PCB contamination in and around New Bedford, Mass.

Although higher levels exist elsewhere in North America, the cumulative exposure involving aquatic life and humans in this locality is said to be unique

Grant Wenzer
Department of Public Utilities
City of Norwich
Norwich, Conn. 06360

As home port to those vessels that ply the rich offshore waters of Georges Bank, New Bedford is the largest revenue-producing fishing port on the U.S. Atlantic seaboard. Bounded by the Acushnet River estuary, New Bedford Harbor, and Buzzards Bay, this community of 100 000 has weathered wave after wave of changing economic fortunes—first as the world's largest whaling port and later as a major textile center.

Since the end of World War II, the city has struggled to broaden its economic base through the development of an industrial park as well as other incentives designed to encourage the movement of new industry to the area. Two of the mainstays of New Bedford's recently diversified economy are electronic capacitor manufacturers located in old textile mill houses situated on the banks of the Acushnet River estuary.

The past use of polychlorinated biphenyls (PCBs) in southeastern Massachusetts by these capacitor manufacturers has left a lasting impact on New Bedford's vibrant port. PCBs are industrial chemical compounds that were commercially manufactured and marketed in the U.S. from 1929 to 1977. The Monsanto Corporation of St. Louis, Mo., the former industrial producer of PCBs in the U.S., marketed PCB blends and mixtures under the trade name Aroclor. The total national production of PCBs during the approximately 50 years of their manufacture is believed to have totaled 600 million kg.

The chemically stable, nonflammable nature of PCBs, together with their high boiling point, low solubility, and nonconductive nature makes these chemical compounds nearly ideal for many industrial applications, including capacitors and transformers. Unfortunately, these same properties cause PCBs to persist in the environment and bioconcentrate, creating potential hazards to affected biota.

The four-digit number following the trade name Aroclor was used to characterize the blend of polychlorinated biphenyls. Except for Aroclor 1016, which was not named according to protocol, the first two digits were assigned to represent 12 carbon atoms (thereby identifying the biphenyl structure) while the final two digits were used to represent the approximate percentage of chlorine by weight in the PCB blend.

The physical characteristics of PCBs vary according to the mixture. As the chlorine content increases, the Aroclors change from a colorless oil, to a sticky resin, to a white powder, and their persistence in the environment generally increases.

Even very small concentrations of PCBs can be detrimental. The U.S. EPA has recommended a marine water quality standard of 0.03 ppb to protect marine life. Marine and freshwater organisms have been found to concentrate PCBs in their bodies to levels 100 000 to one million times or higher than those levels present in ambient waters.

The U.S. Food and Drug Administration (FDA) has established regulatory limits for PCBs in various foods (Table I). The limit for fish and shellfish is 5 ppm wet weight in the edible portions of these foodstuffs. (Biotic concentrations are given as wet weight; all other solid-phase data are reported as dry weight. Solid fraction PCB concentrations of mg/L are considered equivalent to ppm.)

At this time there are no federal standards for PCBs in drinking water or ambient air. The Occupational Safety and Health Administration (OSHA) has set a workplace standard of 1 mg/m^3 for Aroclor 1254. The National Institute for Occupational Safety and Health (NIOSH) recommended a more stringent workplace standard of 1 μg/m^3 total PCBs; however, the OSHA standard remains in effect.

Wastewater discharges of PCBs are regulated by EPA in accordance with Code of Federal Regulations, 40 CFR 129.105. This regulation is implemented through the National Pollution Discharge Elimination System (NPDES) permitting program. PCBs are severely limited in discharges from electrical capacitor manufacturers.

Localized PCB spills have contaminated surface sediments in a number of widespread locations across North America. A number of sites including the Hudson River (N.Y.), Lake Michigan's Waukegan Harbor (Ill.), and the municipal wastewater treatment facility in Bloomington, Ind., have been contaminated by PCBs. Nonetheless, the recently completed Remedial Action Master Plan states that New Bedford "is one of the most extensive cases of environmental contamination by polychlorinated biphenyls. . . ." Although the concentration of PCBs in water, sediment, and air has occasionally been found to exist elsewhere at levels greater than that observed in the New Bedford area, the cumulative environmental exposure affecting New Bedford's

0013-936X/83/0918-0022A$01.50/0

biota (including portions of the human population) is said to be unique.

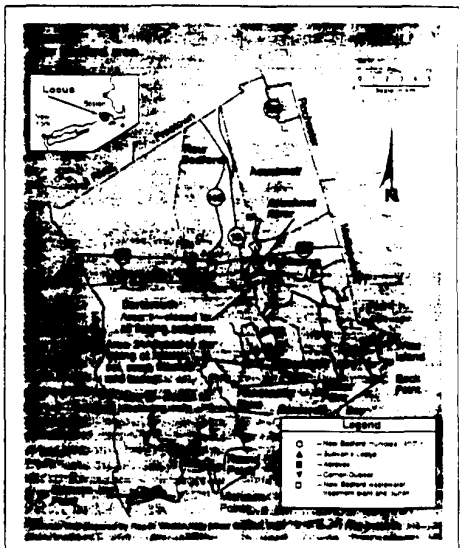
Other contaminated areas

Hudson River. The most widely publicized PCB contamination of an American waterway—more than 250 000 kg were discharged over 25 years from two capacitor manufacturing plants—is that which exists in New York State's Hudson River near Fort Edward. In 1975, PCB levels in some fish were found to exceed the FDA's tolerance level of 5 ppm. As a result, the New York State Department of Environmental Conservation (NYSDEC), with the advice of the Department of Health, instituted a ban on fishing in the upper Hudson River from the Troy Dam to Fort Edward. In the lower Hudson River, commercial fishing was restricted, and recreational fishermen were advised to restrict fish consumption to one meal per week (American eel excluded).

In 1976, after lengthy hearings, the state and the General Electric Company, the principal PCB discharger, sharing the responsibility, agreed to seek ways to remove PCBs from the river. The two parties established a $7-million fund for research and engineering studies, which were carried out by consultants, universities, and federal and state agencies in one of the most comprehensive investigations of a hazardous waste problem ever undertaken in the U.S. These studies found that the PCB-contaminated sediments in the upper Hudson River act as a source to the entire downstream river system. According to 1979 U.S. Geological Survey readings at the Troy Dam, approximately 3200 kg of the chemical moved downstream of the dam annually.

Much of the Hudson's contamination is concentrated in a relatively small area. Forty "hot spots" have been located by the NYSDEC in the upper reach where PCB concentration is equal to or greater than 50 ppm. Removal of these hot spots from the river would greatly reduce the amount of PCBs available to the ecosystem, according to the study.

Waukegan, Ill. Another documented case of the contamination of a navigable waterway by PCBs exists in Lake Michigan's Waukegan Harbor. The area of contamination encompasses a 15-hectare (ha) shipping port, an adjacent upland industrial area, and a lengthly drainage ditch. PCB concentrations up to 250 000 ppm, or 25% by weight, have been observed in areas of upland and submerged sediments in the vicinity of the Outboard Marine Corporation's Johnson Motors facility. Fish containing PCBs at levels exceeding 100 ppm have been captured within the harbor, while immediately outside Waukegan Harbor fish exhibit PCB levels characteristic of Lake Michigan fish (averaging, and occasionally exceeding, 2–5 ppm).



Bloomington, Ind. PCB contamination of the city's Winston Thomas wastewater treatment plant has resulted in the stockpiling of six years' accumulation of residual sludges amounting to approximately 25 000 m^3 of material with a PCB concentration averaging 100–300 ppm.

New Bedford PCBs

Contamination of New Bedford Harbor was first documented in 1976 when EPA conducted a New England PCB survey and found elevated levels of the material in various harbor locations. Testing revealed that two industrial operations were discharging wastewaters containing PCBs. Both the direct discharge of contaminated waters to the Acushnet River estuary and PCB contamination of the New Bedford municipal wastewater treatment facility were identified.

Since this initial survey of the New Bedford area, a much better, although not yet complete, understanding of the extent of PCB contamination has been gained. The direct discharge of PCB-contaminated wastewater from all industrial operations has been significantly reduced. The discharge of PCBs from the city wastewater treatment plant, however, remains significant. Recent studies have documented that 90–300 kg of PCBs continue to be discharged annually in this manner.

The sediments underlying the entire 440-ha New Bedford Harbor contain elevated levels of PCBs. Concentrations range from a few parts per million to well over 100 000 ppm. Portions of Buzzards Bay are also contaminated with concentrations occasionally exceeding 50 ppm. The water column in New Bedford Harbor has been found to contain PCBs in the parts-per-billion range, well in excess of EPA's 0.001-ppb guideline. (Liquid fraction PCB concentrations of μg/L are considered equivalent to ppb.) EPA, ac-

TABLE 1
FDA limits on PCB concentrations in foodstuffs

Foodstuff	PCB limit (mg/L wet weight)
Fish and shellfish	5.0[a] (edible portion)
Milk and manufactured dairy products	1.5 (fat basis)
Poultry	3.0 (fat basis)
Red meat	3.0 (fat basis)—action level
Eggs	0.3
Infant and junior foods	0.2
Paper food package in direct contact with foodstuff	10.0—action level
Animal feed components of animal origin	2.0
Feed for food-producing animals	0.2 (except concentrates, supplements, and premixes)

[a] FDA recommended lowering this standard to 2.0 mg/L in 1977; however, challenges by the seafood industry resulted in the courts ordering a temporary stay on any changes.

knowledging this contamination, has placed New Bedford Harbor on the expanded Superfund listing of the nation's most imminently hazardous sites.

Closed fishing grounds

Widespread contamination of the Acushnet River estuary and environs has resulted in the accumulation of PCBs in many marine species. Thousands of hectares have been closed to the harvesting of shellfish, finfish, and lobsters because of PCB contamination.

The fisheries closure established by the Massachusetts Department of Public Health on Sept. 25, 1979, is divided into three areas as shown in Figure 1. Area 1, New Bedford Harbor, is closed to the taking of all finfish, shellfish, and lobsters. Area 2 is closed to the harvesting of lobster and bottom-feeding finfish (eel, scup, flounder, and tautog). Area 3 is closed to the taking of lobsters. Since the FDA has determined that the affected fishery resources are not marketed as interstate products, the enforcement of these closures is entrusted to the Massachusetts Division of Law Enforcement.

Although the median PCB levels in five finfish species have been found to exceed the 5-ppm standard (see Table 2), lobster contamination concerns area residents the most. The closing of the bountiful lobstering grounds of Buzzards Bay has resulted in lawsuits being filed against both the Commonwealth of Massachusetts and the former manufacturers of PCB-impregnated capacitors. These lawsuits call on the industries to remedy the pollution and on the state to reopen the prized lobstering gounds.

Of 183 lobsters collected from Areas 1, 2, and 3 between 1976 and 1980, a median PCB concentration of 4.9 ppm was found in edible tissues. The mean value was 8.7 ppm, the maximum was 84 ppm, and the minimum was 0.1 ppm. Subsequently, lobster data have been compiled only for Area 3. In this, the most seaward portion of the closure area, the following results were observed: Of the 66 lobsters sampled from April to December 1982, the highest value observed was 8.8 ppm; the lowest recorded was 0.7 ppm. The median was found to be 4.1 ppm and the mean 4.4 ppm. In 1982, in the interest of economy, two lobsters were collected per sampling station and analyzed as composites. Therefore, the PCB concentrations reported above for these 66 lobsters are defined by 33 sampling results.

Industrial properties

Two areas known to contain substantial quantities of PCB wastes are the industrial properties of the capacitor manufacturers. Landfilling at these sites has taken place in recent years, and some of the materials used as fill were apparently contaminated with PCBs. Even today, capacitors containing concentrations of PCBs in the thousands of parts per million litter the New Bedford Harbor foreshore behind one factory. Upland sediments in the vicinity of another contain up to 99 000 ppm PCBs.

Other sites in New Bedford may contain substantial quantities of PCBs. One suspected area to the north is Sullivan's Ledge (Figure 1). Located near the municipal landfill, this site is now a vacant lot owned by the city of New Bedford, and was, until recently, to be developed into a commuter parking lot. Sullivan's Ledge was filled when the city used the area as a dumpsite for brush, rubble, and demolition and industrial wastes.

Waste oils containing PCBs were used by New Bedford and possibly other area public works departments in the oiling of local roadways. In summary, past activities in New Bedford have resulted in the presence of PCBs in diverse areas throughout the community.

The few New Bedford area residents who have been studied have been found to contain elevated levels of PCBs in their blood. Recently, two small-scale epidemiology studies were conducted by the Massachusetts Department of Public Health, Harvard's School of Public Health, and the Centers for Disease Control in Atlanta, Ga. Consumers of large quantities of fish and occupationally exposed individuals were selected for study. The results of these studies indicate that the 51 residents tested possessed blood serum PCB concentrations ranging from 2 to 343 ppb (measured as Aroclor 1260). The mean concentration of Aroclor 1260 observed was 36 ppb, and the median was 15 ppb.

Industrial PCB practices

PCBs were used in the manufacture of electronic capacitors during the years 1947–78 in buildings presently occupied by Aerovox Inc., a subsidiary of R.T.E. Corp. (Figure 1). Capacitors were produced for a wide range of electrical applications ranging from ballasts used in fluorescent light fixtures to components used in atomic research. Their size ranged from approximately 15 cm^3 to nearly 1 m^3.

PCB Aroclor 1242 was purchased from Monsanto for use in capacitor manufacture until 1972 when Aroclor 1016 completely replaced Aroclor 1242 as the impregnation fluid. Lesser quantities of Aroclors 1254 and 1252 were also used by Aerovox. At the peak of production, Aerovox used approximately 500 000 kg/y of PCBs. All use of PCBs stopped in 1978 when dioctyl phthalate (DOP) was substituted in the manufacture of capacitors.

To determine the extent, if any, of PCB contamination of Aerovox's sanitary waste discharges, the Massachusetts Department of Environmental Quality Engineering (DEQE) retrieved two wastewater grab samples in 1981. No PCBs were found. In 1976, when PCBs were still being used, EPA sampling detected PCB levels ranging from 73 to 400 ppb in the

wastewater.

Open channels parallel the northern and southern exterior walls of the factory, terminating at the Acushnet River. At one time, the troughs conveyed cooling waters. Today, a closed-cycle cooling system has eliminated the need for anything other than an occasional discharge. An EPA sampling effort in June 1981 led to the detection of the presence of contamination in the sediments in the bottom of the external troughs. After the findings of 40–22 000 ppm were reported to the company, Aerovox removed the contaminated sediments and disposed of them in accordance with state and federal laws.

All analyzed soil and sediment samples collected on the Aerovox property have been found to contain elevated levels of PCBs. Soils inside the chain link fence surrounding the property contain up to 24 000 ppm. Seaward of the fence, sediment sampling revealed levels of 190–190 000 ppm. These values were found in upland, intertidal, and subtidal sediment samples collected from a widespread area of several hectares.

NIOSH performed an extensive industrial hygiene survey of the Aerovox facility in March 1977 when PCBs were still being used in the manufacture of capacitors. As part of this survey both "personal" and "area" air samples were collected throughout the facility and analyzed for PCB content. Results indicated that the 29 personal and 25 area air samples that had been collected and analyzed for PCBs ranged from 0.17 to 1.26 mg/m^3. Atmospheric sampling has begun only recently.

Cornell-Dubilier Electronics Corporation (Figure 1) is also engaged in the manufacture and sale of capacitors for use in consumer products. Cornell-Dubilier is a wholly owned subsidiary of Federal Pacific Electric which is, in turn, wholly owned by Reliance Electronics, itself a wholly owned subsidiary of Exxon. Located across New Bedford from Aerovox, Cornell-Dubilier manufactured PCB-impregnated capacitors from 1941 to 1977.

Most of the capacitators manufactured prior to mid-1977 contained PCBs. A relatively small number, however, were produced using mineral oil and no PCBs. Aroclor 1016 was in use from 1971 to 1977; Aroclor 1242 was used prior to 1971. From 1971 to 1975, Cornell-Dubilier used over 1.4 million kg of Aroclor 1016 and approximately 10 000 kg of Aroclor 1254. PCB-containing capacitors are no longer manufactured.

Industrial wastewaters are discharged to the municipal wastewater treatment plant via sanitary sewers. A direct discharge of process water via a city storm sewer is received by the Acushnet River estuary. Cornell-Dubilier's direct discharge permit, NPDES No. MA0003930, allows limited discharges of PCBs to Buzzards Bay. Monitoring conducted by the corporation and by the Massachusetts Division of Water Pollution Control (DWPC) reveals that less than 250 g/y of PCBs are discharged in this manner. Although EPA sampling in 1976 found up to 110 ppb PCBs in this discharge, the PCB concentration is now generally maintained at or below 5 ppb.

Cornell-Dubilier's discharge to the municipal sewer system has proven somewhat difficult to monitor. The presence of combined sewer overflows in the municipal collection system allows seawater to enter during high tide, confusing sampling efforts. Nonetheless, EPA sampling in 1976 located one discharge containing up to 2900 ppb PCBs. Three grab samples taken by the Commonwealth of Massachusetts in 1981 indicate that the wastewater in the municipal sewer line downstream of the factory contained as much as 118 ppb. Sediments removed from the city of New Bedford sewer at this location were recently found to contain 660 ppm PCBs.

Soils collected from the factory grounds during a June 1981 EPA inspection contained from 4400 to 99 000 ppm. A playground area immediately west of Cornell-Dubilier was filled with dredge spoils during the construction of a nearby hurricane barrier in the mid-1960s. Sediment samples taken by the state in 1981 revealed that the soils contain PCBs at concentrations consistently below 5 ppm, and the playground has remained open. September 1978 air monitoring conducted at several sites in New Bedford showed atmospheric PCB levels in the vicinity of Cornell-Dubilier to be 767–862 ng/m^3.

TABLE 2
PCB concentrations in New Bedford area finfish (1978–80)

Species	PCB concentration (mg/L wet weight, edible portion): Mean	Median	Range	Number Sampled
American eel	181	24	11–730	32
Cunner	[illegible]	—	[illegible]–57	2
Summer flounder	[illegible]	7.4	0.2–[illegible]	[illegible]
Windowpane	[illegible]	[illegible]	3.1–14.3	[illegible]
Winter flounder	[illegible]	[illegible]	[illegible]	44
Silver hake	[illegible]	—	0.7–[illegible]	[illegible]
Scup	2.1	[illegible]	0–11.4	[illegible]
Bluefish	[illegible]	[illegible]	[illegible]	11
Tautog	[illegible]	[illegible]	[illegible]	[illegible]
Striped bass	1.2	[illegible]	[illegible]	[illegible]
Fourspot flounder	[illegible]	—	[illegible]	[illegible]
Butterfish	[illegible]	[illegible]	[illegible]	[illegible]
Black sea bass	[illegible]	—	[illegible]	[illegible]
Dogfish	[illegible]	—	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Sewage treatment plant

Located at the southern terminus of Clark's Point, the New Bedford wastewater treatment plant (Figure 1) discharges a daily average of 10^8 L (26.5 million gal) of primary treated wastewater to Buzzards Bay. Influent and effluent PCB concentrations are typically in the range of 1–6 ppb, and no decrease in PCB level is evident following treatment. Recent monitoring by the city's consultant and the Commonwealth of Massachusetts reveals that the facility releases from 90 to 300 kg/y of PCBs.

Wastewater entering the facility passes through coarse screens to remove bottles, cans, sticks, and rags. These screenings are raked, collected, and transported to the municipal landfill for disposal. The wastewater next flows through a grit chamber where gravel and coarse sand are removed. This grit is also trucked to the city landfill for disposal. Following this, the wastewater is pumped to sedimentation tanks where settling of the heavier solids occurs. The liquid

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effluent from these tanks is chlorinated and discharged to Buzzards Bay via a 1000-m-long outfall pipe.

The sludge that settles to the bottom of these basins is thickened and pumped to centrifuges for dewatering. The dewatered sludge is incinerated on the premises in a multiple-hearth incinerator, and the residual ash is taken to the municipal landfill where it is dumped with the screenings and grit.

Even though the reduction of PCBs in the wastewater as it passes through the treatment facility is too small to be accurately quantified, wastewater residuals have been found to contain elevated levels of PCBs. During the past two years of sampling, the concentration in the sludge has generally fluctuated between 0.5 and 20 ppm. Levels in ash, however, are typically less than 0.1 ppm.

In 1977, EPA contracted with an environmental consultant to study the atmospheric release of PCBs during sludge incineration. The consultant concluded that approximately 50% of the PCBs fed into the New Bedford incinerator were destroyed during combustion. Other EPA sampling efforts found atmospheric PCB levels in the area of the incinerator to range from 13 to 240 ng/m^3 during March 1977 and January 1978.

Although the level of contamination is generally below EPA hazardous waste criteria, wastewater, sludges, and other residuals contain PCB levels much higher than those encountered at most municipal treatment facilities. For example, a 1974 survey of 33 Canadian wastewater treatment plant effluents revealed values typically in the range of a 0.1-ppb detection limit. Local, state, and federal entities are presently allocating funds to design and implement changes to improve the New Bedford treatment facility.

The wastewater collection system contains approximately 30 combined sewer overflows, and these overflows may, during periods of wet weather, release PCB-contaminated wastewaters. Monitoring of these sewer overflows for PCBs in future studies will lead to a better understanding of this situation. An evaluation of industrial discharges and the level of industrial pretreatment needed to protect the municipal facilities and the waters of Buzzards Bay will also be undertaken in the near future by the city's consultant.

New Bedford landfill

The New Bedford municipal landfill has been used as a repository for domestic, commercial, and industrial wastes since the early 1920s. The landfill includes 16 ha of marshland, 10 of which (as of 1978) were filled with refuse and cover material. The geology of the area consists of a layer of freshwater peat varying from 2 to 3 m thick, underlain by a thin layer of silty fine sand. Under this are layers of stratified silts and clayey silts with thin layers of silty clay. These sand and silt layers vary from 2 to 11 m in depth.

Originally operated as an open dump, the site is now maintained as a sanitary landfill in accordance with state and federal requirements. For decades, reject capacitors and other PCB-contaminated wastes, including sludges, ash, and grit from the sewage treatment plant, were disposed of at this site; over 200 000 kg of PCBs have been deposited in the municipal landfill. Before 1972, Aroclor 1242 was the predominant PCB material disposed. From 1972 to 1978, Aroclor 1016 replaced Aroclor 1242 as the PCB most commonly used in the local production of capacitors, and presumably in the waste products disposed of at the landfill.

Monitoring for PCBs has not revealed the presence of any significant groundwater contamination problems in the area of the landfill. The release of PCBs to the atmosphere may, however, be significant. Data compiled by EPA in 1978 revealed that the summertime atmospheric level of PCBs exceeded the NIOSH recommended workplace exposure limit of 1 μg/m^3. No atmospheric monitoring has been conducted since 1978; air sampling of the area will be conducted in the near future. Lately there has been some concern over the placement of monitoring wells at the landfill, and the results of the 1978 groundwater leachate study are now being reassessed.

Widespread contamination

In addition to the direct discharges of PCB-containing wastewaters from the municipal wastewater treatment facility and by the capacitor manufacturers, other as yet unidentified discharges of PCB-contaminated fluids may be entering New Bedford Harbor and Buzzards Bay. Numerous combined sewer overflows and storm sewer outfalls discharge into the estuary. It is very likely that during storms PCBs are discharged from those sewer overflows immediately downstream from the capacitor manufacturers. Other combined sewer overflows may contribute to the PCB contamination; however, no information has been gathered on PCB levels in any storm or combined sewer discharges.

Urban storm drains in the communities of New Bedford, Acushnet, and Fairhaven may carry measurable levels of PCBs into the harbor. The source of PCBs, if present, could be atmospheric fallout or residual PCBs remaining on the roadways from what is believed to have been a common practice in the past—the oiling of municipal streets with PCB-contaminated waste oils. Urban runoff from industrial properties may contain PCBs as may runoff from railroad sidings where PCBs were transferred from rail cars to tank trucks for delivery to the factories.

A site in northern New Bedford known as Sullivan's Ledge may contain large quantities of PCBs. Originally Sullivan's Ledge was operated as a quarry. Later, after it filled with water, it became a popular neighborhood swimming hole.

Today, this approximately 5-ha site is completely filled to a nearly level grade. Rubble, brush, and other demolition materials are evident. A brook flows along the southern and eastern boundaries of the property, through a municipal golf course and into the Apponganset Swamp in the vicinity of the New Bedford municipal landfill.

Although it is not presently used as a dumpsite, in years past the city of New Bedford used Sullivan's Ledge as an industrial dump. Rubber tires were the primary waste product disposed of, but industrial waste oils, sludges, and other materials were also disposed of there. According to landfill operators and one local official, PCBs were deposited at the site. Random piles of electronic capacitors are evident at various locations at Sullivan's Ledge today. The quantity of PCBs disposed of is unknown but may be substantial. EPA has identified this area as a Superfund site and is currently exploring the extent of contamination.

Only two PCB samples have been collected at Sullivan's Ledge. No detectable level of PCB was identified in the one water sample obtained from the brook adjoining the property in 1978. A grab sample of the sediment underlying this brook was found to contain 0.288 ppm PCBs. No air monitoring has been conducted to date; however, EPA plans to establish an atmospheric sampling station at Sullivan's Ledge in the near future.

In the mid-1970s, a report documenting the historical solid waste disposal practices in New Bedford, Acushnet, Fairhaven, and Dartmouth was prepared. In addition to the New

Bedford municipal landfill and Sullivan's Ledge, several sites were discussed. Any number of these locales may contain PCBs. Although there exists no evidence to support the belief that area scrap dealers may have inadvertently contaminated their properties by accepting PCB-containing materials for metal recycling, this situation was found to exist in the upper Hudson River Valley. Thus, areas adjacent to the capacitor manufacturers that received fill while these companies were using PCBs should be considered contaminated until shown otherwise. Sediments dredged from New Bedford Harbor anytime during the past 30–40 years possibly contained PCBs.

Pollution abatement

Before concluding this report on PCB contamination in New Bedford, it is appropriate to list those abatement procedures that have been implemented. By 1972 both Aerovox and Cornell-Dubilier ceased using Aroclor 1242 and substituted Aroclor 1016, which was considered much less harmful environmentally. Whether *Aroclor 1016 is more or less hazardous* is now a matter of scientific debate, but at the time of its introduction, the lower percentage of chlorine in 1016 was believed to render it relatively innocuous. In 1978, all use of PCBs at the New Bedford capacitor manufacturing facilities ceased.

Early in 1982, both capacitor manufacturers reached agreements with EPA and the Massachusetts DEQE in which the companies accepted the final obligation of implementing limited cleanup measures. The corporations have cleaned and replaced contaminated sewer pipes, installed monitoring wells, and applied asphaltic coverings over all exposed soils on their properties. In addition, cleanup efforts, such as sediment removal and containment, have been performed.

New Bedford's wastewater treatment plant is currently operating well below its design efficiency. Suspended solids and biochemical oxygen demand (BOD_5) removal efficiencies often approach zero, and NPDES discharge permit levels are exceeded on a daily basis. City administrators applied for a waiver of the secondary wastewater treatment requirement in accordance with Section 301(h) of the Clean Water Act. The application was made in 1978 and denied by EPA in 1982. The city must now embark on the construction of a secondary, or biological, wastewater treatment facility to supplement the existing primary treatment plant.

The fate of the extensive harbor contamination is unknown. A state-funded study prepared in 1981 concluded that 90% of the PCBs could be dredged from the harbor at a cost of $140 million. New findings regarding the extent of the harbor contamination will undoubtedly surface as EPA's Superfund study progresses, and these findings will, in all probability, change this figure.

Acknowledgment

I am grateful to James Okun of GZA (Newton, Mass.), Charles Berring of EPA Region I, Steve Bliven of the Massachusetts Coastal Zone Management program, and Martha Weaver of the U.S. Geological Survey (Hartford, Conn.) for their technical support and advice.

Before publication, this article was reviewed for suitability as an *ES&T* feature by Gil Addis, Electric Power Research Institute, Palo Alto, Calif. 94303.

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For any queries concerning further references, the reader is invited to contact the author at P.O. Box 1008, Norwich, Conn. 06360, (203) 887-2555.

Grant Weaver is the manager of Water and Sewer for the Norwich, Conn., Department of Public Utilities. His work on PCB contamination in New Bedford was conducted during his previous employment as staff environmental engineer for the Massachusetts Coastal Zone Management program. Weaver holds a BS in biology from Kansas State University, an MS in environmental engineering from Oklahoma State University, and has completed postgraduate studies in environmental toxicology at the Massachusetts Institute of Technology. He is a registered professional engineer and a licensed wastewater treatment plant operator.