, and smelter activities, mining depositories, transportation routes from mining, milling and smelter sites and the use of mining wastes in public and residential areas.

C. DEFINITIONS

Residential properties: As defined in the Handbook, residential properties are any areas with high accessibility to sensitive populations, and include properties containing single- and multi-family dwellings, apartment complexes, vacant lots in residential areas, schools, day-care centers, community centers, playgrounds, parks, green ways, and any other areas where children may be exposed to site-related contaminated media.

X-Ray Fluorescence (XRF) spectrometer: An instrument used to resolve radiation into spectra to determine measurements. Will be used to analyze soils for metals contamination as described in the Instruction Manual for the XRF spectrometer.

Integrated Exposure Uptake Biokinetic Model (IEUBK) – Predicts blood-lead concentrations (PbBs) for an individual child, or group of similarly exposed children (six months to seven 7 years old), who are exposed to lead in the environment.

D. HEALTH AND SAFETY WARNINGS

Proper health and safety procedures must be observed during the investigation at all times. The Occupational Safety and Health Administration (OSHA) regulation for Hazardous Waste Operations and Emergency Response (HAZWOPER), specified in 29 CFR 1910.120(b)(4), requires a site-specific Health and Safety Plan (HASP) for each site where workers are engaged in handling/operations involving hazardous waste. In compliance with this regulation, all responding Region 7 personnel and their designated representatives are covered by a site-specific HASP developed to address the health and safety hazards, physical and chemical, which may be encountered at each site. The HASP also identifies procedures for protecting employees while on the site.

E. CAUTIONS

This section is not applicable to this SOP.

F. INTERFERENCES

This section is not applicable to this SOP.

G. PERSONNEL QUALIFICATIONS

All field personnel are required to take the 40-hour health and safety training course (as per 29 CFR 1910.120(b)(4)) and regular refresher courses prior to engaging in any field data collection activities.

H. EQUIPMENT AND SUPPLIES

Equipment and supplies used in the field to perform surface soil sampling may include but are not limited to:

- Maps/plot plan
- Safety equipment, as specified in the site-specific Health and Safety Plan
- Survey equipment or global positioning system (GPS) to locate sampling points
- Tape measure
- Survey stakes or flags
- Camera and film
- Stainless steel, plastic, or other appropriate homogenization bucket, bowl or pan
- Appropriate size sample containers
- Ziplock plastic bags
- Logbook
- Labels
- Chain of Custody records and custody seals

- Field data sheets and sample labels
- Decontamination supplies/equipment
- Canvas or plastic sheet
- Spade or shovel
- Spatula
- Scoop
- Plastic or stainless steel spoons
- Trowel(s)
- Continuous flight (screw) auger
- Bucket auger
- Post hole auger
- Extension rods
- T-handle
- Sampling trier
- Thin wall tube sampler
- Split spoons
- Vehimeyer soil sampler outfit
  - Tubes
  - Points
  - Drive head
  - Drop hammer
  - Puller jack and grip
- Shaker sieve #10
- Shaker sieve (initially 250 micron #60 for risk assessment)
- X-Ray Fluorescence (XRF) spectrometer

I. PROCEDURAL STEPS

Soil screening activities will be conducted in accordance with the guidelines established in the Handbook.

1. PREPARATION

- Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies required.
- Obtain necessary sampling and monitoring equipment.
- Decontaminate or pre-clean equipment, and ensure that it is in working order.
- Prepare schedules and coordinate with staff, client, and regulatory agencies, if appropriate.
- Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.
- Use stakes, flagging, or buoys to identify and mark all sampling locations.

Specific site factors, including extent and nature of contaminant, should be considered when selecting sample location.

2. SAMPLING STRATEGY

The Handbook provides the sampling strategy when sampling residential properties. The sampling strategy is specific to the following categories:

- Residential yards;
- Drip zones;
- Play areas, gardens, and driveways;
- Potable water, lead-based paint, and interior dust; and
- Backfill and waste soil.

Soil sampling will be conducted in accordance with the guidelines established in the Handbook.

3. SAMPLING METHOD

3.1 Sample Collection

The Handbook describes the sampling depth when sampling residential properties. The following has been taken from this document.

Composite samples should consist of discrete aliquots of equal amounts of soil. The soil from each aliquot should be collected into one clean container, such as a stainless steel bowl or plastic bag, and thoroughly mixed. After mixing, the sample can then be analyzed by XRF spectrometer or sent to the laboratory. Remaining sample volume can then be disposed in the general location from where it was collected, or archived, depending on the requirements of the project. In some, cases material other than grass and/or soil will be encountered at a sample location, e.g., wood chips and sand are often found in recreation areas of day-care and school playgrounds. Samples of the soil below the cover material should be collected.

Collection of samples from near-surface soil can be accomplished with tools such as spades, shovels, trowels, spoons, and scoops. Surface material is removed to the required depth and a stainless steel or plastic scoop is then used to collect the sample.

This method can be used in most soil types but is limited to sampling at or near the ground surface. Accurate, representative samples can be collected with this procedure depending on the care and precision demonstrated by the sample team member. A flat, pointed mason trowel to cut a block of the desired soil is helpful when undisturbed samples are required. Tools plated with chrome or

other materials should not be used. Plating is particularly common with garden implements such as potting trowels.

3.2 Sample Depth

The Handbook describes the sampling depth when sampling residential properties. Collection of samples from specified depth intervals serves two primary purposes: risk assessment and remedial decision-making. The following has been taken from this document.

3.2.1 Surface Soil Sampling For Risk Assessment Decision Making

With respect to risk assessment, the top inch of soil best represents current exposure to contaminants and is the source of data typically used in the IEUBK model to represent exposure from soil. This sampling should be done at all properties and will be used to determine whether a property exceeds the cleanup criteria and qualifies for response actions.

A five-point composite surface soil samples should be collected from any portion within the 0- to 1-inch depth interval for human health risk assessment purposes. The samples should be collected using the procedure described in Section 3.1. If a measuring device is not used to determine the 1-inch depth, then the spoon or sampling device should sample the upper portion of the 0- to 1-inch interval to avoid going below the 1-inch depth.

3.2.2 Soil Sampling for Cleanup Decisions

The sampling design discussed below is based on the assumption that a minimum of 12-inch soil cover is adequate.

Initial sampling for lead contamination in residential soils should also be conducted to a depth of at least 18 inches, but does not need to exceed 24 inches to define the vertical extent of contamination for cleanup purposes. Composite samples should be collected at 6 inch depth intervals, i.e., 0-6 inches, 6-12 inches, 12-18 inches, and 18-24 inches. Additional sampling may be required at lead sites when contamination is associated with coarse-grained material. Stone-sized material, such as tailings and crushed battery casings, will, over time, migrate upward through the soil via freeze/thaw effects. At such sites, composite sampling should be conducted at 6-inch intervals to the approximate maximum frost depth. In all cases, composites should consist of aliquots collected from the same depth interval.

In site-specific situations, deeper sampling may be conducted to determine the total vertical extent of contamination for groundwater issues or institutional controls (ICs), and to determine if complete removal of contaminated soil is possible. Depth sampling should be conducted until the vertical extent of contamination has been adequately defined, but does not need to be conducted on every property.

3.3 Sample Preparation

The Handbook describes the sampling preparation when sampling residential properties. The following has been taken from this document.

Composite samples should consist of discrete aliquots of equal amounts of soil. The soil from each aliquot should be collected into one clean container, such as a stainless steel bowl or plastic bag, and thoroughly mixed.

Samples collected from all depth intervals should be dried, sieved with a No. 10 sieve (2 mm), and homogenized. Samples should not be ground prior to sieving, as this changes the physical structure of the soil and may bias the analytical results.

For those soil samples that are collected for risk assessment purposes, the sample will also be processed through a No. 60 sieve (250 μm) to obtain the fine fraction. The EPA Technical Review Workgroup (TRW) and American Society for Testing and Materials (ASTM) have issued guidance on sieving (ASTM, 1998; EPA, 2000). To reduce sampling costs, it may be desirable to develop a correlation between sieved and unsieved data, to eliminate the need to sieve all samples. The correlation can be used to predict sieved results from unsieved samples. The EPA TRW guidance addresses appropriate sieve size (No. 60) and a method for predicting the concentration in the fine fraction using concentrations measured in unsieved samples. A portion of each homogenized sample from each sampling area will be screened for lead using XRF spectrometer or submitted for laboratory analysis.

3.4 Sample Analysis

The Handbook describes the sampling analysis when sampling residential properties. The 4220.03A SOP should also be consulted for decision making for using the XRF spectrometer.

J. DATA AND RECORDS MANAGEMENT

Documentation of environmental data collection and analysis procedures (i.e. laboratory documentation, field logbook, photo documentation, chain-of-custody) should be completed and managed using the requirements specified in the Generic Quality Assurance Project Plan for Region 7's Superfund Lead-Contaminated Sites.

K. QUALITY ASSURANCE AND QUALITY CONTROL

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

1. All data must be documented on field data sheets or within site logbooks.

2. The XRF spectrometer is not calibrated. Accuracy checks are performed using certified prepared standards daily. Record these accuracy checks in the field logbook. The following information is recorded.

- Equipment identification (name) and control number.
- Date of accuracy check.
- Activity performed on instrument.
- Adjustments made and accuracy of equipment before and following accuracy check (where applicable).
- Record of equipment failure.
- Identification of person performing accuracy.

L. REFERENCES

American Society for Testing and Materials (ASTM). 1998. *Standard Test Method for Particle-Size Analysis of Soils*. D 422-63.

U.S. Environmental Protection Agency (EPA). 2000. *Short Sheet: TRW Recommendations for Sampling and Analysis of Soil at Lead (Pb) Sites*. April. OSWER Publication 9285.7-38. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. EPA Publication EPA/540-F-00-010.

U.S. Environmental Protection Agency (EPA). 2003. *Superfund Lead-Contaminated Residential Sites Handbook.* OSWER 9285.7-50. August. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response.

U.S. Department of Housing and Urban Development (HUD). 1995. *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*. June.

U.S. Environmental Protection Agency (EPA). Region 7. 2007. *Generic Quality Assurance Project Plan for Region 7's Superfund Lead-Contaminated Sites.* July.