ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Public Health Assessment for

GENERAL ELECTRIC SITE-NEWELL STREET AREA I
(a/k/a GE-HOUSATONIC RIVER)
PITTSFIELD, BERKSHIRE COUNTY, MASSACHUSETTS
EPA FACILITY ID: MAD002084093
SEPTEMBER 19, 2003

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30-day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

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PUBLIC HEALTH ASSESSMENT
GENERAL ELECTRIC SITE
NEWELL STREET AREA I
PITTSFIELD, BERKSHIRE COUNTY, MASSACHUSETTS
FACILITY NO. MAD002084093

Prepared by

MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH
BUREAU OF ENVIRONMENTAL HEALTH ASSESSMENT
ENVIRONMENTAL TOXICOLOGY PROGRAM
under a cooperative agreement with
Public Health Service
Agency for Toxic Substances and Disease Registry
Atlanta, Georgia

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Preface

The Massachusetts Department of Public Health (MDPH) prepared this public health assessment as part of its cooperative agreement with the U.S. Agency for Toxic Substances and Disease Registry. In addition MDPH points out that this is only one of 10 General Electric sites for which public health assessments or health consultations are being or have been prepared. Thus, any conclusions presented here cannot be extrapolated to any other area of the General Electric site or to the entire General Electric site as a whole. Finally, MDPH has attempted to gather available data for the General Electric site through many visits to the U.S. Environmental Protection Agency and the Massachusetts Department of Environmental Protection offices for file reviews or document retrieval. MDPH is preparing a Summary Public Health Assessment that will address health and exposure concerns for the GE sites as a whole. That document will be released for public review and comment.

SUMMARY

The Newell Street Area I site of the General Electric (GE) site in Pittsfield, Massachusetts, is one of 10 areas being evaluated in separate public health assessments and health consultations.[1] In addition, the Massachusetts Department of Public Health (MDPH) is conducting or has conducted other health activities (e.g., descriptive analysis of cancer incidence data, ongoing serum polychlorinated biphenyl [PCB] analyses for Pittsfield area residents), the results of which will be incorporated into the summary public health assessment for the GE site.

The Newell Street Area I site mainly comprises commercial and industrial businesses as well as one club (i.e., Italian-American Club). The site was created in the early 1940s, when some Housatonic River oxbows and low-lying areas were separated from the active course of the river and subsequently filled with various materials from GE and other unknown sources.

The main constituents and environmental medium of concern at the site are polychlorinated biphenyl (PCBs) compounds and dioxin in soil. Employees working at the various businesses at the site, members of the Italian-American Club (and their families and friends), and nearby residents who might use the grounds of the Italian-American Club for recreational purposes are the individuals with the greatest opportunities for exposure to the site contaminants both in the past and at the time of this public health assessment. In the past, PCB concentrations in surface soil were as high as 50,000 parts per million (ppm) in some spots on the site, but various remedial actions and institutional controls implemented in the late 1980s through the mid-1990s have considerably reduced PCB concentrations in soil and access to remaining PCBs in soil. Dioxin levels were also elevated, with concentrations in soil detected as high as 23.2 parts per billion (ppb) before remediation.

A small strip of land and one location of maximum concentration on the Italian-American Club property have PCB surface soil concentrations higher than the rest of the property. While it is unlikely that individuals spend all of their time while at the Club on this strip or the location of maximum concentration, opportunities for exposure to PCBs in these soils should be addressed, particularly for young children. Remedial activities by environmental regulatory agencies and GE currently ongoing according to the consent decree should help address and mitigate such opportunities for exposure.

At the time of this public health assessment, the site is expected to remain commercial, and there are no plans for residential or other future development. Based on the past opportunities for exposure to PCBs and dioxin, the site represented a public health hazard. Under current use conditions and with institutional controls in place and remedial activities ongoing, the site overall represents a "No Apparent Public Health Hazard." Should institutional controls currently in place (e.g., fences) be removed or not be

[1] For a discussion of the difference between public health assessments and risk assessments, see Appendix B.

maintained, construction activities be undertaken that disturb the soil change (e.g., development), should the use of the site change (e.g., new residences, greater recreational use), or remedial activities are not properly completed/maintained, the site could be a potential public health hazard in the future, depending on the extent to which opportunities for exposure increase.

BACKGROUND

A. Purpose and Health Issues

The Newell Street Area I site is one of 10 areas that comprise the GE site in Pittsfield, Massachusetts. On September 25, 1997, the GE site was proposed by the U.S. Environmental Protection Agency (EPA) for the National Priorities List (NPL) (EPA 1997). When a site is proposed for listing, the U.S. Agency for Toxic Substances and Disease Registry (ATSDR) is required by federal law to conduct a public health assessment for the site. MDPH has a cooperative agreement with ATSDR to conduct public health assessments at NPL or other sites in Massachusetts. Thus, public health assessments for nine of the 10 areas of the GE site are being conducted by MDPH under its cooperative agreement with ATSDR. The tenth area, Allendale School Property, was evaluated by ATSDR in a health consultation. A health consultation was also conducted by ATSDR for Silver Lake. Negotiations between EPA and GE resulted in EPA's decision not to add the site to the NPL contingent on various cleanup actions agreed to by GE. In October 2000, a court-ordered consent decree was signed by EPA and GE, and it was agreed that GE would perform remediation actions to U.S. Environmental Protection Agency (EPA) and Massachusetts Department of Environmental Protection (MA DEP) performance standards (e.g., an average of less than 10 parts per million (ppm) PCBs in recreational surface soils, and an average of less than 2 ppm PCBs in residential soils). However, remediation does not eliminate past exposures and exposures occurring at parts of the site that may not yet have been remediated.

The 10 areas evaluated as part of the GE site are as follows:

1. Newell Street Area I
2. Newell Street Area II
3. East Street Area 1
4. East Street Area 2
5. Unkamet Brook Area
6. Hill 78 Area
7. Lyman Street
8. Allendale School Property
9. Housatonic River and Silver Lake
10. The Former Oxbows

Because each site has unique characteristics and opportunities for exposure, separate evaluations were developed for each of the 10 sites listed above. In addition, MDPH is also preparing a summary document for the GE site as a whole that will contain MDPH's overall assessment of public health implications for the entire site.

The GE site has a long history in terms of community health concerns. MDPH has been involved in addressing public health issues in the area since the early 1980s, when it issued a fish consumption advisory for the Housatonic River based on elevated PCB levels in fish. These final public health assessments will address public health concerns

related to contaminants found at the GE site, as well as health studies or exposure investigations that have been conducted or are ongoing by MDPH in the area. These studies include a PCB exposure assessment study completed in 1997 (the information booklet from this report is included as appendix E), a descriptive assessment completed in 2002 of cancer incidence for the Housatonic River area for a 13-year period, an ongoing evaluation of serum PCB levels among residents who called the MDPH PCB Hotline concerned about their opportunities for exposure to PCBs in the Housatonic River area, and a 2000 expert panel report on non-occupational PCB health.

The public health assessments or health consultations for the GE site review environmental data for the 10 areas mentioned above. They do not consider opportunities for past worker exposures within the GE facilities themselves (e.g., handling of materials containing PCBs), although they do consider opportunities for exposure to contaminants found in outdoor air, soil, or surface water bodies (including biota) for all potentially affected populations, including workers. Exposures to groundwater and sediments of the Housatonic River and its tributaries will be discussed in the public health assessment for the river.

These public health assessments also do not include evaluations of specific residential properties throughout Pittsfield (with the exception of properties evaluated as part of the site investigations for the 10 areas of the site). As part of the Residential Fill Property Project, the Massachusetts Department of Environmental Protection (MA DEP) and EPA have sampled residential properties suspected of containing elevated PCB levels in soil due to past use of fill material. As a result of public health concerns following the discovery of the use of PCB-contaminated soil for residential fill, MDPH has offered and continues to offer to any resident concerned about their opportunities for exposure to PCBs the exposure assessment questionnaire and, as warranted, having their blood tested for PCB levels as a service.

B. Site Description and History

In the early 1940s, the Army Corps of Engineers straightened some sections of the Housatonic River flowing through the city of Pittsfield in order to minimize the occurrence and impact of flood events. Some river oxbows and low-lying areas were separated from the active course of the river and subsequently filled with various materials from GE and other unknown sources. These fill materials were also used to elevate ground surface depressions in the area (Blasland, Bouck and Lee 1997; Blasland, Bouck and Lee 1992).

The Newell Street Area I site consisted of Oxbow I and some low-lying areas of the Housatonic River before the rechannelization project. Immediately after the rechannelization, many commercial and industrial businesses were developed at the site. The site mainly comprises eight commercial/light industrial businesses: Moldmaster Engineering, Inc., former Quality Printing, Co., Inc., Ravin Auto Body, Vincent J. Stracuzzi, Anthony Marchetto Contractors, F.W. Webb Company, Pittsfield Transmission Company, Inc., Allegroni Construction Company, Inc., and one

recreational business called the Italian-American Club (See Figure 1). Two of these properties, Quality Printing and F.W.Webb were purchased by GE. At the time of this public health assessment, these two buildings are now vacant and locked (Blasland, Bouck and Lee 1997). The Newell Street Area I site is bounded to the north by the Housatonic River, to the east by the playground of a public school, the Hibbard School, to the south by Newell Street, and to the west by Ontario Street Extension and the Newell Street Area II site[2].

After the initial discovery and further investigation of PCB contamination at the site, the following actions were taken:

- In 1988 through 1989, GE excavated the top four inches of surface soil at the northern portions of the Quality Printing property.
- In 1991, GE proposed to MA DEP a short-term measure (STM), which consisted of institutional controls in areas of high PCB concentration at the Marchetto and Quality Printing properties. For the Marchetto property, a layer of four-inch thick asphalt was placed on areas with PCB concentrations greater than 22 ppm. For the Quality Printing property, a four-inch thick layer of asphalt was placed on areas where soil removal had occurred in 1988 through 1989. Both properties had six-foot high chain-link fences (Blasland, Bouck and Lee 1992) installed around them,
- In 1995 through 1997, an STM/IRA (Immediate Response Action) was carried out for the Italian-American Club property. For areas with elevated PCB levels along the western border of the Club with Quality Printing, the top six inches of PCB-contaminated soil were removed and replaced by a three-inch layer of clean fill, a three-inch layer of loam, and sod on top of the loam.
- In 2000, GE performed additional soil sampling at the Italian-American Club property.

Currently, the Newell Street Area I site is fenced at the north side to prevent access to the site via the Housatonic River. The Quality Printing property is fenced on all sides, and access is restricted (MA DEP 1998a). The grounds of the Italian-American Club are used for picnics and bocce games (MA DEP 1998a). The other commercial businesses are light industries with employees, truckers, contractors, and occasional customers who have contact with the site. Because land at the Newell Street Area I site is currently zoned as commercial and the site is primarily a commercial area, there are no foreseeable changes in land use. Also, residences and businesses in this area, as well as Pittsfield as a whole, use municipal water supplies. No known private wells exist in this area (MA DEP 1998a; DEM 1998).

C. Site Visit

For purposes of this public health assessment, MDPH staff conducted five site visits, one on March 13, 1998, with EPA Region I and ATSDR representatives, one on April 9,

[2] These site boundaries have changed somewhat after the consent decree. These public health assessment documents describe the sites and the site boundaries as they existed prior to the signing of the consent decree in 2000.

1998, with MA DEP and GE representatives, one on August 20, 1998, and one on July 27, 1999. The fifth site visit conducted on June 21, 2001, following initiation of remedial activities outlined in the consent decree[3], provided an update of on-going activities at the GE sites. On this visit, some picnic tables with benches at the back yard of the Italian-American Club and piles of discarded auto parts at the back of Ravin Auto Body were noted. Some areas of the club property were either bare dirt or had evidence of high use (e.g., low grass cover). There is a fence, which is in good repair at the back of all the commercial buildings along the riverbank. The perimeter of the site facing Newell Street is either paved or covered with low grass. Besides a combination of lawns, shrubs, and trees at the riverbank, the areas behind most commercial properties are gravel- and grass-covered. Figure 1 shows the site plan.

D. Demographics

The Newell Street Area I site is located southeast of Silver Lake in the eastern section of Pittsfield. The 1980 U.S. Census indicated that 51,974 persons lived in the city of Pittsfield. The 1990 U.S. Census showed a population of 48,622, which is a 6.5% decrease from the 1980 population. The 2000 U.S. Census totaled a population of 45,793, which is a 5.8% decrease from 1990 and an 11.5% decrease from 1980. The sex, race, and age breakdowns for Pittsfield are presented in Table 1 (U.S. Census 2001).

Within the city of Pittsfield, the Newell Street Area I site is located in U.S. Census Tract 9010. In 1990, U.S. Census Tract 9012 was newly created and separated from Census Tract 9010. It now abuts Census Tract 9010 along the opposite bank of the Housatonic River and primarily comprises the General Electric property itself. The 2000 U.S. Census shows that 5226 individuals live in Census Tract 9010. Census Tract 9012 shows only 66 residents. The sex, race, and age breakdowns are presented in Table 1.

E. Health Outcome Data

Cancer incidence as reported by the Massachusetts Cancer Registry (MCR) for the city of Pittsfield is described in Table 2. To determine whether Pittsfield experienced elevated cancer rates, standardized incidence ratios (SIRs) were calculated[4]. For the years 1995 through 1999, the most recent years for which cancer incidence data are available, no cancers were statistically significantly elevated (MDPH 2002b).

MDPH evaluated cancer incidence data for Pittsfield, Lenox, Lee, Stockbridge, and Great Barrington and for smaller geographic areas within each community for the period from 1982 through 1994. Cancers evaluated include bladder, liver, breast, non-Hodgkin's lymphoma (NHL), thyroid, and Hodgkin's disease. Results of this analysis were presented in a separate health consultation report released in April 2002. Cancer information relevant to the GE sites was examined for patterns that might indicate an environmental exposure pathway.

[3] The consent decree was signed by several regulatory agencies, GE, and the city of Pittsfield.
[4] A detailed explanation of SIRs is presented in Appendix D.

ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS

To evaluate whether a site poses an existing or potential hazard to an exposed or potentially exposed population, health assessors review all available on-site and off-site environmental contamination data for all media (e.g., soil, surface water, groundwater, air). The quality of the environmental data is discussed in the Quality Assurance and Quality Control section. Physical conditions of the contaminant sources and physical hazards, if any, are discussed in the Physical and Other Hazards section. A plain language glossary of environmental health terms can be found at the end of this document (Appendix C).

A. On-Site Contamination

Groundwater and air data from environmental sampling at the Newell Street Area I site are available for the years from 1988 to 1997 (Blasland, Bouck and Lee 1997; Blasland, Bouck and Lee 1992). Surface soil and soil boring sampling are available from 1988 to 2000 (Blasland, Bouck and Lee 1997, Blasland, Bouck and Lee 2000). Data for soil of 0 to 1 foot, 0 to 2 feet, 0 to 0.33 feet (the top four inches), and 0 to 0.5 feet (the top six inches), subsurface soil, groundwater, and air were reviewed for this site[5].

Health assessors use a variety of health-based screening values, called comparison values, to help decide whether compounds detected at a site might need further evaluation. These comparison values include environmental media evaluation guides (EMEGs), reference dose media evaluation guides (RMEGs), cancer risk evaluation guides (CREGs), maximum contaminant levels for drinking water (MCLs), or other applicable standards. These comparison values have been scientifically peer reviewed or derived using scientifically peer-reviewed values and published by ATSDR and/or EPA. The MA DEP has established Massachusetts's maximum contaminant levels (MMCL) for public drinking water supplies. EMEG, RMEG, MCL, and MMCL values are used to evaluate the potential for noncancer health effects. CREG values provide information on the potential for carcinogenic effects. For chemicals that do not have these comparison values available for the medium of concern, EPA risk-based concentrations (RBCs), developed by EPA regional offices, are used. For lead, EPA has developed a hazard standard for residential soil (EPA 2001).

If the concentration of a compound exceeds its comparison value, adverse health effects are not necessarily expected. Rather, these comparison values help in selecting compounds for further consideration. For example, if the concentration of a chemical in a medium (e.g., soil) is greater than the EMEG for that medium, the potential for exposure to the compound should be further evaluated for the specific situation to determine whether noncancer health effects might be possible. Conversely, if the concentration is less than the EMEG, it is unlikely that exposure would result in noncancer health effects. EMEG values are derived for different durations of exposure according to ATSDR's guidelines. Acute EMEGs correspond to exposures lasting 14 days or less. Intermediate EMEGs correspond to exposures lasting longer than 14 days to less than one year.

[5] Most data considered in this public health assessment are pre-consent decree.

Chronic EMEGs correspond to exposures lasting one year or longer. CREG values are derived assuming a lifetime duration of exposure. RMEG values also assume chronic exposure. All the comparison values (i.e., CREGs, EMEGs, RMEGs, and RBCs) are derived assuming opportunities for exposure in a residential setting.

Tables 3a and 3b show the minimum, mean, and maximum values of soil compounds that exceeded their respective health-based comparison values developed by ATSDR or, in the case of polycyclic aromatic hydrocarbons (PAHs) and inorganic compounds, typical background levels. Of the compounds that were detected for soil at 0 to 0.33 feet, 0 to 0.5 feet, and 0 to 2 feet at this site, the ones that exceeded health comparison values or typical background levels in soil were PCBs, dioxins, three PAHs, and antimony. However, only two of 16 samples detected antimony, with one sample at 100 ppm and one at 6.7 ppm. The latter sample was within the typical background range reported for this inorganic chemical. Only PCBs were detected above comparison values in the 0- to 2-foot samples.

Before short-term measures and institutional controls were implemented for the Newell Street Area I site, PCBs were mainly concentrated in "hot spots" at the Quality Printing and Italian-American Club properties. Four samples located in the grass-covered backyard of the Club had PCB concentrations of 1,440 ppm; 1,500 ppm; 5,550 ppm (average of 5,400 ppm and 5,700 ppm); and 50,000 ppm. Two other samples with concentrations of 1,130 ppm and 29,900 ppm were located in the gravel backyard of Quality Printing. Figure 2 shows the PCB surface soil samples at Quality Printing and the Italian-American Club. The next highest PCB concentrations for the entire site ranged from 107 ppm to 850 ppm. Except for three samples located at the Moldmaster and F.W. Webb properties, most of the samples with PCB levels in this range were located at the Club, Quality Printing, and Marchetto properties.

After short-term measures and institutional controls were implemented for the Newell Street Area I site (in 1988 through 1989, 1991, and 1995 through 1997), the overall site concentrations of PCBs in surface soil were lower, and access to PCB-contaminated areas was restricted. Table 3c shows PCB concentrations that remain after the implementation of remedial and institutional controls for the Quality Printing, Marchetto, and the Italian-American Club properties. With five exceptions, the rest of the soil samples on the site showed PCB concentrations less than 10 ppm. The five exceptions showed concentrations ranging from 22 ppm to 76 ppm and were located at the Moldmaster, F.W.Webb, and Italian-American Club properties.

Eight surface soil samples were collected at the unpaved areas of the site and analyzed for dioxins. Soil concentration results for dioxins shown in Table 3a are reported as toxicity equivalents (TEQ).[6]

[6] Toxicity equivalents (TEQ) represent 2,3,7,8-TCDD toxic equivalents for mixtures of dioxin-like chlorinated dibenzo-p-dioxins (CDDs) and chlorinated dibenzofurans (CDFs). Since limited data on toxicity exist for many of the CDDs and CDFs, toxic equivalency factors (TEFs) were developed and validated in animals. TEFs compare the relative toxicity of individual congeners to that of 2,3,7,8-TCDD. The 2,3,7,8-TCDD congener is used as the basis of the TEFs because it appears to be the most toxic of the

Four of the eight soil samples were collected at the Quality Printing property and had TEQ levels of 2.95 parts per billion (ppb), 4.70 ppb, 5.80 ppb, and 23.18 ppb. One sample on the Italian-American Club property showed a level of slightly greater than 1 ppb, while three other samples from the Marchetto and Stracuzzi properties were less than 1 ppb. All samples, except for the Italian-American Club sample, were collected from non-remediated areas of the properties that are currently fenced.

Table 3d summarizes surface soil sampling (0 – 1 foot) performed by GE at the Italian American Club property in January 2000 in preparation of remedial activities under the forthcoming consent decree (Blasland, Bouck, and Lee, 2000). Ten surface soil samples were tested for PCBs, which were detected in all 10 samples from a minimum of 0.53 ppm to a maximum of 390 ppm (15 ppm second highest), with a mean of 44.2 ppm (mean = 4.95 ppm without 390-ppm location of maximum concentration). Two of the surface samples were also analyzed for VOCs, SVOCs, PAHs, dioxins, and metals. PAHs were detected above comparison values in one sample (i.e., benzo(a)anthracene at 1.9 ppm, benzo(a)pyrene at 1.8 ppm, benzo(b)fluoranthene at 2.4 ppm, and indeno(1,2,4-cd)pyrene at 1.2 ppm). The compound 2,3,7,8-TCDD was detected in one sample at 0.009 ppb, with a total dioxin TEQ of 0.68 ppb. In the sample that 2,3,7,8-TCDD was not detected, however, there was a total dioxin TEQ of 1.2 ppb.

Table 3e summarizes subsurface soil sampling performed by GE at the Italian American Club property in January 2000 in preparation of remedial activities under the forthcoming consent decree (Blasland, Bouck, and Lee 2000). Forty-one subsurface soil samples were collected from the club property and were analyzed for PCBs. PCBs were detected in all samples, with concentrations ranging from a minimum 0.081 ppm at a depth of 10 – 15 feet to a maximum 3600 ppm at 6 – 10 feet. Thirteen of the subsurface samples were also analyzed for VOCs, SVOCs, PAHs, dioxins, and metals. Four PAHs, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and indeno(1,2,4-cd)pyrene, were detected above comparison values in 3 of the 13 samples with maximums of 4.9 ppm, 5.6 ppm, 6.3 ppm, and 3.1 ppm respectively. The compound 2,3,7,8-TCDD was detected in 5 of the 13 samples with a maximum of 1.2 ppb, and dioxin TEQ was calculated for all 13 samples with a maximum of 55.5 ppb. Also, the metals antimony (maximum 48 ppm), arsenic (maximum 82 ppm), cadmium (maximum 20 ppm), chromium (maximum 350 ppm), copper (maximum 13,000 ppm), lead (maximum 9,000 ppm), sulfide (maximum 595), and tin (maximum 1,600 ppm) were detected above comparison values or typical background ranges in at least one subsurface sample each. Although these contaminants were found in subsurface soils above their respective comparison values, they will not be further evaluated because subsurface soil is not accessible at the site.

Unfiltered groundwater samples from monitoring wells at the site were tested for VOCs, SVOCs, PCBs, PAHs, metals, and dioxins. The groundwater samples showed that PCBs,

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CDDs to mammals. The TEQ is calculated by calculating the sum of the products of the TEFs for each congener and its concentration in the mixture. The unit for dioxin toxicity equivalence is parts per billion or micrograms per kilogram (μg/kg).

benzene, methylene chloride, arsenic, barium, and chromium, exceeded the comparison values established for drinking water. Elevated levels of PCBs were found in groundwater samples collected at Quality Printing and the Italian-American Club. Other compounds found in groundwater were distributed consistently through the site. Although some unfiltered groundwater samples had contaminant levels exceeding their respective comparison values, these data will not be discussed in this public health assessment because these are no known drinking water wells using this groundwater. Groundwater from the site discharges to the Housatonic River, but surface water data from the Housatonic River will be addressed in a separate public health assessment for the Housatonic River. Table 4 summarizes the groundwater data.

Air monitoring for PCBs was conducted at the Quality Printing and F.W. Webb properties (See Table 5). Some samples were taken with a high-volume sampler, while others with a low-volume sampler. High-volume samplers are usually used for outdoor sampling where there is a lot of vibration, while low-volume samplers are usually used for indoor sampling because the samplers are handier than the high-volume samplers. There is no major difference in sampling techniques between high- and low-volume samplers (MA DEP 1998b). The low-volume samplers were placed near the ground, while the high-volume samplers were placed two to six meters above the ground. In general, the high-volume samplers had lower detection limits (Blasland, Bouck and Lee 1992; Blasland; Blasland, Bouck and Lee 1997). Results from the low-volume samples were higher than the high-volume samples.

The sampling was conducted as part of the site assessment work during the following periods:

- August 1991 through August 1992: high-volume sampling one to three times per month at the beginning, middle, and end of the month, except for June 1992 with four sampling times;
- May 1993 through August 1993: high-volume and low-volume sampling twice per month at the beginning and middle of the month;
- July 1996 through September 1996: high-volume and low-volume sampling once per month; and
- July 1997 through August 1997: high-volume sampling.

All air sampling occurred after remedial measures were taken at the Quality Printing property, and at least some samples were taken after remediation at the Marchetto property. Remediation at the adjacent Italian-American Club occurred during the 1995 through 1997 period and, hence, some air sampling appears to overlap with these remediation activities.

One station was set up on the F.W. Webb property. Two stations were set up on the Quality Printing property—one in the rear and one in the front. In addition, a second monitor (the "co-locator") was set up for each monitor. The co-locator was used for quality control purposes and showed similar ambient concentrations. Thus, for purposes of evaluating air data from the site, for each sampling event, we averaged the value

recorded by the monitor and its corresponding co-locator to get a single PCB concentration.

For all the sampling periods combined, 64 high-volume sample results were available for review. Of these, 41 samples were taken during the summer months (mid-May to mid-September). For sampling periods of May 1993 through August 1993 and July 1996 through September 1996, 11 low-volume sample results were available for review. All of these low-volume samples were taken during the summer months (mid-May to mid-September). Table 5 summarizes these results:

- PCBs were detected in 52 of the 62 high-volume samples, with a mean concentration of 0.0082 microgram per cubic meter ($\mu g/m^3$)
- PCBs were detected in 39 of the 42 high-volume samples taken during the summer months, with a mean concentration of 0.011 $\mu g/m^3$
- PCBs were detected in 13 out of 20 high-volume samples taken during the non-summer months of 1991 through 1992, with a mean concentration of 0.002 $\mu g/m^3$
- Five of 11 low-volume results available for the summer months showed only PCB detections, with a mean concentration of 0.046 $\mu g/m^3$.

An ambient air monitoring station was set up at the Berkshire Community College 3.5 miles west of the GE facility sites to establish background concentrations. The sampling was conducted during the following periods:

- August 1991 through August 1992, high-volume sampling one to three times per month at the beginning, middle, and end of the month, except for June 1992 with four sampling times;
- May 1993 through August 1993, high-volume sampling twice per month at the beginning and middle of the month;
- June 1995 through August 1995, high-volume sampling twice per month at the second and last weeks of the month; and
- July 1996 through September 1996, high-volume sampling once per month

Table 5 shows the results from the background sampling for PCBs:

- PCBs were detected in 19 out of 48 samples, with a mean concentration of 0.0007 μg/m3
- PCBs were detected in 15 out of 27 samples taken during the summer months, with a mean concentration of 0.001 $\mu g/m^3$
- PCBs were detected in 4 out of 21 samples taken during the non-summer months (mid-May to mid-September), with a mean concentration of 0.0004 $\mu g/m^3$.

Thus, the background concentrations were about 10 times lower than those detected at the Newell Street Area I site. Both monitoring programs at the site and at the background location indicate that ambient PCB concentrations increase when temperature rises, starting at about 60°F (Blasland, Bouck and Lee 1997).

B. Off-Site Contamination

The GE site comprises 10 different areas, for which separate public health assessments are being developed. Those 10 areas are the Housatonic River/Silver Lake, the Former Oxbows (Oxbows A,B,C,J, and K), the East Street Area 1, the East Street Area 2, the Newell Street Area I, the Newell Street Area II, the Unkamet Brook Area, the Lyman Street Parking Lot, the Hill 78 Area, and the Allendale School Property. Environmental data for the Housatonic River, which borders the Newell Street Area I site, typically would be considered "off-site" from the Newell Street Area I site. However, these data will be addressed in a separate public health assessment for the Housatonic River rather than be included as off-site contamination for the Newell Street Area I site.

In addition, some residences are located along Newell Street. Some residences on Newell Street had soil sampled as part of the MA DEP Residential Fill Property Project, and these results are not addressed here. The Hibbard School playgrounds, which are located to the east of the Newell Street Area I site, had soil sampling conducted for PCBs as part of the Newell Street Area I site investigation. Eleven surface soil samples and one duplicate sample were taken. The average value of the sample and its duplicate was used for calculating the overall mean. The average PCB concentration was 0.4 ppm, with a maximum concentration of 1.1 ppm. Because parts of the Newell Street Area I site are accessible (e.g., Italian-American Club), nearby residents or school-aged children could come into contact with the site. Also, concentrations of PCBs from ambient air stations on the site might closely approximate concentrations to which these residents or school children might be exposed.

C. Quality Assurance/Quality Control (QA/QC)

The reports on GE facilities were also associated with a sampling and analysis plan that included information on QA/QC. The information indicates that QA/QC was performed appropriately for the samples collected by GE. The validity of the conclusions made in this public health assessment depends on the accuracy and reliability of the data provided in the cited reports.

For surface soil, some values of dioxin compounds are estimated because of the presence of interference. Some dioxin values for surface soil and groundwater are estimated below the lower calibration limit, but above the target detection limit. All data have been approved by EPA pursuant to the Field Sampling Plan/Quality Assurance Project Plan (EPA 2000).

D. Physical and Other Hazards

There are no known physical hazards to the general public at this site. Two properties that are now owned by GE are vacant and locked. Access to other commercial properties at the site are mainly by Newell Street. The fences surrounding the northern, western, and eastern boundaries of the site are well maintained.

PATHWAY ANALYSIS

To determine whether nearby residents and people on-site were, are, or could be exposed to contaminants, an evaluation was made of the environmental and human components that lead to human exposure. An exposure pathway consists of five elements: a source of contamination, transport through an environmental medium, a point of exposure, a route of human exposure, and a receptor population.

Exposure to a chemical must first occur before any adverse health effects can result. Five conditions must be met for exposure to occur. First, there must be a source of that chemical. Second, a medium (e.g., water) must be contaminated by either the source or by chemicals transported away from the source. Third, there must be a location where a person can potentially contact the contaminated medium. Fourth, there must be a means by which the contaminated medium could enter a person's body (e.g., ingestion). Finally, the chemical must actually reach the target organ susceptible to the toxic effects from that particular substance at a sufficient dose for a sufficient time for an adverse health effect to occur (ATSDR 1993).

A completed exposure pathway exists when all of the above five elements are present. A potential exposure pathway exists when one or more of the five elements is missing and indicates that exposure to a contaminant could have occurred in the past, could be occurring in the present, or could occur in the future. An exposure pathway can be eliminated if at least one of the five elements is missing and will not likely be present. The discussion that follows incorporates only those pathways that are important and relevant to the site.

A. Completed Exposure Pathways

Surface Soil

Past and present opportunities for exposure to compounds in soil at this site likely occurred. These opportunities for exposure could have begun as early as the 1940s, when contaminated fill materials were used on the site. Potentially affected populations include employees at the commercial businesses, customers of these businesses, and those who might have used the site recreationally (for example, members of the Italian-American Club who picnicked and played bocce games). Past and present exposures might have occurred through incidental ingestion of contaminated soils or possibly skin absorption of PCBs through direct contact with PCB-contaminated soils at the site.

Ambient Air

Past and present exposures to PCBs in ambient air at this site likely occur to employees at the commercial businesses, residents living in neighborhoods adjacent to the site, nearby school children, and those who might have used the site through the inhalation route of exposure.

B. Potential Exposure Pathways

Subsurface Soil

Future exposures to contaminated soils might occur to individuals who contact soil should excavation activities occur. Exposure to PCBs through contact with these soils would mostly happen through incidental ingestion or possibly skin absorption. At this time, MDPH is not aware of excavation activities (e.g., new buildings) planned for the site.

Surface Water

Groundwater from this site discharges into the Housatonic River (Blasland, Bouck and Lee 1992). However, the contribution of PCBs or other compounds in the Housatonic River via groundwater from the Newell Street Area I site versus other sources is difficult to assess due to limited sampling data. Thus, although this might be considered a potential exposure pathway (e.g., via ingestion of fish contaminated with PCBs or incidental ingestion of surface water), the Newell Street Area I public health assessment will not attempt to quantify the possible role of groundwater as a contributor of PCBs for the Housatonic River. Also, surface water, sediment, and fish chemical concentration data exist for the Housatonic River itself. Evaluation of opportunities for exposure to PCBs or other contaminants in the river will be included in the public health assessment for the Housatonic River.

C. Eliminated Exposure Pathways

Groundwater

Past, present, and future exposures to PCB-contaminated groundwater are not likely to occur in this area because residences and businesses in the Newell Street Area I site, as well as Pittsfield as a whole, are on a municipal water supply. They are not likely to use this groundwater for potable or processing purposes.

DISCUSSION

MDPH staff have summarized the available environmental data and exposure pathways for the Newell Street Area I site in this public health assessment. Completed exposure pathways included contact with surface soil and ambient air. The main compounds of concern at the site are PCBs in surface soil and air, and dioxin in surface soil. Other compounds that exceeded screening or typical background values in at least some surface soil samples were PAH compounds.

Opportunities for exposure to these compounds are primarily via incidental ingestion of surface soil at the site or via inhalation of PCBs in ambient air. Groundwater at the site has not been and is not being used for drinking water and, hence, groundwater does not present a complete exposure pathway. Although groundwater might discharge to the Housatonic River, it is more appropriate to use actual chemical concentration data for the

river surface water and sediment in estimating public health effects. Public health implications from opportunities for exposure to chemicals in the river will be covered in the public health assessment for the river.

In evaluating the public health implications of opportunities for exposure to PCBs, MDPH has been conducting a variety of activities in the Housatonic River area. MDPH previously completed an exposure assessment study of the Housatonic River area (MDPH 1997). Residents of eight communities that live within one-half mile of the Housatonic River were randomly chosen to participate in the exposure assessment study. In addition, residents who were not chosen for the study but who were concerned about exposure to PCBs were offered the opportunity to volunteer to participate in a separate effort.

The exposure assessment study found that although the participants generally had serum PCB levels within the reported background range for non-occupationally exposed individuals (ATSDR 2000), those who engaged in high-risk activities (e.g., high frequency and duration of consumption of contaminated fish) had higher serum PCB levels.

Because of the discovery during summer 1997 of widespread residential PCB soil contamination, MDPH is conducting a separate study of residents who might be at risk of exposure through contact with residential soil. MDPH set up a hotline number for individuals to call with health-related concerns, to complete exposure questionnaires, and to request serum PCB testing. Since August of 1997, over 150 individuals have had their serum tested for PCBs. This is an ongoing community service by MDPH. Results of serum PCB testing and evaluation of the community health concerns resulting from the hotline calls will be reported in the summary public health assessment for the GE sites.

MDPH has also been conducting ongoing outreach with the local health community to inform them of activities in the area. For example, MDPH held Grand Rounds in 1993, 1996, 1997, September 2000, and December 2000 at the Berkshire Medical Center or North Adams Hospital to discuss MDPH activities, particularly those related to serum PCB testing, with health professionals at these facilities. During 1999, MDPH staff have spoken at a number of other health-related forums sponsored by local health professionals and community groups.

Other activities performed or ongoing by MDPH include the following:

1. MDPH conducted a descriptive cancer incidence analysis of selected cancer types (i.e., bladder cancer, liver cancer, non-Hodgkin's lymphoma, breast cancer, thyroid cancer, and Hodgkin's disease) in Pittsfield, Lenox, Lee, Stockbridge, and Great Barrington that occurred from 1982 through 1994, utilizing data from the Massachusetts Cancer Registry. This analysis included evaluations of temporal and geographic trends (e.g., analysis of smaller geographic areas, or census tracts).

2. The Executive Office of Health and Human Services (EOHHS) convened an independent panel of national experts to advise MDPH on the most up-to-date information on possible health effects from non-occupational exposure to PCBs. A public meeting attended by the panel chair was held in Pittsfield in January 1999, prior to the first panel meeting. The panel prepared a written report that was submitted to EOHHS and released to the public in October 2000 (MDPH 2000). A public meeting attended by most of the panel members was held in Pittsfield in December 2000. In addition, panel members along with MDPH met with MDPH's advisory committee and with physicians at the Berkshire Medical Center.

3. MDPH established its Housatonic River Area Advisory Committee on Health in 1995. This committee is comprised of local residents, representatives from the local medical community, environmental and health professionals, representatives from the offices of elected officials and local health departments. MDPH staff hold meetings with committee members to report on the status of various activities and to discuss and get feedback on the conduct of MDPH health activities and investigations (e.g., education and outreach) in the area.

Information gathered from these additional activities improves MDPH's ability to assess the public health implications of PCB contamination in the Pittsfield area. The following discussion of potential public health implications is based on available information. A summary public health assessment incorporating all available information from the individual GE site PHAs and addressing public health and exposure concerns will be developed and released for public comment.

A. Chemical-Specific Toxicity Information

As noted earlier in this public health assessment, the chemicals of concern at the Newell Street Area I site are PCBs, dioxins, and PAH compounds. These chemicals exceeded either comparison or typical background values in surface soil at the site. In addition, PCBs were detected in ambient air samples at the site at levels higher than background for the area. One soil sample (of 16 taken) at the site exceeded ATSDR's comparison value for antimony for children but was less than ATSDR's comparison value for adults. This sample was on the Quality Printing property. Because only one sample exceeded the comparison value and occurred in an area not frequented by young children (i.e., behind the Quality Printing property), it is not likely that opportunities for exposure to this compound would result in adverse health effects. Thus, antimony will not be further considered.

In order to evaluate possible public health implications, estimates of opportunities for exposure to compounds (e.g., in soil) must be combined with what is known about the toxicity of the chemicals. ATSDR has developed minimal risk levels (MRL) for many chemicals. An MRL is an estimate of daily human exposure to a substance that is likely to be without an appreciable risk of adverse noncancer health effects over a specified duration of exposure. MRLs are derived based on no-observed-adverse-effect levels (NOAELs) or lowest-observed-adverse-effect levels (LOAELs) from either human or animal studies. The LOAELs or NOAELs reflect the actual levels of exposure that are

used in studies. ATSDR has also classified LOAELs into "less serious" or "serious" effects. "Less serious" effects are those that are not expected to cause significant dysfunction or whose significance to the organism is not entirely clear. "Serious" effects are those that evoke failure in a biological system and can lead to illness or death. When reliable and sufficient data exist, MRLs are derived from NOAELs or from less serious LOAELs, if no NOAEL is available for the study. To derive these levels, ATSDR also accounts for uncertainties about the toxicity of a compound by applying various margins of safety to the MRL, thereby establishing a level that is well below a level of health concern.

PCBs

For PCBs, the rhesus monkey is the most sensitive animal species in terms of health effects resulting from exposure to PCBs, and studies in this species form the basis of ATSDR's screening values for PCBs. ATSDR derived a chronic oral MRL of 0.00002 milligrams per kilogram per day (mg/kg/day) for chronic exposure to PCBs. The MRL was based on a LOAEL for immunological effects (e.g., decreased IgM and IgG antibody levels in response to sheep red blood cells) in female rhesus monkeys administered 0.005 mg/kg/day aroclor 1254 by gavage for 55 months (Tryphonas et al. 1989, 1991a; as cited in ATSDR 2000). A LOAEL of 0.005 mg/kg/day for 37 months also induced adverse dermatological effects (e.g., prominent toe nail beds, elevated toe nails, separated toe nails) in adult monkeys (Arnold et al. 1993a; as cited in ATSDR 2000) as well as in their offspring (Arnold et al. 1995; as cited in ATSDR 2000). A LOAEL of 0.005 mg/kg/day for 37 months in adult monkeys also induced effects (e.g., inflammation of tarsal glands, nail lesions, and gum recession) in their offspring.

An uncertainty factor of 300 was used to derive the chronic oral MRL (10 for extrapolation from a LOAEL to a NOAEL, 10 for human variability, and 3 for extrapolation from animals to humans). These effects at the LOAELs discussed above are considered by ATSDR to be "less serious" effects. Other effects ("less serious" or "serious") were generally reported to occur at levels approximately four times greater than those that form the basis for the lowest LOAELs (ATSDR 2000). A panel of international experts cited support for this chronic oral MRL from human studies (ATSDR 2000).

ATSDR has also developed an intermediate oral MRL of 0.00003 mg/kg/day. The MRL was based on a LOAEL of 0.0075 mg/kg/day for neurobehavioral effects in infant monkeys that were exposed to a PCB congener mix representing 80% of the congeners typically found in human breast milk (ATSDR 2000).

ATSDR has not developed an MRL for the inhalation route of exposure because of a lack of sufficient data on which to base an MRL. The chronic MRL will be used for evaluating human health concerns associated with opportunities for exposure to PCBs at this site, regardless of duration or route of exposure. This is a conservative assumption.

While the above health effects were the most sensitive health effects (forming the basis of the MRL), a number of human and animal studies have suggested that other effects include liver damage, neurological effects, reproductive and developmental effects, and cancer. Also, the International Agency for Research on Cancer (IARC) has classified PCBs as "probable human carcinogens" based on sufficient evidence of carcinogenicity in animals and limited evidence in humans. Because it is difficult to show that a chemical causes cancer in humans, animal studies are used to identify chemicals that have the potential to cause cancer in humans. PCBs do cause cancer in animals. Thus, it is assumed that exposure to PCBs over a period of time might pose a risk for humans. The degree of risk depends on the intensity and frequency of exposure.

Dioxins

The compound 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) is one of 75 different congeners of chlorinated dibenzo-p-dioxins (CDDs). Dioxins are not intentionally manufactured but can be formed in the manufacturing process of chlorophenols (e.g., herbicides and germicides). The main environmental sources of dioxins are herbicides, wood preservatives, germicides, pulp and paper manufacturing plants, incineration of municipal and certain industrial and medical wastes, transformer/capacitor fires involving PCBs, exhaust from automobiles using leaded gasoline, chemical wastes from improper disposal, coal combustion, and residential wood burning stoves.

ATSDR has developed an MRL for TCDD of 1x10-9 mg/kg/day, or 1 picogram per kilogram per day (pg/kg/day) (ATSDR 1998). This was based on an LOAEL for developmental effects in rhesus monkeys. This MRL is similar to what ATSDR has estimated as a background exposure level of approximately 0.7 pg/kg/day for TCDD. ATSDR notes that the primary route of exposure to dioxin compounds for the general population is the food supply (e.g., fish), which is the main contributor to the background exposure. The EPA has estimated that greater than 90 percent of the human body burden of dioxins is derived from foods. If one considers exposure to all CDD and chlorinated dibenzofuran congeners, the background exposure level increases to as much as 2.75 pg/kg/day (ATSDR 1998).

The EPA has determined that TCDD is a "probable human carcinogen" based on sufficient animal and limited or inadequate evidence in human studies. IARC has classified TCDD as carcinogenic to humans (Group 1) (ATSDR 1998).

PAH Compounds

PAHs are ubiquitous in soil. Combustion processes release PAHs into the environment. Therefore, the major sources of PAHs in soils, sediments, and surface water include fossil fuels, cigarette smoke, industrial processes, and exhaust emissions from gasoline engines, oil-fired heating, and coal burning. PAHs are also found in other environmental media and in foods, particularly charbroiled, broiled, or pickled food items, and refined fats and oils (ATSDR 1995).

No MRLs are available for benzo(a)pyrene or dibenz(a,h)anthracene. The primary health concern for these compounds is carcinogenicity, and EPA considers both compounds to be "probable human carcinogens," based on sufficient evidence in animal studies and inadequate evidence for human studies.

B. Evaluation of Possible Health Effects

For the Newell Street Area I site, populations that could have been exposed to PCBs and other compounds in soil or PCBs in ambient air include employees and customers of the businesses located on the site, members or guests of the Italian-American Club, and nearby residents on Newell Street. It is likely that members or guests of the Italian-American Club would have had the greatest opportunities for exposure to PCBs and other compounds in soil at the site because of possible frequent recreational use of the Club property and the fact that some of the highest concentrations of soil PCBs at the site were found on this property. Employees and customers of commercial businesses on the site likely would have less opportunity for such exposure (e.g., customers or employees walking between their cars and the building are unlikely to have much opportunity for exposure to compounds in soil). Residents on Newell Street or school children from the Hibbard School could access the Italian-American Club property, and it can be reasonably assumed that ambient air concentrations of PCBs on the site would be similar on these off-site adjacent properties.

Soil at Italian-American Club Prior to 1995-1997 Remedial Activities:

Assuming that young children (five years of age or younger) accompanying adult members of the Italian-American Club spent two days per week for the five warmer months of the year (i.e., May through September) picnicking or generally playing on the grounds at the site, that they could have incidentally ingested soil during their visits, and that they could have been exposed to the locations of highest concentration in the grassy backyard of the Club property (average concentration of about 14,600 ppm among four samples) that existed prior to the 1995 through 1997 remediation measures, it is possible that such past exposure could have resulted in some health concerns (e.g., immunological effects) for some individuals. In addition, frequent exposure to locations of highest concentration could have posed a moderate increased concern for cancer. It is more likely, however, that young children did not spend their entire time at the Club playing on the locations of highest concentration. If we therefore assume that opportunities for exposure for the children were more likely to have occurred at average concentrations across the Italian-American Club property (i.e., about 861 ppm, including the locations of highest concentration), estimated exposures based on spending two days per week for the five warmer months of the year on the Club property were less than the LOAELs reported for PCBs but higher than ATSDR's MRL for PCBs, and resulted in no apparent increased concern for cancer. Thus, the site could have presented health concerns to some younger children in the past; however, if frequent exposure exclusively to the locations of highest concentration did not occur, which is more likely, health concerns were unlikely for younger children.

For adult members of the Italian-American Club, we assumed that they could have spent five days per week for five of the warmer months of the year, using the grounds for recreational purposes (e.g., bocce games). They could have had opportunities for exposure to the locations of highest concentration on the grounds, and such opportunities for exposure could have resulted in health concerns (e.g., immunological effects). Opportunities for exposure to average PCB concentrations at the property, using the above assumptions, could have resulted in exposures slightly above the ATSDR MRL but below the lowest reported level at which any adverse effect occurred in any animal or human study, and may have resulted, in a low increased concern for cancer.

One dioxin sample was taken from the Italian-American Club, and it showed a concentration of 1.37 ppb TEQ (0.0021 ppb TCDD). Dioxin sampling was very limited. Dioxin TEQ may have contributed slightly to health concerns. Additional sampling for dioxin would be helpful in interpreting health concerns. Opportunities for exposure to PAHs prior to remediation do not appear to contribute appreciably to increased cancer concerns relative to those already posed by PCB compounds.

Soil at Italian-American Club after 1995-1997 Remedial Activities:

For small children playing two days a week for the five warmer months of the year, opportunities for exposure to the average or maximum PCB soil concentration (39 ppm or 58 ppm, respectively) on the strip of land next to the bocce court could be higher than ATSDR's MRL but less than the lowest reported LOAEL and would not result in an increased concern for cancer. For adults recreating (e.g., bocce games) five days a week for the warmer months of the year, opportunities for exposure to the strip of land next to the bocce court could result in estimated exposures higher than ATSDR's MRL but less than the lowest reported LOAEL and would not be expected to result in an apparent increased concern for cancer. Also, for the 390-ppm location of maximum concentration north of the bocce court, opportunities for exposure were higher than ATSDR's MRL, but less than the lowest reported LOAEL for small children playing two days a week for the five warmer months of the year, and would not be expected to result in an apparent increased concern for cancer. For adults recreating five days a week for the warmer months of the year, opportunities for exposure to the 390-ppm location of maximum concentration were higher than ATSDR's MRL, but less than the lowest reported LOAEL, and may result in a low increased concern for cancer. However, assuming the average 0 – 0.5-foot PCB soil concentration (4 ppm) at the Club property outside of the strip of land between the bocce court and the parking lot and the average 0- to 1-foot PCB concentrations (4.95 ppm) outside the location of maximum concentration, opportunities for exposure with the above assumptions to PCBs to surface soil did not exceed ATSDR's MRL for small children or adults, and would not be expected to result in an increased concern for cancer for small children or adults.

Although accessible, it is unlikely that all of an individual's exposure to PCBs in soil at the Club would occur to the strip of land between the bocce court and the parking lot or at the 390-ppm location of maximum concentration north of the bocce court. Nonetheless, while it might be unlikely that overall opportunities for exposure at the Italian-American

Club will result in adverse health concerns under current conditions and use patterns, it is prudent to reduce opportunities for exposure to levels at or below the MRL, which is derived using margins of safety to account for individual and species differences with respect to the toxicity of PCBs. It is particularly important to address opportunities for exposure, particularly for young children, to PCBs remaining in surface soils on the strip of land between the bocce court and the parking lot and the 390-ppm 0- to 1-foot location of maximum concentration. Remedial activities by environmental regulatory agencies and GE currently ongoing according to the consent decree should help address and mitigate such opportunities for exposure.

Dioxin TEQ was detected in two post remediation samples. However, one sample was under pavement; therefore, opportunities for exposure would be limited to the accessible dioxin TEQ level (0.68 ppb). The number of dioxin samples were very limited. Dioxin TEQ may contribute slightly to health concerns. Additional sampling for dioxin would be helpful in interpreting health concerns and will be done by the environmental agencies and GE according to ongoing remedial activities under the consent decree.

Post-remediation samples at the Italian-American Club for PAH compounds in surface soils revealed levels above comparison values in one sample (e.g., benzo(a)pyrene at 1.9 ppm). Opportunities for exposure to these PAHs do not contribute appreciably to increased health concerns beyond those posed by PCBs.

It should be noted that additional ongoing remedial activities under the consent decree will reduce PCB levels to less than 10 ppm in recreational surface soils (e.g., the Italian American Club) and will help to reduce opportunities for exposure to other compounds in surface soils (e.g., dioxins and PAH compounds).

Soil at Quality Printing Past and Present:

Average PCB concentrations at the Italian American Club were 3,677 ppm prior to institutional controls. Four of eight surface soil samples analyzed for dioxin compounds were taken from the Quality Printing property in the area between the building and the river. The concentrations in these four samples ranged from 2.94 to 23.8 ppb TEQ, averaging 9.2 ppb (the average TCDD concentration was 0.005 ppb, with a maximum of 0.0125 ppb in these four samples). For the Quality Printing property, it is unclear to what extent past opportunities for exposure to soil between the building and the river might have occurred. Intermittent contact in the past by employees of Quality Printing is not expected to have resulted in adverse health effects based on the PCB, dioxin, and PAH results. MDPH is not aware of any reports of frequent recreational use of this property in the past. Currently, the entire Quality Printing property is enclosed by a locked fence and would not present opportunities for exposure if properly maintained.

Air at Newell Street Area I Site Overall Past and Present:

In addition, ambient air monitoring for PCBs at the Newell Street Area I site showed that average concentrations throughout the year were approximately 0.008 $\mu g/m^3$ and

0.011µg/m^3 on average for the summer months. Estimated year round exposures to both levels were below the MRL and were not expected to result in increased concerns for cancer or non-cancer effects.

The implementation of various institutional controls (e.g., fences with locked gates) has resulted in reduced opportunities for exposure by restricting access to various parts of the site (e.g., Quality Printing property). The highest levels of PCBs in surface soil on the site have been removed or made inaccessible. However, there are still a few locations of higher PCB concentration at the Italian-American Club that were undergoing remediation at the time of this public health assessment. This site does not appear to be frequently used in terms of recreational or trespassing activities, with the exception of the Italian-American Club property. Currently the Newell Street Area I site poses no apparent public health hazard. Should the institutional controls currently in place be removed or not be maintained, should construction activities occur that would disturb soil, should the use of the site change (e.g., new residences, greater recreational use), or remediation activities under the consent decree are not properly completed or maintained, the site could be a public health hazard in the future, depending on the extent to which opportunities for exposure increase.

Furthermore, the MDPH's 1997 Exposure Assessment Study concluded that serum levels of the non-occupationally exposed participants from communities surrounding the Housatonic River including Pittsfield were generally within background levels. The 2000 Expert Panel on the Health Effects of Non-Occupational Exposure to PCBs agreed that the available data indicate that serum PCB-levels for non-occupationally exposed populations from MDPH's Exposure Assessment Study are generally similar to the background exposure levels in recent studies (MDPH 2000). However, MDPH notes that serum PCB levels tended to be higher in older residents of the Housatonic River Area who were frequent and/or long-term fish eaters or who reported opportunities for occupational exposure. In addition, there was some indication that other activities (e.g., fiddlehead fern consumption, gardening) may have contributed slightly to serum PCB levels.

The MDPH 2002 Assessment of Cancer Incidence Health Consultation showed that, for the majority of cancer types evaluated, residents of the Housatonic River Area did not experience excessive rates of cancer incidence during the period 1982-1994. For most primary cancer types evaluated, the incidence occurred at or below expected rates, concentrations of cancer cases appeared to reflect the population density, and, when reviewed in relation to the GE sites, the pattern of cancer incidence did not suggest that these sites played a primary role in this development. While Pittsfield did experience more cancer elevations than the other communities and the pattern of some cancer types showed elevations that were statistically significantly higher than expected in certain areas or during certain time periods, no pattern among those census tracts with statistically significant elevations was observed. Specifically, although two of the three census tracts in Pittsfield adjacent to the GE site experienced statistically significant elevations in cancers of the bladder, breast, and NHL, a pattern suggesting that a common environmental exposure pathway played a primary role in these census tracts was not

observed nor were cases distributed more toward the vicinity of the GE sites. It is important to note, however, that it is impossible to determine whether exposure to GE site contaminants may have played a role in any individual cancer diagnosis. Further review of the available risk factor and occupational information suggested that workplace exposures and smoking may have been potential factors in the development of some individuals' cancers (e.g., bladder cancer). However, the pattern of cancer in this area does not suggest that environmental factors played a primary role in the increased rates in this area (MDPH 2002a).

As noted earlier in this public health assessment, more recent cancer incidence data for the period 1995–1999 shows that for Pittsfield as a whole, no cancer type was statistically significantly elevated. Although bladder cancer among males for Pittsfield as a whole was statistically significantly elevated during 1982 – 1994 (MDPH 2002a), this cancer type occurred less often than expected among males during 1995 – 1999 (28 cases observed vs. approximately 36 cases expected) (MDPH 2002b).

C. ATSDR Child Health Considerations

ATSDR and MDPH recognize that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination of their environment. Children are at a greater risk than adults from certain kinds of exposure to hazardous substances emitted from waste sites. They are more likely exposed because they play outdoors and because they often bring food into contaminated areas. Because of their smaller stature, they might breathe dust, soil, and heavy vapors close to the ground. Children are also smaller, resulting in higher doses of contaminant exposure per body weight. The developing body systems of children can sustain permanent damage if certain toxic exposures occur during critical growth stages. Most importantly, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care.

MDPH evaluated the likelihood of exposures to children from compounds in ambient air or surface soil at the Newell Street Area I site and the adjacent Hibbard School and residential neighborhood. See section B above ("Evaluation of Possible Health Effects") for a discussion of these exposure scenarios.

CONCLUSIONS

MDPH has conducted public health activities in the past for Pittsfield and the Housatonic River area. These included the MDPH Housatonic River Area Exposure Assessment Study, which concluded that serum levels of the non-occupationally exposed participants from communities surrounding the Housatonic River including Pittsfield were generally within background levels; the MDPH Expert Panel on the Health Effects of Non-occupational Exposure to PCBs, which generally agreed with these findings; and the MDPH Assessment of Cancer Incidence Health Consultation, which concluded that the pattern of cancer in this area does not suggest that environmental factors played a primary role in increased rates in this area.

MDPH is currently conducting ongoing public health activities (e.g., exposure assessment and serum PCB testing on an individual basis as a public service). Information gathered from these additional activities will continue to improve MDPH's ability to assess the public health implications of PCB contamination at all sites being evaluated in public health assessments for the GE site. Thus, MDPH evaluation of potential public health implications related to the Newell Street I Area site is based on currently available information. An extensive sampling effort, including additional work on the site by the environmental agencies to better define the nature and extent of contamination (surface, subsurface, PCBs, and other constituents) at the site is generating new information regarding the site. Information from this public health assessment will be included in the summary public health assessment for all of the GE sites.

The primary compounds of concern at the Newell Street Area I site are PCBs and dioxin in soil. Under past conditions, the site represented a public health hazard because of likely exposure to elevated levels of PCBs and dioxin in surface soil. Individuals most likely to be affected were those who used the Italian-American Club recreationally for most days during the warmer months of the year (i.e., May through September). After remedial and institutional control measures were undertaken in the mid-to-late 1990s, surface soil concentrations of PCBs or opportunities for exposure to PCBs in soils were considerably reduced. Under current conditions (e.g., current use, current institutional controls), it is unlikely that overall opportunities for exposure at the Italian-American Club would result in adverse health effects. However, concentrations of PCBs are elevated in some areas that are accessible (i.e., a small strip of land on the Italian-American Club property and the location of maximum concentration north of the bocce court have PCB surface soil concentrations higher than the rest of the property). While it is unlikely that individuals spend all of their time while at the Club on this strip or the area of maximum concentration, opportunities for exposure to PCBs in these soils, particularly for young children, should be addressed. Remedial activities by environmental regulatory agencies and GE currently ongoing according to the consent decree should help to address and mitigate such opportunities for exposure. At this time, the site is expected to remain commercial with no plans for residential or other future development. Should institutional controls currently in place be removed or not be maintained, construction activities be undertaken, should the use of the site change (e.g., new residences, greater recreational use), or remedial activities are not properly completed/maintained, the site could be a public health hazard in the future, depending on the extent to which opportunities for exposure increase.

ATSDR requires that one of five conclusion categories be used to summarize findings of health consultations and health assessments. These categories are: 1) Urgent Public Health Hazard, 2) Public Health Hazard, 3) Indeterminate Public Health Hazard, 4) No Apparent Public Health Hazard, and 5) No Public Health Hazard. A category is selected from site-specific conditions such as the degree of public health hazard based on the presence and duration of human exposure, contaminant concentration, the nature of toxic effects associated with site-related contaminants, presence of physical hazards, and community health concerns.

Based on past opportunities for exposure to PCBs and dioxin, the site represented a "Public Health Hazard" particularly to those who used the grounds of the Italian-American Club for frequent recreational purposes, and possibly the Quality Printing property, particularly below the building and the River where dioxin concentrations are elevated.

Remediation and institutional controls implemented in the late 1980s through the mid-1990s have resulted in considerably lower PCB concentrations in surface soil or reduced access to soils containing PCBs at the Newell Street Area I site. Thus, under current use conditions and with institutional controls in place and ongoing remedial activities by GE and environmental regulatory agencies, ATSDR would classify the site overall as "No Apparent Public Health Hazard." Should institutional controls currently in place be removed or not be maintained, should construction activities be undertaken, or should the use of the site change (e.g., new residences, greater recreational use), the site may pose a "Public Health Hazard" in the future, depending on the extent to which opportunities for exposure increase. However, remedial actions being overseen by EPA for the GE sites under the consent decree of 2000 should help to prevent these future concerns.

RECOMMENDATIONS

1. MDPH recognizes that there have been multiple opportunities for exposure to PCBs throughout Pittsfield and the Housatonic River area and supports ongoing remedial efforts to reduce opportunities for exposure to PCBs throughout Pittsfield and the Housatonic River Area.

2. MDPH supports ongoing site characterization efforts, including collection of additional samples and remedial activities, by the environmental regulatory agencies, in order to reduce opportunities for exposure to PCBs throughout the Pittsfield and Housatonic River area. Such activities at the Italian-American Club are particularly important for the Newell Street Area I site.

PUBLIC HEALTH ACTION PLAN

1. Due to the discovery during summer 1997 of widespread residential PCB soil contamination, MDPH is conducting a separate study of residents who were concerned about this exposure. MDPH set up a hotline number for individuals to call with health-related concerns, to complete exposure questionnaires, and to request serum PCB testing. Results of these more recent analyses of serum PCB levels and evaluation of the community health concerns expressed on the hotline calls are being developed as part of the summary public health assessment for the GE sites.

2. MDPH will continue to offer to evaluate any resident's opportunities for past exposure to PCBs and, if warranted, have their serum PCB levels determined.

3. As previously stated in the Health Consultation's Assessment of Cancer Incidence, Housatonic River Area, 1982-1994, MDPH will continue to monitor bladder cancer incidence in Pittsfield through the Massachusetts Cancer Registry to determine whether the pattern of bladder cancer changes.

4. MDPH established its Housatonic River Area Advisory Committee on Health in 1995. This committee is comprised of local residents, representatives from the local medical community, environmental and health professionals, representatives from the offices of elected officials and local health departments. MDPH staff will continue to hold meetings with committee members to report on the status of various activities and to discuss and get feedback on the conduct of MDPH health activities (e.g., education and outreach) in the area.

5. MDPH will incorporate information from the Newell Street Area I site public health assessment into the summary public health assessment for the GE sites.

6. Upon receipt from EPA of any additional data that EPA believes may warrant further public health assessment, MDPH will review this information and determine an appropriate public health response (e.g., health consultation, technical assistance).

This document was prepared by the Bureau of Environmental Health Assessment of the Massachusetts Department of Public Health. If you have any questions about this document, please contact Suzanne K. Condon, Director of BEHA/MDPH, 7th Floor, 250 Washington Street, Boston, Massachusetts 02108.

TABLES

Table 1. Demographic Characteristics of Pittsfield (2000 U.S. Census)

	Pittsfield		Census Tract 9010		Census Tract 9012	
Characteristics	Persons	%	Persons	%	Persons	%
Age[1]						
Under 5	2719	5.9	298	5.7	2	3.03
5 – 14	6072	13.2	705	13.5	8	12.12
15 – 44	17924	39.1	1988	38.04	25	37.88
45 – 64	10540	23.0	1262	24.15	13	19.7
65 and over	8538	18.6	973	18.61	18	27.27
Sex						
male	21,765	47.5	2,485	47.55	31	43.8
female	24,028	52.5	2,741	52.45	35	56.2
Race						
Not Hispanic or Latino:	44,859	97.96	5,191	99.33	66	100.0
White alone	41,951	91.61	5,036	96.36	61	0.92
Black or African American alone	1,592	3.48	68	1.30	3	0.05
American Indian and Alaska Native alone	57	0.12	1	0.02	2	0.03
Asian alone	525	1.15	43	0.82	0	0
Native Hawaiian and Other Pacific Islander alone	18	0.04	1	0.02	0	0
Some other race alone	70	0.15	11	0.21	0	0
Two or more races	646	1.41	31	0.59	0	0
Hispanic or Latino:	934	2.04	35	0.67	0	0
White alone	444	0.97	25	0.48	0	0
Black or African American alone	82	0.18	3	0.06	0	0
American Indian and Alaska Native alone	8	0.02	0	0.00	0	0
Asian alone	8	0.02	0	0.00	0	0
Native Hawaiian and Other Pacific Islander alone	2	0.0	2	0.04	0	0
Some other race alone	284	0.6	4	0.08	0	0
Two or more races	106	0.2	1	0.02	0	0

[1] Within Census Tracts 9002, 9010, and 9011, the total numbers of persons by race are higher than the total numbers of persons by sex and by age because many people might come from more than 2 different racial origins.

Table 2. Pittsfield Cancer Incidence: Expected and Observed Case Counts, with Standardized Incidence Ratios, 1995-1999

	Exp	Obs	SIR
Bladder, Urinary			
Male	36.46	28	77
Female	15.43	14	91
Total	51.88	42	81
Brain and Other Central Nervous System			
Male	9.65	9	93
Female	8.51	6	71
Total	18.15	15	83
Breast			
Male	1.65	1	NC*
Female	217.96	226	104
Total	219.61	227	103
Cervix Uteri			
Female	11.32	13	115
Colon / Rectum			
Male	89.61	85	95
Female	97.11	75	77 #-
Total	186.72	160	86
Esophagus			
Male	12.24	9	74
Female	4.74	3	NC*
Total	16.98	12	71
Hodgkin's Disease (Hodgkin Lymphoma)			
Male	4.64	4	NC*
Female	3.83	1	NC*
Total	8.47	5	59
Kidney and Renal Pelvis			
Male	19.90	13	65
Female	13.83	9	65
Total	33.72	22	65 #-
Larynx			
Male	11.24	10	89
Female	3.09	4	NC*
Total	14.34	14	98
Leukemia			
Male	16.23	15	92
Female	13.77	6	44 #-
Total	29.99	21	70
Liver and Intrahepatic Bile Ducts			
Male	7.72	3	NC*
Female	3.82	3	NC*
Total	11.54	6	52
Lung and Bronchus			
Male	111.39	94	84
Female	96.82	83	86
Total	208.21	177	85 #-

	Exp	Obs	SIR
Melanoma of Skin			
Male	22.34	16	72
Female	17.80	12	67
Total	40.14	28	70
Multiple Myeloma			
Male	6.88	10	145
Female	6.68	4	NC*
Total	13.56	14	103
Non-Hodgkin('s) Lymphoma			
Male	27.40	18	66
Female	27.74	17	61 #-
Total	55.14	35	63 ~-
Oral Cavity and Pharynx			
Male	20.47	15	73
Female	11.24	3	NC*
Total	31.71	18	57 #-
Ovary			
Female	25.16	28	111
Pancreas			
Male	14.81	21	142
Female	17.81	10	56
Total	32.62	31	95
Prostate			
Male	215.29	168	78 ^-
Stomach			
Male	15.06	10	66
Female	10.52	8	76
Total	25.58	18	70
Testis			
Male	6.82	4	NC*
Thyroid			
Male	4.09	3	NC*
Female	11.18	11	98
Total	15.28	14	92
Uteri, Corpus and Uterus, NOS			
Female	42.36	34	80
All Sites / Types			
Male	701.74	584	83 ^-
Female	715.26	606	85 ^-
Total	1417.00	1190	84 ^-

Table 2 (continued). Pittsfield Cancer Incidence: Expected and Observed Case Counts, with Standardized Incidence Ratios, 1995-1999

Exp = expected case count, based on the Massachusetts average age-specific incidence rates for this cancer
Obs = observed case count

SIR = standardized incidence ratio [(Obs / Exp) X 100]

* = **SIR** and statistical significance not calculated when Obs < 5

+ indicates number of observed cases is statistically significantly higher than the expected number of cases
- indicates number of observed cases is statistically significantly lower than the expected number of cases

# indicates statistical significance at the p <= 0.05 level
~ indicates statistical significance at the p <= 0.01 level, as well as at the p <= 0.05 level
^ indicates statistical significance at the p <= 0.001 level, as well as at the p <= 0.05 and p <= 0.01 levels

Table 3a. Summary of top 4- or 6- inch Surface Soil Contaminants of Concern collected throughout the Newell I Site between 1988 and 1996[1]

Compound	Detects/ Samples	Minimum (mg/kg)	Mean[2] (mg/kg)	Maximum (mg/kg)	Comparison Value	Background (mg/kg)
Total PCBs	209/210[3]	ND	461[4]	50,000	CREG = 0.4	NA
Dioxin TEQ[5] (µg/kg)	8/8	0.060 (µg/kg)	4.8 (µg/kg)	23.2 (µg/kg)	EMEG (child) = 0.05 EMEG (adult) = 0.7	NA
Benzo(a)pyrene	8/8	0.057J	0.73	1.4	CREG = 0.1	0.17-0.22[6]
Dibenz(a,h) anthracene	6/8	ND	0.15	0.29J	*CREG=0.02	NA
Antimony	2/16	ND	NC	100	RMEG (child) = 20 RMEG (adult) = 300	<1-8.8[7]

CREG Cancer Risk Evaluation Guide (ATSDR)
EMEG Environmental Media Evaluation Guide (ATSDR)
J Estimated value less than contract lab program required quantitation limit
ND Not detected
NC Not available
RMEG Reference Dose Media Evaluation Guide (ATSDR, based on EPA Reference Dose)
* CREG value calculated by using TEFs relative to CREG = 0.1 ppm for benzo(a)pyrene, as found in ATSDR toxicological profile for PAHs

[1] Concentrations are listed as parts per million, ppm, by dry weight unless otherwise noted.
[2] Mean values calculated using one half the method detection limit for samples in which the compound was below detection.
[3] Of 210 PCB samples, 122 samples were collected at 0 to 0.33 ft and 88 samples were collected at 0 to 0.5 ft. Eleven samples were collected at the Hibbard Playground east of the site.
[4] Nine PCB samples had duplicates; average of sample and its duplicate taken as single value in calculating overall mean
[5] Toxicity equivalents (TEQ) represent 2,3,7,8-TCDD toxic equivalents for mixtures of dioxin-like chlorinated dibenzo-p-dioxins (CDDs) and chlorinated dibenzofurans (CDFs). Because limited data on toxicity exist for many of the CDDs and CDFs, toxic equivalency factors (TREFs) were developed. TEFs compare the relative toxicity of individual congeners to that of TCDD. The TCDD congener is used as the basis of the TEFs because it appears to be the most toxic of the CDDs to mammals. The TEQ is calculated by calculating the sum of the products of the TEFs for each congener and its concentration in the mixture.
[6] From Toxicological Profile for Polycyclic Aromatic Hydrocarbons (PAHs), August 1995, ATSDR
[7] From Shacklette (1984), "Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States."

Table 3b. Summary of 0- to 2-foot Surface Soil Contaminants of Concern Collected throughout the Newell Street Area I Site between 1988 and 1996[1]

Compound	Detects/ Samples	Minimum (mg/kg)	Mean[2] (mg/kg)	Maximum (mg/kg)	Comparison Values
Total PCBs	24/26	ND	171	1,110	CREG = 0.4

CREG Cancer Risk Evaluation Guide (ATSDR)
ND Not detected

[1] Concentrations are listed as parts per million, ppm, by dry weight unless otherwise noted.
[2] Mean values calculated using one half the method detection limit for samples in which the compound was below detection.

Table 3c. Summary of 0- to 0.5-foot Surface Soil Concentrations Post-Remediation Newell Street Area I Site[1]

Compound	Detects/ Samples	Minimum (mg/kg)	Mean[2] (mg/kg)	Maximum (mg/kg)	Comparison Values
Total PCBs	157/158	ND	12	76	CREG = 0.4

CREG Cancer Risk Evaluation Guide (ATSDR)
ND Not detected

[1] Samples taken at Quality Printing, Inc., the Anthony Marchetto Contractors, and the Italian-American Club properties.
[2] Mean values calculated using one half the method detection limit for samples in which the compound was below detection.

Table 3d. Summary of PCB 0 – 1 foot Surface Soil Concentrations, Post-Remediation
Italian American Club, Newell Street Area I Site[1]

Compound	Detects/ Samples	Minimum (mg/kg)	Mean (mg/kg)	Maximum (mg/kg)	Comparison Values (mg/kg)
Total PCBs	10/10	0.53	44.2	390	CREG = 0.4
Benzo(a)anthracene	1 /2	ND(0.39)	1.05	1.9	CREG = 1
Benzo(a)pyrene	1 /2	ND(0.39)	0.98	1.8	CREG = 0.1
Benzo(b)fluoranthene	2/2	0.42	1.41	2.4	CREG=1
Indeno(1,2,3-cd)pyrene	1 /2	ND(0.78)	0.78	1.2	CREG=1
Dioxin (2,3,7,8-TCDD) ug/kg[2]	1 /2	ND(0.0035) ug/kg	0.0054 ug/kg	0.0090 ug/kg	Child Chronic EMEG = 0.05 ug/kg Adult Chronic EMEG = 0.7 ug/kg
Dioxin TEQ ug/kg	2/2	0.68 ug/kg	0.94 ug/kg	1.2 ug/kg	Child Chronic EMEG = 0.05 ug/kg Adult Chronic EMEG = 0.7 ug/kg

CREG Cancer Risk Evaluation Guide (ATSDR)
EMEG Environmental Media Evaluation Guide (ATSDR)
ND Not detected detection limit in parenthesis
RMEG Reference Dose Media Evaluation Guide (ATSDR, based on EPA Reference Dose)

[1] All values in mg/kg (ppm) dry weight unless otherwise noted.
[2] ug/kg = ppb

Table 3e. Summary of PCB Subsurface Soil Concentrations Post-Remediation
Italian-American Club, Newell Street Area I Site[1]

Compound	Detects/ Samples	Minimum (mg/kg)	Maximum (mg/kg)	Comparison Values
Total PCBs	41/41	0.081	3600	CREG = 0.4
Benzo(a)anthracene	3/13	ND(0.36)	4.9	CREG = 1
Benzo(a)pyrene	3/13	ND(0.36)	5.6	CREG = 0.1
Benzo(b)fluoranthene	3/13	ND(0.36)	6.3	CREG = 1
Indeno(1,2,4-cd)pyrene	3/13	ND(0.73)	3.1	CREG = 1
2,3,7,8 – TCDD ug/kg[2]	5/13	ND(0.0020) ug/kg	1.2 ug/kg	Child Chronic EMEG = 0.05 ug/kg Adult Chronic EMEG = 0.7 ug/kg
Dioxin TEQ ug/kg	13/13	0.014 ug/kg	55.5 ug/kg	Child Chronic EMEG = 0.05 ug/kg Adult Chronic EMEG = 0.7 ug/kg
Antimony	3/13	ND(9.7)	48	Child RMEG = 20 Adult RMEG = 300
Arsenic	1/13	ND(16)	82	CREG = 0.5 Child Chronic EMEG = 20 Adult Chronic EMEG =200
Cadmium	3/13	ND(1.6)	20	Child Chronic EMEG = 10 Adult Chronic EMEG = 100 Child RMEG = 50 Adult RMEG = 700
Chromium	13/13	5.5	350	(Hexavalent) Child RMEG = 200 (Hexavalent) Adult RMEG = 2000
Copper	12/13	ND(17.0)	13000	Child Intermediate EMEG = 2000 Adult Intermediate EMEG = 20000
Lead	13/13	14	9000	MA DEP Action Level = 300
Sulfide	3/13	ND(5.4)	595	Hydrogen Sulfide Child RMEG = 200 Hydrogen Sulfide Adult RMEG = 2000
Tin	4/13	ND(48)	1600	USGS Background[3] = 0.1 - 10

CREG Cancer Risk Evaluation Guide (ATSDR)
EMEG Environmental Media Evaluation Guide (ATSDR)
ND Not detected, detection limit in parenthesis
RMEG Reference Dose Media Evaluation Guide (ATSDR, based on EPA Reference Dose)

[1] All values in mg/kg (ppm) dry weight unless otherwise noted.
[2] ug/kg = ppb
[3] From Shacklette and Boerngen, 1984

Table 4. Summary for Groundwater Contaminants of Concern (µg/L) Newell Street Area I

Compound	Detects/ Samples	Minimum (µg/L)	Mean (µg/L)	Maximum (µg/L)	Comparison Values
Total PCBs	10/11	ND	78	800	EMEG child = 0.2 EMEG adult = 0.7 MMCL = 0.5
Benzene	1/8	ND	2.9	6	CREG = 0.6 MMCL = 5
Methylene chloride	1/8	ND	12	83	EMEG child = 600 EMEG adult = 2,000 CREG = 5 MCL = 5
Arsenic	7/8	ND	9.9	20.4	EMEG child = 3 EMEG adult = 10 CREG = 0.02 MMCL = 50
Barium	8/8	15.4J	690	3,630	RMEG child = 700 RMEG adult = 2,000 MMCL = 2,000
Chromium	7/8	ND	18	59.8	hexavalent RMEG child = 30 RMEG adult = 100 trivalent RMEG child = 20,000 RMEG adult = 50,000 MMCL (total) = 100

CREG Cancer Risk Evaluation Guide (ATSDR)
EMEG Environmental Media Evaluation Guide (ATSDR)
J estimated value less than the control lab program required quantitation limit
mean values calculated using one half the method detection limit for samples in which the compound was below detection.
MMCL Massachusetts Maximum Contaminant Level for Drinking Water (Massachusetts Drinking Water Standards and Guidelines for Chemicals in Massachusetts Drinking Water, MA DEP, Spring 2001)
ND not detected
RMEG Reference Dose Media Evaluation Guide (ATSDR, based on EPA Reference Dose)

Table 5. PCB Concentrations in Ambient Air (μg/m^3) - Newell Street Area I

Location	Total	Summer Months[1]	Nonsummer Months	Comparison Values
Site[2]	Mean = 0.0082 Max = 0.035	Mean = 0.011 Max = 0.035	Mean = 0.0022 Max = 0.014	CREG = 0.01
Background[3]	Mean = 0.0007 Max = 0.0035	Mean = 0.001 Max = 0.0035	Mean = 0.0004 Max = 0.0014	CREG = 0.01

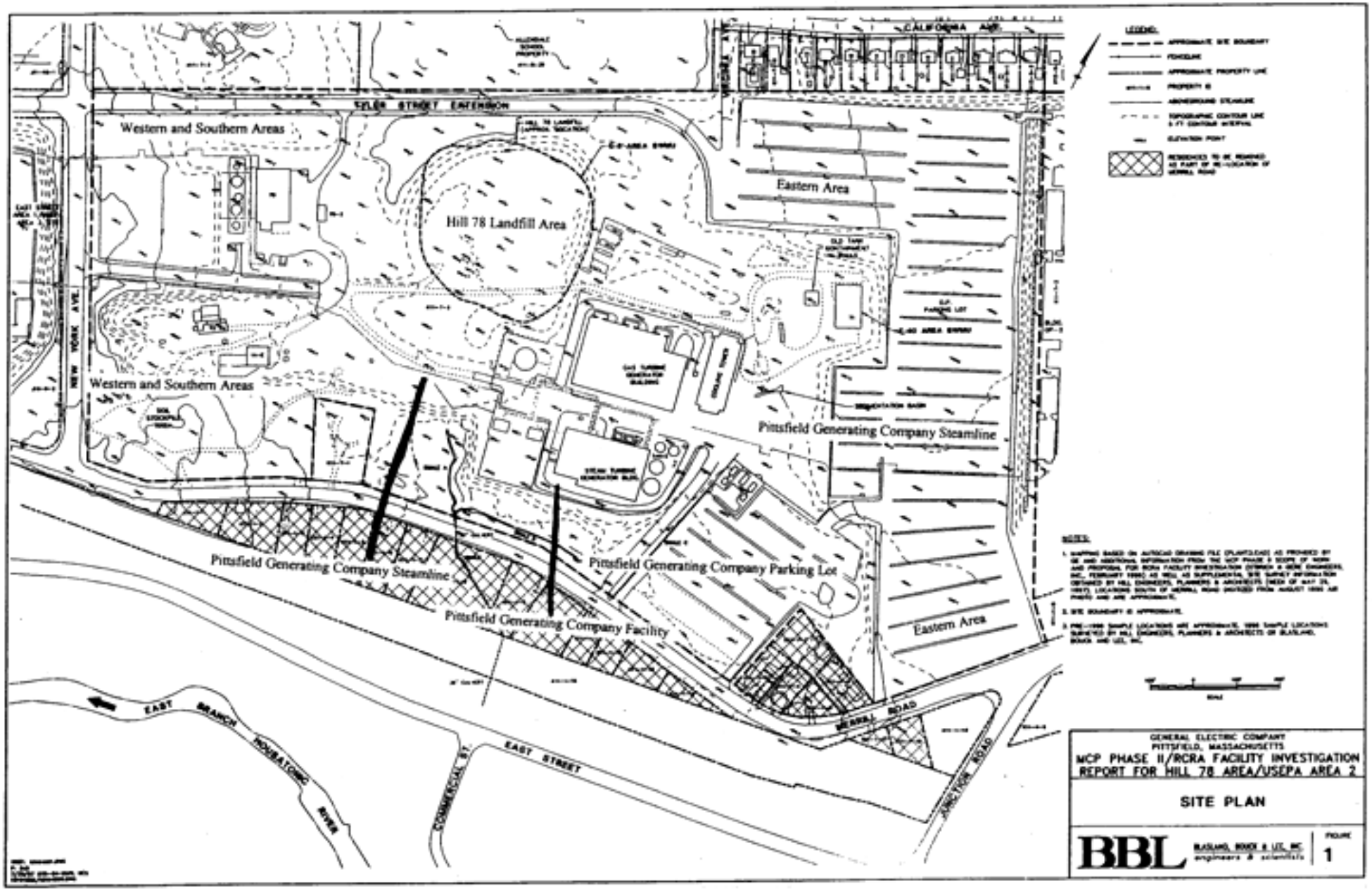
Mean values calculated using one half the method detection limit for samples in which the compound was below detection.

[1] Summer months are mid-May to early September.

[2] Site results are 24-hour high volume ambient mean PCB concentrations for Newell Street 1 site (August 1991 through August 1992; May 1993 through August 1993; July 1996 through September 1996).

[3] Background location is Berkshire Community College; sampling periods August 1991 to August 1992; May 1993 to August 1993, June 1995 to August 1995; July 1996 to September 1996; 24-hour high volume ambient mean PCB concentrations.

FIGURES



GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
MCP PHASE II/RCRA FACILITY INVESTIGATION
REPORT FOR HILL 78 AREA/USEPA AREA 2

SITE PLAN

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 1

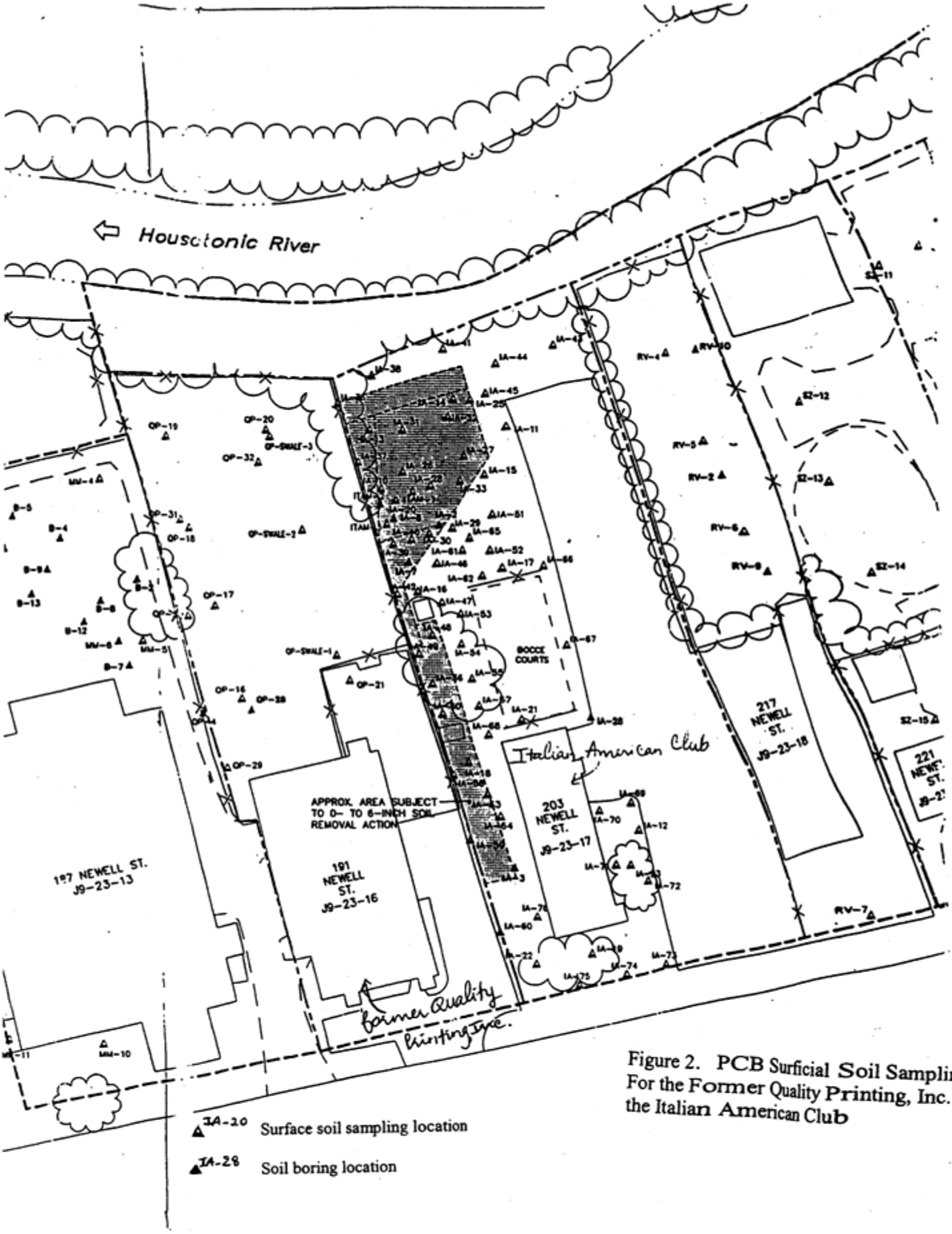


Figure 2. PCB Surficial Soil Samplings For the Former Quality Printing, Inc. and the Italian American Club

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APPENDICES

Appendix A:

Comments on General Electric Site – Newell Street Area I Public Health Assessment

The Massachusetts Department of Public Health (MDPH), Bureau of Environmental Health Assessment (BEHA), Environmental Toxicology Program (ETP), received and responded to the following comments for the General Electric Site – Newell Street Area I Public Health Assessment. Nineteen comments were received from both the Housatonic River Initiative (HRI), a community group based in Pittsfield, and from General Electric (GE).

General Comments

1. **Comment:** Serum testing of people surrounding the Newell Street Area I site should be done including congener specific analysis.

   Response: MDPH continues to offer an exposure assessment survey developed by MDPH for the Housatonic River Area, and, as warranted, serum testing as a public service to those concerned about PCB exposure in the Housatonic River Area, including people in the vicinity of the Newell Street Area I site. To request this assistance, residents may contact MDPH Bureau of Environmental Health Assessment 250 Washington Street, Boston, MA, 02018 at 1-800-319-3042 or 1-617-624-5757. In the 1997 Housatonic River Area Exposure Assessment Study, MDPH used CDC packed gas chromatography analysis methods that identified total PCBs in serum as most closely resembling Aroclor 1260. The Expert Panel on the Heath Effects of Non-occupational Exposure to PCBs agreed that this method can ascertain differences in the degree of exposure and is good for exposure assessment purposes. Congener specific analysis can be helpful for research studies that focus on linking a particular health outcome or biological response to PCB exposures. Results of the 1997 Housatonic River Area Exposure Assessment Study, which included serum testing results for 148 people, indicated that PCB levels were generally within the background range reported for the non-occupationally exposed population in the U.S. However, serum PCB levels tended to be higher in older residents of the Housatonic River Area who were frequent and/or long-term fish eaters or who reported opportunities for occupational exposure. In addition, there was some indication that other activities (e.g., fiddlehead fern consumption, gardening) may have contributed slightly to serum PCB levels.

2. **Comment:** More soil sampling is needed, GE initiated and EPA testing were inadequate. Particularly, the Italian American Club required three different short-term remediation activities as more and more PCB-contaminated soil was discovered, contradicting previous

testing regimes and demonstrating a lack of reliable soil data. Also, the initial estimates for PCB amounts in the entire Housatonic River were grossly underestimated as 39,000 pounds in 1982.

Response: MDPH has incorporated all known and the most recent available data. MDPH feels the available data are sufficient to characterize exposure opportunities in areas tested because we have estimated exposures from maximum soil concentrations as well as average soil concentrations. It is important to note that the methods for evaluating exposures are a very conservative approach. While maximum concentrations are unlikely to be representative of the entire site, some areas of higher concentration have been accessible to people in the past. However, the recommendation section states that "MDPH supports ongoing site characterization efforts, including collection of additional samples and remedial activities, by the regulatory agencies, in order to reduce opportunities for exposure to PCBs throughout the Pittsfield and Housatonic River area." This supplemental sampling has been necessary for the Newell I site, especially for the accessible areas of the Italian-American Club. This additional site work is reportedly ongoing in accordance with the consent decree signed by EPA and GE in 2000 (see comment 9). Data for the Housatonic River is being assessed in a separate public health assessment for the river, expected to be released for public comment in 2003. MDPH has also noted that estimates of PCB contamination in the River have been revised upward since 1982.

3. **Comment:** MDPH should address possibly contaminated oak planks used in home construction.

Response: MDPH is not aware of past or current use of oak wood that may have contained PCBs and were subsequently used in home construction. According to the MA DEP, GE used wooden crates to transport transformers. If there was a leak, the lumber would have been impacted, but MA DEP reported that most leaking occurred at the plant where transformers were being drained, serviced, or dismantled. MA DEP reports that they are aware of one instance where wood panels from a GE source were used to construct panel walls in a basement, and one instance where lumber from a GE source was going to be used to construct a swing set. However, MA DEP reports that the wood in question did not show evidence of being subject to PCB spills. It is possible that GE employees had access to scrap lumber at the plant, and may have taken some of it home, but MA DEP reports that it is

unlikely that this lumber was contaminated or that there was enough to do major home construction projects (MA DEP 2002).

4. **Comment:** MDPH's first cancer registry statistics for 1982 – 1989 revealed that male bladder cancer rates for Pittsfield were up by 35%. MDPH should address this.

Response: MDPH's Bureau of Health Statistics, Research, and Evaluation along with the National Institute for Occupational Safety and Health (NIOSH) investigated bladder cancer in Pittsfield due to noted elevations through 2 studies, *Bladder Cancer and Employment in the Pittsfield Massachusetts Area a Preliminary Investigation,* January 1988, and *Bladder Cancer and Employment in the Pittsfield Massachusetts Follow-up Survey of Bladder Cancer Cases*, May 1989. These studies attributed this excess to a likely occupational exposure. In April 2002, MDPH completed a cancer incidence review (including data for the period 1982-1994) for Housatonic River area communities, including Pittsfield. One of the cancers evaluated was bladder cancer. This review noted that bladder cancer among males for Pittsfield during 1982-1986 was statistically significantly elevated (69 observed vs. 54.2 expected). During the later time period, 1987-1994, bladder cancer among males was elevated (65 observed vs. 58.2 expected), but this elevation was not statistically significant. These data are consistent with the comment that in the 1980s, bladder cancer among males in Pittsfield was elevated. Importantly, the MDPH 2002 report concluded that upon evaluation of the geographic distribution of bladder and other cancer types in Pittsfield, a pattern suggesting that a common environmental exposure pathway played a primary role in the elevations was not observed nor were cases distributed more toward the vicinity of the GE site. Furthermore, review of the available risk factor information suggested that cigarette smoking may have played a role in the increased rates of male bladder cancer in Pittsfield. Evaluation of the cancer incidence data are available and will be further discussed in relation to all GE sites in the summary Public Health Assessment for the GE sites. Thus, no changes in this Newell Street Area I public health assessment have been made in response to this comment.

5. **Comment:** A study by Rosenman showed GE workers, their families, and those who lived in the Lakewood section, including Newell St. Area I, had significantly higher PCB serum levels than other Pittsfield residents. MDPH should address this.

Response: The Rosenman study refers to an evaluation of retired GE workers, residents of the Lakewood area of Pittsfield, and residents in an area of Pittsfield thought to be unaffected by PCB contamination. MDPH's copy of this report is undated, but it appears that the work was conducted in the early 1980s. Participants had serum PCB levels measured, and they completed a questionnaire. Rosenman reported that former GE workers had the highest PCB exposures and that family members of workers exposed to PCBs had an excess body burden of PCBs. The author also reported that "because of the large number of residents who were exposed to PCBs at work or through a family member who worked with PCBs, we were unable to document the tissue accumulation of PCBs as a consequence of living in the contaminated neighborhood. No significant difference in median serum PCB values were found between the 7 residents of the contaminated community who had had no association with GE and the 9 residents of a control community who also had had no association with GE" (pg 5-6, Rosenman, undated).

Based on the figure included with the Rosenman study, it appears that no participating Lakewood area resident resided in the area referred to as the Newell Street Area I site. Rather, it appears that the participating Lakewood area residents resided in the East Street 1 area site, which is evaluated in a separate public health assessment. Hence, no change to this Newell Street Area I public health assessment is made based on this comment. Results of the Rosenman study briefly discussed above have been added to the final East Street Area 1 public health assessment.

6. **Comment:** MDPH should address possible (now defunct) thermal oxidizer ambient air exposures – gets rid of 99.5 % of PCBs, but where does the rest go, monitoring devices were said to have been melted.

Response: The former thermal oxidizer actually resides on the East Street Area 2 site. The history of the thermal oxidizer and an evaluation of possible health effects are addressed in the East Street Area 2 PHA. However, ambient air sampling for Newell Street Area I was conducted and evaluated for this public health assessment.

7. **Comment:** MDPH should do comprehensive indoor air testing of residents surrounding the Newell Street Area I site.

Response: With respect to indoor air data for PCBs, MDPH is aware of testing that has been done in the GE Facility vicinity and has reviewed the results. For example, the Agency for Toxic Substances and Disease Registry (ATSDR) in Atlanta, Georgia, has prepared a health consultation for indoor air quality testing at parcel number J9-23-7 in April of 2000, which included data from a State University of New York study, an EPA/Roy F. Weston report. ATSDR concluded that PCBs measured in indoor air at the residence were below levels of health concern and presented no apparent public health hazard (ATSDR 2000b). Also, MDPH has incorporated all known available ambient air data, which included data from August 1991 through August 1992, May 1993 through August 1993, and July 1996 through September 1996. Opportunities for exposure to ambient air were addressed in the pathway analysis section. Testing was conducted during summer months, when one would expect the highest concentrations. Unless environmental conditions at the site change, the available information suggests additional indoor air or ambient air testing is not necessary to characterize potential exposure opportunities at the Newell Street Area I site.

8. **Comment:** MDPH should take into account multiple exposure pathways (i.e., soil exposures at multiple sites, and eating fish from the Housatonic River).

Response: Each site was evaluated separately in order to assess health concerns specific to a particular site. For those sites with multiple exposure pathways, these exposure opportunities were taken into account in developing the conclusions for that individual site. However, MDPH is working on putting together an executive summary for all the public health assessments combined, including the Housatonic River, that will summarize overall health concerns for the entire GE site that will include an evaluation of health concerns related to all applicable exposure opportunities and available health (e.g., cancer incidence) and biomonitoring information.

Background

9. **Comment:** The consent decree for remediation actions to EPA and MDEP performance standards (i.e., average of < 2 ppm PCBs in residential soils) should be emphasized in all PHAs.

Response: MDPH has mentioned in the background section that there is an agreement between EPA and GE for various clean-up actions.

This has been elaborated on and expanded in the text of the Background section under section A, Purpose and Health Issues, by adding the following on page 2:

"In October 2000, a court-ordered consent decree was signed by EPA and GE, and it was agreed that GE would perform remediation actions to U.S. Environmental Protection Agency (EPA) and Massachusetts Department of Environmental Protection (MA DEP) performance standards (e.g., an average of less than 10 parts per million (ppm) PCBs in recreational surface soils, and an average of less than 2 ppm PCBs in residential soils). However, remediation does not eliminate past exposures and exposures occurring at parts of the site that have not yet been remediated."

Pathway Analysis

10. **Comment:** MDPH should interview residents in the area to gain more accurate depictions of contamination and use of properties in the area.

Response: MDPH conducted the 1997 Housatonic River Area PCB Exposure Assessment Study, which is mentioned in the conclusion section of this public health assessment. This study included administering an exposure assessment questionnaire to approximately 1,500 residents that included questions about residential and employment history, and a general comment section. MDPH continues to offer the exposure assessment questionnaire and, as warranted, serum testing as a public service to those concerned about PCB exposure opportunities. This activity involves interviewing residents about a range of exposure opportunities in the Housatonic River area. To request this assistance, residents may contact MDPH Bureau of Environmental Health Assessment, 250 Washington Street, Boston, MA 02108 at 1-800-319-3042.

Discussion

11. **Comment:** The serum PCB background level should be revised to 0.9 to 1.5 ppb.

Response: On page 16 of the Newell Street Area I PHA, MDPH noted that background serum PCB levels were within the reported background range for non-occupationally exposed individuals (ATSDR 2000a). The Expert Panel on the Health Effects of Non-Occupational Exposure to Polychlorinated Biphenyls (PCBs) states "that the information that now exists suggests that the range is probably lower than 4 – 8 ppb, but that comparisons are difficult due to differences in the age of various study populations and

whether or not they eat fish. Some recent studies have found background serum PCB levels for women of reproductive age around 2 ppb, while other researchers have observed levels around 6 ppb for elderly people who do not eat much fish." In addition the Panel concluded that overall "[b]ecause of complications [i.e., methods, detection limits, differences in exposure scenarios] direct comparisons between studies are difficult. However, the available data indicate that serum PCB levels for the non-occupationally exposed populations from MDPH's Exposure Assessment Study are generally similar to the background exposure levels reported in recent studies" (MDPH 2000).

The 2000 ATSDR Toxicological Profile for PCBs states, "Since the 1970s, researchers have noticed a decrease in PCB concentrations in human blood serum. In a study of 1,631 individuals from 1978 to 1979 living in the United States, the mean PCB concentration in human blood serum was 6.4 ng/mL [ppb]. Currently, mean serum PCB levels range from 0.9 to 1.5 ng/mL [ppb] in individuals who do not have a diet high in fish, especially fish from the Great Lakes" (ATSDR 2000a). The 2000 ATSDR Toxicological profile also presents a table of all reported background mean serum PCB levels from 1979 to 1996, which range from 0.9 – 15 ppb with a decline over time (ATSDR 2000a). MDPH believes that the data show that serum PCB levels are declining and that the MDPH 1997 Housatonic River Area Exposure Assessment Study results are generally consistent with background exposure levels. However, MDPH notes that serum PCB levels tended to be higher in older residents of the Housatonic River Area who were frequent and/or long-term fish eaters or who reported opportunities for occupational exposure. In addition, there was some indication that other activities (e.g., fiddlehead fern consumption, gardening) may have contributed slightly to serum PCB levels.

12. **Comment:** The CREG is too conservative to use as a comparison value for PCBs and MDPH should use the 2-ppm EPA action level as a comparison value.

Response: MDPH has a cooperative agreement with the US ATSDR to conduct PHAs in Massachusetts. ATSDR has published health based comparison values to screen for possible health effects from exposure to a particular contaminant. A comparison value does not indicate that health effects occur at that particular level. This is explained in the Environmental Contamination and Other Hazards under section A, On-Site Contamination in paragraphs two and three. Comparison values are used to determine if a

particular contaminant needs to be further evaluated for possible health effects that may or may not occur given the potential opportunities for exposure at the site. Regulatory action levels are set by environmental regulatory agencies for clean-up/remediation purposes and are not typically used by health agencies to evaluate possible health concerns based on site-specific exposure opportunities.

13. **Comment:** The exposure factors used in the risk calculations are too conservative and should be more realistic and clarified at least in the appendix.

Response: MDPH has used exposure factors reasonable for this area in evaluating site-specific information. MPDH used more conservative exposure factors than typically used because in Pittsfield, many people reportedly grew up playing near GE sites, have had jobs at GE as teenagers, and could have gone on to work at GE as adults and worked there throughout there working lifetime, because GE was the major Pittsfield employer. Hence, MDPH has used exposure factors consistent with the community-based history and discussions with individuals who reported such a history of contact with the GE sites.

14. **Comment:** MDPH should reference studies that assess the possible link between PCBs and cancer or non-cancer health effects that found no credible links to cancer or other serious health effects (i.e., *A Weight-of-Evidence Review of the Potential Human Cancer Effects of PCBs*, and *Non-Cancer- Effects of PCBs – A Comprehensive Review of Literature*).

Response: MDPH has relied on the ATSDR Toxicological Profile for PCBs (ATSDR 2000) and other scientifically peer-reviewed documents that discuss cancer and non-cancer health effects of PCBs. For example, PCBs are currently considered a probable human carcinogen by EPA, and the International Agency for Research on Cancer currently classifies PCBs as probable human carcinogens based on sufficient evidence in animals and limited evidence in humans as presented in the Discussion Section under section A Chemical-Specific Toxicity Information in this PHA. Also, discussed in this section of the PHA are the ATSDR derivations of Minimal Risk Levels (MRLs) for non-cancer health effects. In addition, the summary report of the Expert Panel on the Health Effects of Non-Occupational Exposure to PCBs convened by MDPH stated: "While the panel cited some conflicting human studies, overall the panel members agreed that the evidence is clear that PCBs are a definitive carcinogen in animals. In humans, the

evidence with regard to cancer is suggestive, but inconclusive." The panel also stated: "PCBs are thought to behave as tumor promoters in susceptible tissues. Therefore, the carcinogenic effects of PCBs are likely to be influenced by other carcinogens or toxins that may be present." Large epidemiological studies of GE workers were included in the Expert Panel's considerations. The Expert Panel also "agreed that there appears to be some developmental effects (e.g., subtle cognitive deficits) associated with exposures to PCB," and stated, "The current research suggests that prenatal exposures to fetuses at near background levels of PCBs may subtly affect the mental development of children." These sources are referenced in the public health assessments.

15. **Comment:** MDPH should use a revised higher MRL of 0.0002 mg/kg/d for PCBs developed by AMEC Earth and Environmental, Inc. in their study, *Development of a Revised Reference Dose for Polychlorinated Biphenyls (Aroclor 1254) Based on Empirical Data*.

Response: MDPH, through its Cooperative Agreement with ATSDR, will continue to use the ATSDR chronic MRL of 0.00002 mg/kg/d as derived and supported in the toxicological profile for PCBs, which was scientifically peer reviewed and put out for a public comment period prior to adoption (ATSDR, 2000a). EPA's reference dose (Rfd) for chronic exposure is also 0.00002 mg/kg/d (EPA IRIS, 2002).

16. **Comment:** Page 20 of the Lyman Street PHA states average soil PCB concentrations were used in risk calculations, while the equation states the maximum value was used, which is it for the Lyman Street PHA as well as the other PHAs.

Response: Both maximum and average PCB concentrations were used in the risk calculations. Separate calculations were done for hotspot locations as well. The risk calculations have been reviewed by MDPH and references to them in the PHAs have been clarified.

Conclusions

17. **Comment:** No Public Health Hazard for the future should be declared because the site will be cleaned up according to EPA and MDEP performance standards.

Response: MDPH cannot make conclusion contingent upon actions that have not been completed yet. There are also opportunities for future exposures that are not possible to define at this time (e.g.,

pavement on the site is torn up or a building on the site is demolished). However, it is expected that once the activities in the consent decree are fully implemented the likelihood that future exposures could be of public health concern should be considerably reduced or eliminated.

18. **Comment:** Health risk evaluations should be qualified by the fact that serum levels in the area were generally found to be in the background range for non-occupationally exposed people.

Response: MDPH has added the following text to the Discussion section on page 23:

"Furthermore, the MDPH's 1997 Exposure Assessment Study concluded that serum levels of the non-occupationally exposed participants from communities surrounding the Housatonic River including Pittsfield were generally within background levels. The Expert Panel on the Health Effects of Non-Occupational Exposure to PCBs agreed that the available data indicate that serum PCB-levels for non-occupationally exposed populations from MDPH's Exposure Assessment Study are generally similar to the background exposure levels in recent studies (MDPH 2000). However, MDPH notes that serum PCB levels tended to be higher in older residents of the Housatonic River Area who were frequent and/or long-term fish eaters or who reported opportunities for occupational exposure. In addition, there was some indication that other activities (e.g., fiddlehead fern consumption, gardening) may have contributed slightly to serum PCB levels."

19. **Comment:** The MDPH Cancer Incidence Report findings that any elevations in cancer had no statistically significant link to the GE site should be reiterated in all the conclusion sections.

Response: MDPH has added the following to the text of the Discussion section on pages 23 and 24:

"The MDPH 2002 Assessment of Cancer Incidence Health Consultation showed that, for the majority of cancer types evaluated, residents of the Housatonic River Area did not experience excessive rates of cancer incidence during the period 1982-1994. For most primary cancer types evaluated, the incidence occurred at or below expected rates, concentrations of cancer cases appeared to reflect the population density, and, when reviewed in relation to the GE sites, the pattern of cancer incidence did not suggest that these sites played a primary role in this development. While Pittsfield did experience more cancer

elevations than the other communities, and the pattern of some cancer types showed elevations that were statistically significantly higher than expected in certain areas or during certain time periods, no pattern among those census tracts with statistically significant elevations was observed. Specifically, although two of the three census tracts in Pittsfield adjacent to the GE site experienced statistically significant elevations in cancers of the bladder, breast, and NHL, a pattern suggesting that a common environmental exposure pathway played a primary role in these census tracts was not observed nor were cases distributed more toward the vicinity of the GE sites. It is important to note, however, that it is impossible to determine whether exposure to GE site contaminants may have played a role in any individual cancer diagnosis. Further review of the available risk factor and occupational information suggested that workplace exposures and smoking may have been potential factors in the development of some individuals' cancers (e.g., bladder cancer). However, the pattern of cancer in this area does not suggest that environmental factors played a primary role in the increased rates in this area (MDPH 2002a).

As noted earlier in this PHA, more recent cancer incidence data for the period 1995–1999 shows that for Pittsfield as a whole, no cancer type was statistically significantly elevated. Although bladder cancer among males for Pittsfield as a whole was statistically significantly elevated during 1982 – 1994 (MDPH 2002a), this cancer type occurred less often than expected among males during 1995 – 1999 (28 cases observed vs. approximately 36 cases expected). (MDPH 2002b)"

Appendix B:
Public Health Assessments vs. Risk Assessments

Public health assessments and risk assessments both investigate the impact or potential impact of hazardous substances at a specific site on public health. However, the two types of assessment differ in their goals and focus. Quantitative risk assessments are geared largely toward arriving at numeric estimates of the risk posed to a population by the hazardous substances found on a site. These calculations use statistical and biological models based on dose-response data from animal toxicologic studies and (if available) human epidemiological studies. Risk assessments estimate the public health risk posed by a site, and their conclusions can be used to establish allowable contamination levels, or to establish clean-up levels and select remedial measures to be taken at the site.

Public health assessments are intended to determine the past, current or future public health implications of a specific site, but focus more than risk assessments do on the health concerns of the specific community. Public health assessments are based on environmental characterization information (including information on environmental contamination and exposure pathways), community health concerns associated with the site, and community-specific health outcome data. They make recommendations for actions needed to protect public health (which may include the development and issuing of health advisories), and they identify populations in need of further health actions or studies.

Appendix C:
ATSDR Glossary of Environmental Health Terms

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency with headquarters in Atlanta, Georgia, and 10 regional offices in the United States. ATSDR's mission is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances. ATSDR is not a regulatory agency, unlike the U.S. Environmental Protection Agency (EPA), which is the federal agency that develops and enforces environmental laws to protect the environment and human health.

This glossary defines words used by ATSDR in communications with the public. It is not a complete dictionary of environmental health terms. If you have questions or comments, call ATSDR's toll-free telephone number, 1-888-42-ATSDR (1-888-422-8737).

Absorption
The process of taking in. For a person or animal, absorption is the process of a substance getting into the body through the eyes, skin, stomach, intestines, or lungs.

Acute
Occurring over a short time [compare with **chronic**].

Acute exposure
Contact with a substance that occurs once or for only a short time (up to 14 days) [compare with **intermediate duration exposure** and **chronic exposure]**.

Additive effect
A biologic response to exposure to multiple substances that equals the sum of responses of all the individual substances added together [compare with **antagonistic effect** and **synergistic effect]**.

Adverse health effect
A change in body function or cell structure that might lead to disease or health problems.

Aerobic
Requiring oxygen [compare with **anaerobic**].

Ambient
Surrounding (for example, *ambient* air).

Anaerobic
Requiring the absence of oxygen [compare with **aerobic**].

Analyte
A substance measured in the laboratory. A chemical for which a sample (such as water, air, or blood) is tested in a laboratory. For example, if the analyte is mercury, the laboratory test will determine the amount of mercury in the sample.

Analytic epidemiologic study
A study that evaluates the association between exposure to hazardous substances and disease by testing scientific hypotheses.

Antagonistic effect
A biologic response to exposure to multiple substances that is **less** than would be expected if the known effects of the individual substances were added together [compare with **additive effect** and **synergistic effect**].

Background level
An average or expected amount of a substance or radioactive material in a specific environment, or typical amounts of substances that occur naturally in an environment.

Biodegradation
Decomposition or breakdown of a substance through the action of microorganisms (such as bacteria or fungi) or other natural physical processes (such as sunlight).

Biologic indicators of exposure study
A study that uses (a) **biomedical testing** or (b) the measurement of a substance [an **analyte**], its **metabolite**, or another marker of exposure in human body fluids or tissues to confirm human exposure to a hazardous substance [also see **exposure investigation**].

Biologic monitoring
Measuring hazardous substances in biologic materials (such as blood, hair, urine, or breath) to determine whether exposure has occurred. A blood test for lead is an example of biologic monitoring.

Biologic uptake
The transfer of substances from the environment to plants, animals, and humans.

Biomedical testing
Testing of persons to find out whether a change in a body function might have occurred because of exposure to a hazardous substance.

Biota
Plants and animals in an environment. Some of these plants and animals might be sources of food, clothing, or medicines for people.

Body burden
The total amount of a substance in the body. Some substances build up in the body because they are stored in fat or bone or because they leave the body very slowly.

CAP
See **Community Assistance Panel**.

Cancer
Any one of a group of diseases that occurs when cells in the body become abnormal and grow or multiply out of control.

Cancer risk
A theoretical risk of for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

Carcinogen
A substance that causes cancer.

Case study
A medical or epidemiologic evaluation of one person or a small group of people to gather information about specific health conditions and past exposures.

Case-control study
A study that compares exposures of people who have a disease or condition (cases) with people who do not have the disease or condition (controls). Exposures that are more common among the cases may be considered as possible risk factors for the disease.

CAS registry number
A unique number assigned to a substance or mixture by the American Chemical Society Abstracts Service.

Central nervous system
The part of the nervous system that consists of the brain and the spinal cord.

CERCLA [see **Comprehensive Environmental Response, Compensation, and Liability Act of 1980**]

Chronic
Occurring over a long time (more than 1 year) [compare with **acute**].

Chronic exposure
Contact with a substance that occurs over a long time (more than 1 year) [compare with **acute exposure** and **intermediate duration exposure**].

Cluster investigation
A review of an unusual number, real or perceived, of health events (for example, reports of cancer) grouped together in time and location. Cluster investigations are designed to confirm case reports; determine whether they represent an unusual disease occurrence; and, if possible, explore possible causes and contributing environmental factors.

Community Assistance Panel (CAP)
A group of people, from a community and from health and environmental agencies, who work with ATSDR to resolve issues and problems related to hazardous substances in the community. CAP members work with ATSDR to gather and review community health concerns, provide information on how people might have been or might now be exposed to hazardous substances, and inform ATSDR on ways to involve the community in its activities.

Comparison value (CV)
Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.

Completed exposure pathway [see **exposure pathway**].

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)
CERCLA, also known as **Superfund**, is the federal law that concerns the removal or cleanup of hazardous substances in the environment and at hazardous waste sites. ATSDR, which was created by CERCLA, is responsible for assessing health issues and supporting public health activities related to hazardous waste sites or other environmental releases of hazardous substances.

Concentration
The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Contaminant
A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Delayed health effect
A disease or injury that happens as a result of exposures that might have occurred in the past.

Dermal
Referring to the skin. For example, dermal absorption means passing through the skin.

Dermal contact
Contact with (touching) the skin [see **route of exposure**].

Descriptive epidemiology
The study of the amount and distribution of a disease in a specified population by person, place, and time.

Detection limit
The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

Disease prevention
Measures used to prevent a disease or reduce its severity.

Disease registry
A system of ongoing registration of all cases of a particular disease or health condition in a defined population.

DOD
United States Department of Defense.

DOE
United States Department of Energy.

Dose (for chemicals that are not radioactive)
The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An "exposure dose" is how much of a substance is encountered in the environment. An "absorbed dose" is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

Dose (for radioactive chemicals)
The radiation dose is the amount of energy from radiation that is actually absorbed by the body. This is not the same as measurements of the amount of radiation in the environment.

Dose-response relationship
The relationship between the amount of exposure [**dose**] to a substance and the resulting changes in body function or health (response).

Environmental media
Soil, water, air, **biota** (plants and animals), or any other parts of the environment that can contain contaminants.

Environmental media and transport mechanism
Environmental media include water, air, soil, and **biota** (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can

occur. The **environmental media and transport mechanism** is the second part of an **exposure pathway**.

EPA
United States Environmental Protection Agency.

Epidemiologic surveillance
The ongoing, systematic collection, analysis, and interpretation of health data. This activity also involves timely dissemination of the data and use for public health programs.

Epidemiology
The study of the distribution and determinants of disease or health status in a population; the study of the occurrence and causes of health effects in humans.

Exposure
Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [**acute exposure**], of intermediate duration, or long-term [**chronic exposure**].

Exposure assessment
The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.

Exposure-dose reconstruction
A method of estimating the amount of people's past exposure to hazardous substances. Computer and approximation methods are used when past information is limited, not available, or missing.

Exposure investigation
The collection and analysis of site-specific information and biologic tests (when appropriate) to determine whether people have been exposed to hazardous substances.

Exposure pathway
The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a **source of contamination** (such as an abandoned business); an **environmental media and transport mechanism** (such as movement through groundwater); a **point of exposure** (such as a private well); a **route of exposure** (eating, drinking, breathing, or touching), and a **receptor population** (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a **completed exposure pathway**.

Exposure registry
A system of ongoing followup of people who have had documented environmental exposures.

Feasibility study
A study by EPA to determine the best way to clean up environmental contamination. A number of factors are considered, including health risk, costs, and what methods will work well.

Geographic information system (GIS)
A mapping system that uses computers to collect, store, manipulate, analyze, and display data. For example, GIS can show the concentration of a contaminant within a community in relation to points of reference such as streets and homes.

Grand rounds
Training sessions for physicians and other health care providers about health topics.

Groundwater
Water beneath the earth's surface in the spaces between soil particles and between rock surfaces [compare with **surface water**].

Half-life ($t_{½}$)
The time it takes for half the original amount of a substance to disappear. In the environment, the half-life is the time it takes for half the original amount of a substance to disappear when it is changed to another chemical by bacteria, fungi, sunlight, or other chemical processes. In the human body, the half-life is the time it takes for half the original amount of the substance to disappear, either by being changed to another substance or by leaving the body. In the case of radioactive material, the half life is the amount of time necessary for one half the initial number of radioactive atoms to change or transform into another atom (that is normally not radioactive). After two half lives, 25% of the original number of radioactive atoms remain.

Hazard
A source of potential harm from past, current, or future exposures.

Hazardous Substance Release and Health Effects Database (HazDat)
The scientific and administrative database system developed by ATSDR to manage data collection, retrieval, and analysis of site-specific information on hazardous substances, community health concerns, and public health activities.

Hazardous waste
Potentially harmful substances that have been released or discarded into the environment.

Health consultation
A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical [compare with **public health assessment**].

Health education
Programs designed with a community to help it know about health risks and how to reduce these risks.

Health investigation
The collection and evaluation of information about the health of community residents. This information is used to describe or count the occurrence of a disease, symptom, or clinical measure and to estimate the possible association between the occurrence and exposure to hazardous substances.

Health promotion
The process of enabling people to increase control over, and to improve, their health.

Health statistics review
The analysis of existing health information (i.e., from death certificates, birth defects registries, and cancer registries) to determine if there is excess disease in a specific population, geographic area, and time period. A health statistics review is a descriptive epidemiologic study.

Indeterminate public health hazard
The category used in ATSDR's public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.

Incidence
The number of new cases of disease in a defined population over a specific time period [contrast with **prevalence**].

Ingestion
The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see **route of exposure**].

Inhalation
The act of breathing. A hazardous substance can enter the body this way [see **route of exposure**].

Intermediate duration exposure
Contact with a substance that occurs for more than 14 days and less than a year [compare with **acute exposure** and **chronic exposure**].

In vitro
In an artificial environment outside a living organism or body. For example, some toxicity testing is done on cell cultures or slices of tissue grown in the laboratory, rather than on a living animal [compare with **in vivo**].

In vivo
Within a living organism or body. For example, some toxicity testing is done on whole animals, such as rats or mice [compare with **in vitro**].

Lowest-observed-adverse-effect level (LOAEL)
The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

Medical monitoring
A set of medical tests and physical exams specifically designed to evaluate whether an individual's exposure could negatively affect that person's health.

Metabolism
The conversion or breakdown of a substance from one form to another by a living organism.

Metabolite
Any product of **metabolism**.

mg/kg
Milligram per kilogram.

mg/cm^2
Milligram per square centimeter (of a surface).

mg/m^3
Milligram per cubic meter; a measure of the concentration of a chemical in a known volume (a cubic meter) of air, soil, or water.

Migration
Moving from one location to another.

Minimal risk level (MRL)
An ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects. MRLs are calculated for a route of exposure (inhalation or oral) over a specified time period (acute, intermediate, or chronic). MRLs should not be used as predictors of harmful (adverse) health effects [see **reference dose**].

Morbidity
State of being ill or diseased. Morbidity is the occurrence of a disease or condition that alters health and quality of life.

Mortality
Death. Usually the cause (a specific disease, condition, or injury) is stated.

Mutagen
A substance that causes **mutations** (genetic damage).

Mutation
A change (damage) to the DNA, genes, or chromosomes of living organisms.

National Priorities List for Uncontrolled Hazardous Waste Sites (National Priorities List or NPL)
EPA's list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The NPL is updated on a regular basis.

No apparent public health hazard
A category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.

No-observed-adverse-effect level (NOAEL)
The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

No public health hazard
A category used in ATSDR's public health assessment documents for sites where people have never and will never come into contact with harmful amounts of site-related substances.

NPL [see **National Priorities List for Uncontrolled Hazardous Waste Sites]**

Physiologically based pharmacokinetic model (PBPK model)
A computer model that describes what happens to a chemical in the body. This model describes how the chemical gets into the body, where it goes in the body, how it is changed by the body, and how it leaves the body.

Pica
A craving to eat nonfood items, such as dirt, paint chips, and clay. Some children exhibit pica-related behavior.

Plume
A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.

Point of exposure
The place where someone can come into contact with a substance present in the environment [see **exposure pathway**].

Population
A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

Potentially responsible party (PRP)
A company, government, or person legally responsible for cleaning up the pollution at a hazardous waste site under Superfund. There may be more than one PRP for a particular site.

ppb
Parts per billion.

ppm
Parts per million.

Prevalence
The number of existing disease cases in a defined population during a specific time period [contrast with **incidence**].

Prevalence survey
The measure of the current level of disease(s) or symptoms and exposures through a questionnaire that collects self-reported information from a defined population.

Prevention
Actions that reduce exposure or other risks, keep people from getting sick, or keep disease from getting worse.

Public comment period
An opportunity for the public to comment on agency findings or proposed activities contained in draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

Public availability session
An informal, drop-by meeting at which community members can meet one-on-one with ATSDR staff members to discuss health and site-related concerns.

Public health action
A list of steps to protect public health.

Public health advisory
A statement made by ATSDR to EPA or a state regulatory agency that a release of hazardous substances poses an immediate threat to human health. The advisory includes recommended measures to reduce exposure and reduce the threat to human health.

Public health assessment (PHA)
An ATSDR document that examines hazardous substances, health outcomes, and community concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health [compare with **health consultation**].

Public health hazard
A category used in ATSDR's public health assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances or **radionuclides** that could result in harmful health effects.

Public health hazard categories
Public health hazard categories are statements about whether people could be harmed by conditions present at the site in the past, present, or future. One or more hazard categories might be appropriate for each site. The five public health hazard categories are **no public health hazard, no apparent public health hazard**, **indeterminate public health hazard**, **public health hazard**, and **urgent public health hazard**.

Public health statement
The first chapter of an ATSDR **toxicological profile**. The public health statement is a summary written in words that are easy to understand. The public health statement explains how people might be exposed to a specific substance and describes the known health effects of that substance.

Public meeting
A public forum with community members for communication about a site.

Radioisotope
An unstable or radioactive isotope (form) of an element that can change into another element by giving off radiation.

Radionuclide
Any radioactive isotope (form) of any element.

RCRA [See **Resource Conservation and Recovery Act (1976, 1984)**]

Receptor population
People who could come into contact with hazardous substances [see **exposure pathway**].

Reference dose (RfD)
An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

Registry
A systematic collection of information on persons exposed to a specific substance or having specific diseases [see **exposure registry** and **disease registry**].

Remedial Investigation
The CERCLA process of determining the type and extent of hazardous material contamination at a site.

Resource Conservation and Recovery Act (1976, 1984) (RCRA)
This Act regulates management and disposal of hazardous wastes currently generated, treated, stored, disposed of, or distributed.

RFA
RCRA Facility Assessment. An assessment required by RCRA to identify potential and actual releases of hazardous chemicals.

RfD
See **reference dose**.

Risk
The probability that something will cause injury or harm.

Risk reduction
Actions that can decrease the likelihood that individuals, groups, or communities will experience disease or other health conditions.

Risk communication
The exchange of information to increase understanding of health risks.

Route of exposure
The way people come into contact with a hazardous substance. Three routes of exposure are breathing [**inhalation**], eating or drinking [**ingestion**], or contact with the skin [**dermal contact**].

Safety factor [see **uncertainty factor]**

SARA [see **Superfund Amendments and Reauthorization Act**]

Sample
A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see **population**]. An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

Sample size
The number of units chosen from a population or environment.

Solvent
A liquid capable of dissolving or dispersing another substance (for example, acetone or mineral spirits).

Source of contamination
The place where a hazardous substance comes from, such as a landfill, waste pond, incinerator, storage tank, or drum. A source of contamination is the first part of an **exposure pathway**.

Special populations
People who might be more sensitive or susceptible to exposure to hazardous substances because of factors such as age, occupation, sex, or behaviors (for example, cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Stakeholder
A person, group, or community who has an interest in activities at a hazardous waste site.

Statistics
A branch of mathematics that deals with collecting, reviewing, summarizing, and interpreting data or information. Statistics are used to determine whether differences between study groups are meaningful.

Substance
A chemical.

Substance-specific applied research
A program of research designed to fill important data needs for specific hazardous substances identified in ATSDR's **toxicological profiles**. Filling these data needs would allow more accurate assessment of human risks from specific substances contaminating the environment. This research might include human studies or laboratory experiments to determine health effects resulting from exposure to a given hazardous substance.

Superfund Amendments and Reauthorization Act (SARA)
In 1986, SARA amended CERCLA and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from substance exposures at hazardous waste sites and to perform activities including health education, health studies, surveillance, health consultations, and toxicological profiles.

Surface water
Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with **groundwater**].

Surveillance [see **epidemiologic surveillance**]

Survey
A systematic collection of information or data. A survey can be conducted to collect information from a group of people or from the environment. Surveys of a group of people can be conducted by telephone, by mail, or in person. Some surveys are done by interviewing a group of people [see **prevalence survey**].

Synergistic effect
A biologic response to multiple substances where one substance worsens the effect of another substance. The combined effect of the substances acting together is greater than the sum of the effects of the substances acting by themselves [see **additive effect** and **antagonistic effect**].

Teratogen
A substance that causes defects in development between conception and birth. A teratogen is a substance that causes a structural or functional birth defect.

Toxic agent
Chemical or physical (for example, radiation, heat, cold, microwaves) agents which, under certain circumstances of exposure, can cause harmful effects to living organisms.

Toxicological profile
An ATSDR document that examines, summarizes, and interprets information about a hazardous substance to determine harmful levels of exposure and associated health effects. A toxicological profile also identifies significant gaps in knowledge on the substance and describes areas where further research is needed.

Toxicology
The study of the harmful effects of substances on humans or animals.

Tumor
An abnormal mass of tissue that results from excessive cell division that is uncontrolled and progressive. Tumors perform no useful body function. Tumors can be either benign (not cancer) or malignant (cancer).

Uncertainty factor
Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the lowest-observed-adverse-effect-level (LOAEL) or the no-observed-adverse-effect-level (NOAEL) to derive a minimal risk level (MRL). Uncertainty factors are used to account for variations in people's sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. Scientists use uncertainty factors when they have some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people [also sometimes called a **safety factor**].

Urgent public health hazard
A category used in ATSDR's public health assessments for sites where short-term exposures (less than 1 year) to hazardous substances or conditions could result in harmful health effects that require rapid intervention.

Volatile organic compounds (VOCs)
Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, methylene chloride, and methyl chloroform.

Other glossaries and dictionaries:
Environmental Protection Agency
http://www.epa.gov/OCEPAterms/
National Center for Environmental Health (CDC)
http://www.cdc.gov/nceh/dls/report/glossary.htm
National Library of Medicine
http://www.nlm.nih.gov/medlineplus/dictionaries.html

Appendix D:
Explanation of a Standardized Incidence Ratio (SIR)

In order to evaluate cancer incidence a statistic known as a standardized incidence ratio (SIR) was calculated for each cancer type. An SIR is an estimate of the occurrence of cancer in a population relative to what might be expected if the population had the same cancer experience as some larger comparison population designated as "normal" or average. Usually, the state as a whole is selected to be the comparison population. Using the state of Massachusetts as a comparison population provides a stable population base for the calculation of incidence rates. As a result of the instability of incidence rates based on small numbers of cases, SIRs were not calculated when fewer than five cases were observed.

Specifically, an SIR is the ratio of the observed number of cancer cases to the expected number of cases multiplied by 100. An SIR of 100 indicates that the number of cancer cases observed in the population evaluated is equal to the number of cancer cases expected in the comparison or "normal" population. An SIR greater than 100 indicates that more cancer cases occurred than expected and an SIR less than 100 indicates that fewer cancer cases occurred than expected. Accordingly, an SIR of 150 is interpreted of 50% more cases than the expected number; an SIR of 90 indicates 10% fewer cases than expected.

Caution should be exercised, however, when interpreting an SIR. The interpretation of an SIR depends on both the size and the stability of the SIR. Tow SIRs can have the same size but not the same stability. For example, a SIR of 150 based on four expected cases and six observed cases indicates a 50% excess in cancer, but the excess is actually only two cases. Conversely, an SIR of 150 based on 400 expected cases and 600 observed cases represents the same 50% excess in cancer, but because the SIR is based upon a greater number of cases, the estimate is more stable. It is very unlikely that 200 excess cases of cancer would occur by chance alone.

Source: Massachusetts Department of Public Health, Bureau of Environmental Health Assessment (December 1998)

Appendix E:

INFORMATION BOOKLET

for

THE FINAL REPORT ON THE HOUSATONIC RIVER AREA PCB EXPOSURE ASSESSMENT

and

RELATED HEALTH ISSUES

prepared by
MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH
BUREAU OF ENVIRONMENTAL HEALTH ASSESSMENT

September 1997

QUESTIONS AND ANSWERS

1. **Q. Why was the "Housatonic River Area PCB Exposure Assessment" conducted?**

   A. The assessment was conducted to identify the frequency of different activities that might lead to opportunities for PCB exposure, and to determine, through the use of blood testing, how various activities may have contributed to higher serum PCB levels among HRA residents.

2. **Q. What is meant by the "Housatonic River Area" (or "HRA")?**

   A. The Housatonic River Area or HRA comprises eight communities in Berkshire County, Massachusetts: Dalton, Great Barrington, Lanesborough, Lee, Lenox, Pittsfield, Sheffield, and Stockbridge.

3. **Q. What are PCBs?**

   A. PCBs or polychlorinated biphenyls are man-made, odorless chemicals. They do not evaporate and do not dissolve easily in water. In the HRA, PCBs were largely used in the manufacture of electrical transformers.

4. **Q. How did PCBs get into the Housatonic River and the surrounding communities?**

   A. PCBs were used in the manufacture of electrical and associated products in Pittsfield from 1932 to 1972, and they reached the Housatonic River in large quantities. This contamination was first discovered in the 1970s, in fish and sediments in lakes along the Housatonic. Extensive environmental sampling has revealed widespread contamination of Housatonic River sediments, floodplain soil, fish and other biota. Very recently, some residential properties were found to be contaminated with PCBs due to contaminated fills.

5. **Q. Who conducted the study?**

   A. The Housatonic River Area PCB Exposure Assessment was conducted by the Massachusetts Department of Public Health (MDPH), Bureau of Environmental Health Assessment, with support from the Massachusetts Department of Environmental Protection and the federal Agency for Toxic Substances and Disease Registry. The MDPH received input from local citizens or citizens' groups (e.g. Housatonic River Initiative), especially during the study design and protocol development. The MDPH also formed the Housatonic River Area Advisory Committee for Health Studies and MDPH staff held periodic meetings with committee members to report status and get feed back on the conduct of the study.

6. **Q. How were participants chosen for the Exposure Prevalence Study?**

A. In the Exposure Prevalence Study, 800 households were randomly chosen from among all those located within one-half mile of the Housatonic River in the following eight communities: Dalton, Great Barrington, Lanesborough, Lee, Lenox, Pittsfield, Sheffield, and Stockbridge. Four hundred of those households were from Pittsfield, and four hundred were from the other seven communities.

7. Q. How were participants chosen for the Volunteer Study?

A. In the Volunteer Study, subjects were recruited by means of a Public Service Announcement in local newspapers and radio stations, and through a mass mailing to interested parties. The Volunteer Study allowed those residents who were concerned about PCB exposure, but who were not selected to participate in the Exposure Prevalence Study, to be scheduled for a blood test. MDPH arranged to administer questionnaires to the volunteers in person at three walk-in sites: the Great Barrington Senior Center, the Tri-town Health Department in Lee, and the Berkshire Athenaeum in Pittsfield. The questionnaire administered to the volunteers was the same as the one used in the Exposure Prevalence Study.

8. Q. How were opportunities for exposure to PCBs assessed?

A. A household screening questionnaire was administered to the 800 households. A representative of each household answered questions for all the members of his or her family. After the questionnaires were completed, the responses of every household member were weighted, with those activities more likely to lead to greater potential for PCB exposure weighted more heavily. Thus, those with the greatest potential for PCB exposure would receive the highest weights or scores.

9. Q. How were respondents selected to participate in blood testing?

A. In the Exposure Prevalence Study, individuals with the highest potential exposure to PCBs based on screening questionnaire scores were offered the opportunity for a blood test. Results of blood tests allowed MDPH to determine whether those individuals who were suspected to have had greater opportunities for exposure to PCBs did in fact have higher levels than those with lesser opportunities for exposure. All respondents in the Volunteer Study were offered blood testing.

10. Q. What was the range of serum PCB levels found in the Exposure Prevalence and Volunteer Studies?

A. Sixty-nine residents who participated in the Exposure Prevalence Study had serum PCB levels as follows:

Concentrations of PCBs in Parts Per Billion (ppb)	Number of Individuals

0-4	43
5-9	18
10-14	6
15-20	1
over 20	1

Seventy-nine residents who participated in the Volunteer Study had serum PCB levels shown as follows:

Concentrations of PCBs in Parts Per Billion (ppb)	Number of Individuals
0-4	32
5-9	25
10-14	15
15-20	2
over 20	5

The average serum PCB level in the Exposure Prevalence Study among non-occupationally exposed participants was 4.49 ppb, and in the Volunteer Study, the average was 5.77 ppb. These levels were generally within the normal background range for non-occupationally exposed individuals.

11. Q. Was occupational exposure related to serum PCB levels?

A. Yes. Among all participants who had blood testing, those who had had opportunities for occupational exposure had higher serum PCB levels than the rest.

12. Q. Was age related to serum PCB levels?

A. Yes. Age was found to be the prominent predictor of serum PCB level.

13. Q. Do most people in the United States have PCBs in their bodies?

A. PCBs have been measured in human blood, fatty tissue, and breast milk throughout the country. Ninety-five percent of the U.S. population have serum levels of less than 20 ppb. Ninety-nine percent of the U.S. population have serum levels of less than 30 ppb. The national average for serum PCB level in persons non-occupationally exposed is between 4 and 8 ppb. The greatest on-going source of public exposure to PCBs is from food, particularly fish.

14. Q. Is there anything I can do to reduce PCB levels in my blood?

A. Currently, there is no treatment available to lower PCB blood levels. However, if an individual was exposed, PCB levels will decrease over time once exposure to PCBs has been reduced.

15. Q. Is it safe to eat fish from the Housatonic River and its tributaries?

A. No. In 1982, the MDPH restricted fish, frog, and turtle consumption in the Housatonic River and its tributaries. Because of continued evidence of PCB contamination, it is expected that PCB levels in these species still remain elevated.

Both the Exposure Prevalence Study and the Volunteer Study showed that study participants who had higher frequency and duration of contaminated fish consumption had higher serum PCB levels. Due to health effects that have been suggested as potentially related to PCB exposure, the MDPH maintains that the current ban on these activities in or near the river remain in effect.

16. Q. Is it safe to eat fish from restaurants, supermarkets, and local markets in the Housatonic River Area?

A. Yes. In general, fish caught in marine open and bay waters is the source of most commercial catches in New England and is not affected by PCB contamination from local and freshwater areas. State and federal health regulatory officials regulate fish sold for the commercial markets.

17. Q. Was consumption of fiddlehead ferns associated with higher serum PCB levels?

A. Individuals who reported greater frequency and duration of fiddlehead fern consumption had slightly higher serum PCB levels.

18. Q. If my only exposure to PCBs is through soil contact, should I be concerned?

A. Previous studies conducted by MDPH have not shown that exposure through soil contact alone has resulted in appreciable increases in serum PCB levels. MDPH continues to consider consumption of contaminated fish to be the most significant non-occupational exposure concern. However, due to the recent discovery of widespread residential PCB contamination, MDPH is coordinating a separate study of residents who may be concerned about exposure.

19. Q. If PCBs have been discovered in soils on my property, what can I do about getting my health concerns addressed or my blood tested?

A. MDPH has established a toll free hot-line to advise local area residents about any health related concerns or questions they may have. The exposure assessment questionnaire will be provided to all residents who wish to have their

opportunities for exposure evaluated and a blood test taken. The hot-line number is 1-800-240-4266.

20. Q. What health effects are caused by exposure to PCBs?

A. PCBs are not very acutely toxic. Large amounts of PCBs are necessary to produce acute effects. These effects can include skin lesions or irritations, fatigue, and hyperpigmentation (increased pigmentation) of the skin and nails. Chronic effects occur after weeks or years of exposure or long after initial exposure to PCBs. A number of studies have suggested that these effects include immune system suppression, liver damage, neurological effects, and possibly cancer.

21. Q. What happens to PCBs in your body?

A. Once PCBs enter the body they are first distributed in the liver and muscles and then are stored in fatty tissues. PCBs can be stored in fat tissue for years. Also, breast milk may concentrate PCBs because of its fat content. The PCBs can then be transferred to children through breastfeeding.

22. Q. Are cancer rates elevated in the HRA?

A. According to the most recent data from the Massachusetts Cancer Registry, cancer rates during 1982-1986 and 1987-1992 for the eight communities (i.e., Dalton, Great Barrington, Lanesborough, Lee, Lenox, Pittsfield, Sheffield, and Stockbridge) showed that, with the exception of bladder cancer in Pittsfield males during the 1982-1986 period, no statistically significant elevation was noted.

23. Q. Do PCBs cause reproductive effects?

A. Studies have reported that infants born to mothers who were environmentally or occupationally exposed to PCBs had decreases in birth weight, gestational age, and neonatal performance. However, the strength of the association with PCBs is unclear. PCBs have been shown to cause these and other reproductive effects in a variety of mammalian species.

24. Q. Are there any problems with reproductive outcomes for the HRA?

A. According to 1990-1994 birth data from the MDPH Registry of Vital Records and Statistics, infant mortality and the proportion of low birth weight in the HRA were similar to those of the state averages.

Appendix F:
Commonwealth of Massachusetts
EXECUTIVE OFFICE OF HEALTH AND HUMAN SERVICES

Expert Panel on the Health Effects of Non-Occupational Exposure to Polychlorinated Biphenyls (PCBs)

Questions and Answers

1. Q. Why was an expert panel convened?

A. Because of continuing concerns relative to the health effects of PCBs among Pittsfield area residents, the Secretary of the Executive Office of Health and Human Services (EOHHS) called for a review of this topic by a panel of independent experts. It was hoped that this panel would establish consensus on the available health information where possible, reflect the range of scientific opinion, and report on the current state of the science and directions of current research.

2. Q. Who was on the expert panel?

A. The panel comprised 11 nationally and internationally recognized experts on the health effects of PCBs from a wide range of disciplines, including toxicology, epidemiology, public health, and analytical chemistry.

3. Q. How and why were the panelists selected?

A. The Secretary of EOHHS invited the public to nominate potential panel members who had expertise in one of the following disciplines: toxicology; epidemiology; environmental exposure assessment; laboratory science; medicine (including cancer and reproductive outcomes); environmental fate and transport; and organic chemistry. The public comment period for submission of nominations ran from August 2nd to August 21st, 1998. Nearly 40 individuals were nominated representing a variety of disciplines. In selecting the final 11 panelists, the Secretary made every effort to have a panel of individuals with the diversity of technical disciplines noted above and who were nominated by a variety of publicly interested parties.

4. Q. What topics did the panel discuss? How were these topics selected?

A. The role of the panel was to review, assess, and summarize the most up-to-date published and ongoing research on PCBs and public health, with special emphasis on:

- The latest information on typical levels in the U.S. of PCBs in blood serum and the public health significance of these levels;
- The adverse health outcomes associated with exposure to PCBs;
- The thoroughness of information on ways humans can be exposed to PCBs (such as via air, water, soil, food);
- The interactions between PCBs and other chemicals.

EOHHS compiled a preliminary list of questions for the panel based on the experiences of the Massachusetts Department of Public Health (MDPH) with PCB contamination in the Houstonic River Area and throughout the Commonwealth. Furthermore, EOHHS and the chairman of the panel held a public meeting in Pittsfield on the eve of the panel meeting to solicit additional questions and comments from the public in Berkshire County.

5. Q. What were the findings of the expert panel with respect to typical background levels of PCBs in blood serum?

A. The panel agreed that the information on typical background serum PCB levels for non-occupationally exposed people in the Toxicological Profile for PCBs[1] (i.e., 4-8 ppb) is not current. In addition, the panel concluded that the information that now exists suggests that the range is probably lower than 4-8 ppb, but that comparisons are difficult due to differences in the age of various study populations and whether or not they eat fish. Some recent studies have found background serum PCB levels for women of reproductive age around 2 ppb, while other researchers have observed levels around 6 ppb for elderly people who do not eat much fish. The recent studies provide valuable data points that must be shared within the context of all relevant factors. For example, studies have consistently shown that serum PCB levels increase with age and are correlated to factors such as fish consumption and exposures to PCBs at work.

The varied analytical and statistical methods used by different researchers often make comparisons between studies difficult or impossible. Therefore, the panel strongly recommended that an individual's serum PCB level be evaluated by comparisons to the distribution of levels within the local and other comparable populations, considering age, fish consumption habits, and occupational exposures.

6. Q. How do the serum PCB levels from residents of the Housatonic River Area compare to the current estimates of typical background levels for non-occupationally exposed individuals?

A. When comparing serum PCB levels between different studies, it is important to match populations with similar ages and opportunities for exposures to PCBs (e.g., occupation, fish consumption habits). Analytical and statistical methods (e.g., chromatographic and detection methods, detection limits, target congeners, treatment of non-detected samples) can also vary among studies, further complicating comparisons. Nevertheless, if the appropriate factors are considered, the serum PCB levels measured in recent studies may provide useful comparison data for the results from the Housatonic River Area.

7. Q. How do the serum PCB levels from residents of the Housatonic River Area compare to the population in the study from The Netherlands?

A. In a recent study from The Netherlands, 415 women of reproductive age (i.e., mid-20s to

[1] Toxicological Profile for Polychlorinated Biphenyls, Draft for Public Comment, Agency for Toxic Substances and Disease Registry, Atlanta, Georgia, December 1998.

mid-30s) were found to have median serum PCB levels around 2 ppb. Because of the analytical methods used in this study, this result may actually correspond to approximately 4 ppb of total serum PCBs as measured for MDPH's Exposure Assessment Study. This could be predicted with greater certainty if some samples are analyzed by both techniques. In contrast, non-occupationally exposed residents of the Housatonic River Area between 18 and 34 years old (n=8) had median serum PCB concentrations less than 2 ppb.

8. Q. How do the serum PCB levels from residents of the Housatonic River Area compare to people over 50 years old who do not each much fish?

A. A recently published study reportedly found that 180 people over 50 years old who do not eat much fish (i.e., less than 6 pounds per year) had serum PCB levels around 6 ppb. The median serum PCB levels for non-occupationally exposed, older (i.e., 50 years and older, including those greater than 70) participants in MDPH's Exposure Assessment Study were 3.70 (n=19) and 5.90 (n=12) ppb for the Exposure Prevalence and Volunteer phases, respectively.

9. Q. How do the serum PCB levels from residents of the Housatonic River Area compare to the population in the Great Lakes study?

A. A mixed-age population in the Great Lakes region who did not consume sport-caught fish had geometric mean (i.e., approximately median) serum PCB levels of 1.5 and 0.9 ppb for males (n=57) and females (n=42), respectively. For a similar population in the Housatonic River Area (i.e., non-occupationally exposed participants, 18-64 years old, who either never ate fish or ate only store-bought fish), the median serum PCB levels were 3.30 (n=10) and 1.66 (n=8) ppb in the Exposure Prevalence and Volunteer phases, respectively. Direct comparisons between these studies are hampered by the fact that the method detection limit for MDPH's Exposure Assessment Study (2 ppb) was greater than the median levels measured in the Great Lakes study.

10. Q. How do the serum PCB levels from residents of the Housatonic River Area compare to the populations in the New York breast disease studies?

A. Two studies of women with benign breast disease in the New York area reported average concentrations of serum PCBs of 2.15 (n=173) and 4.06 (n=19) ppb. The average serum PCB concentrations for non-occupationally exposed participants in MDPH's Exposure Assessment Study were slightly higher than this range, 4.49 (n=52) and 5.77 (n=53) ppb for the Exposure Prevalence and Volunteer phases, respectively. This may be because the women in the New York studies were on average about 10 years younger than the participants in MDPH's Exposure Assessment Study. Furthermore, the method detection limit for the larger of the New York studies (0.5 ppb) was four times lower than the detection limit for MDPH's Exposure Assessment Study (2 ppb).

11. Q. Overall, how do the serum PCB levels from residents of the Housatonic River Area compare to the populations in these recent studies?

A. Because of the complications discussed earlier, direct comparisons between studies are difficult. However, the available data indicate that serum PCB levels for the non-occupationally exposed population from MDPH's Exposure Assessment Study are generally similar to the background exposure levels reported in recent studies.

12. Q. What were the findings of the expert panel with respect to adverse health outcomes associated with PCB exposures?

A. While the panel cited some conflicting human studies, overall the panel members agreed that the evidence is clear that PCBs are a definite carcinogen in animals. In humans, the evidence with regard to cancer is suggestive but inconclusive.

Most of the panel agreed that there appears to be some developmental effects (e.g., subtle cognitive deficits) associated with exposure to PCBs. Developmental effects observed in animal studies have also been seen in humans. However, frank neurotoxic effects such as seizure disorders have not been seen. Many agreed that the most susceptible population to these effects seems to be fetuses *in utero*.

There is some suggestive, but not conclusive, evidence from animal and human studies that exposures to PCBs can affect the immune system. Dermal effects (e.g., chloracne) have been observed in workers who were exposed to PCBs on the job.

13. Q. What were the findings of the expert panel with respect to the public health implications of serum PCB levels near background levels?

A. The current research suggests that prenatal exposures to fetuses at near background levels of PCBs may subtly affect the mental development of children. Immunological and hormonal effects have also been seen following prenatal exposure, in addition to the neurological effects. Recent studies in The Netherlands observed that children born to mothers with greater than 3 ppb of serum PCBs scored slightly lower on tests of cognitive abilities than children whose mothers had serum PCB levels less than 1.5 ppb. While statistically significant for the study population, the panel agreed that these effects were probably not noticeable on an individual basis. Moreover, because of the analytical methods used in this study, the serum PCB measurements represent approximately one-half the total serum PCBs and, hence, should be doubled to be comparable to the test results from MDPH's Exposure Assessment Study.

Importantly, this same study also found that children who were breast fed scored better on cognitive tests than children who were fed formula, despite additional exposures to PCBs and dioxins in breast milk. This finding reinforces the beneficial properties of breast feeding and highlights that exposures to PCBs *in utero* are likely of greatest concern.

14. Q. Should I be concerned about the cognitive development of my children?

A. The results of recent studies from The Netherlands raise legitimate concerns about

developmental effects as a result of near background exposures to PCBs for fetuses *in utero*. However, the cognitive effects observed are slight and many panelists felt they were not biologically significant on an individual basis. Furthermore, the panel felt that other factors that affect a child's aptitude for learning (e.g., parental involvement with the child's education, good nutrition, supportive family environment) probably play a much larger role than background PCB exposures. Nevertheless, these findings provide more justification for continuing to clean up PCB contamination to reduce opportunities for exposure as much as possible.

15. Q. What were the findings of the expert panel with respect to exposure routes for non-occupationally exposed populations?

A. The panel agreed that exposures to PCBs are possible through multiple routes (e.g., air, water, soil, and food), however, the vast majority of exposure typically occurs through eating food of animal origin (e.g., fish, meat, dairy).

16. Q. How can people avoid important opportunities for exposure to PCBs?

A. Observing fish consumption advisories and eating a healthy diet that is low in fatty foods is the most effective way to reduce overall exposures to PCBs. However, because even small exposures add incrementally to overall body burden, it is important to reduce exposures via all routes.

Because the bioavailability of PCBs in air, water, and soil is uncertain, the expert panel endorsed serum PCB tests as the best available measure of actual exposure for individuals who are concerned about their exposures to PCBs.

17. Q. What were the findings of the expert panel with respect to interactions between PCBs and other chemicals?

A. PCBs are thought to behave as tumor promoters in susceptible tissues. Therefore, the carcinogenic effects of PCBs are likely to be influenced by other carcinogens or toxins that may be present. It is hoped that ongoing research will reveal more about the toxicity of mixtures of PCBs and other chemicals in the future.

18. Q. The focus in the Housatonic River Area Exposure Assessment Study was on individuals living near the river. Is there a need for the MDPH to examine the PCB serum levels of a population further away from the river?

A: The Housatonic River Area Exposure Assessment Study was purposely aimed to select individuals with highest opportunity for exposure, therefore the focus was on individuals living near the river or engaging in a variety of activities that may increase their opportunities for exposure to PCBs (e.g., fish consumption, recreational activities near the river, gardening, construction activities, fiddlehead fern consumption). Since these people were largely found to have levels near typical background ranges, individuals living further away from the river would not be expected to have higher PCB levels.

19. Q. Will MDPH evaluate all the adverse health outcomes that have been associated with PCB exposures?

A. In addition to a large number of public health assessments, MDPH is conducting an analysis of cancer incidence from 1982 to 1994 in the Housatonic River Area using data from the Massachusetts Cancer Registry. For this project, the cancers most strongly associated with PCB exposures will be evaluated (i.e., liver cancer, breast cancer, non-Hodgkin's lymphoma, Hodgkin's disease, thyroid cancer, and bladder cancer). If environmental data indicate significant opportunities for exposure to other carcinogens (e.g., PCBs and smoking as co-carcinogens), or if the literature and further discussions with appropriate experts identifies additional cancers of concern (e.g., brain, testicular, lung cancer), the list of cancers under review may be expanded. The expert panel agreed that MDPH's approach for the health assessment and other public health activities, along with the continued clean-up efforts, were adequate measures to be taken at this time.

MDPH is also conducting a pilot study assessing the relationship between environmental exposures to PCBs and DDE and new diagnoses of breast cancer.

20. Q. What can I do if I am concerned about my exposures to PCBs?

A. MDPH has established a toll free hotline to advise local area residents about any health related concerns or questions they may have. An exposure assessment questionnaire has been and will continue to be provided to all residents who wish to have their opportunities for exposure evaluated and a blood test taken. The hotline number is (800) 240-4266.

21. Q. Where can I get additional information?

A. For information on the expert panel or MDPH health studies in the Housatonic River Area, contact the Bureau of Environmental Health Assessment of MDPH at (617) 624-5757 or (800) 240-4266.

Certification

The Public Health Assessment for Newell Street Area I was prepared by the Massachusetts Department of Health under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the public health assessment was initiated.

Gail Godfrey
Technical Project Officer
Superfund Site Assessment Branch (SSAB)
Division of Health Assesment and Consulttion (DHAC)
ATSDR

The Division of Public Health Assessment and Consultation (DHAC), ATSDR, has reviewed this public health assessment and concurs with its findings.

Roberta Erlwein, MPH
Section Chief, SPS, SSAB, DHAC, ATSDR