Chapter 3

HAZARDOUS WASTE SITES ALONG THE EASTBAY SHORELINE

John Cruz Thomas

The United States in 1980 generated between 30 to 40 million metric tons of hazardous wastes (EPA, 1980). This translates into nearly 300 to 400 pounds of wastes per person. The Environmental Protection Agency (EPA) foresees a doubling of annual hazardous waste generation by the year 2000 (CBE, 1981). A 1972 study of San Francisco Bay has indicated that human-related activities may be responsible for 15 elements in detectable concentrations (Peterson et al., 1972). Considering the present set of circumstances and the EPA's grim prognosis, a close examination of hazardous waste as a threat to human health and the environment is of extreme importance. Therefore, plans for future East Bay shoreline development would not be complete without a thorough investigation of hazardous waste sites within the proposed region.

Whenever resources are converted into goods, waste is generated and much of it is hazardous. According to the Resource Conservation and Recovery Act, a waste is hazardous if, "because of its quantity, concentration, or physical, chemical or infectious characteristics it: (a) causes or significantly contributes to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness; or (b) poses a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of or otherwise managed" (EPA, 1980, p. 4). Certain natural materials become hazardous when they have been concentrated or released into the environment or because processes have changed materials into hazardous substances. These substances may be ignitable, reactive, corrosive, radioactive, infectious, or toxic. They may exist as solids, liquids, sludges, powders, and slurries; but about 90 percent are liquid (Goodman, pers. comm., 1982). Some of these wastes are nondegradable and persist in nature indefinitely.

Before presenting the following case studies, we will look in detail at three types of hazardous waste, polychlorinated biphenyls (PCB), chromium, and lead. A discussion of these waste types is essential because they play major roles in each study.

PCBs were first identified in 1881 and first used in 1929. There about 210 possible PCBs, of which around 102 are probable (Kruus and Valeriote, 1979). PCBs are inert chemically and have high dielectric constants, properties which explain their suitability for many industrial purposes. They are not soluble in water and are unaffected by acids, bases or corrosive chemicals. They have high boiling points and may be heated and boiled without decomposing. They are related to DDT but are even less biodegradable than that substance. Thus, although their stability makes them ideal for many industrial uses, this same stability makes them very persistent chemicals in the environment.

PCBs have been found widely dispersed (even in Antarctica), in many fish and birds, in human and animal fat tissue, in milk, food, plankton, snow, industrial waste discharge, river-bottom sediments and lactating women's milk (Kruus and Valeriote, 1979). The PCB in the environment accumulates in living organisms because it prefers organic media such as body fat to water.

The health effects of PCBs have been studied in animals and, to a lesser extent, observed in humans. In several animal species (birds, monkeys) reproductive processes have been shown to be affected; livers enzyme systems and immunities of some animals are also affected (Kruus and Valeriote, 1979). Several studies on rodents suggest strongly that some PCBs are carcinogenic, and that they can enhance the carcinogenicity of other chemicals (Sittig, 1980). It is known that PCBs can cause skin disorders in humans, and the chemical has been implicated in human cancers in workers exposed to it (Kruus and Valeriote, 1979).

Chromium is included in the group of heavy metals designated by the EPA as hazardous substances. Much of the detectable chromium in air and water is presumably derived from industrial processes, which in 1972 consumed 320,000 metric tons of the metal in the U.S. alone (Sittig, 1980). Chromium is used in chrome plating, copper stripping, aluminum anodizing, as a catalyst, in refractories, inorganic synthesis, and photography (Sittig, 1981). Chromium is also used in cooling waters, in the leather tanning industry, in pigments and primer paints, and in fungicides and wood preservatives (Sittig, 1980). Chromium is water soluble; therefore, if it exceeds permissible concentrations in water, aquatic life and human health can be threatened.

Chromium compounds are irritants and corrosive, and can enter the body by being swallowed, inhaled or by penetrating the skin. Acute exposure to dust or mist may cause coughing and wheezing, headache, fever, and loss of weight. The corrosive action that chromium has on the skin results in small ulcers about the size of a matchhead. These ulcers tend to be quite deep, heal slowly and leave scars. Liver injury and increased risk of lung cancer have been reported from exposure to chromium (Sittig, 1981).

Lead is also a heavy metal and has been deemed by the EPA to be a hazardous substance. Lead is a soft, malleable, stable, heavy, bluish-grey metal. It reaches the aquatic environment through precipitation, fallout of lead dust, leaching from soil, street runoff, and both industrial and municipal wastewater discharges (Sittig, 1980). Lead consumption in the U.S. is about $1.3x10^6$ metric tons annually. Approximately half of that consumption has been for the manufacture of storage batteries, and one-fifth has been for the manufacture of gasoline anti-knock additives. Pigments and ceramics account for about 6 percent of annual production. All other major uses are for metallic lead products or for lead-containing alloys (Sittig, 1980).

Lead affects the nervous system, the kidneys, and red blood synthesis in humans. The early symptoms of lead poisoning include stomach ache, weakness, irritability, and fatigue. In later stages, the victim may experience headaches, loss of appetite, drowsiness, vomiting, cramps, clumsiness, or convulsions. Finally, it can lead to a deterioration of the central nervous system, produce sterility, paralysis and eventual death (Kruus and Valeriote, 1979).

It has been reported that in the U.S. approximately 100 children die of lead poisoning each year; 12,000 to 16,000 are treated and survive, but at least one quarter of these suffer permanent injury (Kruus and Valeriote, 1979). Children's vulnerability to lead poisoning is possibly related to their pica for paint chips or for soil. Women are another group that have a higher likelihood of experiencing adverse effects from lead exposure. This is due to the fact that their blood-forming system is more lead-sensitive than men's (Sittig, 1980).

Case Studies

Historically, the major industries of Alameda County were located along the shoreline. The water's edge is the center for industrial activity because of easy access for products, import and export by boat, rail or air transport. The shoreline is also the location for municipal and industrial waste disposal. In the following section, two hazardous waste sites in Alameda County and one in Contra Costa County will be discussed (FIGURE 1). These are only a few examples of many possible hazardous waste sites in the two counties. The reason for isolating these sites is because of their importance with respect to the bay.

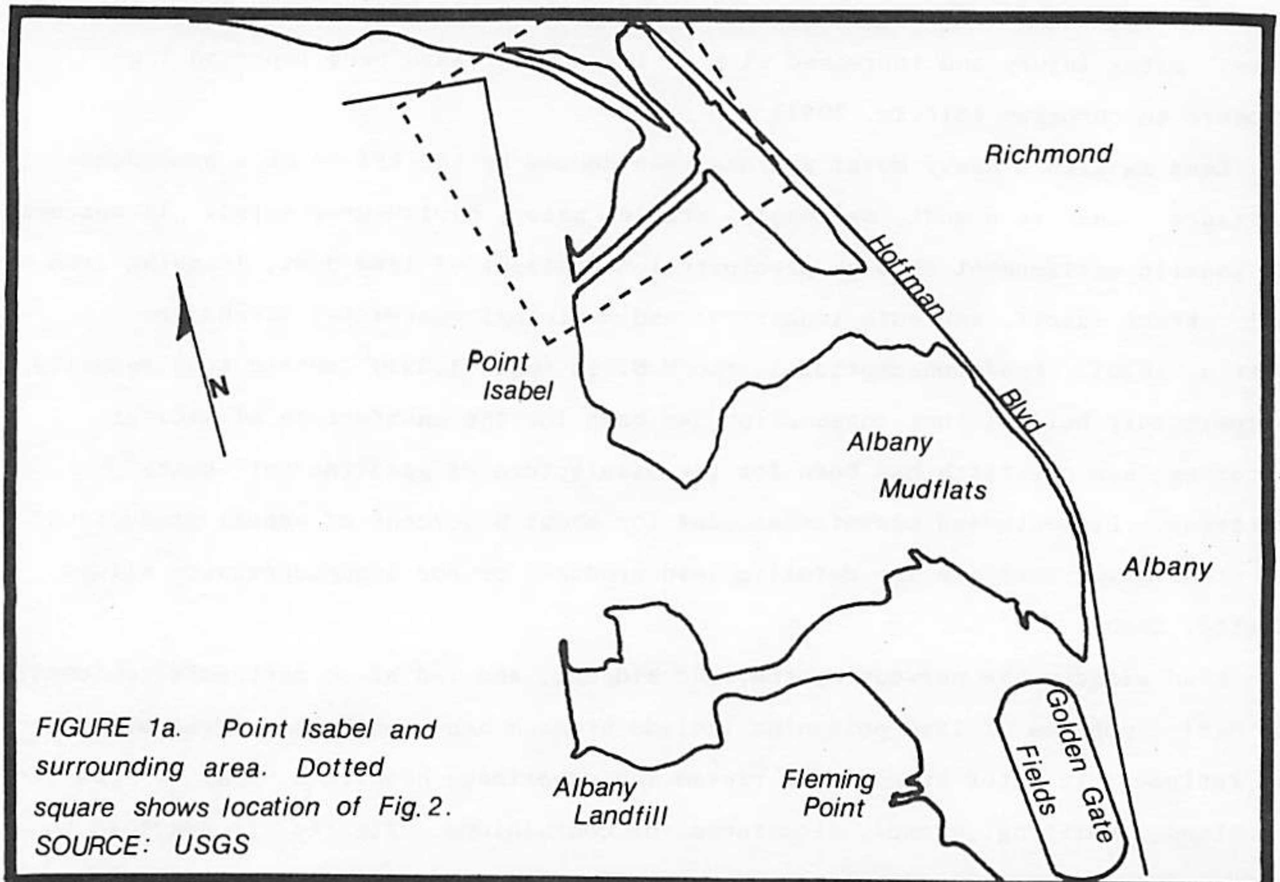


FIGURE 1a. Point Isabel and surrounding area. Dotted square shows location of Fig. 2. SOURCE: USGS

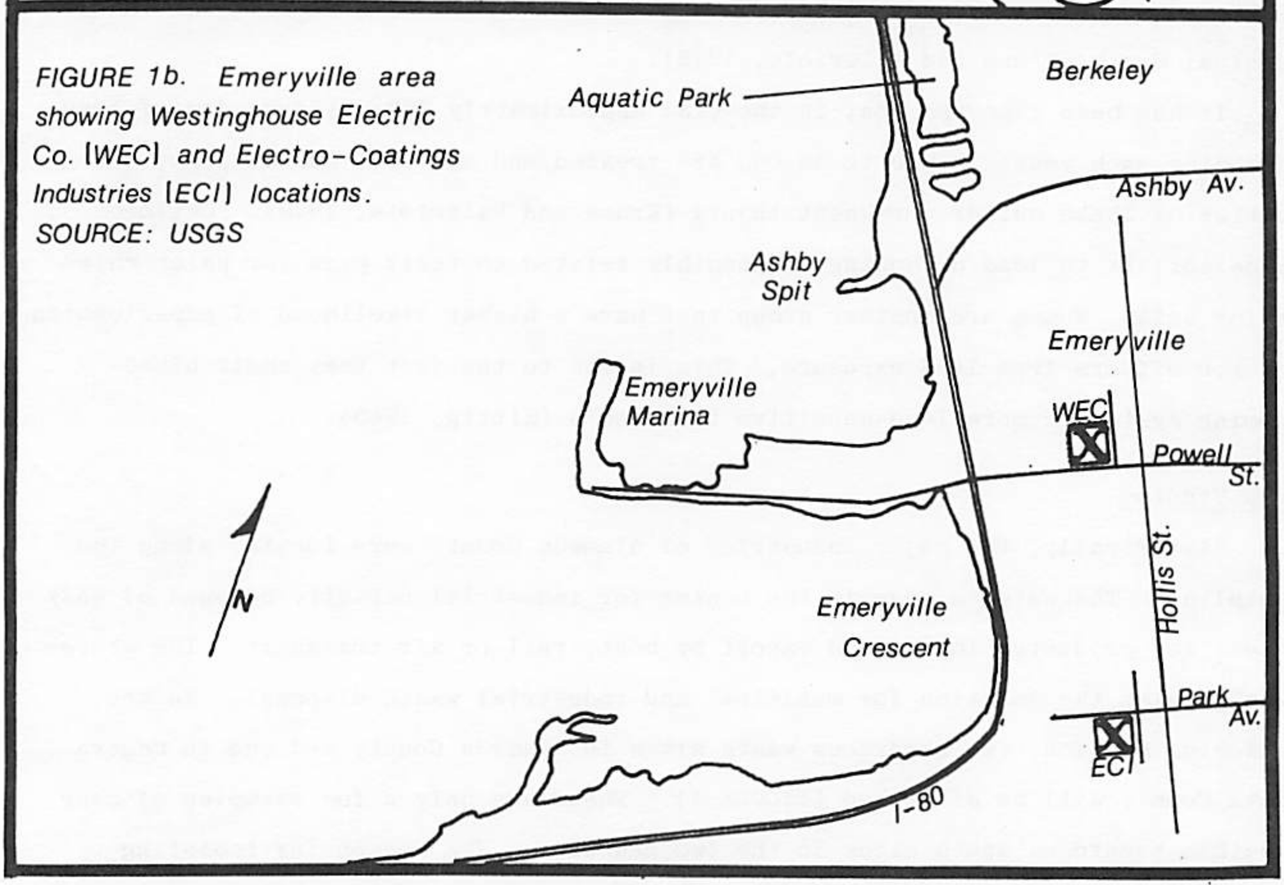


FIGURE 1b. Emeryville area showing Westinghouse Electric Co. (WEC) and Electro-Coatings Industries (ECI) locations. SOURCE: USGS

Westinghouse Site

Westinghouse Electric Company (WEC) (FIGURE 1b) began operations at its site in 1924. In the 1940's, WEC manufactured equipment for the transmission, use, and control of electricity. Since that time, this site has been used for transformer repair and maintenance work (Goodman, pers. comm., 1982).

During a 1981 field check of the site by the Department of Health Services - Abandoned Site Project (DOHS-ASP) staff, discolored soil was noticed along a railroad spur outside the enclosed WEC area. Transformers were visible in this enclosed area. Initial soil samples collected by the DOHS-ASP staff showed very high levels of PCBs. The contaminated area was subsequently barricaded and the site referred to the EPA for enforcement (Goodman, pers. comm., 1982).

In October 1981, the firm of Brown and Caldwell prepared a report of the WEC property for the EPA (Samaniego, pers. comm., 1982). The investigation was undertaken to determine the extent of PCB contamination on the property adjacent to the plant. The results show PCBs in significant concentration to a depth of 11 feet. Two possible explanations may account for the significant vertical migration. The PCBs may have been buried (a 1950 aerial photograph shows what looks like a waste disposal pond on the property). The other possibility is that the PCBs were carried into the ground by solvents (chlorobenzenes may have been used to clean remaining PCBs from transformers after they were drained). Proving these possible explanations for vertical migration of PCBs is difficult, as WEC has not cooperated in providing information on past practices or documentation (Samaniego, pers. comm., 1982).

The results of the Brown and Caldwell report leave many questions unanswered. For one, the total extent of vertical migration of PCBs was never determined, since drilling by the firm stopped at arbitrary depths. The extent of sub-surface migration off the testing site was not considered. Also, the amount of groundwater contamination was not determined. This is of importance because the groundwater table in Emeryville is shallow (4 feet below the surface, in some areas) (Samaniego, pers. comm., 1982). Lastly, the possible threat to the bay from surface runoff of PCBs must be addressed.

At the present time, the Regional Water Quality Control Board (RWQCB) is the local agency involved in working with WEC on clean-up or mitigation measures. To obtain necessary data, RWQCB requested EPA to have WEC do a detailed hydrogeological study of the area (Samaniego, pers. comm., 1982). There has been no clean-up activity at the WEC site to date. An estimated cost of clean-up is between

$10 to 15 million (CBE, 1981).

Electro-Coatings Site

Electro-Coatings Industries (ECI) began plating operations at the Emeryville location (FIGURE 1b) in 1963. This site was previously occupied by Industrial Hard Chrome. Between 1964 and 1965, ECI disposed of chromic acid plating wastes in an on-site shallow disposal well (Goodman, pers. comm., 1982). RWQCB received information regarding the disposal of the wastewater and ordered ECI to stop disposal. ECI ceased use of the well and turned to hauling waste to off-site disposal facilities (Samaniego, pers. comm., 1982).

Subsequent analysis of the groundwater was made by the firm of Woodward-Clyde. This investigation, referred to as Phase I by RWQCB, showed chromium contamination in significant quantities to a depth of 30 feet beneath the ECI site. Groundwater exists in the vicinity of the site at a depth of approximately 7 feet. The direction of groundwater movement in the area is westerly. Therefore, the contaminated groundwater will tend to move in that direction, i.e., towards the bay. The movement of the chromium-contaminated groundwater is between 2 to 122 feet per year. Although there is no solid evidence of the contaminated groundwater reaching the bay, this possibility is of concern to the RWQCB (Samaniego, pers. comm., 1982).

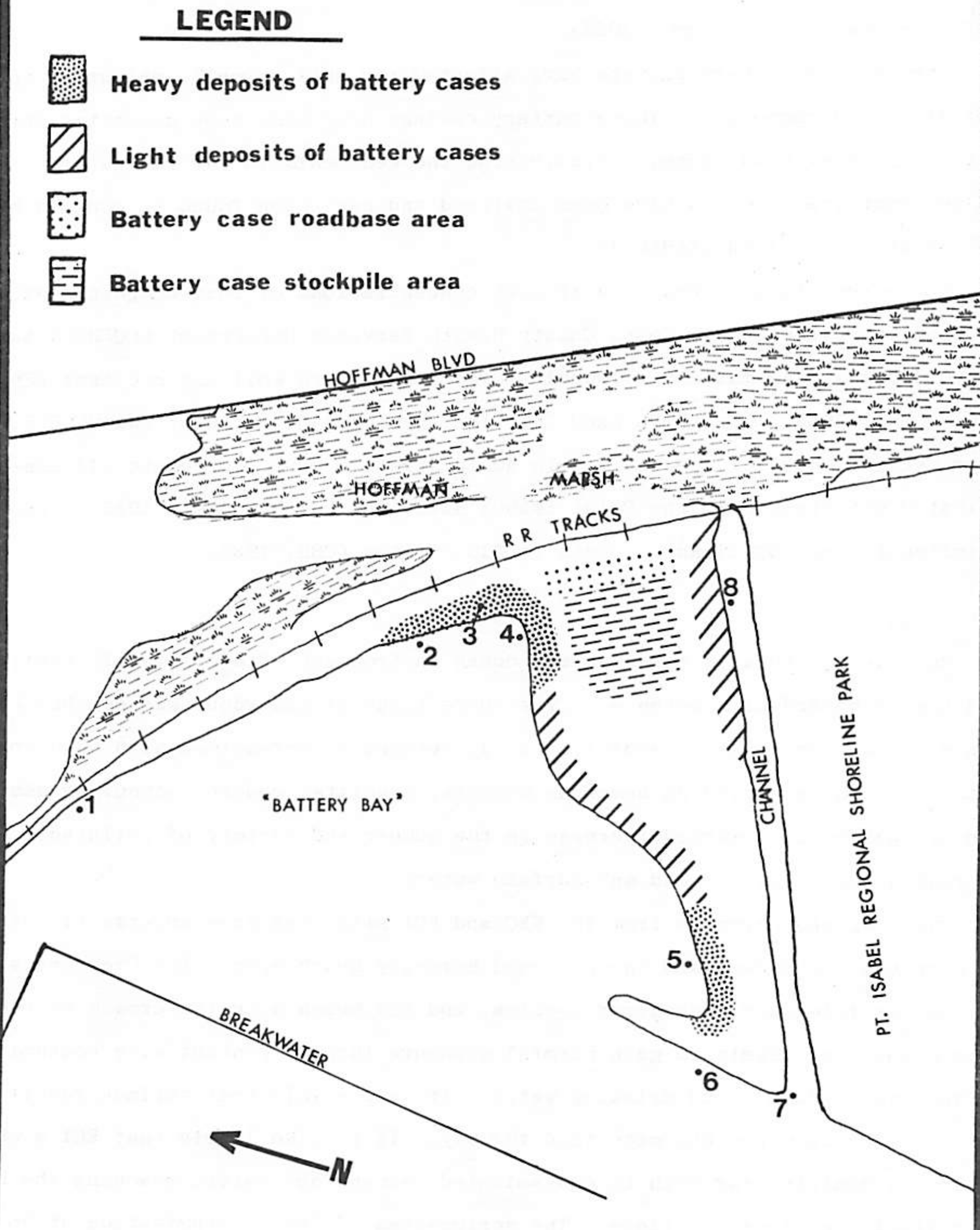
In spite of the fact that the Phase I investigation showed that groundwater contamination exists, it did not go into enough detail. A Phase II study by the firm of Klienfelder and Associates is underway better to define the extent of horizontal and vertical chromium contamination. This study will assist RWQCB and ECI in determining the type and feasibility of clean-up procedures (Samaniego, pers. comm., 1982). It is estimated that clean-up costs at the ECI site will be about $1 million (CBE, 1981).

Point Isabel

The Point Isabel site (FIGURE 1a) has been owned by Santa Fe Land Co., Inc. since the 1940's. Aerial photographs reveal that solid waste disposal on the property began in the early 1960's. Staffs of the RWQCB, DOHS-ASP, State Department of Fish and Game (DFG) and the U.S. Army Corps of Engineers all have observed large volumes of shattered automobile battery cases on the filled land just north of Point Isabel REgional Shoreline Park (FIGURE 2) (Goodman, pers. comm., 1982). The DFG and RWQCB have indicated that these battery cases may be responsible for

FIGURE 2. POINT ISABEL SITE. LOCATION of SOIL & SEDIMENT SAMPLES and BATTERY CASES. FOR SITE LOCATION SEE FIG. 1a.

SOURCE: COX, UNPUBLISHED DATA.



the high concentration of lead detected in shellfish in the area. Levels of lead obtained were maximum 9.6 ppm in clams, 64.0 ppm in mussels (Cox, pers. comm., 1982). The alert level of the U.S. Food and Drug Administration is 5 ppm (Jones and Stokes, 1977). Signs banning shellfish fishing in the area have been posted. Clammers, nevertheless, have been observed in the contaminated site by RWQCB staff (Goodman, pers. comm., 1982).

The crushed battery casings have affected the soil as well, polluting the area with lead compounds. These battery casings have also been deposited near and in the bay water tidal zone, contaminating the sediments in the bay waters. Soil and sediment grab samples have been analyzed and have been found to contain high concentrations of lead (TABLE 1).

These results show that significant concentrations of lead compounds exist on the property. The Contra Costa County Health Services Department (CCCHSD) has set 50 mg/kg as the maximum allowable level for lead in soil and sediment (Shahid, pers. comm., 1982). Santa Fe Land Co., Inc. has been directed by the CCCHSD, under Section 66336 of the California Administrative Code, to remove all contaminated materials from the Point Isabel site (Cox, pers. comm., 1982). An estimated figure for clean-up costs is $10 million (CBE, 1981).

Conclusion

Man has continually burdened the ocean environment with criminally negligent handling of hazardous substances. The three kinds of hazardous wastes that have been discussed are only a handful in a bay seemingly overwhelmed with such contaminants. While providing numerous societal benefits, modern technology has also brought about a marked increase in the number and variety of pollutants entering natural surface and sub-surface waters.

The PCBs and chromium from the WEC and ECI sites can have adverse effects on the Emeryville Crescent and the proposed Berkeley Beach area. The Crescent's fragile ecosystem and endangered species, and the beach with its crowds of recreating people are likely to gain harmful exposure through contact with contaminated surface, subsurface, and drinking water. It is possible that surface runoff is carrying PCBs from the WEC site into the bay. It is also likely that ECI's chromium problem is contributing both to contaminated subsurface waters reaching the bay and pollution of local aquifers. The seriousness of lead contamination at Point Isabel is evidenced by the results in TABLE 1. Lead concentrations in soil and sediment are so significant that, in one sample, the maximum allowable level is

SAMPLE NUMBER	SAMPLE DEPTH	LOCATION/DESCRIPTION	CONC. mg/kg
1a	Surface	Shoreline, NW of Battery Bay; half-way between jetties; 6' out from edge of rocks / soft, brown mud	93
1b	1 ft.	Same as 1a / clayey-silty, dark brown to black mud.	165
2a	Surface	Shoreline, N side of battery case mount, Battery Bay at edge of intertidal rocks / soft brown mud.	296
2b	1 ft.	Same as 2a / dark brown to black mud.	308
3a	Surface	Above high tide line, beneath battery cases (about 1' deep), about 15' bay-ward from a big wood beam / sandy-sooty sediment.	857
3b	1½ ft.	Same as 3a / same as 3a.	693
4a	Surface	Shoreline, Battery Bay, about 35' SW from sample #3, about 15' out from edge of rocks / dark brown to black mud.	449
4b	1 ft.	Same as 4a / same as 4a.	240
5a	Surface	Shoreline, SW of Battery Bay in the cove; at edge of battery cases in the mud; battery cases inter-bedded in 5-6 ft. high landfill bank above high tide / very soft, black mud.	329
5b	1 ft.	Same as 5a / same as 5a.	640
6a	Surface	On the S.F. Bay side, directly across the jetty from the cove, edge of riprap / silty, sandy sediment.	58
6b	1 ft.	Same as 6a / same as 6a.	52
7a	Surface	Mouth of Pt. Isabel channel, just N of the middle / sandy sediment.	62
7b	1 ft.	Same as 7a / same as 7a.	55
8a	Surface	Pt. Isabel channel about 80' up from railroad bridge on N side near battery cases in the mud / soft black mud.	173
8b	1 ft.	Same as 8a / same as 8a.	150

TABLE 1. Lead Concentrations in Soil and Sediment at Point Isabel. Samples located on FIGURE 2.

Source: Cox, unpublished data.

exceeded by over 800 mk/kg. Such pollution has brought about restrictions to recreational activities such as shellfish harvesting.

It is clear, then, that before full recreational activities can be enjoyed along the East Bay shoreline, these sites must be thoroughly cleansed of contaminating materials. Westinghouse Electric Company, Electro-Coatings Industries, and Santa Fe Land Co., Inc. are slow in assuming their responsibilities. Public awareness and involvement and stronger stands by federal, state, and local agencies may be the spark that generates necessary action. As our understanding of the aquatic environment has grown, it has become clear that the capacity of our rivers, lakes, oceans, and aquifers to absorb chemical waste and toxic materials discharged into them is not at all infinite and that serious degradation of water quality is the inevitable result of misuse and mismanagement of this invaluable resource.

REFERENCES CITED

Citizens for a Better Environment, (CBE), 1981. On-Site Hazardous Waste Management in the San Francisco Bay Area, 144 pp.

Cox, Joanne, Waste Management Specialist, California Regional Water Quality Control Board, personal communication, 1982.

Goodman, Janet, Project Assistant, Department of Health Services Hazardous Materials Management Section, Abandoned Site Project, personal communication, 1982.

Jones and Stokes Associates, Inc., 1977. San Francisco Bay Shellfish: An Assessment of the Potential for Commercial and Recreational Harvesting, for Association of Bay Area Governments, 171 pp.

Kruus, P., and Valeriote, I.M., 1979. Controversial Chemicals, a Citizen's Guide: Canada, Multiscience Publications Limited, 243 pp.

Peterson, D.H., D.S. McCulloch, T.J. Conomos, and P.R. Carlson, 1972. Distribution of Lead and Copper in Surface Sediments in the San Francisco Bay Estuary, California, U.S. Geological Survey, Basic Data Contribution 36.

Samaniego, Robert, Water Resources Control Engineer, California Regional Water Quality Control Board, personal communication, 1982.

Shahid, Rafat, Director of Occupational Health/Hazardous Waste, Contra Costa County Health Services Department, personal communication, 1982.

Sittig, Marshall, 1980. Priority Toxic Pollutants, Health Impacts and Allowable Limits: New Jersey, Noyes Data Corp, 348 pp.

__________, 1981. Handbook of Toxic and Hazardous Chemicals: New Jersey, Noyes Publications, 719 pp.

U.S. Environmental Protection Agency (EPA), 1980. Controlling Hazardous Waste - Research Summary, EPA-600/8-80-017.