

San Francisco Bay PCBs TMDL – What to do when PCBs are present in soil



This fact sheet's purpose is to clarify expectations for managing soil on property where polychlorinated biphenyls (PCBs) have been detected. PCBs in building materials are also addressed.

BACKGROUND

PCBs are classified as probable human carcinogens ([USEPA Integrated Risk Information System](#)), and they bioaccumulate in food chains due to their stability and ability to dissolve in fats (ATSDR 2000¹). Bioaccumulated PCBs are a concern when fish are ingested by humans. Due to high levels of PCBs in San Francisco Bay fish, State health officials advised the public to limit consumption of Bay fish in 1994, and a PCB-related fish consumption advisory was reissued in 2011. The San Francisco Bay Regional Water Quality Control Board (Water Board) in 2008 adopted a Total Maximum Daily Load (TMDL) with implementation actions to reduce PCBs loads to the Bay.

The TMDL established an initial 20-year timeframe for reducing PCBs in fish tissue to safe levels for human consumption. An estimated ten-fold reduction in San Francisco Bay sediment PCBs concentrations is needed to reach the goal of an average concentration of 1 microgram/kilogram (µg/kg; parts per billion).

Even though much of the PCBs pollution affecting the Bay is the result of releases that occurred decades ago, low-concentration sources continue to transmit PCBs to the Bay via stormwater runoff.

Municipalities, who are responsible for stormwater quality, will spend millions of dollars to achieve the ten-fold reduction in PCBs required by the TMDL. These municipalities are finding PCBs in roads and gutters that can be traced back to "closed" cleanup sites that did not use reasonably rigorous analytical methods and/or remedial actions. Going forward, it is important that PCB-containing sites be remediated such that PCBs, even at low concentrations, are not available for off-site transport. The four steps described in the box below will help ensure this goal is achieved.

1. Low-concentration sources of PCBs must be detected

PCB analytical methods, particularly in post-remediation surface soils, must achieve detection limits for total PCBs in the low parts per billion (ppb) range. See page 3 for recommended analytical methods.

2. PCBs remaining at cleanup sites must not be available for off-site transport

Regardless of the site cleanup level, if any PCBs remain in surface soils at the site, these soils must be managed so that PCBs are not subject to off-site transport. Also, best stormwater management practices must be diligently followed to prevent PCB transport during remediation activities.

3. PCBs that have migrated to streets and storm drains must be included in cleanup

Where off-site transport of PCBs may have occurred, the remediation plan should include sampling of street sediments and storm drain elements and removal of off-site sediments containing PCBs in the low ppb range. Communication with City Public Works Departments is encouraged, because they may wish to conduct street sweeping during or after remediation activities.

4. PCBs may be present in building materials

Structures built between 1950 and 1980 may have PCBs in caulking and other building materials. Methods for investigating and controlling PCBs in building materials are outlined below.

¹ Agency for Toxic Substances and Disease Registry (ASTDR), 2000. Toxicological Profile for Polychlorinated Biphenyls (PCBs). U.S. Depart. Of Health and Human Services, Public

Health Service. Nov. 2000. Available at <http://www.atsdr.cdc.gov/toxprofiles/tp17.pdf>.

ACHIEVING THE PCB ALLOCATION AT CLEANUP & SPILL SITES

For cleanup sites², the TMDL calls for implementing “on-land source control measures, to ensure that on-land sources of PCBs do not further contaminate in-Bay sediments.” However, PCBs cleanup goals are often based on a different route of human exposure than seafood ingestion and there are implications for screening criteria, cleanup goals, and laboratory detection limits. For example, the Water Board’s February 2016, ESLs³ include a PCBs screening level for soil direct contact in a residential scenario that is 0.25 mg/kg, or 250 µg/kg, based on the protection of human health via direct exposure to PCB-contaminated soil through incidental ingestion, inhalation of particulates, or dermal contact. For non-residential scenarios, PCBs cleanup goals are close to or exceed 1,000 µg/kg in soil.

Because cleanup goals are based on protection of human health from direct contact with on-site PCBs, remediated sites can contain residual PCBs in surface soils. This is true of voluntary cleanup sites, State- and federal-ordered cleanup sites, and spill sites. To prevent such sites from contributing to PCBs concentrations in urban runoff and the Bay, the following additional steps are necessary:

Regardless of the cleanup goal, cleanup sites should not allow PCBs, at any concentration, to remain available for transport to surface water runoff. The remedial action goal should be to minimize, if not eliminate, the post-remediation off-site movement of residual, low concentration PCBs.

Where PCBs-containing soils may have migrated off-site, remedial actions should include sampling of street sediments and storm drain elements. Soil or storm drain sediment found to contain PCBs in the low parts per billion range must be removed and properly disposed of.

Conduct remedial actions so as to eliminate all means of off-site conveyance of PCBs during cleanup, including sediment runoff, vehicular drag out, and airborne dust. Best Management Practices (BMPs) for controlling sediment during site grading and other activities are described in Chapter 4 of US EPA’s [Developing Your Stormwater Pollution Prevention Plan, A Guide for Construction Sites](#). Communication with City Public Works Departments is encouraged, because they may wish to conduct street sweeping during or after remediation activities.

PCBS IN BUILDING MATERIALS

Structures built between 1950 and 1980 may have PCBs in caulking and other building materials. Bay Area municipalities are developing programs for requiring such structures be sampled and PCBs-containing materials removed or controlled during building demolition. The following methods are recommended for sampling and analyzing caulk and sealants suspected of containing PCBs: Remove a one inch strip (or ~10 g) of the sealant sample from the structure using a utility knife with a solvent-rinsed, stainless-steel blade. Place the sample in a glass jar provided by the analytical laboratory. Collect at least one sample per sealant type to fully characterize the PCB content in the structure’s sealants. PCBs can be present in the percentage range in caulk, so a high resolution method is not necessary. US EPA Method 3500/3540C for chemical extraction and Method 8082 for analysis are appropriate.

BMPs for controlling PCBs during removal from structures can be found at US EPA’s [PCBs in Building Materials](#) web site. Further information on PCB-containing caulks and sealants can be found at <http://www.sfestuary.org/taking-action-for-clean-water-pcbs-in-caulk-project/>.

² This may include sites of previously unreported spills as well as previously documented or closed sites with residual PCBs.

³ The Water Board has developed [Environmental Screening Levels](#) (ESLs) to help expedite the identification and evaluation of potential environmental concerns at contaminated sites.

PCBs ANALYTICAL METHODS

Soil samples should be passed through a 2 mm sieve so that larger particles are removed from the sample. Analytical methods for PCBs in soils should be able to detect total PCBs in the low parts per billion range, or approximately 10 micrograms per kilogram ($\mu\text{g/kg}$) dry weight for soil. The analytical method should provide a high likelihood that all PCB congeners present in the sample will be detected. Analysis of PCB mixtures (i.e., Aroclors) is not recommended due to the likelihood that they have weathered over time. Recommended analytical methods to attain these two goals are as follows:

- **EPA Method 1668A or 1668C** - high-resolution gas chromatography with high-resolution mass spectrometry (GC/HRMS). Results are reported for all 209 congeners in $\mu\text{g/kg}$ dry weight with detection limits as low as 0.001 $\mu\text{g/kg}$ per congener. Approximate cost is \$725-900/sample.⁴ An alternative is to use the same method, but report results for the 40 PCB congeners monitored by the SF Bay Regional Monitoring Program (RMP 40).⁵ This alternative may cost 15% less than full congener analysis.⁴
- **EPA Method 8082A** – low-resolution gas chromatography with electron capture detector (GC/ECD). Formerly used to analyze for Aroclors, some labs have modified Method 8082A to detect individual congeners with reporting limits as low as 0.5 $\mu\text{g/kg}$ per congener. Approximate cost is \$300 per sample for the RMP 40.⁴ Method 8082A is appropriate for screening-level applications but results could be compromised if proper sample extraction techniques are not followed. If your lab is unfamiliar with this modification of Method 8082A, it is more appropriate to use Method 1668.

AT A GLANCE - Select PCB Thresholds and Reporting Level	$\mu\text{g/kg}$
SF Bay sediment goal in PCBs TMDL	1
Water Board Region 2 Environmental Screening Level for residential land use (direct human contact with soil)	250
Water Board Region 2 Environmental Screening Level for nonresidential land use	1,000
Recommended soil sample target analytical method reporting level for cleanup & spill sites	≈ 10

- Note that cleanups conducted under the authority of the Toxic Substances Control Act (TSCA) have their own PCBs analysis requirements. For further information contact the US EPA, Region 9, TSCA staff or see <http://www.epa.gov/Region9/pcbs/>. In the San Francisco Bay region, TSCA cleanups should be conducted such that PCBs, at any concentration, are not available for off-site transport as described in this fact sheet.

PCBs Analytical Reporting Terminology
Congener – One of 209 possible configurations of the number and position of chlorines on the two phenyl rings.
Homolog – Set of congeners having the same number of chlorines / molecular weight.
Aroclor - Trade name of the commercial PCB mixtures manufactured by the Monsanto Chemical Company and sold in the United States. An Aroclor PCB mixture might consist of over 100 different individual PCB congeners, although 10-20 congeners might make up over 50% of the mixture.

⁴ Axys Analytical, ALS Analytical, Frontier Analytical. Personal conversations. Sept. 2016.

⁵ The SF Bay Regional Monitoring Program congeners include PCBs 8, 18, 28, 31, 33, 44, 49, 52, 56, 60, 66, 70, 74, 87, 95, 97, 99, 101, 105, 110, 118, 128, 132, 138, 141, 149, 151, 153, 156, 158, 170, 174, 177, 180, 183, 187, 194, 195, 201, and 203.