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Clean Estuary Project

PCB TMDL Implementation Plan Development

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The purpose of this report is to assist with development of the implementation plan for the PCBs TMDL. This report is general in nature, written at a level suitable to support a policy discussion. It is not intended to provide legal or regulatory advice to municipalities or others intending to pursue specific actions to address PCBs. Anyone intending to pursue legal or regulatory strategies to address PCBs at a specific site should consult with the appropriate regulatory agencies and their own legal counsel to ensure that they comply with all applicable regulatory requirements and that their work ensures protection of human and environmental health.

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Executive Summary

The PCB TMDL has identified in-Bay hotspots and urban runoff as sources of concern. To address and reduce PCB loadings from these sources within their jurisdictions, the responsible entities will have to determine which control strategies are feasible and make decisions on which control strategies to pursue. In making these decisions, costs will have to be balanced with achieving environmental benefits. The role of various agencies in implementing control strategies will also have to be determined within the context of the current regulations at the local, state and federal level. The implementation plan will address how these decisions will be made and describes the regulatory agencies responsible for various types of contaminated sites. This report evaluated the steps that would be included in an implementation plan and the options available to municipalities to implement PCB reduction efforts.

Monitoring of sediments in San Francisco Bay, along the Bay margins, in tributaries and stormwater facilities has revealed PCBs at levels above ambient in-bay PCB concentrations throughout the Bay area. In general, elevated levels of PCBs have been associated with urban land uses. However, PCBs concentrations in sediments vary widely even within the subset of samples representing urban land uses. Stormwater runoff has been identified as a conveyance of PCBs and, therefore, approaches for municipalities to meet reduction goals are needed. The first steps in the approach will be to identify sources and conveyances within the municipality's service area and prioritize those sources and conveyances as necessary. These steps are described in Sections 2 and 3 of this report. The next step of the approach will depend on the source or conveyance to be addressed and will combine control options and management options discussed in Sections 4 and 5 of this report. In addition to the information presented in this report, approaches to identifying, prioritizing and abating PCB Sources are being developed through two ongoing Proposition 13-funded projects (i.e., the Ettie Street Pump Station watershed project described in Section 2.2, and SFEI's Regional Stormwater Monitoring and Urban BMP Evaluation). Information obtained from these projects should assist with some of the technical aspects of implementing the PCB TMDL. Management options that may be used for accumulated sediments, on-land spill sites, and unenclosed sources are discussed below.

Accumulated sediments can be addressed through approaches including increased maintenance or upstream source identification as described for the Ettie Street Pump Station watershed project. Increased maintenance is within the direct control of the municipality and may be straightforward to implement because there may already be an established program with staff and resources that may only need to be augmented. An upstream source identification is a more costly route and may require municipalities to obtain grants or enter into partnerships as described in the section on management options. Other options municipalities may implement to address accumulated sediments, depending on available resources, include reconstructing industrial area streets, removing or capping PCB-contaminated roadside soils, creating sweepable pavement surfaces, and constructing facilities to treat street runoff.

Options to municipalities for addressing on-land spill sites will, in many cases revolve around working with other agencies to initiate or facilitate a cleanup through one of the programs available through Cal EPA. Depending on the site, these options can be addressed as follows:

> <u>For a contaminated site that is a candidate for redevelopment</u> – most cleanups occur in conjunction with redevelopment of the contaminated property. Municipalities can encourage redevelopment of PCB-contaminated sites. One option is for a municipality to partner with a developer, a redevelopment agency or school district to redevelop the site. The municipality's role would generally

be assisting other agencies with regulatory oversight while other agencies, responsible parties and/or developers would generally bear the cleanup cost burden, excepting cleanups of municipal properties. Both redevelopment agencies and school sites have programs and funds available for cleanup of sites that meet their criteria. Developers may also provide funding for site cleanups as was the case for IKEA as discussed in Section 5.6. DTSC's Targeted Site Investigation program is another program that can be used to facilitate the redevelopment of a contaminated site by characterizing the site's contamination issues.

For a contaminated site that is currently owned by an identifiable party/business but is not a candidate for redevelopment– where a property owner is identifiable, there are regulatory approaches that can be used to abate immediate hazards (e.g., to require the owner to address PCBs that are migrating off of a property). A municipality can refer the site to local environmental health or appropriate hazardous waste agency for abatement of immediate hazards (e.g., PCB runoff) and eventual clean-up of the site with oversight by DTSC or the local hazardous waste regulatory agency. Programs are also available that will help limit current owner's liability helping to facilitate clean-up. Some of these include theVoluntary Clean-up Program and Private Site Management Program.
These programs are most likely to be useful at sites that are currently in use and that have economic value to the property owner. If a site does not have economic value to the owner, it may be functionally abandoned, in which case cleanup is likely to be better addressed through the strategies described for abandoned properties (below).

For an abandoned site that is known to be contaminated -- options include municipalities working with other agencies, private entities and individuals to identify historical owners of record responsible for cleanup or asking state agencies for assistance. Specific tasks will include identifying PRPs and pursuing cleanup options with the PRP once identified. Searches for historical owners can be pursued in a variety of ways, including title searches, searches in the files of DTSC, RWQCB, and local regulatory agencies. Additionally, Sanborn fire insurance maps, available for most of the Bay Area, can be found in the UC Berkeley library system or on-line from http://sanborn.umi.com. If the PRP can not be identified or is insolvent, other funding sources such as the Expedited Remedial Action Program (ERAP) may potentially provide funding for site clean-up costs.

For any site that is suspected—but not known—to be contaminated – few options exist to force investigation of contamination suspected to exist on a property. Municipalities have the legal authority to access private property to conduct inspections and collect samples. However, not all municipalities have established the policies, structures and funding mechanisms to facilitate this. Requests for voluntary investigation can be made; however, property owners generally prefer to avoid the liability associated with identifying contamination, making them unlikely to comply with voluntary requests. If contamination can be proven to be migrating off of the property, a municipality can refer the site to local environmental health or appropriate hazardous waste agency for abatement of immediate hazards (e.g., PCB runoff) and eventual clean-up of the site with oversight by DTSC or the locally designated hazardous materials agency.

Unenclosed sources of PCBs are mostly associated with building materials in older buildings. Fee-funded programs could be implemented for PCB-containing building materials at either the local or regional level. A local program has the advantage of convenient identification of remodeling and demolition projects through the municipal building permit function. However, a municipality-based program has the disadvantage of involving the need for each municipality to develop technical expertise on PCB-containing

building materials, PCBs chemical testing, and appropriate abatement procedures. It also has the disadvantage of requiring every municipality to adopt individual requirements.
Approaches that may fit into the existing structure of a municipality's stormwater program include

- Expand municipal stormwater industrial inspection programs to include potentially PCB-contaminated sites (based on age of buildings and site history). Conduct tiered evaluations of each site's potential for PCB hazard to water quality. Require remediation under existing municipal stormwater pollution-prevention ordinances, including removal or fixing of PCB-containing paint and caulk, removal of contaminated soils, regrading, and repaving.
- Require retrofitting of some commercial/industrial sites or areas with stormwater treatment facilities similar to those being implemented for new development sites in some municipalities.
- The municipality may also want to consider requiring evaluation of potential PCB releases, and mitigation plans, as a condition of demolition permits.

While these approaches could be incorporated into an existing program, the resources necessary to implement these programs would need to be considered and compared to resources needed to implement other approaches.

Municipalities will be responsible for implementing actions to address PCB sources and conveyances. The basic steps that comprise an implementation approach are discussed below and a potential set of actions are found in Table ES-1. Actual PCB TMDL municipal implementation actions are currently under negotiation as part of development of a stormwater NPDES Municipal Regional Permit.

As a first step, municipalities could review and identify the sources and conveyances in their jurisdiction. Specific actions may include:

- Review of databases to identify contaminated sites in the municipality
- Review of businesses in service area to identify potential use or release of PCBs
- Historical review of buildings in service area to identify buildings that may have been constructed using PCB-containing materials
- Monitoring/ inspection of identified sites/businesses/buildings to further characterize PCB contamination or releases.
- Characterization of sediments accumulated in stormwater conveyances to assess PCB levels.

Ideally every identified site would be targeted for mitigation. However, resources may dictate a phased approach and require municipalities to prioritize identified sources and associated implementation actions. Prioritization is part of an iterative process to source control. As actions are implemented and progress is evaluated, additional actions may be added. In addition, as more information is obtained regarding sources, priorities may be reassigned.

Sites with significant PCB contamination should be addressed once they are identified. The approach to remediation will depend on the source of contamination as discussed above and highlighted in Table ES-1.

As indicated in Table ES-1, some of the activities associated with achieving PCB reductions lend themselves to a regional effort to assist municipalities and avoid duplication of effort. Other regional activities that will support PCB reduction efforts include

- Researching unenclosed PCB applications to determine which building materials contain PCBs and when and where they were used. There may be a partnering opportunity through the RMP or through SFEI's Proposition 13 project. The purpose of this project is to evaluate urban best management practices (BMPs) as control strategies for particulate-associated pollutants such as PCBs and mercury.

- Conducting a technical and economic feasibility assessment and prioritization of the source investigation and control strategies discussed in this report. An economic analysis of the no-action alternative (i.e., not remediating a contaminated site) should be included in such an assessment.
- Conduct a more detailed legal review regarding municipal and state authorities to act to address PCBs sources and PCB-contaminated properties. This review should include (1)evaluation of the water board's authorities to regulate PCBs directly (e.g., building materials during construction), which sections of the water code provide the most defensible authority to take action (2) municipal abilities to use stormwater control, nuisance abatement and other authorities to require investigation of and abatement of PCB-contaminated properties. This may entail recommendations for ordinance modification and/or procedures to ensure that authorities are properly used in a manner that is not pre-empted by hazardous waste laws. (3) evaluation of possible conflicts with existing hazardous waste laws and other possible legal challenges that may result from efforts to require investigation and abatement of PCB contamination.

Table ES-1. Implementation Options for Municipalities

Action	Tools / Sub-tasks	Implementing Agency
Source Identification & prioritization		
Identify PCB contaminated sites in service area	Online databases, DTSC & Waterboard records, site investigations	Individual municipalities
Research types and age of structures that would most likely contain PCB-containing materials	Define procedures to identify which structures are most likely to contain these materials.	One-time regional study
Identify unenclosed PCB sources in service area	Use procedures identified above to identify structures. Review building & planning department records, Sanborn maps, other local agency records, site investigations	Individual municipalities
Identify areas likely to have elevated levels of PCBs in sediments	Evaluate based on information obtained for contaminated sites and unenclosed sources	Individual municipalities
Evaluate accumulated sediments in conveyance systems	Conduct sediment monitoring, upstream investigations in identified areas	Individual municipalities
Prioritize identified sources for further action	Prioritization conducted periodically as information on sources is developed. Tools include: • Screening level load estimate • Concentration evaluation • Ease of implementation/ cost • Potential for runoff • Other factors	Individual municipalities
Remediation options/ control strategies		
Conduct demonstration project to address on-land sites	• Identify 6-10 sites split between redevelopment candidates and sites that are not targeted for redevelopment • Determine most effective approach for municipalities to mitigate runoff from on-land sites	Regional effort

Action	Tools / Sub-tasks	Implementing Agency
Develop individual municipal plan for on-land sites	• Use approaches identified in demonstration projects to address candidates for redevelopment and sites not targeted for redevelopment	Individual municipalities
Unenclosed sources BMP development	• Develop BMPs for dealing with disposal during remodeling and demolition • Develop education materials and procedures	Regional effort
Unenclosed sources regulatory strategies	• Evaluate existing regulatory authorities and programs to determine approaches to enforcing requirements as necessary	Regional effort
Unenclosed sources education and outreach program	• Work with building departments to create protocols for identifying sources • Conducting outreach regarding BMPs	Individual municipalities or regional effort as appropriate
Unenclosed sources regulatory approaches	• Implement programs to require measures to prevent runoff from unenclosed sources	Individual municipalities or regional effort as appropriate
Develop plan for addressing accumulated sediments in conveyance systems based on source evaluation	• Revise maintenance programs to increase sediment removal • Conduct upstream investigations to identify ultimate PCB sources to sediments.	Individual municipalities
Periodic review of effectiveness of implemented strategies to determine future directions	• Monitoring • BMP implementation review • Other effectiveness measures	Individual municipalities or regional effort as appropriate

Note:

Further analysis of the feasibility of the above implementation options for municipalities is needed, including quantitative evaluation of costs and benefits. Factors other than strict cost-effectiveness may be important in assessing feasibility, such as the likelihood of identifying responsible parties or obtaining state or federal funding for identification and cleanup of on-land PCBs sites. The benefit of implementing strategies that address multiple sediment-bound pollutants should also be taken into consideration.

1. Introduction

The PCB TMDL for the San Francisco Bay (TMDL) is under development by the San Francisco Regional Water Quality Control Board (Water Board). A project report was issued in January 2004 and the Water Board received comments on this report through March 2004. The TMDL and Basin Plan Amendment are scheduled for adoption in 2006. The goal of the PCB TMDL is to reduce PCBs in aquatic life so that humans and wildlife can safely consume fish.

The California TMDL process requires that an implementation plan be developed to provide a roadmap for reducing or eliminating PCB loadings from identified sources to the San Francisco Bay (Bay). This document reviews options that may be incorporated as part of the implementation plan. Included in these options are approaches to further source identification and source characterization, available control strategies and regulatory options. In addition, this document examines the roles and responsibilities of municipalities (and potential responsible parties) to address PCB sources (i.e., clean-up of contaminated on-land and runoff conveyance systems). The role of municipalities may include identification and prioritization of contaminated sites, identification of responsible parties, providing oversight for clean-up and source control projects, or implementing the clean-up or source control project. This report explores the options available for each of these roles and provides information to develop a process for identifying the appropriate role of the municipalities and other interested parties that may be incorporated into the TMDL implementation plan.

The implementation plan should describe pollution prevention, control, and restoration actions necessary to implement allocations to restore the water body and remove impairment. It should identify responsible parties and schedules for actions. It may also specify studies needed to confirm key assumption made while developing the TMDL, resolve any uncertainties and establish a process for revising the TMDL, as necessary, in the future.

The San Francisco Bay was initially placed on the 303(d) list for PCBs in 1998. This listing was based on data collected under the Regional Monitoring Program (RMP) which has conducted monitoring to characterize PCB levels in sediments, the water column, benthic organisms and fish tissue. In addition, stormwater agencies including the Alameda Countywide Clean Water Program (ACCWP), Santa Clara Valley Urban Runoff Pollution Prevention Program(SCVURPPP), and San Mateo Countywide Stormwater Pollution Prevention Program (SMCSTOPPP) have conducted investigations of sources of PCBs in the San Francisco Bay area and evaluated control options to address these sources. Two Proposition 13 grant-funded projects are currently underway to determine feasible actions to reduce PCBs in urban runoff. One of these projects is the PCB Abatement Program in the Ettie Street Pump Station Watershed being conducted by the City of Oakland with the assistance of the Alameda Countywide Clean Water Program. The other project is a San Francisco Estuary Institute Project to develop methods to quantify and control stormwater loads of PCBs, mercury and other pollutants to surface waters in California.

The PCB TMDL has identified in-Bay hotspots and urban runoff as sources of concern. To address and reduce PCB loadings from these sources within their jurisdictions, the responsible entities will have to determine which control strategies are feasible and make decisions on which control strategies to pursue. In making these decisions, costs will have to be balanced with achieving environmental benefits. The role of various agencies in implementing control strategies will also have to be determined within the context of the current regulations at the local, state and federal level. The implementation plan will address how these decisions will be made and describes the regulatory agencies responsible for various types of contaminated sites.

This report is divided into the following sections:

- Approaches to identification of PCB sources and contaminated sites
- Prioritization of sources
- Control strategies
- Regulatory oversight and non-regulatory management options
- Assessment of options for municipalities

The sections are presented in the order of the steps that will be taken by municipalities to address PCB sources. First, the various sources of PCBs to the Bay within a municipality's jurisdiction will be identified. Second, the identified sources will be prioritized for remedial measures. Third, control strategies will be determined for the sources with higher priority. Fourth, the roles of local and state agencies in implementing the control strategies will be defined. Each of these components of a program for reducing PCB loading to the Bay is described below.

2. Identification of PCB Sources and Contaminated Sites

This section describes information collected regarding the distribution of PCBs throughout the SF Bay region, approaches that can be used by municipalities for identifying areas with significant PCB contamination, and techniques that can be used by municipalities for identifying specific sites with PCB contamination. PCBs were manufactured in the United States between 1929 and 1977 for a variety of uses including dielectric fluids in capacitors and transformers and in unenclosed applications (e.g., paints, adhesives, etc.). The manufacturing, processing, and distribution of PCBs were banned in the United States in 1978. Use of PCBs was restricted to totally enclosed applications at that time. USEPA banned the manufacture and distribution of materials containing any detectable PCBs in 1984. Because of this, PCB contamination often originates in older sites and materials. However, PCBs are still in use to some extent today (e.g., in transformers) and the potential for continued PCBs release to the environment remains.

2.1 Distribution of PCBs throughout the San Francisco Bay Region

The "Joint Stormwater Agency Project to Study Urban Sources of Mercury and PCBs" (KLI 2002), looked at PCBs in selected counties and special districts surrounding the San Francisco Bay. These counties and districts include San Mateo County, Santa Clara County, Contra Costa County, Marin County, Vallejo Flood Control and Sanitation District (VFCSD), and Fairfield-Suisun Sewer District (FSSD). VFCSD and FSSD are located in Solano County. The study evaluated geographic/ regional impacts and land use impacts. The sediment collected was bedded in a variety of stormwater conveyances, including storm drain piping, catch basins, engineered channels, pump stations and creeks.

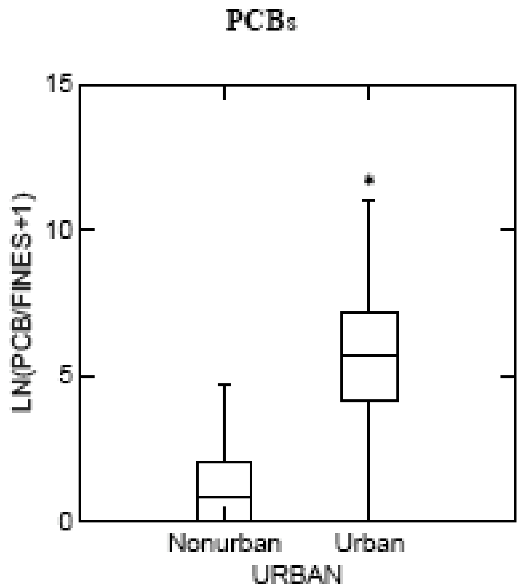

Figure 1. Distribution of total PCBs in storm drains from urban and open land use areas tributary to San Francisco Bay (KLI 2002).

While there were no clear geographic or regional differences, the study found that open space land uses had lower PCB levels than urban areas as shown in Figure 1. The median concentration of total PCBs in samples from urban areas was 311 μg/Kg fines and in samples from undeveloped areas was 1.2 μg/Kg fines. Because of this, it was concluded that sediments in storm drains that drain urban impervious areas have consistently higher PCB concentrations than sediments found in rural drainages. This finding was confirmed by analysis of storm drain sediments and in-bay sediments. Storm drain sediments from urban areas were found to have higher levels of PCBs than bay sediments, and storm drains from open space areas were found to have lower PCBs levels than bay sediments.

Sediment samples were taken at 164 sites throughout the Bay area representing industrial, residential, commercial, and open spaces. Table 1 below shows the mean PCB levels for various land uses from the joint stormwater program study (KLI 2002). A wide range of PCB levels are found in sediments with open spaces having statistically less PCBs than urban land uses. In addition, there is a wide range of PCB levels ranging from 0.25 μg/Kg fines to 124198 μg/kg fines for sites with urban uses. As shown in Table 1, mean PCB levels in open space are 9.4 ppb normalized to the fine fraction of sediment. The median PCB concentration in sediments for urban land uses overall (i.e., industrial, commercial and residential) was determined to be 310 ppb normalized to the fine fraction while median open space concentration was 1.2 μg/kg fines. For the sites ranked in the top 15^{th} percentile of the joint study sites, PCB levels were greater than or equal to 2100 μg/Kg fines. The 75^{th} percentile PCB concentration was 1300 μg/Kg fines.

Table 1. Mean PCB Levels (normalized to the fine fraction) by Land Use (KLI,2002)

Land Use	Mean PCB Concentration (ppb)
Industrial	4500
Residential/ Commercial	2200
Mixed	720
Open Space	9.4

Because urbanization has a significant effect on the amount of PCBs present, the concentration of PCBs in sediments varies highly by watershed within each county. For example, in a separate but parallel study by the ACCWP, the concentration of PCBs in sediments in Alameda County watersheds ranges from .3 to 3300 ppb loosely depending on how much of the watershed is urban. Figure 2 illustrates the variability in concentration of PCBs in sediment from the base of about 20 watersheds in Alameda County.

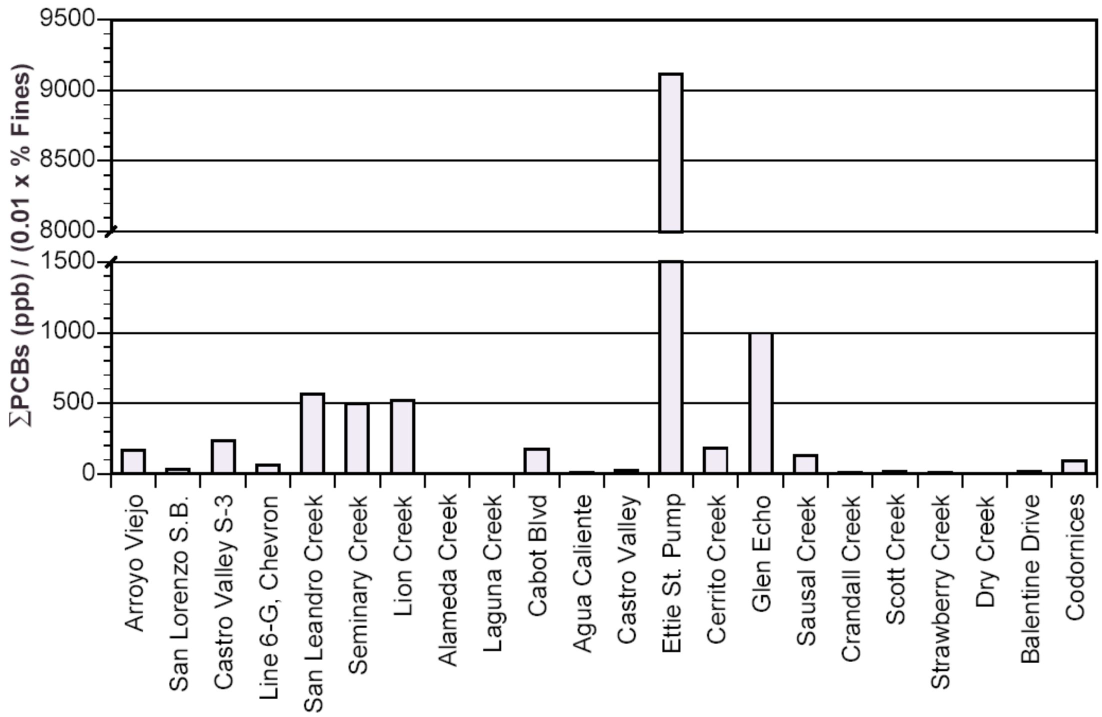

Figure 2. PCBs in sediments in Alameda County normalized to percent fines (AMS, 2001)

More detailed case studies have been completed for selected areas with higher PCB levels in sediment samples collected during the Joint Stormwater Agency Project.

Table 2 below shows the results of selected case studies conducted in local watersheds.

Table 2. Watershed Assessment Results for Selected Case Studies

Case Study	PCB Levels (ug/Kg)
Colma Creek, San Mateo[1]	2 to 31
Pulgas Creek Pump Station, San Mateo[2]	3 to 11,500
Rheem Creek, Contra Costa [3]	40 to 200
Drainage Area 114, Contra Costa[3]	30 to 170
Ettie Street Pump Station, Alameda[4]	25 to 3300
Glen Echo Creek, Alameda[4]	310 max
Bradford pump station, Redwood City[5]	2-340
Broadway pump station, Redwood City[5]	14-116
South Maple Pump Station, South San Francisco[5]	70-480
Nebraska Street, Vallejo[6]	60-2055

(1) EOA 2004b (2) SMCSTOPP, 2003
(3) CCWP 2002 (4) ACCWP 2002
(5) SMCSTOPP, 2002b (6) KLI 2003

2.2 Approaches to Identifying PCB contaminated sites

The first step to addressing PCB sources in their jurisdiction is for municipalities to identify contaminated sites. Sites with PCB contamination fall into the following categories: on-land spill sites (primarily industrial and commercial parcels), accumulated sediment in Bay tributaries and flood control facilities, and unenclosed sources. On-land spill sites and unenclosed sources are locations of initial release of PCBs into the environment. Once released, PCBs are conveyed to and accumulate in the watershed including locations in stormwater facilities and Bay tributaries. Understanding each type of site is important because different approaches will have to be taken to identify each type of site.

On-land spill sites have high concentrations of PCBs in the soil compared to background levels. These sites are often associated with a previous commercial or industrial activity. Many of these sites are brownfield sites for which expansion, redevelopment or reuse may be complicated by the presence or potential presence of a hazardous substance. Elevated levels of PCBs have also been found in public rights of way. The on-land spill sites may be located anywhere in the Bay area. Most identified sites are in urban areas. (KLI 2002, SFRWQCB 2004)

Accumulated sediment occurs in or near waterbodies where sediment is conveyed by flowing water and deposited. They may occur where a tributary feeds into a larger water body. Sediments may also accumulate at a stormwater system outfall as runoff that is transported through flood control facilities is discharged into a water body. PCBs accumulate in flood control facilities when PCB-laden sediments from upstream sources are transported by runoff to storm drains, catch basins, and channels. Stormwater systems are designed to convey stormwater and associated sediment from urban areas to surface waters.

However, sediments may accumulate at depositional areas within a system such as flood control channels in low-lying areas and low areas in storm drain system pipes. Sediments also accumulate by design in some structures such as pump station wet wells and detention basins.

Unenclosed sources refer to uses of PCBs that are open to the environment and have the potential to be released. For example, some sealants and paints used historically in building construction may contain PCBs. These PCBs may be released during demolition or during degradation that occurs upon exposure to the outdoor environment.

A methodology for seeking out sites in each source category is presented below. In general, approaches that have been used in previous assessments and source identifications include sediment sampling, records review, and site investigations. Some of the sampling efforts were described above while approaches that include records review and site investigations are discussed more below.

2.2.1On-land spill sites

Much work has been done to identify commercial and industrial sites containing PCB contamination in the Bay area. This information can be found in the following locations:

- Numerous databases available online
- Information on PCB contaminated sites already compiled by some of the Bay counties
- Water Board records
- DTSC Records
- Local government agency files
- Historical land use maps
- Site visits

Examples of how each of these resources can be utilized to compile a list of contaminated sites in municipality's service area are described below.

2.2.1.1 Databases

Searchable databases are readily available containing information on PCB contaminated sites. Databases that can be used to identify potential or confirmed PCB contaminated sites are described in Appendix A. To determine the usefulness of these databases, they were all searched for PCB contaminated sites within San Mateo and Sonoma Counties. The results of this search are shown in Tables 3 and 4. Based on the results of the search for San Mateo and Sonoma Counties, the contents of the databases tend to overlap. However, there are different criteria for including sites within each database, so it is important to search all of them to develop a comprehensive list of sites. The available databases provide useful information but they do have limitations. Some sites found in the databases may already be undergoing remediation and the databases are not necessarily comprehensive. Several sites discussed elsewhere in this report are not found in any of the databases.

To find information for San Mateo County, it took about 7 hours to locate and search all of the databases and to download and sort some of the databases. To find information for Sonoma County, this time was significantly reduced to 1 hour because a few of the databases were already downloaded and sorted. Familiarity with the websites and the smaller number of contaminated sites in the databases also decreased the time taken to perform the search. This time does not include conversations with Water Board staff and other regulators to find sites that are not contained within the databases.

Table 3. PCB Sites Identified in San Mateo County

Site Name	City	Data Source*
San Francisco International Airport Dyke Reconstruction	South San Francisco	Spills, Leaks Investigation & Cleanups Database (SLIC)
Delta Star/ H.K. Porter Company	San Carlos	SLIC, Cortese List, CalSites, Calsites Deed Restrictions
USX Corporation	South San Francisco	Water Board Information obtained through discussions with the Stormwater Pollution Prevention Program
Romic Environmental Technology Corporation	East Palo Alto	PCBs Activity Database (PADS)
Raychem/ Tyco Electronics	Menlo Park	PADS
North State Environmental	South San Francisco	PADS
Stanford Linear Acceleratory Center	Menlo Park	PADS, PCB Transformer Registration Database
Homart Development	South San Francisco	Cortese List, CalSites, Calsites Deed Restrictions, Voluntary Cleanup Program
CalTrans/ SSF Maintenance Station	South San Francisco	Voluntary Cleanup Program

* More information on the databases listed in this table is found in Appendix A

Table 4. PCB Sites Identified in Sonoma County

Site Name	City	Data Source
City of Healdsburg	Healdsburg	PADS
Geysers Power Company	Healdsburg	PCB Transformer Registration Database
MGM Brakes California	Cloverdale	NPL (Superfund) Database, CalSites, Cortese List, CalSites Deed Restrictions
Skaggs Island Naval Security Group facility	NA	CalSites, Cortese List

2.2.1.2Water Board Records

Water Board staff and records are a good resource for a municipality seeking information on PCB contaminated sites that are not included within the databases. Working with the Water Board to conduct an exhaustive search is essential because the staff have local knowledge that is not captured in the State and Federal databases.

2.2.1.3 Local Government Agency Files

Municipalities are likely to find information on sites within their jurisdictions through review of records compiled by various internal departments. Stormwater agencies may have information on PCB contamination within their flood control facilities. Wastewater agencies may have older information on industrial dischargers connected to their sewers who produced or processed PCBs through industrial records including Pretreatment Program records. The Federal requirement to establish Industrial Pretreatment Programs went into effect after the cessation of manufacture and sale of PCBs. Even so Pretreatment Program records often have useful historical information. City planning departments may have information on PCB contaminated sites identified during the development of Environmental Impact Reports (EIRs). In support of this TMDL, ACCWP, SCVURPPP, and SMCSTOPPP have compiled information regarding sites contaminated with PCBs within their jurisdictions (ACCWP 2004,EOA 2004a, SMCSTOPPP 2002a).

2.2.1.4 Historical maps and records

Review of historical records may be an effective approach to identifying contaminated sites, activities associated with PCB releases and previous ownership. Historical ownership can be researched through title searches, regulatory agency permit histories, historic telephone records or maps. Approaches using telephone records and maps were explored and are discussed below. It should be noted that these approaches have limitations with respect to the information that may be obtained. They are likely to reveal potential sites but direct evidence of PCB use would have to be obtained as a next step. The Sanborn Maps desccribed below may also have limited utility for obtaining concrete information regarding PCB use. They may be more useful for identifying potential responsible parties. These maps may also be useful identifying sites with building materials containing PCBs if specific materials and timeframes of use can be determined.

The Silicon Valley Toxics Coalition conducted a study of PCB concentrations in the Guadalupe River Watershed, Coyote Creek, and the Sunnyvale East Channel (SVTC, 2001). PCB uptake in clams was evaluated during an 11-week period. PCB concentrations in clams in certain portions of the Guadalupe River (i.e., Trimble Road station) were significantly higher than in control samples and samples taken elsewhere during the study. To identify potential sources draining to the Guadalupe River, local directories available through the City of San Jose for the 1950s and 1960s were reviewed to identify business activities in the watershed that may have used PCBs. The business activities that were included in this search are:

- Agricultural Implement Manufactures
- Iron and Steel Work
- Steel Fabricators
- Automobile Accessories and Parts Manufacturers
- Machinery Manufacturers
- Steel Products – Manufacturers
- Electrical Repair
- Machinists
- Tool Manufacturers
- Elevator Manufacturers
- Metal Goods Manufacturers
- Welders and Brazers
-
- Food Machinery Manufacturers
- Metal Stamping
- Wire and Iron Work
- Forging Iron and Steel
- Paint Manufacturers
- Wire Goods Manufacturer
- Foundries
- Power Plant Equipment and Supplies
- Bus Maintenance Yards
- Heat Treating (Steel)
- Sheet Metal Workers
- Electrical Substations

The identified businesses were then geocoded and mapped as shown in Figure 3. Potential PCB sites were concentrated in a 7-mile stretch near the study site with the higher PCB concentrations. Researching telephone directories may be useful for identifying potential PCB sources but also for identifying responsible parties once a source has been identified.

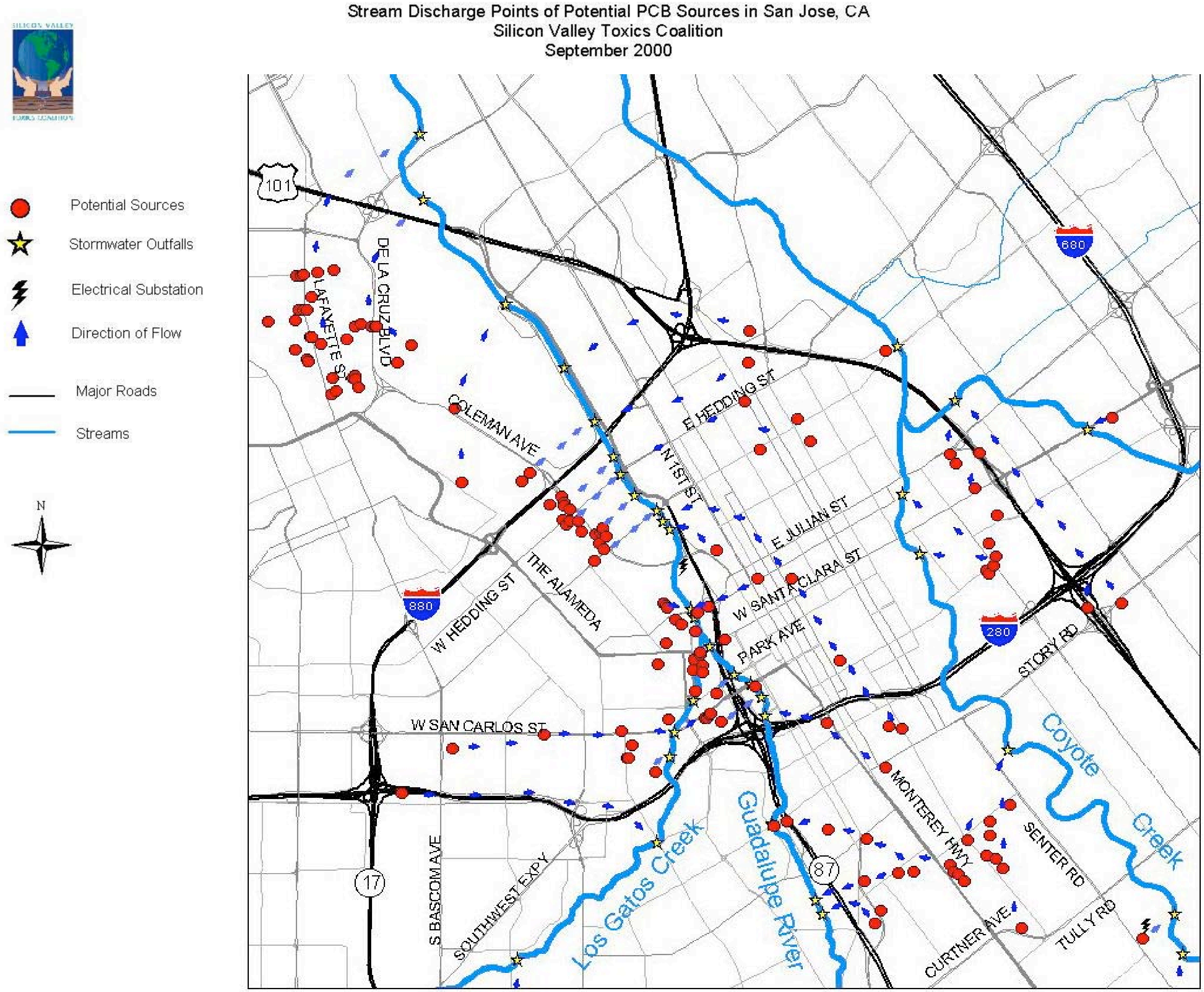

Figure 3. Potential PCB Source in San Jose, CA

Another approach involving review of historical records is to use maps created for insurance purposes, such as those of the Sanborn Fire Insurance Company. Fire insurance maps are a potential source for information on the historical use of a contaminated site from the mid-1880s to the late 1950s. Maps of California and specifically cities and towns in the San Francisco Bay Area are available locally as originals and on microfilm. A digital collection of Sanborn maps is also available on-line through Environmental Data Resources, the company that currently owns the Sanborn Fire Insurance maps.

Fire insurance maps were created for insurance underwriters beginning around 1884. The detailed information, including building construction materials, building use, location of water sources and water pipes, were used to determine risks and establish insurance premiums. The maps are currently used for historic preservation, urban archaeology and other fields. Sanborn maps are still produced today under contract for most major cities and some smaller ones.

The following excerpt from the UC Berkeley Library System's web page on Sanborn maps provides a concise description of the level of detail available on the maps themselves:

> *Fire insurance maps are detailed city plans, usually at scales of 50 or 100 feet to an inch. They show individual building "footprints," complete with construction details such as building material (brick, adobe, frame, etc.), height (of larger buildings), number of stories, location of doors, windows, chimneys and elevators, use of structure (dwelling, hotel, church, etc.), street address, and occasionally the ethnicity of the occupants. Other features shown include lot lines, street widths, water pipes, hydrants and cisterns, and fire-fighting facilities.*

In the maps researched for this example, building information also included ownership and usage (e.g., the "Fruitvale Hotel", "doctors' offices", "day nursery", "French Laundry", etc.) Sanborn Insurance Maps are available as originals and microfilm at the University of California at Berkeley's Bancroft Library (originals) and the Earth Sciences and Map Library (microfilm). The Earth Sciences library also holds current maps for San Francisco. The largest collection at UC Berkeley contains all the Sanborn maps of California in the Library of Congress' collection, which includes 569 cities and towns, dating from about 1884 through 1957. More specific information on these collections can be found at UC Berkeley's library system web site at: http://www.lib.berkeley.edu/EART/sanborn.html#micro.

Individual maps can be ordered directly from the Sanborn Map Company, now owned by Environmental Data Resources, Inc. (EDR) at http://www.edrnet.com/. In addition, access to Digital Sanborn Maps, 1867-1970 is available to authorized users at subscribing institutions. Further information about the digital map collection and becoming an authorized user can be found at http://sanborn.umi.com/HelpFiles/about.html.

The advantage of the originals and microfilm collections is that they are readily available at the University of California Berkeley's libraries for research and copying. In order to best utilize the original and microfilm collections, however, a fairly precise listing of contaminated sites should be developed in order to effectively navigate the extensive map collection.

The digital map collection has the advantage of being easier to manipulate, search by broad geographic area, and magnify features of particular interest Becoming an "authorized user" of the digital collection via an academic library would facilitate more general research on distributed sources of PCB contamination (for example, concrete commercial buildings that used PCBs in window sealants and joint caulking over a particular time period).

2.2.1.5 Site Visits

Site visits can also yield valuable information on potential sources of PCBs that will aid municipalities in their source identification efforts. Through conducting site inspections from the edge of the parcels or more in-depth inspections where activities are not visible from the parcel edge, the presence of activities that might involve the use of PCBs can be ascertained. Methods to choose parcels for site visits will vary depending on the information available and the information desired. Databases, maps, and other sources of information on contaminated sites, industrial businesses, or commercial businesses can be used to plan and organize site visits.

Site visits conducted as a part of the City of Oakland's (Oakland) PCB abatement program provide an example of this approach. Oakland searched an entire watershed for businesses with industrial and commercial activities that are often associated with PCB discharges. Over 1,700 businesses are located in the watershed, and this number was whittled down by reviewing historical databases and conducting site inspections from the edge of parcels. 107 sites required more in-depth inspections because their activities were not visible from the parcel edge. Of the 107 sites, 2 were found to have PCB containing materials on site. Sediment samples were collected in the public right of way near facilities selected based on the inspections and a review of historical activities (Kleinfelder 2005). A wide range of sediment PCB concentrations were detected with a maximum concentration of 31,000 µg/kg.

2.2.2 Unenclosed Sources

The literature contains information about PCB uses in a range of products that are present in open applications today including coatings, sealants and other products. An abbreviated literature review was conducted and is found in Appendix B. According to available information, the primary open applications of PCBs remaining are grouting, sealants, paints, and plasticizers. Remaining open applications are products with long service lifetimes, such as building materials. The literature review found that caulking and sealants are probably the most important still relevant source of PCB emissions from open applications. While these appear to be the most significant uncontained sources, other PCB uses that may release PCBs to the environment include degraded paint and coatings, natural gas line condensates, insulation and sound-dampening materials, plastics, foam rubber and rubber parts, adhesive tape, fluorescent light ballasts, small capacitors, other electrical equipment, gaskets in duct systems and gaskets in insulated windows. PCB levels found in some of these materials are summarized in Table 5.

Table 5. Unenclosed Sources of PCBs

PCB containing material	Observed PCB levels	Source
Building caulking & sealants	Upper values range from 2,700 mg/kg to 550,000 mg/kg	Kohler et al. 2005; Herrick et. al. 2004; USEPA 1999a
Paint and Coatings	<1 – 97,000 mg/kg	USEPA 1999a
Coatings for concrete	700 mg/kg to 87,000 mg/kg	Montana Fish wildlife and Parks 2004
Chlorinated rubber paint for industrial equipment	150,000 mg/kg to 250,000 mg/kg	Himes 2001
Roofing and siding material	<2– 30,000 mg/kg	USEPA 1999a
Fiberglass insulation	<1 - 40,000 mg/kg	USEPA 1999a
Pre-1978 fluorescent light ballasts	30-45 g per ballast	USEPA 1999a

The lifetime of these materials can be assumed to be the same as the structure they are in. Release of PCBs from these materials is likely during remodeling and demolition. Approaches to identifying structures containing PCBs will include review of historical records and municipality building and planning records and to conduct site investigations of locations identified through records review.

2.2.3 Accumulated Sediment

As described earlier, the search for accumulated sediments with significant PCB contamination can begin with the sampling of sediments at different locations in a watershed and subsequent evaluation of potential sources upstream. If elevated concentrations of PCBs are found, the search can proceed increasingly further upstream and branches off until the location(s) of significant sources are identified. This approach can be used to prioritize source investigations. However, the high variability of PCB concentrations in stormwater conveyance sediments may confound such investigations. Sites upstream of a low PCB level result should therefore not be excluded from consideration if they are identified as potential sources through another approach (e.g., review of databases, etc.). This approach was applied to numerous watersheds tributary to the Bay in an effort to identify significant on-land PCB sources. An important point to emphasize is that the goal of watershed source assessments is to identify significant sources of PCBs and not all sources of PCBs. One mitigating factor toward implementation of these types of investigations is the fact that many industrialized areas within the Bay Area are located below the area of tidal extent, a mixing zone of sediments originating from upstream and Bay sources. An example of how these assessments are conducted is presented below to illustrate the process and considerations that must be taken into account.

2.2.3.1 Example of a Watershed Source Assessment – Ettie Street Pump Station Watershed

The watershed source assessment approach was applied in the western portion of the Alameda County in two phases through investigations supported by the ACCWP. Initially, sediments from approximately 20 watersheds spread throughout Alameda County were sampled and analyzed. Based on elevated PCB sediment concentrations found at a downstream pump station, the Ettie Street Pump Station Watershed was determined to be a likely source of PCBs and was selected for further investigation. In Phase I of the follow-on investigation, sampling sites were then selected along the five main stormwater lines draining into the pump station. Based on the PCB concentrations found in the samples from the five lines, one catchment was found to have the highest PCB concentrations and was selected for further sampling in Phase 2.

During Phase 2, 39 of the approximately 54 inlets feeding into the catchment were sampled to focus more narrowly within this watershed. Cost concerns prevented all of the inlets from being analyzed individually. Sediment samples were collected, composited, analyzed, and compared to the samples from the downstream catchment and pump station. The comparison of PCB samples included looking at the specific PCB congeners of each upstream and downstream sample and regressing the congeners of each upstream site against the congeners at the catchment and pump station. Surprisingly, correlations were found between the upstream sites and the pump station but not the catchment. Because of this finding, further analysis focused on correlations between the upstream sites and the pump station. Any upstream sites with significant correlations were assumed to contribute significant amounts of PCBs to the downstream pump station sampling site. A model was then constructed to estimate the loadings from the upstream sites determined to be significant PCB contributors to the pump station. Based on this model, one area was suggested to be contributing substantially more PCBs than other sites. Of particular interest, the site with the highest total PCB concentrations was not found to be the largest source of PCBs. Such a discrepancy could be due to a lower flux of sediment into storm drains. This highlights the need to conduct analyses such as PCB congener analysis and modeling to accurately identify sites and focus future remediation efforts. The ACCWP investigations in the Ettie Street Pump Station watershed led to a successful State Proposition 13 proposal (PCB Grant Project) to further test innovative techniques for identifying PCB source areas and remediate if appropriate.

The following should be considered when developing a watershed source assessment to identify PCB contaminated sites:

- *Budget* – Oakland was not able to conduct a complete search of its upstream sites because funds were limited. Funding will largely determine how exhaustive and comprehensive a watershed source assessment can be.
- *Accessibility to the sampling site* – The method for collecting sediment samples was determined by the structure of the sampling site. Some sites were more amenable to collection of sediment samples than others, and this affected how and where the samples were collected.
- *Sediment age* – Congeners that are less chlorinated degrade faster than highly chlorinated congeners. Thus, older sediment will have lower levels of less chlorinated congeners and lower total PCB levels. Consideration of sediment age is important when comparing sediments from different sites.
- *Sediment grain size* – Higher PCB levels are associated with fine grain sediments because of increased surface area. Normalizing PCB levels to grain size can remove this effect, although uncertainties can be associated with such normalization when the percentage of fine material is very low.
- *Time of sampling* - Sediment sampling for watershed source assessments should take place toward the end of the dry season to allow sediments to accumulate. Sampling sediments during the wet season or the beginning of the dry season is not as likely to be representative because fine sediments could be scoured out during storm events.
- *Selection of watersheds for sampling and study* - According to previous watershed source assessments, PCBs only tend to accumulate at the bottom of watersheds where there has been development of some kind. If resources are limited, watersheds that are highly developed and/ or industrialized should be focused on first.

3. Prioritization of Sources

Once sources are identified, adequate resources to remediate all identified sources at once may not be available. Therefore, which sources or contaminated sites to address first will need to be determined. One approach to prioritizing PCBs sources for control strategy implementation would be to develop screening level estimates of the magnitude of PCBs sources in terms of discharges to the Bay. Such estimates can be highly uncertain, but they can be invaluable in effectively directing limited available resources. This process may also reveal data gaps that can also be addressed to assist in evaluation of PCB sources. Another approach may be to compare relative concentrations of PCBs found at different sites under consideration for immediate action. In cases where exposure or potential for bioaccumulation is more immediate, concentrations may be the more appropriate tool for prioritization. It should be noted that to some extent, the prioritization will depend on the oversight agency. For example, if DTSC is the oversight agency, hazard to human health will likely be the driving priority. However, for cases where the municipality is setting priorities for its program, approaches like screening level load estimates may be useful as described below.

3.1 Screening Level Load Estimates

Developing screening level estimates of PCBs releases from watershed sources via stormwater pathways involves the following steps:

1. Source Characterization. Estimate the magnitude of the source. What is the quantity of PCBs? If it is a contaminated site, what concentration of PCBs exists at the surface? Are there multiple sources at the same site? (For example, at buildings with PCB-containing sealant, PCBs may be released directly from the sealant, from concrete near the sealant, and from soils adjacent to the building.)

2. Pathway for washoff. Determine the pathways for release in urban runoff. Pathways may include washoff from stormwater runoff or aerial deposition of particulates. Explore each pathway to estimate the fraction of PCBs that can be washed off in urban runoff.
   - Are control measures in place to prevent releases or treat or divert the runoff?
   - If an event would cause a release (e.g., transformer leak, building remodeling caulk removal), what is the estimated frequency of such events?

   Based on the release pathway and control measures, what is the reasonably anticipated annual washoff? (Note: this may be a quantity, concentration, or fraction.)

3. Load. Combine source and washoff estimates to calculate an estimated annual load.

Some PCB quantities are discussed below but they are based on small data sets (often a single data point). They are intended to be used to compare sources from an order of magnitude perspective.

Reviewing readily available information for Bay Area PCB sources, it is possible to estimate the PCB quantities to some extent for the source characterization step described above. PCB quantities can be estimated for individual sources (i.e., an on-land spill site, accumulated sediment in a specific watershed, sediment contamination for one county's demolished building). These quantities may be useful as order of magnitude or screening level estimates that may be used for comparison purposes. Determining and quantifying the pathway for washoff is also not possible due to a lack of information. Estimated quantities for source categories that can be calculated are discussed below.

3.1.1 On-land spill sites

PCBs quantities may be estimated based on sediment concentration levels and the volume of soil that is contaminated. It may be possible to estimate the potential PCB release from an as-yet unidentified and unremediated PCB-contaminated site by quantifying the PCB loadings from existing data on contaminated sites. For suspected source properties, estimates of the PCB quantities from contaminated sites can be evaluated by reviewing information on certain projects described in the Calsites database and by reviewing information on PCB spills from Water Board records.

A search of the CalSites Database discussed above revealed several Bay Area sites which had been determined to have PCB contamination. Although actions have been taken to reduce or eliminate PCB-containing runoff from these identified sites, information from these sites can be used to understand the potential releases from other similar sites that are not currently identified or controlled. Not all sites descriptions contained the same level of detail, but two project descriptions included some quantitative information regarding PCBs. The data from these project descriptions may be used to develop a screening level estimate of PCB quantities that may be associated with on-land spill sites. The Myers Drum, Emeryville, site is a drum recycling facility located in a mixed-use area. PCB levels of up to 100 ppm were found in soil at this site. Approximately 30 cubic yards of contaminated soil was removed from the site. Assuming a soil density of 1.3 mg/cm^3, this would correspond to approximately 3000 g of PCBs being removed from the site. Delta Star, Inc. is a 5.6 acre facility that has been used to manufacture, test, and repair electrical power supply transformers and mobile substations. Environmental investigations detected PCBs in soil (up to 440 ppm) and asphalt (up to 1200 ppm) in one part of the site. Further investigation identified PCBs in soil on-site up to 3000 ppm. Approximately 800 cubic yards of PCB impacted soil were removed from the site. Using 440 ppm as an approximate concentration, this would correspond to approximately 350,000 g PCBs.

Washoff rates may be evaluated by looking at information from the Delta Star Site. At the same time as the initial soil and asphalt samples were taken and found to be up to 440 ppm and 1200 ppm respectively, storm drain sediment samples were taken. PCB levels in the sediments were measured at up to 4.9 ppm. Washoff would be between 0.4% and 1.2 %. Also of interest would be the quantity of PCBs in the sediment removed from the site. Approximately 15 55-gallon drums of contaminated sediment were removed. At a concentration of 4.9 ppm, this would correspond to approximately 15 g of PCBs.

3.1.2 Residuals from Remediated Sites.

PCB sources may also include remediated sites, as remediation may leave PCB-containing materials on surfaces exposed to runoff. While the concentrations remaining are relatively low [sufficient to protect human health], washoff could be meaningful in some circumstances, as annual washoff quantity is usually not a PCB-contaminated site remediation endpoint. Remediation of PCB-contaminated sites usually focuses on protecting human health. While site-specific cleanup standards are usually selected, regulatory agencies have developed guidance values that give an indication of the PCBs concentrations that may be found on the surfaces of previously remediated sites. Neither California nor Federal guidance values consider the amount of PCBs that may be washed off from remediated sites in urban runoff. Table 6 lists California and Federal cleanup guidelines.

A screening level estimate of PCB quantities associated with remediated sites can be developed using information from the spill sites discussed in the previous section. The Myers Drum and Delta Star sites are 'deed-restricted'. Sites restricted to commercial use are remediated to PCB levels of 10 ppm. The same volumes of soil with levels of PCBs at 10 ppm would correspond to 300 g PCBs at the Myers Drum Facility and 8000 g at the Delta Star Facility. Therefore, sites that have undergone remediation may still have significant amounts of PCBs present in soil.

It should be noted that USEPA Region 9's preliminary remediation goals include goals for tap water: 0.96 µg/l for "low risk" PCBs and 0.034 µg/l for "high risk" PCBs. Since these goals are applied at the tap, their achievement may reflect removal of PCBs by drinking water treatment. These goals do not equate directly to allowable discharges to surface waters that may serve as sources of drinking water. Note that these goals significantly exceed the water quality criteria of 0.00017 µg/l (for protection of human health, consumption of organisms).

Table 6. Federal and California Remediation Goals for PCBs

Type of site	Cleanup Guidelines (Dry Soil)
Residential Soil	3.9 mg/kg USEPA, for "Low Risk" PCBs 0.22 mg/kg USEPA, for "High Risk" PCBs 0.089 mg/kg California Screening Number
Industrial Soil	21 mg/kg USEPA, for "Low Risk" PCBs 0.74 mg/kg USEPA, for "High Risk" PCBs 0.3 mg/kg California Screening Number

Source: Federal values from USEPA 2004. California values from (OEHHA 2005).

3.1.3 Sites with reported spills.

Information on reported spills was summarized by San Mateo and Santa Clara Counties (SMCSTOPPP 2002a. SCVURPPP 2002). For the incidents for which both volumes and concentrations were reported, the total per county was determined annually. The annual total PCBs spills reported ranged from 1.1 g to 34 g between 1995 and 1999 in Santa Clara County. For San Mateo County, the annual PCB total from spills ranged from 3 g to 176 g between 1995 and 1998. PCB concentrations associated with these spills ranged from 3-1000 ppm with an average value of about 200 ppm.

3.1.4 Outdoor PCB-containing coatings, building sealants and caulkings.

Exterior PCB-containing sealant, caulking, and coatings are subject to washoff. Washoff rates would relate to surface area and sealant, caulking, or coating integrity. Washoff can occur as a result of direct leaching from materials or from chips of materials released from material degradation. PCBs may also be released when the building is remodeled (e.g., windows replaced; caulking replaced) or demolished, as there does not appear to be any requirement to survey buildings and remove PCB-containing sealants, caulking, or coatings prior to demolition or remodeling.

As noted in the discussion on sealants and caulking above and in Appendix B, PCB levels have been measured in building materials in some European studies and one US study. (Astebro et. al. 2000, Herrick et. al. 2004, Ljung et. al. 2002, OSPAR 2001) One study analyzed PCB levels in different waste streams from a demolished 7-story building. Approximately 2.5 g of PCBs were estimated to be lost to soil and 2-20 g went to water. BMPs were employed during this study to minimize releases of PCBs. Therefore, for this calculation the high end of the range estimated for discharge to water is used (i.e., 20 g/building). It is assumed that building demoliton in the US would not be likely to employ BMPs targeting the release of PCBs. Approximately 45,000 buildings are demolished in the US each year (Franklin Associates, 1998). If this is scaled based on population, that would correspond to approximately 1070 building demolished in the Bay Area annually. If approximately 10% of these buildings were built, repainted or recaulked between 1950 and 1975, then the amount of PCBs released to soil as a result of building demolition would be on the order of 320 g annually. The amount released to water would be on the order of 2143 g annually. While this calculation is based on the number of buildings demolished, additional release of PCBs will occur through remodeling and maintenance of buildings also. Smaller amounts per building may be released due to remodeling and maintenance but far more buildings would be included in this estimate. To account for this, the estimated release is doubled to 4286 g of PCBs released to water annually.

In addition to release during demolition or remodeling, caulking and sealants present an ongoing, source of PCB releases into the environment. Kohler et al. document both external releases to soil and releases to indoor air (Kohler et al. 2005). While they provide no annual release estimates for outdoor areas, they do provide an indoor example where as much as 60 g of PCBs per year were estimated emitted into building air each year from sealants containing about 90 kg of PCBs. Assuming conservatively that an average emissions rate from sealants into urban runoff was 1% of this value and that the Bay Area PCBs sealant inventory is similar to the Swiss inventory (about 100,000 kg), this would represent releases of 700 g per year.

3.1.5 Unreleased materials that might be released in the future.

The potential exists for unreleased materials to enter the environment through a leak, spill, or other disturbance. Sources of unreleased materials may include:

> *Outdoor PCB-containing equipment*. PCBs are contained within the equipment (and thus not subject to washoff) until it leaks or until a spill occurs (most likely during servicing, could also occur due to equipment failure, accidents, etc.). Such equipment may include previously inspected transformers, which are allowed to contain fluids with PCB concentrations up to 50 ppm.
>
> *Indoor PCB-containing equipment and building materials*. PCBs may exist in fluorescent light ballasts, specialized electrical equipment, hydraulic fluid, paints and coatings, sealants and caulking, etc. Even if a release occurs, as long as the material remains indoors, it is not subject to washoff (though it may be subject to airborne transport to the outdoors). PCBs may be released when the building is demolished, as there does not appear to be any requirement to survey

buildings and PCB-containing equipment prior to demolition (unless the PCB-containing equipment was previously identified to USEPA).

Contained contamination. Control measures are often put in place to prevent contaminant releases while sites await full cleanup. Contaminated sites may have been paved, covered, or otherwise subject to management measures to prevent or reduce runoff.

Accumulated sediments. Estimates of PCB removal possible through municipal maintenance programs (i.e., street sweeping, stormwater conveyance maintenance, and channed desilting) gives an indication of PCB quantities from this source. The ACCWP estimated that between 0 and 3 kg of PCBs are removed annually through stormwater conveyance maintenance, 0 to 2 kg annually from street sweeping and 1 to 6 kg annually from channel de-silting (Salop and Akashah, 2004).

The screening level estimates of PCB quantities in different sources or conveyances are based on many assumptions and are intended to distinguish between large and small sources. Based on these estimates, potential quantity of PCBs in sediments, sediments in conveyance systems, unremediated on-land sites, and building sealants and caulking appear to be more significant than the other sources evaluated using this approach.

3.2 Concentration based prioritization

PCB quantity is only one element to consider in prioritization. In some cases, concentration will be the more significant indicator due to potential exposure concerns and sources may be prioritized based on relative PCB concentrations. Observed PCB concentrations associated with the sources discussed above are summarized in Table 7.

Table 7. Concentrations associated with PCB sources and conveyances

Source or conveyance	PCB concentration
On-land spill sites	100-3,000 ppm
Remediated on-land sites	10 ppm
Spills	3-1,000 ppm
PCB- containing Caulking & sealants	2,700-550,000 ppm
Paints & coatings	<1 – 97,000 ppm
Depositional sediments in stormwater conveyances	ND – 27,000 ppb

3.3 Other Factors

In addition to assessing PCB quantity or concentration, prioritization requires an evaluation of technical and economic feasibility. Other factors that should also be considered include:

- Ability to coordinate with existing agency activities
- Appropriateness for implementation at local or regional level or a combination
- Experience/capabilities of agencies that would need to implement the measure
- Public interest/support

- Ability to identify a specific party responsible for implementing the control measure (e.g., PRP, building owner)
- Other barriers to control measure implementation (regulatory requirements, capacity of municipalities or water board to require action)
- Funding availability
- Availability of a mechanism to require the needed action (a “hook”, e.g., demolition permit, development permit, other desired action that a cleanup requirement can be linked to).
- Other benefits of action (e.g., reduction of human exposures)
- Possible adverse impacts of action (e.g., short-term exposures to humans and the environment during a site cleanup)

These factors will influence selection of control strategies and are discussed below for the various control strategies available for sources of PCBs.

4. Control Strategies

Potential sources of PCBs could include contaminated sites (hot spots), contaminated sediments, and unenclosed sources Source control may also be addressed by focusing on conveyances of PCBs, including storm drains and urban runoff. Once these sources and conveyances have been prioritized, PCB loadings to the Bay can be addressed in a number of ways. The strategies to be used will include a technical element (i.e., treatment, containment, etc.) and a management element (i.e., regulatory framework, voluntary programs, etc.). Technical control options are discussed below and management options are discussed in the next section.

Contamination at individual sites can be cleaned up or contained, sediments can be collected before and after they reach the flood control system, stormwater can be treated, and source control measures can be implemented. Each of these control strategies for decreasing PCB loadings is discussed below.

4.1. Site-specific Remediation of PCB Contamination

Techniques for cleaning up individual sites contaminated with PCBs include offsite disposal of contaminated sediment and capping. Offsite disposal involves the excavation of contaminated soil and its disposal, usually in a Class 1 (hazardous) or Class 2 (nonhazardous) landfill. Capping involves creating a physical barrier such as paving over a site and prevents mobilization of contaminated soils and exposure to the contamination. A site cleanup can include a combination of both capping and soil excavation and disposal.

The main advantage of disposal and capping of contaminated soil is that ongoing PCBs loadings to a watershed are eradicated. Offsite disposal has the advantage that PCBs are removed from a watershed permanently, and capping has the advantage that it can be a lower cost alternative to soil excavation and disposal. Disadvantages to capping, however, are that it can require placing deed restrictions on future uses of a property and may conflict with design goals for future development on the site.

The costs for site cleanup can vary highly depending on the extent of PCB contamination, the requirements for post-cleanup monitoring, and the remediation goals.   The degree of contamination affects cleanup costs by dictating whether excavated soil is disposed of in a Class 1 or 2 landfill. Disposal in a Class 1 landfill can cost twice as much as disposal in a Class 2 landfill. If PCBs are over 50 ppm, disposal in a Class 1 landfill is required.   The amount of post cleanup monitoring required determines the magnitude of long term costs associated with remediating a site and varies highly by site. The remediation goals affect costs by defining how much cleanup is required.   Because there are no uniform guidelines for determining remediation goals, they also contribute to the high variability in cleanup costs.

Maximum Contaminant Levels (MCLs) and Preliminary Remediation Goals (PRGs) often provide the most conservative remediation goals. MCLs are enforceable under state and Federal regulation while PRGs are unenforceable. PRGs are used as screens to assess risk, set initial cleanup goals, and consider remedial alternatives. One issue with the criteria and standards used as remediation goals is that they may not be protective enough of the beneficial uses in the Bay. Criteria are usually intended to be protective of human health and wildlife in the vicinity of the site only.

4. 2 Management of Sediment in Stormwater Facilities Containing PCBs

Sediments accumulate within stormwater facilities in low lying areas and in structures such as pump stations and detention basins. Because PCBs are often associated with these sediments, management of sediment in flood control facilities can have a significant impact on the amount of PCBs reaching the Bay. Sediment management in stormwater facilities falls under the purview of municipalities, who are responsible for street sweeping and cleaning structures within the stormwater conveyance system, flood control agencies, who are responsible for desilting flood control channels and creeks, and in some cases, private property owners. The sediment management activities each of these entities are described below.

4.2.1 Municipal Agencies

To increase the amount of sediments they collect, municipalities can improve upon their current street sweeping operations and stormwater conveyance system maintenance through structural controls and increased frequency of their cleaning efforts. These improvements are described below and based on an analysis of street sweeping by Alameda County (ACCWP 2004).

Street sweeping is employed by all municipal agencies to prevent leaves, trash and the larger grain sediments from entering the storm drain system. Improvements in street sweeping to increase sediment collection include changing the type of street sweeper and the frequency of street cleaning. The types of street sweepers include low, medium, and high efficiency. As the efficiency increases, more fine sediments are typically removed. PCBs are often associated with fine sediments, so this is an important consideration. The drawback of high efficiency sweepers is that they can cost more than $200,000.

To increase the volume of sediment collected, the frequency of street sweeping could also be intensified just before the wet season or on a regular basis, such as from monthly to weekly. Factors to be considered when increasing the frequency include increases in staff, use of equipment, and required access to curbs. Increased access to curbs would entail working with parking enforcement agencies to prevent parked cars from obstructing street sweepers' paths. Factors to be considered if sweeping is intensified just before storm events include inaccurate precipitation forecasts, the quick turnaround time required for equipment and personnel, and parking issues.

Although reductions in PCB loadings due to street sweeping have not been fully analyzed, it is possible that increasing the frequency of street sweeping would not have a big impact because weekly and nightly street sweeping may already be in effect in industrial and commercial areas where higher concentrations of PCBs would be expected. This was one of the conclusions of the ACCWP report based on practices in Alameda County. It should also be noted that, in some older industrial areas, street sweeping may be impractical or ineffective because of the condition of the pavement or lack of curb and gutter, or both. Currently, assessing the costs and benefits of using high efficiency street sweeper is not feasible due to the lack of knowledge of the levels of PCBs in waste removed by sweepers.

Municipalities could also increase the frequency with which they clean storm drain facilities such as inlets, catch basins, and pump stations. Currently, they are required to clean these structures at least once per year. They could also install more screens and grates near inlets to prevent sediments from entering the storm drain system. Both options would increase the total number of structures to be cleaned and the required staff.

4.2.2 Flood Control Agencies

If PCBs are measured at significant levels in channel sediments, flood control agencies could decrease PCB loadings to the Bay by increasing the frequency of channel desilting. Doing so would decrease the volume of contaminated sediments reaching the Bay, but there are environmental concerns with doing so. When channels are desilted, the ecosystems within them are disrupted. Because of this, permits to conduct the cleanouts are becoming more difficult to obtain, and recent permits have required more expensive phased cleanup to minimize impacts. The high volume of sediment that is removed when desilting channels could also disrupt sediment dynamics in the Bay. These environmental concerns make channel desilting a less likely candidate for reducing loadings of PCBs to the Bay.

4.2.3 Private Property Owners

Private property owners could also take measures to prevent erodible sediments from leaving their properties. They could regularly clean their properties and implement best management practices (BMPs) to minimize the PCB loadings from their properties. This approach has not been fully implemented and would require outreach efforts. Stormwater programs have industrial inspection programs, construction site programs and post-construction program that include working with a variety of property owners. Therefore, property owners, subject to either Industrial Stormwater Permit Requirements or NPDES Stormwater Permit requirements, are required to prevent contamination from migrating off their property. For property owners not subject to such requirements outreach on PCB related BMPs could be incorporated into to stormwater programs to inform them of the issues and any requirements associated with them. Outreach efforts for business owners can be effective especially when combined with some sort of incentive (e.g., recognition programs) or regulatory program (LWA 2000, LWA 2001).

4.2.3 Benefits of Sediment Management

It is important to consider that any of the changes above will increase the cost per unit of PCBs removed. Because of this, collecting data on the content of PCBs in removed sediments would be very helpful in determining which measures would most efficiently decrease PCB loadings from storm drain and flood control facilities. Currently, it is not possible to conduct such an analysis because little is known on the PCB levels in removed sediment, although it is estimated that roughly about 1 kg of PCBs is removed annually through sediment management activities in storm drain systems and channels(ACCWP 2004).

4.3 Source Control

PCBs can be found in older equipment such as transformers and capacitors and in building materials such as paints, sealants, wood preservatives, insulation, roofing, and siding materials. These sources can contribute new PCB loadings to the Bay. Such sources could be controlled through the implementation of appropriate practices during demolition, remodeling and electrical equipment replacement. Control measures for sealants, paint, and other building-related materials would have to be encouraged on a voluntary basis as there are currently no programs or regulatory structures for addressing these diffuse sources. Education could also reinforce the need to ensure that PCB-containing electrical equipment such as fluorescent light ballasts and transformers are properly managed. Regulatory incentives could also be developed.

Encouraging voluntary efforts would require outreach to businesses and developers. The Ettie Street Pump Station watershed PCB Grant Project discussed previously provides a prime example of conducting such outreach. During the site inspection phase of the Ettie Street Pump Station watershed PCB Grant Project, BMP materials were distributed to businesses to educate them on how to minimize PCB loadings from their parcels. Business owners appeared open to implementing the BMPs.

While the example above is encouraging, there are potential limitations to this approach. The effectiveness of outreach could be limited by the fact that many businesses have already replaced older equipment with PCBs and that the mass of PCBs in older equipment and building materials may be relatively small given that use and production of PCBs are banned. It could also be limited by the extra time and expense required of property owners and contractors to properly dispose of PCB contaminated materials from demolished buildings.   Lastly, there is a risk of accidental release of PCBs to the environment during equipment replacement.

One other element to consider are regulations governing disposal of materials containing high levels of PCBs that may require businesses to change their practices depending on the requirements of the landfills being used for disposal. The CIWMB has state oversight and regulatory powers over landfills but the majority of actual permits are written by local solid waste enforcement agencies (LEAs). The RWQCBs issue Waste Discharge Requirements that affect waste acceptance at the landfills. Additional local requirements may also be identified in the CEQA document for each facility.

Owners and operators of municipal solid waste landfill facilities (MSWLF) are required byTitle 27 CCR, Section 20870 to implement a plan to ensure that incoming wastes do not contain PCB wastes. The regulation further requires that such a facility inform DTSC or the RWQCB if and when such a waste is discovered. The facility cannot accept the waste unless it is a permitted hazardous waste facility. Sites authorized to accept hazardous waste, including PCBs, must implement a plan to eliminate or control exposures to facility personnel and the general public. Businesses disposing of hazardous wastes would need to comply with the landfills requirements.(McCarron, 2005)

4.4 Stormwater Treatment

Treatment of stormwater falls into two categories: treatment retrofits and diversion to POTWs. Treatment retrofits within the storm drain system could include diversion of gutter flows to infiltrate through swales and bioretention areas. Swales and bioretention areas can be underdrained with pipes leading to existing storm drains, allowing them to be installed in any soil type. Other treatment options include detention basins and construction of wetlands at the base of watersheds. When designed and maintained properly, retrofits can be an effective tool to reduce pollutant levels in stormwater.   Constraints could include limited space, soil types, and insect breeding. The decision to construct and implement retrofits would have to be considered on a site-specific basis because of the constraints.

Site-specific factors affecting the feasibility of diversion to treatment plants differ from the constraints for retrofits. Stormwater during wet weather would have to be diverted because it is under high flow conditions when sediments containing PCBs are mobilized. Diversion of dry weather runoff would probably not significantly reduce PCB loadings. Unfortunately, many POTWs do not have the excess capacity to accept wet weather flow. Those that may have this capacity probably will not in the near future due to growth. In addition, PCBs from diverted flows would ultimately end up in the biosolids which may have implications for the disposal of the biosolids. Diversion of non-stormwater flows during dry weather would also have to be evaluated for volume and quality.

When determining if a POTW is a candidate for treating stormwater to reduce PCB loadings, the following should be considered:

- How long will the excess capacity be available
- The ability of the POTW to comply with effluent limits if it accepts stormwater influent
- Whether water quality improvements would be achieved for multiple pollutants. It is unlikely that the cost of such a project would be offset by reductions in PCB levels alone.
- The pollutant concentrations in the sediments and the TSS levels in stormwater. Higher concentrations in sediment and higher TSS levels increase the cost effectiveness of this option.

An alternative to diverting stormwater to POTWs is to build separate wet weather treatment facilities where there are high sediment PCB concentrations.

4.5 Control Strategy Cost-Effectiveness

Determining the cost-effectiveness of controlling a particular PCBs source involves considering if feasible control measures exist and estimating the cost of implementing each feasible control measure. In considering potential control measures, it is important to recognize that runoff prevention may not necessarily entail full remediation of a PCBs source.

While detailed cost effectiveness analysis is often prohibitively expensive, the relative cost effectiveness of various possible actions can usually be determined on the basis of a preliminary scoping out of the measure. This screening level of detail is generally sufficient for initial prioritization of potential pollutant control measures.

The first goal is to bracket the relative annual runoff quantity reduction and the control measure cost. Cost should include the cost of agency staff time to develop and implement the measure, as this activity is likely to involve relatively significant resources for some options. As discussed above, PCBs that may be removed annually through changes in municipal maintenance procedures have been estimated by Alameda County. In addition, remediation levels for some contaminated site clean-ups are discussed above. Comparing this to the cost of each approach provides intial information on cost-effectiveness. Available cost information for selected control strategies are shown in Table 9.

Table 8. Control Strategies Cost Information for Selected More Significant Sources

PCBs source	Control Measure	Cost of control measure
Unremediated PCB contaminated on-land sites	Excavation & removal	$300,000 -$3,000,000/ acre[1] ($7-$70/sq.ft.)
Outdoor PCB-containing coatings	Remove coating and seal concrete	$7-$15/ sq. ft. [2]
Outdoor building sealants and caulking	Removal and disposal with BMPs to minimize releases	$23/ meter[3] ($75/ ft)
Accumulated sediments	1. Street sweeping with higher efficiency equipment	1. $200,000 – $250,000 per unit[1]

	2. More frequent channel desilting	2. $7 - $73/ cubic yard ($190 - $1970/cubic foot) ($300,000 annually)[1]

1) ACCWP, 2004. Costs are planning level only and do not include additional operating or permitting costs that may be necessary.
2) Montana Fish, Wildlife, and Parks 2004
3) Von Bahr and Janson 2004

The cost of implementing source control actions should be compared to the costs associated with taking no action. In some cases there could be a large cost associated with leaving a contaminated site in place. For example, costs may be incurred in association with a responsible party's continued liability from contamination or from long term monitoring that may be required to demonstrate that human health and/or ecological risk from known contamination is being managed at a property. In most cases, however, property owners do not incur such costs. The reason that brownfields are a major problem in California is that it is generally substantially less expensive to functionally abandon contaminated or potentially contaminated sites (i.e., take no action with the property, but continue to pay taxes on it) than it is to clean it up.

5. Regulatory Oversight and Non-Regulatory Management Options

In California, cleanup of contaminated sites can be addressed under the authority of the Department of Toxic Substances Control (DTSC) or the State and Regional Water Boards depending on the circumstances. The regulatory authority for DTSC comes from the State Superfund Act and the regulatory authority for the Water Boards comes from the Porter-Cologne Act. The authority provided under these statutes is described briefly below. (CalEPA, 2003)

The State Superfund Act is primarily implemented by DTSC, although it also authorizes the Water Boards to act under it s authority. It is focused on protection of public health and the environment from threats posed by releases or threatened releases of hazardous substances. DTSC utilizes a variety of legal mechanisms to compel Responsible Parties to respond to a release of hazardous substances including

- Imminent and Substantial Endangerment Determination and Order – used to compel investigation and clean-up of a contaminated site
- Consent Order - used when parties agree to cooperate in the investigation and cleanup of a contaminated sites
- Fence and Post Order - Used to compel fencing and posting of a site
- Voluntary Cleanup Agreement – used for oversight of site assessments and site cleanups through the Voluntary Cleanup Program.
- Operation and Maintenance Agreemetns – Used when a clean-up requires long term operation and maintenance.

The Porter-Cologne Act focuses on the Water Boards' responsibility to preserve and protect water quality. Included in the regulatory authority provided under this statute, the Water Boards have the authority to conduct, order, and oversee investigation and cleanup where discharges of waste cause or threaten to cause discharges to waters of the state that could cause or threaten to cause pollution or nuisance, including impacts to public health and the environment. Orders and agreements that may be used by the Water Boards include:

- Cleanup and Abatement Orders – used to compel responsible parties to investigated discharges, prepare work plans, and to clean up the waste or abate the affects of the waste.
- 13267 Orders – used to compel dischargers to prepare technical reports including monitoring.
- Cease and Desist Orders – used to compel compliance with permits or prohibitions.
- Voluntary Actions – Responsible parties may agree to pay oversight costs and conduct clean up and abatement actions as directed by Regional Board staff.

In general, the Water Boards have jurisdiction to require cleanup where there are discharges of wastes to water or waste that threatens to discharge to water and cause pollution or nuisance. Water Board programs that direct site cleanups include the Spills, Leaks, Investigation and Clean Program, the Underground Storage Tank Program, and the Land Disposal Program. In addition, the Water Board has authority to regulate specific sources of stormwater pollutants through the issuance and enforcement of municipal stormwater NPDES permits and through other means. Upon identifying a source or potential source--for example, a specific site, or a whole class of sites or even a whole class of activities--the Water Board can request studies and additional information through a Section 13267 request. They could issue Waste Discharge Requirements for the source. Also, through a general WDR, the Water Board may regulate classes of similar discharges.

DTSC has jurisdiction over releases or threatened releases of hazardous substances that may pose a threat to public health and the environment. DTSC programs that direct site cleanups include the Site Mitigation and Brownfields Reuse Program and the Hazardous Waste Management Program.

Several regulatory options are potentially applicable to PCB site cleanups under DTSC's Brownfields Cleanup Program; detailed descriptions are provided below. Brownfields are properties for which the expansion, redevelopment, or reuse may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Many of the options available for Brownfields are based on working with other public agencies and private entities that may have funds for development of contaminated sites, e.g., a redevelopment agency interested in supplying low-income housing, a school district interested in siting a new school or developers that may have an interest in private development or collaboration under the Polanco Redevelopment Act. Most of DTSC's regulatory incentive programs for brownfields focus on site remediation and reducing or eliminating liability for qualified purchasers and developers of contaminated sites, which increase the likelihood that said parties can obtain loans for site clean-up. One option is for local agencies that are designated hazardous material agency, usually a county health or environmental agency, to enter into a written agreement with DTSC or the RWQCB to supervise regulatory oversight of the cleanup of a simple waste release. Local agencies that are not the designated hazardous material agency could potentially partner with the applicable program, typically a local county environmental or health agencies, redevelopment agencies, or school districts for regulatory oversight of the clean up of some PCB-contaminated sites. Redevelopment agencies, school districts, responsible parties, and/or developers would generally bear the cleanup cost burden rather than municipalities, excepting cleanups of municipal properties. There may be special federal notification requirements for PCBs as discussed below.

Most site cleanups being conducted in California are in response to a proposal to develop the contaminated property. Even so, contaminated sites are more costly to develop than uncontaminated property resulting in only a small portion of contaminated properties in California being candidates for redevelopment. Most of the programs described in this section were designed to try to increase the fraction of contaminated sites that are successfully redeveloped. In the absence of a redevelopment proposal, it is very difficult to force the remediation of a contaminated site, or to require testing of a property to determine the existence and extent of contamination.

Some of the considerations in working with PCB-contaminated sites include identifying the sites, identifying the responsible party, whether or not the site meets the hazardous waste criteria, who is the lead agency, potential funding sources and incentive programs. These consideration are discussed below.

5.1 Site Identification

There is no list of brownfields sites, as property owners have been resistant to being listed by the state as a contaminated site. However, as discussed above in the Source Identification section, potential sites can be identified either on DTSC's CalSites list or Cortese list, both available on DTSC's web site at http://www.dtsc.ca.gov/SiteCleanup/index.html. Other approaches to site identification discussed in the Source Identification section may also be applicable to identifying potential brownfields sites. For example, Sanborne Insurance maps, many available in UC Berkeley's library, can be a source for historical information on changes in geographic features (stream beds, storm drains, etc.)

5.2 Potentially Responsible Party Identification

Identification of Potentially Responsible Parties (PRPs) comes into play once sites have been identified and includes title searches, or searches of the local city or county for business purposes. Since the inception of the Comprehensive, Environmental Response, Compensation and Liability Act, CERCLA or Superfund in 1980, the identification of PRPs to assist with cleanup at contaminated sites has been a major focus of the federal Superfund program. PRPs conduct nearly 70% of the cleanup at Superfund sites.

Key issues around PRP identification include:

- Tracking down PRPs through histories of corporate buyouts and mergers and establishing what proportion of the waste issues at any given site is the responsibility of each PRP. Companies that caused the initial contamination at a site may no longer exist, but their successors and purchasers are still responsible for the site contamination.
- Establishing and allocating PRP liability for clean up activities and costs.

5.2.1 PRP Searches

The EPA has a comprehensive 381-page "PRP Search Manual", which can be downloaded from the EPA Superfund web site: *http://www.epa.gov/compliance/resources/publications/cleanup/superfund/prpmanual/*. The manual provides detailed information on resources and strategies for identifying PRPs.

EPA's Superfund Enforcement web site further elucidates the goals of the federal Superfund program as follows (http://www.epa.gov/compliance/cleanup/superfund/find.html).

In addition to identifying potentially responsible parties, EPA tries to determine early on:

- The nature of a party's involvement (e.g., owner, generator),
- A party's potential defenses (e.g., 3rd party defense),
- Any applicable exemptions or exclusions,
- The amount of waste a party contributed, and
- Whether the party can pay only very little or nothing at all toward the cleanup.

The information described above then allows EPA to target its program resources to the PRPs most likely to assist in reducing public health and environmental impacts from contaminated sites.

5.2.2 Liability

The identification of PRPs for Superfund sites has generated considerable legal discussion around precisely who is responsible and for what. Courts have broadened corporate liability over the past twenty-five years such that corporations may inadvertently purchase environmental liability by purchasing another company and/or its subsidiaries. The following description of corporate liability/responsible parties under Superfund is excerpted from a February 1, 1999 article in *Mergers and Acquisitions* by John H. Grady .

> *Superfund creates four classes of "responsible parties" liable for identified releases or threats of releases of hazardous substances into the environment at or from a facility:*
>
> ** The current "owner or operator" of the facility;*
>
> ** The owner or operator at the "time of the disposal" of a hazardous substance;*
>
> ** The "arranger" for the disposal or treatment of the hazardous substance; and*
>
> ** Transporters who select the place of disposal.*
>
> *Under CERCLA, responsible parties are liable for the costs of responding to releases or threatened releases of hazardous substances, including the costs of investigating the nature and extent of the release and the costs of any corrective or remedial measures required in response to the release. At times, the costs of the investigations alone have run into the millions of dollars.*
>
> *Liability attaches regardless of when the disposal of the substances occurred or whether such use and disposal was completely legal at the time*.

5.3 Hazardous Waste Considerations

PCBs are regulated by US EPA under the Toxic Substances Control Act (TSCA) so any activity involving clean-up of PCBs triggers notification requirements under 40 CFR § 761.61. According to TSCA *any site with PCBs falls under TSCA* and therefore US EPA purview and notification requirements. Practically, only PCBs at relatively high levels will attract the attention of the US EPA Regional office. Most sites would fall under Self-Directed or Self-Implementing Site Cleanups, but US EPA can choose to become more heavily involved at any time. Sites with higher PCB concentrations may engender more federal interest. Notification under 40 CFR § 761.61 (a) includes submitting to US EPA 30 days prior to the initiation of clean-up a description of the site, extent of contamination, and a site-clean-up plan. If US EPA's Regional

Administrator does not respond within 30 days of the notification, the clean-up can proceed. 40 CFR § 761.61 also specifies the permissible cleanup level for clean up sites as less than or equal to 1 ppm for high occupancy areas, and less than or equal to 25 ppm for low occupancy areas. (This is not a comprehensive read of the requirements for TSCA clean up of PCBs.)

Another aspect of disposing of a hazardous waste is potential human exposure to the hazardous waste. Local county (health) officials are responsible for public exposure to elevated levels of PCBs only insofar as the sources of those elevated levels of PCBs are within their normal jurisdiction. For example, county health officials might be involved if a building with potential PCB contamination in its structure is being remodeled or demolished in their geographic jurisdiction. A county health agency involved in a Brownfields redevelopment in partnership with DTSC or a redevelopment agency might similarly be responsible for alerting the public to potential exposure from the mitigation of that site. (Stettler 2005)

5.4 Lead agency determination

If a municipality is a designated hazardous materials agency (e.g. a fire department or city designated as a Certified Unified Program Agency or CUPA), options include entering into an agreement with DTSC either under a Voluntary Clean Up Agreement or the California Land Environmental Restoration and Reuse Act (SB 32, 2000) to oversee clean up of a site. This latter option, however, has never been utilized by local agencies due to burdensome reporting requirements.

In March 2005 an MOA between DTSC, the State Water Resources Control Board and the Water Boards clarified the roles of lead and support agencies in Brownfields cleanup. Anyone applying for Brownfields cleanup oversight from DTSC or a Water Board must submit a request for oversight agency designation. More information on this MOA's requirements can be found at http://www.calepa.ca.gov/Brownfields/MOA/.

One approach to managing a clean-up project by the Water Boards is through the Spills, Leaks, Investigation and Clean-up (SLIC) Program. This program is designed to cleanup the impacts of current or historic unauthorized discharges, primarily to groundwater, but in some cases also to surface waters or sediments. The program issues cleanup orders that require investigations, source removals, set final cleanup standards, treatment and monitoring. The Water Board works with the property owner or responsible party to develop a work plan for remediating contaminated sites. Agreements may be voluntary or may be based on a Clean-up Order issued by the Water Board. Through the SLIC cost recovery program a formal agreement is developed to implement the developed work plan. Clean-up of contaminated sites could be facilitated by developing a standard template containing the following items:

1. Description of problem (site data, Order requirements if applicable)
2. Estimate of work to be performed and expected outcome (timeframe, list of typical or standard tasks, likelihood of site achieving clean-up goals) and next steps to be taken
3. Attachments describing process and cost.

The SLIC Cost Recovery program only applies where a Clean-up Order has been issued to an identified responsible party and the party is willing to provide cost-recovery funds. These funds cannot be used to conduct surveillance, seek out responsible parties, or issue Clean-up Orders. They can only be used the oversee the clean-up. However, if municipalities did the surveillance and identification of responsible parties, the Water Board could follow through with clean-up oversight.

5.5 Potential Funding Sources

Some grant and loan programs that may be used are listed in Attachment C. Some examples include:

- US EPA has brownfields clean-up monies, including Assessment Grants, Clean-Up Grants and Revolving Loan funds, which are open to non-profits, counties and cities. The definition of a brownfield has been recently broadened, making this option worth pursuing. http://www.epa.gov/region09/waste/brown/grants.html
- Redevelopment agencies or school districts may have money to clean-up some sites under specific DTSC cleanup programs.

Under the US EPA Brownfields Grants and Loans programs, $200,000 to $700,000 is available annually for assessment and clean up grants, and up to $1 million in loan funds for site clean-ups. For more information: http://www.epa.gov/region09/waste/brown/grants.html

5.6 Non-regulatory Options

Non-regulatory program options and incentive programs that may be useful for addressing PCBs are described below. As noted above, most of these programs are intended to encourage redevelopment of contaminated sites.

Voluntary Cleanup Program- Most sites under DTSC oversight fall into this category; under this program, the property owner or "project proponent" does not admit legal liability for remediation of a site. State or local agencies are eligible to be project proponents under this program.

An example of the Voluntary Cleanup Program is the project conducted by the Vacaville Redevelopment Agency for Basic Vegetable Products Site. The Redevelopment Agency of Vacaville entered into a Voluntary Cleanup Agreement with the DTSC in 1995 to oversee the cleanup of contaminated soil at a 29-acre site that was used for vegetable processing for over 50 years until its closure in 1986. While the site had not generated hazardous waste as a vegetable-processing plant, it had been contaminated by lead-containing slag from historic steel production. The Vacaville Redevelopment Agency was able to remove 1,300 cubic yards of contaminated soil from 3.5 acres of the property in 12 months and reduce lead concentrations below residential standards of 210 ppm. The property is now the site of a 90,000 square foot building that has been a catalyst for further commercial development in the area.

Redevelopment Agency Process- This program is a potential source of clean-up funds if one can partner with a redevelopment agency. The program is intended as a liability waiver incentive for prospective purchasers and all future potential owners of a redevelopment site. The involvement of a redevelopment agency triggers a notification requirement under the Polanco Redevelopment Act, and a redevelopment agency must be involved in this process. Emeryville has apparently cleaned up sites under this program twice successfully, and Milpitas has attempted to do it. These agencies might be useful sources of additional information.

As an example of this redevelopment process, in January 2004, DTSC awarded grants to six communities statewide for Targeted Site Investigation (TSI). The TSI program is available to government agencies and non-profit organizations with specific projects that involve the redevelopment of potentially contaminated properties. Funding for the TSI program is being provided through a USEPA Brownfields grant which will provide funds for Cal/EPA Departments to perform environmental site investigations at no cost to the applicant. The TSI funds are intended to provide state and local governments, school districts, redevelopment agencies, or non-profit organizations an opportunity to gain more information about a site's condition, which can directly affect decisions on property acquisition or cleanup strategy. (DTSC, 2005b) A Bay Area grantee is the Oakland Redevelopment Agency, which received $65,000 for investigation of a site that is part of the planned Macarthur Transit Village development. The grant will allow the agency to determine the extent of contamination of the site from past businesses on the property, which included fuel storage.

Additional information for the Oakland site and the TSI program can be found in a January 2004 press release at:
http://www.dtsc.ca.gov/SiteCleanup/Brownfields/NEWS_2004_T-06-04.pdf

Similarly, in February 2005, DTSC granted site investigation funds granted to seven cities, including Antioch and Fairfield, for Brownfields sites slated for redevelopment. Redevelopment agencies are not specifically named as recipients. As noted above, TSI funds are available for any government agency for the purpose of site characterization in preparation for clean up and redevelopment.

Additional information on the uses of the TSI funds in Antioch and Fairfield can be found in a February 2005 fact sheet at: http://www.dtsc.ca.gov/SiteCleanup/Brownfields/SMBRP_FS_TSI.pdf

School Sites- All proposed school sites seeking state funding for acquisition and/or construction are required to go through a comprehensive environmental review and cleanup process under DTSC oversight. School districts have independent funding sources that might be available for site clean-up if a potential school site is contaminated with PCBs.

Expedited Remedial Action Program (ERAP)- Under ERAP, the state can provide money for a so-called “orphan share” of site clean-up costs at a particular site if the original owner and contaminator of the site is not available for cost recovery. ERAP is a pilot project administered by DTSC’s Site Mitigation and Brownfields Reuse Program to promote the cleanup of up to 30 hazardous substance release sites. Since June 1995, 18 sites have been designated to participate in ERAP. ERAP provides for payment of "orphan" share remediation costs for up to ten sites allowable (depending on available State funding) where the responsible party is either insolvent, or cannot be located or identified. ERAP has designated five of the allowable ten sites with orphan shares. Three of the sites have had their orphan shares paid and two more sites are still in the remediation process and will receive orphan share funding upon certification. Whether or not a site will be eligible for orphan share funding is determined by the ERAP application and approval process. In order to receive the orphan share funding, one or more of the responsible parties must complete the investigation and remediation of the site and pay for all of DTSC's oversight costs. Once the site is certified, the responsible parties can submit a claim for payment of the orphan share. Examples of this process are Fountain Grove Plaza in Santa Rosa and Lindbergh StreetDevelopment in Santa Cruz. (DTSC 2005a)

Fountaingrove Plaza was an abandoned property that was previously the site of a trucking operation used for heavy equipment sales and repair, auto repair, petroleum storage, warehouse, and other industrial uses. Shallow groundwater was impacted by trichloroethylene (TCE). The site has been certified and is in the Operation and Maintenance(O&M) phase. O&M requires the continued operation of a groundwater extraction trench and the discharge of extracted water into the sanitary sewer under a permit. In March 1999, Fountaingrove Plaza submitted an orphan share claim for $41 5,664 which was paid by the Expedited Remedial Action Trust Fund in FY 1998-99. Due to changes in City of Santa Rosa discharge requirements, a granular activated carbon treatment system was installed in September 2003. The site completed its first five-year review in 2004.

The Lindbergh Street site consists of two parcels in downtown Santa Cruz. Lead was likely released during a previous auto wrecking operation at the site, and was present in the soil. The Lindberg Street site was certified in March 2001. Soil containing chemicals above residential cleanup goals were removed and disposed of offsite. In FY 2000-01, the responsible party submitted an orphan share claim for $555,612 which was paid by the Expedited Remedial Action Trust Fund.

Cleanup Loans and Environmental Assistance to Neighborhoods (CLEAN) Program – This program provided low-interest loans of up to $100,000 for assessments and up to $2.5 million for site cleanup. CLEAN is currently out of money and future funding depends on the Governor's budget. Governor Schwarzenegger has indicated some interest in funding brownfields cleanups in the past.

State Superfund Cleanup Program – State Superfund sites are identified on the Cortese list. A site owner will occasionally ask DTSC to provide a consent order for clean-up under this option, as insurance claims can be triggered if the clean-up is under a regulatory order.

California Land Environmental Restoration and Reuse Act- SB 32 (2000) - This program allows a local agency hazardous materials program to provide oversight for cleanups, in an attempt to streamline the brownfields cleanup process. The requirements have proved so burdensome, however, that to date no local agency has utilized this option for site clean-up.

State Cleanup and Abatement Account (CAA). The Cleanup and Abatement Account was created by Water Code Sections 13440-13443 to provide public agencies with grants for the clean up or abatement of a condition of pollution when there are no viable responsible parties available to undertake the work. The Account is supported by court judgments and administrative civil liabilities assessed by the State Water Resources Control Board and the Regional Water Quality Control Boards. Only public agencies with authority to clean up or abate a waste are eligible to receive funding. More information is available at www.swrcb.ca.gov/funding/clean-abatement.html.

Prospective Purchaser Program – This program provides a liability waiver for prospective purchasers, but only from DTSC's requirements; US EPA and the Water Boards have equivalent programs with waivers for their specific requirements.

This approach was used by IKEA, Inc. to allow the redevelopment of the Barbary Coast Steel Plant site in Emeryville. IKEA, Inc., a Swedish retail company, and DTSC entered into a Prospective Purchaser Agreement (PPA) and Covenant Not to Sue in late 1997 in order to encourage IKEA to redevelop a 15.5 acre site in Emeryville and Oakland for IKEA's first Northern California furniture store and warehouse. The site had previously been owned and operated as a steel manufacturing plant by Barbary Coast Steel Corporation. Barbary Coast Steel conducted substantial cleanup activities in 1996 and 1997 under an approved Remedial Action Plan. Activities included building demolition, site-wide removal of contaminated soil, installation of groundwater monitoring wells and a site cap. The removed soil was contaminated with petroleum hydrocarbons, metals, pesticides, PCBs, and volatile and semi-volatile organic compounds. Barbary Coast steel will continue to monitor groundwater on and off the site, while IKEA agreed to construct and maintain a permanent site cap after its construction activities are completed.

More details on this project are available in an October 2001 Brownfields projects brochure on at: http://www.dtsc.ca.gov/SiteCleanup/Brownfields/SMP_Brownfields_Brochure.pdf

Private Site Management Program - This program allows a Registered Environmental Assessor (REA) to manage the clean up of low-risk sites with limited DTSC oversight.

Lead Agency Designation - This provides a “super certification” at the end of clean-up, e.g., certification that the site is clean according to all agencies involved, thereby reducing future liability. The effort is instead expended at the beginning of the project, as getting all the agencies on board at the front end is something of a challenge.

California Land Reuse and Revitalization Act of 2004 - This program is designed to “provide immunity from liability for response costs or damage claims to qualified innocent landowners, bona fide purchasers or contiguous property owners.” This law came into effect January 1, 2005, and has not yet been implemented.

6. Assessment of Options for Municipalities

As discussed in this report, monitoring of sediments in San Francisco Bay, along the Bay margins, in tributaries and stormwater facilities has revealed PCBs at levels above background throughout the Bay area. In general, elevated levels of PCBs have been associated with urban land uses. However, PCBs concentrations in sediments vary widely even within the subset of samples representing urban land uses. Stormwater runoff has been identified as a conveyance of PCBs and, therefore, approaches for municipalities to meet reduction goals are needed. The first steps in the approach will be to identify sources and conveyances within the municipality's service area and prioritize those sources and conveyances as necessary. These steps are described in Sections 2 and 3 of this report. The next step of the approach will depend on the source or conveyance to be addressed and will combine control options and management options discussed in Sections 4 and 5 of this report. In addition to the information presented in this report, approaches to identifying, prioritizing and abating PCB Sources are being developed through two ongoing Proposition 13-funded projects (i.e., the Ettie Street Pump Station watershed project described in Section 2.2, and SFEI's Regional Stormwater Monitoring and Urban BMP Evaluation). Information obtained from these projects should assist with some of the technical aspects of implementing the PCB TMDL. Management options that may be used for accumulated sediments, on-land spill sites, and unenclosed sources are discussed below.

6.1 Accumulated sediments

Accumulated sediments can be addressed through approaches described above including increased maintenance or upstream source identification as described for the Ettie Street Pump Station watershed project. Increased maintenance is within the direct control of the municipality and may be straightforward to implement because there may already be an established program with staff and resources that may only need to be augmented. An upstream source identification is a more costly route and may require municipalities to obtain grants or enter into partnerships as described in the section on management options. Other option to address accumulated sediments, depending on available resources, would be for a municipality to evaluate actions including reconstructing industrial area streets to remove or cap PCB-contaminated roadside soils, creating sweep-able pavement surfaces, and adding treatment for street runoff.

6.2 On-land spill sites

As discussed above, options to municipalities for addressing on-land spill sites will, in many cases revolve around working with other agencies to initiate or facilitate a cleanup through one of the programs available through Cal EPA. Depending on the site, these options can be addressed as follows:

> <u>For a contaminated site that is a candidate for redevelopment</u> – most cleanups occur in conjunction with redevelopment of the contaminated property. Municipalities can encourage redevelopment of PCB-contaminated sites. One option is for a municipality to partner with a developer, a redevelopment agency or school district to redevelop the site. The municipality's role would generally be assisting other agencies with regulatory oversight while other agencies, responsible parties and/or developers would generally bear the cleanup cost burden, excepting cleanups of municipal properties. Both redevelopment agencies and school sites have programs and funds available for cleanup of sites

that meet their criteria. As discussed in Section 5.6, Emeryville has apparently cleaned up sites under the 'Redevelopment Agency Process' twice successfully. School sites undergo a similar process that may be useful. Developers may also provide funding for site cleanups as was the case for IKEA as discussed above. DTSC's TSI program is another program that can be used to facilitate the redevelopment of a contaminated site by characterizing the site's contamination issues.

<u>For a contaminated site that is currently owned by an identifiable party/business but is not a candidate for redevelopment</u>– where a property owner is identifiable, there are regulatory approaches that can be used to abate immediate hazards (e.g., to require the owner to address PCBs that are migrating off of a property). A municipality can refer the site to local environmental health or appropriate hazardous waste agency for abatement of immediate hazards (e.g., PCB runoff) and eventual clean-up of the site with oversight by DTSC or the local hazardous waste regulatory agency. Programs are also available that will help limit current owner's liability helping to facilitate clean-up. Some of these were described above in Section 5.6 and include:

Voluntary Clean-up Program
Private Site Management Program

These programs are most likely to be useful at sites that are currently in use and that have economic value to the property owner. If a site does not have economic value to the owner, it may be functionally abandoned, which case cleanup is likely to be better addressed through the strategies described for abandoned properties (below).

<u>For an abandoned site that is known to be contaminated</u> -- options include municipalities working with other agencies, private entities and individuals to identify historical owners of record responsible for cleanup or asking state agencies for assistance. Specific tasks will include identifying PRPs and pursuing cleanup options with the PRP once identified. As discussed in Section 2.2.1.4, searches for historical owners can be pursued in a variety of ways, including title searches, searches in the files of DTSC, RWQCB, and local regulatory agencies. Additionally, Sanborn fire insurance maps, available for most of the Bay Area, can be found in the UC Berkeley library system or on-line from http://sanborn.umi.com. Other issues associated with Potential Responsible Parties are discussed in Section 5.2. If the PRP can not be identified or is insolvent, other funding sources such as the Expedited Remedial Action Program (ERAP) may potentially provide funding for site clean-up. This program and examples of such clean-ups Santa Cruz and Santa Rosa are described above in Section 5.6.

<u>For any site that is suspected—but not known—to be contaminated</u> – few options exist to force investigation of contamination suspected to exist on a property. Municipalities have the legal authority to access private property to conduct inspections and collect samples. However, not all municipalities have established the policies, structures and funding mechanisms to facilitate this. Requests for voluntary investigation can be made; however, property owners generally prefer to avoid the liability associated with identifying contamination, making them unlikely to comply with voluntary requests. If contamination can be proven to be migrating off of the property, a municipality can refer the site to local environmental health or appropriate hazardous waste agency for abatement of immediate hazards (e.g., PCB runoff) and eventual clean-up of the site with oversight by DTSC or the locally designated hazardous materials agency.

6.3 Unenclosed sources

Unenclosed sources of PCBs are mostly associated with building materials in older buildings. Fee-funded programs could be implemented for PCB-containing building materials at either the local or regional level. A local program has the advantage of convenient identification of remodeling and demolition projects through the municipal building permit function. However, a municipality-based program has the disadvantage of involving the need for each municipality to develop technical expertise on PCB-containing building materials, PCBs chemical testing, and appropriate abatement procedures. It also has the disadvantage of requiring every municipality to adopt individual requirements. A regional program has the advantage of centralization of specialized expertise (which could likely be fully fee-funded) and possible coordination with the BAAQMD asbestos demolition notification requirement (described below), but the disadvantage of difficulty to identify projects and to enforce requirements. Regional agencies or organizations (e.g., ABAG) could possibly coordinate such a program.

Approaches that may fit into the existing structure of a municipality's stormwater program include

- Expand municipal stormwater industrial inspection programs to include potentially PCB-contaminated sites (based on age of buildings and site history). Conduct tiered evaluations of each site's potential for PCB hazard to water quality. Require remediation under existing municipal stormwater pollution-prevention ordinances, including removal or fixing of PCB-containing paint and caulk, removal of contaminated soils, regrading, and repaving.
- Require retrofitting of some commercial/industrial sites or areas with stormwater treatment facilities similar to those being implemented for new development sites in some municipalities.
- The municipality may also want to consider requiring evaluation of potential PCB releases, and mitigation plans, as a condition of demolition permits.

While these approaches could be incorporated into an existing program, the resources necessary to implement these programs would need to be considered and compared to resources needed to implement other approaches.

Asbestos is a commonly present hazardous component of older buildings and, therefore, may provide a useful example for developing a regional approach to addressing environmental releases of PCBs that may be associated with remodeling and demolition. The hazards associated with air emissions during building remodeling and demolition were recognized in the Bay Area by 1976, when the BAAQMD adopted the first version of its rule to require building surveys and proper asbestos removal prior to building demolition or remodeling (BAAQMD 1998). Since its 1976 adoption, the BAAQMD rule has been amended at least 3 times (1990, 1991, and 1998) to bring it to its current form (BAAQMD 1998).

The rule establishes a fee-funded program to prevent emissions of asbestos during demolition and renovation, and to ensure proper asbestos waste disposal (it also includes other elements unrelated to buildings). The rule (BAAQMD 1998) requires that:

- For every renovation involving the removal of 100 square feet, 100 linear ft, or 35 cubic feet or greater of asbestos, and for <u>every</u> demolition (even when no asbestos is present), BAAQMD must be notified at least 10 working days (except in special circumstances) prior to commencement of demolition/renovation.
- Prior to building demolition, an asbestos survey must be performed. The person who performs the survey must be California Occupational Safety and Health Administration (Cal/OSHA) certified and must have taken and passed an EPA approved building course.

- Specific procedures must be followed when removing asbestos.

BAAQMD uses its existing field inspector team to enforce these requirements.

While this program provides a good model for a program to address unenclosed sources of PCBs, the BAAQMD has not identified PCBs as an air pollutant of concern. However, an analogous program may be possible based on concern over potential releases of PCBs to surface water and sediments through the Water Board or municipalities. Water Board programs have not previously addressed releases of this nature related to demolition and renovations. While the Water Board does not have the authority to dictate specific management measures, they can require that dischargers utilize management measures to control runoff to protect water quality (i.e. prepare a management plan or include in a SWPPP specific measures that are designed to control PCBs from entering storm drains when demolishing buildings). Regulatory options may be available to the Water Board to implement a program for PCBs similar to the BAAQMD asbestos program through its construction or industrial stormwater permitting programs. This would require the Water Board to identify the resources to develop a new program. Another possible approach may be a locally run but regionally coordinated program.

6.4 Regulatory authority

Many of the programs described above rely on working with other agencies who are designated to oversee hazardous waste and hazardous materials programs. However, in some instances a municipality may identify a property or a business within its jurisdiction for which local regulation is warranted. While most stormwater ordinances provide some regulatory authority over businesses in the service area, lead regulatory cleanup authority typically rests with state agencies or CUPAs

A review of some Bay Area stormwater ordinances indicates that the legal authority is available for stormwater agencies to require some type of action by businesses or property owners for sites that are identified as sources of PCBs. The Alameda County Stormwater Management and Discharge Control ordinance (Chapter 13.08 of the Alameda County code) is a typical example. Section 13.08.070.A. prohibits the 'discharge of nonstormwater discharges to the county stormdrain system.' Exceptions to this prohibition include discharges that are permitted through an NPDES permit and specifically identified discharges that are not considered to contain pollutants (i.e., discharges from potable water source, landscape irrigation, irrigation water, diverted groundwater, foundation and footing drains, water from crawl space pumps, air conditioning condensation, dechlorinated swimming pool discharges, etc.). In addition, according to Section 13.08.100, 'any person engaged in activities which will or may result in pollutants entering the county stormdrain system shall undertake all practicable measures to reduce such pollutants.' Stormwater agencies have the legal authority to inspect any building or property for which there is reasonable cause to believe that it is a source of pollutants and to take enforcement actions against any person violating the requirements laid out in the stormwater ordinance. In addition, Section 13.08.250 requires coordination with the county's hazardous materials inventory and response program. 'The first revision of the business plan for an facility subject to the county's hazardous materials inventory and response program shall include a program for compliance with the chapter, including the prohibitions on nonstormwater discharges and illicit discharges, and the requirement to reduce stormwater pollutants to the maximum extent practicable.'

These requirements are consistent with the Federal Guidance (USEPA 1991) regarding adequate legal authority for a stormwater program. A stormwater program should have the authority to

- Control…the contribution of pollutants to the municipal storm sewer by storm water discharges associated with industrial activity
- Prohibit illicit discharges
- Control the discharge to the municipal storm sewer of spills, dumping or disposal of materials other than stormwater
- Require compliance with conditions in the ordinance
- Carry out all inspection, surveillance and monitoring procedures necessary to determine compliance and noncompliance

Therefore, if a site is identified with PCB contaminated sediment or with runoff containing PCBs at a level of concern, a municipality may assist in identification of potentially responsible parties and/or it may use its stormwater quality authorities to require the current property owner to take action to contain or clean up the site. It should be noted that while local governments may have the regulatory authority in place to require actions by business and property owners, they may not have established the mechanisms and procedures needed to facilitate and oversee such actions. Further, because this would be an untested or new approach, the development of a program based on using stormwater control and/ or nuisance abatament authorities to require abatement of contaminated sites may result in unanticipated legal challenge by property owners. Therefore, in many cases, the municipality may choose to work with other agencies to provide regulatory oversight of a cleanup. The municipality may also choose to establish the mechanisms and procedures that would be needed to provide regulatory oversight themselves.

The type of control strategy being pursued will influence the municipality's decision to work with another agency or to develop regulatory procedures of its own. For contaminated site-clean up, the regulatory responsibility typically lies with DTSC, the Water Board or the local hazardous waste regulatory agency. Therefore, in these cases, the municipality would choose to partner with the agency with regulatory responsibility. For unenclosed sources, the control strategy would most likely be to develop a program working with businesses to identify potential PCB sources (i.e., buildings constructed with PCB containing materials) and potential releases (i.e., demolition or remodeling projects). This may mean creating or expanding a business inspection program and/or the municipality's new development program. Regulatory elements of these programs would be the municipality's responsibility and the municipality would need to make sure that the mechanisms were in place to utilize its regulatory authority. For conveyances with accumulated sediments, these are generally directly under the municipality's control to address and would require no additional regulatory authority to implement control strategies. The exception would be if the conveyance were on private property. In this case, the municipality would need to exert its regulatory authority over the property owner if needed.

6.5 Potential approaches for implementation

Municipalities will be responsible for implementing actions to address PCB sources and conveyances. The basic steps that comprise an implementation approach are discussed below and a potential set of actions is found in Table 10. Actual PCB TMDL municipal implementation actions are currently under negotiation as part of development of a stormwater NPDES Municipal Regional Permit.

As a first step, municipalities could review and identify the sources and conveyances in their jurisdiction. Specific actions may include:

- Review of databases to identify contaminated sites in the municipality
- Review of businesses in service area to identify potential use or release of PCBs

- Historical review of buildings in service are to identify buildings that may have been constructed using PCB-containing materials
- Monitoring/ inspection of identified sites/businesses/buildings to further characterize PCB contamination or releases.
- Characterization of sediments accumulated in stormwater conveyances to assess PCB levels.

Ideally every identified site would be targeted for mitigation. However, resources may dictate a phased approach and require municipalities to prioritize identified sources and associated implementation actions. Prioritization is part of an iterative process to source control. As actions are implemented and progress is evaluated, additional actions may be added. In addition, as more information is obtained regarding sources, priorities may be reassigned.

One approach to prioritization would be to use monitoring results obtained to date to set some initial thresholds for implementation. As discussed above, the median PCBs concentration in sediments from urban land uses was 310 μg/kg with the 75th and 85th percentile values being 1300 μg/kg and 2100 μg/kg respectively. The San Francisco Bay Water Board developed screening values of 8.6 μg/kg and 22 μg/kg for coarse and fine grain sediments, respectively, based on the Regional Monitoring Program (RMP) and the Bay Protection and Toxic Cleanup Program (BPTCP) (Gandesbery, et. al., 1998). These values may be potential candidates for setting guidelines regarding whether further source investigation is warranted.

Another approach to prioritization for implementation would be to develop screening level estimates of loads associated with identified on-land sites or conveyances containing accumulated sediments. Another element of prioritization will be to evaluate the technical and economic feasibility of remediating an identified source and the associated reduction in PCB contamination that may be achieved.

Sites with significant PCB contamination should be addressed once they are identified. The approach to remediation will depend on the source of contamination.

- <u>On-land spill sites</u> –The effectiveness of pursuing clean-up of contaminated sites may depend largely on if the site is a candidate for redevelopment. For sites that are not candidates for redevelopment, a more detailed evaluation of ways to use the existing regulatory authorities of the Water Board and municipalities is needed. For redevelopment candidates, a range of programs and initiatives are available to facilitate the process. An initial step to addressing these sites will be to find PRPs and acquire funding for cleanups. Characterization of sites may benefit from DTSC's TSI program. "Orphan site" clean-ups may benefit from the ERAP program. In addition, as described in Section 5.6, several other programs are available to facilitate clean-up of contaminated sites. Clean-ups will not be the sole responsibility of the municipality and will likely require working through EPA programs and partnering with the appropriate local designated hazardous materials agencies. Municipalities may want to work with Water Board staff to develop standardized procedures through the SLIC program to facilitate the remediation process.
- <u>Accumulated sediments in stormwater conveyances</u> – Municipalities can take a direct role in addressing this source through maintenance procedures, or they can investigate upstream sources and use regulatory authority to work with property owners. Education and outreach materials describing programs available to assist with clean-up could be developed as part of a program to address identified upstream sources.
- <u>Unenclosed sources</u> – For areas and/or specific buildings identified as being likely to contain PCB-containing materials, municipalities may choose to conduct analysis of building materials or soil adjacent to the building to further characterize PCB releases. Municipalities may choose to work

with their Building and Planning Departments to develop procedures associated with redevelopment, demolition and remodeling. The probability for remodeling, maintenance or demolition that may release PCBs should be assessed. Municipalities can use regulatory authority to require BMPs for proper containment and disposal during demolition, redevelopment, remodeling and maintenance as appropriate.

Some of the activities associated with achieving PCB reductions lend themselves to a regional effort to assist municipalities and avoid duplication of effort. These activities include

- Researching unenclosed PCB applications to determine which building materials contain PCBs and when and where they were used. There may be a partnering opportunity through the RMP or through SFEI's Proposition 13 project. The purpose of this project is to evaluate urban best management practices (BMPs) as control strategies for particulate-associated pollutants such as PCBs and mercury.
- Conducting a technical and economic feasibility assessment and prioritization of the source investigation and control strategies discussed in this report. An economic analysis of the no-action alternative (i.e., not remediating a contaminated site) should be included in such an assessment.
- Conduct a more detailed legal review regarding municipal and state authorities to act to address PCBs sources and PCB-contaminated properties. This review should include (1)evaluation of the water board's authorities to regulate PCBs directly (e.g., building materials during construction), which sections of the water code provide the most defensible authority to take action (2) municipal abilities to use stormwater control, nuisance abatement and other authorities to require investigation of and abatement of PCB-contaminated properties. This may entail recommendations for ordinance modification and/or procedures to ensure that authorities are properly used in a manner that is not pre-empted by hazardous waste laws. (3) evaluation of possible conflicts with existing hazardous waste laws and other possible legal challenges that may result from efforts to require investigation and abatement of PCB contamination.

Table 9. Implementation Options for Municipalities

Action	Tools / Sub-tasks	Implementing Agency
Source Identification & prioritization		
Identify PCB contaminated sites in service area	Online databases, DTSC & Waterboard records, site investigations	Individual municipalities
Research types and age of structures that would most likely contain PCB-containing materials	Define procedures to identify which structures are most likely to contain these materials.	One-time regional study
Identify unenclosed PCB sources in service area	Use procedures identified above to identify structures. Review building & planning department records, Sanborn maps, other local agency records, site investigations	Individual municipalities
Identify areas likely to have elevated levels of PCBs in sediments	Evaluate based on information obtained for contaminated sites and unenclosed sources	Individual municipalities
Evaluate accumulated sediments in conveyance systems	Conduct sediment monitoring, upstream investigations in identified areas	Individual municipalities
Prioritize identified sources for further action	Prioritization conducted periodically as information on sources is developed. Tools include: • Screening level load estimate • Concentration evaluation • Ease of implementation/ cost • Potential for runoff • Other factors	Individual municipalities
Remediation options/ control strategies		
Conduct demonstration project to address on-land sites	• Identify 6-10 sites split between redevelopment candidates and sites that are not targeted for redevelopment • Determine most effective approach for municipalities to mitigate runoff from on-land sites	Conducted as regional effort by multiple municipalities
Develop individual municipal plan for on-land sites	• Use approaches identified in demonstration projects to address candidates for redevelopment and sites not targeted for redevelopment	Individual municipalities
Unenclosed sources BMP development	• Develop BMPs for dealing with disposal during remodeling and demolition • Develop education materials and procedures	Regional effort
Unenclosed sources regulatory strategies	• Evaluate existing regulatory authorities and programs to determine approaches to enforcing requirements as necessary	Regional effort
Unenclosed sources education and outreach program	• Work with building departments to create protocols for identifying sources • Conducting outreach regarding BMPs	Individual municipalities or regional effort as appropriate
Unenclosed sources regulatory approaches	• Implement programs to require measures to prevent runoff from unenclosed sources	Individual municipalities or regional effort as appropriate
Develop plan for addressing accumulated sediments in	• Revise maintenance programs to increase sediment removal	Individual municipalities

Action	Tools / Sub-tasks	Implementing Agency
conveyance systems based on source evaluation	• Conduct upstream investigations to identify ultimate PCB sources to sediments.	
Periodic review of effectiveness of implemented strategies to determine future directions	• Monitoring • BMP implementation review • Other effectiveness measures	Individual municipalities or regional effort as appropriate

Note:

Further analysis of the feasibility of the above implementation options for municipalities is needed, including quantitative evaluation of costs and benefits. Factors other than strict cost-effectiveness may be important in assessing feasibility, such as the likelihood of identifying responsible parties or obtaining state or federal funding for identification and cleanup of on-land PCBs sites. The benefit of implementing strategies that address multiple sediment-bound pollutants should also be taken into consideration.

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Appendix A. Databases Containing Information on PCB Contaminated Sites

Database	Web Address	Responsible Agency	Criteria for Inclusion in Database	Description
Accidental Release Information Program (ARIP)	http://yosemite.epa.gov/oswer/ceppoweb.nsf/content/ds-epds.htm#arip	EPA	Significant release of a hazardous substance	The ARIP database collects information on accidental releases of hazardous chemicals at fixed facilities. Facilities submit information on their facility, the circumstances and causes of a particular spill, and the accidental release prevention practices and technologies in place prior to, and added or changed as a result of, the event. The current version was updated in July 2000. This database contains incidents from 1986 to 1999. This database contains information on facilities throughout the country. It can be downloaded to an Excel file and sorted. Larry Walker Associates (LWA) can provide a sorted version of this database to the Clean Estuary Partnership (CEP).
PCB Transformer Registration Database	http://epa.gov/pcb/data.html	EPA	Transformer with greater than 500 ppm PCBs	This database contains information submitted by facility owners on PCB-containing transformers on their property. The last update was July 2004. This database contains information on facilities throughout the country. It can be downloaded to an Excel file and sorted. Larry Walker Associates (LWA) can provide a sorted version of this database to the CEP.
National Priorities List (Superfund) Database	http://www.epa.gov/superfund/sites/query/basic.htm	EPA	Hazardous waste site	This database can be searched by pollutant and county making the information very accessible. These profiles are very comprehensive and provide plentiful information on site histories.
PCB Activity Database (PADS)	http://epa.gov/pcb/data.html	EPA	Generator, transporter, or permitted disposer of PCBs	The PCB Activity Database System (PADS) is used to monitor the activities of polychlorinated biphenyls (PCB) handlers. The database is updated quarterly with the most recent update in September 2004. PCB handlers submit information on their facilities including the type of activities where they handle PCBs. This database contains information on facilities throughout the country. It can be downloaded to an Excel file and sorted. Larry Walker Associates (LWA) can provide a sorted version of this database to the CEP.
Envirofacts Multisystem Database	http://www.epa.gov/enviro/html/multisystem_query_java.html.	EPA	Varies depending on each database	The Envirofacts Query Form allows 13 of EPA's environmental databases to be searched for facility information, including toxic chemical releases, water discharge permit compliance, hazardous waste handling processes, Superfund status, and air emission estimates. This database can be searched by pollutant as well as county. NPDES permits are included in this database, so not all results indicate a contamination problem.

Database	Web Address	Responsible Agency	Criteria for Inclusion in Database	Description
Spills, Leaks Investigation & Cleanups (SLIC) Database	http://www.swrcb.ca.gov/rwqcb2/Lustis/SLIC.xls	SWRCB	Unauthorized discharge polluting or threatening to pollute a waterbody	This database includes facilities throughout California. It can be sorted by city or county. A keyword search for "PCB" or "polychlorinated biphenyls" can locate sites of concern. Larry Walker Associates (LWA) can provide a sorted version of this database to the CEP.
Leaking Underground Storage Tank Information System (LUSTIS)	http://www.swrcb.ca.gov/rwqcb2/Lustis/Lustis.xls	SWRCB	Leak from underground storage tank	This database includes facilities in Region 2. It is sorted by city but a keyword search for "PCB" or "polychlorinated biphenyls" can locate sites of concern. No PCB contaminated sites were found in this database.
DTSC's CalSites	http://www.dtsc.ca.gov/database/calsites/calf001.cfm	DTSC	Site has confirmed hazardous contamination	This database can be searched by county but not by pollutant. Once contaminated sites within a county of interested are retrieved, profiles on individual facilities must be read to ascertain if PCBs are a concern. These profiles are, for the most part, very comprehensive and provide plentiful information on site histories.
DTSC's Cortese List	http://www.dtsc.ca.gov/database/Calsites/Cortese_List.cfm	DTSC	Site has potential or confirmed hazardous contamination	The Hazardous Waste and Substances Sites (Cortese) List is a planning document used by the State, local agencies and developers to comply with the California Environmental Quality Act requirements in providing information about the location of hazardous materials release sites. DTSC is responsible for a portion of the information contained in the Cortese List. Other State and local government agencies are required to provide additional hazardous material release information for the Cortese List. This website provides DTSC's portion of the Cortese List, which consists of the Calsites database and sites that are Certified with Operation and Maintenance. Similar to CalSites, this database can be searched by county but not by pollutant. Once contaminated sites within a county of interested are retrieved, profiles on individual facilities must be read to ascertain if PCBs are a concern. These profiles are, for the most part, very comprehensive and provide plentiful information on site histories.

Database	Web Address	Responsible Agency	Criteria for Inclusion in Database	Description
DTSC's Voluntary Cleanup Fund	http://www.dtsc.ca.gov/database/calsites/calf001.cfm	DTSC	Voluntary investigation and/ or cleanup where contamination is a low threat to public health or the environment	This database can be searched by county but not by pollutant. Once contaminated sites within a county of interested are retrieved, profiles on individual facilities must be read to ascertain if PCBs are a concern. These profiles are, for the most part, very comprehensive and provide plentiful information on site histories.
Site Mitigation and Brownfields Reuse Program (Calsites) Deed Restrictions	http://www.dtsc.ca.gov/database/calsites/deed_list_contaminant.cfm	DTSC	Site has use limits placed by DTSC due to possible or necessary cleanup	This database can be searched by pollutant or county and includes 25 sites with PCB material contamination and 18 sites with PCB contamination. Searching for sites in the Bay Area will not be time-consuming. Larry Walker Associates (LWA) can provide the current list as of January 18, 2005 to the Clean Estuary Partnership.
Hazardous Waste Management Program (HWMP) Deed Restrictions	http://www.dtsc.ca.gov/database/LUC/county_list.cfm	DTSC	Site has use limits placed by DTSC due to possible or necessary cleanup	This database reports results in two parts: deed notices and land use restrictions. The database can be searched by county but not pollutant. There are only 32 sites in this entire database, so searching it is not time consuming.
National Repsonse Center Data	http://www.nrc.uscg.mil/foia.html	US Coast Guard	All chemical and oil spill data reported to the National Response Center is available on this site.	This database can be searched by pollutant and county, cityh or state. Other more specific information can also be queried. Spill reports include date, location and a description of the spill incident.

Appendix B. Unenclosed PCB sources

This section reviews unenclosed PCB sources that may occur in the San Francisco Bay Area[1].
A recently updated report from the organization that manages the Convention for the Protection of the Marine Environment of the North-East Atlantic (the "OSPAR Convention") provides a wealth of information on PCB sources, particularly unenclosed sources (OSPAR 2001; updated 2004).[2] The report is based on PCB data from a survey of most OSPAR members. Such recent comprehensive data does not appear to exist for North America. According to the OSPAR inventory, in Northern Europe the primary open applications of PCBs remaining are grouting, sealants, paints, and plasticizers. Remaining open applications are products with long service lifetimes, such as building materials. OSPAR concluded that sealants were probably the most important still relevant source of PCB emissions from open applications (OSPAR 2001).

Because the literature review suggests that sealants (including caulking and grout) and paints and other coatings are potentially significant uncontrolled sources of PCBs in urban environments, the discussion below focuses on these two sources.

B.1 Caulking and Sealants

PCB-containing sealants were used to seal joints between masonry units and around windows in various types of concrete structures, including buildings, dams, water tanks, and bridges. The literature survey suggests that this may have been a common practice in the 1950s, 1960s, and 1970s (Herrick et al. 2004; OSPAR 2001; Government of Western Australia 2002).

In Boston, 24 concrete structures were surveyed to determine if PCBs were present in building caulking. One third (8 of 24) of the buildings had caulk with concentrations exceeding 50 mg/kg by weight; the highest measured concentration was 36,200 mg/kg (Herrick et al. 2004). The authors of this investigation believe that the surveyed structures were not unique; many urban buildings likely contain caulking with high concentrations of PCBs (Herrick et al. 2004). Other U.S. data are quite limited. Identified examples include caulking at a school with up to 310,000 mg/kg PCBs and grout in the joints and cracks of a water reservoir with up to 2,700 mg/kg PCBs (USEPA 1999a).

The Swiss government conducted a national survey of sealants in 1,348 buildings constructed between 1950 and 1980 (Kohler et al. 2005). They found 48% of sampled sealants contained PCBs. Almost 10% of the samples contained more than 10% PCBs (100 mg/kg) by weight. The sealants most commonly appeared in buildings constructed between 1955 and 1975. The highest frequency was in buildings constructed between 1966 and 1971—more than one third of these buildings contained sealant with PCB concentrations exceeding 1% PCBs (10 mg/kg) by weight. The study estimated that there are 50-150

[1] The information in this section was obtained through an abbreviated literature review. A follow up review of scientific literature (including use of literature search databases) is recommended. Much of the information in this appendix comes from the gray literature. However, most of the PCB concentration values were obtained from USEPA or from multiple sources with similar values, suggesting that these data are appropriate for screening-level estimates. Cost data were much more limited—as such, they have a very high uncertainty.

[2] The OSPAR Convention is an agreement among Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland and the United Kingdom and approved by the European Community and Spain. It took effect in 1998. OSPAR has placed PCBs on its "List of Chemicals for Priority Action."

metric tons (50,000 to 150,000 kg) of PCBs present in Swiss buildings. Note that the population of Switzerland (7.3 million) is similar to that of the Bay Area (6.8 million); however, building construction dates and methods may differ.

In Australia, government reports indicate that prior to 1980, PCB-containing caulk was used to seal expansion joints in nearly every concrete structure; for example, PCB-containing caulk was used in office buildings, bridges, parking structures, entertainment facilities, and water storage tanks (Government of Western Australia 2002). Government data indicates that these sealants may contain as much as 30% PCBs (300,000 mg/kg).

PCB-containing sealants are common in Sweden, where an aggressive housing program catalyzed the construction of many concrete buildings in the 1960s and 1970s (von Bahr and Janson 2004). As a result, the Swedish building industry launched a voluntary campaign to get building owners to survey affected structures and replace any PCB-containing sealants. By 2003, about 10% of building owners had completed the replacement. This program stimulated many government and scientific studies of the sealants. The data on sealants from these studies indicate significant PCB concentrations: one study gives concentrations from 87,000 mg/kg to 180,000 mg/kg (Ljung et al. 2002); in another concentrations range from 80,000 mg/kg to 160,000 mg/kg (Astebro et al 2000). Similarly, a German survey showed an average sealant PCB content of 110,000 mg/kg (OSPAR 2001).

Figure B-1. Caulking compound in an expansion joint of a concrete structure.
Photo source: Department of Consumer and Employment Protection, Government of Western Australia

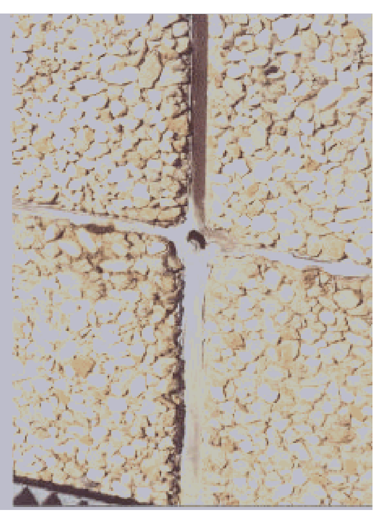


Figure B-2. PCB-containing sealants in concrete buildings.
Photo on the right is a close up of the sealant junction. Photo source: (Stockholms Stad 2000)

The caulking in these structures releases PCBs into the environment. While the PCB-containing material is in place, PCBs can migrate into surrounding materials, air and soil (Ljung et al 2002). In the Boston study, dust taken from the building ventilation system contained up to 81 mg/kg PCBs (Herrick et al. 2004). Two Swedish studies note elevated PCBs concentrations in soils near buildings (Ljung et al. 2002; Astebro et al. 2000).

One study was identified that estimated the PCB releases during replacement of a PCB-containing sealant in a 7 story concrete building in Stockholm (Astebro et al. 2000). The researchers measured the PCB content of each waste stream, with the following results:

- 70 kg of PCBs were in the removed sealant material, which was sent off for proper disposal;
- 2.5 g was estimated lost into the soil at the site during the cleanup (soil concentrations increased after removal);
- 2-20 g were washed into water (the building was pressured washed after the caulk was removed); and
- 0.6 to 1.3 grams were emitted into air during replacement (Astebro et al. 2000).

In less controlled circumstances, such as those where the sealant was removed without special precautions, greater losses to soil and water would be expected.

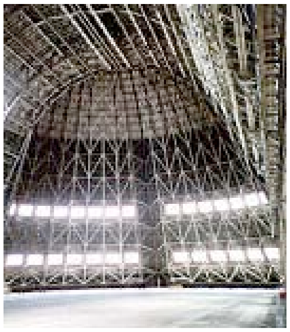
Von Bahr and Janson 2004 used Swedish cost data to estimate that the cost of PCB-containing sealant removal and proper disposal is about 18 Euros/meter of sealant. Assuming costs are similar in U.S. this would translate (at April 2005 conversion rates) to $23/meter for replacement.

B.2 Paint and Coatings

PCBs were a component of paint and coatings from the 1930s until the late 1970s (USEPA 1999a; Gill et al. 1997). PCBs were used as drying oils and as plasticizers or softening agents (USEPA 1999a). A USEPA survey found PCB-containing coatings with PCB concentrations from <1 to 97,000 mg/kg (dry weight) (USEPA 1999a). These coatings included waterproofing compounds, anti-fouling compounds, and fire retardant coatings. The literature suggests that the most common applications were on concrete surfaces, industrial equipment, surfaces requiring waterproofing, metal structures (including pylons and bridges), and military buildings (constructed of any material, including wood and metal).

OSPAR estimated the useful lifetime of these paints and coatings to be 25-40 years (OSPAR 2001). After the functional lifetime, the coating may remain in place physically, but is more likely to degenerate (and thus become easier to wash off (e.g., paint chips).

The literature review identified a number of examples of PCB-containing coatings, which are summarized below:



ıngar 1 Interior
otograph by Judith
/a,courtesy of the City
Santa Clara

Hangar 1 Exterior

Military facility building paint. PCB-containing paints and coatings were apparently used at many U.S. military facilities (USEPA 1999a). An example in the San Francisco Bay area is the coating on the largest hangar at the former Moffett Naval Air Station (Hangar 1). Hangar 1, located at the former Moffett Naval Air Station in Mountain View, was constructed to house the airship USS Macon in 1932. The floor of the hangar encompasses approximately 8 acres (~10 football fields) and has an indoor height of 200 feet. The interior of the building is so large that fog sometimes forms near the ceiling. In 1997, PCBs as Aroclor-1268 were detected in sediments in adjacent wetlands, used as a stormwater retention pond (called Site 25) for the facility and the runway area. As a result of various investigations, it was discovered that the siding comprising Hangar 1 consists of a composite of asbestos and PCB Aroclor-1268 painted with lead based paint. This is also the case for the material comprising the roof of Hangar 1. Pieces of building material have been detaching from the building and discharging into the wetlands via stormwater runoff. Based upon this information, the Navy completed a Time Critical Removal Action in February 2004 to reduce wetland contamination by coating the surface of Hangar 1 with special sealant paint along with focused interim sediment removal.

The Canadian government found PCBs in point on numerous military buildings at many locations in the Canadian Arctic, with PCB concentrations from <1 to 74,000 mg/kg (Gill et al. 1997).

Coatings for concrete. Coatings for concrete may contain PCBs. The extent of this use has not been documented; however, individual incidents have been very well documented in site investigations and remediation plans. In a recent well-publicized case, the Big Springs Fish Hatchery (operated by the State of Montana) was found to have a substantial amount of PCB-containing paint, apparently used as a waterproofing coating on concrete hatchery structures (e.g., raceways). The coating contains 0.07% PCBs (red paint) and 8.65% PCBs (blue-green paint). In total, the hatchery contains almost 200 pounds of PCBs (Montana Fish, Wildlife, and Parks 2004). Water released from the fishery has contaminated the creek downstream (this may be from PCBs leaching from the coating since its application and/or from flaking off of the deteriorated coating). Planning for the remediation is currently actively underway (USEPA 2005). The remediation plan involves removing the approximately 55,000 square feet of PCB-containing coating and sealing the concrete beneath to prevent release of PCBs that have migrated into the concrete. Estimated cleanup costs are $400,000 to $800,000 (Montana Fish, Wildlife, and Parks 2004); this is about $7 to $15 per square foot.

Chlorinated rubber paint used on industrial equipment. From the 1950s through the 1970s, chlorinated rubber paint commonly contained PCBs, which served as a plasticizer in this otherwise brittle paint (Himes 2001). Such coatings reportedly contained about 15-25% PCBs, dry weight (Himes 2001). This type of paint may have been the most common PCB-containing paint (Himes 2001). This type of paint was used on industrial equipment, such as furnaces, heat exchangers, milling and grinding machinery, hydraulic pump motors, lathes, prior to 1979 (Himes 2001).

Coal-tar enamel coatings for steel water pipe and underground storage tanks. According to USEPA, this type of coating (e.g., AWWA C203 coal tar enamel), which has PCB concentrations of up to 1,300 mg/kg, was used in some older Army, municipal and private water supply systems (USEPA 1999a).

Roofing and siding materials. USEPA reported that roofing and siding materials with PCB-containing coatings (<2 mg/kg to 30,000 mg/kg) were marketed as Robertson Protected Metal (RPM) and Galbestos to airlines, railroads, chemical plants, steel mills, mines, industrial/manufacturing facilities, and military facilities (USEPA 1999a).

Coatings for ceiling tiles. In a USEPA survey, ceiling tiles contaminated with PCBs (surface concentrations up to 53 mg/kg) were reported at educational institutions (USEPA 1999a). USEPA did not identify any information about the use of such coated ceiling tiles (USEPA 1999a).

B.3 Other PCB uses that may release PCBs to the environment

Many other PCB sources were identified in the literature review. These are briefly described below.

Natural Gas lines condensate. PCBs appear in condensate in natural gas lines. (This condensate is comprised of condensed hydrocarbons that drop out of gases onto surfaces of gas lines.) PCBs were used as lubricant in compressors on natural gas distribution systems and despite years of removal and mitigation efforts on the part of gas pipeline and distribution companies, PCBs remain in the systems (Erickson, 1997). These PCBs may be released to the environment during gas line leak incidents. PCBs originally entered natural gas lines from various sources, such as valve sealant, compressor pump oil; turbine oil, and line "fogging" with waste oil that contained PCBs (NNG 2003). Gas providers can monitor lines and clean them and install filters in locations where PCBs are identified. USEPA is aware of the presence of PCBs in gas lines; it has sought testing and formal management of pipelines where condensate PCBs concentrations exceeded 50 mg/kg. No quantitative information about presence of PCBs in Bay Area gas lines, release frequency, or cleanup methods was identified.

Insulation and sound-dampening materials. According to USEPA, "[t]he use of PCB-contaminated fiberglass insulation may be widespread throughout the United States." (USEPA 1999a). In a survey of Federal government-owned buildings, fiberglass insulation contained <1 to almost 40,000 mg/kg PCBs. Wool felt and foam rubber insulation and sound-dampening materials in ships and submarines have been reported to contain PCB concentrations from <1 mg/kg to almost 700,000 mg/kg (USEPA 1999a). PCBs in insulation and sound-dampening materials would be released to the environment during remodeling and demolition. The lifetime of these PCB-containing materials can be assumed to be the same as the structure they are in; in other words, these materials are likely to remain in place until the structure they are in is remodeled or demolished. There is no requirement to identify and remove these materials prior to remodeling or demolition.

Plastics, small foam rubber and rubber parts, adhesive tape, and insulating materials. While USEPA information implies that these uses were generally limited to products for electrical cabling (USEPA 1999a), data from elsewhere suggests that they were quite widespread (OSPAR 2001). According to USEPA, PCBs may be in electrical cable components at concentrations ranging from <1 mg/kg to 280,000 mg/kg PCBs (USEPA 1999a). The uses of these cables are not known. OSPAR suggests broader uses of PCBs as a plasticizer for rubber (at concentrations from 20-70% PCBs) and synthetic resins (at concentrations from 50-70% PCBs) and in adhesives (at concentrations from 20-55% PCBs) (OSPAR 2001).

Fluorescent light ballasts. Old fluorescent light fixtures (pre-1978) have PCB-containing ballasts, which contain about 30 - 45 g of liquid PCBs (USEPA 1999a). These may also contain PCBs in associated "potting materials" (petroleum-asphalt insulating material) (USEPA 1999a). While facilities managers are generally aware that older fluorescent lights may have PCB-containing ballasts—and therefore can be anticipated to manage them properly—others (like homeowners) may not be aware of them. There is no specific legal requirement to identify and remove these ballasts before they leak or prior to building renovation or demolition. PCBs in fluorescent light ballasts could be released to the environment when the ballast leaks (if the material is tracked outside) or during remodeling and demolition. Programs for disposal and management of PCB-containing materials, including fluorescent light ballast, are administered by DTSC.

Small Capacitors. PCBs may be present in small capacitors in old appliances, such as refrigerators, air conditioners and washing machines, and as starting aids for small motors (USEPA 1999b). PCBs could be released to urban surfaces if the capacitor leaks (and the material is tracked outside) or when the appliance is disposed of (if the capacitor does not maintain its integrity during transport to the landfill). Given that the typical lifetime of such appliances is less than 30 years, most such appliances should already have gone out of service, limiting the potential for this source to be a meaningful current PCBs release source.

Electrical Equipment. The most well-known and well-regulated source of PCBs is leaks and spills of PCB-containing dielectric fluid from transformers and other electrical equipment. USEPA has attempted to inventory and manage this PCBs source; however, its management methods do have gaps that allow PCBs to remain in the community. One of the biggest gaps is privately held non-utility owned electrical equipment, some of which was not properly inventoried. For example, voltage regulators, electromagnets, switches, circuit breakers, reclosers, cable, and rectifiers may still contain unidentified PCBs (USEPA 1999b). Another issue is that USEPA does not require that all possible PCB-containing equipment be inventoried; for example, utility pole transformers are usually not tested until they are removed from service. Self-reports of PCB uses in the Bay area identified approximately 100 PCB-containing transformers in the Bay area in 1999 (SFRWQCB, 2004).

Gaskets in duct systems. USEPA reported that older government buildings had heating, ventilation and air conditioning (HVAC) system gaskets with PCB concentrations of up to 18,900 mg/kg; however, it is not known whether PCB-containing gaskets in HVAC and other duct systems represent a widespread use (USEPA 1999a). The government-identified gaskets were of generic design, suggesting that it is possible that they were installed in commercial and industrial buildings (USEPA 1999a).

Gaskets in Insulated Windows. In Europe, PCBs were used as a plasticizer in the seal between the layers of glass in insulated window glass panes in windows manufactured between 1956 and 1972 (von Bahr and Janson 2004). The Swedish EPA estimates that about 70% of such windows have already been replaced (von Bahr and Janson 2004). It is not clear whether such windows were used in the U.S.

Hydraulic Oils. The historic use of hydraulic fluids containing PCBs has potential to result in past releases to the environment, since hydraulic systems were designed to leak slowly to provide lubrication (Binational Toxics Strategy, 1998).

Other. The following additional sources were mentioned in the literature, but no details on these uses were found in the literature review:

- Wood preservatives
- Dust, erosion and weed and insect control sprays (ingredient or extender, e.g., railroad lines)
- Flooring and floor wax/sealants

Appendix C. Additional Funding Sources

US EPA Brownfields Grants and Loans
http://www.epa.gov/region09/waste/brown/grants.html

According to information on this website, $200,000 to $700,000 is available annually for assessment and clean up grants, and up to $1 million in loan funds for site clean-ups. For additional information, the contact for general program related questions is:

Jim Hanson, Brownfields Team Leader
(415) 972-3188
hanson.jim@epa.gov

DTSC Brownfields Cleanup Programs
Contact: Lynn Nakashima
Department of Toxic Substances Control
(510) 540-3839 LNakashi@dtsc.ca.gov

Fact sheets on each of the programs listed below are available at
http://www.dtsc.ca.gov/SiteCleanup/Brownfields/

Technical Committee comments on draft report for 4.28

Dan Cloak, ETR
Page 5, third paragraph, last sentence, rewrite for clarity:

Other options municipalities may implement to address accumulated sediments, depending on available resources, include reconstructing industrial area streets, removing or capping PCB-contaminated roadside soils, creating sweepable pavement surfaces, and constructing facilities to treat street runoff.

RESPONSE: Revision made.

page 7, middle of page, third bullet, "area" not "are"

Table 10 and Table ES-1, third row: "review" not "reveiew"

RESPONSE: Revision made.

Format of Table 5 is confusing -- it seems that a list would be more appropriate than a matrix, as there is no particular significance to entries being aligned on the same row.

RESPONSE: Revision made. Changed table to a list.

Section 4.4, page 33, revise the second sentence in this section to read:

Treatment retrofits within the storm drain system could include diversion of gutter flows to infiltrate through swales and bioretention areas. Swales and bioretention areas can be underdrained with pipes leading to existing storm drains, allowing them to be installed in any soil type. Other treatment options include detention basins and construction of wetlands at the base of watersheds.

RESPONSE: Revision made.

Comments on comments by others:

I concur with the Water Board's comments regarding the Water Board's existing authority to control discharges through WDRs and NPDES permits, including general permits for industrial and construction activities. A paragraph or two of additional detail regarding these authorities should be developed in consultation with Water Board staff and included in the report.

RESPONSE: Water Board provided paragraphs that were added on page 36 at the beginning of section 5.

Regarding the comments on the draft made on behalf of BASMAA:
Pages 7 and 48, addition of the statement,

"Actual PCB TMDL implementation actions are currently under negotiation as part of development of a stormwater NPDES Municipal Regional Permit."

is not acceptable, as this is confusing regarding the actual process leading to TMDL adoption. Please reject this change.

On the same pages, the changes from "should" to "could" are not acceptable and should be rejected.

Regarding a proposed change on p. 50, and a corresponding change in the ES, I don't agree that it is useful or correct to prioritize source control investigations and control strategies at this time, particularly as it is implied that this prioritization should precede implementation. Please reject this change.

On pages 9 and 51, the note below the table is not needed as the need for further analysis is adequately addressed elsewhere in the text. Please reject this change.

RESPONSE: No revisions made based on these comments as agreed upon in subsequent communication.

Arleen Feng, ACCWP / BASMAA rep to TC
I support the edits recommended by Jon Konnan, Mark Arniola and also Water Board staff, subject to some additional comments or suggestions below:

1. Check section numbering and update Table of Contents, e.g. section 2.3.1 is after 2.2.3 with no 2.3

RESPONSE: Revision made.

2. Re Water Board's comment for page 6 ("few options..."), legal authority may still require instituting policy and/or funding mechanisms to enable implementation, especially in current fiscal climate.

RESPONSE: Additional wording was added to indicate that having the legal authority does not mean that the mechanisms are in place.

3. Re WB comment for Table 2 (p. 14) perhaps can address with caption like "Selected results from case studies in local watersheds".

RESPONSE: Revision made. Table title was changed.

4. Section 2.3.1: following Jon's other edits, use the term "case study" throughout, or perhaps "watershed sources assessment" is ok for the more extensive suite of activities described here. (The term "watershed assessment" is usually used in a still more comprehensive context, not focused on a single issue.)

RESPONSE: Revision made.

5. In Table 2, section 2.3.1 and elsewhere, the correct description for the watershed is "Ettie Street Pump Station watershed" or "Ettie St. PS watershed" for short.

RESPONSE: Revision made.

6. Re WB comment for p. 26 ("...values greatly exceed..."), I would retain the sentence in some form, but seek rewording on 2 points: what "typical" means (85% isn't necessarily a bad criterion), also does "sediment in urban runoff" refer mainly to 2000-01 sampling of "sediment deposits in streams and other major storm drain conveyances"?

RESPONSE: The sentence was deleted as per the Water Board comment.

7. Re WB comment #2 for p. 32 ("Private property…"), the text does note existing programs that involve work with "a variety of property owners." However there are likely to be at least a few properties with legacy PCBs on site, whose current landuses exclude them (at present) from involvement with either the general industrial permit or a site-specific NPDES permit.

RESPONSE: A suggestion to create outreach to property owners not subject to regulatory requirements was added.

8. Re WB comment #1 for p. 33 ("Diversion…"), this paragraph still needs a topic sentence, so I suggest revising to something like "Site-specific factors affecting the feasibility of diversion to treatment plants differ from the constraints for retrofits".

RESPONSE: Revision made.

9. Re WB comment #1 for p. 34 ("The ability…"), since credit structure is still hypothetical, suggest retaining bullet item but adding "after applicable credit" to qualify "effluent limits"

RESPONSE: This bullet was left as is as is explained in the response to the Water Board comment..

10. Kleinfelder 7/05 report is cited in text so should be added to References:

Kleinfelder, Inc., 2005. Sediment Sampling Report: Ettie Street Pump Station Watershed, Oakland, California. Prepared for the City of Oakland.

RESPONSE: Revision made.

Email comments of Mark Arniola, City of Oakland

Following up on our discussion at today's meeting, the CEP report looks fine to me except for a minor comment on the paragraph about Ettie Street at the top of page 33. BMPs were distributed to the business owners, but I think we should delete the portion of the last sentence that states the business owners "were very receptive to the outreach effort". Some of the business owners may have been very receptive to the outreach effort, but the statement infers a more enthusiastic response than we can confirm.

RESPONSE: Revision made.

BASMAA comments
Revisions included in text from J. Konnan on behalf of BASMAA were all included in final version of report.

Water Board comments
General Comments:

The Final Report is greatly improved in presenting the regulatory oversight and responsibilities with respect to controlling PCBs in stormwater discharges. However, the Report emphasizes the development of new regional programs such as for example the control PCB releases from building during demolition. These programs may be effective controls of PCBs, but will likely take a significant time to develop. In the mean time, there are authorities in place to control contaminated stormwater run-off from being discharged to the Bay. The authorities exist for all facilities having signed a Notice of Intent (NOI) and prepared a SWPPP under the Industrial NPDES General Permit as well as under the various Bay area stormwater NPDES Permits. Local municipalities usually implement the programs to comply with these Permits and have the authority to require that contaminants do not migrate from a facility to stormwater and that the stormwater does not enter the Bay carrying this contamination. Basically, we want the Report to reflect that many effective control actions are possible under current local authorities and that these should be taken to the maximum extent practicable.

Response: No specific revisions were made to the report in response to this comment. The report reflects the range of options and proposes several actions within the existing legal authority and program structure of stormwater programs. The sealant/ building actions are also consistent with existing stormwater program authorities. However, for many of the options suggested, having the regulatory authority in place does not mean that a municipality has the staffing, policies or program structure needed to implement the program. In addition, an adequate time period is needed to properly staff and develop the needed programs.

Specific Comments:

p.5. "Monitoring of sediments in San Francisco Bay, along the Bay margins, in tributaries and stormwater facilities has revealed PCBs at levels above background throughout the Bay area." I can only think of two alternatives for background PCBs:

ambient in-bay sediment PCB concentrations and open space sediment PCB concentrations. Please specify whether you are using one of these to define background. If not please state what you mean by background.
Response: Background was changed to ambient in-bay PCB concentrations

p.6. "For **any site that is suspected—but not known—to be contaminated** – few options exist to force investigation of contamination suspected to exist on a property. Requests for voluntary investigation can be made; however, property owners generally prefer to avoid the liability associated with identifying contamination…" However most municipalities have the legal authority to access private property for inspections and to collect samples.

Response: Language was added regarding legal authority to access private property and non-regulatory approaches available where legal authority is not clear.

p.8. "This review should include (1)evaluation of the water board's authorities to regulate PCBs directly…" However as stated on page 36, DTSC has jurisdiction over releases or threatened releases of hazardous substances that may pose a threat to public health and the environment.

Response: No specific revisions were made to address this comment. DTSC's priorities are very different than the Water Boards. This action is suggested to find ways to address issues that may be outside of DTSC's concern (non-hazardous levels of PCBs that are still above water quality criteria for example) or too low on their priority list. Support from the Water Board is more direct than support from DTSC.

p.11. Alameda County did not participate in the KLI joint stormwater agency project. They performed their own separate study.

Response: Revision made to correct this.

p.12. Grain size normalization of the sediment PCB data is not appropriate in terms of screening for levels of concern, and therefore non-normalized data should be used.

Response: This is how this information was reported and we were not able to find non-normalized data in the KLI report.

p.14 Table 4 does not include San Jose studies conducted in the Leo Avenue, Monterey Highway and Old Oakland study areas.

Response: We believe the Water Board is referring to Table 2. As suggested by another reviewer, Table 2 was retitled to indicate that it is not a comprehensive list.

p.15. Please add the bolded words to the following sentence "For example, ***some*** sealants and paints used ***historically*** in building construction may contain PCBs." I am concerned that the sentence as written may be interpreted as all buildings and paints.

Response: Revision made.

p.17. “For example, the Water Board provided an Excel file with information on PCB spills in San Mateo County that was not available elsewhere.” This information is available elsewhere. It was downloaded from a the U.S. Coast Guard National Response Center (NRC) accessible at: http://www.nrc.uscg.mil/nrchp.html

Response: This sentence was deleted. This information source is listed elsewhere in the report.

p.21 Change the following sentence “Sediment sampling will be conducted at the sites identified through the site visits and database searches.” to “Sediment samples were collected in the public right of way near facilities selected based on the inspections and a review of historical activities (Kleinfelder 2005). A wide range of sediment PCB concentrations were detected with a maximum concentration of 31,000 µg/kg.” or similar language (Kleinfelder 2005-Sediment sampling report-Ettie street pump station watershed, Oakland, CA. July 29, 2005)

Response: Revision made.

p.23. Please provide a citation for the following: “*Matrix effects*- Organochlorine pesticides can interfere with the analysis of samples for certain congeners. Because of this, the levels of PCBs can be underestimated.”

Response: This sentence was deleted.

p.24. “One approach to prioritizing PCBs sources for control strategy implementation would be to develop screening level estimates of the magnitude of PCBs sources in terms of discharges to the Bay.” The prioritization will depend on the oversight agency. For example, if DTSC is the oversight agency, hazard to human health will likely be the driving priority.

Response: A revision was made based on this comment. However, the point of this prioritization section is that, when a municipality is faced with having to implement a range of options and doesn’t have the budget or staff to do everything at once, they need to decide which thing to do first, etc.

p.25. “Assuming a soil density of 1.3 mg/cm^{3}…” This is low for soil bulk density in urban environments.

Response: This was corrected – the units used were incorrect.

p.26. “Note that these values greatly exceed typical sediment concentrations in urban runoff...” Please delete this sentence. I do not agree that the data show this. Over15 percent of the sediment samples collected over two years by the stormwater agencies had

PCB concentrations greater than the residential RBSL and over 30 percent were greater the CHSSL.

Response: Revision made.

p.27. Please add a citation to: “As noted in the discussion on sealants and caulking above and in Appendix B, PCB levels have been measured in building materials in some European studies and one US study.”

Response: Revision made.

p. 27. Please consider editing as follows: “If approximately 10% of these buildings were built***, repainted or recaulked*** between 1950 and 1975…”

Response: Revision made.

p.27. Please reformat the following sentence: “The potential exists for unreleased materials to enter the environment through a leak, spill, or other disturbance.”

Response: Revision made.

p.28. Table 8 needs to be reformatted. For example, the data in this Table infer that all caulks and sealants have PCB concentrations between 2,700 and 550,000 ppm. This is not the case. For a period of time, PCBs were added to some (not sure whether it was all) caulks and sealant up to these concentrations. This is also the case for paints. I suggest adding the words “**up to**” in the concentration column. Similarly, PCBs were detected at concentrations over 20,000 ppm in sediments collected in a San Jose stormwater conveyance system, and this should be reflected in this Table.

Response: Table was revised to clarify the information presented.

p.28. Please add bold text: “Appropriateness for implementation at local or regional level **or a combination**”

Response: Revision made.

p. 28. Please edit as follows: “Ability to identify ~~identification~~ of a specific party…”

Response: Revision made.

p.31. Please edit as follows: “Street sweeping is employed by all municipal agencies to prevent **leaves, trash and the larger grain** sediments from entering the storm drain system.

Response: Revision made.

p.32. "Flood control agencies could decrease PCB loadings to the Bay by increasing the frequency of channel desilting." This is not likely as PCBs have yet to be detected at significant concentrations as part of the testing programs conducted in channel desilting projects.
Response: "If PCBs are detected at signicant levels in channel sediments' was added to the beginning of this sentence.

p.32. "Private property owners could also take measures to prevent erodible sediments from leaving their properties." Please edit this sentence that property owners are required to prevent contamination from migrating off their property either through the industrial stormwater NPDES Permit or from local authorities in place to comply with a stormwater NPDES permit. This paragraph should be edited to reflect this requirement of property owners. If property owners are not aware of this requirement, the local industrial and stormwater inspection programs shall (should?) be required to implement this component of their Permit/authorities.

Response: Revision made.

p.33. "Diversion of stormwater to treatment plants may not be as feasible an option for reducing PCB loadings as retrofits." Please delete as we disagree with this statement. However, this is likely to be tested soon, as a treatment project is being contemplated by EBMUD. Also, treatment does not have to occur during rain events. Treatment of "stormwater" runoff can be performed in conjunction with street washing and collection of runoff prior to the rainy season.

Response: A sentence suggested by another reviewer was used to replace this sentence.

p.33. Please edit as follows: "How long ***will*** the excess capacity ~~will~~ be available" Also, see previous comment regarding street washing.

Response: Revision made.

p.34. "The ability of the POTW to comply with effluent limits…" This should not be an issue, as POTWs should get some form of credit for accepting and treating stormwater.

Response: No revision was made for this comment. This is a critical issue and a very real concern of POTWs and there is no guarantee that POTWs will get credit. We are not aware of a precedent for POTWs getting credit. Even if the Water Board recommends a credit, EPA may not approve it. This is especially a concern based on EPA's actions with respect to the Hg TMDL. Even though POTWs are a de minimus source for PCBs, EPA could come back with requirements that would be difficult for POTWs to meet.

p.34. Table 9 would be more user friendly if the cost of control measure column used constant units.

Response: This was added to the table but the original units were also retained because the scale is very different for these different activities. When removing coatings from a building you are talking about square feet reflecting the magnitude of the total cost. When talking about remediating a contaminated site, acres is the magnitude of the job so using the same units may actually make things seem more comparable cost-wise when they are not.

p.46. "Like PCBs, asbestos is a commonly present hazardous component of older buildings." This statement should be toned down to reflect that there is currently little local knowledge of this and only some of the buildings that were caulked and painted in a certain era may have PCBs in them.

Response: This sentence was revised.