

2. Characterization: Sampling and Testing Approaches for PCBs

Brochure Series

Guiding States and Brownfield Projects through the PCB Rules under TSCA: Navigating the TSCA process is complex and represents a challenge for many Brownfield remediation and redevelopment projects which can stretch limited funds. This brochure series focuses on the topics most relevant to the states and their Brownfield stakeholders:

1. Working with the Federal and State PCB Regulations on Brownfield Sites: When and What Federal Involvement is Required;
2. Characterization: Sampling and Testing Approaches for PCBs;
3. Cleanup and Management of PCBs;
4. PCBs in Building Materials; and
5. PCB Articles, Containers and Liquids.

This brochure is the second of five in a guidance series to help applicants work through sampling of polychlorinated biphenyl (PCB) remediation waste at Brownfields projects. The Toxic Substances Control Act (TSCA) and the federal PCB regulations under 40 (CFR) Part 761 govern the manufacture, use, distribution in commerce, storage, and disposal of PCBs.

This brochure focuses on characterization and verification of PCB remediation waste subject to TSCA. Remediation waste is defined in Brochure 1. There are three options for the type of cleanup performed: self-implementing, risk based, and performance based. See Brochure 3 of these series for more information. The majority of the information in this brochure pertains to the self-implementing option.

Sampling requirements specified under the self implementing cleanup and disposal option should be considered as a starting point when designing sampling programs under the risk or performance-based disposal option. The self implementing option is very prescriptive and can be very costly to implement at large sites. The risk based option can provide more flexibility and may lead to significant project cost savings.

- Characterization sampling assesses the nature and extent of PCB impacted materials and is described in Subpart N (40 CFR 761.260.)
- Verification sampling of PCBs is performed after remediation to assess achievement of remediation goals.

State regulations may affect characterization and remediation objectives and should always be considered when developing a sampling plan. Brochure 5 provides state-specific information.

PCB remediation waste characterization sampling must be based on as-found conditions (i.e., in place before any disturbance) rather than collected from stockpiles or roll-off containers generated during excavation or demolition activities.

There are four classes of **PCB remediation waste**, discussed in the table below, that are sampled and tested differently during characterization and verification: bulk remediation waste, porous materials, non-porous materials, and liquid remediation waste.

Sampling Requirements by PCB Remediation Classification Type

PCB Remediation Waste Classification	Examples	Characterization Regulatory Reference	Verification Regulatory Reference
Bulk Remediation Waste	Existing piles of soil, in-situ soil, sediments, sludge	40 CFR 761.61(a)(2) and (a)((5)(i)(B)(2)(i); and, 40 CFR 761.265	40 CFR 761.61(a)(6) and Subpart O (40 CFR 761.280).
Porous surfaces	Unpainted or painted structural surfaces made of concrete, brick, wood, plaster, plasterboard		
Non-porous surfaces	Smooth unpainted solid surfaces that limit penetration of liquid containing PCBs beyond the immediate surface (e.g. smooth un-corroded metal, smooth glass, high-density plastics, impermeable building stone such as marble or granite).	40 CFR 761.267	40 CFR 761.61 (a)(6) and Subpart P (40 CFR 761.300).
Liquid PCB waste	Homogenous flowable material containing PCBs and no more than 0.5 percent by weight non-dissolved material (e.g. hydraulic oil and dielectric fluid).	40 CFR 269 40 CFR 761.61(a)(6) and 40 CFR 761.269	

Characterization of Remediation Waste

A Conceptual Site Model (CSM) is the initial step in developing a sampling plan for characterization. This model should identify all possible sources of PCBs, their release mechanisms, and classes of remediation waste potentially impacted. Sample location, sample depth, collection method, and sampling density will be based on this information.

EPA established sampling procedures for site characterization which are found in 40 CFR 761, Subpart N.

Bulk **remediation waste** and porous surfaces (40 CFR 761.265)

- In-situ soils and porous materials should be sampled on a horizontal grid interval of 3 meters (10 feet).
- Unlike horizontal sampling, vertical sampling of a surficial release is not as prescriptive. It is an iterative sampling process until the uppermost clean interval from surface can be demonstrated. Multiple samples may need to be collected at the intervals you select, based on the results of the prior sampled interval, until the first clean interval is reached. Alternatively, to minimize sampling and analytical costs, you could analyze only the sample from the shallow and deep intervals. If the deep interval is clean, assume the soil is contaminated from the surface to the depth of the deeper sample analyzed. If the deep interval is not clean, additional sampling is required.
- Collect a minimum of three samples for each type of remediation waste or porous surface even if waste is present at the site in a small amount. There is no upper limit to the number of samples to be collected.
- If PCB impacted soils are in contact with groundwater, then a groundwater sample should be collected and analyzed for PCBs.
- Bulk-remediation soils found in containers (e.g. drums or roll-off containers) should be characterized using one core sample per container if three or less containers are on site. For more than three containers, 10 percent of all containers, or three samples, whichever is larger should be sampled. This applies to bulk **remediation waste** containerized before you begin working at the site and therefore has unknown origin, since bulk **remediation waste** should always be sampled in place.

Non-Porous surfaces (40 CFR 761.267)

- Sample large, nearly flat, non-porous surfaces by dividing the surface into rough square portions approximately 2 meters on each side.
- Standard wipe tests as defined in 40 CFR 761.123 should be performed.
- It is not necessary to sample small or irregularly shaped surfaces.

Liquid **remediation waste** (40 CFR 761.269)

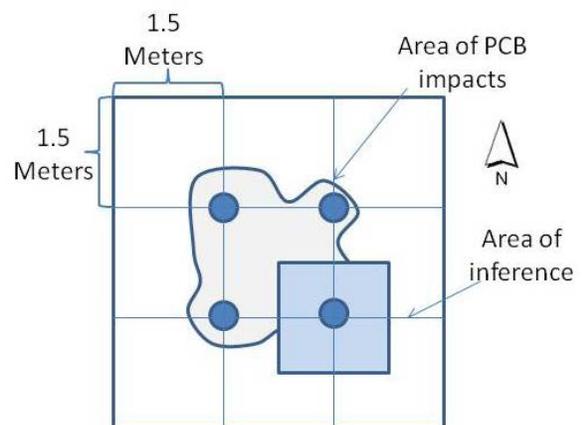
- Collect one sample for each phase of the liquid; only one sample is required for a single phase liquid. There are no specified procedures for collecting a sample under 40 CFR 761.269; however, adherence to acceptable sampling procedures is recommended.
- If a liquid contains a non-liquid phase (greater than 0.5 percent by total weight) the non-liquid waste should be separated and sampled as a bulk **remediation waste** (e.g. sludge).

Verification of Cleanup

Bulk **remediation waste** and porous surfaces (Subpart O)

- Collect a minimum of 3 samples per each type of **remediation waste**.
- Use a square-based grid system to overlie the entire area to be sampled. Orient the grid axes north to south. Mark out a series of sampling points 1.5 meters (5 feet) apart. The area of inference provides the area characterized by each sample result (see Figure 1).
- Compositing of soil samples is a method of combining several samples of a specific type of bulk PCB waste or porous material for a single chemical analysis. It is better to composite the samples in the laboratory. Individual samples should be saved for potential analysis.
- There are two procedures:
 - o Compositing of samples for sites with multiple point sources of contamination (40CFR 761.289(b)(1)(i)).
 - o Compositing of samples for sites with a single point source of contamination (40CFR 761.289(b)(1)(ii)).

Figure 1: Verification Sampling Example



Non-Porous surfaces (Subpart P)

- For large nearly flat surfaces, divide the entire surface into a grid composed of uniquely identified 1 meter square portions.
 - 3 square meters or less, sample entire area.
 - More than 3 square meters, sample 10% (10 cm by 10 cm) of each 1 meter square portion.

PCB Remediation Waste Classification	Sampling Method	Reporting Units
Bulk Remediation Waste	Core samples in accordance with 40 CFR 761.286. Compositing of samples (in laboratory) is allowed in accordance with 40 CFR 761.289.	Dry weight basis as micrograms of PCBs per gram of sample (ppm by weight).
Porous surfaces	EPA Region 1 has a Standard Operating Procedure for Sampling Porous Surfaces in the Field.	
Non-porous surfaces	Wipe sample specified in 40 CFR 761.123.	Report as $\mu\text{g}/100\text{ cm}^2$. Divide 100 cm^2 by the surface area and multiply this quotient by the total number of micrograms of PCBs on the surface.
Liquid PCB waste	No sampling method specified	Wet weight basis as micrograms of PCBs per gram of sample (ppm by weight) or micrograms of PCBs per liter of sample.

- If the grid is uniform in shape, sample the same 10 cm by 10 cm position within each cell (see 40 CFR 761.306 or 40 CFR 761.308).
- If the grid is irregular in shape, randomly select the 10 cm by 10 cm sampling position for each different 1 square meter surface (see 40 CFR 761.308).
- If non-porous surfaces have been cleaned and the cleaned surfaces do not meet the applicable standards or levels, surfaces may be re-cleaned and re-sampled. When re-sampling surfaces previously sampled to verify cleanup levels, use the sampling procedures in 40 CFR 761.306 through 761.316 to re-sample the surfaces.
- For a surface originally contaminated by a single source of PCBs with a uniform concentration, it is permissible to composite surface wipe tests. Compositing of surfaces to be used or reused are regulated under 40 CFR 761.312(a).

Liquid remediation waste

- If the liquid is single phase, collect and analyze one sample.
- If the liquid is multi phases, separate the phases, and collect and analyze a sample from each liquid phase (see 40 CFR 761.269).

Analytical Methods

- The extraction method should be the Soxhlet Method 3500B/3540C or a method validated under Subpart Q (40 CFR 761.320). Other methods such as microwave extraction have demonstrated good results but must be validated on a site- and matrix-specific basis. Validation can be costly and time consuming. Sonication, although referenced in the regulations, is an inferior extraction method and should not be performed.
- Analysis for PCB Aroclors should be performed as Method 8082 from SW-846, or a method validated under Subpart Q (40 CFR 761.320). An alternative method, such as EPA Method 680 or Method 1668 may be necessary for PCB homologues or congeners. PCB homologues and congeners offer a more detailed analysis of PCB chemical structure. Homologues and congeners are especially helpful in characterizing weathered or aged PCB releases.
- All sampling should include quality control samples including field duplicates, equipment blanks, laboratory duplicates, and matrix spike/matrix spike duplicates. These samples should be collected at a frequency of 1 sample per 20 samples collected.

- Extraction holding times must be considered and should be kept below 14 days if possible. Samples can be frozen to extend the holding time.
- The use of field screening data is limited. The data can assist with field decisions but cannot be used to meet the characterization and verification sampling requirements in these regulations. The accuracy and precision of any field screening should be demonstrated through laboratory data and field instrument calibration. Field screening can assess, on a preliminary basis, if PCB removal is complete or to fill in data for a risk-based approved sampling grid. Laboratory data must be used to provide final documentation that a PCB cleanup and disposal has been completed.
- All analytical data must be retained by the responsible party for a minimum of 3 years.

References

EPA Website: <http://www.epa.gov/epawaste/hazard/tsd/pcbs/index.htm>.

The following documents are available at the EPA website:

- *Code of Federal Regulations Part 761*
- *The Polychlorinated Biphenyl (PCB) Site Revitalization Guidance, November 2005.*
- *PCB Questions and Answers Manual, Updated January 2009.*
- *EPA Region 1 - Standard Operating Procedures for Sampling Porous Surfaces for Polychlorinated Biphenyls (PCBs), Revision 4, May 5, 2011.*
- Sampling Guidance for 40 CFR 761 Subparts M, O, P, and R

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This guidance document addresses cleanup and disposal requirements for Polychlorinated Biphenyls (PCBs) only. This guidance document does not replace or supplant the requirements of the Toxic Substances Control Act (TSCA) PCB regulations. Please refer to the PCB regulations at 40 CFR Part 761 for specific regulatory and legal requirements.

EPA Region 1 Contact Information

Kim Tisa (Regional PCB Coordinator)
phone: 617-918-1527

Marianne Milete (Enforcement)
phone: 617-918-1854

TSCA Hotline - 202-554-1404 or e-mail
tsca-hotline@epamail.epa.gov

For **State Contact Information**,
please see Brochure #5 - **PCB Articles, Containers and Liquids**

