San Francisco Bay PCBs TMDL – Implementation at Cleanup & Spill Sites

This fact sheet's purpose is to clarify expectations when remediating polychlorinated biphenyls (PCBs) contaminated sites in the San Francisco Bay region.

BACKGROUND

PCBs are classified as probable human carcinogens (USEPA Integrated Risk Information System), and they bioaccumulate in food chains due to their stability and lipophilicity (ATSDR 2000[1]). 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. To achieve this, 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).

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 (right) 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 part-per-billion range. *See pages 3-4 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 construction 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 parts per billion 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 sites, 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, ESLs[2] 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 sites from contributing to PCBs concentrations in urban runoff and the Bay, the following 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. 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. EPA Method 8270 (semi-volatile organic compounds by gas chromatography-mass spectrometry) is appropriate. Report analytical results as the total of 209 PCB congeners, or the shorter list of 40 congeners (see PCBs Analytical Methods, page 3).

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] 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

To be sure that low concentrations of PCBs are detected at cleanup sites in the San Francisco Bay area, 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 (µg/kg) dry weight for soil. In addition, the PCBs analytical method should provide a high likelihood that all PCBs present in the sample will be detected. Recommended analytical methods to attain these two goals are as follows:

- EPA Method 1668A or 1668C, which combine high-resolution gas chromatography with high-resolution mass spectrometry (HRGC/HRMS). Results are reported for all 209 congeners in µg/kg dry weight. Approximate cost for this analysis is $800-900/sample.[2] An alternative is to use the same method, but report results for the 40 PCB congeners monitored by the SF Bay Regional Monitoring Program: PCBs 8, 18, 28, 31, 33, 44, 49, 52, 56, 60, 66, 70, 74, 87, 95, 97, 99, 101, l05, 110, 118, 128, 132, 138, 141, 149, l51, 153, 156, 158, 170, 174, 177, 180, 183, 187, 194, 195, 201, 203. This alternative may cost 15% less than full congener analysis.[2]
- EPA Method 8270D (semivolatiles in soils/waste) gas chromatography/low resolution mass spectrometry (GC/LRMS) modified by EPA Method 1625. Method 1625 is the application of isotope dilution/recovery correction to GC/MS methodology. GC/LRMS is lower resolution and less rigorous than PCB congener analysis. PCB homolog analysis is intermediary between high resolution and Aroclor methods, reporting the total concentration of homolog groups. Total PCBs are determined by summing the individual congener results. Results can be reported as either, or both, congeners or Aroclors. Approximate cost for this analysis is $375/sample.[3]

AT A GLANCE - Select PCB Thresholds and Reporting Level	**µg/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. Contact the U.S. Environmental Protection Agency, Region 9, TSCA staff or see http://www.epa.gov/Region9/pcbs/ for further information. 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.

[3] Axys Analytical, personal conversation. May 1, 2012.

Other analytical methods, such as Method 8082A, generally do not identify and quantify all the PCB congeners that may be present, which can result in inadequate cleanups.

EPA Method 8082A – GC/ECD (gas chromatography/electron capture detector) is a low resolution PCB method that reports a concentration for each Aroclor. Each Aroclor consists of a number of PCB congeners. Between 5-8 Aroclors are typically reported in an 8082A method, depending on the lab method used. Some high production Aroclor mixtures, such as 1270 (almost 100% congener 209), are rarely included in the method. In addition, PCBs in the environment undergo volatilization, partitioning, chemical transformation, photo-degradation, and biodegradation over time. These changes confound the matching of an environmental sample to an Aroclor pattern. **As a result, other analytical methods often do not measure the total PCBs present in an environmental sample, and we do not recommend relying solely on such methods at this time.**