ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Public Health Assessment for

GENERAL ELECTRIC SITE – HOUSATONIC RIVER
PITTSFIELD, LENOX, LEE, STOCKBRIDGE, GREAT BARRINGTON, AND SHEFFIELD
BERKSHIRE COUNTY, MASSACHUSETTS

EPA FACILITY ID: MAD002084093

AUGUST 25, 2008

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

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EPA FACILITY ID: MAD002084093

Prepared by:

MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH
CENTER FOR ENVIRONMENTAL HEALTH
ENVIRONMENTAL TOXICOLOGY PROGRAM
under a cooperative agreement with the
Agency for Toxic Substances and Disease Registry
Atlanta, Georgia

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Summary

The Massachusetts portion of the Housatonic River site starts at the East Branch adjacent to the General Electric (GE) Facility in Pittsfield and continues to the Connecticut Border in Sheffield on the main stem of the Housatonic River. The Housatonic River passes through the towns of Pittsfield, Lenox, Lee, Stockbridge, Great Barrington, and Sheffield. For this public health assessment[1], the Massachusetts Department of Public Health (MDPH) has divided the Housatonic River into nine Reaches (Reaches 1 – 9) according to previous segmentations by the U.S. Environmental Protection Agency (EPA) and GE:

Reach 1: Headwaters in Hindsdale/Washington to Unkamet Brook in Pittsfield (Upstream of the GE Facility, included as background)
Reach 2: Unkamet Brook in Pittsfield to Newell Street in Pittsfield
Reach 3: Newell Street in Pittsfield to Lyman Street in Pittsfield
Reach 4: Lyman Street in Pittsfield to the confluence of the East Branch and the West Branch of the Housatonic River in Pittsfield
Reach 5: The confluence of the East Branch and the West Branch in Pittsfield to the headwaters of Woods Pond in Lenox
Reach 6: Woods Pond in Lenox and Lee
Reach 7: Woods Pond Dam in Lenox and Lee to the headwaters of Rising Pond in Great Barrington
Reach 8: Rising Pond in Great Barrington
Reach 9: Rising Pond Dam in Great Barrington to the Connecticut Border in Sheffield.

The main constituents and environmental media of concern at the site are polychlorinated biphenyls (PCBs) and dioxins/furans in fish tissue and waterfowl tissue, and PCBs, and to a lesser extent dioxins/furans and polycyclic aromatic hydrocarbons (PAHs) in soils along the Housatonic River and in sediments from the Housatonic River. The health concerns related to opportunities for exposure to PCBs in the Housatonic River currently considerably outweigh the concerns from other contaminants that are present in the various environmental media. Health concerns from opportunities for exposure to PCBs and dioxin/furans through fish and waterfowl consumption from the Housatonic River pose a "Public Health Hazard," according to the federal Agency for Toxic Substances and Disease Registry (ATSDR) criteria. Also, the presence of contaminants, particularly PCBs, in surface soils and surface sediments may have also contributed somewhat to health concerns in some Reaches in the past (i.e., Reaches 3 and 4 prior to remediation) and currently (i.e., Reaches 5 and 6). Thus MDPH has emphasized the importance of following the recommendations outlined in this public health assessment in order to avoid exposures that could result in adverse health effects, in particular the recommendations to follow the fish and waterfowl consumption advisories currently in place.

In November 2007, MDPH released this document as a draft public health assessment for public comment. The public was notified by MDPH of the document's availability for comment through notices provided in local newspapers. We also discussed the PHA with

[1] For a discussion of the difference between Public Health Assessments and Risk Assessments, see appendix A

our Housatonic River Area Advisory Committee (HRAAC) at a meeting held on November 13, 2007 when the PHA was released for public comment. Although no written comments were received Appendix I provides a summary of comments provided during the November HRAAC meeting. This blue cover PHA document serves as the final public health assessment for the Housatonic River site.

Purpose and Health Issues

This public health assessment evaluates the Housatonic River and floodplain from adjacent to the GE Facility in Pittsfield, and through the towns of Lenox, Lee, Stockbridge, Great Barrington, and Sheffield to the Connecticut Border, the Massachusetts portion of the Housatonic River site. This portion of the River is one of 10 areas that compose the GE site. On September 25, 1997, as announced in the Federal Register, volume 26, Number 186, the GE site was proposed by the EPA for the National Priorities List (NPL). When a site is proposed for listing, the federal ATSDR is required by federal law to conduct a public health assessment for the site. The MDPH has a cooperative agreement with ATSDR to conduct public health assessments at NPL or other sites in Massachusetts. Thus, MDPH is conducting a public health assessment for the Housatonic River site.

Negotiations between EPA and GE during the fall of 1998 resulted in EPA's decision not to add the GE site, including the upper portions of the Housatonic River, to the NPL in exchange for various clean up actions agreed to by GE. According to EPA, the comprehensive remediation and restoration of the GE-Pittsfield/Housatonic River Site is being performed pursuant to a court-ordered consent decree. The parties to the decree included, EPA, the U.S. Department of Justice, the Commonwealth of Massachusetts' Attorney General's Office, Executive Office of Environmental Affairs, and Department of Environmental Protection, the U.S. Department of the Interior, the National Oceanic and Atmospheric Administration, the City of Pittsfield, the Pittsfield Economic Development Authority (PEDA), and the General Electric Company. The decree was approved by the U.S. District Court on October 27, 2000 (EPA 2005). It was agreed that GE would perform remediation actions to EPA and Massachusetts Department of Environmental Protection (MA DEP) performance standards, (e.g., an average of less than 2 milligrams per kilogram (mg/kg)[2] PCBs in residential soils, an average of less than 10 mg/kg PCBs in recreational surface soils, pump and treat controls for groundwater plumes, etc.) and to conduct any other clean up to ensure public health protection. However, remediation does not eliminate past exposures and exposures occurring at parts of the site that may not yet have been remediated.

The GE site has a long history in terms of community health concerns. In addition to the GE site-specific public health assessments, MDPH has been involved in addressing public health issues in the area since the early 1980s, when it issued a public health fish consumption advisory for fish, frogs, and turtles for the Housatonic River and its tributaries based on elevated PCB levels. MDPH has also been preparing a summary document for the GE site as a whole that will summarize the overall assessment of public health implications for the entire site, including the Housatonic River. The summary public health assessment for the GE site will address public health concerns related to contaminants found at all of the GE sites, as well as health or exposure assessment evaluations that have been conducted or are ongoing by MDPH for this area. These include an ongoing evaluation of serum PCB levels among residents who called the MDPH PCB Hotline, a PCB exposure assessment study completed in 1997, a 2000 expert panel report on non-occupational PCB health effects, a health consultation for Goodrich Pond in 2001, a descriptive cancer incidence

[2] milligrams per kilogram (mg/kg) = parts per million (ppm).

assessment completed in 2002, and a study of the feasibility of conducting an occupational epidemiological investigation of former GE workers completed in 2003.

MDPH has reviewed environmental data including ambient air, soil, sediment, surface water, and biota for the Housatonic River. Opportunities for exposure to PCBs and other contaminants associated with groundwater plumes entering the Housatonic River from the individual GE Facility sites are also discussed. This public health assessment for the Housatonic River does not include evaluations of specific residential properties throughout Pittsfield with the exception of properties adjacent to the Housatonic River. As part of the Residential Fill Property Project, MA DEP and EPA, starting in 1997 and continuing to date, have sampled residential properties suspected of containing elevated PCB levels in soil due to past use of fill material. As a result of the discovery of the residential fill property concern in 1997, MDPH has offered and continues to offer to any resident concerned about their opportunities for exposure to PCBs the service of having their blood tested for PCB levels. At the time of this public health assessment, the results of the blood tests and Residential Fill Property soil testing were being summarized by MDPH in the GE Summary public health assessment.

Consultants for both GE (BBL) and EPA (Weston) sampled soil and sediment along the Housatonic River over the past two decades for different purposes. Overall there were many more samples collected for the Human Health Risk Assessment for the "Rest of River" (Reaches 5 through 9) than for initial evaluations of the Housatonic River in Reaches 5 through 9. The "Rest of River" sampling focused on many different types of individual properties. These were categorized by low and high contact residential use, low and high contact industrial use, agricultural use, low and high contact commercial/industrial use, and use by utility workers based on observations of land use. EPA used a screening approach to screen out properties with contamination less than 2 mg/kg PCBs (the residential cleanup standard in Massachusetts), and spatially weighted contamination on properties with contamination over 2 mg/kg PCBs in order to come up with exposure point concentrations to use in the risk assessment. This public health assessment combined all consultant data as well as data from Residential Fill Properties that abut the Housatonic River in order to take into account all available information and used average concentrations reach-wide for surface soil and sediment in order to come up with exposure estimates. Later sampling efforts contributed much more data overall to sampling done previously and taken together substantially increased the robustness of the information available. In order to see all sampling efforts by property refer to Appendix B.

Background

Major Events in Environmental Site Characterization of the Housatonic River

In the 1970s, testing by the Connecticut Department of Environmental Protection and the U.S. Geological Survey indicated the presence of PCBs in sediments and fish of the Housatonic River in Connecticut. Subsequent to this, the following major actions have been taken to characterize the environmental contamination in the Housatonic River and its floodplain:

- 1978–1982: Investigations by the Connecticut Department of Public Health and the U.S. Geological Survey of the Massachusetts and Connecticut portions of the Housatonic River from Pittsfield to Long Island Sound (including Reaches 4 through 9 in Massachusetts) to estimate the mass of PCBs in River sediments and the flux of PCBs downstream (Frink et al. 1982).

- 1980–1982: Investigation by the U.S. Geological Survey to characterize the presence and distribution of PCBs in the Housatonic River system (including Reaches 1 through 9 in Massachusetts) published by Stewart Laboratories in two volumes in 1981 and 1982 (BBE 1991; Stewart 1982).

- 1990–1992: Interim Phase II Comprehensive Site Assessment of the Housatonic River (including reaches 1 through 8) by MA DEP under the Massachusetts Contingency Plan, which included bank soil, sediment, water, and fish testing (BBE 1991; BBE 1992a).

- 1993: Cow milk from all seven active dairy farms in the Housatonic River basin south of Pittsfield to the Connecticut border was tested for PCBs and organochlorine residuals by the Massachusetts Department of Food and Agriculture and the U.S. Food and Drug Administration (MDFA 1993; FDA 1993). Also, Devos Farm was taken out of production several years ago after cow milk sampling; however, no record of this cow milk data has been found (Weston 2003b; EPA 2003a).

- 1992–1994: Soil testing at residential properties by MA DEP and EPA in the Housatonic River floodplain (including reaches 2 through 8) to investigate the need for short-term measures to mitigate public health concerns. At several properties, contaminated soils were excavated, warning signs were posted, or vegetation was planted to limit opportunities for exposure to PCBs in surface soils (BBE 1992b; BBE 1992c; BBE 1992d; BBE 1993; BBL 1994b; GE 1997; Hill 1994; MA DEP & EPA, 1997; MA DEP & EPA 1998b).

- 1994–1995: Supplemental Phase II Comprehensive Site Assessment of the Housatonic River by MA DEP under the Massachusetts Contingency Plan, which included soil testing at more floodplain properties in Reaches 1 through 9 and more fish testing from Reaches 5, 6 (Lee and Lenox), and 9 (Great Barrington and Sheffield) including the Green and Williams River, which are tributaries to Reach 9, species tested included whole body composites of bluegill, pumpkinseed, large mouth bass, and yellow perch. (BBL 1996a; BBL 1996b).

- 1996–1997: Removal Action of contaminated sediments and soils along a 500-foot stretch of River near Building 68 in Reach 3 conducted by EPA (EPA 1996; BBL 1999r, MDPH 2003b).

- 1997: The Housatonic River Area Exposure Assessment Study was conducted by MDPH 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 Housatonic River Area (including Reaches 1 through 9) residents (MDPH 1997). This study included a total of 1,638 individuals, of which 148 participated in blood testing.

- 1998: Riverbank soil sampling conducted by MA DEP and EPA between Newell Street and the confluence (Reach 4) (EPA 1998a; EPA 1998b; EPA 1998c; MA DEP & EPA 1998a; Weston 1998).

- 1998: Silver Lake Health Consultation (Near Reach 4) was conducted by ATSDR (ATSDR 1998a). The health consultation concluded that frequent contact with the near shore surface sediments may result in exposures of health concern for residents, especially older children, who come into contact with those surface sediments. It is unlikely that bait fisherman or walkers would experience health effects from occasional contact with contaminated surface soil or surface sediment. Ambient air concentrations of PCBs measured at the bank of Silver Lake do not pose a health threat to residents, bait fisherman, or walkers (ATSDR 1998a).

- 1998–1999 Extensive soil and sediment sampling was conducted by EPA in and along the Housatonic River between the GE facility and the confluence (Reach 2) in preparation for remediation (BBL 1999r).

- 1998 – 2002: Sampling of soil, sediment, water, and various biota was conducted by EPA in support of the EPA Ecological Risk Assessment (Reaches 5 – 9 in Massachusetts) (EPA 1999; Weston 2003a).

- 1998 – 2002: Sampling of soil, sediment, water, and biota in support of the EPA Human Health Risk Assessment (Reaches 5 – 9 in Massachusetts) (EPA 1999; Weston 2003b).

- 2001: The Goodrich Pond Health Consultation was conducted by MDPH. PCBs were detected in fish from the pond (adjacent to Reach 2) at levels of health concern. As a result, a public health fish consumption advisory for PCBs was issued by MDPH for Goodrich Pond that recommended the general public, including children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from Goodrich Pond (MDPH 2001).

- 2002: Remediation of EPA's ½ Mile Reach (Reach 3) between Newell Street and Lyman Street was completed in September (EPA 2003c). This included removal of tons of sediments and bank soil, and restoration of the banks and River bottom. In September 2002, immediately following GE's completion of the Upper ½-Mile Reach remediation, EPA initiated remediation activities in the 1½ Mile Reach. EPA completed excavation activities in March of 2006. Restoration activities, including restoration of support areas, were substantially completed by the end of 2006. In 2007, EPA continued with minor restoration and maintenance activities (EPA 2008a).

- 2003: The initial EPA Ecological Risk Assessment for the "Rest of River" (Reaches 5 – 9 in Massachusetts) was released in 2003 (Weston 2003a). The Ecological Risk Assessment characterizes the risk posed to animals exposed to PCBs and other contaminants from the GE facility in Pittsfield, Massachusetts, while living and/or feeding in the Housatonic River and floodplain. The report concluded that high risks exist for benthic invertebrates, amphibians, and fish-eating mammals; intermediate risks

exist for fish-eating birds (some), omnivorous and carnivorous mammals (some), threatened and endangered species (some); low to intermediate risks exist for fish; and low risks exist for insectivorous birds (EPA 2003b). After completion of peer review and a public comment period in November 2004, the Ecological Risk Assessment was finalized in March 2005 (EPA 2005).

- 2003: The initial EPA Human Health Risk Assessment for the "Rest of River" (Reaches 5 – 9 in Massachusetts) was completed in 2003 (Weston 2003b). The Human Health Risk Assessment characterizes the cancer and non-cancer risks to adults and children who are exposed to PCBs and other contaminants from the GE facility in Pittsfield, Massachusetts, while living or working near the Housatonic River, or using the Housatonic River and floodplain for recreation or agricultural purposes. The report concluded that the greatest risks were attributed to eating fish or consuming waterfowl. On a parcel-specific basis there may be some risks from direct contact exposures. Consumption of backyard or commercial agricultural products was unlikely to pose a risk unless average soil concentrations exceeded 2 mg/kg in soil. Backyard gardens with soil concentrations less than 2 mg/kg were unlikely to pose risks (EPA 2003c). After completion of peer review and a public comment period in February 2005, the Human Health Risk Assessment was finalized in June 2005 (EPA 2005).

- 2003: MDPH released final versions of the public health assessments for each of the GE facility sites, East Street Area 1, East Street Area 2, Former Oxbows, Hill 78 Area, Lyman Street Area, Newell Street Area I, Newell Street Area 2, and Unkamet Brook, which are available at http://www.mass.gov/dph/ceh.

- 2005: The Morewood Lake Health Consultation was conducted by MDPH. PCBs were detected in fish from the lake (adjacent to Reach 5) at levels of health concern. As a result, a public health fish consumption advisory for PCBs was issued by MDPH for Morewood Lake that recommended the general public, including children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from Morewood Lake (MDPH 2005).

- Ongoing environmental investigation/restoration activities:

    - Soil sampling at additional residential and other properties since the 1992 to 1994 testing, affected by River flooding, particularly in Reach 4 (conducted by EPA) or by contaminated fill material throughout Pittsfield (conducted by MA DEP) and the implementation of short-term measures to mitigate health concerns or long-term remediation as necessary (1996 to present).

    - In 2008 EPA began review of GE's Corrective Measures Study (CMS) for the "Rest of River" (Reaches 5 – 9 in Massachusetts). EPA stated that the purpose of the CMS is to evaluate potentially applicable technologies and cleanup alternatives for the Rest of River to reduce risk to human health and the environment from PCBs, and to prevent further downstream transport of PCBs (EPA 2008b).

Demographics

As the Housatonic River flows from Dalton to the Connecticut Border, it passes through seven towns: Dalton, Pittsfield, Lenox, Lee, Stockbridge, Great Barrington, and Sheffield.

The 1980 U.S. Census indicated that 51,974 individuals lived in the city of Pittsfield. The 2000 U.S. Census showed a population of 45,793, which is an 11.9% decrease from the 1980 population. The 2000 populations of Dalton, Lenox, Lee, Stockbridge, Great Barrington, and Sheffield were: 6,892, 5,077, 5,985, 2,276, 7,527, and 3,335, respectively. The sex, race, and age breakdowns for these seven towns are presented in Table 1.

Health Outcome Data

MDPH previously 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. To determine whether these geographical areas experienced elevated cancer rates, standardized incidence ratios (SIRs) were calculated.[3]

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.

MDPH's 2002 Assessment of Cancer Incidence, Housatonic River Area, 1982–1994, 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, no pattern suggesting that a common environmental exposure pathway played a primary role in these census tracts was 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

[3] A detailed explanation of SIRs is presented in Appendix C.

cancer in this area does not suggest that environmental factors played a primary role in the increased rates in this area (MDPH 2002).

More recent cancer incidence data for the period 1996 – 2000 shows that for Pittsfield as a whole, no cancer type was statistically significantly elevated (MDPH 2004). Although bladder cancer among males for Pittsfield as a whole was statistically significantly elevated during 1982 – 1994, this cancer type occurred less often than expected among males during 1996 – 2000 (26 cases observed versus approximately 35 cases expected). Updated cancer incidence data will be included in the summary public health assessment for the GE sites.

Data Sources

Environmental data generated between 1978 and 2002 are available for the site from the following references cited:

ATC 1997	BBE 1991	BBE 1992a	BBE 1992c	BBE 1992d
BBE 1993	BBL 1994b	BBL 1996a	BBL 1996b	BBL 1996-1998
BBL 1998a	BBL 1998b	BBL 1999a	BBL 1999b	BBL 1999c
BBL 1999d	BBL 1999e	BBL 1999f	BBL 1999g	BBL 1999h
BBL 1999i	BBL 1999j	BBL 1999k	BBL 1999l	BBL 1999m
BBL 1999n	BBL 1999o	BBL 1999p	BBL 1999q	BBL 2000a
BBL 2000b	BBL 2000c	BBL 2001a	BBL 2001b	BBL 2001c
BBL 2002, BBL/QEA 2003	ChemRisk 1994	Coles 1996	Frink et al. 1982	GE 1997
GE 1998	FDA 1993	EPA 1998a	EPA 1998b	EPA 1998c
FDA 1993		MDFA 1993	Weston 1998	Weston 2000a
Weston 2000b	Weston 2003a	Weston 2003b	Zorex 1993	

Approximately 5,000 samples were collected and analyzed for PCBs and approximately 10,500 samples were analyzed for dioxin/furans, PAHs, volatile organic chemicals (VOCs), pesticides, or metals for surface soils (top 6 inches). Approximately 6,500 samples were collected and analyzed for PCBs and approximately 5,600 samples were analyzed for dioxin/furans, PAHs, VOCs, pesticides, or metals for subsurface soils (below 6 inches) for riverbanks and properties that lie within the floodplain. Approximately 2,200 samples were collected and analyzed for PCBs, and approximately 5,700 samples were analyzed for dioxin/furans, PAHs, VOCs, pesticides, or metals for surface sediments (top 6 inches). Approximately 4,800 samples were collected and analyzed for PCBs and approximately 2,000 samples were analyzed for dioxin/furans, PAHs, VOCs, pesticides, or metals for subsurface sediments (below 6 inches). Approximately 1,700 samples were collected and analyzed for PCBs and approximately 6,200 samples were analyzed for dioxin/furans, PAHs, VOCs, pesticides, or metals for surface water. Also, approximately 50 were collected and analyzed for PCBs for groundwater. Approximately 70 samples were collected and analyzed for PCBs for ambient air. Approximately 800 samples were collected and analyzed for PCBs, and

5,600 samples were analyzed for dioxin/furans, PAHs, VOCs, pesticides, or metals for fish tissue, which included both skin-on and skin-off fillets, as well as whole fish composite samples. Also, 25 duck samples were collected and analyzed for PCBs. These samples were also analyzed for dioxin/furans, PAHs, VOCs, pesticides, or metals for duck tissue, which included breast and liver tissue. Cow milk samples that were analyzed for PCBs from seven farms were also reviewed for this public health assessment.

Quality Assurance/Quality Control (QA/QC)

Many reports on GE facilities were associated with sampling and analysis plans. MDPH assumes that adequate QA/QC measures were followed regarding chain-of-custody, laboratory procedures, and data reporting. 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. Some of the results were estimated (J-flagged) for various reasons. For example, results fell in the range between the lower calibration limit and the detection limit or results were interfered with by other compounds during analyses.

Data Limitations

The data summarized in this document are from reports issued from environmental regulatory agencies and GE through July 2003. Some data from 1996 to present are also from a variety of unconsolidated sources that include letters, monthly data tables in MA DEP files, and EPA electronic files. Therefore, it is uncertain whether these sources of data for PCBs in the Housatonic River, while comprehensive, are complete.

While there are sufficient data on PCBs in the Housatonic River to approximate exposure conditions in the nine reaches, these data may not be adequate to direct remedial programs in the lower reaches, particularly Reach 9. MDPH supports ongoing efforts by environmental regulatory agencies to determine appropriate clean-up activities for the "Rest of River" (Housatonic River) in Massachusetts (Reaches 5, 6, 7, 8, and 9).

Determining Contaminants of Concern[4]

Health assessors use a variety of health-based comparison values to help decide whether compounds detected at a site may need further evaluation. These comparison values include Environmental Media Evaluation Guides (EMEG), Reference Dose Media Evaluation Guides (RMEG), Cancer Risk Evaluation Guides (CREG), Risk Based Concentrations (RBCs) and Maximum Contaminant Levels for drinking water (MCL). These comparison values have been scientifically peer-reviewed and published by ATSDR or EPA. The MA DEP has established a Massachusetts Maximum Contaminant Level or Action Level (MMCL) for many compounds for public drinking water supplies. EMEG, RMEG, MCL, and MMCL values are used to evaluate the potential for non-

[4] For chemical specific toxicity information regarding the main contaminants of concern in this public health assessment see Appendix D.

cancer health effects. CREG values provide information on the potential for carcinogenic effects.

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 compound 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 non-cancer health effects may be possible. Conversely, if the concentration is less than the EMEG, it is unlikely that exposure would result in non-cancer health effects. EMEG values are derived for different durations of exposure according to ATSDR's guidelines. Acute EMEGs correspond to exposures lasting less than 14 days. Intermediate EMEGs correspond to exposures lasting between 14 days and 1 year. Chronic EMEGs correspond to exposures lasting longer than 1 year. CREG and EMEG values are derived assuming a lifetime duration of exposure. RMEG values also assume chronic exposures. All the comparison values (i.e., CREG, EMEG, RMEG) are derived assuming opportunities for exposure in a residential setting.

CREGs are estimated contaminant concentrations that would be expected to cause no more than one excess cancer in a million (10^{-6}) persons exposed during their lifetime (70 years). ATSDR's CREGs are calculated from EPA's cancer slope factors for oral exposures or unit risk values for inhalation exposures. These values are based on EPA evaluations and assumptions about hypothetical cancer risks at low levels of exposure.

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. The federal Agency for Toxic Substances and Disease Registry (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 non-cancer 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.

What Constitutes a Pathway

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. The pathway analysis 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 receptor population can potentially contact the contaminant. Fourth, there must be a means by which the contaminated medium could enter a person in the receptor population'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 1993c).

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 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 those pathways that are important and relevant to the site.

Overall Observations

Overall Data Implications

If all the soil sampling results from each reach are combined, there is a general pattern of decreasing contamination with distance down the Housatonic River from the GE facility. Most of the soil samples analyzed in association with the Housatonic River were taken from the riverbanks or within the 10 or 100-year floodplains of the Housatonic River. The average value of soil PCB contamination on properties in the floodplain and along the riverbank in Reaches 1 (upstream), 2 (downstream of Unkamet Brook, but upstream from the main GE facility), 3, 4, 5, 6, 7, 8, and 9 were 0.05, 5.5, 218.1, 20.3, 15.4, 17.8, 2.2, 1.2, and 0.4 mg/kg, respectively (Table 2). There was also a decreasing pattern of the highest PCB concentrations found in floodplain and River bank samples in Reaches 1, 2, 3, 4, 5, 6, 7, 8, and 9 which were 0.08, 320, 21,410, 1,435, 874, 321, 33.4, 6, and 1.7 mg/kg, respectively (Table 2). Even though the highest samples detected also decrease down River from the GE Facility, average concentrations in Reaches 5 and 6 are not much lower than average concentrations in Reach 4, and maximum samples from Reach 7 demonstrate there are areas of elevated concentrations of PCBs in that Reach as well. Locations of maximum PCB surface soil samples per Reach are illustrated on Figures 4a through 4i.

Overall, PCB concentrations greater than 1 mg/kg are thought to lie predominantly within the 10-year and 100-year floodplains of the Housatonic River (BBL 1996a; Weston 2000a; BBL/QEA 2003; Weston 2003b). However, determining the edge of a floodplain can be imprecise because of the large effects that minute variations in topography can have on the width of the floodplain. Estimating the extent of the floodplain in the past is further complicated by the possibility of changes in land use and former structures, such as dams and bridges in the Housatonic River. Nevertheless, the estimated extent of the

10-year and 100-year floodplains provides a good indication of the areas where PCB contamination is most likely. The approximate floodplain outlines are illustrated on Figures 4b through 4i.

Data on PCBs in surface sediments collected between 1978 and 2002 are summarized on Table 6, and maximum surface sediment PCB level locations are depicted on Figures 4a through 4i. In the Housatonic River as a whole, the highest concentrations of PCBs were found in Reach 3 between Newell Street and Lyman Street (average 59.5 mg/kg, maximum 9,411 mg/kg). In Reaches 2 (Unkamet Brook to Newell Street), 3 (Newell Street to Lyman Street), and 4 (Lyman Street to the confluence), the average sediment PCB concentrations were 0.3, 59.5, and 27 mg/kg, respectively. Surface sediment PCB levels down stream of the Silver Lake Conduit in Reach 4 did not appear to be higher than sediment PCB levels upstream of the Silver Lake Conduit in Reach 4. It should be noted that Reach 3 and Reach 4 have been remediated as part of the 2-mile clean up under the consent order signed by GE and EPA in October 2000.

In Reach 5, from the confluence to the headwaters of Woods Pond, the surface sediment PCB concentrations averaged 19.30 mg/kg. Surface sediment PCB levels did not appear to be higher downstream of the Pittsfield Municipal Waste Water Treatment Plant discharge in Reach 5 than upstream of the Pittsfield Municipal Waste Water Treatment Plant discharge in Reach 5. In Woods Pond, Reach 6, the first major impoundment of the Housatonic River south of GE, the average sediment PCB concentrations (39.13 mg/kg) are nearly double those in Reach 5. Downstream of Woods Pond Dam to the headwaters of Rising Pond, Reach 7, the average concentrations of PCBs in the sediments were lower (6.63 mg/kg). Average PCB sediment concentrations were lower still in Reach 8, Rising Pond (4.15 mg/kg), and in Reach 9, Rising Pond to the Connecticut border (0.71 mg/kg). These are general observations in order to give a sense of the overall distribution of PCBs in the Housatonic River. Locations of maximum PCB surface sediment samples per Reach are illustrated on Figures 4a through 4i.

It should be noted that comparison values for direct contact with soil are being used for compounds found in sediment; however, these values may not be fully protective for bioaccumulation heath concerns with regards to human fish or waterfowl consumption. PCBs and dioxin/furans in sediments are a particular concern for bioaccumulation in fish and other aquatic species (e.g., ducks, frogs, turtles), and in turn a concern in terms of human consumption.

PCBs in surface water have been monitored at several locations along the Housatonic River between 1982 and 2002. There is very little variation in the PCB concentrations in surface waters down the Housatonic River. For example, in Reaches 1, 2, 3, 4, 5, 6, 7, 8 and 9 the average unfiltered samples during non-storm events, which include suspended particles, contained average PCB concentrations of 0.06, 0.05, 0.09, 0.3, 0.1, 0.1, 0.1, not sampled, and 0.1 μg/L, respectively (Table 10). The average filtered samples during non-storm events, which have had suspended particles removed from the water, contained average PCB concentrations at 0.02, 0.02, 0.02, 0.05, 0.04, 0.05, 0.06, not sampled, and 0.04 μg/L, respectively (Table 11). However, during storm events there was evidence of higher PCB levels and total suspended solids than during non-storm events, especially above Woods Pond Dam (BBL/QEA 2003). Unfiltered storm event samples were available for Reaches 2, 4, 5, 6, 7 and 9, which showed average levels of 0.5, 5.9, 0.3,

0.08, 0.05, and 0.06 μg/L, respectively (Table 12). Filtered storm event samples were available for Reaches 4, 5, 6, 7, and 9, which showed average levels of 0.02, 0.009, 0.007, 0.01, and 0.03 μg/L, respectively (Table 13). Unfiltered samples are a more accurate measure of PCBs entering the Housatonic River through contaminated sediments suspended in the water column than filtered samples. Unfiltered samples in Reaches 2, 4, and 5 for storm events were much higher than non-storm event samples in those Reaches (0.53, versus 0.050, 5.90 versus 0.3, and 0.3 versus 0.1 μg/L, respectively). Filtered samples did not show significant differences between storm events and non-storm events. Sediment is clearly mobilized and suspended during storm events.

Contaminated groundwater could have discharged to Unkamet Brook and contaminated sediments, which have washed into the Housatonic River. Erosion could have washed contaminated soils from East Area 1, East Street Area 2, and the Lyman Street sites into the Housatonic River, thereby causing sediments to become contaminated. Other past industrial discharges could have contributed to sediment contamination. Also, some sediment contamination is likely to have been deposited via former or current groundwater plumes coming off the Unkamet Brook, East Area 1, East Street Area 2, and Lyman Street sites, which may act as source areas.

Due to PCB contamination in fish tissue, MDPH issued a public health fish consumption advisory for the Housatonic River between Dalton and Sheffield in 1982. The general public (including sensitive populations) was advised against eating any fish, frogs, or turtles taken from this stretch of the Housatonic River. For fish taken from feeder streams to the Housatonic River, MDPH recommended that they be trimmed of fatty tissue prior to cooking, because fish from the Housatonic River might enter these streams. Data on PCBs in fish tissue collected since 1982 (Table 19) support the need to continue this advisory and strengthen the advisory for tributaries of the Housatonic River. This recommendation includes the West Branch of the Housatonic River since there are no significant barriers preventing fish migration from the main stem of the river to the West Branch (MA DEP 2000c).

The available data indicate that PCB contamination of the fish tissues has remained consistently elevated over time. In fact, the highest PCB concentrations in largemouth bass from Reach 5 were detected in the most recent sampling effort (2002). Therefore, present and future opportunities for exposures to PCBs in fish tissue are likely. In the past, before the MDPH advisory, opportunities for exposure to PCBs in fish from the Housatonic River were probably higher.

In 1999, due to PCB contamination in waterfowl tissue, MDPH along with EPA issued a public health advisory against eating any waterfowl from the Housatonic River Area in Massachusetts, and instructing consumers to trim fatty tissues, and not use drippings for gravy from waterfowl statewide (the advisory did not include Canadian Geese). More waterfowl testing may need to be done to further define waterfowl contamination in parts of the Housatonic River other than Reaches 5 and 6, especially in backwater areas, often frequented by ducks, and to determine if other species, such as Canadian Geese, have high levels of PCBs.

Surface water and ambient air PCB opportunities for exposure did not pose health concerns on their own, and had a very slight additive effect on exposure dose estimates. Also, indoor air levels may be higher than ambient air levels. For example, PCBs tracked in on shoes and deposited on carpeting may be an important source of indoor air levels. However, while MDPH is aware that indoor testing has been done in several private residences, data on indoor air levels or dust wipe concentrations were not available at the time this Health Assessment was completed. It should be noted that in order to estimate opportunities for exposures to air in residences, it was assumed that the concentrations of PCBs in indoor air were the same as in ambient air[5] due to the limited availability of indoor air data.

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 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.

Though general averages based on property specific data of all samples per reach are used to determine potential health concerns for each reach, specific property data were looked at in each reach. Details for specific properties for the "Rest of River" (Reaches 5 – 9) are available in Appendix B.

Evaluation of Potential Exposure Pathways

Vegetables Grown in the Housatonic River Floodplain

Several residences along the Housatonic River have vegetable gardens either within or close to the 10-year floodplain. It is possible for PCBs to accumulate in the tissues of plants grown in soils contaminated with PCBs or in areas with PCBs in the ambient air. The primary mode of uptake for total PCBs in terrestrial vegetation is vapor-to-plant transfer (i.e., gaseous deposition or absorption of PCBs onto or into plants) (Bohme et al. 1999; Lober et. al. 1994; O'Connor et al. 1990; Schonherr and Riederer 1989, as cited in ATSDR 2000d). Strong sorption of PCBs to soil organic matter and clay inhibits the uptake of PCBs in plants through the roots (Bacci and Gaggi 1985; Chu et al. 1999; Gan and Berthouex 1994; Paterson et al. 1990; Strek et al. 1982; Webber et al. 1994; Ye et al. 1992, as cited in ATSDR 2000d). Therefore, residents may ingest PCBs in homegrown vegetables and fruits, especially in aboveground crops. The 1997 MDPH Housatonic River Area PCB Exposure Assessment Study indicated that fiddlehead fern consumption and gardening may contribute slightly to serum PCB levels.

[5] Since ambient air data along the Housatonic River were limited to five sampling sites, the average PCB levels of these three sites combined was used to estimate exposure opportunities to ambient air for all nine Reaches.

Agricultural Products produced in the Housatonic River Floodplain

In 1993, milk samples were collected from all seven active dairy farms in Housatonic River basin between Pittsfield and the Connecticut border (Reaches 5 through 9) and analyzed for PCBs and organochlorine pesticides. This testing was prompted by concerns that PCBs could accumulate in the milk of cows that graze within the Housatonic River floodplain or eat silage grown in the floodplain. No residues of either PCBs or pesticides were detected in the milk samples (FDA 1993; MDFA 1993). Devos Farm was taken out of production several years ago after cow milk sampling that indicated PCB contamination (Weston 2003b; EPA 2003a). However, no record of this data has been found. Although cow's milk has been tested and PCBs have not been detected, it is possible that PCBs could get into milk or other agricultural products (e.g., meat) (FDA 1993; MDFA 1993). PCBs could be taken up or deposited on grass or corn, which in turn could be eaten by farm animals, and could get into milk or meat consumed by humans. EPA has done modeling based on grass data in their Human Health Risk Assessment for the "Rest of River," which indicates this may be a significant pathway if silage is grown in the floodplain (Weston 2003b).

Groundwater from the Housatonic River Floodplain

Past, present, and future opportunities for exposures to PCBs in groundwater are possible. Based on private well drilling records from the Massachusetts Department of Conservation and Recreation (MA DCR), there are approximately 20 potable private wells within one-half mile of the Housatonic River between the GE facility and Rising Pond (Reaches 2 - 8). Pittsfield, where the GE facility is located, has its own public water supply; however, residents of the Housatonic River floodplain in other towns who have private wells could ingest PCBs, if PCBs were in the groundwater in the vicinity of these wells. There are no data on PCBs in groundwater in the flood plain other than limited data in Pittsfield, and the exact location of the private wells is uncertain. While it would seem an unlikely pathway of exposure, there is a potential for exposure to occur.

Indoor Air and Dust in Residences in the Housatonic River Floodplain

Past, present, and future exposures to elevated concentrations of PCBs in indoor air and dust are possible for residents and workers in the Housatonic River floodplain. Contaminated soil may be carried into commercial buildings or residences on shoes and be deposited in carpeting. If floodwaters were to enter buildings and then retreat, PCBs may be left behind on floors and in carpets. PCBs brought indoors could enter the indoor air as dust when people vacuum and could be a source of inhalation exposure, direct contact, or incidental ingestion exposure opportunities, especially for infants crawling on floors and putting toys from the floor into their mouths. ATSDR (2000d) noted that some studies show concentrations of PCBs in indoor air higher than in ambient air. However, it was not clear from ATSDR (2000d) whether buildings with indoor air measurements contained PCB inside sources such as fluorescent lighting ballasts. MDPH is aware that indoor air quality testing has been done in several other homes in Pittsfield but has not received any final reports on these projects. In the absence of residential indoor air data, MDPH assumed that the concentrations of PCBs in ambient and indoor air are similar.

Contact with Subsurface Soils and Subsurface Sediments in the Housatonic River and Floodplain

Subsurface soils and sediments are relatively inaccessible. However, future exposures to PCBs may occur during excavations for construction or gardening that may expose subsurface soils in the floodplain. Also, sediments on the Housatonic River bottom that are contaminated with PCBs could be deposited in accessible areas after flooding.

Site Description and Evaluation of Completed Pathways

The Housatonic River

There are three main branches of the Housatonic River (Figure 1), the East Branch, West Branch, and Southwest Branch that combine to make up the main body of the Housatonic River in Pittsfield, Massachusetts (Figure 2). The East Branch of the Housatonic River originates at the outlet of Mud Pond in Washington; from there it flows north through Washington, Hindsdale, and Dalton where it is impounded by Center Pond Dam. This dam is a barrier to the upstream migration of fish. Just upstream of the center of Pittsfield, the Housatonic River joins with Unkamet Brook, which drains the Unkamet Brook Area of the GE site. Over the next 4 miles, the Housatonic River runs through the center of Pittsfield, receiving seasonal flow from Goodrich Pond, and passing by the main GE facility in the middle of this stretch of the Housatonic River. South of Lyman Street, the Housatonic River receives intermittent storm water discharges from a Silver Lake conduit. South of Pittsfield city center is the confluence where the East Branch meets the West Branch of the Housatonic River. About a half mile up stream of the confluence with the East Branch, the Southwest Branch enters the West Branch of the Housatonic River[6]. The West Branch of the Housatonic River originates at the outlet of Pontoosuc Lake in the northwest part of Pittsfield and receives flow from the outlet stream of Onota Lake. The Southwest Branch originates at the outlet of Richmond Pond in the southwest part of Pittsfield. Below the confluence of the West and East Branches, the Housatonic River runs southward through Berkshire County for approximately 53 miles. The Housatonic River receives flow from the outlet stream of Laurel Lake in Lee and the outlet stream of Stockbridge Bowl in Stockbridge. The Housatonic River also receives flow from the Williams River in Great Barrington, the Green River in Great Barrington, Hubbard Brook in Sheffield, and the Konkapot River in Sheffield, as well as many other smaller tributaries until it reaches the Connecticut border. After 83 miles in Connecticut, the Housatonic River discharges to the Atlantic Ocean at Long Island Sound (BBE 1991; MA DEP 2000a; EPA 2003a). Many tributaries contain edible fish according to MA DEP (2000a), including, but not limited to the Williams River, the Green River, the Konkapot River, and the West Branch.

In terms of geology, the Housatonic River in general passes through lowland areas with limestone bedrock overlain by deep deposits of porous, permeable, stratified sand and gravel. Surface water runoff from upland areas of resistant metamorphic rock recharge

[6] Although this is the way local residents and EPA describe the Housatonic River, according to USGS maps, the Main Stem begins at the intersection of the West and Southwest Branches, and the East Branch joins the Main Stem (USGS 2001).

aquifers, which eventually discharge to the Housatonic River. The effect of discharges from groundwater and tributaries is evident by the increased average flow in the Housatonic River from 114 cubic feet per second upstream of the GE facility to 529 cubic feet per second in Great Barrington (BBE 1991; BBL/QEA 2003).

EPA has documented past and present releases of PCBs and other chemicals from the GE facility to the Housatonic River. Between 1932 and 1977, there were releases of PCBs to the Housatonic River and Silver Lake via the storm water and wastewater systems. In the 1960s, a 1,000 gallon tank of PCBs near Building 68 fractured, releasing PCBs to the Housatonic River, riverbank, and nearby soils. Fill material containing PCBs was deposited in the former oxbows after the Housatonic River was re-channelized by the U.S. Army Corps of Engineers in the 1940s. In addition to the past releases previously discussed, until all remedial work is finished, PCBs and other chemicals could possibly be released to the Housatonic River from non-aqueous phase liquid plumes in the groundwater at Unkamet Brook, East Street Area 1, East Street Area 2, and the Lyman Street sites if institutional controls are not adequately maintained (EPA 1998d; MDPH 2003a; MDPH 2003b; MDPH 2003d, MDPH 2003h).

For this public health assessment, MDPH adopted EPA's nine Massachusetts reach designations. A reach is a segment of the Housatonic River that has similar characteristics. The reaches were chosen according to Housatonic River and riverbank characteristics (e.g., volume or rate of flow, steep banks), floodplain land use (e.g., farm land, residential properties), and opportunities for exposure (e.g., bank is used by hikers) (Figure 3).

Reach 1: Upstream of the GE facility in Pittsfield—specifically, upstream of Unkamet Brook north to the Headwaters in Hindsdale/Washington

Reach Description

Reach 1 (Figure 4a), considered a background Reach, starts at the outlet of Mud Pond in Hindsdale/Washington, flows north through Hinsdale and Dalton, to Center Pond, and then spills over the Center Pond Dam (a barrier to upstream migration of fish). It then flows through Dalton where it receives flow from Walker Brook from the north and an unknown intermittent tributary from the north. The Housatonic River then flows through Pittsfield where it turns south and receives flow from Barton Brook from the east and meets Unkamet Brook. There are groundwater plumes containing chlorinated solvents at the Unkamet Brook Area GE Site that could enter the Unkamet Brook if institutional controls are not adequately maintained, and therefore could enter the Housatonic River (MDPH 2003h). If there were contamination in the Housatonic River from such plumes, this might be reflected in surface water and sediment data for the next Reach of the Housatonic River, Reach 2. Reach 1 of the River is fairly narrow with five small dams associated with a paper mill in Dalton. Three of these dams are being considered for breaching, one has been breached, and one, Government Mill Dam in Pittsfield, according to EPA is also a barrier to upstream fish migration. The dam is located just north of Hubbard Avenue (See Figure 4a) (MA DEP 2000a; EPA 2003a).

Site Visit

Reach 1 was visited by MDPH staff on April 6, 2005, from the Hubbard Avenue Bridge on foot, from a parking lot near Government Mill dam on foot, the Center Pond dam area on foot, and all along the Reach by car. The Government Mill dam just upstream from Hubbard Avenue is, according to EPA, a barrier to upstream fish migration. It does indeed appear to be a barrier to upstream fish migration. It was partially concealed behind a paper mill building, but it was viewable from the parking lot, and it did appear to have a sufficient drop to be a barrier to upstream fish migration. There were several paper company buildings obstructing the view of the Housatonic River from the road in Pittsfield north to Dalton until close to Center Pond in Dalton. The other bank of the Housatonic River (opposite the buildings) appeared to be heavily vegetated along this stretch of the Housatonic River. Center Pond has a very large dam that drops off about 50 feet, and is definitely a barrier to upstream fish migration. No fish or waterfowl advisory signs were observed in this Reach.

Reach 1 Data[7]

In Reach 1, surface soil samples were collected and analyzed for PCBs, PAHs, dioxin/furans, and metals. Subsurface samples were collected and analyzed for PCBs. Surface sediment was collected and analyzed for PCBs, PAHs, dioxin/furans, and metals. Subsurface sediment samples were collected and analyzed for PCBs. Surface water samples were collected and analyzed for PCBs, dioxin/furans, VOCs, and metals. Also, red ear, sunfish, and trout fish species were collected and analyzed for PCBs.

Surface Soil

For surface soil in Reach 1, seven samples were collected and analyzed for PCBs with an average[8] PCB concentration of 0.047 milligrams per kilogram (mg/kg) and a maximum PCB concentration of 0.08 mg/kg with three detects (See Table 2).

Other contaminants of concern in Reach 1 surface soil included dioxin/furans, polycyclic aromatic hydrocarbons (PAHs), and tin. It should be noted that the results for dioxin and furan congeners are reported as toxicity equivalents (TEQ), which represent a cumulative toxicity for the sum of chlorinated dibenzo-p-dioxin (CDD) and chlorinated dibenzofuran compounds. The TEQ is based on the relative toxicity of individual congeners to that of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD), which is considered the most toxic of the CDDs to mammals. The TEQ is then determined by summing the products of the concentration of each congener in the environmental media with the toxicity equivalency factor (TEF) for the specific congener[9]. The measured concentration of 2,3,7,8-TCDD, the most toxic of the dioxin congeners, is also reported. For dioxin, 2,3,7,8-TCDD was detected in three of three samples at an average concentration of 8.2E-07 mg/kg and a maximum concentration of 9.3E-07 mg/kg and dioxin TEQ calculated for those three

[7] For explanation of environmental health terms see Appendix E

[8] All averages in this document include ½ the detection limit for samples that were not detected.

[9] For older samples collected prior to 1998, dioxins were reported in documents as TEQs calculated using MA DEP TEFs or EPA methods. EPA used its own TEFs to calculate dioxin TEQs derived from studies done prior to 1989. MA DEP used TEFs that were derived from more recent studies, post 1989, that resulted in more conservative TEFs (MA DEP 1991). Hence, when MA DEP TEFs are available they are used. After 1998, dioxins were reported in some documents as TEQs calculated using World Health Organization (WHO) TEFs alone, which were published in 1998 (Van den Berg 1998). These TEQs were used because they were reported in other site documents.

samples (MA DEP method) had an average TEQ of 6.9E-05 mg/kg and a maximum TEQ of 1.4E-04 mg/kg. The PAH benzo(a)pyrene was detected in three of three samples at an average concentration of 0.67 mg/kg with a maximum of 0.78 mg/kg. Also, the PAH dibenzo(a,h)anthracene was detected in three of three samples at an average concentration of 0.17 mg/kg with a maximum concentration of 0.2 mg/kg. The possible health effects from the combined toxicity equivalency in terms of benzo(a)pyrene are evaluated below. Tin was detected in five of seven samples with an average concentration of 16.6 mg/kg with a maximum concentration of 22 mg/kg (See Table 3).

Subsurface Soil

For subsurface soil in Reach 1, seven samples were collected and analyzed for PCBs with a maximum PCB concentration of 0.1 mg/kg at a depth of 0.5 to 1 foot among four detects (See Table 4). No other contaminants of concern were found in Reach 1 subsurface soil.

Surface Sediment

For surface sediment in Reach 1, 68 samples were collected and analyzed for PCBs with an average PCB concentration of 0.23 mg/kg and a maximum PCB concentration of 1 mg/kg with 15 detects (See Table 6).

Other contaminants of concern in Reach 1 surface sediment included dioxin/furans, PAHs, and tin. For dioxin, 2,3,7,8-TCDD was detected in three of eight samples at an average concentration of 4.6E-06 mg/kg and a maximum concentration of 9.0E-06 mg/kg and dioxin TEQ had an average TEQ of 1.10E-04 mg/kg and a maximum TEQ of 3.55E-04 mg/kg. The PAH benzo(a)pyrene was detected in two of four samples at an average concentration of 0.405 mg/kg with a maximum of 0.54 mg/kg. Also, the PAH dibenzo(a,h)anthracene was detected in one of four samples at an average concentration of 0.16 mg/kg with a maximum concentration of 0.16 mg/kg. Tin was detected in four of eight samples with an average concentration of 13.45 mg/kg with a maximum concentration of 19.4 mg/kg (See Table 7).

Subsurface Sediment

For subsurface sediment in Reach 1, 100 samples were collected and analyzed for PCBs with a maximum PCB concentration of 1.80 mg/kg at a depth of 1 to 1.5 feet among five detects (See Table 8). No other contaminants of concern were found in Reach 1 subsurface sediment.

Surface Water

For surface water in Reach 1, 102 unfiltered non-storm event samples were collected and analyzed for PCBs with an average PCB concentration of 0.064 micrograms per liter (μg/L) and a maximum PCB concentration of 0.534 μg/L with 25 detects. Also, 48 filtered non-storm event samples were collected and analyzed for PCBs with and average PCB concentration of 0.017 μg/L and a maximum PCB concentration of 0.12 μg/L with seven detects. Unfiltered samples include suspended particles, which may have contaminants adhered to them, when they are analyzed, while filtered samples are

analyzed after suspended particles are removed. No storm event samples were collected in this Reach (See Tables 10, 11, 12 and 13).

Other surface water contaminants of concern in Reach 1 included di(2-ethylexyl)phthalate. Di(2-ethylexyl)phthalate was detected in two of four samples at an average concentration of 5.5 μg/L with a maximum concentration of 6 μg/L (See Table 15).

Groundwater

No groundwater samples were collected near this Reach.

Ambient Air

No air samples were collected near this Reach.

Fish

Fish tissue samples from Reach 1, the portion above Government Mill Dam, but below Center Pond Dam had PCB concentrations ranging from 0.67 mg/kg to 135 mg/kg for five skin-on fillet samples (See Table 19). No other contaminants of concern were found in fish tissue in the portion of Reach 1 above Government Mill Dam, but below Center Pond Dam.

For fish tissue data in Reach 1 below Government Mill Dam through Reach 6 see the Reach 2 Data section.

Waterfowl

No duck samples were collected from this Reach.

Completed Pathways and Evaluation of Possible Health Effects in Reach 1

Living or Working in the Housatonic River Floodplain, Reach 1 (soil, air)

No data are available for residential or commercial properties in Reach 1; therefore, this pathway was not evaluated for Reach 1. Reach 1 is upstream from the GE property, and thus exposure opportunities are unlikely.

Using the Housatonic River and the Floodplain for Recreation, Reach 1 (soil, sediment, air, and water)

The data available do not indicate that PCBs or other contaminants were present at levels of health concern for people using Reach 1 for recreational purposes (e.g., walking, wading, canoeing).

Eating Fish Caught from the Housatonic River, Reach 1

For all reaches of the Housatonic River below Center Pond Dam in Dalton, eating fish caught from the Housatonic River poses health concerns (e.g., increased concern for cancer) based on data for all reaches of the Housatonic River.

Eating Waterfowl Taken from the Housatonic River Area, Reach 1

For all reaches of the Housatonic River, eating waterfowl taken from the Housatonic River area poses health concerns (e.g., increased concern for cancer) based on duck data from Reaches 5 and 6, as ducks can travel along all reaches of the Housatonic River.

Reach 2: Downstream of Unkamet Brook to Newell Street

Description

Reach 2 (Figure 4b) starts approximately at the Unkamet Brook confluence and flows adjacent to Brattle Brook Park, where it receives flow from Brattle Brook from the south. It then receives seasonal flow from Goodrich Pond, flows adjacent to several homes and businesses in the Lakewood area, flows adjacent to Former Oxbows J and K, and flows adjacent to the GE East Street Area 1 Site, where Reach 2 ends at Newell Street. East Street 1 contains a groundwater oil plume comprised of PCBs and mineral oil. This plume historically discharged to the Housatonic River (BBL 1994a). However, at the time of this public health assessment, the plume had been significantly contained (MDPH 2003a).

Site Visit

Reach 2 was visited by MDPH staff on August 28, 1998. The parcels abutting the Housatonic River are densely developed with residential and commercial buildings.

Reach 2 was also visited on April 6, 2005, by foot from the Newell Street Bridge, and a footbridge a little upstream from the Newell Street Bridge, from Parkside and Ventura Avenues, and by car from the East Street Bridge. In the south part of Reach 2, many residential properties abut the Housatonic River on the west bank. These homes are part of the East Street Area 1 GE Site. Much of Reach 2 flows through thickly vegetated wetlands, including the area where Unkamet Brook meets the Housatonic River. Along Ventura Avenue, a seasonal brook connects Goodrich Pond to the Housatonic River. The brook was flowing due to recent heavy rains combined with snowmelt. Also, on the corner of Ventura Avenue and Parkside Avenue, Former Oxbow K abuts residential properties and a heavily vegetated portion of the Housatonic River. From the East Street Bridge, the Housatonic River appeared to flow through heavily vegetated areas north and south of the bridge. No fish or waterfowl advisory signs were observed in this Reach.

Reach 2 Data

In Reach 2, surface soil samples were collected and analyzed for PCBs, PAHs, dioxin/furans, semi-volatile organic chemicals (SVOCs), and metals. Subsurface samples were collected and analyzed for PCBs. Surface sediment was collected and

analyzed for PCBs, PAHs, dioxin/furans, SVOCs and metals. Subsurface sediment samples were collected and analyzed for PCBs. Surface water samples were collected and analyzed for PCBs, dioxin/furans, VOCs, and metals. Groundwater samples were collected and analyzed for PCBs, dioxin/furans, VOCs, and metals. Also, fish samples were collected and analyzed for PCBs, dioxin/furans, SVOCs, pesticides, and metals. Fish and shellfish species collected included, Bluegill, Crappie, Brown Bullhead (catfish), Brown Trout, Chain Pickerel, Largemouth Bass, Mussel, Pumpkinseed, Rainbow Trout, Red Eat Sunfish, Rock Bass, Sunfish, Trout, White Sucker, and Yellow Perch. Frogs and turtles were also collected and analyzed for PCBs.

Surface Soil

For surface soil in Reach 2, 289 samples were collected and analyzed for PCBs with an average PCB concentration of 5.55 mg/kg and a maximum PCB concentration of 320 mg/kg with 285 detects (See Table 2). No other contaminants of concern were found in Reach 2 surface soil.

Subsurface Soil

For subsurface soil in Reach 2, 777 samples were collected and analyzed for PCBs with a maximum PCB concentration of 640 mg/kg at a depth of 4 to 6 feet among 502 detects (See Table 4). No other contaminants of concern were found in Reach 2 subsurface soil.

Surface Sediment

For surface sediment in Reach 2, 187 samples were collected and analyzed for PCBs with an average PCB concentration of 0.33 mg/kg and a maximum PCB concentration of 1.38 mg/kg with 13 detects (See Table 6). No other contaminants of concern were found in Reach 2 surface sediments.

Subsurface Sediment

For subsurface sediment in Reach 2, 343 samples were collected and analyzed for PCBs with a maximum PCB concentration of 6 mg/kg at a depth of 2.5 to 3 feet among 20 detects (See Table 8). No other contaminants of concern were found in Reach 2 subsurface sediments.

Surface Water

For surface water in Reach 2, 36 unfiltered non-storm event samples were collected and analyzed for PCBs with an average PCB concentration of 0.05 μg/L and a maximum PCB concentration of 0.27 μg/L with eight detects. Also, 21 filtered non-storm event samples were collected and analyzed for PCBs with an average PCB concentration of 0.019 μg/L and a maximum PCB concentration of 0.071 μg/L with three detects. For storm events 21 unfiltered samples were collected and analyzed for PCBs with an average PCB concentration of 0.53 μg/L and a maximum PCB concentration of 2.5 μg/L with 21 detects (See Tables 10, 11, 11 and 12). No other contaminants of concern were found in Reach 2 surface water.

Groundwater

Unfiltered samples include suspended particles, which may have contaminants adhered to them, when they are analyzed, while filtered samples are analyzed after suspended particles are removed. Unfiltered groundwater PCB samples in the vicinity of Reach 2 had PCB concentrations ranging from non-detectable to 7.6 μg/L. Filtered groundwater PCB samples in the vicinity of Reach 2 had PCB concentrations ranging from non-detectable to 6.5 μg/L (See Table 16 and 17). No other contaminants of concern were found in Reach 2 groundwater.

Ambient Air

No ambient air samples were collected near Reach 2 of the Housatonic River; however, average PCB air levels from other reaches were used to estimate opportunities for exposure in Reach 2.

Fish

The highest concentrations of PCBs in fish were found in the Housatonic River between the Government Mill Dam in Pittsfield and Woods Pond Dam (Reaches 1-6). It should be noted that the vast majority of fish were collected in Reaches 5 and 6; however, all available fish data were used to calculate averages. Also, because there are no upstream barriers to fish migration in this entire area, all data between Government Mill Dam in Pittsfield and Woods Pond Dam sampled prior to remediation activities in Reaches 1 through 6 were averaged by species and type of sample (e.g., skin-off fillet, whole fish composite) to determine exposure opportunities by species. MDPH did not receive any comments on the evaluation of fish data during the public comment release of this Housatonic River public health assessment; however MDPH encourages continued input from the community relating to fish consumption advisories for this area. Skin-off fillets of largemouth bass (a top level predator and a popular sport fish) contained 49.73 mg/kg of PCBs on average, with some samples containing as much as 419 mg/kg PCBs. Bottom feeders such as catfish also had high levels of PCBs, as would be expected. Skin-off fillets of Brown Bullhead (a type of catfish) from Reaches 1 through 6 had average PCB levels of 16.85 mg/kg with some fish as high as 31.8 mg/kg (See Table 19). Dioxin/furans[10] were also found at levels above health based comparison values between Reaches 1 and 6 (e.g., skin-off fillets of large mouth bass had average dioxin TEQ levels of 8.65E-06 mg/kg) and thus will be evaluated further.

Other fish tissue contaminants of concern found in the Housatonic River between the Government Mill Dam in Pittsfield and Woods Pond Dam (Reaches 1-6) included 1,2,3,4-tetrachlorobenzene, 1,1,1-trichloro-2,2-bis[p-chlorophenyl]ethane (DDT) and metabolites, other chlorinated pesticides, and the metals, lead and mercury. For dioxin/furans, Bluegill, Brown Bullhead (catfish), Largemouth Bass, Pumpkinseed, and Yellow Perch had detectable levels. Although some of these compounds and metals were detected above health-based comparison values in fish, the concentrations of PCBs in some of the same fish were at least 100 times greater; therefore, because of these relative concentrations and because these chemicals generally affect similar target organs (e.g.,

[10] It should be noted that the majority of TEQ comes from the presence of furan compounds.

nervous system) and/or have similar cancer concerns, they are unlikely to contribute an appreciably additive effect in terms of health concerns and thus will not be discussed further (ATSDR 1993a; ATSDR 1994; ATSDR 1995a; ATSDR 1996; ATSDR 1997; ATSDR 2000c; ATSDR 2000d; ATSDR 2002a; ATSDR 2002b; ATSDR 2002c).

Waterfowl

No waterfowl samples were collected from Reach 2 of the Housatonic River.

Completed Pathways and Evaluation of Possible Health Effects in Reach 2

Living or Working in the Housatonic River Floodplain, Reach 2 (soil, air)

In Reach 2, four residential properties had average surface soil PCB concentrations between 2 and 20 mg/kg. Estimated opportunities for exposure for adult residents or workers (assumed to be exposed 5 days a week for 50 weeks a year for 52 years via incidental ingestion) ranged from below to slightly above the MRL. Estimated opportunities for exposure for children (assumed to be exposed 5 days a week for 50 weeks a year for 18 years via incidental ingestion) at these properties were higher than the MRL for all except one property, but were still well below the level at which adverse health effects have been observed. No properties had levels of PCB contamination that resulted in an apparent increase in cancer concern over an assumed 70-year lifetime for children or adults. Therefore, adverse health effects from these opportunities for exposure were unlikely. It should be noted that opportunities for exposure at these properties are estimated from pre-remediation PCB levels. The properties abutting the Housatonic River in Reach 2 are being addressed as part of the East Street Area 1 GE site or the MA DEP Residential Fill Property sampling program. These properties are in the process of being remediated or have already been remediated, and 175 Residential Fill Properties have been remediated throughout the Pittsfield area to date.

It should be noted that opportunities for exposure were driven by surface soil PCB levels. Ambient air PCB opportunities for exposure (estimated from data from other reaches) did not pose health concerns on their own, and had little additive effect on exposure estimates.

Using the Housatonic River and the Floodplain for Recreation, Reach 2 (soil, sediment, air, and water)

The data available do not indicate that PCBs or other contaminants were present at levels of health concern for people using Reach 2 for recreational purposes (e.g., walking, canoeing).

Eating Fish Caught from the Housatonic River, Reach 2

For all reaches of the Housatonic River below Center Pond Dam in Dalton, eating fish caught from the Housatonic River poses health concerns (e.g., increased concern for cancer).

The United Stated Food and Drug Administration (US FDA) has a tolerance level of 2 mg/kg of PCBs in the edible portions of fish and shellfish (21 CFR 109.30[a][7]). For more information on the US FDA tolerance level see Appendix F. This is not strictly a health-based level (it was developed for regulatory and interstate commerce purposes). EPA Region III's RBC for PCBs in fish is much lower (i.e., 0.16 mg/kg). The average concentrations of nearly all fish species collected from the Housatonic River between the Center Pond Dam in Dalton and the Connecticut border contain PCBs above, in some cases substantially above, EPA's RBC and the FDA tolerance level. For example, skin-off fillets from largemouth bass (a popular fish for human consumption) caught in the section of the Housatonic River between the Government Mill Dam in Pittsfield and Woods Pond Dam (Reaches 1 - 6) contain 49.73 mg/kg of PCBs on average, with a maximum of 419 mg/kg. Consumption of these fillets with average PCB concentrations at the general rate, 17.5 g/day for the general population, would result in opportunities for exposure 1,243 and 622 times greater than the MRL (i.e., 0.00002 mg/kg/day) for children and adults, respectively[11]. Estimated exposures at those consumption levels would be above levels at which adverse health effects were observed in animal and human studies (e.g., developmental effects, immunological effects). An increase in cancer concern for adults and children would also be expected (assuming a 70-year lifetime)[12]. Avid recreational fishers (e.g., Native American tribes), who might have consumption rates as high as 142.4 g/day, would have even greater opportunities for exposure, due to this greater consumption rate and due to possible use of whole body fish, which had maximum PCB levels up to 640 mg/kg. Also, consumption of frog legs and turtles at 8.75 g/day (half of EPA's assumed fish consumption rate for the general population) with average levels of PCBs at 3.97 mg/kg and 2.1 mg/kg, respectively, would result in average opportunities for exposure 50 and 25 times the MRL, but below the LOAEL, for children. Similar consumption would result in average opportunities for exposure 26 and 13 times the MRL, but below the LOAEL for adults[13]. Frequent

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[11] **Fish Child Non-Cancer Exposure Estimate**
C = Average PCB Fish Concentration (Largemouth Bass Skin-off fillets, Reaches 1 – 6) = 49.73 milligrams/kilogram
IR = Assumed Fish Consumption Rate for General Population = 0.0175 kilograms/day EPA (2000)
BW = Assumed Child Body Weight = 35 kilograms

Child Exposure Dose = (49.73 milligrams/kilogram * 0.0175 kilograms/day) / 35 kilograms = 2.49E-02 milligrams/kilogram/day

Fish Adult Non-Cancer Exposure Estimate
Average PCB Fish Concentration (Reaches 1 – 6) = 49.73 milligrams/kilogram
Assumed Fish Consumption Rate = 0.0175 kilograms/day EPA (2000)
Adult Body Weight = 70 kilograms
Adult Exposure Dose = (49.73 milligrams/kilogram * 0.0175 kilograms/day) / 70 kilograms = 1.24E-02 milligrams/kilogram/day

PCB MRL = 2.0E-05 milligrams/kilogram/day
PCB LOAEL = 5.0E-03 milligrams/kilogram/day

[12]**Fish Child Cancer Risk Estimate**
PCB Oral Slope Factor = 2 $(\text{milligrams/kilogram/day})^{-1}$
Cancer Risk = 2 $(\text{milligrams/kilogram/day})^{-1}$ * 2.49E-02 milligrams/kilogram/day = 4.97E-02

Fish Adult Cancer Risk Estimate
PCB Oral Slope Factor = 2 $(\text{milligrams/kilogram/day})^{-1}$
Cancer Risk = 2 $(\text{milligrams/kilogram/day})^{-1}$ * 1.24E-02 milligrams/kilogram/day = 2.49E-02

[13] **Frog Child Non-Cancer Exposure Estimate**
Average PCB Frog Concentration (Reaches 1 – 5) = 3.97 milligrams/kilogram

consumption of frog legs over many years would result in an increased concern for developing cancer for both adults and children[14]. Therefore, consuming fish, frog legs, or turtles from the Housatonic River can result in adverse health effects.

The maximum dioxin TEQ (WHO method) calculated was 1.575E-05 mg/kg or 15.7 nanograms per kilogram (ng/kg), the average of 32 catfish (Brown Bullhead) samples from Reaches 5 and 6 (confluence to Woods Pond). Estimated exposures were above the MRL for both children and adults respectively, but below levels at which adverse health effects have been observed in both children and adults for a general population consuming 17.5 g/day[15]. Estimated exposure to dioxin TEQ would result in an increased concern for cancer for children and adults[16]. For the maximum dioxin TEQ (WHO

Assumed Frog Consumption Rate for General Population = 8.75 kilograms/day
Assumed Child Body Weight = 35 kilograms

Child Exposure Dose = (4.1 milligrams/kilogram * 0.00875 kilograms/day) / 35 kilograms = 1.0E-03 milligrams/kilogram/day

Frog Adult Non-Cancer Exposure Estimate
Average PCB Frog Concentration (Reaches 1 – 5) = 3.97 milligrams/kilogram
Assumed Frog Consumption Rate = 0.00875 kilograms/day
Adult Body Weight = 70 kilograms
Adult Exposure Dose = (3.97 milligrams/kilogram * 0.00875 kilograms/day) / 70 kilograms = 5.0E-04 milligrams/kilogram/day

PCB MRL = 2.0E-05 milligrams/kilogram/day
PCB LOAEL = 5.0E-03 milligrams/kilogram/day

[14]**Frog Child Cancer Risk Estimate**
PCB Oral Slope Factor = 2 $(\text{milligrams/kilogram/day})^{-1}$
Cancer Risk = 2 $(\text{milligrams/kilogram/day})^{-1}$ * 1.0E-04 milligrams/kilogram/day = 2.00E-03

Frog Adult Cancer Risk Estimate
PCB Oral Slope Factor = 2 $(\text{milligrams/kilogram/day})^{-1}$
Cancer Risk = 2 $(\text{milligrams/kilogram/day})^{-1}$ * 5.0E-04 milligrams/kilogram/day = 1.00E-03

[15] **Fish Child Non-Cancer Exposure Estimate**
C = Dioxin TEQ Concentration (Reaches 5 and 6) = 1.575E-05 milligrams/kilogram
IR = Assumed Fish Consumption Rate for General Population = 0.0175 kilograms/day EPA (2000)
BW = Assumed Child Body Weight = 35 kilograms

Child Exposure Dose = (1.575E-05 milligrams/kilogram * 0.0175 kilograms/day) / 35 kilograms = 7.88E-09 milligrams/kilogram/day

Fish Adult Non-Cancer Exposure Estimate
C = Dioxin TEQ Concentration (Reach 5 and 6) = 1.575E-05 milligrams/kilogram
Assumed Fish Consumption Rate = 0.0175 kilograms/day EPA (2000)
Adult Body Weight = 70 kilograms
Adult Exposure Dose = (21.575E-05 milligrams/kilogram * 0.0175 kilograms/day) / 70 kilograms = 3.94E-09 milligrams/kilogram/day

2,3,7,8-TCDD MRL = 1.0E-09 milligrams/kilogram/day
2,3,7,8-TCDD LOAEL = 1.2E-07 milligrams/kilogram/day

[16] **Fish Child Cancer Risk Estimate**
2,3,7,8-TCDD Oral Slope Factor = 156,000 $(\text{milligrams/kilogram/day})^{-1}$
Cancer Risk = 156,000 $(\text{milligrams/kilogram/day})^{-1}$ * 7.88E-09 milligrams/kilogram/day = 1.23E-03

Fish Adult Cancer Risk Estimate
2,3,7,8-TCDD Oral Slope Factor = 156,000 $(\text{milligrams/kilogram/day})^{-1}$

Method) 4.9393E-05 mg/kg or 49.39 ng/kg, exposure estimates would be above the MRL and above levels at which adverse health effects have been observed in both children and adults, and would result in an increased concern for cancer.

Eating Waterfowl Taken from the Housatonic River Area, Reach 2

For all reaches of the Housatonic River, eating waterfowl taken from the Housatonic River area poses health concerns (e.g., increased concern for cancer) based on duck data from Reaches 5 and 6, as ducks can travel along all reaches of the Housatonic River. For a detailed explanation of waterfowl health concerns, see the Reach 5 Completed Pathways and Evaluation of Possible Health Effects.

Reach 3: Newell Street to Lyman Street

Description

Reach 3[17] (Figure 4c) flows adjacent to the GE East Street Area 2 and Lyman Street sites to the north and the Newell Street Area I and Newell Street Area II sites to the south between Newell Street and Lyman Street. Two significant plumes of contaminants discharged historically to the Housatonic River in Reach 3. These included a mineral oil plume containing PCBs (maximum concentration of 53,000 mg/kg) and organic compounds associated with the Building 3C area of the East Street Area 2 site (BBL 1994a), and intermittent oil seepages containing PCBs (maximum concentration 260 mg/kg) associated with the Former Oxbow D area of the Lyman Street site (MDPH 2003b, MDPH 2003c, MDPH 2003e). According to EPA, remediation was done in these areas to prevent any further discharge to the Housatonic River (BBL 1996c; HSI GeoTrans Inc. 1999; MA DEP 2000b, MDPH 2003c). Also, as part of EPA's Upper ½ Mile Reach cleanup, permanent sheet piling was installed to prevent possible discharges to the Housatonic River from the GE facility (EPA 2005). The River is narrow and straight, due to modifications by the U.S. Army Corps of Engineers in the 1940s (BBE 1991). These modifications resulted in the Former Oxbows Areas, which have been evaluated in a public health assessment (MDPH 2003c). The riverbanks are often steep in the area of the GE facility; hence, the floodplain of the Housatonic River does not extend far outside the riverbanks. Also, in the area of the GE facility are several outfalls for storm water and treated groundwater (MA DEP 2000a, MDPH 2003c).

Site Visit

Reach 3 was visited on August 28, 1998, by car. During three earlier site visits to the GE facility on March 13, April 9, and August 25, 1998, MDPH staff also noted Reach 3 River conditions where it passes through certain areas of the GE facility. Evidence was found at that time that people were going near the Housatonic River (e.g., worn path along River bank).

Cancer Risk = 156,000 (milligrams/kilogram/day)$^{-1}$ * 3.94E-09 milligrams/kilogram/day = 6.14E-04

[17] It should be noted that Reach 3 corresponds with EPA's Upper ½ Mile Reach, Reach 4 corresponds to EPA's 1 ½ Mile Reach, and Reaches 5 – 9, correspond to the EPA's Rest of River Reach in Massachusetts. These designations are based on remediation plans for the Housatonic River described in the consent decree.

Reach 3 was visited again on June 5, 2002, on foot from the Lyman Street Bridge. This Reach was in the process of being remediated, and, hence, the site was inaccessible. The area was fenced, and there was heavy construction equipment present. Retaining walls and booms were in place.

Reach 3 was again visited on June 2, 2004, on foot from the Lyman Street Bridge. This Reach had been fully remediated, vegetation had taken hold along the banks, and the Housatonic River bottom was lined with interlocking stones.

Reach 3 was also visited on April 6, 2005, from the Lyman Street Bridge as well as the Newell Street Bridge. The new vegetation planted after remediation had really taken hold, and the stone lining has silted in. No fish or waterfowl advisory signs were observed, but one old, rusted sign warning of PCB contamination in soil and sediment was observed along this stretch of River that has already been remediated.

Reach 3 Data

In Reach 3, surface soil samples were collected and analyzed for PCBs, PAHs, dioxin/furans, SVOCs and metals. Subsurface samples were collected and analyzed for PCBs. Surface sediment was collected and analyzed for PCBs, PAHs, dioxin/furans, SVOCs and metals. Subsurface sediment samples were collected and analyzed for PCBs. Surface water samples were collected and analyzed for PCBs, dioxin/furans, VOCs, and metals. Groundwater samples were collected and analyzed for PCBs, dioxin/furans, VOCs, and metals. Also, ambient air samples were collected and analyzed for PCBs.

Surface Soil

The highest concentrations of PCBs in surface soils in recreational areas were found in the riverbanks in Reach 3 between Newell Street and Lyman Street. Data on these soils, collected by EPA in 1998 and 1999, indicate that PCB concentrations can be as high as 21,410 mg/kg (found in Reach 3) in some locations. The second and third highest concentrations detected in Reach 3 were 15,800 and 13,000 mg/kg. Furthermore, the 18 highest concentrations in recreational areas were all found in Reach 3 between Newell and Lyman streets, where the main GE facility abuts the Housatonic River. The average concentration of PCBs in riverbank and floodplain soils in Reach 3 was 218 mg/kg (See Table 2).

Other contaminants of concern in Reach 3 surface soil included dioxin/furans, hexachlorobenzene, PAHs, the pesticides 4,4-DDE and dieldrin, and the metals copper, lead, mercury and tin. For dioxin/furans, dioxin TEQ was calculated (MA DEP Method) for eight of eight samples and had an average TEQ of 1.1E-04 mg/kg and a maximum TEQ of 3.3E-04 mg/kg. Dioxin TEQ was calculated (WHO Method) for 50 out of 50 samples and had an average TEQ of 7.84E-05 and a maximum TEQ of 2.10E-04. Hexachlorobenzene was detected in three of 47 samples and had an average concentration of 0.50 mg/kg and a maximum concentration of 1.16 mg/kg. The PAH benzo(a)anthracene was detected in 62 of 62 samples and had an average concentration of 1.64 mg/kg and a maximum concentration of 26 mg/kg. The PAH benzo(a)pyrene was detected in 62 of 62 samples and had an average concentration of 1.64 mg/kg and a

maximum concentration of 22 mg/kg. The PAH benzo(b)fluoranthene was detected in 62 of 62 samples and had an average concentration of 1.79 mg/kg with a maximum concentration of 22 mg/kg. The PAH benzo(k)fluoranthene was detected in 62 of 62 samples and had an average concentration of 1.90 mg/kg and a maximum concentration of 11 mg/kg. The PAH dibenz(a,h)anthracene was detected in 52 of 62 samples and had an average concentration of 0.40 mg/kg and a maximum concentration of 5.2 mg/kg. The PAH indeno(1,2,3-cd)pyrene was detected in 62 of 62 samples and had a concentration of 1.03 mg/kg and a maximum concentration of 14 mg/kg. The possible health effects from the combined toxicity equivalency in terms of benzo(a)pyrene are evaluated in the Completed Pathways and Evaluation of Possible Health Effects section. The pesticide 4,4-DDE was detected in seven of 54 samples and had an average concentration of 34.52 mg/kg and a maximum concentration of 150 mg/kg. The pesticide dieldrin was detected in three of 36 samples and had an average concentration of 0.20 mg/kg and a maximum concentration of 0.365 mg/kg. Copper was detected in 62 of 62 samples and had an average concentration of 155.13 mg/kg and a maximum concentration of 2,820 mg/kg. Lead was detected in 62 of 62 samples and had an average concentration of 164.51 mg/kg and a maximum concentration of 2,020 mg/kg. Mercury was detected in 61 of 62 samples and had an average concentration of 0.49 mg/kg, and a maximum concentration of 12.5 mg/kg. Tin was detected in 54 of 62 samples and had an average concentration of 18.57 mg/kg and a maximum concentration of 154.5 mg/kg (See Table 3).

Subsurface Soil

For subsurface soil in Reach 3, 845 samples were collected and analyzed for PCBs with a maximum PCB concentration of 17,000 mg/kg at a depth of 2 to 2.5 feet among 777 detects (See Table 4).

Other contaminants of concern in Reach 3 subsurface soil included pesticides, PAHs and metals (See Table 5). Because these compounds were detected in subsurface soil they are less likely to pose an immediate exposure concern, unless construction activities disturb them such that exposure to them could occur.

Surface Sediment

Because a major contamination accident occurred previously in Reach 3, the sediment in this area was dredged during the Building 68 Removal Action in 1997. The Building 68 Removal Action dredged a relatively small stretch of the Housatonic River (500 feet) (see Figure 4c). The average PCB concentration of sediment before the building 68-removal action dredging was 372.24 mg/kg with a high of 20,200 mg/kg, as compared to the post-removal action average of 59.46 mg/kg with a high of 9,411 mg/kg (See Table 6). The post-removal levels still presented considerable exposure concerns. It should be noted that Reach 3 has been remediated under EPA's "First ½ Mile Clean-up".

Other contaminants of concern in Reach 3 surface sediment included dioxin/furans, pesticides, PAHs, and metals. For dioxin/furans, dioxin TEQ was calculated (MA DEP Method) for nine of 14 samples and had an average TEQ of 2.30E-04 mg/kg and a maximum TEQ of 1.77E-03 mg/kg. Dioxin TEQ was also calculated (WHO Method) for 15 of 15 samples and had an average TEQ of 9.65E-05 mg/kg and a maximum TEQ of 9.6E-04 mg/kg. Hexachlorobenzene was detected in two of 14 samples and had an

average concentration of 1.04 mg/kg and a maximum concentration of 2 mg/kg. Also, 3-nitroaniline was detected in one of 13 samples and had an average concentration of 8 mg/kg and a maximum concentration of 8 mg/kg. Pentachlorobenzene was detected in five of 28 samples and had an average concentration of 10.73 mg/kg and a maximum concentration of 50 mg/kg. The PAH benzo(a)anthracene was detected in 21 of 29 samples and had an average concentration of 0.39 mg/kg and a maximum concentration of 2.2 mg/kg. The PAH benzo(a)pyrene was detected in 22 of 28 samples and had an average concentration of 0.37 mg/kg and a maximum concentration of 2 mg/kg. The PAH benzo(b)fluoranthene was detected in 22 of 28 samples and had an average concentration of 0.30 mg/kg and a maximum concentration of 1.5 mg/kg. The PAH benzo(a,h)anthracene was detected in eight of 28 samples and had an average concentration of 0.080 mg/kg and a maximum concentration of 0.16 mg/kg. The possible health effects from the combined toxicity equivalency in terms of benzo(a)pyrene are evaluated in the Completed Pathways and Evaluation of Possible Health Effects section. The pesticide dieldrin was detected in two of 13 samples and had an average concentration of 0.15 mg/kg and a maximum concentration of 0.23 mg/kg. The pesticide kepone was detected in one of four samples and had an average concentration of 420 mg/kg and a maximum concentration of 420 mg/kg. Lead was detected in 28 of 28 samples and had an average concentration of 1,692 mg/kg and a maximum concentration 30,871.07 mg/kg. Thallium was detected in four of 14 samples and had an average concentration of 80.9 mg/kg and a maximum concentration of 320 mg/kg. Tin was detected in 20 of 28 samples and had an average concentration of 354 mg/kg and a maximum concentration of 7,000 mg/kg (See Table 7).

Subsurface Sediment

For subsurface sediment in Reach 3 before the Building 68 Removal Action, 529 samples were collected and analyzed for PCBs with a maximum PCB concentration of 54,000 mg/kg at a depth of 3 to 3.5 feet among 334 detects. For subsurface sediment in Reach 3 after the Building 68 Removal Action, 435 samples were collected with a maximum PCB concentration of 5,756 mg/kg at a depth 2 to 2.5 feet among 251 detects (See Table 8).

Other contaminants of concern in Reach 3 subsurface sediment included dioxin/furans, PAHs, pesticides, VOCs, and metals (See Table 9). Because these compounds were detected in subsurface sediments, they are less likely to pose an immediate exposure concern.

Surface Water

For surface water in Reach 3, 65 unfiltered non-storm event samples were collected and analyzed for PCBs with an average PCB concentration of 0.087 μg/L and a maximum PCB concentration of 2.12 μg/L with 28 detects. During non-storm conditions, 39 filtered samples were collected and analyzed for PCBs with an average PCB concentration of 0.017 μg/L and a maximum PCB concentration of 0.058 μg/L with seven detects. No storm event samples were collected for this Reach (See Tables 10, 11, 12 and 13).

An intense monitoring program was performed before and during the Building 68 Removal Action. The goal of this program was to determine whether the dredging

activities from June 1997 through September 1997 at Building 68 in Reach 3 were mobilizing PCBs from the sediments to the water column. Dredging occurred in two phases (southern phase and northern phase) as to not significantly increase the already swift flow in Reach 3. In each phase, sheet piling was installed, and the area to be remediated was dewatered. The sediment was removed using mechanical equipment, dried, and transported for disposal. After removal was complete, sampling was done to determine if removal to further depths was necessary. If further removal was necessary, it was done; if not, the riverbed was restored (BBL 1997). The data in Table 14 indicate that the PCB concentrations (0.40 μg/L) in filtered surface water immediately downstream of Building 68 during dredging were ten times higher on average than they were before the activity (0.035 μg/L). However, filtered surface samples collected from the same downstream sample location after the removal action was complete from 1998 and 1999 averaged 0.0086 μg/L (See Table 14). This indicates that PCBs can be mobilized in water far greater in areas downstream of active dredging than when no dredging is occurring.

Other contaminants of concern in Reach 3 surface water included benzene and di(2-ethylexyl)phthalate. Benzene was detected in six of ten samples and had an average concentration of 2.83 μg/L and a maximum concentration of 8 μg/L. Di(2-ethylexyl)phthalate was detected in seven of 12 samples and had an average concentration of 3.86 mg/kg and a maximum concentration of 7 mg/kg (See Table 15).

Groundwater

One unfiltered groundwater sample was collected and analyzed for PCBs in the vicinity of Reach 3 and had a PCB concentration of 0.42 μg/L. One filtered groundwater sample was collected and analyzed for PCBs in the vicinity of Reach 3 and had a PCB concentration of 0.33 μg/L (See Tables 16 and 17). No other contaminants of concern were identified in groundwater samples. Contaminants in groundwater at GE sites abutting the Housatonic River in Reach 3 have been mentioned above and are also addressed in the public health assessments for the East Street Area 2, Former Oxbows, and Lyman Street sites (MDPH 2003b, MDPH 2003c, MDPH 2003e).

Ambient Air

Ambient air PCB concentrations in the vicinity of Reach 3 ranged from 0.0023 to 0.035 micrograms per cubic meter ($\mu g/m^3$) with an average PCB concentration of 0.015 $\mu g/m^3$ among 24 samples collected (See Table 18). Both high and low volume samples were collected. No ambient air samples were analyzed for other contaminants of concern.

Fish

Reach 3 was within the area of the Housatonic River that had the highest PCB and dioxin levels in fish tissue (See summary in Reach 2 Data section and Tables 19 and 20).

Waterfowl

No waterfowl were sampled from Reach 3.

Completed Pathways and Evaluation of Possible Health Effects Reach 3

Living or Working in the Housatonic River Floodplain, Reach 3 (soil, air)

No residences abut Reach 3 of the Housatonic River. The GE facility abuts the Housatonic River in Reach 3. For possible health effects to GE workers due to environmental exposures please see the public health assessments for each of the individual GE sites (e.g., East Street Area 1, East Street Area 2, Former Oxbows, Hill 78 Area, Lyman Street, Newell Street Area I, Newell Street Area II, and Unkamet Brook).

Using the Housatonic River and the Floodplain for Recreation, Reach 3 (soil, sediment, air, and water)

Reach 3 contained the highest concentrations of PCBs found in the entire River system. The average surface soil and surface sediment PCB concentrations before the most recent remediation activities were 218 and 59 mg/kg, respectively, and before the 1997 building 68 removal action dredging, levels were 218 and 372 mg/kg, respectively. The abutting properties are mainly commercial and include the main GE facility. None of the properties are residential, although residential neighborhoods are within a short walk of the Housatonic River in this area (MA DEP & EPA 1998a). People using Reach 3 of the Housatonic River with unrestricted access for recreation would have had opportunities for exposures to PCBs in surface soil, surface sediment and surface water through incidental ingestion, and to PCBs in ambient air through inhalation. Estimated opportunities for exposure (assuming use of 5 days a week for 26 weeks a year) were as much as 41 times above the MRL before the 1997 building 68 removal action and 25 times above the MRL before the start of EPA's "First ½ Mile Clean-up." However, exposure opportunities under those circumstances would have been below levels at which non-cancer adverse health effects have occurred in animals or humans studies[18]. For

[18] **Recreational Child Non-Cancer Exposure Estimate**
Average Soil PCB Concentration (Reach 3) = 218.06 milligrams/kilogram
Average Sediment PCB Concentration (Reach 3 before Bldg. 68 Dredging) = 372.24 milligrams/kilogram
Water PCB Concentration in Reach 3 = 0.087 micrograms/liter
Average Air PCB Concentration along River assumed for Reach 3 = 0.0610 micrograms/meter cubed
Assumed Child Soil Ingestion Rate = 200 milligrams/day
Assumed Child Sediment Ingestion Rate = 100 milligrams/day
Assumed Child Water Ingestion Rate = 0.1 Liters/day (EPA (1989)
Assumed Child Air Inhalation Rate = 15 meters cubed/day
Assumed Child Non-Cancer Exposure Factor = Child Playing (5 days/week)(26 weeks/year)(18 years)/(18 years)(365 days/year) = 0.356
Assumed Child Body Weight = 35 kilograms

Exposure Dose (Soil) = (218.06 milligrams/kilogram * 200 milligrams/day * 0.000001 kilograms/milligram 0.356) / 35 kilograms = 4.4E-04 milligrams/kilogram/day
Exposure Dose (Sediment) = (372.24 milligrams/kilogram * 100 milligrams/day * 0.000001 kilograms/milligram * 0.356) / 35 kilograms = 3.8E-04 milligrams/kilogram/day
Exposure Dose (Water) = (0.087 micrograms/liter * 0.1 Liters/day * 0.001 milligrams/microgram * 0.356) / 35 kilograms = 8.8E-08 milligrams/kilogram/day
Exposure Dose (Air) = (0.00610 micrograms/meter cubed * 15 meters cubed/day * 0.001 milligrams/microgram * 0.356) / 35 kilograms = 9.3E-7 milligrams/kilogram/day

anyone who actually was exposed under those circumstances, an increased concern for cancer may have resulted[19]. If individuals came into frequent contact with the maximum levels of PCBs in surface soil (21,410 mg/kg) and sediment (9,411 mg/kg), adverse non-cancer health effects (e.g., immunological effects) and further increased cancer concerns could be possible. It should be noted that this area of the Housatonic River has been remediated by EPA as of September 2002; therefore, currently, opportunities for exposure to PCBs have been greatly reduced.

Dioxin/furans were also detected in surface soil and surface sediment samples from Reach 3 of the Housatonic River. The dioxin TEQ for the surface soil and surface sediment samples, however, was several times higher on average than the most conservative comparison value for residential soils 5.0E-05 mg/kg or 50 ng/kg. The average TEQ level for surface soil was 1.1E-04 mg/kg or 110 ng/kg with a maximum of 3.30E-04 mg/kg or 330 ng/kg for MA DEP TEQ samples, and 7.8737E-05 mg/kg or 78.37 ng/kg with a maximum of 2.10E-04 mg/kg or 210 ng/kg for WHO Method TEQ samples in Reach 3. For surface sediment, the average TEQ level was 2.30E-04 mg/kg or 230 ng/kg with a maximum of 1.767E-03 mg/kg or 1,767 ng/kg for MA DEP Method TEQ samples, and 9.65E-05 mg/kg or 96.5 ng/kg with a maximum of 9.60E-05 mg/kg or 960 ng/kg for WHO TEQ samples in Reach 3. There were two samples above ATSDR's action level for residential soils (1.0E-03 mg/kg or 1,000 ng/kg) in surface sediment in Reach 3. Frequent exposure to these levels may result in adverse health effects. However, frequent exposure opportunities exclusively to these maximum levels in surface sediment are unlikely. Exposures to average dioxin TEQ in surface sediment and

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Exposure Dose (Total) = 4.4E-04 milligrams/kilogram/day + 3.8E-04 milligrams/kilogram/day + 8.8E-08 milligrams/kilogram/day + 9.3E-07 milligrams/kilogram/day = 8.2E-04

PCB MRL = 2.0E-05 milligrams/kilogram/day
PCB LOAEL = 5.0E-03 milligrams/kilogram/day

[19] **Recreational Child Cancer Risk Estimate**
Maximum Average Soil PCB Concentration (Reach 3)= 218.06 milligrams/kilogram
Maximum Average Sediment PCB Concentration (Reach 3 before Bldg. 68 Dredging)= 372.24 milligrams/kilogram
Water PCB Concentration in Reach 3 = 0.087 micrograms/liter
Average Air PCB Concentration along River assumed for Reach 3 = 0.00610 micrograms/meter cubed
Assumed Child Soil Ingestion Rate = 200 milligrams/day
Assumed Child Sediment Ingestion Rate = 100 milligrams/day
Assumed Child Water Ingestion Rate = 0.1 Liters/day EPA(1989)
Assumed Child Air Inhalation Rate = 15 meters cubed/day
Assumed Child Cancer Exposure Factor = Child Playing (5 days/week)(26 weeks/year)(18 years)/(70 years)(365 days/year) = 0.092
Assumed Child Body Weight = 35 kilograms
PCB Oral Slope Factor = 2 (milligrams/kilogram/day)$^{-1}$

Exposure Dose (Soil) = (218.06 milligrams/kilogram * 200 milligrams/day * 0.000001 kilograms/milligram * 0.092) / 35 kilograms = 1.1E-04
Exposure Dose (Sediment) = (372.24 milligrams/kilogram * 100 milligrams/day * 0.000001 kilograms/milligram * 0.092) / 35 kilograms = 9.8E-05
Exposure Dose (Water) = (0.087 micrograms/liter * 0.1 Liters/day * 0.001 milligrams/microgram * 0.092) / 35 kilograms = 2.3E-08
Exposure Dose (Air) = (0.00610 micrograms/meter cubed * 15 meters cubed/day * 0.001 milligrams/microgram * 0.092) / 35 kilograms = 2.4E-07
Exposure Dose (Total) = 1.1E-04 milligrams/kilogram/day + 9.8E-05 milligrams/kilogram/day + 2.3E-08 milligrams/kilogram/day + 2.4E-07 milligrams/kilogram/day = 2.1E-04 milligrams/kilogram/day

Cancer Risk = 2 (milligrams/kilogram/day)$^{-1}$ * 2.1E-04 milligrams/kilogram/day = 4.3E-04

surface soil combined (assuming exposures of 5 days a week for 26 weeks per year) were estimated to be below the MRL, and would not result in an apparent increased concern for non-cancer adverse health effects[20] nor cancer over a 70-year lifetime[21] for both children or adults. It should be noted that comparison values for direct contact with soil are being used for compounds found in surface sediment; however, these values may not be fully protective for heath concerns with regards to fish, which can bioaccumulate contaminants from sediments, which may not be at levels of health concern in terms of direct contact, but could reach levels of health concern in fish tissue, if those fish are consumed. This would be especially true if Reach 3 surface sediment has not been remediated sufficiently.

Benzo(a)pyrene was detected in surface soil and surface sediment samples in Reach 3 between the GE facility and the confluence at average concentrations of 1.54 and 0.37 mg/kg, respectively. Several other PAHs were also detected in Reach 3 at similar concentrations. The concentrations of benzo(a)pyrene were higher than its health-based comparison value (0.1 mg/kg), which is based on cancer risk estimates for lifetime exposures at a residence. Toxicity equivalence in terms of benzo(a)pyrene were calculated for the six most carcinogenic PAHs (dibenz(a,h)anthracene, benzo(a)pyrene, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-

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[20]**Recreational Child Non-Cancer Exposure Estimate**
Maximum Average Soil Dioxin TEQ Concentration (Reach 3) = 1.1E-04 milligrams/kilogram
Maximum Average Sediment Dioxin TEQ Concentration (Reach 3) = 2.3E-04 milligrams/kilogram
Assumed Child Soil Ingestion Rate = 200 milligrams/day
Assumed Child Sediment Ingestion Rate = 100 milligrams/day
Assumed Child Non-Cancer Exposure Factor = Child Playing (5 days/week)(26 weeks/year)(18 years)/(18 years)(365 days/year) = 0.356
Assumed Child Body Weight = 35 kilograms

Exposure Dose (Soil) = (1.1E-04 milligrams/kilogram * 200 milligrams/day * 0.000001 kilograms/milligram * 0.356) / 35 kilograms = 2.24E-10 milligrams/kilogram/day
Exposure Dose (Sediment) = (2.3E-04 milligrams/kilogram * 100 milligrams/day * 0.000001 kilograms/milligram * 0.356) / 35 kilograms = 6.05E-11 milligrams/kilogram/day
Exposure Dose (Total) = 2.24E-10 milligrams/kilogram/day + 6.05E-11 milligrams/kilogram/day = 2.845E-10 milligrams/kilogram/day

2,3,7,8-TCDD MRL = 1.0E-09 milligrams/kilogram/day
2,3,7,8-TCDD LOAEL = 1.2E-07 milligrams/kilogram/day

[21]**Recreational Child Cancer Risk Estimate**
Maximum Average Soil Dioxin TEQ Concentration (Reach 3) = 1.1E-04 milligrams/kilogram
Maximum Average Sediment Dioxin TEQ Concentration (Reach 3) = 2.3E-04 milligrams/kilogram
Assumed Child Soil Ingestion Rate = 200 milligrams/day
Assumed Child Sediment Ingestion Rate = 100 milligrams/day
Assumed Child Cancer Exposure Factor = Child Playing (5 days/week)(26 weeks/year)(18 years)/(70 years)(365 days/year) = 0.092
Assumed Child Body Weight = 35 kilograms
2,3,7,8-TCDD Oral Slope Factor = 156,000 $(\text{milligrams/kilogram/day})^{-1}$

Exposure Dose (Soil) = (1.1E-04 milligrams/kilogram * 200 milligrams/day * 0.000001 kilograms/milligram 0.092) / 35 kilograms = 5.8E-11
Exposure Dose (Sediment) = (2.3E-04 milligrams/kilogram * 100 milligrams/day * 0.000001 kilograms/milligram * 0.092) / 35 kilograms = 6.05E-11
Exposure Dose (Total) = 5.8E-11 milligrams/kilogram/day 6.05E-11 milligrams/kilogram/day = 1.19E-10 milligrams/kilogram/day

Cancer Risk = 156,000 $(\text{milligrams/kilogram/day})^{-1}$ * 1.19E-10 milligrams/kilogram/day = 1.85E-05

c,d)pyrene) by multiplying each PAH concentration by its corresponding toxicity equivalency factor in terms of benzo(a)pyrene. In Reach 3, average benzo(a)pyrene equivalency for surface soil and surface sediment were 4.26 mg/kg and 0.90 mg/kg, respectively. Exposure estimates (assuming exposures of 5 days a week for 26 weeks per year via incidental ingestion) to these levels would not result in an apparent increased concern for cancer over a 70-year lifetime[22] in children or adults.

PAHs and dioxin/furans have similar chemical properties to PCBs (ATSDR 1995; ATSDR 1997b). Short-term measures and cleanup plans for PCBs in Reach 3 should mitigate exposures to PAHs and dioxin/furans as well. As demonstrated above, the presence of these compounds in surface soils and surface sediments in Reach 3 may have had an incremental additive effect on adverse health outcomes. Even though, dioxin/furans and PAHs have more potent risk per unit, when risks from PCBs are added with those of dioxin/furans and PAHs, PCBs contribute the most to the total risk. In fish and waterfowl throughout the Housatonic River, on the other hand, the presence of dioxin/furans may appreciably increase adverse health outcomes already posed by PCBs due to levels of dioxin/furans that resulted in exposure estimates that exceeded the MRL. Health concerns from other contaminants are not expected.

Eating Fish Caught from the Housatonic River, Reach 3

For all reaches of the Housatonic River below Center Pond Dam in Dalton, eating fish caught from the Housatonic River poses health concerns (e.g., increased concern for cancer).

Eating Waterfowl Taken from the Housatonic River Area, Reach 3

For all reaches of the Housatonic River, eating waterfowl taken from the Housatonic River area poses health concerns (e.g., increased concern for cancer) based on duck data from Reaches 5 and 6, as ducks can travel along all reaches of the Housatonic River.

[22] **Recreational Child Cancer Risk Estimate**
Maximum Average Soil PAH TEQ Concentration (Reach 3) = 4.26 milligrams/kilogram
Maximum Average Sediment Dioxin PAH Concentration (Reach 3) = 0.90 parts per million (milligrams/kilogram)
Assumed Child Soil Ingestion Rate = 200 milligrams/day
Assumed Child Sediment Ingestion Rate = 100 milligrams/day
Assumed Child Cancer Exposure Factor = Child Playing (5 days/week)(26 weeks/year)(18 years)/(70 years)(365 days/year) = 0.092
Assumed Child Body Weight = 35 kilograms
Benzo(a)pyrene Oral Slope Factor = 7.3(milligrams/kilogram/day)$^{-1}$

Exposure Dose (Soil) = (4.26 milligrams/kilogram * 200 milligrams/day * 0.000001 kilograms/milligram 0.092) / 35 kilograms = 2.2E-06 milligrams/kilogram/day
Exposure Dose (Sediment) = (0.90 milligrams/kilogram * 100 milligrams/day * 0.000001 kilograms/milligram * 0.092) / 35 kilograms = 2.4E-06 milligrams/kilogram/day
Exposure Dose (Total) = 2.2E-06 milligrams/kilogram/day 2.4E-07 milligrams/kilogram/day = 2.44E-06 milligrams/kilogram/day

Cancer Risk = 7.3 (milligrams/kilogram/day)$^{-1}$ * 2.44E-06 milligrams/kilogram/day = 1.8E-05

Reach 4: Lyman Street to the confluence of the East Branch and West Branch of the Housatonic River

Description

Reach 4 (Figure 4d) flows from Lyman Street to the confluence with the West Branch of the Housatonic River adjacent to the GE Former Oxbows sites A, B, and C, and then flows adjacent to several residential properties where contamination has previously been identified. In this area some of the riverbanks are relatively steep. The River receives flow from an unnamed, intermittent tributary from the south in the area of the former oxbows and intermittent discharges from the Silver Lake conduit to the north (MA DEP 2000a). Near and at the confluence, the banks are less steep and the floodplain widens out. This includes areas of Fred Garner Park, a public park (BBE 1991; EPA 1998b). Due to the wider floodplain, flooding is likely to be more frequent, resulting in contamination observed on residential properties in this Reach (EPA 1998b). Use Areas were areas designated as recreationally used areas in an earlier study of floodplain soil done by GE (BBL 1992).

Site Visit

Reach 4 was visited on August 28, 1998, by car and on June 2, 2004 on foot from the Lyman Street and Elm Street bridges and along Deming Street. In 2004, the portion of Reach 4 between Elm Street and Dawes Avenue was in the process of being remediated. The Housatonic River was diverted into to large pipes at a temporary dam upstream and along the Housatonic River at storm drains, while workers removed soil from the banks and River bottom. The Housatonic River bottom was replaced with clean fill and topped with interlocking stones. Retaining walls were rebuilt where necessary and vegetation was planted along the banks after bank soil was replaced with clean fill. The day of the visit the diversion did not work because a thunderstorm had come through and overtopped the diversion dam, and runoff from storm drains overtopped diversion channels at the storm drains.

Reach 4 was also visited on April 6, 2005, from the Lyman Street Bridge, the Elm Street Bridge, the Dawes Avenue Bridge, Deming Street, the Pomeroy Avenue Bridge, and Fred Garner Park. This "1 ½ Mile" area was in the process of being remediated by EPA and GE at the time the site visit was conducted. This area has steep banks and is abutted by many residential and commercial properties. The Housatonic River becomes heavily vegetated near and abutting Fred Garner Park. Remediation activities have extended downstream beyond Dawes Avenue, and involve co-remediation of abutting residential properties. EPA had returned to the practice of sheet piling to block flow to half of the Housatonic River in order to facilitate sediment removal. EPA set up a staging area in Fred Garner Park and moved the portable dewatering tanks to the park. The riverbanks are less steep in Fred Garner Park (but still quite steep in some places), although they are heavily vegetated. The Housatonic River had been very high due to heavy rain combined with snowmelt during the previous week. The confluence was inaccessible due to heavy vegetation and mud. Fred Garner Park was temporarily closed to the public. No fish or waterfowl advisory signs were observed in Reach 4.

Reach 4 Data

In Reach 4, surface soil samples were collected and analyzed for PCBs, PAHs, dioxin/furans, SVOCs and metals. Subsurface samples were collected and analyzed for PCBs. Surface sediment was collected and analyzed for PCBs, PAHs, dioxin/furans, SVOCs and metals. Subsurface sediment samples were collected and analyzed for PCBs. Surface water samples were collected and analyzed for PCBs, dioxin/furans, VOCs, and metals. Also, ambient air samples were collected and analyzed for PCBs.

Surface Soil

In Reach 4, 1,189 surface soil samples were collected and analyzed for PCBs with an average PCB concentration of 20.27 mg/kg and a maximum PCB concentration of 1,435 mg/kg with 1,049 detects (See Table 2). No other contaminants of concern were identified in Reach 4 surface soil.

Subsurface Soil

For subsurface soil in Reach 4, 2,197 samples were collected and analyzed for PCBs with a maximum PCB concentration of 1,835 mg/kg at a depth of 0.5 to 1 foot among 1,699 detects (See Table 4). No other contaminants of concern were identified in Reach 4 subsurface soil.

Surface Sediment

For surface sediment in Reach 4, 518 samples were collected and analyzed for PCBs with an average PCB concentration of 59.46 mg/kg and a maximum PCB concentration of 510 mg/kg with 479 detects (See Table 6). No other contaminants of concern were identified in Reach 4 surface sediment.

Subsurface Sediment

For subsurface sediment in Reach 4, 1,470 samples were collected with a maximum PCB concentration of 677 mg/kg at a depth of 1 to 1.5 feet among 1,004 detects (See Table 8). No other contaminants of concern were identified in Reach 4 subsurface sediment.

Surface Water

For surface water in Reach 4, 193 unfiltered non-storm event samples were collected and analyzed for PCBs with an average PCB concentration of 0.25 μg/L and a maximum PCB concentration of 6.15 μg/L with 123 detects. Also during non-storm conditions, 126 filtered surface water samples were collected and analyzed for PCBs with an average PCB concentration of 0.048 μg/L and a maximum PCB concentration of 0.095 μg/L with 25 detects. During stormy conditions (e.g., storm events or high flow) conditions, 69 unfiltered surface water samples were collected and analyzed for PCBs with an average PCB concentration of 5.90 μg/L and a maximum PCB concentration of 382.4 μg/L with 57 detects. Also during stormy conditions (e.g., storm events or high flow) conditions, 19 filtered surface water samples were collected and analyzed for PCBs with an average PCB concentration of 0.017 μg/L and a maximum PCB concentration of 0.087 μg/L with

four detects (See Tables 10, 11, 12 and 13). No other contaminants of concern were identified in Reach 4 surface water.

Groundwater

No groundwater samples were collected in the vicinity of Reach 4.

Ambient Air

For ambient air in the vicinity of Reach 4, eight samples were collected and analyzed for PCBs with average PCB concentration of 0.0053 $\mu g/m^3$, and a maximum PCB concentration of 0.011 $\mu g/m^3$ with seven detects (See Table 18). Both low volume (slow air flow through the sampler) and high volume (fast air flow through sampler) samples were collected. No other contaminants of concern were identified in Reach 4 ambient air.

Fish

Reach 4 was within the area of the Housatonic River that had the highest PCB and dioxin/furan levels in fish tissue (See summary in Reach 2 Data section and Table 19).

Waterfowl

No waterfowl were collected from Reach 4.

Completed Pathways and Evaluation of Possible Health Effects

Living or Working in the Housatonic River Floodplain, Reach 4 (soil, air)

In Reach 4, nine residential properties had average surface soil PCB concentrations between 2 and 20 mg/kg. Estimated exposures for adult residents or workers (assumed to be exposed 5 days a week for 50 weeks a year for 52 years) ranged from below to slightly above the MRL. Estimated exposures for children (assumed to be exposed 5 days a week for 50 weeks a year for 18 years) at these properties were higher than the MRL for all except one property, but were still well below the level at which adverse health effects have been observed. No properties had levels of PCB contamination that resulted in an apparent increase in cancer concern over an assumed 70-year lifetime for children or adults. Therefore, adverse health effects from these exposures were unlikely.

Three residential properties in Reach 4 had PCB concentrations greater than 20 mg/kg. Both child and adult residents of these three properties with average surface soil PCB concentrations greater than 20 mg/kg (Deming Street Properties, Use Area 4, Use Area 3) could have had opportunities for exposure greater than the MRL but less than the level at which adverse health effects have been observed.[23] Opportunities for exposure to

[23] **Resident Child Non-Cancer Health Risk**
Maximum Average Soil PCB Concentration (Deming Street Properties) = 42.65 milligrams/kilogram
Average Air PCB Concentration along River Assumed = 0.0061 micrograms/meter cubed
Assumed Child Soil Ingestion Rate = 200 milligrams/day
Assumed Child Air Inhalation Rate = 15 meters cubed/day
Assumed Child Non-Cancer Exposure Factor = Child Playing (5 days/week)(50 weeks/year)(18 years)/(18 years)(365 days/year) = 0.68

average surface soil PCB levels could also have resulted in a low increased concern for cancer.[24] However, if individuals frequently used localized areas for gardening or other activities that would bring them into direct contact with the contamination on these properties where substantially elevated PCB concentrations were found, these individuals have a higher potential for exposure, which could pose both non-cancer (e.g., immunological effects) and cancer health concerns. Based on the available environmental data, the population with the greatest opportunities for exposure was residents of the Deming Street properties in Pittsfield, which had an average surface soil PCB concentration of 42.65 mg/kg, with a maximum concentration of 1,435 mg/kg PCBs on an accessible lawn. Conversely, on the parcels at Use Area 4 in Pittsfield, the highest concentrations of PCBs in surface soil were found in wooded areas. In the lawn areas at this property, the PCB concentrations were less than 10 mg/kg. Therefore, opportunities for exposures on this property were likely lower than might be estimated from the average concentrations for the whole property.

It should be noted that the opportunities for exposure were driven by surface soil PCB levels. Ambient air PCB opportunities for exposure did not pose health concerns on their own, and had a very slight additive effect on exposure dose estimates.

Using the Housatonic River and the Floodplain for Recreation, Reach 4 (soil, sediment, air, and water)

Downstream of Lyman Street to the confluence (Reach 4), the available data indicate that PCB concentrations in surface soil and surface sediments are much lower than in Reach 3. Average surface soil and surface sediment PCB concentrations for Reach 4 were 20.27

Assumed Child Body Weight = 35 kilograms

Exposure Dose (Soil) = (42.65 milligrams/kilogram * 200 milligrams/day * 0.000001 kilograms/milligram * 0.68) / 35 kilograms = 1.7E-04
Exposure Dose (Air) = (0.0061 micrograms/meter cubed * 15 meters cubed/day * 0.001milligrams/microgram * 0.68) / 35 kilograms = 1.8E-06
Exposure Dose (Soil + Air) = 1.7E-04

PCB MRL = 2.0E-05 milligrams/kilogram/day
PCB LOAEL = 5.0E-03 milligrams/kilogram/day

[24] **Resident Child Cancer Risk Estimate**
Maximum Average Soil PCB Concentration (Deming Street Properties) = 42.65 milligrams/kilogram
Average Air PCB Concentration along River Assumed = 0.0061 micrograms/meter cubed
Assumed Child Soil Ingestion Rate = 200 milligrams/day
Assumed Child Air Inhalation Rate = 15 meters cubed/day
Assumed Child Cancer Exposure Factor = Child Playing (5 days/week)(50 weeks/year)(18 years)/(70 years)(365 days/year) = 0.18
Assumed Child Body Weight = 35 kilograms

Exposure Dose (Soil) = (42.65 milligrams/kilogram * 200 milligrams/day * 0.000001 kilograms/milligram * 0.68) / 35 kilograms = 4.4E-05
Exposure Dose (Air) = (0.0061 micrograms/meter cubed * 15 meters cubed/day * 0.001 milligrams/microgram * 0.18) / 35 kilograms = 4.7E-07
ED (Soil + Air) = 4.4E-05

Cancer Risk = 2 $(\text{milligrams/kilogram/day})^{-1}$ * 4.4E-05 milligrams/kilogram/day = 8.9E-05

and 27.04 mg/kg, respectively. The land abutting the Housatonic River is a mixture of residential and undeveloped properties (including Oxbows A and C, which are discussed in the public health assessment for The Former Oxbows (MDPH 2003c)). Estimated opportunities for exposure to PCBs in surface soil, surface sediment, water, and ambient air (assuming use of 5 days a week for 26 weeks a year) for adults who use this area for recreation (e.g., canoeing, walking, fishing) are about equal to the MRL in Reach 4. For children, opportunities for exposure from recreation (e.g., playing, walking, wading) were estimated to be slightly above the MRL for Reach 4, but still much lower than the level at which non-cancer health effects have been observed. Also, no apparent increased concern for cancer is expected. It is unlikely that past and current opportunities for exposure to PCBs from recreation in these sections would result in adverse health effects. However, some individuals with frequent opportunities for exposure to localized areas of elevated PCB concentrations (e.g., areas with 1435 mg/kg in soil, and 510 mg/kg in sediments) in the surface soils or surface sediments may have increased health concerns. Opportunities for exposure may increase in the future if development exposes subsurface PCB contamination. Health concerns from other contaminants are also not expected.

Eating Fish Caught from the Housatonic River, Reach 4

For all reaches of the Housatonic River below Center Pond Dam in Dalton, eating fish caught from the Housatonic River poses health concerns (e.g., increased concern for cancer).

Eating Waterfowl Taken from the Housatonic River Area Reach 4

For all reaches of the Housatonic River, eating waterfowl taken from the Housatonic River area poses health concerns (e.g., increased concern for cancer) based on duck data from Reaches 5 and 6, as ducks can travel along all reaches of the Housatonic River.

Reach 5: Confluence of the East Branch and West Branch of the Housatonic River to the Woods Pond Headwaters in Lenox

Description

Reach 5 (Figure 4e) flows between the confluence of the East Branch with the West Branch in Pittsfield and the headwaters of Woods Pond. The Housatonic River is slower and has more meanders at this point. The flat topography results in wide floodplains on both sides of the Housatonic River with meanders, wetlands, and backwaters. Ducks breed and raise their young in the wetlands adjacent to the Housatonic River (Weston 2003b). Further downstream, however, the floodplain on the east side of the Housatonic River narrows as the Housatonic River runs against the west side of October Mountain (BBE 1991; BBL/QEA 2003). The land abutting the Housatonic River is mostly part of the Housatonic Valley Wildlife Management Area, which is run by the Massachusetts Division of Fisheries and Wildlife (MA DFW). It is used primarily for hunting, fishing, boating, and other recreational purposes, except where the floodplain is less accessible due to extensive wetlands on the west side of the Housatonic River close to the Woods Pond headwaters (Weston 2003b). Several private homes and farms also abut the Housatonic River in Reach 5. Farms in Reach 5 grow corn and hay and are located mainly to the east of the Housatonic River along the Pittsfield/Lenox Border and

northward toward the confluence of the West Branch and the East Branch of the Housatonic River (BBL/QEA 2003). Access points include several trails and utility easements that provide access to the floodplain and River as well as the John Decker Canoe launch, used by both recreational and marathon canoeists, and two other boat launches (Weston 2003b). The Housatonic River receives flow from Morewood Lake Brook in Pittsfield, Yokun Brook and Willow Brook from the west in Lenox, Sackett Brook, Sykes Brook, as well as three unnamed tributaries, two of them intermittent from the east in Pittsfield, and Mill Brook and Roaring Brook from the east in Lenox. It should be noted the fish in Morewood Lake were found to be contaminated with PCBs, and MDPH conducted a public health consultation for Morewood Lake in 2005 (MDPH 2005) and also issued a public health fish consumption advisory for Morewood Lake. The Pittsfield Municipal Waste Water Treatment Plant also discharges into the Housatonic River in Pittsfield north of Lenox (MA DEP 2000a).

Site Visit

Reach 5 was visited by MDPH staff on August 28, 1998, by boat. For most of Reach 5, the floodplain areas are covered with tall, thick vegetation that makes access difficult. There were some areas where access was facilitated by trails. These access points were more common near Woods Pond where October Mountain Road cut close to the Housatonic River. Fishing tackle found in the bushes here was evidence that some people fish in the Housatonic River along Reach 5. One sign warning against eating fish caught from the Housatonic River was observed along Reach 5.

Reach 5 was also visited on April 6, 2005, from the New Lenox Road Bridge and from Roaring Brook Road, a dirt road abutting the east bank of the Housatonic River through the wildlife management area. The road was muddy in many locations due to recent rain. Near New Lenox Road canoers and a brood (family) of ducks were observed. The banks were generally vegetated with tall grasses on the west bank. For the most part, along Roaring Brook Road the riverbanks were heavily vegetated with trees and underbrush, some banks were steep and others were not. There were many areas where the Housatonic River was accessible, and a man preparing to fish was observed. A black bear with two cubs was also observed. The Housatonic River became more accessible closer to Woods Pond. No fish or waterfowl advisory signs were observed in Reach 5.

Reach 5 Data

In Reach 5, surface soil samples were collected and analyzed for PCBs, PAHs, dioxin/furans, SVOCs and metals. Subsurface samples were collected and analyzed for PCBs. Surface sediment was collected and analyzed for PCBs, PAHs, dioxin/furans, SVOCs and metals. Subsurface sediment samples were collected and analyzed for PCBs. Surface water samples were collected and analyzed for PCBs, dioxin/furans, VOCs, and metals. Ambient air samples were collected and analyzed for PCBs. Also, duck samples were collected and analyzed for PCBs and dioxin/furans. Duck species collected included, Wood Duck and Mallard. Both breast tissue and liver tissue were analyzed for PCB content.

Surface Soil

For surface soil in Reach 5, 2,224 samples were collected and analyzed for PCBs with an average PCB concentration of 15.4 mg/kg and a maximum PCB concentration of 874 mg/kg with 1,743 detects (See Table 2).

Other contaminants of concern in Reach 5 surface soil included, dioxin/furans, PAHs, and pesticides. Dioxin toxicological equivalency levels (TEQ) in terms of 2,3,7,8–TCDD were estimated by EPA for Reaches 5 and 6 via regression analyzes based on TEQ calculations (WHO method) of 10% of the samples being analyzed for individual PCB congeners and dioxin/furans in their Human Health Risk Assessment for the "Rest of River" (Weston 2005b). According to EPA's regression model, average dioxin TEQ levels, including dioxin-like PCB congeners, would be estimated at about 2E-04 mg/kg for Reaches 5 and 6. It should be noted that other than dioxin-like PCB congeners, furans contributed the most to the TEQ in Reaches 5 and 6 (BBL/QEA 2003a). The PAH benzo(a)anthracene was detected in 96 of 106 samples in Reaches 5 and 6 and had an average concentration of 0.69 mg/kg and a maximum concentration of 12 mg/kg. The PAH benzo(a)pyrene was detected in 93 of 106 samples in Reaches 5 and 6 and had a maximum concentration of 0.72 mg/kg and a maximum concentration of 11 mg/kg, respectively. The PAH benzo(b)fluoranthene was detected in 97 of 106 samples in Reaches 5 and 6 and had an average concentration of 0.79 mg/kg and a maximum concentration of 11 mg/kg, respectively. The PAH benzo(k)fluoranthene was detected in 96 of 106 samples in Reaches 5 and 6 and had an average concentration of 0.71 mg/kg and a maximum concentration of 13 mg/kg. The PAH dibenz(a,h)anthracene was detected in 69 of 105 samples in Reaches 5 and 6 and had an average concentration of 0.23 mg/kg and a maximum concentration of 0.94 mg/kg. Indeno(1,2,3-c,d)pyrene was detected in 94 of 106 samples in Reaches 5 and 6 and had an average concentration of 0.381 mg/kg and a maximum concentration of 3.84 mg/kg. The possible health effects from the combined toxicity equivalency in terms of benzo(a)pyrene are evaluated below. The pesticide 1,1-dichloro-2,2-bis(*p*-chlorophenyl)ethylene (4,4'-DDE) was detected in 12 of 110 samples in Reaches 5 and 6 and had an average concentration of 0.29 mg/kg and a maximum concentration of 2 mg/kg. The pesticide 1,1,1-trichloro-2,2-bis(*p*-chlorophenyl)ethane (4,4'-DDT) was detected in 10 of 85 samples in Reaches 5 and 6 and had an average concentration of 0.27 mg/kg and a maximum concentration of 2.8 mg/kg (See Table 3).

Subsurface Soil

For subsurface soil in Reach 5, 1,533 samples were collected with a maximum PCB concentration of 907 mg/kg at a depth of 2 to 2.5 feet among 961 detects (See Table 4). No other contaminants of concern were identified for Reach 5 subsurface soil.

Surface Sediment

For surface sediment in Reach 5, 1,059 samples were collected with an average PCB concentration of 19.30 mg/kg and a maximum PCB concentration of 522 mg/kg with 971 detects (See Table 6).

Other contaminants of concern in Reach 5 surface sediment included PAHs, SVOCs, and metals. The PAH benzo(a)anthracene was detected in 52 of 58 samples in Reaches 5 and 6 with a maximum concentration of 20 mg/kg. The PAH benzo(a)pyrene was detected in 48 of 57 in Reaches 5 and 6 samples with a maximum concentration of 15 mg/kg. The PAH benzo(b)fluoranthene was detected in 51 of 58 samples in Reaches 5 and 6 with a maximum concentration of 14 mg/kg. The PAH benzo(k)fluoranthene was detected in 51 of 58 samples in Reaches 5 and 6 with a maximum concentration of 12 mg/kg. The PAH chrysene was detected in 53 of 59 samples in Reaches 5 and 6 with a maximum concentration of 14 mg/kg. The PAH dibenz(a,h)anthracene was detected in 36 of 56 in Reaches 5 and 6 samples with a maximum concentration of 2.3 mg/kg. The PAH indeno(1,2,3-c,d)pyrene was detected in 51 of 58 samples in Reaches 5 and 6 with a maximum concentration of 14.4 mg/kg. The possible health effects from the combined toxicity equivalency in terms of benzo(a)pyrene are evaluated below. The SVOC 4-methylphenol was detected in 11 of 58 samples in Reaches 5 and 6 with a maximum concentration of 0.88 mg/kg. Methapyrilene was detected in one of 57 samples in Reaches 5 and 6 with a maximum concentration of 0.82 mg/kg. Arsenic was detected in 54 of 59 samples in Reaches 5 and 6 with a maximum concentration of 14.4 mg/kg. Chromium (total) was detected in 60 of 60 samples in Reaches 5 and 6 with a maximum concentration of 382 mg/kg. Lead was detected in 60 of 60 in samples in Reaches 5 and 6 with a maximum concentration of 303 mg/kg. Thallium was detected in 32 of 58 samples in Reaches 5 and 6 with a maximum concentration of 7.9 mg/kg. Sulfide was detected in 22 of 50 samples in Reaches 5 and 6 with a maximum concentration of 447 mg/kg (See Table 7).

Subsurface Sediment

For subsurface sediment in Reach 5, 1,243 samples were collected with a maximum PCB concentration of 2,270 mg/kg at a depth of 1.33 to 1.67 feet among 1,021 detects (See Table 8). No other contaminants of concern were identified in Reach 5 subsurface sediment.

Surface Water

For surface water in Reach 5, 253 unfiltered non-storm event samples were collected and analyzed for PCBs with an average PCB concentration of 0.12 μg/L and a maximum PCB concentration of 0.95 μg/L with 187 detects. Also during non-storm conditions, 149 filtered surface water samples were collected and analyzed for PCBs with an average PCB concentration of 0.037 μg/L and a maximum PCB concentration of 0.89 μg/L with 31 detects. During stormy conditions (e.g., storm events or high flow), 70 unfiltered surface water samples were collected and analyzed for PCBs with an average PCB concentration of 0.25 μg/L and a maximum PCB concentration of 1.49 μg/L with 64 detects. Also during stormy conditions (e.g., storm events or high flow), 21 filtered surface water samples were collected and analyzed for PCBs with an average PCB concentration of 0.0085 μg/L and a maximum PCB concentration of 0.02 μg/L with three detects (See Tables 10, 11, 12 and 13).

Other contaminants of concern in Reach 5 surface water included dioxin, PAHs, pesticides, SVOCs, and metals. Dioxin TEQ (WHO method) was calculated for 102 of

141 samples in Reaches 5 through 9 with a maximum TEQ of 7.09E-05 μg/L. Bromodichloromethane was detected in 10 of 32 samples in Reaches 5 through 9 with a maximum concentration of 42 μg/L. Dibromochloromethane was detected in four of 32 samples in Reaches 5 through 9 with a maximum concentration of 2 μg/L. Vinyl chloride was detected in four of 32 samples in Reaches 5 through 9 with a maximum concentration of 0.93 mg/kg. Di(2-ethylhexyl)phthalate was detected in eight of 116 samples in Reaches 5 through 9 with a maximum concentration of 120 mg/kg. The PAH benzo(a)pyrene was detected in three of 127 samples in Reaches 5 through 9 with a maximum concentration of 0.014 μg/L. The PAH chrysene was detected in six of 127 samples in Reaches 5 through 9 with a maximum concentration of 0.5 μg/L. The PAH indeno(1,2,3-c,d)pyrene was detected in six of 127 samples in Reaches 5 through 9 with a maximum concentration of 0.05 μg/L. The possible health effects from the combined toxicity equivalency in terms of benzo(a)pyrene are evaluated below. The pesticide delta-benzene hexachloride (delta-BHC) was detected in one of 140 samples in Reaches 5 through 9 with a maximum concentration of 0.11 μg/L. Antimony was detected in one of 116 samples in Reaches 5 through 9 with a maximum concentration of 5.2 μg/L. Arsenic was detected in four of 116 samples in Reaches 5 through 9 with a maximum concentration of 3.5 μg/L. Lead was detected in 11 of 116 samples in Reaches 5 through 9 with a maximum concentration of 14.3 μg/L. Thallium was detected in two of 116 samples in Reaches 5 through 9 with a maximum concentration of 4.1 μg/L (See Table 15).

Groundwater

No groundwater samples were collected in the vicinity of Reach 5.

Ambient Air

Ambient air samples were collected and analyzed for PCBs at two separate sites in Reach 5 (i.e., Devos Farm, and the headwaters of Woods Pond). No PCBs were detected among 30 samples (See Table 18). No other contaminants of concern were identified in Reach 5 ambient air.

Fish

Reach 5 was within the area of the Housatonic River that had the highest PCB levels and dioxin TEQ levels in fish tissue (See summary in Reach 2 Data section and Tables 19 and 20).

Waterfowl

From Reaches 5 and 6, 25 ducks were collected from the Housatonic River between New Lenox Road in Lenox and Woods Pond Dam in Lenox/Lee and analyzed for PCBs, dioxin/furans, and pesticides. The highest levels of PCBs were found in immature mallard breast tissue samples from Reaches 5 and 6, which contained 9.10 mg/kg of PCBs on average, with some samples containing as much as 19.36 mg/kg (See Table 21) (Weston, 2005b). Overall, the 25 duck breast tissue samples from Reaches 5 and 6 had average PCB concentrations of 7.1 mg/kg. When measured on a fat-basis, the PCB

concentration averaged 648 mg/kg. The tolerance level for poultry set by the US FDA is 3 mg/kg on a fat-basis, making these results over 200 times higher than the national tolerance level.

Other contaminants that were above comparison values from Reach 5 and 6 waterfowl included: dioxin/furans, hexachlorobenzene, pentachlorobenzene, 1,2,3,4-tetrachlorobenzene, 1,2,3,5-tetrachlorobenzene, DDT and metabolites, and other chlorinated pesticides as detected in sampling regiments that included Reaches 5 and 6 (See Reach 5 Data section and Table 22) (Weston 2005b). For dioxin/furans, dioxin and/or furan congeners were detected in 24 of the 25 duck breast tissue samples, and dioxin TEQ was calculated (WHO Method) for them. Dioxin TEQ averaged 2.25E-05 mg/kg for all samples; the maximum TEQ was calculated for an immature wood duck at 1.42E-04 mg/kg. Other compounds (dioxin/furans, hexachlorobenzene, pentachlorobenzene, 1,2,3,4-tetrachlorobenzene, 1,2,3,5-tetrachlorobenzene, DDT and metabolites, and other chlorinated pesticides) were detected above comparison values in duck tissue in both Reaches 5 and 6, the concentrations of PCBs in the same ducks were at least 100 times greater; therefore because of these relative concentrations and because these compounds generally affect similar target organs (e.g., nervous system) and/or have similar cancer concerns, they are unlikely to contribute an appreciably additive effect in terms of health concerns and thus, will not be discussed further, with the exception of dioxin/furans (ATSDR 1993a; ATSDR 1994; ATSDR 1995a; ATSDR 1996; ATSDR 1997; ATSDR 2000c; ATSDR 2000d; ATSDR 2002a; ATSDR 2002b; ATSDR 2002c).

Completed Pathways and Evaluation of Possible Health Effects

Living or Working in the Housatonic River Floodplain, Reach 5 (soil, air)

Seven properties or groups of properties in Reach 5 had average PCB concentrations in surface soil between 2 and 20 mg/kg. Estimated exposures for adult residents or workers (assumed to be exposed 5 days a week for 50 weeks a year for 52 years via incidental ingestion of soil, inhalation of air) ranged from below to slightly above the MRL. Estimated exposures for children (assumed to be exposed 5 days a week for 50 weeks a year for 18 years via incidental ingestion of soil, inhalation of air) to average levels of PCBs at these properties were higher than the MRL for three of the seven properties, but were still well below the level at which adverse health effects have been observed (the LOAEL). No property or group of properties had average PCB levels that resulted in an apparent increase in cancer concern over an assumed 70-year lifetime for children or adults. Therefore, adverse health effects from exposures to average PCB levels were unlikely.

It should be noted that these evaluations are based on averages for some individual properties, but mostly on averages for groups of properties, which differs from the EPA risk assessment evaluations done for this area, which were based on property-specific concentrations (see Appendix B).

Using the Housatonic River and the Floodplain for Recreation, Reach 5 (soil, sediment, air, and water)

In Reach 5, surface soil and surface sediment PCB concentrations averaged 15.44 mg/kg and 18.83 mg/kg, respectively. Non-cancer adverse health effects from using these reaches of the Housatonic River for recreation (e.g., walking, canoeing, playing, wading) are not expected, and no apparent increased concern for cancer is likely. However, individuals who frequent the area with 874 mg/kg of PCBs in surface soil along the riverbank in Reach 5 and other localized areas with elevated concentrations of PCBs in the surface soils or surface sediments may have some health concerns (e.g., increased cancer concerns). Also, opportunities for exposure at levels associated with adverse health effects may increase in the future if these recreational areas are developed for residences or other uses.

According to EPA estimates dioxin TEQ levels would be similar to Reach 3 dioxin TEQ levels. Exposures to average TEQ of dioxins in surface soil (assuming exposures of 5 days a week for 26 weeks per year via incidental ingestion and inhalation) were estimated to be below the MRL, and would not result in an apparent increased concern for non-cancer adverse health effects nor cancer over a 70-year lifetime for both children or adults. PAH levels in Reach 5 were lower than in Reach 3 and are not expected to cause health concerns. Health concerns from other contaminants of concern (SVOCS, VOCs, metals, and pesticides) are also not expected.

It should be noted that these evaluations are based on Reach-wide averages, which differs from the EPA risk assessment evaluations done for this area, which were based on property-specific concentrations (see Appendix B).

Eating Fish Caught from the Housatonic River, Reach 5

For all reaches of the Housatonic River below Center Pond Dam in Dalton, eating fish caught from the Housatonic River poses health concerns (e.g., increased concern for cancer).

Eating Waterfowl Taken from the Housatonic River Area, Reach 5

For all reaches of the Housatonic River, eating waterfowl taken from the Housatonic River area poses health concerns (e.g., increased concern for cancer).

The FDA has a commercial food tolerance level of 3 mg/kg of PCBs (fat basis) in poultry. The average concentrations of PCBs in ducks (7.1 mg/kg) collected from the Housatonic River between New Lenox Road in Lenox and Woods Pond in Lenox and Lee (Reaches 5 and 6) contain PCBs above this tolerance level in breast tissue. Consumption of this breast tissue at the rate of two 8-ounce meals per month, year round, for the general population would result in average exposures 195 and 98 times greater than the MRL for children and adults, respectively, and slightly lower than the LOAEL or levels at which adverse health effects have been observed in animal or human studies (ATSDR 2000d)[25]. Two meals per month is consistent with the most frequently reported

[25] **Waterfowl Child Non-Cancer Exposure Estimate**

consumption rate on MPDH surveys conducted during the 1997 Housatonic River Area Exposure Assessment Study, which ranged once in a lifetime to three waterfowls meals per month, year round. Consumption of ducks containing average levels of PCBs twice a month might result in an increased concern for cancer[26]. Higher rates of consumption or consumption of maximum PCB levels (i.e., 19.34 mg/kg) would result in even greater exposures above which adverse health effects have been observed in animal or human studies (e.g., developmental effects, immunological effects). Therefore, consuming waterfowl (i.e., mallards, wood ducks) from the Housatonic River may have resulted in adverse health effects in the past and may currently result in adverse health effects if ducks are consumed[27].

Dioxin TEQ (MA DEP method) was calculated for 25 waterfowl breast tissue samples from Reaches 5 and 6 (New Lenox Road in Lenox to Woods Pond Dam in Lenox). Estimated exposures to average dioxin TEQ (2.25E-05 mg/kg, WHO Method) were above the MRL for children and adults, but below levels at which non-cancer adverse health effects have been observed[28], but would result in an increased concern for cancer

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Average PCB Waterfowl Breast Tissue Concentration (Reaches 5 & 6) = 7.10 milligrams/kilogram
Assumed Waterfowl Consumption Rate = 0.015 kilograms/day
Child Body Weight = 35 kilograms
Child Exposure Dose = (7.10 milligrams/kilogram * 0.015 kilograms/day) / 35 kilograms = 3.0E-03 milligrams/kilogram/day

Waterfowl Adult Non-Cancer Exposure Estimate
Average PCB Waterfowl Breast Tissue Concentration (Reaches 5 & 6) = 7.10 milligrams/kilogram
Assumed Waterfowl Consumption Rate = 0.015 kilograms/day
Adult Body Weight = 70 kilograms
Adult Exposure Dose D = (7.10 milligrams/kilogram * 0.015 kilograms/day) / 70 kilograms = 1.5E-03 milligrams/kilogram/day

PCB MRL = 2.0E-05 milligrams/kilogram/day
PCB LOAEL = 5.0E-03 milligrams/kilogram/day

[26] **Waterfowl Child Cancer Risk Estimate**
PCB Oral Slope Factor = 2 (milligrams/kilogram/day)$^{-1}$
Cancer Risk = 2 (milligrams/kilogram/day)$^{-1}$ * 3.0E-03 milligrams/kilogram/day = 6.0E-03

Waterfowl Adult Cancer Risk Estimate
PCB Oral Slope Factor = 2 (milligrams/kilogram/day)$^{-1}$
Cancer Risk = 2 (milligrams/kilogram/day)$^{-1}$ * 1.5E-04 milligrams/kilogram/day = 3.0E-03

[27] In 1999, due to PCB contamination in waterfowl tissue, MDPH along with EPA issued a public health advisory against eating any waterfowl from the Housatonic River Area in Massachusetts, and instructing to trim fatty tissues, and not use drippings for gravy from waterfowl statewide (the advisory did not include Canada Geese).

[28] **Waterfowl Child Non-Cancer Exposure Estimate**
Average Dioxin TEQ Waterfowl Breast Tissue Concentration (Reaches 5 & 6) = 2.25E-05 milligrams/kilogram
Assumed Waterfowl Consumption Rate = 0.015 kilograms/day
Child Body Weight = 35 kilograms
Child Exposure Dose = (2.25E-05 milligrams/kilogram * 0.015 kilograms/day) / 35 kilograms = 9.6E-09 milligrams/kilogram/day

Waterfowl Adult Non-Cancer Exposure Estimate
Average Dioxin TEQ Waterfowl Breast Tissue Concentration (Reaches 5 & 6) = 2.25E-05 parts per million (milligrams/kilogram)
Assumed Waterfowl Consumption Rate = 0.015 kilograms/day
Adult Body Weight = 70 kilograms
Adult Exposure Dose = (2.25E-05 milligrams/kilogram * 0.015 kilograms/day) / 70 kilograms = 4.8E-09 milligrams/kilogram/day

in children and adults[29]. Estimated exposures to the maximum dioxin TEQ (1.42E-04 mg/kg, WHO Method), assuming two 8-ounce meals a month would result in levels above the MRL and above levels at which adverse health effects have been observed (e.g., developmental effects) for children. Under those exposure circumstances, adults and children would have an increased concern for cancer from dioxin/furans.

Reach 6: Woods Pond in Lenox/Lee

Description

Reach 6 (Figure 4f) comprises Woods Pond and its headwaters. The headwaters receive flow from an unnamed tributary from the east. Woods Pond covers approximately 60 acres and generally ranges in depth from 3 to 15 feet, with backwaters ranging from 3 to 5 feet with still shallower sills (e.g., natural sand bars) separating backwaters from the main pond (BBE 1991; BBL/QEA, 2003). Backwater areas are choked with aquatic vegetation, and Woods Pond and its backwaters are frequented by ducks for brooding and breeding (BBE 1991; Weston 2000a; Woodlot 2002). MDPH staff observed wildlife (e.g., ducks, birds) on Woods Pond during a site visit. Woods Pond Dam, which forms this impoundment, was reconstructed in 1989 by GE to prevent the migration of PCB-laden sediments through its control gates (BBE 1991; BBL/QEA 2003). Prior to 1989, there was another dam that was formerly used by the Smith Paper Company (MA DEP 2000a). There is a pedestrian footbridge and a canoe launch at a narrow part of the pond upstream of the dam. There is also a boat launch area adjacent to the footbridge (Weston 2003b). Fishing has been reported to occur from the shore and from boats (Weston 2003b). A residence, a few businesses, and recreational properties abut the pond. There is also a road going around the pond (BBE 1991; Weston 2000a).

Site Visit

Reach 6 was visited by MDPH staff on August 28, 1998, by boat. The best public access to Woods Pond is at the canoe launch near the pedestrian footbridge; however, Woods Pond can be reached easily from a dirt road that follows its eastern shore. A sign warning against eating fish caught from the Housatonic River was posted prominently at the pedestrian footbridge and canoe launch. A family that was fishing from the bridge said that they knew not to eat the fish.

Reach 6 was also visited on April 6, 2005, from Woodlawn Road, which was a continuation of Roaring Brook Road, abutting Woods Pond. There was a footbridge over part of Woods Pond, and two walkers were observed. The road came to a dead end just

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2,3,7,8-TCDD MRL = 1.0E-09 milligrams/kilogram/day
2,3,7,8-TCDD LOAEL = 1.2E-07 milligrams/kilogram/day

[29] **Waterfowl Child Cancer Risk Estimate**
2,3,7,8-TCDD Oral Slope Factor = 156,000 $(\text{milligrams/kilogram/day})^{-1}$
Cancer Risk = 156,000 $(\text{milligrams/kilogram/day})^{-1}$ * 9.6E-09 milligrams/kilogram/day = 1.5E-03

Waterfowl Adult Cancer Risk Estimate
2,3,7,8-TCDD Oral Slope Factor = 156,000 $(\text{milligrams/kilogram/day})^{-1}$
Cancer Risk = 156,000 $(\text{milligrams/kilogram/day})^{-1}$ * 4.8E-09 milligrams/kilogram/day = 7.5E-04

before Woods Pond dam. There were what appeared to be construction vehicles near the dam, possibly working on a dilapidated bridge that paralleled the dam. The dam was visible, and had a large drop-off. No fish or waterfowl advisory signs were observed in Reach 6 during this visit.

Data

In Reach 6, surface soil samples were collected and analyzed for PCBs, PAHs, dioxin/furans, SVOCs and metals. Subsurface samples were collected and analyzed for PCBs. Surface sediment was collected and analyzed for PCBs, PAHs, dioxin/furans, SVOCs and metals. Subsurface sediment samples were collected and analyzed for PCBs. Surface water samples were collected and analyzed for PCBs, dioxin/furans, VOCs, and metals. Ambient air samples were collected and analyzed for PCBs. Also, duck samples were collected and analyzed for PCBs and dioxin/furans. Duck species collected included Wood Duck and Mallard. Both breast tissue and liver tissue were analyzed.

Surface Soil

For surface soil in Reach 6, 106 samples were collected and analyzed for PCBs with an average PCB concentration of 17.8 mg/kg and a maximum PCB concentration of 32.1 mg/kg with 80 detects (See Table 2).

Other contaminants of concern in Reach 6 surface soil included, dioxin/furans, PAHs, and pesticides as detected in sampling regiments that included both Reaches 5 and 6 (See Reach 5 Data section and Table 3).

Subsurface Soil

For subsurface soil in Reach 6, 78 samples were collected and analyzed for PCBs with a maximum PCB concentration of 137 mg/kg at a depth of 1 to 1.5 feet among 35 detects (See Table 4). No other contaminants of concern were identified for Reach 6 subsurface soil.

Surface Sediment

For surface sediment in Reach 6, 294 samples were collected and analyzed for PCBs with an average PCB concentration of 39.1 mg/kg and a maximum PCB concentration of 379 mg/kg with 284 detects (See Table 6).

Other contaminants of concern in Reach 6 surface sediment included PAHs, SVOCs, and metals as detected in sampling regiments that included both Reaches 5 and 6 (See summary in Reach 5 Data section and Table 7).

Subsurface Sediment

For subsurface sediment in Reach 6, 757 samples were collected and analyzed for PCBs with a maximum PCB concentration of 383 mg/kg at a depth of 0.67 to 1 foot among 590 detects (See Table 8). No other contaminants of concern were identified for Reach 6 subsurface sediment.

Surface Water

For surface water in Reach 6, 80 unfiltered non-storm event samples were collected and analyzed for PCBs with an average PCB concentration of 0.11 μg/L and a maximum PCB concentration of 0.64 μg/L with 69 detects. Also during non-storm conditions, 38 filtered surface water samples were collected and analyzed for PCBs with an average PCB concentration of 0.054 μg/L and a maximum PCB concentration of 0.5 μg/L with 15 detects. During stormy conditions (e.g., storm events or high flow) conditions, 18 unfiltered surface water samples were collected and analyzed for PCBs with an average PCB concentration of 0.080 μg/L and a maximum PCB concentration of 0.20 μg/L with 18 detects. Also during stormy conditions (e.g., storm events or high flow), 18 filtered surface water samples were collected and analyzed for PCBs with a single PCB detection at a concentration of 0.015 μg/L (See Tables 10, 11, 12 and 13).

Other contaminants of concern in Reach 6 surface water included dioxin/furans, PAHs, pesticides, SVOCs, and metals as detected in sampling regiments that included Reaches 5 through 9 (See summary in Reach 5 Data section and Table 15).

Groundwater

No groundwater samples were collected in the vicinity of Reach 6.

Ambient Air

In Reach 6, eight ambient air samples were collected and analyzed for PCBs at the Woods Pond sampling station with average ambient air concentration of 0.00312 $\mu g/m^3$ PCBs and a maximum of 0.0052 $\mu g/m^3$ PCBs with eight detects (See Table 18).

Fish

Reach 6 was within the area of the Housatonic River that had the highest PCB levels and dioxin/furan levels in fish tissue (See summary in Reach 2 Data section and Tables 19 and 20).

Waterfowl

Reach 6 was within the area of the Housatonic River that had the highest PCB and dioxin/furan levels in waterfowl tissue (See summary in Reach 5 Data section and Table 21).

Completed Pathways and Evaluation of Possible Health Effects

Living or Working in the Housatonic River Floodplain, Reach 6 (soil, air)

The residential property sampled by EPA in Reach 6 had an average PCB concentration in surface soil greater than 20 mg/kg. Estimated exposures for adult residents or workers (assumed to be exposed 5 days a week for 50 weeks a year for 52 years via incidental

ingestion and inhalation) were slightly above the MRL. Estimated exposures for children (assumed to be exposed 5 days a week for 50 weeks a year for 18 years) at this property were higher than the MRL, but were still well below the level at which adverse health effects have been observed. This level of PCB contamination resulted in a low increase in cancer concern over an assumed 70-year lifetime for children and no apparent increase concern for cancer in adults over a 70-year lifetime. It should be noted that the exposure dose estimates were driven by surface soil PCB levels. Ambient air PCB exposures did not pose health concerns on their own, and had a small additive effect on exposure dose estimates.

Using the Housatonic River and the Floodplain for Recreation, Reach 6 (soil, sediment, air, and water)

In Reach 6, surface soil and surface sediment PCB concentrations averaged 17.8 mg/kg and 40.8 mg/kg, respectively. Non-cancer adverse health effects from using these reaches of the Housatonic River for recreation are not expected, and no apparent increased concern for cancer is likely. However, individuals who frequent localized areas with elevated concentrations of PCBs in the surface soils or surface sediments may have some health concerns (e.g., increased cancer concerns). Also, opportunities for exposure at levels associated with adverse health effects may increase in the future if this area is developed for residences or other uses. It should be noted that the exposure dose estimates were driven by surface soil and surface sediment PCB levels. Ambient air and water PCB exposures did not pose health concerns on their own, and had a small additive effect on exposure dose estimates.

Dioxin TEQ and PAH levels in Reach 6 are not expected to cause health concerns. Health concerns from other contaminants of concern are also not expected.

Eating Fish Caught from the Housatonic River, Reach 6

For all reaches of the Housatonic River below Center Pond Dam in Dalton, eating fish caught from the Housatonic River poses health concerns (e.g., increased concern for cancer). Reach 6 was within the area of the Housatonic River with the highest levels of fish contamination.

Eating Waterfowl Taken from the Housatonic River Area, Reach 6

For all Reaches of the Housatonic River, eating waterfowl taken from the Housatonic River area poses health concerns (e.g., increased concern for cancer) based on waterfowl data from Reaches 5 and 6.

Reach 7: Woods Pond Dam in Lenox/Lee to Rising Pond headwaters in Great Barrington

Description

Reach 7 (Figure 4g) flows between Woods Pond Dam in Lenox and Rising Pond headwaters in Great Barrington. Over the course of Reach 7, the gradient of the Housatonic River increases from 4.2 feet per mile to 12 feet per mile, which increases the

rate of flow in the Housatonic River (BBE 1991; BBL/QEA 2003). The Housatonic River is impounded by a series of dams. These include the Columbia Mill Dam in Lee used by the Schweitzer-Maudit Paper Company, the Willow Mill Dam in Lee used by the MEAD Paper Company, and the Glendale Village hydroelectric dam in Stockbridge (MA DEP 2000a). As it flows through the communities of Lenoxdale, Lee, South Lee, Stockbridge, Glendale, and Housatonic, the Housatonic River is abutted by farmland, and thickly settled areas of residential and commercial properties (EPA 2003a). Some properties, such as the Stockbridge Golf Course, abutting the Housatonic River are also used for recreation. Farms in Reach 7 grow corn used as silage. These farms are located in Southern Lee just before and near the bend in the Housatonic River toward the west. There are also some farms in Reach 7 that grow hay and contain beef cattle grazing areas. These farms are located in Stockbridge upstream of Glendale Dam (BBL/QEA 2003). The Housatonic River receives flow from many small tributaries. In Lenox, the Housatonic River receives flow from an unnamed tributary from the west. In Lee, the Housatonic River receives flow from Washington Mountain Brook from the east, Codding Brook from the east, Laurel Lake Brook (drains Laurel Lake) from the west, an unnamed tributary from the east, Goose Pond Brook from the east (drains Goose Pond from Goose Pond Dam), Willow Brook (intermittent) from the northwest, an unnamed intermittent brook from the northwest, Hop Brook from the southeast, Beartown Brook from the south, and an unnamed intermittent brook from the north. In Stockbridge, the Housatonic River receives flow from Kampoosa Brook from the north, Agawam Brook from the south, Larrywaug Brook (drains Stockbridge Bowl) from the north, and Mohawk Brook (drains Mohawk Lake) from the north (MA DEP 2000a). Unnamed tributaries are intermittent, and are unlikely to contain fish of edible size.

Site Visit

Reach 7 was visited by MDPH staff on August 28, 1998, by car. The Housatonic River along this stretch is frequently crossed by roads, which allows for easy public access. There were a few signs advertising the public health fish consumption advisory. All the dams along the Housatonic River have spillways that would allow for fish migration over the dam going downstream.

Reach 7 was also visited on April 6, 2005, by car and foot from various roads along the Housatonic River. Just before Glendale Dam was a recreational area that had a fish advisory sign, which was worn and cracked in half. This was the only fish advisory sign observed on the entire site visit. At this recreational area Mohawk Brook joined the Housatonic River through a 3-foot culvert. North of the recreational area was the Glendale Dam. North of Glendale Dam the Housatonic River flowed through a golf course, which was flooded in many areas. North of the golf course was Willow Mill dam. Willow Mill dam is very large, and there was a heavy volume of water flowing over the dam due to the recent heavy rains and snowmelt. Between Willow Pond Dam and Columbia Mill Dam were some farms that abut the Housatonic River and potentially flood, although they were dry when observed by MDPH staff on April 6, 2005. Columbia Mill Dam was obstructed from view by an industrial building and steep banks.

Data

In Reach 7, surface soil samples were collected and analyzed for PCBs, PAHs, dioxin/furans, SVOCs and metals. Subsurface samples were collected and analyzed for PCBs. Surface sediment was collected and analyzed for PCBs, PAHs, dioxin/furans, SVOCs and metals. Subsurface sediment samples were collected and analyzed for PCBs. Surface water samples were collected and analyzed for PCBs, dioxin/furans, VOCs, and metals. Also, fish samples were collected and analyzed for PCBs, dioxin/furans, SVOCs, pesticides, and metals. Fish Species collected included, Bass, Bluegill, Blunt Nose Minnow, Brown Bullhead (catfish), Brown Trout, Largemouth Bass, Pumpkinseed, Sunfish, Trout, and Yellow Perch.

Surface Soil

For surface soil in Reach 7, 633 samples were collected and analyzed for PCBs with an average PCB concentration of 2.2 mg/kg and a maximum PCB concentration of 33.4 mg/kg with 485 detects (See Table 2). No other contaminants of concern were identified in Reach 7 surface soil.

Subsurface Soil

For subsurface soil in Reach 7, 816 samples were collected and analyzed for PCBs with a maximum PCB concentration of 28.9 mg/kg at a depth of 0.5 to 1 foot among 466 detects (See Table 4). No other contaminants of concern were identified in Reach 7 subsurface soil.

Surface Sediment

For surface sediment in Reach 7, 194 samples were collected and analyzed for PCBs with an average PCB concentration of 6.6 mg/kg and a maximum PCB concentration of 210 mg/kg with 132 detects (See Table 6). No other contaminants of concern were identified in Reach 7 surface sediment.

Subsurface Sediment

For subsurface sediment in Reach 7, 263 samples were collected and analyzed for PCBs with a maximum PCB concentration of 90 mg/kg at a depth of 0.5 to 1 foot among 198 detects (See Table 8). No other contaminants of concern were identified in Reach 7 subsurface sediment.

Surface Water

For surface water in Reach 7, 111 unfiltered non-storm event samples were collected and analyzed for PCBs with an average PCB concentration of 0.11 μg/L and a maximum PCB concentration of 1.1 μg/L with 83 detects. Also during non-storm conditions, 40 filtered surface water samples were collected and analyzed for PCBs with an average PCB concentration of 0.058 μg/L and a maximum PCB concentration of 0.6 μg/L with 10 detects. During stormy conditions (e.g., storm events or high flow), 10 unfiltered surface

water samples were collected and analyzed for PCBs with an average PCB concentration of 0.048 μg/L and a maximum PCB concentration of 0.07 μg/L with 10 detects. Also during stormy conditions (e.g., storm events or high flow), 10 filtered surface water samples were collected and analyzed for PCBs with an average PCB concentration of 0.014 μg/L and a maximum PCB concentration of 0.01 μg/L with two detects (See Tables 10, 11, 12 and 13).

Other contaminants of concern in Reach 7 surface water included dioxin/furans, PAHs, pesticides, SVOCs, and metals as detected in sampling regiments that included Reaches 5 through 9 (See summary in Reach 5 Data section and Table 15).

Groundwater

No groundwater samples were collected in the vicinity of Reach 7.

Ambient Air

No ambient air samples were collected in the vicinity of Reach 7.

Fish

For Reaches 7 and 8, Woods Pond Dam to Rising Pond Dam, PCB levels in fish tissue were lower than PCB levels in fish tissue in Reaches 1 through 6, but were still significantly elevated. The highest levels were found in Brown Trout, Largemouth Bass, and Brown Bullhead (catfish). A Brown Trout skin-on fillet had PCB levels of 33 mg/kg. For Largemouth Bass, skin on fillets had average PCB levels of 14.3 mg/kg with a range of 7.4 mg/kg to 16 mg/kg, for skin-off fillets average PCB levels were 2.4 mg/kg with a range of 1.5 mg/kg to 3.5 mg/kg. Brown Bullhead (catfish) skin-off fillets had average PCB levels of 5.5 mg/kg with a range of 1.3 mg/kg to 13 mg/kg (See Table 19). Dioxin/furans were also detected above levels of health concern (e.g., Largemouth Bass skin-off fillets had average dioxin TEQ levels of 7.9E-06 mg/kg) and thus will be evaluated further. It should be noted that all fish data available for this area was used to calculate averages, and that the majority of more recent data were collected from Reach 8.

Other fish tissue contaminants of concern found in the Housatonic River in Reaches 7 and 8 between Woods Pond Dam and Rising Pond Dam included 1,2,3,4-tetrachlorobenzene, 1,2,3,5-tetrachlorobenzene, DDT and metabolites, and other chlorinated pesticides (See Table 20). Although some of these compounds listed above were detected above health-based comparison values in fish tissue from Reaches 7 and 8, the concentrations of PCBs in some of the same fish were at least 100 times greater; therefore, because of these relative concentrations and because the compounds listed above generally affect similar target organs (e.g., nervous system) and/or have similar cancer concerns, they are unlikely to contribute an appreciably additive effect in terms of health concerns and thus will not be discussed further (ATSDR 1993a; ATSDR 1994; ATSDR 1995a; ATSDR 1996; ATSDR 1997; ATSDR 2000c; ATSDR 2000d; ATSDR 2002a; ATSDR 2002b; ATSDR 2002c).

Waterfowl

No waterfowl were collected from Reach 7 of the Housatonic River.

Completed Pathways and Evaluation of Possible Health Effects

Living or Working in the Housatonic River Floodplain, Reach 7 (soil, air)

One property in Reach 7 had an average PCB concentrations in surface soil between 2 and 20 mg/kg, and estimated exposures for adult residents or workers (assumed to be exposed 5 days a week for 50 weeks a year for 52 years) ranged from below to slightly above the MRL. Estimated exposures for children (assumed to be exposed 5 days a week for 50 weeks a year for 18 years) at this property were higher than the MRL, but were still well below the level at which adverse health effects have been observed. This level of PCB contamination did not result in an apparent increase in cancer concern over an assumed 70-year lifetime for children or adults. Therefore, adverse health effects from these exposures were unlikely.

Using the Housatonic River and the Floodplain for Recreation, Reach 7 (soil, sediment, air, and water)

Between Woods Pond Dam and the headwaters of Rising Pond Dam (Reach 7), the available data indicate that PCB concentrations in surface soil, surface sediment, and surface water are lower than the reaches upstream of Woods Pond Dam. On average, the surface soil and surface sediment PCB levels were 2.2 mg/kg and 6.6 mg/kg, respectively. Consequently, non-cancer adverse health effects from using this section of the Housatonic River for recreation are not expected, and no increased concern for cancer is expected. Development of Reach 7 of the Housatonic River, which runs through several towns, could increase opportunities for exposure to PCBs in the future. Health concerns from other contaminants are also not expected.

Eating Fish Caught from the Housatonic River, Reach 7

For all reaches of the Housatonic River below Center Pond Dam in Dalton, eating fish caught from the Housatonic River poses health concerns (e.g., increased concern for cancer). Reach 7 is below Woods Pond, and has fish levels not quite as high as reaches above Woods Pond, but still presents similar health concerns (e.g., increased concern for cancer).

Eating Waterfowl Taken from the Housatonic River Area, Reach 7

For all reaches of the Housatonic River, eating waterfowl taken from the Housatonic River area poses health concerns (e.g., increased concern for cancer) based on waterfowl data from Reaches 5 and 6.

Reach 8: Rising Pond in Great Barrington

Description

Reach 8 (Figure 4h) consists of Rising Pond. Rising Pond is the impoundment of the Housatonic River behind the Rising Pond Dam of the Rising Paper Company in Great Barrington. Rising Pond Dam was reconstructed in 1993 to comply with Massachusetts structural stability laws (BBL/QEA 2003).

Site Visit

Reach 8 was visited by MDPH staff on August 28, 1998, by car. There were a few signs advertising the public health fish consumption advisory, including one in a visible location on a tree adjacent to Rising Pond.

Reach 8 was also visited on April 6, 2005, from Park Street, a road that was parallel to it, and by walking along Rising Pond. Rising Pond was very accessible, and one walker was observed. Rising Pond Dam is very large and has a significant drop. No fish or waterfowl advisory signs were observed in Reach 8.

Reach 8 Data

In Reach 8, surface soil samples were collected and analyzed for PCBs, PAHs, dioxin/furans, SVOCs and metals. Subsurface samples were collected and analyzed for PCBs. Surface sediment was collected and analyzed for PCBs, PAHs, dioxin/furans, SVOCs and metals. Subsurface sediment samples were collected and analyzed for PCBs. Surface water samples were collected and analyzed for dioxin/furans, VOCs, and metals.

Surface Soil

For surface soil in Reach 8, 26 samples were collected and analyzed for PCBs with an average PCB concentration of 1.2 mg/kg and a maximum PCB concentration of 6 mg/kg with 20 detects (See Table 2).

No other contaminants of concern were identified in Reach 8 surface soil.

Subsurface Soil

For subsurface soil in Reach 8, 27 samples were collected and analyzed for PCBs with a maximum PCB concentration of 3.9 mg/kg at a depth of 0.5 to 1 foot among 16 detects (See Table 4). No other contaminants of concern were identified in Reach 8 subsurface soil.

Surface Sediment

For surface sediment in Reach 8, 38 samples were collected and analyzed for PCBs with an average PCB concentration of 4.2 mg/kg and a maximum PCB concentration of 26 mg/kg with 35 detects (See Table 6).

Other contaminants of concern in Reach 8 surface sediment included dioxin/furans and the metal tin. For dioxin/furans, dioxin TEQ was calculated (MA DEP method) for one of two samples and had a TEQ of 5.4E-05 mg/kg. Tin was detected in two of two samples and had an average concentration of 6.5 mg/kg with a maximum concentration of 10 mg/kg (See Table 7).

Subsurface Sediment

For subsurface sediments in Reach 8, 143 samples were collected and analyzed for PCBs with a maximum PCB concentration of 51 mg/kg at a depth of 6 to 6.5 feet among 117 detects. No other contaminants of concern were identified in Reach 8 subsurface sediment.

Surface Water

No PCB surface water samples were collected for Reach 8. Other contaminants of concern in Reach 8 surface water included dioxin/furans, PAHs, pesticides, SVOCs, and metals as detected in sampling regiments that included Reaches 5 through 9 (See summary in Reach 5 Data section and Table 15).

Groundwater

No groundwater samples were collected in the vicinity of Reach 8.

Ambient Air

No ambient air samples were collected in the vicinity of Reach 8.

Fish

This Reach was within the Reach 7 and 8 area of the Housatonic River with elevated PCB and dioxin/furan levels in fish tissue, which were lower than levels for the same compounds in the Reach 1 through 6 area (See summary in Reach 7 Data section and Tables 19 and 20).

Waterfowl

No waterfowl were collected from Reach 8 of the Housatonic River.

Completed Pathways and Evaluation of Possible Health Effects

Living or Working in the Housatonic River Floodplain, Reach 8 (soil, air)

No residential or commercial properties lie within the floodplain in Reach 8; therefore, no soil samples were collected from residential and commercial properties, and this pathway was not evaluated for Reach 8.

Using the Housatonic River and the Floodplain for Recreation, Reach 8 (soil, sediment, air, and water)

For Rising Pond (Reach 8), the available data indicate that PCB concentrations in surface soil and surface sediment are lower than the Reach 7. On average, the surface soil and surface sediment levels were 1.2 mg/kg and 4.2 mg/kg, respectively. Consequently, non-cancer adverse health effects from using this section of the Housatonic River for recreation (e.g., canoeing, walking) via incidental ingestion of sediment, soil, and water, and inhalation of air, are not expected, and no increased concern for cancer is expected. Development of Reach 8 of the Housatonic River, which runs through several towns, could increase opportunities for exposure to PCBs in the future. Health concerns from other contaminants of concern are also not expected.

Eating Fish Caught from the Housatonic River, Reach 8

For all reaches of the Housatonic River below Center Pond Dam in Dalton, eating fish caught from the Housatonic River poses health concerns (e.g., increased concern for cancer). Reach 8 is below Woods Pond, and has fish levels not quite as high as reaches above Woods Pond, but still presents similar health concerns (e.g., increased concern for cancer).

Eating Waterfowl Taken from the Housatonic River Area, Reach 8

For all reaches of the Housatonic River, eating waterfowl taken from the Housatonic River area poses health concerns (e.g., increased concern for cancer) based on waterfowl data from Reaches 5 and 6.

Reach 9: Rising Pond Dam in Great Barrington to the Connecticut Border in Sheffield

Description

Reach 9 (Figure 4i) flows downstream of Rising Pond Dam of the Rising Paper Company in Great Barrington to the Connecticut border in Sheffield. The Housatonic River flows through the center of Great Barrington and then Sheffield before entering Connecticut 1 mile north of Canaan, Connecticut (BBE 1991). Many farms abut the Housatonic River along Reach 9. A few farms grow vegetables, raise free-range chickens, or raise dairy cattle, while most farms grow corn silage or hay. These farms are located in Great Barrington north of the downtown area and south of the downtown area. The density of farms along the Housatonic River remains consistently high from southern Great Barrington, south through Sheffield until the Connecticut Border (BBL/QEA 2003). In Great Barrington, the Housatonic River receives flow from an unnamed tributary from the east, the Williams River from the west, an unnamed tributary from the east, Mansfield Brook (drains Mansfield Pond) from the west, and the Green River from the west. In Sheffield, the Housatonic River receives flow from the two unnamed tributaries from the east, Hubbard Brook from the west, Ironwork Brook from the east, a series of unnamed small tributaries, and Konkapot River from the east. Ashley Falls Dam is about 1 mile up the Konkapot River from its confluence with the Housatonic River (MA DEP 2000a).

Site Visit

Reach 9 was visited by MDPH staff on April 6, 2005, by car and by foot from various roads starting at the Connecticut border along a road in the Massachusetts Trustees of Reservations land. Just south of here along Reach 10 in Connecticut were several farms. In the Trustees of Reservations land, the banks were extremely steep and heavily vegetated. Signs were posted in the Trustees of Reservations land reminding visitors that hunting and trapping was not allowed on reservation land. The Housatonic River was about 100 feet below the road for a good stretch in the Trustees of Reservations land. Northeast of the Trustees of Reservations land was a large tract of flooded farmland. According to EPA, a large tract of land to the east of the Trustees of Reservation land on the Bartholomew's Cobble property is low lying and regularly inundated (EPA 2005). The confluence of the Konkapot River and the Housatonic River appeared as a large flooded area. The Ashley Falls area of the Konkapot River was observed, which was just in view as the Ashley Falls Bridge was under construction and inaccessible. North of here, the Housatonic River followed the main road fairly closely. The Housatonic River was flowing fast and high due to the previous week's rain and snowmelt. At the Sheffield Covered Bridge, a man was observed fishing and several acres of flooded farmland were visible from the park area adjacent to the bridge. Near the covered bridge was the confluence of Hubbard Brook and the Housatonic River. The first dam on Hubbard Brook, Mill Pond dam, which impounds Mill Pond, was visible. The flow of Hubbard Brook was high and deep and a large volume of water was spilling over the approximately 10-foot Mill Pond dam. It appeared to be a barrier for upstream fish migration. North of this area were more acres of flooded farmland as well as a good stretch where the Housatonic River followed the road closely and was quite accessible. North of here, the confluence of the Green River and the Housatonic River also appeared to be a large flooded area with murky water on that particular day. Between the Green River and the Williams River the banks became steep again, then flattened out and became heavily vegetated. The confluence of the Williams River and the Housatonic River was just out of sight from the Division Street Bridge due to very heavy vegetation, but the Williams River was visible at the intersection of Plain Road and Division Street about a quarter mile upstream from the confluence with the Housatonic River, the water was very clear and swiftly moving on that particular day. Upstream of the Division Street Bridge over the Housatonic River was Rising Pond Dam. No fish or waterfowl advisory signs were observed in Reach 9.

Reach 9 Data

In Reach 9, surface soil samples were collected and analyzed for PCBs, PAHs, dioxin/furans, SVOCs and metals. Subsurface samples were collected and analyzed for PCBs. Surface sediment was collected and analyzed for PCBs, PAHs, dioxin/furans, SVOCs and metals. Subsurface sediment samples were collected and analyzed for PCBs. Surface water samples were collected and analyzed for dioxin/furans, VOCs, and metals.

Surface Soil

For surface soil in Reach 9, 155 samples were collected and analyzed for PCBs with an average PCB concentration of 0.40 mg/kg and a maximum PCB concentration of 1.7

mg/kg with 100 detects (See Table 2). No other contaminants of concern were identified in Reach 9 surface soil.

Subsurface Soil

For subsurface soil in Reach 9, 26 samples were collected and analyzed for PCBs with a maximum PCB concentration of 6.32 mg/kg at a depth of 0.5 to 1 foot among 16 detects (See Table 4). No other contaminants of concern were identified in Reach 9 subsurface soil.

Surface Sediment

For surface sediment in Reach 9, 88 samples were collected and analyzed for PCBs with an average PCB concentration of 0.50 mg/kg and a maximum PCB concentration of 2.8 mg/kg with 53 detects (See Table 6). No other contaminants of concern were identified in Reach 9 surface sediment.

Subsurface Sediment

For subsurface sediment in Reach 9, 41 samples were collected and analyzed for PCBs with a maximum PCB concentration of 1.70 mg/kg at a depth of 0.5 to 1 foot among 34 detects (See Table 8). No other contaminants of concern were identified in Reach 9 subsurface sediment.

Surface Water

For surface water in Reach 9, 189 unfiltered non-storm event samples were collected and analyzed for PCBs with an average PCB concentration of 0.11 μg/L and a maximum PCB concentration of 1.1 μg/L with 96 detects. Also during non-storm conditions, 71 filtered surface water samples were collected and analyzed for PCBs with an average PCB concentration of 0.040 μg/L and a maximum PCB concentration of 0.35 μg/L with 16 detects. During stormy conditions (e.g., storm events or high flow), 25 unfiltered surface water samples were collected and analyzed for PCBs with an average PCB concentration of 0.059 μg/L and a maximum PCB concentration of 0.15 μg/L with 21 detects. Also during stormy conditions (e.g., storm events or high flow) conditions, 25 filtered surface water samples were collected and analyzed for PCBs with an average PCB concentration of 0.0284 μg/L and a maximum PCB concentration of 0.08 μg/L with 13 detects (See Tables 10, 11, 12 and 13).

Other contaminants of concern in Reach 9 surface water included dioxin/furans, PAHs, pesticides, SVOCs, and metals as detected in sampling regiments that included Reaches 5 through 9 (See summary in Reach 5 Data section and Table 15).

Groundwater

No groundwater samples were collected in the vicinity of Reach 9.

Ambient Air

No ambient air samples were collected in the vicinity of Reach 9.

Fish

In Reach 9, PCB levels in fish tissue were lower than in Reaches 7 and 8, but were still significantly elevated. The highest PCB levels were found in Largemouth Bass. For one Largemouth Bass skin-on fillet PCB levels were 6.9 mg/kg, for skin-off fillets, PCB levels averaged 4.9 mg/kg with a range of 2.7 mg/kg to 7.2 mg/kg, and for whole fish composites, PCB levels averaged 3.8 mg/kg with a range of 0.1 mg/kg to 53.6 mg/kg (See Table 19). No other contaminants of concern were identified in Reach 9 fish tissue samples.

Waterfowl

No waterfowl samples were collected from Reach 9 of the Housatonic River.

Completed Pathways and Evaluation of Possible Health Effects

Living or Working in the Housatonic River Floodplain, Reach 9 (soil, air)

No data was collected for residential or commercial properties in Reach 9, because initial sampling in recreational areas, were below the residential surface soil standard of 2 mg/kg, therefore, this pathway was not evaluated for Reach 9.

Using the Housatonic River and the Floodplain for Recreation, Reach 9 (soil, sediment, air, and water)

Between Rising Pond Dam and the Connecticut Border (Reach 9), the data do not indicate PCB contamination at levels of health concern for recreation. The average surface sediment and surface soil PCB concentrations were well below MA DEP's residential soil standard of 2 mg/kg. Concentrations of PCBs in surface water of the Housatonic River were below MA DEP drinking water standards. For people using Reach 9 for recreation, opportunities for exposures to PCBs in surface soil, surface sediment, water, and ambient air averaged for the entire River area from available samples (assuming use of 5 days a week for 26 weeks a year) are expected to be less than the MRL for adults and children; therefore, no non-cancer adverse health effects are expected, and no increased concern for cancer is expected. Health concerns from other contaminants of concern are also not expected.

Eating Fish Caught from the Housatonic River, Reach 9

For all reaches of the Housatonic River below Center Pond Dam in Dalton, eating fish caught from the Housatonic River poses health concerns (e.g., increased concern for cancer). Reach 9 is below Rising Pond, and has fish levels lower than reaches between Woods Pond and Rising Pond (Reaches 7 and 8), but still presents similar health concerns (e.g., increased concern for cancer).

Eating Waterfowl Taken from the Housatonic River Area, Reach 9

For all reaches of the Housatonic River, eating waterfowl taken from the Housatonic River area poses health concerns (e.g., increased concern for cancer) based on duck data from Reaches 5 and 6.

Off Site Description and Evaluation of Completed Pathways

Silver Lake

Silver Lake, which is part of the GE site, is adjacent to the GE facility in Pittsfield. It covers approximately 26 acres and has a maximum depth of approximately 30 feet. There is a hydraulic connection between Silver Lake and the Housatonic River. A 4-foot diameter conduit allows for intermittent discharges of water from Silver Lake to the Housatonic River (BBE 1991). Silver Lake was evaluated by ATSDR through their health consultation process in 1998 (ATSDR 1998a). The health consultation concluded that frequent contact with the near shore surface sediments may result in exposures of health concern for residents, especially older children, who come into contact with those surface sediments. It is unlikely that bait fisherman or walkers would experience health effects from occasional contact with contaminated surface soil or surface sediment. Ambient air concentrations of PCBs measured at the bank of Silver Lake do not pose a health threat to residents, bait fisherman, or walkers (ATSDR 1998a).

Goodrich Pond

Goodrich Pond is south of the Housatonic River and adjacent to Brattle Brook Park in Pittsfield (Reach 2). Goodrich Pond is seasonally connected to the Housatonic River. A health consultation for Goodrich Pond was released by MDPH in February 2001 (MDPH 2001). PCBs were detected in fish from the pond at levels of health concern. As a result, a public health fish consumption advisory for PCBs was issued for Goodrich Pond by MDPH that recommended the general public, including children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from Goodrich Pond (MDPH 2001).

The GE Facility

The GE site comprises 10 different areas, for which separate public health assessments or health consultations were or 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 1, the Newell Street Area 2, the Unkamet Brook Area, the Lyman Street Parking Lot, the Hill 78 Area, and the Allendale School Property. Environmental data for the sites that abut the Housatonic River would typically be considered “off-site” from the Housatonic River Area. However, soil data for residential properties within the East Street Area 1 site that abut the Housatonic River were included for evaluation in this public health assessment. Extensive groundwater data are available for Unkamet Brook, Hill 78, East Street Area 1, East Street Area 2, Newell Street Area I, Newell Street II, Lyman Street, and Former Oxbows, which are the eight GE sites adjacent to the Housatonic River, and were included in the public health

assessments for those sites. Ambient air sampling done at a number of the GE sites near the Housatonic River as well other data from the GE sites were included in the public health assessments for those sites available for download at http://www.mass.gov/dph/ceh. Soil data for properties being tested as part of the MA DEP residential fill property project are not included in this public health assessment for the Housatonic River except for those properties that abut the Housatonic River. Those properties are currently being summarized in a separate summary health assessment.

Morewood Lake

Morewood Lake is south of the Housatonic River, just south of the confluence of the East and West Branches of the Housatonic River in Pittsfield (Reach 5). Morewood Lake is seasonally connected to the Housatonic River. A health consultation for Morewood Lake was released by MDPH in May 2005 (MDPH 2005). PCBs were detected in fish from the lake at levels of health concern. As a result, a public health fish consumption advisory for PCBs was issued by MDPH for Morewood Lake that recommended the general public, including children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from Morewood Lake (MDPH 2005).

Background Data (Air, Fish, Waterfowl)

The year-round ambient air data from a background location at Berkshire Community College were very low and averaged 0.00064 $\mu g/m^3$ PCBs year round. Background low and high volume samples, taken every few months in 1991, 1992, and 1993, as well as in 1995 and 1996, indicated that PCB concentrations in ambient air increase during the summer months when it is warmer, as summer samples average 0.00086 $\mu g/m^3$ and non-summer samples averaged 0.00034 $\mu g/m^3$. Therefore, because all the samples from near the Housatonic River were collected during summer months, the measured concentrations are a conservative estimate of the annual average concentrations (i.e., PCB levels are generally higher during summer months).

Between 1994 and 1995, fish were collected from the Green River, the Williams River, and the Konkapot River, which are all major tributaries to the Housatonic River, between 0.25 and 0.5 miles from their respective confluences with the Housatonic River (BBL 1996b; USGS 1996). Some samples contained PCB levels above the 2 mg/kg US FDA tolerance level for edible portions of fish and the EPA cancer RBC value for PCBs in fish of 0.0016 mg/kg. In the Green River, two Brown Trout skin-on fillets averaged 17.5 mg/kg (maximum 21 mg/kg), two Rock Bass skin-on fillets averaged 0.9 mg/kg (maximum 1 mg/kg), and one whole fish composite of eight White Sucker averaged 0.62 mg/kg (maximum 0.62 mg/kg per fish). In the Williams River, two Brown Trout skin-on fillets averaged 1.23 mg/kg (maximum 2.3 mg/kg), and two Smallmouth Bass skin-on fillets averaged 1.8 mg/kg (maximum 2.5 mg/kg). In the Konkapot River, one whole fish composite of four White Sucker averaged 0.05 mg/kg (maximum 0.05 mg/kg per fish).

Also, in 1998, Roeder et al collected fish from Hop Brook, and the Williams River from both near their respective confluences with the Housatonic River and ½ to 1 mile upstream of their respective confluences with the Housatonic River. Skin-on fillets were analyzed for PCB content. From Hop Brook, six Fallfish were collected and skin-on

fillets were found to contain a minimum PCB concentration of 0.06 mg/kg PCBs and a maximum PCB concentration of 5.8 mg/kg PCBs with a mean PCB concentration of 1.1 mg/kg. Three Rock Bass were also collected from Hop Brook, and skin-on fillets were found to have a minimum PCB concentration 0.29 mg/kg and a maximum PCB concentration of 2.2 mg/kg with a mean PCB concentration of 1.2 mg/kg. One Bullhead was collected from Hop Brook, and the skin-on fillet was found to contain 0.31 mg/kg PCBs. From the Williams River, five Rock Bass were collected, and skin-on fillets were found to contain a minimum PCB concentration of 0.12 mg/kg and a maximum PCB concentration of 3.2 mg/kg with a mean PCB concentration of 0.9 mg/kg. Two Smallmouth Bass were also collected from the Williams River, and the skin-on fillets were found to have 0.12 mg/kg and 4.8 mg/kg PCBs, respectively, and the mean PCB concentration was 2.46 mg/kg. Two Bluegill collected from the Williams River had skin-on fillet PCB concentrations of 0.04 mg/kg and 0.08 mg/kg, respectively, and the mean PCB concentration was 0.06 mg/kg (Roeder et al 2000; Roeder 2006).

Given these data, MDPH has determined it prudent to extend the existing fish consumption advisory to the tributaries of the Housatonic River as well. The section of each tributary to be covered by the advisory should be determined through consultations with MA DEP and MA DFW and others. MDPH did not receive any written comments on the evaluation of fish data during the public comment release of this Housatonic River public health assessment; however MDPH encourages continued input from the community relating to fish consumption advisories.

At the time this health assessment was released for public comment, public concerns were raised related to contamination in the West Branch of the Housatonic River. Riverbank soil and sediment contamination along a stretch of the West Branch that runs adjacent to Dorothy Amos Park in Pittsfield further supports the need to strengthen the fish advisory for tributaries of the Housatonic River including the West Branch. Additionally, there are no significant barriers to fish migration from the main stem of the Housatonic River into the West Branch (MA DEP 2000c).

Duck breast tissue from Three Mile Pond, an area considered to be uncontaminated, had PCB levels as high as 3.36 mg/kg. Therefore, the MDPH waterfowl consumption advisory includes advice about consuming waterfowl statewide.

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 surface soils, surface sediments, surface water, ambient air, fish tissue, and waterfowl tissue in the Housatonic River area. See the above "Site Description and Evaluation" sections for Reaches 1 through 9 for a discussion of these exposure scenarios.

Conclusions

ATSDR requires that one of five conclusion categories be used to summarize findings of health consultations and public 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 on the basis of 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 exposures, the presence of physical hazards, and community health concerns.

Conclusions from evaluating the Housatonic River area include the following:

1. PCB and dioxin/furan contamination in the Housatonic River is and was a "Public Health Hazard" due to PCBs and dioxin/furans in fish tissue for people who consume fish caught from the Housatonic River. Despite the efforts of MDPH through the fish consumption advisory and the efforts of others, it is possible that some people may not be aware of (e.g., because signs are relatively sparse) or may not heed the advisory and eat fish from the Housatonic River. Fish containing PCBs in their tissues at levels of health concern can be found in the Housatonic River and its tributaries from the Center Pond Dam in Dalton to the Connecticut border.

2. PCBs in frogs and turtles from the Housatonic River also pose a "Public Health Hazard" for those who may consume them on a routine basis. Therefore, they have been included in the public health fish consumption advisory for the Housatonic River.

3. Due to data suggesting elevated PCB levels in the Williams and Green Rivers, the fish advisory should be modified to include tributaries of the Housatonic River.

4. PCB and dioxin/furan contamination in the Housatonic River is and was a "Public Health Hazard" for people who consume mallards, wood ducks, and possibly other waterfowl taken from the Housatonic River and surrounding area due to PCBs and dioxin/furans in waterfowl tissue. Despite the efforts of MDPH through the waterfowl consumption advisory issued in 1999 in collaboration with EPA New England, it is possible that some people may not be aware of or may not heed the advisory and eat waterfowl obtained from the Housatonic River and surrounding contaminated areas. More species should be sampled to determine the risk from other types of waterfowl in the area, such as geese.

5. MDPH needs to continue to maintain the fish and waterfowl advisories and promote awareness of these advisories (e.g., new signage).

6. In the past, PCB contamination in surface soil in the Housatonic River floodplain posed a "Public Health Hazard" for people who lived in approximately 22 of the 28 groups of properties that had average PCB surface soil levels above 2 mg/kg, the MA DEP residential soil standard. People living along the Housatonic River

in the Pittsfield area in Reach 4 (especially those at the Deming Street properties, the properties at Use Area 4, and Use Area 3, see Figure 4d), and those living around Woods Pond in Lenox and Lee in Reach 6 (See Figure 4f) would have had the greatest opportunities for exposure because their soil PCB levels were the highest. Currently, the short-term measures (e.g., warning signs, excavations), and long-term remediation (i.e., soil removals, sediment removals) that have been implemented have reduced the opportunities for exposures to PCBs in the surface soils at the residential properties along the Housatonic River in Reach 4. Hence, the properties that have been remediated currently pose "No Apparent Public Health Hazard," however, those that have not, particularly those in Reach 6, may still pose a "Public Health Hazard."

For the properties that are adjacent to areas of the Housatonic River where contamination is still present in sediments, further potential opportunities for exposure could occur from contaminated sediments being transported onto yards abutting the Housatonic River during flood events. Thus, if long-term remedial measures are not adopted, the short-term measures could become ineffective which would result in increased exposure opportunities in the future. Furthermore, changes in land use (e.g., further development) at the properties could increase exposures even while short-term measures are maintained.

Continued releases to the Housatonic River via groundwater from the Unkamet Brook, East Street Area 1, East Street Area 2, and Lyman Street sites could pose a threat to re-contaminate remediated areas if pump and treat stations are not properly maintained. However, with careful EPA oversight of these activities, this would not be expected. Finally, MDPH supports efforts to ensure that all residential properties in the floodplain with suspected PCB contamination have been identified and tested for PCBs in soil.

7. Current exposure opportunities in the Reach 3 area and its floodplain between Newell and Lyman Streets (Figure 4c) are unlikely because remediation has been completed. Therefore, the soil and sediment of the Reach 3 area poses "No Apparent Public Health Hazard," although past exposures could have occurred at levels of health concern for people who frequently used the area for recreational purposes, and thus this Reach posed a "Public Health Hazard" in the past.

   Between Lyman Street and the confluence of the East Branch with the West branch of the Housatonic River (Reach 4), opportunities for exposure at levels associated with adverse health effects are unlikely, but possible in areas of maximum concentration. Based on information evaluated at the time this assessment was conducted, this reach was undergoing remediation in places, which should reduce opportunities for future exposure. Therefore, Reach 4 (Figure 4d) may have posed a "Public Health Hazard" while remediation was underway and in the past (prior to remediation) posed a "Public Health Hazard" for recreational uses.

   In the reaches below the confluence where the floodplain is undeveloped and heavily vegetated (Reaches 5 and 6) opportunities for exposure that might be of health concern are unlikely on average, but possible in areas of maximum

contamination. Therefore, Reaches 5 and 6 (Figures 4e and 4f) may pose a "Public Health Hazard" currently and may have posed "Public Health Hazard" in the past for recreational uses.

Below Woods Pond Dam to Rising Pond Dam and through to the Connecticut Border (Reaches 7, 8 and 9), opportunities for exposure from recreational activities that might lead to health concerns would not be expected. Therefore, Reaches 7, 8 and 9 (Figures 4g – 4i) currently pose "No Apparent Public Health Hazard" for recreational uses other than through the consumption of fish, turtles, frog, and waterfowl.

If Reaches 5 through 9 undergo development, which could increase opportunities for exposure to PCB contamination in subsurface or surface soil, this information would have to be evaluated before public health implications could be determined.

8. It is likely that the health concerns from PCBs currently considerably outweigh the concerns from other chemicals present on the site in environmental media (e.g., surface soil and surface sediment). However, the presence of these chemicals in surface soils and surface sediments may have a slight incremental effect with regard to health risks (i.e., small additional cancer concerns posed by dioxin/furans, PAHs). In fish and waterfowl on the other hand, contaminants besides PCBs (i.e., dioxins/furans) may appreciably increase exposure concerns already posed by PCBs. Following the recommendation outlined in the fish and waterfowl health advisories will help to minimize exposures and reduce associated health concerns.

Recommendations

1. GE should post new fish advisory signs that include advice about frogs and turtles along the Housatonic River. In addition, GE should post waterfowl consumption advisory signs (based on guidance from MDPH) along the Housatonic River.

2. Environmental regulatory agencies should maintain short-term measures (e.g., fencing, signs, vegetative cover) to mitigate exposures to PCBs on contaminated properties. Any change in land use should be evaluated for exposure opportunities by environmental regulatory agencies and MDPH.

3. Environmental regulatory agencies should continue efforts to see that pump and treat stations, slurry walls, and other measures that contain contaminant releases to the Housatonic River via groundwater from the Unkamet Brook, East Street Area 1, East Street Area 2, and Lyman Street sites be maintained.

4. Environmental regulatory agencies should continue efforts to ensure that all residential properties along the Housatonic River with suspected PCB contamination have been identified and addressed.

5. Selective sampling of groundwater in the floodplain outside of Pittsfield should also be considered by environmental regulatory agencies such that the potential exposure pathway via this media can be evaluated.

6. More waterfowl species should be sampled by environmental regulatory agencies to determine the risk from other types of waterfowl in the area, such as geese.

7. MDPH recommends that the Housatonic River site be remediated to levels that result in acceptable consumption criteria for fish, frogs, turtles and waterfowl.

8. GE should monitor existing advisory signs to ensure maintenance of the signs. In addition, fish consumption advisory signs should be added to the Housatonic River tributaries, including the West Branch, that are currently not signed.

Public Health Action Plan

Past Actions

In addition to the GE site-specific public health assessments, MDPH has been involved in addressing public health issues in the Housatonic River Area since the early 1980s, when it issued a public health fish consumption advisory for fish, frogs, and turtles for the Housatonic River and its tributaries based on elevated PCB levels. MDPH has also been preparing a summary document for the GE site as a whole that will summarize the overall assessment of public health implications for the entire site, including the Housatonic River. The summary public health assessment for the GE site will address public health concerns related to contaminants found at all of the GE sites, as well as health or exposure assessment evaluations that have been conducted or are ongoing by MDPH for this area. These include a PCB exposure assessment study completed in 1997, a descriptive cancer incidence assessment completed in 2002, an ongoing evaluation of serum PCB levels among residents who called the MDPH PCB Hotline, study of the feasibility of conducting an occupational epidemiological investigation of former GE workers completed in 2003, and a 2000 expert panel report on non-occupational PCB health effects. MDPH also completed a health consultation for Goodrich Pond in 2001, and Morewood Lake in 2005. Additional information about past public health actions undertaken by MDPH in the Housatonic River Area can be found in Appendices G and H.

Ongoing Actions

1. MDPH recognizes that there have been multiple opportunities for exposure to PCBs throughout Pittsfield and the Housatonic River area and supports through active involvement ongoing remedial efforts by the environmental agencies to reduce opportunities for exposure to PCBs throughout the Pittsfield and Housatonic River area.

2. Due to the 1997 discovery of widespread residential PCB soil contamination, MDPH conducted a separate exposure assessment for individual residents who were concerned about this exposure. MDPH set up a hotline number for individuals to call in with health-related concerns, complete exposure questionnaires, and request serum PCB testing. Results of these analyses of serum PCB levels and evaluation of the community health concerns expressed on the hotline will be included in the summary public health assessment for the GE sites in the process of development.

3. MDPH established its Housatonic River Area Advisory Committee in 1995 and continues currently. 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 continues to hold periodic 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., plan education and outreach) in the area.

4. MDPH will complete ongoing public health activities (e.g., PCB serum analyses) in the Pittsfield and Housatonic River area and incorporate results of these activities into the final summary public health assessment for the GE site.

5. MDPH will continue to offer to evaluate any resident's opportunities for past exposure to PCBs through administering the exposure assessment questionnaire, and as warranted serum PCB analysis.

Future Actions

1. MDPH will provide additional advice on the existing fish, frog, and turtle consumption advisory for the Housatonic River to the tributaries and feeder streams that join the Housatonic River between Center Pond Dam in Dalton and the Connecticut border. MDPH will consult with MA DEP, MA DCR, MA DFW and EPA to determine the upstream extent of the advisory along each tributary.

2. Should MDPH receive environmental data not included in this public health assessment or information that would be helpful in improving the characterization of opportunities for exposure (e.g., additional groundwater, duck, cow milk analyses, etc.), this information will be reviewed and incorporated, as appropriate and upon request.

3. MDPH will do additional education and outreach regarding the public health fish consumption advisory. These activities will be planned in coordination with MA DFW and others.

4. MDPH will do additional education and outreach regarding the waterfowl consumption advisory particularly targeting hunters in the Housatonic River Area. These activities will be planned in coordination with MA DFW and others.

5. Information gathered from these additional activities will improve MDPH's ability to assess the public health implications of PCB contamination in the Pittsfield area. A final public health action plan will be developed after information from these activities is considered in the summary public health assessment for the GE sites.

Preparer of Public Health Assessment

This document was prepared by the Center for Environmental Health at the Massachusetts Department of Public Health. If you have any questions about this document, please contact Suzanne K. Condon, Associate Commissioner of CEH/MDPH, 7th Floor, 250 Washington Street, Boston, Massachusetts 02108.

Certification

The public health assessment for the General Electric/Housatonic River Site, Pittsfield, Lenox, Lee, Stockbridge, Great Barrington, and Sheffield, Berkshire County, Massachusetts was prepared by the Massachusetts Department of Public 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 this public health assessment was initiated. Editorial review was completed by the Cooperative Agreement partner.

Technical Project Officer, CAT, CAPEB, DHAC

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

Team Leader, CAT, CAPEB, DHAC, ATSDR

Tables 1 - 22

Table 1. Demographic Characteristics of Dalton, Pittsfield, Lenox, Lee, Stockbridge, Great Barrington, and Sheffield (2000 U.S. Census)

Characteristics	Dalton		Pittsfield		Lenox		Lee		Stockbridge		Great Barrington		Sheffield	
	Persons	%	Persons	%	Persons	%	Persons	%	Persons	%	Persons	%	Persons	%
Total Population	6892	100%	45793	100%	5077	100%	5985	100%	2276	100%	7527	100%	3335	100%
Age														
Under 5	388	5.6%	2719	5.9%	176	3.5%	302	5%	75	3.3%	328	4.4%	178	5.3%
5 – 14	1041	15.1%	6072	13.3%	656	12.9%	745	12.4%	210	9.2%	897	11.9%	475	14.2%
15 – 44	2571	37.3%	17924	39.1%	1642	32.3%	2400	40.1%	717	31.5%	2916	38.7%	1245	37.3%
45 – 64	1740	25.2%	10540	23%	1366	26.9%	1535	25.6%	762	33.5%	1937	26.2%	910	27.3%
65 and over	1152	16.7%	8538	18.6%	1237	24.4%	1003	16.8%	512	22.5%	1413	18.8%	527	15.8%
Sex														
Male	3293	47.8%	21765	47.5%	2322	45.7%	2900	48.5%	1086	47.7%	3506	46.6%	1623	48.7%
Female	3599	52.2%	24028	52.5%	2755	54.3%	3085	51.5%	1190	52.3%	4021	53.4%	1712	51.3%
Race														
White	6739	97.8%	42395	92.6%	4903	96.6%	5801	96.9%	2206	96.9%	7131	94.7%	3247	97.4%
Black	35	0.5%	1674	3.7%	66	1.3%	37	0.6%	28	1.2%	157	2.1%	35	1%
American Indian or Alaska Native	8	0.1%	65	0.1%	4	0.1%	9	0.2%	1	0%	12	0.2%	10	0.3%
Asian	49	0.7%	533	1.2%	52	1%	57	1%	10	0.4%	94	1.2%	8	0.2%
Native Hawaiian and Other Pacific Islander	0	0%	20	0%	2	0%	1	0%	1	0%	2	0%	0	0%
Other	30	0.4%	354	0.8%	21	0.4%	44	0.7%	22	1%	53	0.7%	18	0.5%
Multi-race	31	0.5%	752	1.6%	29	0.6%	36	0.6%	8	0.4%	78	1%	17	0.5%
Hispanic or Latino and Race														
Not Hispanic or Latino	6822	99%	44859	98%	4980	98.1%	5836	97.5%	2210	97.1%	7371	97.9%	3291	98.7%
Hispanic or Latino	70	1%	934	2%	97	1.9%	149	2.5%	66	2.9%	156	2.1%	44	1.3%

Table 2. PCBs in surface[1] soils in the Housatonic River floodplain from upstream to downstream.

Sampling Location[2]	Parcel Number	Primary Use	Detects/ Samples	Minimum (mg/kg)	Mean[3] (mg/kg)	Maximum (mg/kg)	Comparison Values (mg/kg)	Comments
Reach 1: Upstream of the GE Facility			3/7	ND(0.05)	0.047	0.080	CREG 0.4	Individual Properties Listed Below
Transect FP1	N/A	Recreational	3/7	ND(0.05)	0.047	0.080	CREG 0.4	
Reach 2 Unkamet Brook to Newell Street			285/289	ND(0.085)	5.55	320	CREG 0.4	Individual Properties Listed Below
Ventura Avenue	K10-10-16 K10-10-17	Residential	2/3	ND(0.15)	0.19	0.27	CREG 0.4	
Commercial Street	K10-10-33	Commercial	37/37	0.13	1.06	5.9	CREG 0.4	
Ventura Avenue	K10-10-12	Commercial	4/4	0.17	0.33	0.55	CREG 0.4	
Ventura Avenue	K10-10-11	Commercial	18/18	0.11	0.91	3.5	CREG 0.4	
Parkside Avenue	K10-16-3	Residential	14/14	0.27	0.87	2.3	CREG 0.4	
Lot Parkside Avenue	K10-16-2	Residential	3/3	0.086	0.12	0.16	CREG 0.4	
Parkside Avenue	J10-4-4 J10-4-5	Residential	34/35	ND(0.085)	2.01	20	CREG 0.4	
Parkside Avenue	J10-4-2 J10-4-3	Residential	33/33	0.26	10.16	121.2	CREG 0.4	
Lot Parkside Avenue	J10-4-1	Residential	43/43	0.061	17.53	320	CREG 0.4	
Fasce Place	K10-15-3	Residential	10/10	0.18	1.06	2.35	CREG 0.4	
Fasce Place	K10-15-1	Residential	3/3	0.14	0.18	0.22	CREG 0.4	
Lot Fasce Place	K10-17-1	Residential	15/15	0.059	0.30	1.2	CREG 0.4	
Fasce Place	K10-17-2	Residential	2/3	ND(0.43)	0.27	0.40	CREG 0.4	
Newell Street	J10-5-1	Residential	50/51	ND(0.13)	6.57	36.1	CREG 0.4	
Lombard Street	J10-5-2	Residential	10/10	0.22	1.3425	4.2	CREG 0.4	
Lombard Street	J10-5-4	Residential	6/6	0.53	1.20	2.18	CREG 0.4	

Sampling Location[2]	Parcel Number	Primary Use	Detects/ Samples	Minimum (mg/kg)	Mean[3] (mg/kg)	Maximum (mg/kg)	Comparison Values (mg/kg)	Comments
Reach 3: Newell Street to Lyman Street			353/366	ND(0.30)	218	21,410	CREG 0.4	Individual Properties Listed Below
Newell Street to Lyman Street	N/A	Mixed Uses	353/366	ND(0.30)	218	21,410	CREG 0.4	EPA Samples Throughout Reach
Reach 4: Lyman Street to Elm Street			1049/1189	ND(0.018)	20.27	1,435	CREG 0.4	Individual Properties Listed Below
Lyman Street to Elm Street	N/A	Mixed Uses	83/93	ND(0.59)	16.32	140 J	CREG 0.4	EPA Samples Throughout Reach
Elm Street to Confluence	N/A	Mixed Uses	702/812	ND(0.018)	19.88	380	CREG 0.4	EPA Samples Throughout Reach
Use Area[4] 1	I9-4-14 I8-24-5	Commercial	8/8	0.66	13.26	47	CREG 0.4	
Root Place	I8-24-3	Residential	2/3	ND(0.12)	0.54	1.42	CREG 0.4	
Demming Street Properties	I7-21-3 I7-21-7 I7-21-8 I8-4-1 I8-4-2 I8-4-3 I8-4-4 I8-4-5 I8-4-7	Residential	80/81	ND(0.1)	42.65	1,435	CREG 0.4	
High Street	I7-19-10	Residential	1/3	ND(0.13)	0.098	0.16	CREG 0.4	
High Street	I7-19-9	Residential	0/3	ND(0.15)	0.74	ND(0.15)	CREG 0.4	
Caledonia Street	I7-19-7	Residential	0/3	ND(0.14)	0.73	ND(0.15)	CREG 0.4	
Use Area 2	I7-2-45	Residential	5/5	1.2	11.7	30	CREG 0.4	
Use Area 3	I7-2-32 I7-2-33	Residential	12/12	2.5	21.12	92	CREG 0.4	
Use Area 4	I7-3-6 17-3-7	Residential	31/31	2.8	38.91	160	CREG 0.4	
Use Area 5	I7-2-25	Residential	4/5	ND(0.05)	10.42	39	CREG 0.4	
Appleton Avenue	I7-3-4	Residential	8/13	ND(0.12)	2.04	18.6	CREG 0.4	
Lowden Street	I7-2-19	Residential	0/3	ND(0.14)	0.074	ND(0.16)	CREG 0.4	
Parcel of Lowden Street	17-2-20	Residential	33/33	1.46	7.99	39.5	CREG 0.4	

Sampling Location[2]	Parcel Number	Primary Use	Detects/ Samples	Minimum (mg/kg)	Mean[3] (mg/kg)	Maximum (mg/kg)	Comparison Values (mg/kg)	Comments
Pomeroy Avenue	I7-2-2 I7-2-3	Residential	18/18	1.2	5.78	16	CREG 0.4	
Use Area 6	I7-2-1	Residential	9/9	0.05	12.84	31	CREG 0.4	
Use Area 7	I7-99-000 I7-3-1	Residential	26/26	0.08	14.29	70	CREG 0.4	
Use Area 8	I7-1-3 I7-1-4	Recreational	3/3	0.44	3.04	8	CREG 0.4	
Use Area 9	I6-1-61 I6-1-62 I6-1-64 I6-1-66 I6-1-67	Residential	24/25	ND(2.2)	14.93	56	CREG 0.4	
Reach 5: Confluence to Woods Pond			1743/2244	ND(0.018)	15.44	874 J	CREG 0.4	Individual Properties Listed Below
Confluence to Woods Pond	N/A	Residential	275/365	ND(0.023)	12.28	163.3	CREG 0.4	EPA Samples Throughout Reach
Confluence to Woods Pond	N/A	Recreational	1017/1304	ND(0.018)	18.11	874 J	CREG 0.4	EPA Samples Throughout Reach
Confluence to Woods Pond	N/A	Commercial	148/190	ND(0.50)	11.78	201 J	CREG 0.4	EPA Samples Throughout Reach
Confluence to Woods Pond	N/A	Agricultural	66/86	ND(0.50)	13	91.3 J	CREG 0.4	EPA Samples Throughout Reach
Transect FP2	N/A	Recreational	18/20	ND(0.047)	31.12	93	CREG 0.4	
Use Area 9	I6-1-1 I6-2-1 I6-3-13 I6-3-1	Residential	6/6	0.54	1.53	3	CREG 0.4	
Use Area 10	J6-2-2	Residential	9/10	ND(0.05)	4.65	19	CREG 0.4	
Holmes Road	J6-3-1	Residential	13/18	ND(0.13)	4.66	52.5	CREG 0.4	
Use Area 11	J5-2-10	Recreational	7/7	0.62	8.22	28	CREG 0.4	
Use Area 12	J6-4-2	Recreational	4/8	ND(0.05)	3.89	25	CREG 0.4	
Transect FP3	N/A	Recreational	13/17	ND(0.023)	4.47	26	CREG 0.4	
School	N/A	Commercial	2/10	ND(0.025)	3.59	29.7	CREG 0.4	

Sampling Location[2]	Parcel Number	Primary Use	Detects/ Samples	Minimum (mg/kg)	Mean[3] (mg/kg)	Maximum (mg/kg)	Comparison Values (mg/kg)	Comments
Holmes Road	J5-2-11	Residential	6/9	ND(0.048)	3.9	28	CREG 0.4	
Transect FP4	N/A	Recreational	14/19	ND(0.05)	19.44	61	CREG 0.4	
Joseph Drive	J3-2-3	Residential	6/9	ND(0.17)	8.73	20.6	CREG 0.4	
Use Area 14	K3-1-19	Recreational	2/3	ND(0.05)	1.01	2.8	CREG 0.4	
Transect FP4A	N/A	Recreational	10/12	ND(0.046)	6.68	27	CREG 0.4	
Use Area 15B	34-1	Commercial	3/3	0.07	7.36	12	CREG 0.4	
Transect FP5	N/A	Recreational	14/18	ND(0.048)	20.85	230	CREG 0.4	
Use Area 15C	29-3	Recreational	½	ND(0.05)	0.56	1.1	CREG 0.4	
New Lenox Road	29-5	Residential	2/3	ND(0.05)	0.24	0.42	CREG 0.4	
Transect FP6	N/A	Recreational	4/5	ND(0.05)	14.04	39	CREG 0.4	
Use Area 17 (Farm)	29-1	Residential	44/52	ND(0.05)	11.17	64	CREG 0.4	
Transect FP6A	N/A	Recreational	9/12	0.029	14.69	71	CREG 0.4	
Transect FP7	N/A	Recreational	16/19	ND(0.05)	13.19	75	CREG 0.4	
Ecosystem Assessment Areas	N/A	Recreational	23/23	0.034 J	6.06	32	CREG 0.4	
Transect FP7A	N/A	Recreational	8/11	0.0245	3.88	16	CREG 0.4	
Use Area 18	1-3	Recreational	3/3	0.08	0.52	1.2	CREG 0.4	
Reach 6: Woods Pond			80/106	ND(0.0169)	17.81	321 J	CREG 0.4	Individual Properties Listed Below
Woods Pond	N/A	Residential	26/31	ND(0.044)	27.14	321 J	CREG 0.4	EPA Samples Throughout Reach
Woods Pond	N/A	Recreational	46/60	ND(0.017)	16.73	102 J	CREG 0.4	EPA Samples Throughout Reach
Woods Pond	N/A	Commercial	1/4	ND(0.05)	0.52	0.85 J	CREG 0.4	EPA Samples Throughout Reach
Use Area 19 & 20	1-1	Recreational	3/3	0.05	0.66	1.4	CREG 0.4	
Use Area 21	9-6	Recreational	3/5	ND(0.05)	7.59	20	CREG 0.4	
Use Area 22	9-17	Residential	1/3	ND(0.05)	0.20	0.54	CREG 0.4	

Sampling Location[2]	Parcel Number	Primary Use	Detects/ Samples	Minimum (mg/kg)	Mean[3] (mg/kg)	Maximum (mg/kg)	Comparison Values (mg/kg)	Comments
Reach 7: Woods Pond Dam to Rising Pond			485/633	ND(0.018)	2.24	33.4	CREG 0.4	Individual Properties Listed Below
Woods Pond Dam to Rising Pond	N/A	Mixed Uses	421/544	ND(0.018)	2.08	31.7	CREG 0.4	EPA Samples Throughout Reach
Transect FP8	N/A	Recreational	6/10	ND(0.05)	0.87	4	CREG 0.4	
Bradley Street	8-38	Residential	6/10	ND(0.13)	1.79	6.87	CREG 0.4	
Golden Hill Road	8-48	Residential	16/16	1.90	11.02	33.4	CREG 0.4	
Transect FP8A	N/A	Recreational	8/11	ND(0.045)	2.53	13	CREG 0.4	
Transect F9	N/A	Recreational	7/10	ND(0.05)	0.47	1.4	CREG 0.4	
Transect FP9A	N/A	Recreational	7/10	ND(0.051)	0.69	1.7	CREG 0.4	
Transect FP9B	N/A	Recreational	8/9	ND(0.069)	2.55	6.1	CREG 0.4	
Transect FP9C	N/A	Recreational	6/13	ND(0.05)	1.30	7.6	CREG 0.4	
Reach 8: Rising Pond			20/26	ND(0.043)	1.15	6 J	CREG 0.4	Individual Properties Listed Below
Rising Pond	N/A	Mixed Uses	13/16	ND(0.50)	1.54	6 J	CREG 0.4	EPA Samples Throughout Reach
Transect FP9D	N/A	Recreational	7/10	ND(0.043)	0.52	4.2	CREG 0.4	
Reach 9: Rising Pond Dam to Connecticut Border			100/155	ND(0.044)	0.40	1.7	CREG 0.4	Individual Properties Listed Below
Rising Pond Dam to Connecticut Border	N/A	Mixed Uses	64/103	ND(0.019)	0.45	1.66	CREG 0.4	EPA Samples Throughout Reach
Transect FP10	N/A	Recreational	8/13	ND(0.05)	0.22	0.8	CREG 0.4	
Transect FP10A	N/A	Recreational	4/4	0.13	0.54	1.1	CREG 0.4	
Transect FP10B	N/A	Recreational	2/4	ND(0.044)	0.30	0.65	CREG 0.4	
Transect FP10C	N/A	Recreational	¾	ND(0.055)	0.30	0.63	CREG 0.4	
Transect FP10D	N/A	Recreational	10/14	ND(0.057)	0.45	1.7	CREG 0.4	
Transect FP11	N/A	Recreational	9/13	ND(0.05)	0.11	0.3	CREG 0.4	

Key
ND(0.05) = Not Detected (lowest Method Detection Limit).
N/A = Not Available.
J = Estimated.
mg/kg = milligrams per kilogram.
CREG = ATSDR Cancer Risk Evaluation Guide (corresponds to a 1/1,000,000 excess lifetime cancer risk).

Notes
1. This table summarizes PCB data for samples taken from a depth of 0 – 0.5 ft. or from the top segment of the soil core.
2. The samples summarized in this table were taken prior to any remediation action.
3. Samples in which PCBs were below detection were assumed to have a concentration of one-half the method detection limit for the calculation of means. Duplicate samples were averaged before being entered into the database.

Table 3. Summary of contaminants of concern other than PCBs[1] in surface[2] soils in the Housatonic River floodplain

River Reach	Compound	Detects/Samples	Minimum (mg/kg)[4]	Mean[3] (mg/kg)[4]	Maximum (mg/kg)[4]	Comparison Value (mg/kg)	Background Concentrations
Reach 1	Benzo(a)pyrene	3/3	0.47	0.67	0.78	CREG 0.1	0.165 – 0.220
Reach 1	Dibenzo(a,h)anthracene	3/3	0.12	0.17	0.2	CREG* 0.1	N/A
Reach 1	2,3,7,8-TCDD	3/3	6.9E-07	8.2E-07	9.3E-07	Child Chronic EMEG 5.0E-05 Adult Chronic EMEG 7.0E-04 Child Intermediate EMEG 0.001 Adult Intermediate EMEG 0.01	1.0E-06 – 1.0E-05
Reach 1	Dioxin TEQ (MA DEP)[5]	3/3	3.1E-05	6.9E-05	1.4E-04	Child Chronic EMEG 5.0E-05 Adult Chronic EMEG 7.0E-04 Child Intermediate EMEG 0.001 Adult Intermediate EMEG 0.01	1.0E-06 – 1.0E-05
Reach 1	Tin	5/7	ND (1.1)	16.6	22	N/A	0.1 – 10
Reach 3	4,4-DDE	7/54	ND(0.01045)	34.52	150 J	CREG 2	N/A
Reach 3	Dieldrin	3/36	ND(0.0021)	0.20	0.37	CREG 0.04 Child Chronic EMEG 3 Adult Chronic EMEG 40 Child Intermediate EMEG 5 Adult Intermediate EMEG 70 Child RMEG 3 Adult RMEG 40	N/A
Reach 3	Benzo(a)anthracene	62/62	0.034	1.64	26	CREG* 1	0.169 - 59
Reach 3	Benzo(a)pyrene	62/62	0.039	1.64	22	CREG 0.1	0.165 – 0.220
Reach 3	Benzo(b)fluoranthene	62/62	0.044	1.79	22	CREG* 1	15 – 62
Reach 3	Benzo(k)fluoranthene	62/62	0.04	1.90	22	CREG* 10	0.3 - 26

River Reach	Compound	Detects/Samples	Minimum (mg/kg)[4]	Mean[3] (mg/kg)[4]	Maximum (mg/kg)[4]	Comparison Value (mg/kg)	Background Concentrations
Reach 3	Dibenz(a,h)anthracene	56/62	ND(0.345)	0.40	5.2 J	CREG* 0.1	N/A
Reach 3	Hexachlorobenzene	3/47	ND(0.34)	0.50	1.16	CREG 0.4 Child Chronic EMEG 3 Adult Chronic EMEG 40 Child Intermediate EMEG 5 Adult Intermediate EMEG 70 Child RMEG 40 Adult RMEG 600	N/A
Reach 3	Indeno(1,2,3-cd)pyrene	62/62	ND(0.345)	1.03	14	CREG* 1	8 – 61
Reach 3	2,3,7,8 TCDD	0/8	ND(3.54E-05)	NC	ND(6.1E-05)	Child Chronic EMEG 5.0E-05 Adult Chronic EMEG 7.0E-04 Child Intermediate EMEG 0.001 Adult Intermediate EMEG 0.01	1.0E-06 – 1.0E-05
Reach 3	Dioxin TEQ (MA DEP)[5]	8/8	3.35E-06	1.10E-04	3.30E-04	Child Chronic EMEG 5.0E-05 Adult Chronic EMEG 7.0E-04 Child Intermediate EMEG 0.001 Adult Intermediate EMEG 0.01	1.0E-06 – 1.0E-05
Reach 3	Dioxin TEQ (WHO)[5]	50/50	5.6E-06	7.84E-05	2.10E-04	Child Chronic EMEG 5.0E-05 Adult Chronic EMEG 7.0E-04 Child Intermediate EMEG 0.001 Adult Intermediate EMEG 0.01	1.0E-06 – 1.0E-05
Reach 3	Copper	62/62	10.1	155.1	2,820	2000 Child Intermediate EMEG Adult Intermediate EMEG 20000	1 – 700

River Reach	Compound	Detects/Samples	Minimum (mg/kg)[4]	Mean[3] (mg/kg)[4]	Maximum (mg/kg)[4]	Comparison Value (mg/kg)	Background Concentrations
Reach 3	Lead	62/62	9.2	164.5	2,020	N/A	10 – 300
Reach 3	Mercury	61/62	ND(0.1)	0.49	12.5	N/A	0.1 – 3.4
Reach 3	Tin	54/62	ND(0.38)	18.57	154.5	N/A	0.1 – 10
Reaches 5 & 6	Benzo(a)anthracene	96/106	ND	0.69	12	CREG* 1	0.169 – 59
Reaches 5 & 6	Benzo(a)pyrene	93/106	ND	0.72	11	CREG 0.1	0.165 – 0.220
Reaches 5 & 6	Benzo(b)flouranthene	97/106	ND	0.79	11	CREG* 1	15 – 62
Reaches 5 & 6	Benzo(k)flouranthene	96/106	ND	0.71	13	CREG* 1	0.300 – 26
Reaches 5 & 6	Dibenzo(a,h)anthracene	69/105	ND	0.23	0.94	CREG* 0.02	N/A
Reaches 5 & 6	Indeno(1,2,3-C,D)Pyrene	94/106	ND	0.38	3.84	CREG* 1	8 – 61
Reaches 5 & 6	4,4'-DDE	12/110	ND	0.29	2	CREG 2	N/A
Reaches 5 & 6	4,4'-DDT	10/85	ND	0.27	2.8	CREG 2	N/A

Key

ND(0.05) = Not Detected (lowest Method Detection Limit).
N/A = Not Available.
J = Estimated Value.
mg/kg = milligrams per kilogram.
CREG = ATSDR Cancer Risk Evaluation Guide (corresponds to a 1/1,000,000 excess lifetime cancer risk).
CREG* = Estimated CREG using toxicity equivalence factors relative to benzo(a)pyrene developed by USEPA.
EMEG = ATSDR Environmental Media Evaluation Guide for chronic exposures.
TCDD – Tetrachlorodibenzodioxin
DDT = 1,1,1-trichloro-2,2-bis[p-chlorophenyl]ethane.
DDE = 1,1-dichloro-2,2-bis[p-chlorophenyl]ethylene.

Notes

1. The source data tables from which this table was derived contains results for "appendix IX+3" Compounds, which include volatile organic compounds, semi-volatile organic compounds, and inorganics. The full list of target compounds is in Appendix IX of 40 CFR 264 plus benzidine, 2-chloroethylvinylether, and 1,2-diphenylhydrazine. The compounds listed in table 5 are those that were detected at concentrations higher than the health-based screening value or did not have screening values. For inorganic compounds, the compound was included if the measured concentrations were higher than typical background ranges for soils in the eastern United States from Shacklette and Boerngen (1984).
2. This table summarizes PCB data for samples taken from a depth of 0 – 0.5 ft. or from the top segment of the soil core.
3. It was not possible to use the detection limits for non-detected samples to calculate a mean value because some method detection limits were much higher than detected concentrations. Duplicate samples were averaged before being entered into the database.
4. All concentrations are reported in parts per million (mg/kg) unless otherwise noted.
5. Seventeen of the 210 dioxin compounds are considered to have dioxin-like toxicity. One of the most toxic of these is 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). The toxicity of all the 17 dioxin-like compounds combined is expressed as the dioxin toxicity

equivalent (TEQ). Because it is based on the relative toxicity of each compound with respect to 2,3,7,8-TCDD, the dioxin TEQ can be compared with health-based screening levels established for 2,3,7,8-TCDD. Therefore, on this table, the levels of dioxin in environmental samples are shown as the concentrations of 2,3,7,8-TCDD and dioxin TEQ.

Table 4. Summary of PCBs in sub-surface[1] soils in the Housatonic River floodplain from upstream to downstream.

Sampling Location[2]	Detects/ Samples	Minimum (mg/kg)	Maximum (mg/kg)	Maximum Depth	Maximum Location	Comparison Values (mg/kg)
Reach 1: Upstream of the GE Facility	4/7	ND(0.05)	0.1	0.5 – 1 ft.	Transect FP1	CREG 0.4
Reach 2: Unkamet Brook to Newell Street	502/777	ND(0.023)	640	4 – 6 ft.	J10-4-2, J10-4-3	CREG 0.4
Reach 3: Newell Street to Lyman Street	777/845	ND(0.017)	17,000	2 – 2.5 ft.	EPA Sample	CREG 0.4
Reach 4: Lyman Street to Confluence	1699/2197	ND(0.018)	1,835	0.5 – 1 ft.	Deming St. Properties	CREG 0.4
Reach 5: Confluence to Woods Pond	961/1533	ND(0.018)	907 J	2 – 2.5 ft.	EPA Recreational Sample	CREG 0.4
Reach 6: Woods Pond	35/78	ND(0.02)	137	1 – 1.5 ft.	EPA Recreational Sample	CREG 0.4
Reach 7: Woods Pond Dam to Rising Pond	466/816	ND(0.017)	28.9	0.5 - 1 ft.	8-48	CREG 0.4
Reach 8: Rising Pond	16/27	ND(0.041)	3.9	0.5 – 1 ft.	EPA Mixed Uses Sample	CREG 0.4
Reach 9: Rising Pond Dam to Connecticut Border	85/167	ND(0.018)	6.32 J	0.5 - 1 ft.	EPA Mixed Uses Sample	CREG 0.4

Key
ND(0.05) = Not Detected (lowest Method Detection Limit).
N/A = Not Available.
mg/kg = milligrams per kilogram.
CREG = ATSDR Cancer Risk Evaluation Guide (corresponds to a 1/1,000,000 excess lifetime cancer risk).

Notes
1. This table summarizes PCB data for samples taken generally from depth of 0.5 – 4 ft.
2. The samples summarized in this table were taken prior to any remediation action.

Table 5. Summary of contaminants of concern other than PCBs[1] in subsurface[2] soils in the Housatonic River floodplain

River Reach	Compound	Detects/Samples	Minimum (mg/kg)	Maximum (mg/kg)	Maximum Depth	Comparison Value (mg/kg)	Background Concentrations
Reach 3	4,4-DDE	5/48	ND(0.017)	24	2 – 2.5 ft.	CREG 2	N/A
Reach 3	Dieldrin	4/43	ND(0.003)	6.05	1 – 1.5 ft.	CREG 0.04 Child Chronic EMEG 3 Adult Chronic EMEG 40 Child Intermediate EMEG 5 Adult Intermediate EMEG 70 Child RMEG 3 Adult RMEG 40	N/A
Reach 3	Heptachlor Epoxide	1/10	ND(0.0019)	0.22 J	1 – 1.5 ft.	CREG 0.08 Child RMEG 0.7 Adult RMEG 9	N/A
Reach 3	Kepone	½	ND(0.049)	0.023 J	1 – 1.5 ft.	Cancer RBC 0.08	N/A
Reach 3	Benzo(a)anthracene	51/59	ND(0.34)	6.2 J	1 – 1.5 ft.	CREG* 1	0.169 – 59
Reach 3	Benzo(a)pyrene	51/59	ND(0.34)	5.1 J	1 – 1.5 ft.	CREG 0.1	0.165 – 0.220
Reach 3	Benzo(b)fluoranthene	52/59	ND(0.34)	4.4	1 – 1.5 ft.	CREG* 1	15 – 62
Reach 3	Dibenz(a,h)anthracene	39/59	ND(0.34)	0.92	1 – 1.5 ft.	CREG* 0.1	N/A
Reach 3	Ideno(1,2,3-cd)pyrene	52/60	ND(0.34)	3 J	1 – 1.5 ft.	CREG* 1	8 – 61
Reach 3	Antimony	29/46	ND(0.84)	25.1	2 – 2.5 ft.	Child RMEG 20 Adult RMEG 300	1 – 8.8
Reach 3	Cadmium	31/59	ND(0.03)	22.25	1 – 1.5 ft.	Child Chronic EMEG 10 Adult Chronic EMEG 100 Child RMEG 50 Adult RMEG 700	N/A
Reach 3	Chromium	59/59	4.8	210	2 – 2.5 ft.	Child RMEG (Cr(VI)) 200 Adult RMEG (Cr(VI)) 2000	N/A

River Reach	Compound	Detects/Samples	Minimum (mg/kg)	Maximum (mg/kg)	Maximum Depth	Comparison Value (mg/kg)	Background Concentrations
Reach 3	Copper	59/59	11.5	30,300	1 – 1.5 ft.	Child Intermediate EMEG 2000 Adult Intermediate EMEG 20000	1 – 700
Reach 3	Lead	59/59	8.9	10,473	1 – 1.5 ft.	N/A	10 – 300
Reach 3	Tin	59/59	ND(0.043)	1,630	1 – 1.5 ft.	N/A	0.1 - 10

Key

ND(0.05) = Not Detected (lowest Method Detection Limit).
N/A = Not Available.
J = Estimated Value.
mg/kg = milligrams per kilogram.
CREG = ATSDR Cancer Risk Evaluation Guide (corresponds to a 1/1,000,000 excess lifetime cancer risk).
CREG* = Estimated CREG using toxicity equivalence factors relative to benzo(a)pyrene developed by USEPA.
EMEG = ATSDR Environmental Media Evaluation Guide for chronic exposures.
RMEG = ATSDR Reference Dose Media Evaluation Guide for chronic exposures.
DDE = 1,1-dichloro-2,2-bis[p-chlorophenyl]ethylene.

Notes

1. The source data tables from which this table was derived contains results for "appendix IX+3" Compounds, which include volatile organic compounds, semi-volatile organic compounds, and inorganics. The full list of target compounds is in Appendix IX of 40 CFR 264 plus benzidine, 2-chloroethylvinylether, and 1,2-diphenylhydrazine. The compounds listed in table 6 are those that were detected at concentrations higher than the health-based screening value or did not have screening values. For inorganic compounds, the compound was included if the measured concentrations were higher than typical background ranges for soils in the eastern United States from Shacklette and Boerngen (1984).
2. This table summarizes data taken generally from depths of 0.5 – 4 ft.

Table 6. Summary of PCBs in surface[1] sediments of the Housatonic River

River Reach	Detects/ Samples	Minimum (mg/kg)	Mean[2] (mg/kg)	Maximum (mg/kg)	Comparison Value (mg/kg)
Reach 1: Upstream of the GE Facility	15/68	ND(0.019)	0.23	1	CREG 0.4
Reach 2: Unkamet Brook to Newell Street	13/187	ND(0.50)	0.33	1.38 J	CREG 0.4
Reach 3[3]: Newell Street to Lyman Street Before Building 68 Dredging	215/280	ND(0.2)	372.2	20,200	CREG 0.4
Reach 3: Newell Street to Lyman Street After Building 68 Dredging	186/280	ND(0.13)	59.46	9,411	CREG 0.4
Reach 4: Lyman Street to Confluence	479/518	ND(0.50)	27.04	510	CREG 0.4
Reach 5: Confluence to Woods Pond	971/1059	ND(0.19)	19.30	522 J	CREG 0.4
Reach 6: Woods Pond	284/294	ND(0.50)	39.13	379 J	CREG 0.4
Reach 7: Woods Pond to Rising Pond	132/194	ND(0.50)	6.63	210	CREG 0.4
Reach 8: Rising Pond	35/38	ND(0.5)	4.15	26	CREG 0.4
Reach 9: Rising Pond Dam to the Connecticut Border	53/88	ND(0.02)	0.50	2.8	CREG 0.4

Key
ND(0.05) = Not Detected (lowest Method Detection Limit).
J = Estimated Value.
mg/kg = milligrams per kilogram.
CREG = ATSDR Cancer Risk Evaluation Guide (corresponds to a 1/1,000,000 excess lifetime cancer risk).

Notes
1. This table contains data for samples from 0 – 0.5 ft. or the top segment of sediment cores. For sediment cores in which the top six inches of sediment was divided into more than one section, the PCB concentrations for all the sections completely within the top six inches of sediment were combined using a weighted average.
2. Samples in which PCBs were below detection were assumed to have a concentration of one-half the method detection limit for the calculation of means. Duplicate samples were averaged before being entered into the database.
3. This table distinguishes Reach 3, and all of Reach 3 for the period before and during the building 68 dredging, and the period after the building 68 area dredging. Dredging took place from 6/1997 – 11/997, according to documentation and Dean Taglaifero of the USEPA.

Table 7. Summary of contaminants of concern other than PCBs[1] in surface[2] sediments of the Housatonic River

River Reach	Compound	Detects/ Samples	Minimum (mg/kg)[4]	Mean[3] (mg/kg)[4]	Maximum (mg/kg)[4]	Comparison Value (mg/kg)	Background Concentrations
Reach 1	Benzo(a)pyrene	2/4	ND(4.0)	0.41	0.54 J	CREG 0.1	N/A
Reach 1	Dbenz(a,h)anthracene	¼	ND(0.89)	0.16	0.16 J	CREG* 0.1	N/A
Reach 1	2,3,7,8 TCDD	3/8	ND(1.1E-07)	4.6E-06	9.0E-06	Child Chronic EMEG 5.0E-05 Adult Chronic EMEG 7.0E-04 Child Intermediate EMEG 0.001 Adult Intermediate EMEG 0.01	N/A
Reach 1	Dioxin TEQ[5] (MA DEP)	6/8	ND	1.10E-04	3.55E-04	Child Chronic EMEG 5.0E-05 Adult Chronic EMEG 7.0E-04 Child Intermediate EMEG 0.001 Adult Intermediate EMEG 0.01	N/A
Reach 1	Tin	4/8	ND(2)	13.45	19.4	N/A	0.1 – 10

River Reach	Compound	Detects/ Samples	Minimum (mg/kg)[4]	Mean[3] (mg/kg)[4]	Maximum (mg/kg)[4]	Comparison Value (mg/kg)	Background Concentrations
Reach 3	Dieldrin	2/13	ND(0.0079)	0.15	0.23 J	CREG 0.04 Child Chronic EMEG 3 Adult Chronic EMEG 40 Child Intermediate EMEG 5 Adult Intermediate EMEG 70 Child RMEG 3 Adult RMEG 40	N/A
Reach 3	Kepone	¼	ND(0.0415)	420	420 J	N/A	N/A
Reach 3	Benzo(a)anthracene	21/28	ND(0.52)	0.39	2.2 J	CREG* 1	0.169 – 59
Reach 3	Benzo(a)pyrene	22/28	ND(0.81)	0.37	2 J	CREG 0.1	0.165 – 0.220
Reach 3	Benzo(b)fluoranthene	22/28	ND(0.81)	0.30	1.5 J	CREG* 1	15 – 62
Reach 3	Dibenz(a,h)anthracene	8/28	ND(0.38)	0.080	0.16 J	CREG* 0.1	N/A
Reach 3	Hexachlorobenzene	2/14	ND(0.38)	1.04	2 J	CREG 0.4 Child Chronic EMEG 3 Adult Chronic EMEG 40 Child Intermediate EMEG 5 Adult Intermediate EMEG 70 Child RMEG 40 Adult RMEG 600	N/A
Reach 3	3-nitroaniline	1/14	ND(3.9)	8	8 J	N/A	N/A

River Reach	Compound	Detects/ Samples	Minimum (mg/kg)[4]	Mean[3] (mg/kg)[4]	Maximum (mg/kg)[4]	Comparison Value (mg/kg)	Background Concentrations
Reach 3	Pentachlorobenzene	5/28	ND(0.38)	10.73	50	Child RMEG 40 Adult RMEG 600	N/A
Reach 3	Dioxin TEQ[5] (MA DEP)	9/14	ND	2.30E-04	1.77E-03	Child Chronic EMEG 5.0E-05 Adult Chronic EMEG 7.0E-04 Child Intermediate EMEG 0.001 Adult Intermediate EMEG 0.01	1.0E-06 – 1.0E-05
Reach 3	Dioxin TEQ[5] (WHO)	15/15	2.5E-07	9.65E-05	9.60E-04	Child Chronic EMEG 5.0E-05 Adult Chronic EMEG 7.0E-04 Child Intermediate EMEG 0.001 Adult Intermediate EMEG 0.01	1.0E-06 – 1.0E-05
Reach 3	Lead	28/28	5.5	1,692	30,871 J	N/A	10 – 300
Reach 3	Thallium	4/14	ND(0.55)	80.89	320.29	Non-Cancer RBC 5.5	2.2 – 23
Reach 3	Tin	20/28	ND(2)	354.2	7,000	N/A	0.1 – 10
Reaches 5 & 6	4-Methylphenol	11/58	ND	NC	0.88	Non-Cancer RBC 390	N/A
Reaches 5 & 6	Methapyrilene	1/57	ND	NC	0.82	N/A	N/A
Reaches 5 & 6	Benzo(a)anthracene	52/58	ND	NC	20	CREG 1*	0.169 – 59
Reaches 5 & 6	Benzo(a)pyrene	48/57	ND	NC	15	CREG 0.1	0.165 – 0.220

River Reach	Compound	Detects/ Samples	Minimum (mg/kg)[4]	Mean[3] (mg/kg)[4]	Maximum (mg/kg)[4]	Comparison Value (mg/kg)	Background Concentrations
Reaches 5 & 6	Benzo(b)flouranthene	51/58	ND	NC	14	CREG 1*	15 – 62
Reaches 5 & 6	Benzo(k)flouranthene	51/58	ND	NC	12	CREG 1*	0.300 – 26
Reaches 5 & 6	Chrysene	53/59	ND	NC	14	CREG 10*	0.251 - 0.640
Reaches 5 & 6	Dibenzo(a,h)anthracene	36/56	ND	NC	2.3	CREG 0.02*	N/A
Reaches 5 & 6	Ideno(1,2,3-C,D)pyrene	51/58	ND	NC	5	CREG 1*	8 – 61
Reaches 5 & 6	Arsenic	54/59	ND	NC	14.4	CREG 0.5 Child Chronic EMEG 20 Child RMEG 20 Adult Chronic EMEG 200 Adult RMEG 200	0.1 – 73
Reaches 5 & 6	Chromium	60/60	5.3	NC	382	Child RMEG 200 Adult RMEG 2000	1 – 1000
Reaches 5 & 6	Lead	60/60	4.0	NC	303	N/A	10 - 300
Reaches 5 & 6	Thallium	32/58	ND	NC	7.9	Non-Cancer RBC 5.5	2.2 – 23
Reaches 5 & 6	Sulfide	22/50	ND	NC	447	Non-Cancer RBC 230	N/A
Reach 8	Dioxin TEQ[5] (MA DEP)	½	ND	5.4E-05	5.5E-05	Child Chronic EMEG 5.0E-05 Adult Chronic EMEG 7.0E-04 Child Intermediate EMEG 0.001 Adult Intermediate EMEG 0.01	1.0E-06 – 1.0E-05

River Reach	Compound	Detects/ Samples	Minimum (mg/kg)[4]	Mean[3] (mg/kg)[4]	Maximum (mg/kg)[4]	Comparison Value (mg/kg)	Background Concentrations
Reach 8	Tin	2/2	3	6.5	10	N/A	0.1 – 10

Key
ND(0.05) = Not Detected (lowest Method Detection Limit).
N/A = Not Available.
J = Estimated Value.
mg/kg = milligrams per kilogram.
CREG = ATSDR Cancer Risk Evaluation Guide (corresponds to a 1/1,000,000 excess lifetime cancer risk).
CREG* = Estimated CREG using toxicity equivalence factors relative to benzo[a]pyrene developed by USEPA.
EMEG = ATSDR Environmental Media Evaluation Guide for chronic exposures.

Notes
1. The source data tables from which this table was derived contains results for "appendix IX+3" Compounds, which include volatile organic compounds, semi-volatile organic compounds, and inorganics. The full list of target compounds is in Appendix IX of 40 CFR 264 plus benzidine, 2-chloroethylvinylether, and 1,2-diphenylhydrazine. The compounds listed in table 9 are those that were detected at concentrations higher than the health-based screening value or did not have screening values. For inorganic compounds, the compound was included if the measured concentrations were higher than typical background ranges for soils in the eastern United States from Shacklette and Boerngen (1984).
2. This table summarizes data for samples taken from a depth of 0 – 0.5 ft. or from the top segment of the soil core.
3. It was not possible to use the detection limits for non-detected samples to calculate a mean value because some method detection limits were much higher than detected concentrations. Duplicate samples were averaged before being entered into the database.
4. All concentrations are shown in parts per million (mg/kg) unless otherwise noted.
5. Seventeen of the 210 dioxin compounds are considered to have dioxin-like toxicity. One of the most toxic of these is 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). The toxicity of all the 17 dioxin-like compounds combined is expressed as the dioxin toxicity equivalent (TEQ). Because it is based on the relative toxicity of each compound with respect to 2,3,7,8-TCDD, the dioxin TEQ can be compared with health-based screening levels established for 2,3,7,8-TCDD. Therefore, on this table, the levels of dioxin in environmental samples are shown as the concentrations of 2,3,7,8-TCDD and dioxin TEQ.

Table 8. Summary of PCBs in subsurface[1] sediments of the Housatonic River

River Reach	Detects/ Samples	Minimum (mg/kg)	Maximum (mg/kg)	Maximum Depth	Comparison Value (mg/kg)
Reach 1: Upstream of the GE Facility	5/100	ND(0.021)	1.80	1 – 1.5 ft.	CREG 0.4
Reach 2: Unkamet Brook to Newell Street	20/343	ND(0.045)	6	2.5 – 3 ft.	CREG 0.4
Reach 3[2]: Newell Street to Lyman Street Before Building 68 Dredging	334/529	ND(0.05)	54,000	3 – 3.5 ft.	CREG 0.4
Reach 3: Newell Street to Lyman Street After Building 68 Dredging	251/435	ND(0.05)	5,756	2 – 2.5 ft.	CREG 0.4
Reach 4: Lyman Street to Confluence	1004/1470	ND(0.047)	677	1 - 1.5 ft.	CREG 0.4
Reach 5: Confluence to Woods Pond	1021/1243	ND(0.023)	2,270	1.33 - 1.67 ft.	CREG 0.4
Reach 6: Woods Pond	590/757	ND(0.021)	383	0.67 - 1 ft.	CREG 0.4
Reach 7: Woods Pond to Rising Pond	198/263	ND(0.5)	90	0.5 - 1 ft.	CREG 0.4
Reach 8: Rising Pond	117/143	ND(0.5)	51 J	6 - 6.5 ft.	CREG 0.4
Reach 9: Rising Pond Dam to the Connecticut Border	34/41	ND(0.05)	1.70	0.5 – 1 ft.	CREG 0.4

Key
ND(0.05) = Not Detected (lowest Method Detection Limit).
mg/kg = milligrams per kilogram.
CREG = ATSDR Cancer Risk Evaluation Guide (corresponds to a 1/1,000,000 excess lifetime cancer risk).

Notes
1. This table contains data for samples taken generally from 0.5 – 4 ft.
2. This table distinguishes Reach 2b, and all of Reach 2 for the period before and during the building 68 dredging, and the period after the building 68 area dredging. Dredging took place for 7/1997 – 11/997, according to documentation and Dean Taglaifero of the USEPA.

Table 9. Summary of Contaminants of Concern other than PCBs[1] in subsurface[2] sediments of the Housatonic River

River Reach	Compound	Detects/ Samples	Minimum (mg/kg)	Maximum (mg/kg)	Maximum Depth	Comparison Value (mg/kg)	Background Concentrations
Reach 3	Beta-HCH	3/39	ND(0.002)	0.026 J	1.5 – 2 ft.	Cancer RBC 0.35	N/A
Reach 3	4, 4 – DDT	1/33	ND(0.004)	2 J	0.5 – 1 ft.	CREG 2 Child Intermediate EMEG 30 Adult Intermediate EMEG 400 Child RMEG 30 Adult RMEG 400	N/A
Reach 3	Dieldrin	2/34	ND(0.004)	1.8 J	0.5 – 1 ft.	CREG 0.04 Child Chronic EMEG 3 Adult Chronic EMEG 40 Child Intermediate EMEG 5 Adult Intermediate EMEG 70 Child RMEG 3 Adult RMEG 40	N/A
Reach 3	Heptachlor Epoxide	4/39	ND(0.002)	0.87 J	0.5 – 1 ft.	CREG 0.08 Child RMEG 0.7 Adult RMEG 9	N/A
Reach 3	Kepone	2/3	ND(0.003)	0.39 J	0.5 – 1 ft	Cancer RBC 0.08	N/A
Reach 3	Benzo(a)anthracene	32/41	ND(0.37)	28	0.5 – 1 ft	CREG* 1	0.169 – 59
Reach 3	Benzo(a)pyrene	32/41	ND(0.37)	27	0.5 – 1 ft	CREG 0.1	0.165 – 0.220
Reach 3	Benzo(b)fluoranthene	32/41	ND(0.37)	13 J	0.5 – 1 ft	CREG* 1	15 – 62
Reach 3	Benzo(k)fluoranthene	32/41	ND(0.37)	15 J	0.5 – 1 ft.	CREG* 10	0.300 – 26
Reach 3	Dibenz(a,h)anthracene	22/41	ND(0.37)	3.8 J	0.5 – 1 ft.	CREG* 0.1	N/A

River Reach	Compound	Detects/ Samples	Minimum (mg/kg)	Maximum (mg/kg)	Maximum Depth	Comparison Value (mg/kg)	Background Concentrations
Reach 3	7, 12 - Dimethylbenz(a)anthracene	1/39	ND(0.36)	0.34 J	1 – 1.5 ft.	N/A	N/A
Reach 3	Ideno(1,2,3-cd)pyrene	29/39	ND(0.37)	13 J	0.5 – 1 ft.	CREG* 1	8 – 61
Reach 3	Hexachlorobenzene	5/37	ND(0.37)	2.6 J	1 – 1.5 ft.	CREG 0.4 Child Chronic EMEG 3 Adult Chronic EMEG 40 Child Intermediate EMEG 5 Adult Intermediate EMEG 70 Child RMEG 40 Adult RMEG 600	N/A
Reach 3	Pentachlorobenzene	8/39	ND(0.38)	77.5 J	1 - 1.5 ft.	Child RMEG 40 Adult RMEG 600	N/A
Reach 3	1,2,4,5 – Tetrachlorobenzene	8/39	ND(0.37)	63 J	1 – 1.5 ft.	Child RMEG 20 Adult RMEG 200	N/A
	1,2,4 – Trichlorobenzene	27/753	ND(0.005)	1,972	2 – 2.5 ft.	Child RMEG 500 Adult RMEG 7000	N/A
Reach 3	Dioxin TEQ[3] (MA DEP)	2/2	9.10E-04	2.89E-03	2 – 8 in.	Child Chronic EMEG 5.0E-05 Adult Chronic EMEG 7.0E-04 Child Intermediate EMEG 0.001 Adult Intermediate EMEG 0.01	1.0E-06 – 1.0E-05
Reach 3	Dioxin TEQ[3] (WHO)	38/39	ND(2.3E-08)	6.23E-03	1.5 – 2 ft.	Child Chronic EMEG 5.0E-05 Adult Chronic EMEG 7.0E-04 Child Intermediate EMEG 0.001 Adult Intermediate EMEG 0.01	1.0E-06 – 1.0E-05

River Reach	Compound	Detects/ Samples	Minimum (mg/kg)	Maximum (mg/kg)	Maximum Depth	Comparison Value (mg/kg)	Background Concentrations
Reach 3	Copper	39/39	4.1	1,800	0.5 – 1 ft.	Child Intermediate EMEG 2000 Adult Intermediate EMEG 20000	1 – 700
Reach 3	Lead	39/39	2.3	1,910 J	0.5 – 1 ft.	N/A	10 – 300
Reach 3	Tin	39/42	ND(0.54)	169	1.5 – 2 ft.	N/A	0.1 – 10

Key

ND(0.05) = Not Detected (lowest Method Detection Limit).
N/A = Not Available.
J = Estimated Value.
mg/kg = milligrams per kilogram.
CREG = ATSDR Cancer Risk Evaluation Guide (corresponds to a 1/1,000,000 excess lifetime cancer risk).
CREG* = Estimated CREG using toxicity equivalence factors relative to benzo[a]pyrene developed by USEPA.
EMEG = ATSDR Environmental Media Evaluation Guide for chronic exposures.
RMEG = ATSDR Reference Dose Media Evaluation Guide for chronic exposures.
DDT = 1,1,1-trichloro-2,2-bis[p-chlorophenyl]ethane.

Notes

1. The source data tables from which this table was derived contains results for "appendix IX+3" Compounds, which include volatile organic compounds, semi-volatile organic compounds, and inorganics. The full list of target compounds is in Appendix IX of 40 CFR 264 plus benzidine, 2-chloroethylvinylether, and 1,2-diphenylhydrazine. The compounds listed in table 10 are those that were detected at concnetrations higher than the health-based screening value or did not have screening values. For inorganic compounds, the compound was included if the measured concentrations were higher than typical background ranges for soils in the eastern United States from Shacklette and Boerngen (1984).
2. This table summarizes data taken generally from depths of 0.5 – 4 ft.
3. Seventeen of the 210 dioxin compounds are considered to have dioxin-like toxicity. One of the most toxic of these is 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). The toxicity of all the 17 dioxin-like compounds combined is expressed as the dioxin toxicity equivalent (TEQ). Because it is based on the relative toxicity of each compound with respect to 2,3,7,8-TCDD, the dioxin TEQ can be compared with health-based screening levels established for 2,3,7,8-TCDD. Therefore, on this table, the levels of dioxin in environmental samples are shown as the concentrations of 2,3,7,8-TCDD and dioxin TEQ.

Table 10. Summary of unfiltered[1] non-storm event PCBs in surface waters of the Housatonic River.

River Reach	Detects/ Samples	Minimum (µg/L)	Mean[2] (µg/L)	Maximum (µg/L)	Comparison Values (µg/L)
Reach 1: Upstream of the GE Facility	25/102	ND(0.012)	0.064	0.53 J	CREG 0.02 MMCL 0.5
Reach 2: Unkamet Brook to Newell Street	8/36	ND(0.012)	0.050	0.27	CREG 0.02 MMCL 0.5
Reach 3: Newell Street to Lyman Street	28/65	ND(0.012)	0.087	2.12	CREG 0.02 MMCL 0.5
Reach 4: Lyman Street to Elm Street	123/193	ND(0.0012)	0.25	6.15	CREG 0.02 MMCL 0.5
Reach 5: Confluence to New Lenox Road	187/253	ND(0.012)	0.12	0.95	CREG 0.02 MMCL 0.5
Reach 6: Woods Pond	69/80	ND(0.012)	0.11	0.64	CREG 0.02 MMCL 0.5
Reach 7: Woods Pond Dam to Rising Pond	83/111	ND(0.012)	0.11	1.1	CREG 0.02 MMCL 0.5
Reach 8: Rising Pond	NS	NS	NS	NS	N/A
Reach 9: Rising Pond Dam to Connecticut Border	96/189	ND(0.012)	0.11	1.1	CREG 0.02 MMCL 0.5

Key

ND(0.05) = Not Detected (lowest Method Detection Limit).
NS = Not Sampled.
J = Estimated Value.
µg/L = micrograms per liter.
CREG = ATSDR Cancer Risk Evaluation Guide (corresponds to a 1/1,000,000 excess lifetime cancer risk).
MMCL = MA DEP Massachusetts Maximum Contaminant Level.

Notes

1. The samples summarized in this table are unfiltered, which refers to samples that include suspended particles. However, in some cases, it was unclear whether the samples had been filtered, they were assumed to be unfiltered.
2. Samples in which PCBs were below detection were assumed to have a concentration of one-half the method detection limit for the calculation of means. Duplicate samples were averaged before being entered into the database.

Table 11. Summary of filtered[1] non-storm event PCBs in surface waters of the Housatonic River.

River Reach	Detects/ Samples	Minimum (µg/L)	Mean[2] (µg/L)	Maximum (µg/L)	Comparison Values (µg/L)
Reach 1: Upstream of the GE Facility	7/48	ND(0.012)	0.017	0.12	CREG 0.02 MMCL 0.5
Reach 2: Unkamet Brook to Newell Street	3/21	ND(0.013)	0.019	0.071	CREG 0.02 MMCL 0.5
Reach 3: Newell Street to Lyman Street	7/39	ND(0.013)	0.017	0.058	CREG 0.02 MMCL 0.5
Reach 4: Lyman Street to Elm Street	25/126	ND(0.013)	0.048	0.095	CREG 0.02 MMCL 0.5
Reach 5: Confluence to New Lenox Road	31/149	ND(0.012)	0.037	0.89	CREG 0.02 MMCL 0.5
Reach 6: Woods Pond	15/38	ND(0.012)	0.054	0.5	CREG 0.02 MMCL 0.5
Reach 7: Woods Pond Dam to Rising Pond Dam	10/40	ND(0.012)	0.058	0.6	CREG 0.02 MMCL 0.5
Reach 8: Rising Pond	NS	NS	NS	NS	N/A
Reach 9: Rising Pond Dam to Connecticut Border	16/71	ND(0.013)	0.040	0.35	CREG 0.02 MMCL 0.5

Key
ND(0.05) = Not Detected (lowest Method Detection Limit).
µg/L = micrograms per liter.
CREG = ATSDR Cancer Risk Evaluation Guide (corresponds to a 1/1,000,000 excess lifetime cancer risk).
MMCL = MA DEP Massachusetts Maximum Contaminant Level.

Notes
1. Unfiltered refers to samples that have had suspended particles removed.
2. Samples in which PCBs were below detection were assumed to have a concentration of one-half the method detection limit for the calculation of means. Duplicate samples were averaged before being entered into the database.

Table 12. Summary of unfiltered[1] storm or snow melt event PCBs in surface waters of the Housatonic River.

River Reach	Detects/ Samples	Minimum (µg/L)	Mean[2] (µg/L)	Maximum (µg/L)	Comparison Values (µg/L)
Reach 1: Upstream of the GE Facility	NS	NS	NS	NS	N/A
Reach 2: Unkamet Brook to Newell Street	21/21	0.11	0.53	2.5	CREG 0.02 MMCL 0.5
Reach 3: Newell Street to Lyman Street	NS	NS	NS	NS	N/A
Reach 4: Lyman Street to Elm Street	57/69	ND(0.014)	5.90	382	CREG 0.02 MMCL 0.5
Reach 5: Confluence to New Lenox Road	64/70	ND(0.025)	0.25	1.49	CREG 0.02 MMCL 0.5
Reach 6: Woods Pond	18/18	0.019	0.08	0.20	CREG 0.02 MMCL 0.5
Reach 7: Woods Pond Dam to Rising Pond	10/10	0.04	0.048	0.07	CREG 0.02 MMCL 0.5
Reach 8: Rising Pond	NS	NS	NS	NS	N/A
Reach 9: Rising Pond Dam to Connecticut Border	21/25	ND(0.03)	0.059	0.15	CREG 0.02 MMCL 0.5

Key
ND(0.05) = Not Detected (lowest Method Detection Limit).
NS = Not Sampled.
J = Estimated Value.
µg/L = micrograms per liter.
CREG = ATSDR Cancer Risk Evaluation Guide (corresponds to a 1/1,000,000 excess lifetime cancer risk).
MMCL = MA DEP Massachusetts Maximum Contaminant Level.

Notes
3. The samples summarized in this table are unfiltered, which refers to samples that include suspended particles. However, in some cases, it was unclear whether the samples had been filtered, they were assumed to be unfiltered.
4. Samples in which PCBs were below detection were assumed to have a concentration of one-half the method detection limit for the calculation of means. Duplicate samples were averaged before being entered into the database.

Table 13. Summary of filtered[1] storm or snow melt event PCBs in surface waters of the Housatonic River.

River Reach	Detects/ Samples	Minimum (µg/L)	Mean[2] (µg/L)	Maximum (µg/L)	Comparison Values (µg/L)
Reach 1: Upstream of the GE Facility	NS	NS	NS	NS	N/A
Reach 2: Unkamet Brook to Newell Street	NS	NS	NS	NS	N/A
Reach 3: Newell Street to Lyman Street	NS	NS	NS	NS	N/A
Reach 4: Lyman Street to Elm Street	4/19	ND(0.013)	0.017	0.087	CREG 0.02 MMCL 0.5
Reach 5: Confluence to New Lenox Road	3/21	ND(0.013)	0.0085	0.02	CREG 0.02 MMCL 0.5
Reach 6: Woods Pond	1/18	ND(0.012)	0.0072	0.015	CREG 0.02 MMCL 0.5
Reach 7: Woods Pond Dam to Rising Pond	2/10	ND(0.03)	0.014	0.01	CREG 0.02 MMCL 0.5
Reach 8: Rising Pond	NS	NS	NS	NS	N/A
Reach 9: Rising Pond Dam to Connecticut Border	13/25	ND(0.03)	0.028	0.08	CREG 0.02 MMCL 0.5

Key
ND(0.05) = Not Detected (lowest Method Detection Limit).
NS = Not Sampled.
J = Estimated Value.
µg/L = micrograms per liter.
CREG = ATSDR Cancer Risk Evaluation Guide (corresponds to a 1/1,000,000 excess lifetime cancer risk).
MMCL = MA DEP Massachusetts Maximum Contaminant Level.

Notes
5. The samples summarized in this table are unfiltered, which refers to samples that include suspended particles. However, in some cases, it was unclear whether the samples had been filtered, they were assumed to be unfiltered.
6. Samples in which PCBs were below detection were assumed to have a concentration of one-half the method detection limit for the calculation of means. Duplicate samples were averaged before being entered into the database.

Table 14. Summary of filtered[1] PCBs in surface waters of the Housatonic River near Building 68 before and during Removal Action

River Reach		Location Relative to Building 68	Detects/ Samples	Minimum (µg/L)	Mean[2] (µg/L)	Maximum (µg/L)	Comparison Values (µg/L)
Reach 2 & 3: GE Facility Lyman Street	Before Removal Action 5/1997 – 6/1997	Upstream	2/15	ND(0.0012)	0.016	0.072	CREG 0.02 MMCL 0.5
		Downstream	7/15	ND(0.022)	0.035	0.15	CREG 0.02 MMCL 0.5
	During Removal Action 6/1997 – 9/1997	Upstream	21/56	ND(0.022)	0.022	0.095	CREG 0.02 MMCL 0.5
		Downstream	47/56	ND(0.022)	0.41	7.04	CREG 0.02 MMCL 0.5

Key

ND(0.05) = Not Detected (lowest Method Detection Limit).
µg/L = micrograms per liter.
CREG = ATSDR Cancer Risk Evaluation Guide (corresponds to a 1/1,000,000 excess lifetime cancer risk).
MMCL = MA DEP Massachusetts Maximum Contaminant Level.

Notes

1. The samples summarized in table 12 are filtered, which refers to samples with suspended particles removed. However, in some cases, it was unclear whether the samples had been filtered, they were assumed to be filtered because the values were typical of the filtered samples.
2. Samples in which PCBs were below detection were assumed to have a concentration of one-half the method detection limit for the calculation of means. Duplicate samples were averaged before being entered into the database.

Table 15. Summary of unfiltered[1] Contaminants of concern other than PCBs in surface waters of the Housatonic River.

River Reach	Compound	Detects/ Samples	Minimum (µg/L)	Mean[2] (µg/L)	Maximum (µg/L)	Comparison Values (µg/L)
Reach 1: Upstream of the GE Facility	Di (2-ethylhexyl) phthalate[3]	2/4	ND	5.5	6 J	Child Chronic EMEG 600 Adult Chronic EMEG 2000 CREG 3 Child RMEG 1000 Adult RMEG 4000 MMCL 6
Reach 3: Newell Street to Lyman Street	Benzene	6/10	ND	2.83	8	CREG 0.6 Child RMEG 40 Adult RMEG 100 MMCL 5
	Di (2-ethylhexyl) phthalate[3]	7/12	ND	3.86	7 J	Child Chronic EMEG 600 Adult Chronic EMEG 2000 CREG 3 Child RMEG 1000 Adult RMEG 4000 MMCL 6
Reaches 5 – 9: Confluence to Connecticut Border	Dioxin TEQ	102/141	ND	NC	7.09E-05	Child Chronic EMEG 1.0E-05 Adult Chronic EMEG 4.0E-05 MMCL 3.0E-05
Reaches 5 – 9: Confluence to Connecticut Border	Bromodichloromethane	10/32	ND	NC	42	Child Chronic EMEG 200 Adult Chronic EMEG 700 CREG 0.4 MCL 80
Reaches 5 – 9: Confluence to Connecticut Border	Dibromochloromethane	4/32	ND	NC	2	Cancer RBC 0.13

River Reach	Compound	Detects/ Samples	Minimum (µg/L)	Mean[2] (µg/L)	Maximum (µg/L)	Comparison Values (µg/L)
Reaches 5 – 9: Confluence to Connecticut Border	Vinyl Chloride	4/32	ND	NC	0.93	Child Chronic EMEG 0.2 Adult Chronic EMEG 0.7 CREG 0.03 Child RMEG 20 Adult RMEG 100 MMCL 2
Reaches 5 – 9: Confluence to Connecticut Border	Di (2-ethylhexyl) phthalate	8/116	ND	NC	120	Child Chronic EMEG 600 Adult Chronic EMEG 2000 CREG 3 Child RMEG 1000 Adult RMEG 4000 MMCL 6
Reaches 5 – 9: Confluence to Connecticut Border	Benzo(a)pyrene	3/127	ND	NC	0.014	CREG 0.005 MCL 0.2
Reaches 5 – 9: Confluence to Connecticut Border	Chrysene	6/127	ND	NC	0.5	CREG* 0.5
Reaches 5 – 9: Confluence to Connecticut Border	Ideno(1,2,3-C,D)Pyrene	6/127	ND	NC	0.05	CREG* 0.05
Reaches 5 – 9: Confluence to Connecticut Border	Delta-BHC	1/140	ND	NC	0.11	N/A
Reaches 5 – 9: Confluence to Connecticut Border	Antimony	1/116	ND	NC	5.2	Child RMEG 4 Adult RMEG 10 MMCL 6
Reaches 5 – 9: Confluence to Connecticut Border	Arsenic	4/116	ND	NC	3.5	Child Chronic EMEG 3 Adult Chronic EMEG 10 CREG 0.02 Child RMEG 3 Adult RMEG 10 MMCL 50 MCL 10
Reaches 5 – 9: Confluence to Connecticut Border	Lead	11/116	ND	NC	14.3	MMCL 15

River Reach	Compound	Detects/ Samples	Minimum (µg/L)	Mean[2] (µg/L)	Maximum (µg/L)	Comparison Values (µg/L)
Reaches 5 – 9: Confluence to Connecticut Border	Thallium	2/116	ND	NC	4.1	LTHA 0.5 MMCL 2

Key

ND = Not Detected.
NC = Not Calculated.
J = Estimated Value.
µg/L = micrograms per liter.
CREG = ATSDR Cancer Risk Evaluation Guide (corresponds to a 1/1,000,000 excess lifetime cancer risk).
MMCL = MA DEP Maximum Contaminant Level .
MCL = EPA Maximum Contaminant Level.

Notes

1. The samples summarized in table 14 are unfiltered, which refers to samples that include suspended particles. However, in some cases, it was unclear whether the samples had been filtered, they were assumed to be unfiltered.
2. It was not possible to use the detection limits for non-detected samples to calculate a mean value because some method detection limits were much higher than detected concentrations. Duplicate samples were averaged before being entered into the database.
3. Di(2-ethylexyl)pthalate was detected in 9 of 16 samples ranging from 2 to 7 µg/L. However, the detections of di(2-ethylexyl)pthalate were predominantly associated with contamination of the laboratory blank (2 of 2 detections in Reach 1, 6 of 7 detections in Reach 2). The measured concentration not associated with laboratory blank contamination was 2 µg/L, which is less than the screening values (CREG 3, MMCL 6).

Table 16. Summary of PCBs in unfiltered Groundwater near the Housatonic River.

Location	Detects/ Samples	Minimum (µg/L)	Mean[1] (µg/L)	Maximum (µg/L)	Comparison Values (µg/L)
Oak Hill Road (North of Reach 2)	2/3	ND(0.25)	3.18	7.60	CREG 0.02 MMCL 0.5
Commercial Street (North of Reach 2)	1/1	7.5	7.5	7.5	CREG 0.02 MMCL 0.5
Amherst Street & Melrose Avenue (South of Reach 2)	2/4	ND(0.10)	0.087	0.18	CREG 0.02 MMCL 0.5
Longview Terrace (South of Reach 2)	7/19	ND(0.30)	4.9	45	CREG 0.02 MMCL 0.5
Lyman Street (South of Reach 3)	1/1	0.42	0.42	0.42	CREG 0.02 MMCL 0.5

Key
ND(0.05) = Not Detected (lowest Method Detection Limit).
µg/L = micrograms per liter.
CREG = ATSDR Cancer Risk Evaluation Guide (corresponds to a 1/1,000,000 excess lifetime cancer risk).
MMCL = MA DEP Massachusetts Maximum Contaminant Level.

Notes
1. Samples in which PCBs were below detection were assumed to have a concentration of one-half the method detection limit for the calculation of means. Duplicate samples were averaged before being entered into the database.

Table 17. Summary of PCBs in filtered Groundwater near the Housatonic River.

Location	Detects/ Samples	Minimum (µg/L)	Mean[1] (µg/L)	Maximum (µg/L)	Comparison Values (µg/L)
Oak Hill Road (North of Reach 2)	2/3	ND(0.25)	1.11	2.1	CREG 0.02 MMCL 0.5
Commercial Street (North of Reach 2)	N/A	N/A	N/A	N/A	CREG 0.02 MMCL 0.5
Amherst Street & Melrose Avenue (South of Reach 2)	0/4	ND(0.50)	ND(0.50)	ND(0.50)	CREG 0.02 MMCL 0.5
Longview Terrace (South of Reach 2)	5/19	ND(0.30)	0.72	6.5	CREG 0.02 MMCL 0.5
Lyman Street (South of Reach 3)	1/1	0.33	0.33	0.33	CREG 0.02 MMCL 0.5

Key
ND(0.05) = Not Detected (lowest Method Detection Limit).
µg/L = micrograms per liter.
CREG = ATSDR Cancer Risk Evaluation Guide (corresponds to a 1/1,000,000 excess lifetime cancer risk).
MMCL = MA DEP Massachusetts Maximum Contaminant Level.
N/A = Not available.

Notes
1. Samples in which PCBs were below detection were assumed to have a concentration of one-half the method detection limit for the calculation of means. Duplicate samples were averaged before being entered into the database.

Table 18. Summary of PCBs in ambient air[1] near the Housatonic River.

Sampling Location[2]	Season[3]	Detects/ Samples	Minimum ($\mu g/m^3$)	Mean[4] ($\mu g/m^3$)	Maximum ($\mu g/m^3$)	Comparison Values ($\mu g/m^3$)
Background (Berkshire Community College Station)	Not –Summer	3/20	ND(0.0005)	0.00035	0.0013	CREG 0.01
	Summer	13/26	ND(0.0005)	0.00086	0.0035	CREG 0.01
	All	16/46	ND(0.0005)	0.00064	0.0035	CREG 0.01
Reach 3: Newell Street to Lyman (Silver Lake stations)	Summer	24/24	0.0023	0.015	0.035	CREG 0.01
Reach 4: Lyman Street to Confluence (Fred Garner Park station)	Summer	7/8	ND(0.0005)	0.0053	0.011	CREG 0.01
Reach 5: Confluence to Woods Pond (2 Sites, Devos Farm, Headwaters of Woods Pond)	Summer	0/30	ND(0.003)	0.0015	ND(0.003)	CREG 0.01
Reach 6: Woods Pond (Woods Pond Station)	Summer	8/8	0.001	0.0031	0.0052	CREG 0.01
All 5 Sites along the Housatonic River combined	Summer	39/70	ND(0.0005)	0.0061	0.035	CREG 0.01

Key
ND(0.0005) = Not Detected (lowest Method Detection Limit).
$\mu g/m^3$ = micrograms/meter cubed.
CREG = ATSDR Cancer Risk Evaluation Guide (corresponds to a 1/1,000,000 excess lifetime cancer risk).

Notes
1. Air samples were collected over a 24 period from 2 – 6 meters above the ground by high-volume samplers.
2. The Silver Lake and Fred Garner Park stations were established along the Housatonic River in Pittsfield. The Woods Pond station was established along the Housatonic River in Lenoxdale. Concentrations form an ambient air monitoring station at Berkshire Community College were used to estimate background levels of PCBs in the ambient air. This site was 3.5 miles west of the GE facility and the Housatonic River.
3. Samples collected from the mid-September to mid-May were considered to be from the "not-summer" period.
4. Samples in which PCBs were below detection were assumed to have a concentration of one-half the method detection limit for the calculation of means. Duplicate samples were averaged before being entered into the database.

Table 19. Summary of PCBs in fish[1] from sections of the Housatonic River[2] and its tributaries

Reach	Species (Feeding Habits[3])	Number of Samples Analyzed	Number of Fish Collected for Samples	Average (Range) (mg/kg)	Comparison Values[4] (mg/kg)
Background (Center Pond)	Trout (BI, C) *Mixed Species Composite* *Skin-on Fillet*	2	9	0.22 (0.04 - 0.31)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Background (Center Pond)	Yellow Perch (C) *Skin-on Fillet*	1	7	0.06 (0.06 - 0.06)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Background (Laurel Lake)	Largemouth Bass *Skin-on fillet*	5	5	0.033 (0.025 - 0.065)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reach 1 (Above Government Mill Dam)	Red Ear Sunfish (WC, I) *Skin-on fillet*	1	4	0.67 (0.67 – 0.67)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reach 1 (Above Government Mill Dam)	Rock Bass (WC, C) *Skin-on fillet*	1	12	1.6 (1.6 – 1.6)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reach 1 (Above Government Mill Dam)	Sunfish (WC, I) *Mixed Species Composite* *Skin-on fillet*	1	12	2.7 (2.7 – 2.7)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reach 1 (Above Government Mill Dam)	Trout (BI, C) *Mixed Species Composite* *Skin-on fillet*	1	3	135 (135 – 135)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reach 1 (Above Government Mill Dam)	Yellow Perch (C) *Skin-on fillet*	1	12	1.7 (1.7 – 1.7)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Bass (TLP) *Mixed Species Composite* *Skin-on Fillet*	3	29	11.91 (4.2 – 20)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Bluegill (WC, I) *Skin-on Fillet*	2	24	4.45 (4.2 – 4.7)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Crappie (WC, P) *Skin-on fillet*	1	8	12 (12 – 12)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Bluegill (WC, I) *Whole Fish Composite*	45	574	19.32 (2.2 – 40)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Brown Bullhead (BF,O) *Skin-on fillet*	2	24	11.5 (11 – 12)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Brown Bullhead (BF,O) *Skin-off Fillet*	3	3	16.85 (9.18 - 31.8)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Brown Trout (BI,C) *Skin-on fillet*	2	4	120.9 (13.8 – 228)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)

Reach	Species (Feeding Habits[3])	Number of Samples Analyzed	Number of Fish Collected for Samples	Average (Range) (mg/kg)	Comparison Values[4] (mg/kg)
Reaches 1 – 6 (Below Government Mill Dam)	Chain Pickerel (TLP) *Skin-on fillet*	2	24	8.35 (3.7 – 13)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Fathead Minnow (BF,O) *Whole Fish Composite*	44	1329	3.33 (0.28 – 25)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Frog *Whole*[5]	1	12	4.4 (4.4 - 4.4)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Frog *Leg Muscle*	3	21	3.97 (2.2 - 5.3)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Largemouth Bass (TLP) *Skin-off Fillet*	40	40	49.73 (3.15 – 419)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Largemouth Bass (TLP) *Whole Fish Composite*	110	568	34.83 (17 – 640)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Largemouth Bass (TLP) *Skin-on fillet*	2	20	16.32 (10.8 – 20)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Muscle *Mixed Species Composite* *Whole Body Minus Shell*	108	648	1.25 (0.0545 - 3.69)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Pumpkinseed (WC, I) *Whole Fish Composite*	18	121	27.60 (23 - 41.56)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Rainbow Trout (BI, C) *Skin-on fillet*	1	1	27 (27 – 27)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Red Ear Sunfish (WC, I) *Skin-on fillet*	1	4	0.67 (0.67 - 0.67)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Rock Bass (WC, C) *Skin-on fillet*	1	10	8.1 (8.1 - 8.1)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Sunfish (WC, I) *Mixed Species Composite* *Skin-on fillet*	3	36	3.03 (2.2 - 4.2)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Trout (BI, C) *Mixed Species Composite* *Skin-on fillet*	1	4	119 (119 – 119)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Turtle *Whole*[5]	1	1	2.1 (2.1 – 2.1)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	White Sucker (BF, O) *Whole Fish Composite*	2	16	63.5 (55 – 72)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)

Reach	Species (Feeding Habits[3])	Number of Samples Analyzed	Number of Fish Collected for Samples	Average (Range) (mg/kg)	Comparison Values[4] (mg/kg)
Reaches 1 – 6 (Below Government Mill Dam)	Yellow Perch (C) *Skin-off Fillet*	5	5	42.62 (2.48 -174.29)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Yellow Perch (C) *Skin-on fillet*	5	54	5.12 (3 - 8.4)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 1 – 6 (Below Government Mill Dam)	Yellow Perch (C) *Whole Fish Composite*	56	429	29.25 (20 – 58)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 7 & 8	Bass (TLP) *Mixed composite* *Skin-on fillet*	1	10	7.2 (7.2 - 7.2)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 7 & 8	Bluegill (WC, I) *Skin-on fillet*	1	12	2.9 (2.9 - 2.9)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 7 & 8	Bluegill (WC, I) *Whole Fish Composite*	19	190	9.40 (0.94 – 19)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 7 & 8	Bluntnose Minnow (BF, O) *Whole Fish Composite*	5	47	11.45 (9.17 - 15.2)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 7 & 8	Brown Bullhead (BF, O) *Skin-off Fillet*	16	16	5.48 (1.29 – 13)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 7 & 8	Brown Trout (BI, C) *Skin-on fillet*	1	1	33 (33 – 33)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 7 & 8	Largemouth Bass (TLP) *Skin-off Fillet*	3	3	2.43 (1.48 - 3.48)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 7 & 8	Largemouth Bass (TLP) *Skin-on fillet*	2	10	14.28 (7.4 – 16)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 7 & 8	Largemouth Bass (TLP) *Whole Fish Composite*	21	210	9.58 (3.4 – 17)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 7 & 8	Pumpkinseed (WC, I) *Whole Fish Composite*	4	37	2.69 (2.5 - 6.96)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 7 & 8	Sunfish (WC, I) *Mixed Species Composite* *Skin-on fillet*	2	24	2.8 (2.6 – 3)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 7 & 8	Trout (BI, C) *Mixed Species Composite* *Skin-on fillet*	1	3	11 (11 – 11)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 7 & 8	Yellow Perch (C) *Skin-off fillet*	8	8	10.63 (4.52 - 24.9)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)

Reach	Species (Feeding Habits[3])	Number of Samples Analyzed	Number of Fish Collected for Samples	Average (Range) (mg/kg)	Comparison Values[4] (mg/kg)
Reaches 7 & 8	Yellow Perch (C) *Skin-on fillet*	4	37	2.86 (1.1 - 6.1)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reaches 7 & 8	Yellow Perch (C) *Whole Fish Composite*	21	210	12.10 (8.6 – 16)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reach 9	Bass (TLP) *Mixed Species Composite* *Skin-on fillet*	1	12	3.9 (3.9 - 3.9)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reach 9	Bluegill (WC, I) *Whole Fish Composite*	20	228	2.88 (0.9 - 4.5)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reach 9	Bluntnose Minnow (BF, O) *Whole Fish Composite*	5	50	4.82 (4.04 - 5.39)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reach 9	Brown Bullhead (BF, O) *Skin-off Fillet*	2	2	1.73 (1.33 - 2.12)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reach 9	Brown Trout (BI, C) *Skin-on fillet*	1	3	3.3 (3.3 - 3.3)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reach 9	Largemouth Bass (TLP) *Skin-off Fillet*	2	2	4.91 (2.65 - 7.17)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reach 9	Largemouth Bass (TLP) *Skin-on fillet*	1	1	6.9 (6.9 - 6.9)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reach 9	Largemouth Bass (TLP) *Whole Fish Composite*	36	274	3.81 (0.12 –53.6)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reach 9	Pumpkinseed (WC, I) *Whole Fish Composite*	8	55	2.75 (0.27 - 4.7)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reach 9	Sunfish (WC, I) *Mixed Species Composite* *Skin-on fillet*	1	12	2.7 (2.7 - 2.7)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reach 9	Yellow Perch (C) *Skin-off Fillet*	20	20	4.38 (0.919 - 9.56)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reach 9	Yellow Perch (C) *Skin-on fillet*	1	12	3 (3 – 3)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Reach 9	Yellow Perch (C) *Whole Fish Composite*	28	260	3.74 (2.5 - 4.6)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Tributary (Green River)	Brown Trout (BI, C) *Skin-on fillet*	2	2	17.5 (14 – 21)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Tributary (Green River)	Rock Bass (WC, C) *Skin-on fillet*	2	2	1.23 (0.16 – 2.3)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)

Reach	Species (Feeding Habits[3])	Number of Samples Analyzed	Number of Fish Collected for Samples	Average (Range) (mg/kg)	Comparison Values[4] (mg/kg)
Tributary (Green River)	White Sucker (BF, O) *Whole Fish Composite*	1	8	0.62 (0.62 – 0.62)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Tributary (Konkapot River)	White Sucker (BF, O) *Whole Fish Composite*	1	8	0.05 (0.05 – 0.05)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Tributary (Williams River)	Brown Trout (BI, C) *Skin-on fillet*	2	2	0.91 (0.81 – 1)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)
Tributary (Williams River)	Smallmouth Bass (TLP) *Skin-on fillet*	2	2	1.8 (1.1 - 2.5)	0.0098 – 0.08 (Non-Cancer) 0.0025 – 0.02 (Cancer)

Key
mg/kg = milligrams per kilogram

Notes
1. Data from a 1997 "caged-fish experiment" near building 68 have not been included in this table because these fish were less than 6 weeks old and could not be caught by the public. The PCB concentrations in the 2 to 6 week old fish were between 0.32 and 0.47 mg/kg.
2. MDPH has a public health fish consumption advisory for the Housatonic River between Dalton and Sheffield. The general public (including sensitive populations) are advised against eating any fish frogs or turtles taken from this stretch of the Housatonic River. Fish taken from feeder streams to the Housatonic River should be trimmed of fatty tissue prior to cooking.
3. On this table, fish species are grouped by the following eating habits:
   - TLP = Top Level Predator
   - C = Carnivore
   - BI, C = Water Column, Piscivore
   - WC, P = Water Column, Carnivore
   - WC, I = Water Column, Invertivore
   - BF, O = Bottom Feeder, Omnivore
4. 4. MDPH uses the Food and Drug Administration's tolerance level for PCBs in the edible portions of fish and shellfish (2 mg/kg, see 21 CFR 109.30[a][7]) as a benchmark for evaluating health threats for the general public from PCB contamination in fish tissue. For sensitive populations (e.g., children and pregnant women), MDPH screens PCB results for fish tissue using a trigger value of 1 mg/kg. Screening values were also derived using the methods in Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Office of Water, U.S. Environmental Protection Agency, EPA 823-B-00-007, November 2000. The screening values are presented in ranges to reflect the variability in fish consumption practices among the population. The lower screening value assumed a daily fish consumption rate of 142.4 g/day (the average consumption of uncooked fish and shellfish by the 99th percentile of subsistence fishers). The higher screening value in the range assumes a daily fish consumption rate of 17.5 g/day (the 90th percentile of recreational fishers , which is used to represent the average consumption of fish and shellfish among the general population and subsistence fishers). Screening values for non-cancer health effects were derived using the ATSDR chronic minimal risk level for each compound. For cancerous effects, the screening values were calculated using the compounds oral slope factor and assuming an excess lifetime cancer risk of 1:1,000,000.
5. Of the four test results for frogs, three results are from leg muscle tissue. It is not clear whether the fourth frog result and single result for turtles are for edible tissue or whole body composite samples.

Table 20. Summary of contaminants of concern other than PCBs in fish from the Housatonic River and its Tributaries.

River Reach	Species *Sample Type*	Compound[1]	Number Samples/ Number Detects	Minimum Concentration (mg/kg)	Average Concentration (mg/kg)	Maximum Concentration (mg/kg)	Screening Values[2] (mg/kg)
Reaches 1 – 6 (Below Government Mill Dam)	Bluegill *Skin-off Fillets*	Dioxin TEQ (WHO)	1/1	5.75E-06	5.75E-06	5.75E-06	Cancer RBC 2.1E-08
Reaches 1 – 6 (Below Government Mill Dam)	Brown Bullhead *Skin-off Fillets*	Dioxin TEQ (WHO)	32/32	7.64E-06	1.57E-05	4.9E-05	Cancer RBC 2.1E-08
Reaches 1 – 6 (Below Government Mill Dam)	Brown Trout *Skin-on Fillets*	Dioxin TEQ (WHO)	0/1	ND	ND	ND	Cancer RBC 2.1E-08
Reaches 1 – 6 (Below Government Mill Dam)	Largemouth Bass *Skin-off Fillets*	Dioxin TEQ (WHO)	23/24	ND(4.46E-06)	8.65E-06	3.14E-05	Cancer RBC 2.1E-08
Reaches 1 – 6 (Below Government Mill Dam)	Largemouth Bass *Skin-on Fillets*	Dioxin TEQ (WHO)	0/1	ND	ND	ND	Cancer RBC 2.1E-08
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	1,2,3,4-Tetrachlorobenzene	198/200	ND(3.05E-04)	NC	3.88E-01	N/A
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	1,2,4,5-Tetrachlorobenzene	191/200	ND(5.3E-04)	NC	8.87E-02	Non-Cancer RBC 4.1E-01
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	4,4'-DDD	199/200	ND(1.65E-03)	NC	3.33E-01	Cancer RBC 1.3E-02
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	4,4'-DDE	194/200	ND(9.88E-04)	NC	2.46E-01	Cancer RBC 9.3E-03
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	4,4'-DDT	115/200	ND(1.00E-05)	NC	1.65E-02	Cancer RBC 9.3E-03
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	Aldrin	21/200	ND(8.95E-04)	NC	7.60E-04	Cancer RBC 1.9E-04
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	Alpha-BHC	97/200	ND(3.00E-05)	NC	6.10E-04	Cancer RBC 5.0E-04
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	Alpha-Chlordane	65/200	ND(7.50E-05)	NC	4.43E-03	Cancer RBC 9E-03

River Reach	Species *Sample Type*	Compound[1]	Number Samples/ Number Detects	Minimum Concentration (mg/kg)	Average Concentration (mg/kg)	Maximum Concentration (mg/kg)	Screening Values[2] (mg/kg)
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	Beta-BHC	41/200	ND(4.50E-06)	NC	6.50E-04	Cancer RBC 1.8E-03
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	Chlorpyrifos	75/200	ND(1.00E-05)	NC	2.19E-03	Non-Cancer RBC 4.1
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	cis-Nonachlor	190/200	ND(9.40E-04)	NC	3.31E-01	N/A
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	Delta-BHC	73/200	ND(1.50E-06)	NC	1.12E-02	N/A
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	Dieldrin	175/199	ND(9.55E-04)	NC	1.97E-02	Cancer RBC 2.0E-04
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	Endosulfan II	141/200	ND(8.95E-04)	NC	1.22E-01	Non-cancer RBC 8.1
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	Endrin	38/200	ND(8.95E-04)	NC	1.14E-03	Non-cancer RBC 4.1E-01
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	Gamma-BHC (Lindane)	154/200	ND(1.00E-05)	NC	1.97E-03	Cancer RBC 2.4E-03
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	Gamma-Chlordane	83/200	ND(5.00E-06)	NC	3.67E-03	Cancer RBC 9.0E-03
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	Heptachlor	66/200	ND(8.95E-04)	NC	1.32E-03	Cancer RBC 7.0E-04
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	Heptachlor Epoxide	36/200	ND(1.80E-04)	NC	1.34E-02	Cancer RBC 3.5E-04
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	Hexachlorobenzene	195/200	ND(1.50E-05)	NC	7.11E-03	Cancer RBC 2.0E-03
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	Lead	2/6	ND(4.00E-02)	NC	8.00E-02	N/A
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	Mercury	6/6	3.30E-01	NC	7.20E-01	4.1E-01

River Reach	Species *Sample Type*	Compound[1]	Number Samples/ Number Detects	Minimum Concentration (mg/kg)	Average Concentration (mg/kg)	Maximum Concentration (mg/kg)	Screening Values[2] (mg/kg)
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	Mirex	7/200	ND(8.95E-04)	NC	1.10E-03	Non-cancer RBC 2.7E-01
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	O,P'-DDD	199/200	ND(9.55E-04)	NC	2.90E-01	Cancer RBC 1.3E-02
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	O,P'-DDE	59/200	ND(8.50E-05)	NC	3.50E-03	Cancer RBC 9.3E-03
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	O,P'-DDT	200/200	1.11E-03	NC	3.80E-01	Cancer RBC 9.3E-03
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	Oxychlordane	95/200	ND(8.95E-04)	NC	1.65E-02	N/A
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	Pentachloroanisole	168/200	ND(1.50E-05)	NC	2.12E-03	N/A
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	Pentachlorobenzene	197/200	ND(7.00E-05)	NC	1.99E-01	Non-cancer RBC 1.1
Reaches 1 – 6 (Below Government Mill Dam)	Mixed Species *Skin-off Fillets*	Trans-Nonachlor	186/200	ND(8.00E-05)	NC	1.08E-02	N/A
Reaches 1 – 6 (Below Government Mill Dam)	Pumpkinseed *Skin-off Fillets*	Dioxin TEQ (WHO)	32/32	5.20884E-06	1.11586E-05	3.89771E-05	Cancer RBC 2.1E-08
Reaches 1 – 6 (Below Government Mill Dam)	White Sucker *Whole Fish Composites*	4,4'-DDD	2/2	0.024	0.062	0.1	Cancer RBC 1.3E-02
Reaches 1 – 6 (Below Government Mill Dam)	White Sucker *Whole Fish Composites*	4,4'-DDE	2/2	0.038	0.099	0.160	Cancer RBC 9.3E-03
Reaches 1 – 6 (Below Government Mill Dam)	White Sucker *Whole Fish Composites*	4,4'-DDT	½	ND(0.005)	0.008	0.011	Cancer RBC 9.3E-03
Reaches 1 – 6 (Below Government Mill Dam)	White Sucker *Whole Fish Composites*	Hexachlorobenzene	½	ND(0.005)	0.0088	0.015	Cancer RBC 2.0E-030.40 – 3.2 (Non-Cancer) 0.003– 0.025 (Cancer)

River Reach	Species *Sample Type*	Compound[1]	Number Samples/ Number Detects	Minimum Concentration (mg/kg)	Average Concentration (mg/kg)	Maximum Concentration (mg/kg)	Screening Values[2] (mg/kg)
Reaches 1 – 6 (Below Government Mill Dam)	White Sucker *Whole Fish Composites*	O,P'-DDD	½	ND(0.008)	0.0045	0.005	Cancer RBC 1.3E-02
Reaches 1 – 6 (Below Government Mill Dam)	White Sucker *Whole Fish Composites*	Oxychlordane	½	ND(0.005)	0.00495	0.0074	N/A
Reaches 1 – 6 (Below Government Mill Dam)	White Sucker *Whole Fish Composites*	Pentachloroanisole	½	ND(0.005)	0.0057	0.0089	N/A
Reaches 1 – 6 (Below Government Mill Dam)	White Sucker *Whole Fish Composites*	Trans-nonachlor	½	ND(0.007)	0.00875	0.014	N/A
Reaches 1 – 6 (Below Government Mill Dam)	Yellow Perch *Skin-off Fillets*	Dioxin TEQ (WHO)	51/51	4.93E-06	1.24E-05	2.67E-05	Cancer RBC 2.1E-08
Reaches 7 & 8	Brown Bullhead *Skin-off Fillets*	Dioxin TEQ (WHO)	5/7	6.32E-06	1E-05	2.44E-05	Cancer RBC 2.1E-08
Reaches 7 & 8	Brown Trout *Skin-on Fillets*	Dioxin TEQ (WHO)	1/1	2.4E-06	2.4E-06	2.4E-06	Cancer RBC 2.1E-08
Reaches 7 & 8	Largemouth Bass *Skin-off Fillets*	Dioxin TEQ (WHO)	10/10	5.33E-06	7.94E-06	1.75E-05	Cancer RBC 2.1E-08
Reaches 7 & 8	Largemouth Bass *Skin-on Fillets*	Dioxin TEQ (WHO)	0/1	ND	ND	ND	Cancer RBC 2.1E-08
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	1,2,3,4-Tetrachlorobenzene	33/37	ND(1.36E-04)	NC	1.80E-03	N/A
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	1,2,4,5-Tetrachlorobenzene	6/37	ND(1.05E-05)	NC	2.07E-03	Non-Cancer RBC 4.1E-01
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	4,4'-DDD	35/37	ND(9.65E-04)	NC	4.49E-04	Cancer RBC 1.3E-02
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	4,4'-DDE	37/37	2.61E-03	NC	4.01E-02	Cancer RBC 9.3E-03
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	4,4'-DDT	30/37	ND(9.60E-04)	NC	3.78E-03	Cancer RBC 9.3E-03

River Reach	Species *Sample Type*	Compound[1]	Number Samples/ Number Detects	Minimum Concentration (mg/kg)	Average Concentration (mg/kg)	Maximum Concentration (mg/kg)	Screening Values[2] (mg/kg)
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	Aldrin	2/37	ND(9.40E-04)	NC	1.43E-04	Cancer RBC 1.9E-04
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	Alpha-BHC	33/37	ND(9.70E-04)	NC	1.94E-04	Cancer RBC 5.0E-04
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	Alpha-Chlordane	18/37	ND(9.40E-04)	NC	1.12E-03	Cancer RBC 9E-03
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	Beta-BHC	18/37	ND(9.80E-04)	NC	1.60E-04	Cancer RBC 1.8E-03
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	Chlorpyrifos	7/37	ND(1.25E-05)	NC	2.05E-04	Non-Cancer RBC 4.1
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	cis-Nonachlor	37/37	1.07E-03	NC	2.49E-02	N/A
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	Delta-BHC	7/37	ND(8.50E-06)	NC	8.70E-05	N/A
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	Dieldrin	26/37	ND(9.85E-04)	NC	6.71E-04	Cancer RBC 2.0E-04
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	Endosulfan II	34/37	ND(9.65E-04)	NC	7.80E-03	Non-cancer RBC 8.1
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	Endrin	8/37	ND(9.40E-04)	NC	7.30E-05	Non-cancer RBC 4.1E-01
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	Gamma-BHC (Lindane)	37/37	6.60E-05	NC	5.69E-04	Cancer RBC 2.4E-03
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	Gamma-Chlordane	19/37	ND(9.40E-04)	NC	6.68E-04	Cancer RBC 9.0E-03
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	Heptachlor	11/37	ND(9.40E-04)	NC	1.74E-04	Cancer RBC 7.0E-04
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	Heptachlor Epoxide	16/37	ND(7.95E-05)	NC	1.38E-03	Cancer RBC 3.5E-04

River Reach	Species *Sample Type*	Compound[1]	Number Samples/ Number Detects	Minimum Concentration (mg/kg)	Average Concentration (mg/kg)	Maximum Concentration (mg/kg)	Screening Values[2] (mg/kg)
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	Hexachlorobenzene	12/37	ND(3.05E-05)	NC	3.06E-04	Cancer RBC 2.0E-03
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	Mirex	6/37	ND(9.60E-04)	NC	9.40E-05	Non-cancer RBC 2.7E-01
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	O,P'-DDD	37/37	1.77E-03	NC	3.85E-02	Cancer RBC 1.3E-02
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	O,P'-DDE	1/37	ND(9.40E-04)	NC	1.68E-04	Cancer RBC 9.3E-03
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	O,P'-DDT	37/37	1.87E-03	NC	5.41E-02	Cancer RBC 9.3E-03
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	Oxychlordane	20/37	ND(9.85E-04)	NC	2.16E-03	N/A
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	Pentachloroanisole	14/37	ND(2.00E-05)	NC	7.51E-04	N/A
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	Pentachlorobenzene	34/37	ND(8.25E-05)	NC	6.64E-04	Non-cancer RBC 1.1
Reaches 7 & 8	Mixed Species *Skin-off Fillets*	Trans-Nonachlor	37/37	1.98E-04	NC	3.13E-03	N/A
Reaches 7 & 8	Pumpkinseed *Skin-off Fillets*	Dioxin TEQ (WHO)	5/13	7.03E-06	1.09E-05	1.43E-05	Cancer RBC 2.1E-08
Reaches 7 & 8	Yellow Perch *Skin-off Fillets*	Dioxin TEQ (WHO)	7/7	8.58E-06	1.51E-05	2.45E-05	Cancer RBC 2.1E-08
Tributary (Green River)	White Sucker *Whole fish composite*	4,4'-DDE	1/1	0.023	0.023	0.023	Cancer RBC 9.3E-03
Tributary (Konkapot River)	White Sucker *Whole fish composite*	4,4' DDE	1/1	0.017	0.017	0.017	Cancer RBC 9.3E-03

Key
RBC = Risk Based Concentration
N/A Not Available.
mg/kg = milligrams per kilogram.
DDT = 1,1,1-trichloro-2,2-bis[p-chlorophenyl]ethane.
DDE = 1,1-dichloro-2,2-bis[p-chlorophenyl]ethylene.
DDD = 1,1-dichloro-2,2-bis[p-chlorophenyl]ethane.

Notes
1. All available detected results for compounds other than PCBs in fish tissue are listed on this table.

Table 21. Summary of PCBs in Duck Breast Tissue from the Housatonic River[1].

Reach	Duck Species	Samples/ Detects	Minimum (mg/kg)	Average (mg/kg)	Maximum (mg/kg)
Reach 5	Immature Mallard	5/5	1.59	9.10	19.340147
	Immature Wood Duck	14/14	2.67	6.52	12.1992
Reach 6	Adult Wood Duck	6/6	1.06	8.12	17.854407
	Immature Wood Duck	3/3	3.25	5.05	6.00491
Three Mile Pond[2]	Adult Wood Duck	12/12	0.003	0.94	3.3606
	Immature Wood Duck	10/10	0.0046	0.37	1.6924

Key
mg/kg = milligrams per kilogram.

Notes
1. MDPH uses the U.S. Department of Agriculture tolerance level for PCBs in the edible portions of waterfowl (3 mg/kg) as a benchmark for evaluating health threats for the general public from PCB contamination in duck tissue. MDPH has a public health duck consumption advisory for the Housatonic River from Pittsfield South to Rising Pond in Great Barrington. The general public should refrain from eating all mallards and wood ducks from the Housatonic River and its impoundments for this stretch of the Housatonic River. In all areas other than the Housatonic River Area, to reduce exposure to PCBs, wild waterfowl should be skinned and all fat removed before cooking. Stuffing should be discarded after cooking. Drippings should not be used for gravy. Waterfowl should be eaten in moderation (e.g., no more than 2 meals per month). Canada geese are not included in the advisory.
2. Ducks were sampled from Three Mile Pond in Sheffield, an area considered uncontaminated.

Table 22. Summary of contaminants of concern other than PCBs in Duck Breast Tissue from the Housatonic River.

River Reach	Duck Species	Compound	Detects/ Samples	Minimum (mg/kg)	Average (mg/kg)	Maximum (mg/kg)
Reach 5	Immature Wood Duck	Dioxin TEQ (WHO)	12/12	7.54E-06	2.44E-05	1.42E-04
Reach 5	Immature Mallard	Dioxin TEQ (WHO)	5/5	9.36E-06	3.16E-05	8.41E-05
Reach 6	Immature Wood Duck	Dioxin TEQ (WHO)	2/3	ND	1.35E-05	1.90E-05
Reach 6	Adult Wood Duck	Dioxin TEQ (WHO)	5/5	7.93E-06	1.40E-05	1.93E-05
Reaches 5 & 6	Mixed Species	Dioxin TEQ (WHO)	24/25	ND	2.25E-05	1.42E-04
Reaches 5 & 6	Mixed Species	1,2,3,4-Tetrachlorobenzene	21/25	ND(1.75E-04)	NC	9.10E-03
Reaches 5 & 6	Mixed Species	1,2,3,5-Tetrachlorobenzene	14/25	ND(1.62E-03)	NC	3.89E-03
Reaches 5 & 6	Mixed Species	4,4'-DDD	22/25	ND(1.23E-03)	NC	7.70E-03
Reaches 5 & 6	Mixed Species	4,4'-DDE	25/25	7.31E-03	NC	1.33E-01
Reaches 5 & 6	Mixed Species	4,4'-DDT	2/25	ND(9.50E-05)	NC	6.83E-03
Reaches 5 & 6	Mixed Species	Aldrin	1/25	ND(9.50E-05)	NC	1.25E-04
Reaches 5 & 6	Mixed Species	Alpha-BHC	5/25	ND(9.50E-05)	NC	1.97E-04
Reaches 5 & 6	Mixed Species	Alpha-Chlordane	8/25	ND(9.00E-05)	NC	8.50E-04
Reaches 5 & 6	Mixed Species	Beta-BHC	1/25	ND(9.50E-05)	NC	1.07E-04
Reaches 5 & 6	Mixed Species	Chlorpyrifos	3/25	ND(2.50E-05)	NC	3.25E-04
Reaches 5 & 6	Mixed Species	Cis-Nonachlor	4/25	ND(8.00E-06)	NC	1.26E-03
Reaches 5 & 6	Mixed Species	Delta-BHC	3/25	ND(7.50E-06)	NC	4.70E-05
Reaches 5 & 6	Mixed Species	Dieldrin	1/25	ND(9.00E-05)	NC	1.74E-02
Reaches 5 & 6	Mixed Species	Endosulfan II	5/25	ND(9.00E-05)	NC	7.30E-04
Reaches 5 & 6	Mixed Species	Endrin	1/25	ND(9.00E-05)	NC	2.14E-04
Reaches 5 & 6	Mixed Species	Gamma BHC (LINDANE)	1/25	ND(9.50E-05)	NC	2.80E-05

River Reach	Duck Species	Compound	Detects/ Samples	Minimum (mg/kg)	Average (mg/kg)	Maximum (mg/kg)
Reaches 5 & 6	Mixed Species	Gamma-CHLORDANE	1/25	ND(9.50E-05)	NC	1.88E-04
Reaches 5 & 6	Mixed Species	Heptachlor	2/25	ND(9.50E-05)	NC	2.25E-04
Reaches 5 & 6	Mixed Species	Heptachlor Epoxide	1/25	ND(9.50E-05)	NC	1.89E-04
Reaches 5 & 6	Mixed Species	Hexachlorobenzene	24/25	ND(1.65E-05)	NC	1.07E-03
Reaches 5 & 6	Mixed Species	Mirex	3/25	ND(8.50E-06)	NC	3.10E-04
Reaches 5 & 6	Mixed Species	O,P'-DDD	24/25	ND(1.23E-03)	NC	2.36E-02
Reaches 5 & 6	Mixed Species	O,P'-DDE	3/25	ND(9E-05)	NC	6.55E-04
Reaches 5 & 6	Mixed Species	O,P'-DDT	25/25	6.65E-03	NC	1.89E-01
Reaches 5 & 6	Mixed Species	Oxychlordane	13/25	ND(9E-05)	NC	2.85E-03
Reaches 5 & 6	Mixed Species	Pentachlorobenzene	25/25	7.00E-05	NC	7.33E-03
Reaches 5 & 6	Mixed Species	Trans-Nonachlor	11/25	ND(3.90E-05)	NC	1.76E-03
Three Mile Pond[1]	Immature Wood Duck	Dioxin TEQ (MA DEP Method)	4/5	ND	1.24E-06	1.80E-06
Three Mile Pond[1]	Adult Wood Duck	Dioxin TEQ (MA DEP Method)	8/9	ND	3.97E-06	1.04E-05

Key
NC = Not Calculated.
ND(0.05) = Not Detected (Detection Limit).
mg/kg = milligrams per kilogram.

Notes
1. Ducks were sampled from Three Mile Pond in Sheffield, an area considered uncontaminated.

Figures 1 – 4i

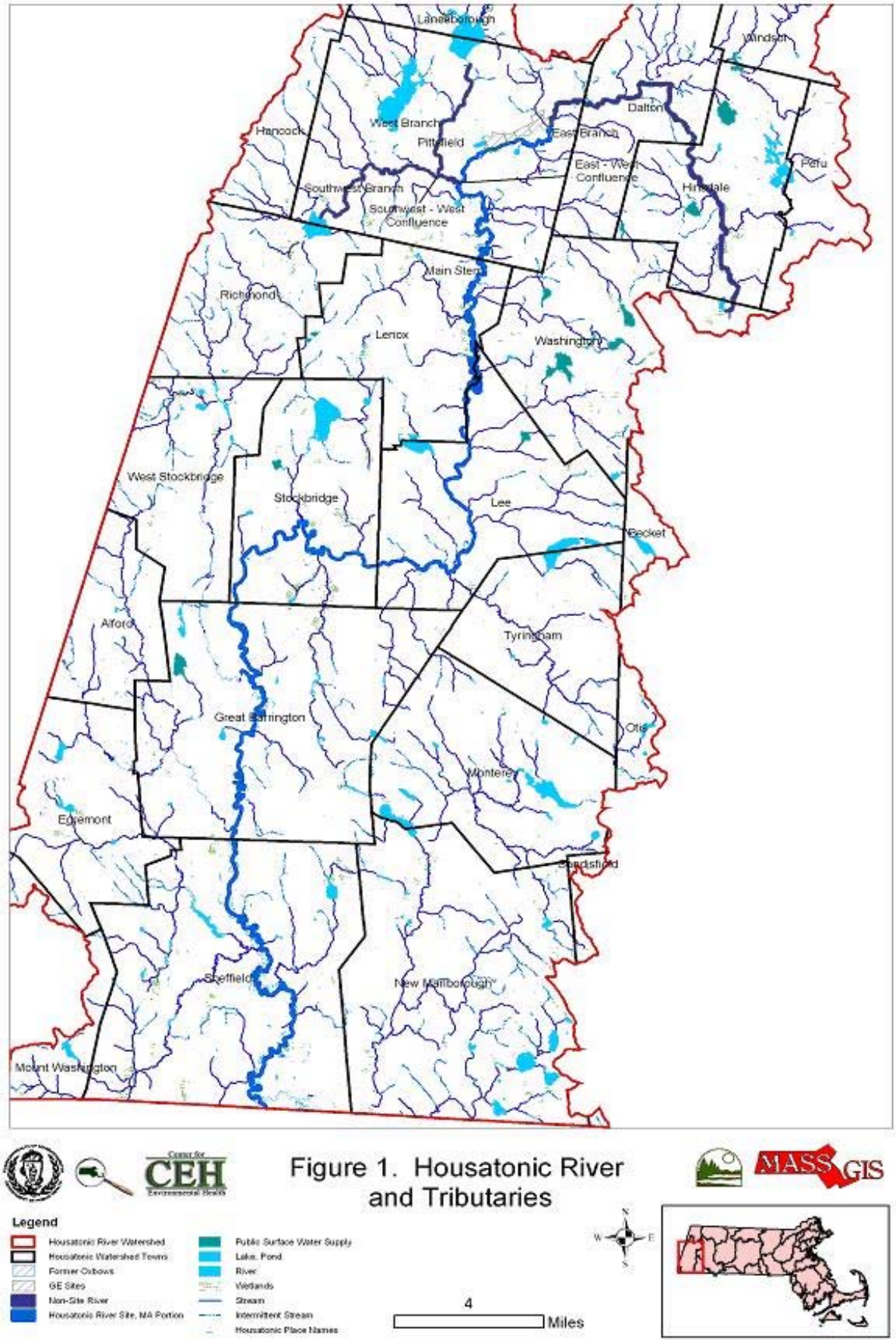
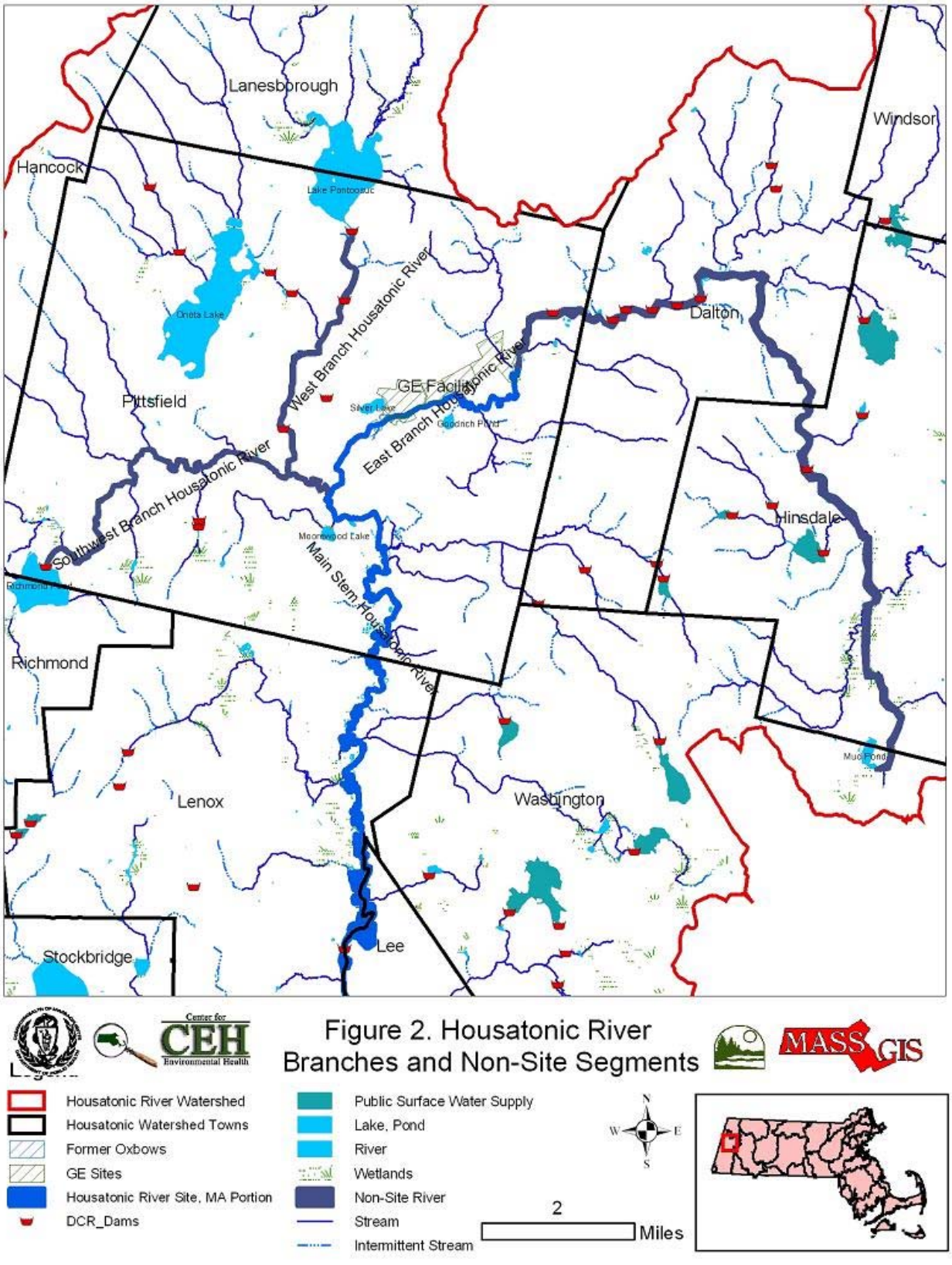
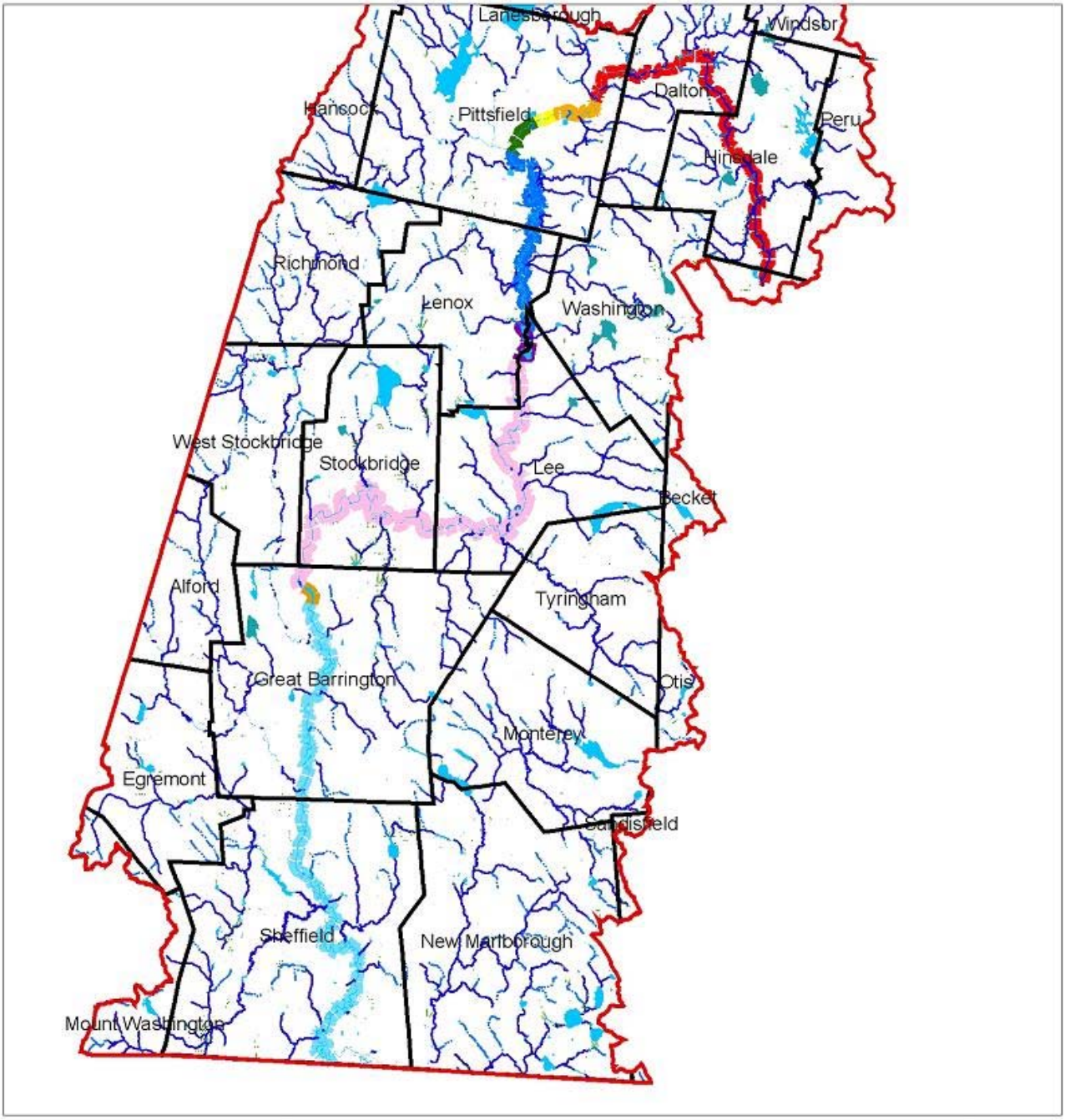


Figure 1. Housatonic River and Tributaries


Lanesborough
Windsor
Hancock
Lake Pontoosuc
Onota Lake
West Branch Housatonic River
Dalton
GE Facilities
East Branch Housatonic River
Pittsfield
Silver Lake
Goodrich Pond
Southwest Branch Housatonic River
Hinsdale
Moorewood Lake
Main Stem Housatonic River
Richmond
Mud Pond
Lenox
Washington
Lee
Stockbridge
Center for CEH Environmental Health
Figure 2. Housatonic River Branches and Non-Site Segments
MASS GIS
Housatonic River Watershed
Housatonic Watershed Towns
Former Oxbows
GE Sites
Housatonic River Site, MA Portion
DCR_Dams
Public Surface Water Supply
Lake, Pond
River
Wetlands
Non-Site River
Stream
Intermittent Stream
N
W
E
S
2
Miles



Center for CEH Environmental Health

MASS GIS

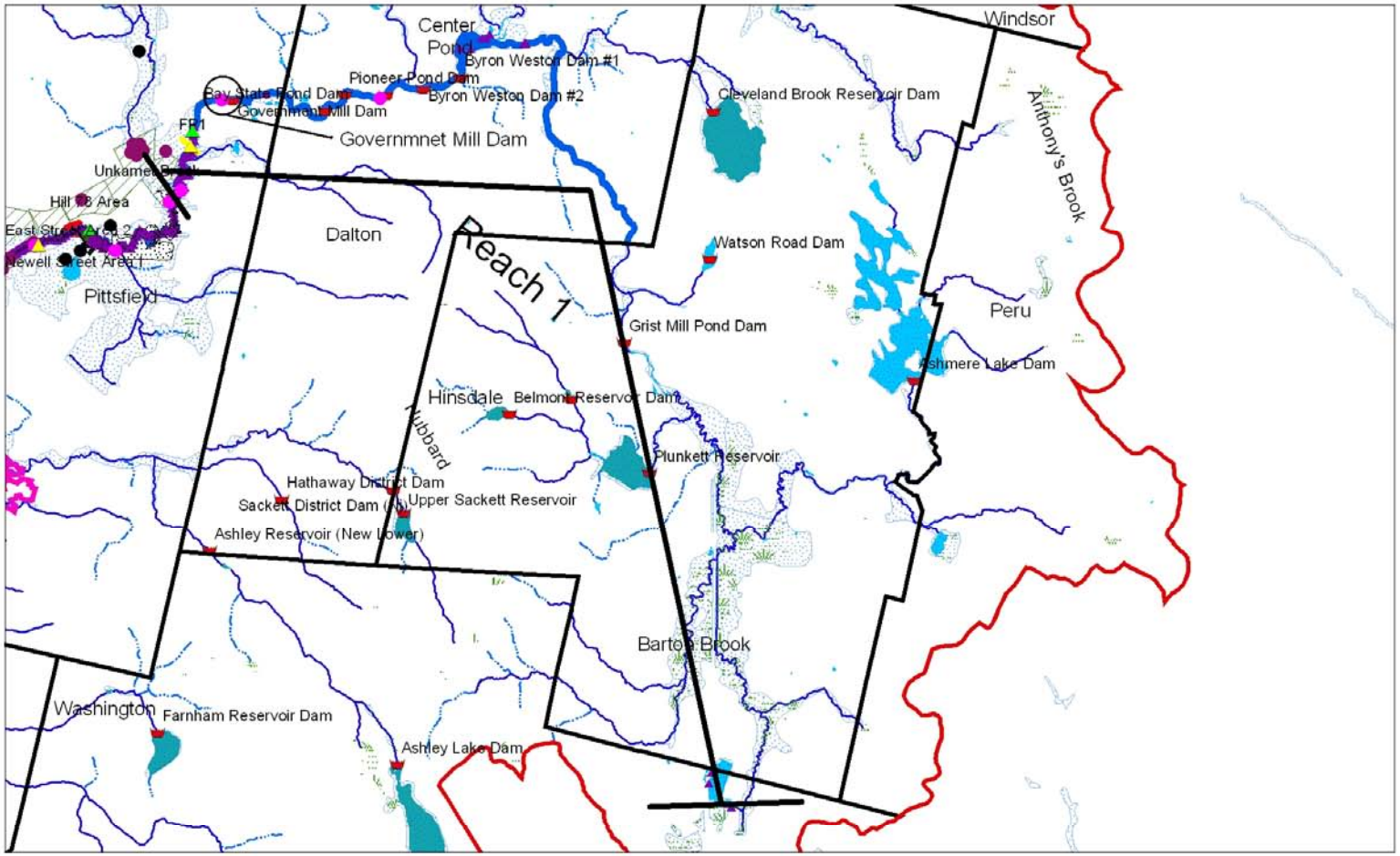
Figure 3. Housatonic River Reaches

Legend

- Housatonic River Watershed
- Housatonic Watershed Towns
- Public Surface Water Supply
- Lake, Pond
- River
- Wetlands
- Stream
- Intermittent Stream
- Reach 1
- Reach 2
- Reach 3
- Reach 4
- Reach 5
- Reach 6
- Reach 7
- Reach 8
- Reach 9

N W E S

7.5 Miles



Legend

- Housatonic River Watershed
- Housatonic Watershed Towns
- Surface Soil PCB Max Level
- Surface Sediment PCB Max Level
- Water Sample Stations
- Groundwater Sample Sites
- Air Sample Stations
- Soil Sample Transects
- EPA PCB Samples
- Soil Sample Areas
- 10_yr Floodplain
- 100_yr Floodplain
- Removal Actions
- Farmland
- Former Oxbows
- GE Sites
- H._River_Fish_Advisory_Extent
- DCR_Dams
- Public Surface Water Supply
- Lake, Pond
- River
- Wetlands
- Stream
- Intermittent Stream

Figure 4a. Housatonic River Reach 1 Detail

* Sample locations are from Blasland Bouck & Lee, Inc. and Roy F. Weston, Inc. Reports issued between 1991 and 2003 as well as EPA data files.

0.75 Miles

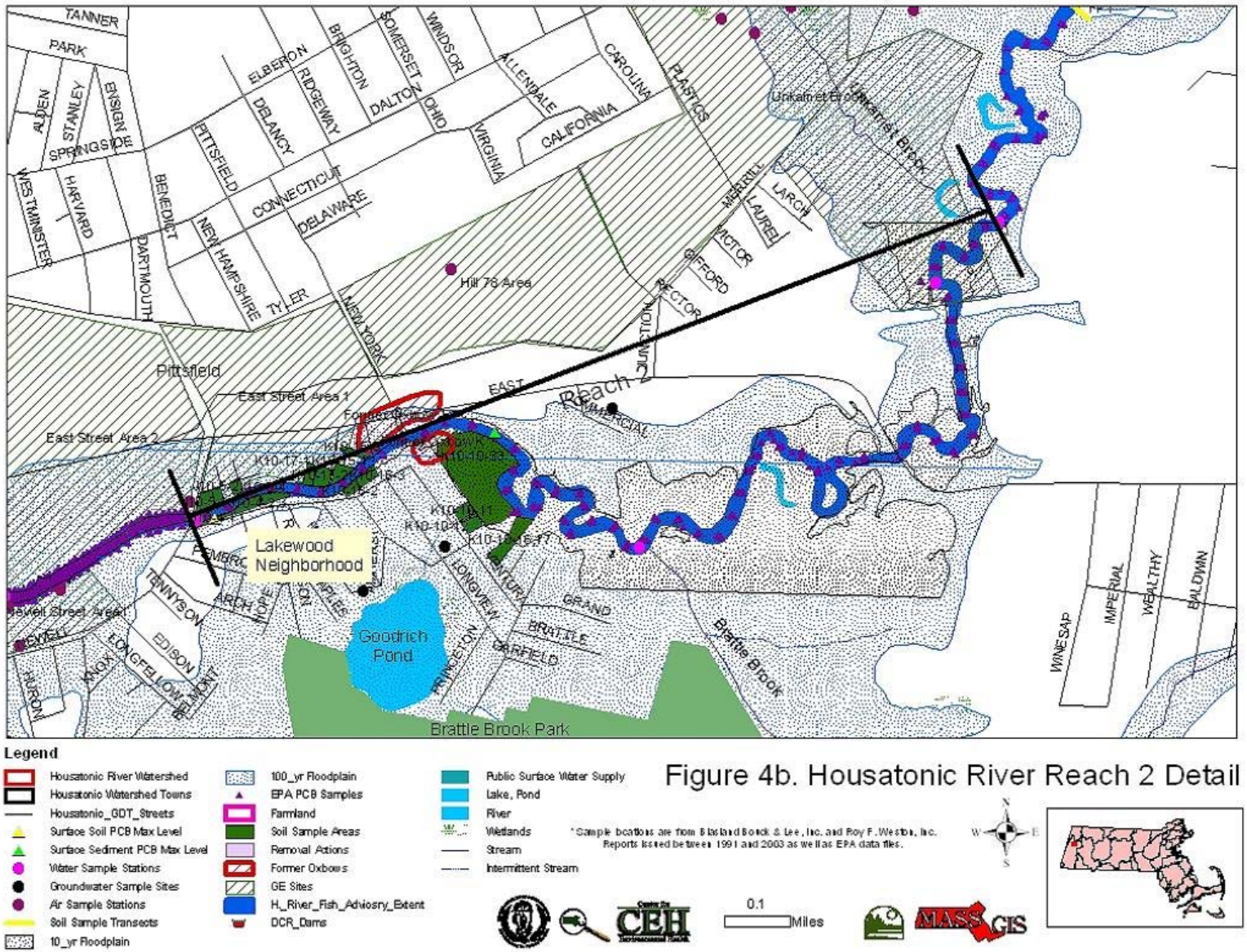


Figure 4b. Housatonic River Reach 2 Detail

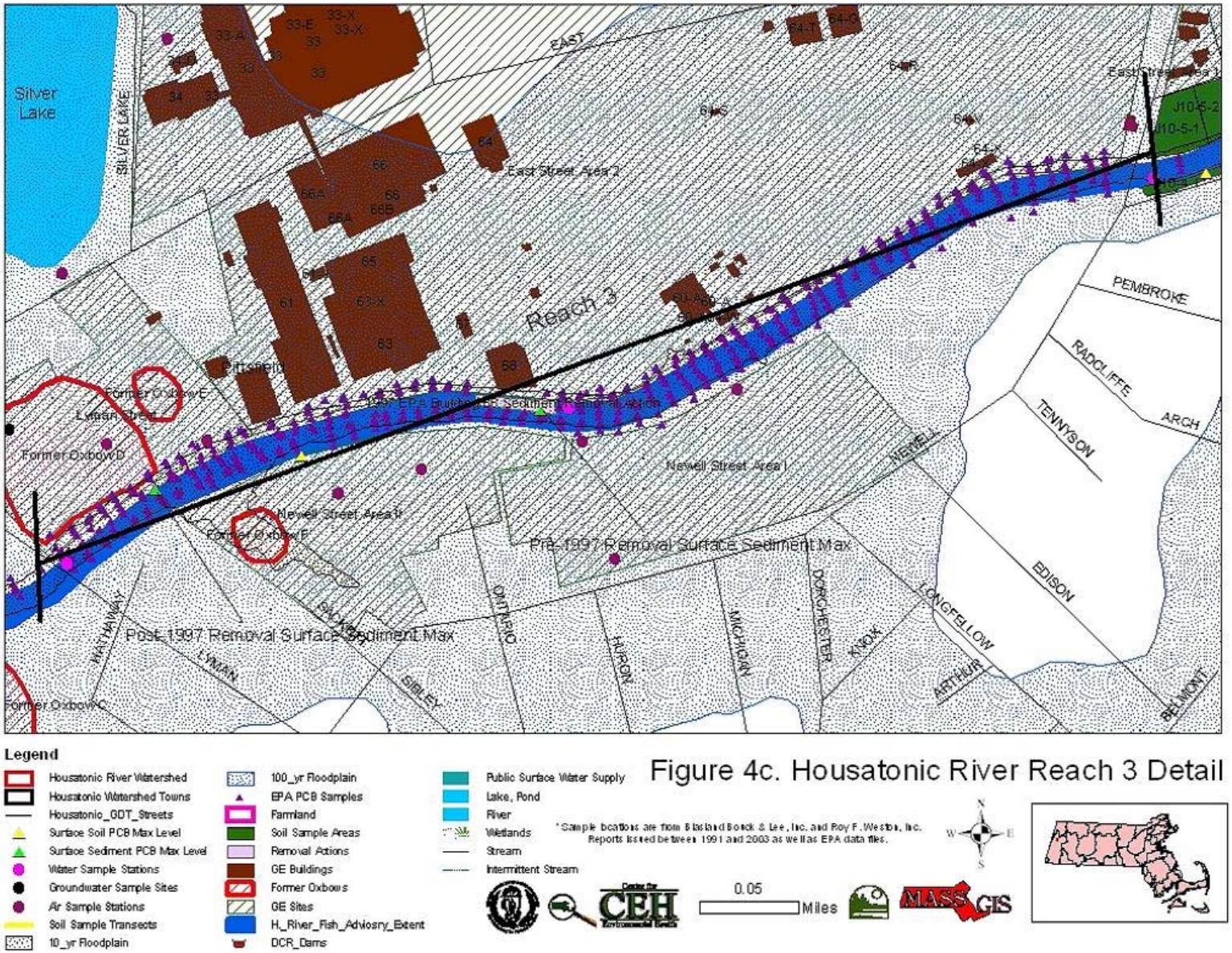


Figure 4c. Housatonic River Reach 3 Detail

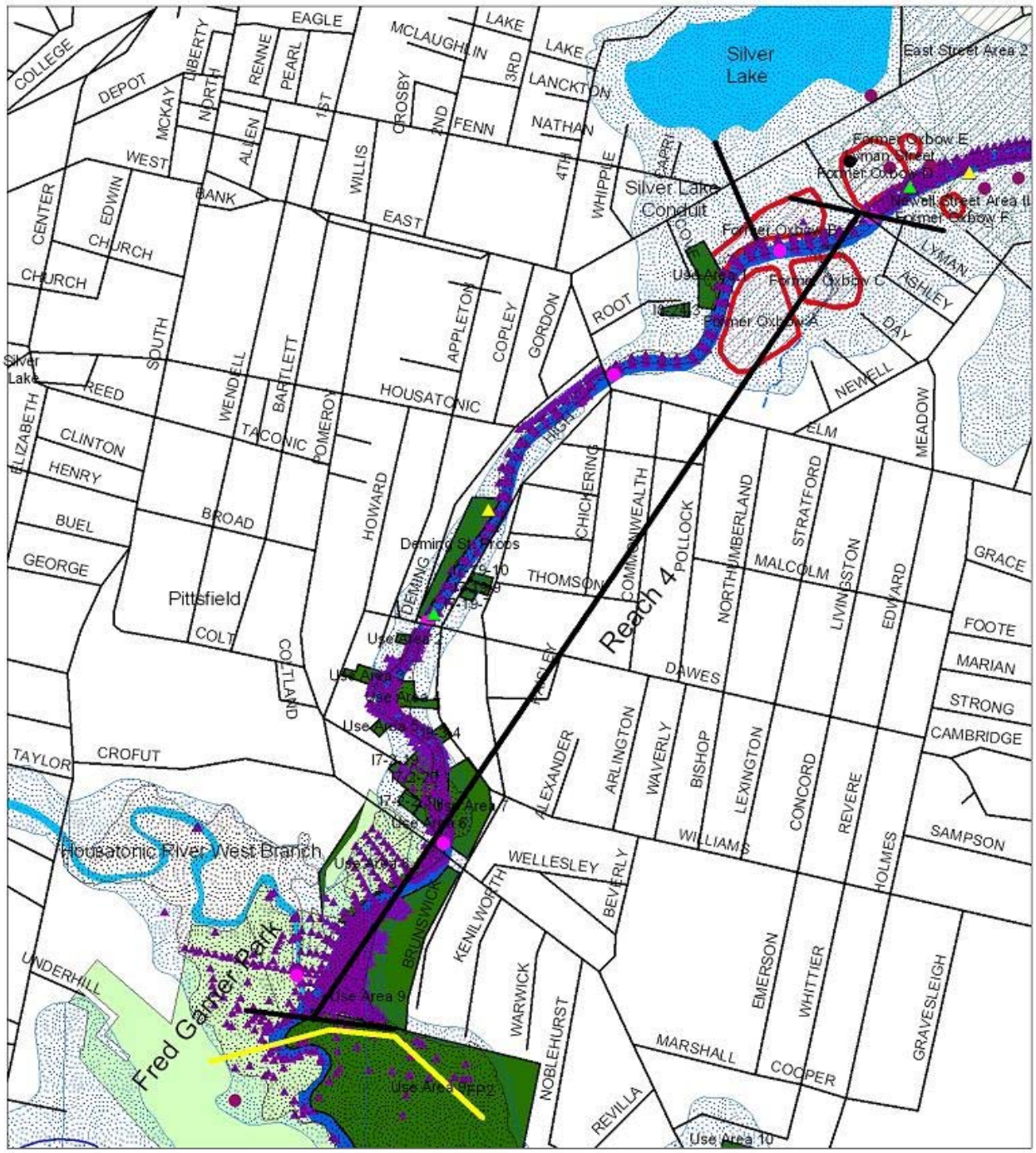


Figure 4d. Housatonic River Reach 4 Detail

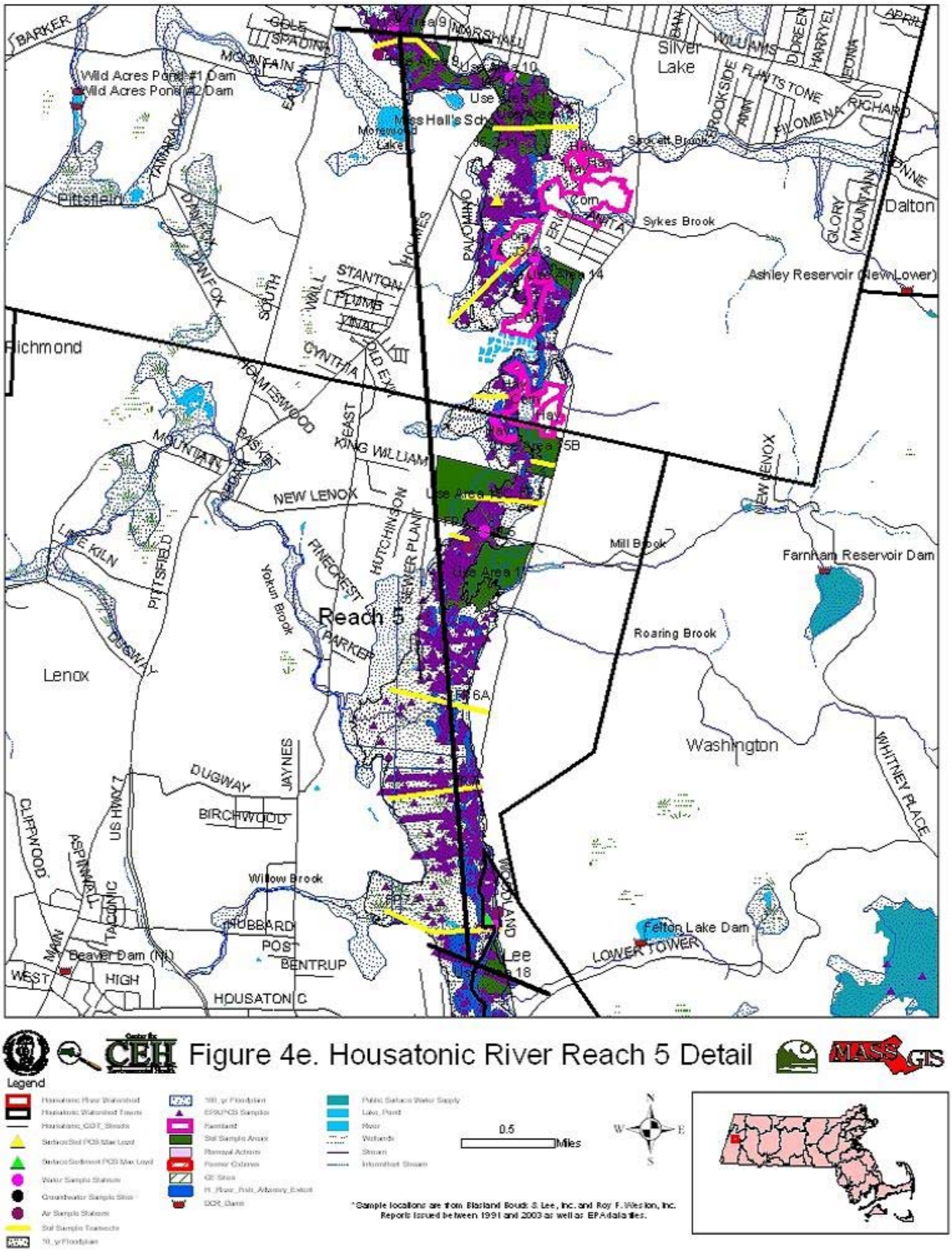
Legend

- Housatonic River Watershed
- Housatonic Watershed Towns
- Housatonic_GDT_Streets
- Surface Soil PCB Max Level
- Surface Sediment PCB Max Level
- Water Sample Stations
- Groundwater Sample Sites
- Air Sample Stations
- Soil Sample Transects
- 10_yr Floodplain
- 100_yr Floodplain
- EPA PCB Samples
- Soil Sample Areas
- Removal Actions
- Farmland
- Former Oxbows
- GE Sites
- H_River_Fish_Advisory_Extent
- DCR_Dams
- Public Surface Water Supply
- Lake, Pond
- River
- Wetlands
- Stream
- Intermittent Stream
- Fred_Garner_Park

0.1 Miles

N W E S

* Sample locations are from Blasland Bouck & Lee, Inc. and Roy F. Weston, Inc. Reports issued between 1991 and 2003 as well as EPA data files.


Wild Acres Pond #1 Dam
Wild Acres Pond #2 Dam
Miss Hall's School
Pittsfield
Silver Lake
Dalton
Sykes Brook
Ashley Reservoir (New Lower)
Richmond
Mill Brook
Farnham Reservoir Dam
Roaring Brook
Reach 5
Lenox
Washington
Willow Brook
Felton Lake Dam
Beaver Dam (NI)
Lee
HOUSATONIC
Use Area 10
Use Area 14
Use Area 15B
Use Area 16A
Use Area 18
Figure 4e. Housatonic River Reach 5 Detail
Legend
0.5
Miles
N
S
E
W
*Sample locations are from Blasland Bouck & Lee, Inc. and Roy F. Weston, Inc. Reports issued between 1991 and 2003 as well as EPA data tables.

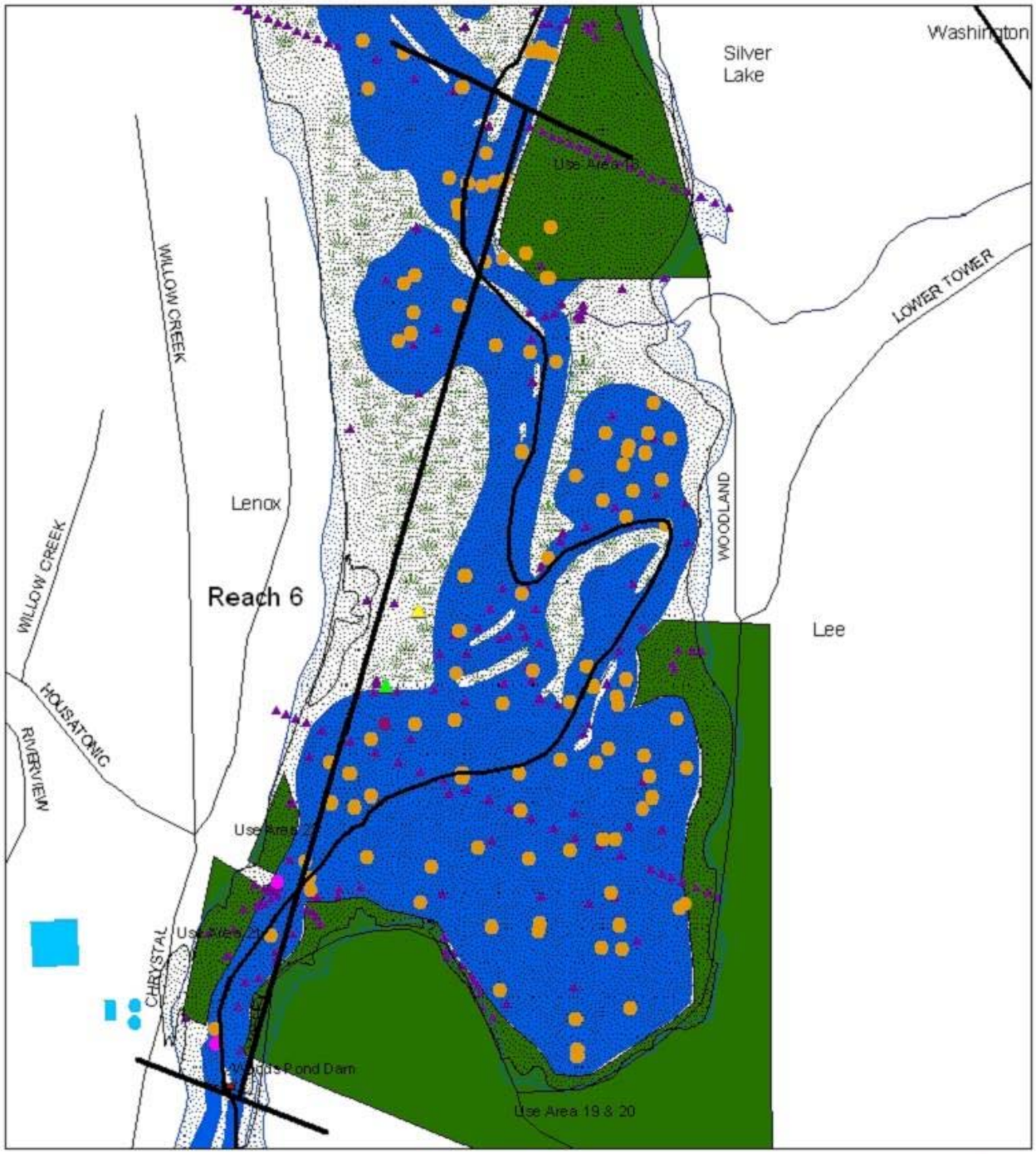


Figure 4f. Housatonic River Reach 6 Detail

Legend

Housatonic River Watershed
Housatonic Watershed Towns
Housatonic_GDT_Streets
Surface Soil PCB Max Level
Surface Sediment PCB Max Level
Water Sample Stations
Groundwater Sample Sites
Air Sample Stations
Soil Sample Transects
10_yr Floodplain
100_yr Floodplain
EPA PCB Samples
Farmland
Soil Sample Areas
GE_Historic_Sediment_Samples
Removal Actions
Former Oxbows
GECSites
H_River_Fish_Advisory_Extent
DCR_Dams
Public Surface Water Supply
Lake, Pond
River
Wetlands
Stream
Intermittent Stream

0.1 Miles

N
W
E
S

*Sample locations are from Blasland Bouck & Lee, Inc. and Roy F. Weston, Inc. Reports issued between 1991 and 2003 as well as EPA data files.

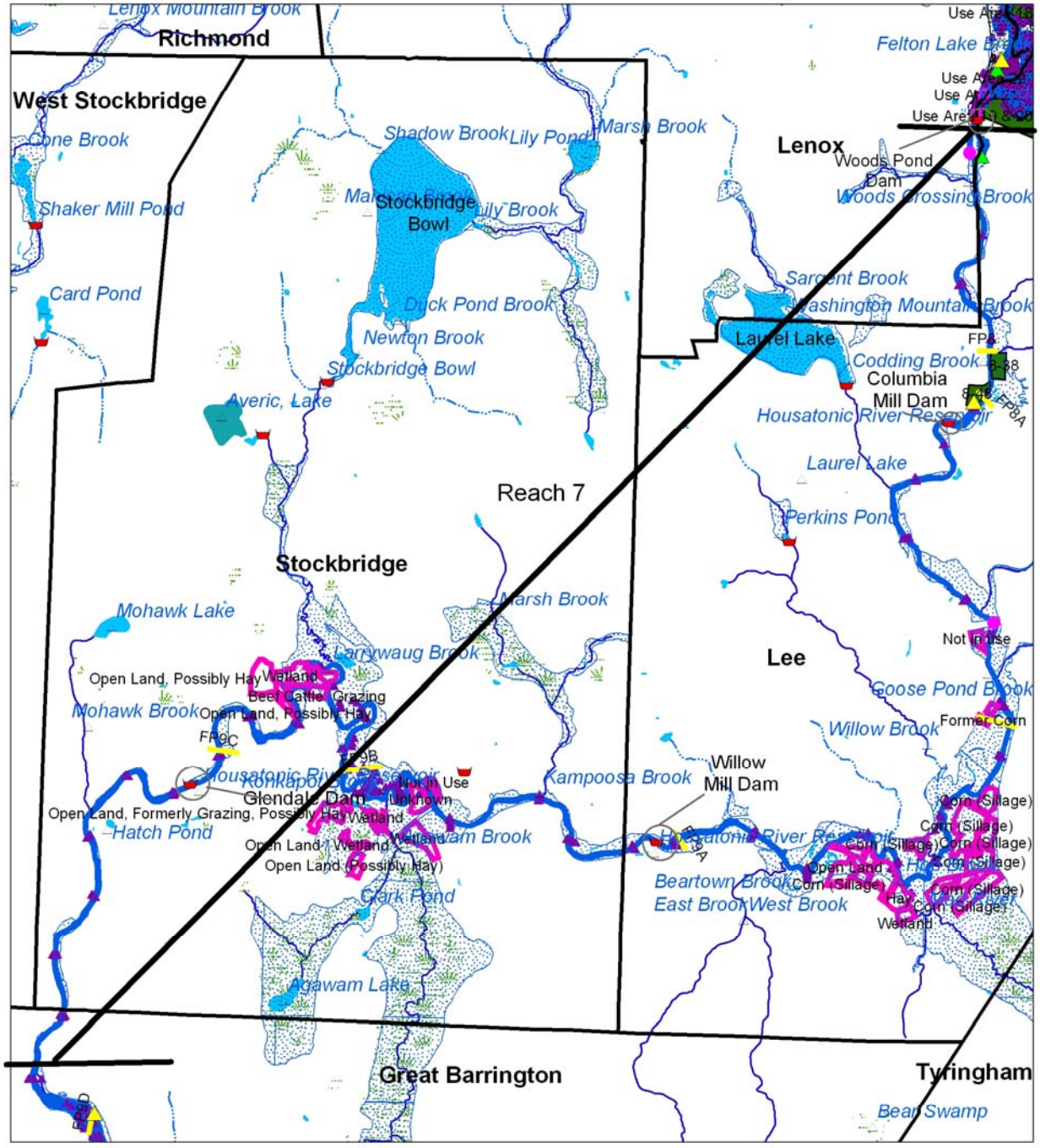


Figure 4g. Housatonic River Reach 7 Detail

Legend

- Housatonic River Watershed
- Housatonic Watershed Towns
- Surface Soil PCB Max Level
- DCR_Dams
- Surface Sediment PCB Max Level
- Water Sample Stations
- Groundwater Sample Sites
- Air Sample Stations
- Soil Sample Transects
- 10_yr Floodplain
- 100_yr Floodplain
- EPA PCB Samples
- Farmland
- Soil Sample Areas
- Removal Actions
- Former Oxbows
- GE Sites
- H._River_Fish_Advisory_Extent
- Public Surface Water Supply
- Lake, Pond
- River
- Wetlands
- Stream
- Intermittent Stream
- DCR_Dams

0.8 Miles

N W E S

* Sample locations are from Blasland Bouck & Lee, Inc. and Roy F. Weston, Inc. Reports issued between 1991 and 2003 as well as EPA data files.

Center for CEH Environmental Health

Figure 4h. Housatonic River Reach 8 Detail

MASS GIS

Legend

- Housatonic River Watershed
- Housatonic Watershed Towns
- Housatonic_GDT_Streets
- Surface Soil PCB Max Level
- Surface Sediment PCB Max Level
- Water Sample Stations
- Groundwater Sample Sites
- Air Sample Stations
- Soil Sample Transects
- 10_yr Floodplain
- 100_yr Floodplain
- EPA PCB Samples
- Farmland
- Soil Sample Areas
- GE_Historic_Sediment_Samples
- Removal Actions
- Former Oxbows
- GE Sites
- H._River_Fish_Advisory_Extent
- DCR_Dams
- Public Surface Water Supply
- Lake, Pond
- River
- Wetlands
- Stream
- Intermittent Stream

0.05 Miles

N W E S

* Sample locations are from Blasland Bouck & Lee, Inc. and Roy F. Weston, Inc. Reports issued between 1991 and 2003 as well as EPA data files.

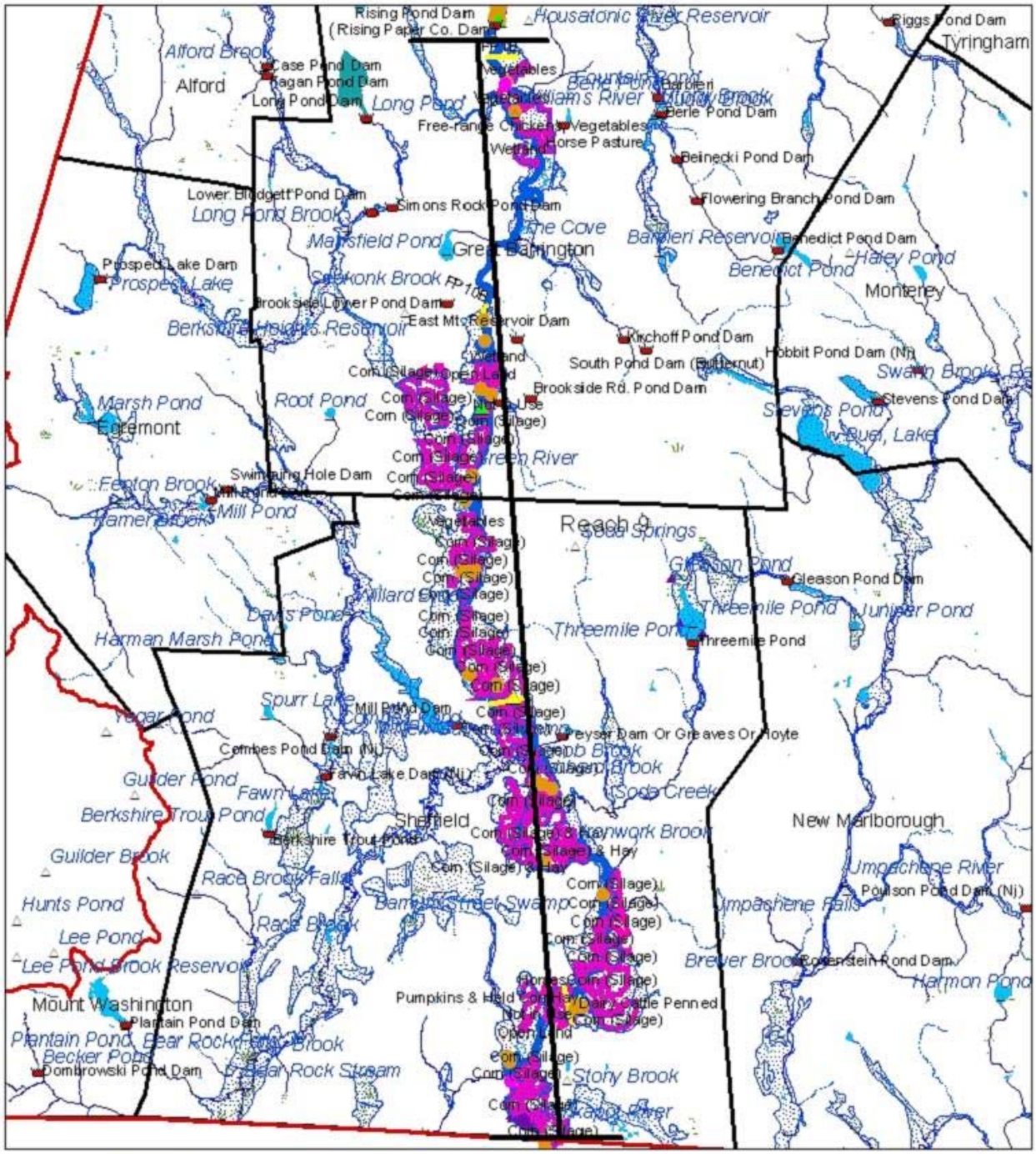


Figure 4i. Housatonic River Reach 9 Detail

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Appendices A – H

Appendix A

Public Health Assessments versus Risk Assessments

ATSDR's public health assessments differ from the more quantitative risk assessments conducted by regulatory agencies, such as EPA. Both types of assessments attempt to address the potential human health effects of low-level environmental exposures, but they are approached differently and are used for different purposes. One needs to understand these differences to know how to interpret and integrate the information generated by each of these assessments.

- *The quantitative risk assessment* is used by regulators as part of site remedial investigations to determine the extent to which site remedial action (e.g., cleanup) is needed. The risk assessment provides a numeric estimate of theoretical risk or hazard, assuming no cleanup takes place. It focuses on current and potential future exposures and considers all contaminated media regardless if exposures are occurring or are likely to occur. By design, it generally uses standard (default) protective exposure assumptions when evaluating site risk. Although this is normally the case, in the specific case the Human Health Risk Assessment conducted by EPA for the "Rest of River" Housatonic River site, EPA relied on site-specific information on exposure pathways and assumptions wherever possible.

- *The public health assessment* is used by ATSDR to identify possible harmful exposures and to recommend actions needed to protect public health. ATSDR considers the same environmental data as EPA, but focuses more closely on site-specific exposure conditions, specific community health concerns, and any available health outcome data to provide a more qualitative, less theoretical evaluation of possible public health hazards. It considers past exposures in addition to current and potential future exposures.

The general steps in the two processes are similar (e.g., data gathering, exposure assessment, toxicologic evaluation), but the public health assessment provides additional public health perspective by integrating site-specific exposure conditions with health effects data and specific community health concerns. ATSDR's public health assessment also evaluates health outcome data, when available, to identify whether rates of disease or death are elevated in a site community, especially if the community expresses concern about a particular outcome (e.g., cancer).

Remedial plans based on a quantitative risk assessment represent a prudent public health approach—that of prevention. By design, however, quantitative risk assessments used for regulatory purposes do not provide perspective on what the risk estimates mean in the context of the site community. The public health assessment does. The process is more exposure driven. The process identifies and explains whether exposures are truly likely to be harmful under site-specific conditions and recommends actions to reduce or prevent such exposures.

Appendix B
Property Specific Soil and Sediment PCB Data for Reaches 5 – 9 ("Rest of River")

The following tables present PCB soil and sediment sample results for samples taken by EPA consultants (Weston) and GE consultants (BBL) by specific property or exposure area within the Housatonic River floodplain in Reaches 5 through 9. Consultants for both GE (BBL) and EPA (Weston) sampled soil and sediment along the Housatonic River over the past two decades for different purposes. Overall there were many more samples collected for the Human Health Risk Assessment for the "Rest of River" (Reaches 5 through 9) than for initial studies of the Housatonic River in Reaches 5 through 9. The "Rest of River" sampling focused on many different types of individual properties. These were categorized by low and high contact residential use, low and high contact industrial use, agricultural use, low and high contact commercial/industrial use, and use by utility workers based on observations of land use. EPA used a screening approach to screen out properties with contamination less than 2 mg/kg PCBs (the residential cleanup standard in Massachusetts), and spatially weighted contamination on properties with contamination over 2 mg/kg PCBs in order to come up with reasonable maximum (based on 90th percentile) and central tendency (based on 50th percentile) exposure point concentrations to use in the risk assessment. This public health assessment combined all consultant data as well as data from Residential Fill Properties that abut the Housatonic River in order to take into account all available information and used average concentrations reach-wide for surface soil and sediment in order to come up with exposure estimates. Later sampling efforts contributed much more data overall to sampling done previously and taken together substantially increased the robustness of the information available. For the tables in the document, we kept the original properties sampled in initial investigation along the Housatonic River separate, and averaged "Rest of River" property data per Reach together due to the volumes of "Rest of River" data in order to come up with property exposure estimates. In this Appendix the range PCB data for each "Rest of River" property or exposure area in Reaches 5 through 9 ("Rest of River") are given along with any properties sampled previously in Reaches 5 through 9. The maximum detection could be considered a worst-case opportunity for exposure at that property. For Reaches 1 through 4 this health assessment used a similar approach, however, EPA samples come from other documents besides the Human Health Risk Assessment, as well as EPA databases.

Surface PCB Levels for EPA Residential Floodplain Soil Reach 5

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 5	I6-1-3	Residential	1.00	2.00	ND(0.5)	0.046 J	0 - 0.5 ft.	0.4 CREG
Reach 5	I6-3-13	Residential	6.00	8.00	ND(0.5)	10.3	0 - 0.5 ft.	0.4 CREG
Reach 5	J6-2-1	Residential	5.00	5.00	14.5	58.1	0.5 - 1 ft.	0.4 CREG
Reach 5	J6-2-2	Residential	10.00	16.00	ND(0.5)	15.4 J	0.5 - 1 ft.	0.4 CREG
Reach 5	J6-3-1	Residential	6.00	6.00	5.42 J	26.8 J	0.5 - 1 ft.	0.4 CREG
Reach 5	J5-2- 9, J5-2-10	Residential	12.00	13.00	ND(0.5)	24.1	0 - 0.5 ft.	0.4 CREG

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 5	J5-2-8	Residential	2.00	2.00	2.4	4.4 J	0.5 - 1 ft.	0.4 CREG
Reach 5	J5-2-7	Residential	1.00	2.00	ND(0.5)	0.56 J	0 - 0.5 ft.	0.4 CREG
Reach 5	J5-2-11	Residential	5.00	7.00	ND(0.5)	7.2	0 - 0.5 ft.	0.4 CREG
Reach 5	29-5	Residential	8.00	9.00	ND(0.5)	133 J	0 - 0.5 ft.	0.4 CREG
Reach 5	9-17	Residential	5.00	12.00	ND(0.5)	1.0	0 - 0.5 ft.	0.4 CREG
Reach 5	I6-1-42	Residential	10.00	10.00	0.63 J	10.5 J	0 - 0.5 ft.	0.4 CREG
Reach 5	I6-1-2	Residential	2.00	4.00	ND(0.5)	0.7	0 - 0.5 ft.	0.4 CREG
Reach 5	I6-2-6	Residential	2.00	2.00	0.5	2.11	0 - 0.5 ft.	0.4 CREG
Reach 5	I6-3-13	Residential	6.00	6.00	11.7	119	0.5 - 1 ft.	0.4 CREG
Reach 5	I6-3-1	Residential	19.00	22.00	ND(0.5)	59.1 J	0 - 0.5 ft.	0.4 CREG
Reach 5	J6-2-11	Residential	0.00	2.00	ND(0.5)	ND(0.5)	0 - 0.5 ft.	0.4 CREG
Reach 5	J5-2-5	Residential	10.00	12.00	ND(1.5)	10.8 J	0 - 0.5 ft.	0.4 CREG
Reach 5	J5-2-11	Residential	4.00	4.00	1.1	21.3	0 - 0.5 ft.	0.4 CREG
Reach 5	J5-2-4	Residential	21.00	24.00	ND(0.018)	51.3 J	0 - 0.5 ft.	0.4 CREG
Reach 5	J4-8-5	Residential	7.00	9.00	ND(0.02)	2.2	0.5 - 1 ft.	0.4 CREG
Reach 5	J4-8-8	Residential	0.00	2.00	ND(0.5)	ND(0.5)	0 - 0.5 ft.	0.4 CREG
Reach 5	J4-8-2	Residential	4.00	7.00	ND(0.5)	2.1	0 - 0.5 ft.	0.4 CREG
Reach 5	J4-8-10	Residential	1.00	3.00	ND(0.5)	0.7	0 - 0.5 ft.	0.4 CREG
Reach 5	J4-3-7	Residential	2.00	2.00	3.3 J	3.5 J	0 - 0.5 ft.	0.4 CREG
Reach 5	J4-3-8	Residential	3.00	5.00	ND(0.5)	5.7 J	0 - 0.5 ft.	0.4 CREG
Reach 5	J4-3-9	Residential	4.00	4.00	0.03	1.9 J	0 - 0.5 ft.	0.4 CREG
Reach 5	J4-3-10	Residential	2.00	2.00	0.04	0.4 J	0 - 0.5 ft.	0.4 CREG
Reach 5	J4-3-11	Residential	3.00	4.00	ND(0.5)	0.68	0 - 0.5 ft.	0.4 CREG
Reach 5	J3-1-14	Residential	5.00	6.00	ND(0.5)	132	0.5 - 1 ft.	0.4 CREG
Reach 5	J3-1-13	Residential	4.00	4.00	2.5	16.8 J	0.5 - 1 ft.	0.4 CREG
Reach 5	J3-1-12	Residential	4.00	4.00	0.034	26	0.5 - 1 ft.	0.4 CREG
Reach 5	J3-1-11	Residential	5.00	5.00	3.7	33	0 - 0.5 ft.	0.4 CREG
Reach 5	J3-1-10	Residential	1.00	4.00	ND(0.5)	0.55	0.5 - 1 ft.	0.4 CREG
Reach 5	J3-1-9	Residential	3.00	6.00	ND(0.5)	0.53	0.5 -1 ft.	0.4 CREG
Reach 5	J3-1-8	Residential	0.00	4.00	ND(0.5)	ND(0.5)	0 - 0.5 ft.	0.4 CREG

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 5	J3-2-2	Residential	4.00	4.00	11.36	93.7	0 - 0.5 ft.	0.4 CREG
Reach 5	J3-2-3	Residential	4.00	4.00	0.52	18.7	0 - 0.5 ft.	0.4 CREG
Reach 5	J3-2-4	Residential	4.00	4.00	6.10	22.8	0 - 0.5 ft.	0.4 CREG
Reach 5	J3-2-5	Residential	2.00	2.00	14.2	19.6	0.5 - 1 ft.	0.4 CREG
Reach 5	J3-2-6	Residential	2.00	2.00	1.4	2.8	0 - 0.5 ft.	0.4 CREG
Reach 5	K3-1-2	Residential	6.00	8.00	ND(0.5)	40.6	0 - 0.5 ft.	0.4 CREG
Reach 5	K2-1-10	Residential	7.00	8.00	ND(0.5)	99.5	0.5 - 1 ft.	0.4 CREG
Reach 5	K2-1-2	Residential	2.00	6.00	ND(0.024)	2.4 J	0 - 0.5 ft.	0.4 CREG
Reach 5	23-37	Residential	3.00	10.00	ND(0.021)	0.4 J	0.5 - 1 ft.	0.4 CREG
Reach 5	24-6	Residential	4.00	4.00	1.8	9.6	0.5 - 1 ft.	0.4 CREG
Reach 5	24-5	Residential	8.00	10.00	ND(0.5)	162	0.5 - 1 ft.	0.4 CREG
Reach 5	24-4	Residential	7.00	8.00	ND(0.5)	163.3	0 - 0.5 ft.	0.4 CREG
Reach 5	24-3	Residential	4.00	9.00	ND(0.5)	5.6	0.5 - 1 ft.	0.4 CREG
Reach 5	24-1	Residential	10.00	10.00	1.4	53.3	0 - 0.5 ft.	0.4 CREG
Reach 5	18-85	Residential	11.00	100.00	ND(0.022)	2.6	0 - 0.5 ft.	0.4 CREG
		TOTALS	**261.00**	**428.00**	**ND(0.018)**	**163.3**	**0 - 0.5 ft.**	**0.4 CREG**

Surface PCB Levels for EPA Residential Floodplain Soil Reach 6

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 6	9-18	Residential	26.00	33.00	ND(0.02)	321 J	0 - 0.5 ft.	0.4 CREG
		TOTALS	**26.00**	**33.00**	**ND(0.02)**	**321 J**	**0 - 0.5 ft.**	**0.4 CREG**

Surface PCB Levels for EPA Residential Floodplain Soil Reach 7

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 7	4-73	Residential	10.00	12.00	ND(0.5)	18.1	0.5 - 1 ft.	0.4 CREG
Reach 7	8-37, 8-38	Residential	2.00	11.00	ND(0.5)	0.86	0 - 0.5 ft.	0.4 CREG
Reach 7	8-48	Residential	6.00	6.00	0.96	31.7	0 - 0.5 ft.	0.4 CREG
Reach 7	18A-117	Residential	0.00	4.00	ND(0.5)	ND(0.51)	0 - 0.5 ft.	0.4 CREG
Reach 7	25A-138	Residential	4.00	4.00	0.19	0.38 J	0.5 - 1 ft.	0.4 CREG
Reach 7	25-33	Residential	2.00	6.00	ND(0.5)	0.3 J	0 - 0.5 ft.	0.4 CREG

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 7	25-34	Residential	4.00	4.00	0.40 J	0.97	0 - 0.5 ft.	0.4 CREG
Reach 7	29-10429-105	Residential	5.00	5.00	0.84	4.0	0 - 0.5 ft.	0.4 CREG
Reach 7	29-102	Residential	4.00	6.00	ND(0.5)	1.5	0.5 - 1 ft.	0.4 CREG
Reach 7	29-101	Residential	2.00	4.00	ND(0.5)	7.3	0.5 - 1 ft.	0.4 CREG
Reach 7	29-100	Residential	4.00	4.00	1.5	4.4	0 - 0.5 ft.	0.4 CREG
Reach 7	29-89	Residential	2.00	2.00	0.45 J	0.75 J	0 - 0.5 ft.	0.4 CREG
Reach 7	29-88	Residential	2.00	2.00	0.15	0.64	0 - 0.5 ft.	0.4 CREG
Reach 7	29-87	Residential	2.00	2.00	0.46 J	0.93	0 - 0.5 ft.	0.4 CREG
Reach 7	29-86	Residential	2.00	2.00	0.32 J	0.90 J	0 - 0.5 ft.	0.4 CREG
Reach 7	29-83	Residential	2.00	2.00	0.62 J	5.6 J	0 - 0.5 ft.	0.4 CREG
Reach 7	29-82	Residential	2.00	2.00	0.23 J	0.54 J	0 - 0.5 ft.	0.4 CREG
Reach 7	29-81	Residential	2.00	2.00	0.11	0.12	0.5 - 1 ft.	0.4 CREG
Reach 7	29-80	Residential	0.00	2.00	ND(0.5)	ND(0.5)	0 - 0.5 ft.	0.4 CREG
Reach 7	29-7829-79	Residential	4.00	4.00	0.40 J	2.1 J	0 - 0.5 ft.	0.4 CREG
Reach 7	29-77	Residential	2.00	2.00	0.57	1.4	0 - 0.5 ft.	0.4 CREG
Reach 7	29-75	Residential	5.00	5.00	0.56	2.3	0 - 0.5 ft.	0.4 CREG
Reach 7	29-74	Residential	2.00	2.00	1.9	2.2	0 - 0.5 ft.	0.4 CREG
Reach 7	29-73	Residential	2.00	2.00	2.1 J	3.7 J	0.5 - 1 ft.	0.4 CREG
Reach 7	29-72	Residential	2.00	2.00	1.9	7.8	0 - 0.5 ft.	0.4 CREG
Reach 7	29-70	Residential	2.00	2.00	3.4 J	3.5 J	0.5 - 1 ft.	0.4 CREG
Reach 7	29-65	Residential	3.00	4.00	ND(0.51)	0.62 J	0.5 - 1 ft.	0.4 CREG
Reach 7	29-64	Residential	2.00	2.00	0.5 J	0.74 J	0.5 - 1 ft.	0.4 CREG
Reach 7	29-63	Residential	2.00	2.00	0.39 J	0.73	0 - 0.5 ft.	0.4 CREG
Reach 7	29-62	Residential	3.00	3.00	0.36 J	1.1 J	0 - 0.5 ft.	0.4 CREG
Reach 7	29-61	Residential	2.00	2.00	0.51 J	0.76 J	0.5 - 1 ft.	0.4 CREG
Reach 7	29-60	Residential	2.00	2.00	0.58	2.4	0 - 0.1 ft.	0.4 CREG
Reach 7	26A-61	Residential	1.00	2.00	ND(0.020)	0.049 J	0 - 0.5 ft.	0.4 CREG
Reach 7	26A-60	Residential	2.00	2.00	0.036 J	1.2 J	0 - 0.5 ft.	0.4 CREG
Reach 7	26A-58	Residential	2.00	2.00	0.11 J	0.53 J	0 - 0.5 ft.	0.4 CREG
Reach 7	26A-56	Residential	2.00	2.00	0.11 J	0.73 J	0 - 0.5 ft.	0.4 CREG

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 7	26A-55	Residential	2.00	3.00	ND(0.5)	1.4 J	0 - 0.5 ft.	0.4 CREG
Reach 7	26A-54	Residential	2.00	2.00	0.26 J	1.0 J	0 - 0.5 ft.	0.4 CREG
Reach 7	26A-53	Residential	2.00	2.00	1.5 J	2.5 J	0 - 0.5 ft.	0.4 CREG
Reach 7	26A-52	Residential	2.00	2.00	0.026 J	0.2 J	0 - 0.5 ft.	0.4 CREG
Reach 7	26A-50.01	Residential	2.00	2.00	1.8 J	3.8 J	0.5 - 1 ft.	0.4 CREG
Reach 7	26A-41	Residential	2.00	2.00	1.7	2.2	0 - 0.5 ft.	0.4 CREG
Reach 7	26A-40	Residential	2.00	4.00	ND(0.5)	4.7	0 - 0.5 ft.	0.4 CREG
Reach 7	26A-40.01	Residential	2.00	2.00	0.06 J	0.23 J	0 - 0.5 ft.	0.4 CREG
Reach 7	26A-36.01	Residential	2.00	2.00	0.91 J	1.4 J	0 - 0.5 ft.	0.4 CREG
Reach 7	26A-36	Residential	4.00	4.00	0.25 J	0.91 J	0 - 0.5 ft.	0.4 CREG
Reach 7	26A-31	Residential	2.00	2.00	0.54 J	0.72 J	0 - 0.5 ft.	0.4 CREG
Reach 7	26A-27	Residential	2.00	2.00	0.25 J	0.96 J	0 - 0.5 ft.	0.4 CREG
Reach 7	26A-26.01	Residential	2.00	2.00	1.8 J	3.8 J	0.5 - 1 ft.	0.4 CREG
Reach 7	26A-24	Residential	2.00	2.00	1.4	2.3	0.5 - 1 ft.	0.4 CREG
Reach 7	26-84	Residential	3.00	4.00	ND(0.5)	1.3 J	0.5 - 1 ft.	0.4 CREG
Reach 7	21-65	Residential	2.00	2.00	1.2 J	3.6 J	0 - 0.5 ft.	0.4 CREG
Reach 7	21-64	Residential	2.00	2.00	0.078 J	0.42 J	0 - 0.5 ft.	0.4 CREG
Reach 7	21-63	Residential	2.00	2.00	0.38 J	0.96	0 - 0.5 ft.	0.4 CREG
Reach 7	20-13	Residential	0.00	4.00	ND(0.5)	ND(0.5)	0.5 - 1 ft.	0.4 CREG
Reach 7	20A-43	Residential	2.00	2.00	2.5 J	3.1 J	0.5 - 1 ft.	0.4 CREG
Reach 7	20A-42	Residential	1.00	2.00	ND(0.021)	0.15 J	0 - 0.5 ft.	0.4 CREG
Reach 7	20A-38	Residential	0.00	2.00	ND(0.51)	ND(0.60)	0 - 0.5 ft.	0.4 CREG
Reach 7	20A-37	Residential	0.00	2.00	ND(0.50)	ND(0.51)	0 - 0.5 ft.	0.4 CREG
Reach 7	20A-34	Residential	1.00	2.00	ND(0.021)	0.12 J	0.5 - 1 ft.	0.4 CREG
Reach 7	20A-33	Residential	1.00	2.00	ND(0.5)	0.29 J	0.5 - 1 ft.	0.4 CREG
Reach 7	20-4	Residential	2.00	5.00	ND(0.51)	2.8	0 - 0.5 ft.	0.4 CREG
Reach 7	9-54.02	Residential	2.00	2.00	1.7	3.2	0 - 0.5 ft.	0.4 CREG
Reach 7	9-54.01	Residential	2.00	2.00	0.89	1.2	0 - 0.5 ft.	0.4 CREG
Reach 7	9-56.01	Residential	3.00	6.00	ND(0.5)	0.39 J	0 - 0.5 ft.	0.4 CREG
Reach 7	9-43	Residential	2.00	2.00	0.31 J	0.42 J	0.5 - 1 ft.	0.4 CREG

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 7	9-39	Residential	1.00	2.00	ND(0.51)	0.50	0.5 - 1 ft.	0.4 CREG
Reach 7	9-38	Residential	0.00	2.00	ND(0.5)	ND(0.5)	0 - 0.5 ft.	0.4 CREG
Reach 7	9-37	Residential	2.00	3.00	ND(0.51)	0.51 J	0 - 0.5 ft.	0.4 CREG
Reach 7	5-31	Residential	2.00	2.00	0.067	0.70	0 - 0.5 ft.	0.4 CREG
Reach 7	5-23	Residential	6.00	8.00	ND(0.5)	1.89	0 - 0.5 ft.	0.4 CREG
Reach 7	5-22	Residential	2.00	2.00	0.33 J	0.73	0 - 0.5 ft.	0.4 CREG
Reach 7	6-1	Residential	2.00	2.00	0.11 J	0.13 J	0 - 0.5 ft.	0.4 CREG
Reach 7	6-2	Residential	2.00	2.00	0.095 J	0.12 J	0 - 0.5 ft.	0.4 CREG
Reach 7	6-3	Residential	3.00	3.00	1.1	4.0	0 - 0.5 ft.	0.4 CREG
		TOTALS	**172.00**	**226.00**	**ND(0.020)**	**31.7**	**0 - 0.5 ft.**	**0.4 CREG**

Surface PCB Levels for EPA Residential Floodplain Soil Reach 9

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 9	All	Residential	114.00	195.00	ND(0.018)	6.3 J	0.5 - 1 ft.	0.4 CREG
		TOTALS	**114.00**	**195.00**	**ND(0.018)**	**6.3 J**	**0.5 - 1 ft.**	**0.4 CREG**

Surface PCB Levels for EPA Recreational Floodplain Soil Reach 5

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 5	H6-4-13	Recreational	2.00	2.00	0.37 J	1.9	0 - 0.5 ft.	0.4 CREG
Reach 5	H6-4-5	Recreational	33.00	50.00	ND(0.5)	123	0.5 - 1 ft.	0.4 CREG
Reach 5	I6-1-41	Recreational	73.00	76.00	ND(0.9)	154 J	0 - 0.5 ft.	0.4 CREG
Reach 5	I6-1-27	Recreational	9.00	14.00	ND(0.5)	7.9	0 - 0.5 ft.	0.4 CREG
Reach 5	I5-1-1	Recreational	9.00	10.00	ND(0.5)	82.1 J	0 - 0.5 ft.	0.4 CREG
Reach 5	I6-1-1	Recreational	10.00	12.00	ND(0.5)	62.5	0 - 0.5 ft.	0.4 CREG
Reach 5	I6-2-1	Recreational	5.00	6.00	ND(0.5)	6.0	0 - 0.5 ft.	0.4 CREG
Reach 5	J6-3-2	Recreational	2.00	2.00	1.66	3.1	0.5 - 1 ft.	0.4 CREG
Reach 5	J6-4-2	Recreational	49.00	57.00	ND(0.5)	77.1	0 - 0.5 ft.	0.4 CREG
Reach 5	J5-2-110	Recreational	13.00	14.00	ND(0.5)	77.2	0 - 0.5 ft.	0.4 CREG
Reach 5	J5-2-6	Recreational	4.00	4.00	0.42 J	9.4	0 - 0.5 ft.	0.4 CREG
Reach 5	J5-2-105	Recreational	24.00	24.00	0.4	46	0 - 0.5 ft.	0.4 CREG

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 5	J4-3-13	Recreational	121.00	124.00	ND(0.019)	874 J	0 - 0.5 ft.	0.4 CREG
Reach 5	J4-3-12	Recreational	41.00	42.00	ND(0.5)	141	0 - 0.5 ft.	0.4 CREG
Reach 5	J3-1-7	Recreational	4.00	4.00	1.9	8.9 J	0 - 0.5 ft.	0.4 CREG
Reach 5	J3-1-6	Recreational	29.00	34.00	ND(0.5)	117 J	0 - 0.5 ft.	0.4 CREG
Reach 5	K3-1-19	Recreational	5.00	5.00	0.54	11.9 J	0 - 0.5 ft.	0.4 CREG
Reach 5	J2-2-2	Recreational	84.00	117.00	ND(0.15)	78.1 J	0 - 0.5 ft.	0.4 CREG
Reach 5	K3-1-1	Recreational	8.00	9.00	ND(0.5)	34.1	0 - 0.5 ft.	0.4 CREG
Reach 5	K2-1-5	Recreational	8.00	8.00	ND(0.1)	48.4 J	0 - 0.5 ft.	0.4 CREG
Reach 5	K2-1-4	Recreational	4.00	5.00	ND(0.5)	67.8	0.5 - 1 ft.	0.4 CREG
Reach 5	K2-1-3	Recreational	5.00	6.00	ND(0.5)	47.5	0.5 - 1 ft.	0.4 CREG
Reach 5	K2-1-1	Recreational	10.00	13.00	ND(0.5)	65.2	0.5 - 1 ft.	0.4 CREG
Reach 5	33-40	Recreational	31.00	37.00	ND(0.5)	82.5	0 - 0.5 ft.	0.4 CREG
Reach 5	29-3	Recreational	84.00	93.00	ND(0.53)	96.9 J	0 - 0.5 ft.	0.4 CREG
Reach 5	29-9	Recreational	19.00	20.00	ND(0.51)	126 J	0 - 0.5 ft.	0.4 CREG
Reach 5	29-2	Recreational	214.00	313.00	ND(0.018)	249	0.5 - 1 ft.	0.4 CREG
Reach 5	29-1	Recreational	35.00	36.00	ND(0.5)	87.9	0.5 - 1 ft.	0.4 CREG
Reach 5	24-7	Recreational	5.00	7.00	ND(0.5)	20 J	0 - 0.5 ft.	0.4 CREG
Reach 5	19-3	Recreational	83.00	99.00	ND(0.5)	76.7	0 - 0.5 ft.	0.4 CREG
Reach 5	19-5	Recreational	12.00	12.00	0.97	49.6 J	0 - 0.5 ft.	0.4 CREG
Reach 5	18-84	Recreational	2.00	5.00	ND(0.032)	0.03 J	0 - 0.5 ft.	0.4 CREG
Reach 5	19-2	Recreational	1.00	3.00	ND(0.5)	3.9 J	0 - 0.5 ft.	0.4 CREG
Reach 5	19-1	Recreational	80.00	142.00	ND(0.59)	93.7	0.5 - 1 ft.	0.4 CREG
Reach 5	14-4	Recreational	41.00	85.00	ND(0.69)	80 J	0 - 0.5 ft.	0.4 CREG
Reach 5	31-2	Recreational	5.00	34.00	ND(0.017)	0.02	0 - 0.5 ft.	0.4 CREG
Reach 5	18-86	Recreational	0.00	1.00	ND(1.2)	ND(1.2)	0 - 0.5 ft.	0.4 CREG
Reach 5	13-1	Recreational	0.00	2.00	ND(1.0)	ND(1.9)	0 - 0.5 ft.	0.4 CREG
Reach 5	1-4	Recreational	35.00	42.00	ND(0.5)	334 J	0 - 0.5 ft.	0.4 CREG
Reach 5	1-3	Recreational	10.00	34.00	ND(0.5)	94.0	0 - 0.5 ft.	0.4 CREG
Reach 5	1-1	Recreational	20.00	27.00	ND(0.5)	101	0 - 0.5 ft.	0.4 CREG
Reach 5	2-8	Recreational	1.00	1.00	68.2	68.2	0 - 0.5 ft.	0.4 CREG

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 5	2-4	Recreational	20.00	28.00	ND(0.5)	102	0 - 0.5 ft.	0.4 CREG
		TOTALS	**1250.00**	**1659.00**	**ND(0.017)**	**874 J**	**0 - 0.5 ft.**	**0.4 CREG**

Surface PCB Levels for EPA Recreational Floodplain Soil Reach 6

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 6	9-16	Recreational	10.00	11.00	ND(0.5)	38.9 J	0 - 0.5 ft.	0.4 CREG
		TOTALS	**10.00**	**11.00**	**ND(0.5)**	**38.9 J**	**0 - 0.5 ft.**	**0.4 CREG**

Surface PCB Levels for EPA Floodplain Soil Exposure Areas Reach 5

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 7	Exp Area 1	Recreational	1.00	3.00	ND(0.5)	0.02 J	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 2	Recreational	3.00	3.00	1.64	3.22 J	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 3	Recreational	1.00	5.00	ND(0.51)	5.5	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 4	Recreational	8.00	13.00	ND(0.5)	12.7	0.5 - 1 ft.	0.4 CREG
Reach 7	Exp Area 5	Residential	11.00	14.00	ND(0.5)	12.5	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 6	Recreational	3.00	3.00	2.6	5.4	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 7	Residential	5.00	6.00	ND(0.02)	3.3	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 8	Recreational	21.00	33.00	ND(0.5)	8.8 J	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 9	Recreational	7.00	9.00	ND(0.5)	7.9	0.5 - 1 ft.	0.4 CREG
Reach 7	Exp Area 10	Recreational	7.00	11.00	ND(0.5)	17.9	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 11	Comm.	3.00	8.00	ND(0.5)	5.4	0.5 - 1 ft.	0.4 CREG
Reach 7	Exp Area 12	Residential	0.00	4.00	ND(0.5)	ND(0.5)	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 13	Recreational	9.00	9.00	0.03	14	0.5 - 1 ft.	0.4 CREG
Reach 7	Exp Area 14	Comm.	9.00	9.00	1.24	5.07	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 15	Residential	4.00	9.00	ND(0.019)	0.53	0.5 - 1 ft.	0.4 CREG
Reach 7	Exp Area 16	Recreational	6.00	14.00	ND(0.5)	2.0	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 17	Recreational	6.00	6.00	0.59	3.2 J	0.5 - 1 ft.	0.4 CREG
Reach 7	Exp Area 18	Recreational	13.00	14.00	ND(0.5)	7.7	0.5 - 1 ft.	0.4 CREG
Reach 7	Exp Area 19	Recreational	8.00	10.00	ND(0.5)	1.3	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 20	Recreational	9.00	9.00	0.92 J	6.7 J	0.5 - 1 ft.	0.4 CREG

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 7	Exp Area 21	Recreational	12.00	13.00	ND(0.7)	11.9	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 22	Comm.	4.00	6.00	ND(0.5)	3.4 J	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 23	Recreational	13.00	13.00	0.27 J	9.7	0.5 - 1 ft.	0.4 CREG
Reach 7	Exp Area 24	Comm.	4.00	4.00	1.0	2.3	0.5 - 1 ft.	0.4 CREG
Reach 7	Exp Area 25	Recreational	12.00	19.00	ND(0.021)	6.2	0.5 - 1 ft.	0.4 CREG
Reach 7	Exp Area 26	Recreational	3.00	13.00	ND(0.5)	1.3	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 27	Comm.	3.00	5.00	ND(0.5)	0.93	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 28	Recreational	22.00	33.00	ND(0.5)	16	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 29	Agricultural	3.00	11.00	ND(0.5)	0.61 J	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 30	Recreational	11.00	11.00	1.6 J	6.4 J	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 31	Recreational	13.00	27.00	ND(0.5)	8.6 J	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 32	Recreational	10.00	10.00	0.37 J	7.9 J	0.5 - 1 ft.	0.4 CREG
Reach 7	Exp Area 33	Comm.	10.00	12.00	ND(0.022)	5.4	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 34	Recreational	6.00	7.00	ND(0.51)	3.6 J	0.5 - 1 ft.	0.4 CREG
Reach 7	Exp Area 35	Recreational	10.00	11.00	ND(0.028)	7.4	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 36	Comm.	3.00	5.00	ND(0.5)	0.73 J	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 37	Recreational	4.00	7.00	ND(0.5)	1.3	0.5 - 1 ft.	0.4 CREG
Reach 7	Exp Area 38	Recreational	4.00	6.00	ND(0.5)	1.7	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 39	Recreational	5.00	6.00	ND(0.5)	1.6 J	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 40	Recreational	12.00	13.00	ND(0.5)	13 J	0.5 - 1 ft.	0.4 CREG
Reach 7	Exp Area 41	Comm.	5.00	5.00	0.12	1.8	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 42	Residential	8.00	9.00	ND(0.51)	1.8 J	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 43	Recreational	8.00	10.00	ND(0.5)	3.4	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 44	Recreational	63.00	68.00	ND(0.019)	9.1 J	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 45	Recreational	1.00	6.00	ND(0.5)	0.23 J	0.5 - 1 ft.	0.4 CREG
Reach 7	Exp Area 46	Recreational	8.00	10.00	ND(0.52)	6.1	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 47	Recreational	6.00	6.00	1.7	2.6	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 48	Recreational	4.00	6.00	ND(0.51)	3.5	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 49	Recreational	4.00	6.00	ND(0.51)	3.5	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 50	Recreational	0.00	4.00	ND(0.5)	ND(0.51)	0 - 0.5 ft.	0.4 CREG

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 7	Exp Area 51	Residential	3.00	4.00	ND(0.022)	14.0	0.5 - 1 ft.	0.4 CREG
Reach 7	Exp Area 52	Recreational	12.00	18.00	ND(0.5)	3.37	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 53	Recreational	17.00	21.00	ND(0.5)	19.1	0 - 0.5 ft.	0.4 CREG
Reach 7	Exp Area 54	Comm.	4.00	5.00	ND(0.5)	3.0	0.5 - 1 ft.	0.4 CREG
Reach 7	Exp Area 55	Comm.	0.00	4.00	ND(0.017)	ND(0.5)	0 - 0.5 ft.	0.4 CREG
		TOTALS	**441.00**	**606.00**	**ND(0.017)**	**19.1**	**0 - 0.5 ft.**	**0.4 CREG**

Surface PCB Levels for EPA Floodplain Soil Exposure Areas Reach 8

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 8	Exp Area 56	Recreational	24.00	31.00	ND(0.5)	6.0 J	0 - 0.5 ft.	0.4 CREG
Reach 8	Exp Area 57	Recreational	7.00	7.00	ND(0.53)	2.2	0.5 - 1 ft.	0.4 CREG
		TOTALS	**31.00**	**38.00**	**ND(0.5)**	**6.0 J**	**0 - 0.5 ft.**	**0.4 CREG**

Surface PCB Levels for EPA Recreational Floodplain Soil Reach 9

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 9	Bart Cobble	Recreational	16.00	26.00	ND(0.018)	6.32 J	0.5 - 1 ft.	0.4 CREG
		TOTALS	**16.00**	**26.00**	**ND(0.018)**	**6.32 J**	**0.5 - 1 ft.**	**0.4 CREG**

Surface PCB Levels for EPA Agricultural Floodplain Soil Reach 5

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 5	K4-6-28	Agricultural	7.00	10.00	ND(0.5)	58.3	0 - 0.5 ft.	0.4 CREG
Reach 5	J3-2-1	Agricultural	34.00	42.00	ND(0.5)	91.3 J	0 - 0.5 ft.	0.4 CREG
Reach 5	J2-2-2	Agricultural	16.00	41.00	ND(0.5)	2.84	0 - 0.5 ft.	0.4 CREG
Reach 5	K1-1-10	Agricultural	33.00	33.00	0.25	68.8 J	0 - 0.5 ft.	0.4 CREG
		TOTALS	**90.00**	**126.00**	**ND(0.5)**	**91.3 J**	**0 - 0.5 ft.**	**0.4 CREG**

Surface PCB Levels for EPA Agricultural Floodplain Soil Reach 9

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 9	Ag Areas	Agricultural	8.00	10.00	ND(0.5)	2.6	0.5 - 1 ft.	0.4 CREG
		TOTALS	**8.00**	**10.00**	**ND(0.5)**	**2.6**	**0.5 - 1 ft.**	**0.4 CREG**

Surface PCB Levels for EPA Commercial Floodplain Soil Reach 5

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 5	Utility 1	Comm	4.00	7.00	ND(0.5)	7.39 J	1 - 4 ft.	0.4 CREG
Reach 5	Utility 2	Comm	6.00	6.00	8.5 J	100	0 - 0.5 ft.	0.4 CREG
Reach 5	Utility 3	Comm	13.00	16.00	ND(0.5)	9.3	0 - 0.5 ft.	0.4 CREG
Reach 5	Utility 4	Comm	0.00	2.00	ND(0.5)	ND(0.5)	0 - 0.5 ft.	0.4 CREG
Reach 5	Utility 5	Comm	58.00	91.00	ND(0.018)	31.9 J	0 - 0.5 ft.	0.4 CREG
Reach 5	Utility 6	Comm	11.00	13.00	ND(0.51)	49.1	0.5 - 1 ft.	0.4 CREG
Reach 5	Utility 7	Comm	10.00	10.00	0.3 J	43.7 J	0.5 - 1 ft.	0.4 CREG
Reach 5	Utility 8	Comm	4.00	6.00	ND(0.5)	67.8	0.5 - 1 ft.	0.4 CREG
Reach 5	Utility 9	Comm	15.00	18.00	ND(0.5)	24.0	0.5 - 1 ft.	0.4 CREG
Reach 5	Utility 10	Comm	7.00	14.00	ND(0.53)	29.5 J	0 - 0.5 ft.	0.4 CREG
Reach 5	Utility 11	Comm	15.00	48.00	ND(0.017)	0.31	0 - 0.5 ft.	0.4 CREG
Reach 5	Utility 12	Comm	9.00	9.00	0.12	3.6	0.5 - 1 ft.	0.4 CREG
Reach 5	Utility 13	Comm	1.00	3.00	ND(0.65)	0.85 J	0 - 0.5 ft.	0.4 CREG
Reach 5	J2-2-1	Comm	30.00	30.00	0.274 J	201 J	0 - 0.5 ft.	0.4 CREG
Reach 5	34-1	Comm	26.00	26.00	0.78 J	75.7 J	0 - 0.5 ft.	0.4 CREG
Reach 5	9-14	Comm	0.00	2.00	ND(0.5)	ND(0.5)	0 - 0.5 ft.	0.4 CREG
		TOTALS	**209.00**	**301.00**	**ND(0.017)**	**201 J**	**0 - 0.5 ft.**	**0.4 CREG**

Surface PCB Levels for EPA Riverbank Soil Reach 5

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 5	Exp Area 1	Recreational	11.00	12.00	ND(0.5)	32.8	0 - 0.5 ft.	0.4 CREG
Reach 5	Exp Area 2	Recreational	10.00	17.00	ND(0.5)	117	0.5 - 1 ft.	0.4 CREG
Reach 5	Exp Area 4	Recreational	20.00	20.00	1.69	89.5	0.5 - 1 ft.	0.4 CREG
Reach 5	Exp Area 5	Recreational	4.00	4.00	16.6	71	0 - 0.5 ft.	0.4 CREG
Reach 5	Exp Area 6	Recreational	11.00	12.00	ND(0.57)	40.8	0.5 - 1 ft.	0.4 CREG
Reach 5	Exp Area 7	Recreational	20.00	20.00	4.32	41.9	0.5 - 1 ft.	0.4 CREG
Reach 5	Exp Area 8	Recreational	3.00	3.00	1.29	3.04	0.5 - 1 ft.	0.4 CREG
Reach 5	Exp Area 9	Recreational	8.00	8.00	3.23	21.9	0.5 - 1 ft.	0.4 CREG

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 5	Exp Area 10	Recreational	5.00	5.00	11.3 J	46	0 - 0.08 ft.	0.4 CREG
Reach 5	Exp Area 11	Recreational	10.00	12.00	ND(0.51)	37	0.5 - 1 ft.	0.4 CREG
Reach 5	Exp Area 12	Recreational	15.00	18.00	ND(0.5)	24.1	0.5 - 1 ft.	0.4 CREG
Reach 5	Exp Area 15	Recreational	10.00	12.00	ND(0.63)	42	0.5 - 1 ft.	0.4 CREG
Reach 5	Exp Area 16	Recreational	0.00	2.00	ND(0.74)	ND(0.79)	0 - 0.5 ft.	0.4 CREG
Reach 5	Exp Area 17	Recreational	24.00	24.00	1	171	0.5 - 1 ft.	0.4 CREG
Reach 5	Exp Area 20	Recreational	8.00	8.00	4	33	0.5 - 1 ft.	0.4 CREG
Reach 5	Exp Area 21	Recreational	1.00	1.00	14.5 J	14.5 J	0 - 0.5 ft.	0.4 CREG
		TOTALS	**160.00**	**178.00**	**ND(0.5)**	**171**	**0.5 - 1 ft.**	**0.4 CREG**

Surface PCB Levels for EPA Riverbank Soil Reach 6

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 6	Exp Area 23	Recreational	4.00	4.00	17.4 J	60 J	0 - 0.5 ft.	0.4 CREG
		TOTALS	**4.00**	**4.00**	**17.4 J**	**60 J**	**0 - 0.5 ft.**	**0.4 CREG**

Surface PCB Levels for EPA Riverbank Soil Reach 9

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 9	River Bank	Recreational	9.00	12.00	ND(0.5)	1.2	0.5 - 1 ft.	0.4 CREG
		TOTALS	**9.00**	**12.00**	**ND(0.5)**	**1.2**	**0.5 - 1 ft.**	**0.4 CREG**

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 5	Exp Area 13	Comm	3.00	3.00	11	28	0 - 0.08 ft.	0.4 CREG
Reach 5	Exp Area 14	Comm	8.00	8.00	1	7	0.5 - 1 ft.	0.4 CREG
Reach 5	Utility 6	Comm	3.00	3.00	12.9	59.3	1 - 5 ft.	0.4 CREG
Reach 5	Utility 9	Comm	12.00	12.00	1	42	0.5 - 1 ft.	0.4 CREG
Reach 5	Utility 10	Comm	4.00	6.00	ND(0.63)	12 J	0 - 0.5 ft.	0.4 CREG
Reach 5	Utility 12	Comm	3.00	3.00	0.5	6.1	0.5 - 1 ft.	0.4 CREG
		TOTALS	**33.00**	**35.00**	**ND(0.63)**	**59.3**	**1 - 5 ft.**	**0.4 CREG**

Surface PCB Levels for EPA Sediment Exposure Areas Reach 5

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 5	Exp Area 1	Recreational	51	52	ND(0.51)	113 J	0 - 0.5 ft.	0.4 CREG
Reach 5	Exp Area 2	Recreational	19	24	ND(0.5)	277	0 - 0.5 ft.	0.4 CREG
Reach 5	Exp Area 3	Recreational	16	16	0.15 J	77.5 J	0 - 0.5 ft.	0.4 CREG
Reach 5	Exp Area 4	Recreational	5	5	5.6 J	104 J	0 - 0.5 ft.	0.4 CREG
Reach 5	Exp Area 5	Recreational	29	29	1.38	290	0 - 0.5 ft.	0.4 CREG
Reach 5	Exp Area 6	Recreational	72	75	ND(1.1)	215 J	0 - 0.5 ft.	0.4 CREG
Reach 5	Exp Area 7	Recreational	15	15	7	52.5	0 - 0.5 ft.	0.4 CREG
Reach 5	Exp Area 8	Recreational	21	21	0.297	180	0 - 0.5 ft.	0.4 CREG
Reach 5	Exp Area 9	Recreational	7	7	1.65	14.6 J	0 - 0.5 ft.	0.4 CREG
Reach 5	Exp Area 10	Recreational	27	27	2.89 J	75.2	0 - 0.5 ft.	0.4 CREG
Reach 5	Exp Area 11	Recreational	7	7	0.5 J	11.9	0 - 0.5 ft.	0.4 CREG
Reach 5	Exp Area 12	Recreational	18	22	ND(0.5)	160 J	0 - 0.5 ft.	0.4 CREG
Reach 5	Exp Area 13	Recreational	17	17	0.5 J	35.6 J	0 - 0.5 ft.	0.4 CREG
Reach 5	Exp Area 14	Recreational	19	20	ND(0.51)	51.2	0 - 0.5 ft.	0.4 CREG
Reach 5	Exp Area 15	Recreational	17	23	ND(0.5)	82	0 - 0.5 ft.	0.4 CREG
Reach 5	Exp Area 16	Recreational	28	33	ND(0.5)	52	0 - 0.17 ft.	0.4 CREG
Reach 5	Exp Area 17	Recreational	74	93	ND(0.5)	94.2	0 - 0.5 ft.	0.4 CREG
Reach 5	Exp Area 18	Recreational	59	68	ND(0.5)	165 J	0 - 0.5 ft.	0.4 CREG
Reach 5	Exp Area 19	Recreational	18	22	ND(0.5)	85.9	0 - 0.5 ft.	0.4 CREG
Reach 5	Exp Area 20	Recreational	101	105	ND(0.5)	284	0 - 0.5 ft.	0.4 CREG
Reach 5	Exp Area 21	Recreational	72	85	ND(0.5)	180	0 - 0.5 ft.	0.4 CREG
		TOTALS	**692**	**766**	**ND(0.5)**	**290**	**0 - 0.5 ft.**	**0.4 CREG**

Surface PCB Levels for EPA Sediment Exposure Areas Reach 6

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 6	Exp Area 22	Recreational	105	114	ND(0.5)	379 J	0 - 0.5 ft.	0.4 CREG
Reach 6	Exp Area 23	Recreational	147	162	ND(0.5)	522 J	0 - 0.2 ft.	0.4 CREG
		TOTALS	**252**	**276**	**ND(0.5)**	**522 J**	**0 - 0.2 ft.**	**0.4 CREG**

Surface PCB Levels for EPA Sediment Exposure Areas Reach 7

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 7	Sed Area 1	Recreational	4	11	ND(0.5)	1.7	0 - 0.5 ft.	0.4 CREG
Reach 7	Sed Area 2	Recreational	3	4	ND(0.5)	19.2	0 - 0.5 ft.	0.4 CREG
Reach 7	Sed Area 3	Recreational	5	8	ND(0.5)	24.6	0 - 0.5 ft.	0.4 CREG
Reach 7	Sed Area 4	Recreational	20	44	ND(0.5)	4.3	0 - 0.5 ft.	0.4 CREG
Reach 7	Sed Area 5	Recreational	5	5	0.51	5.11	0 - 0.5 ft.	0.4 CREG
Reach 7	Sed Area 6	Recreational	14	26	ND(0.5)	1.32	0 - 0.5 ft.	0.4 CREG
Reach 7	Sed Area 7	Recreational	4	4	9.44	37.5	0 - 0.5 ft.	0.4 CREG
Reach 7	Sed Area 8	Recreational	6	19	ND(0.017)	4.68	0 - 0.5 ft.	0.4 CREG
		TOTALS	**61**	**121**	**ND(0.017)**	**37.5**	**0 - 0.5 ft.**	**0.4 CREG**

Surface PCB Levels for EPA Sediment Exposure Areas Reach 8

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 8	Sed Area 1	Recreational	9	14	ND(0.5)	11.2 J	0 - 0.5 ft.	0.4 CREG
		TOTALS	**9**	**14**	**ND(0.5)**	**11.2 J**	**0 - 0.5 ft.**	**0.4 CREG**

Surface PCB Levels for EPA Sediment Exposure Areas Reach 9

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Maximum Depth	Comparison Values
Reach 9	Sediment	Recreational	26	53	ND(0.02)	0.85 J	0 - 0.5 ft.	0.4 CREG
		TOTALS	**26**	**53**	**ND(0.02)**	**0.85 J**	**0 - 0.5 ft.**	**0.4 CREG**

Surface PCB Levels for GE Commercial Floodplain Soil Reach 5

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Mean	Comparison Values
Reach 5	School	Commercial	2.00	10.00	ND(0.025)	29.7	3.588	0.4 CREG
Reach 5	Use Area 15B	Commercial	3.00	3.00	0.07	12	7.36	0.4 CREG
		TOTALS	**5.00**	**13.00**	**ND(0.025)**	**29.7**	**7.36**	**0.4 CREG**

Surface PCB Levels for GE Recreational Floodplain Soil Reach 5

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Mean	Comparison Values
Reach 5	Transect FP2	Recreational	18.00	20.00	ND(0.047)	93	31.12	0.4 CREG

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Mean	Comparison Values
Reach 5	Use Area 11	Recreational	7.00	7.00	0.62	28	8.22	0.4 CREG
Reach 5	Use Area 12	Recreational	4.00	8.00	ND(0.05)	25	3.89	0.4 CREG
Reach 5	Transect FP3	Recreational	13.00	17.00	ND(0.023)	26	4.47	0.4 CREG
Reach 5	Transect FP4	Recreational	14.00	19.00	ND(0.05)	61	19.44	0.4 CREG
Reach 5	Use Area 14	Recreational	2.00	3.00	ND(0.05)	2.8	1.0083	0.4 CREG
Reach 5	Transect FP4A	Recreational	10.00	12.00	ND(0.046)	27	6.68	0.4 CREG
Reach 5	Transect FP5	Recreational	14.00	18.00	ND(0.048)	230	20.85	0.4 CREG
Reach 5	Use Area 15C	Recreational	1.00	2.00	ND(0.05)	1.1	0.56	0.4 CREG
Reach 5	Transect FP6	Recreational	4.00	5.00	ND(0.05)	39	14.041	0.4 CREG
Reach 5	Transect FP6A	Recreational	9.00	12.00	0.0285	71	14.69	0.4 CREG
Reach 5	Transect FP7	Recreational	16.00	19.00	ND(0.05)	75	13.19	0.4 CREG
Reach 5	Ecosystem Assessment Areas	Recreational	23.00	23.00	0.034 J	32	6.065	0.4 CREG
Reach 5	Transect FP7A	Recreational	8.00	11.00	0.0245	16	3.88	0.4 CREG
Reach 5	Use Area 18	Recreational	3.00	3.00	0.08	1.2	0.52	0.4 CREG
		TOTALS	**146.00**	**179.00**	**ND(0.023)**	**230**	**31.12**	**0.4 CREG**

Surface PCB Levels for GE Residential Floodplain Soil Reach 5

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Mean	Comparison Values
Reach 5	Use Area 9	Residential	6.00	6.00	0.54	3	1.53	0.4 CREG
Reach 5	Use Area 10	Residential	9.00	10.00	ND(0.05)	19	4.65	0.4 CREG
Reach 5	Holmes Road	Residential	13.00	18.00	ND(0.133)	52.5	4.66	0.4 CREG
Reach 5	Holmes Road	Residential	6.00	9.00	ND(0.048)	28	3.9	0.4 CREG
Reach 5	Joseph Drive	Residential	6.00	9.00	ND(0.172)	20.6	8.73	0.4 CREG
Reach 5	New Lenox Road	Residential	2.00	3.00	ND(0.05)	0.42	0.24	0.4 CREG
Reach 5	Use Area 17 (Farm)	Residential	44.00	52.00	ND(0.05)	64	11.17	0.4 CREG
		TOTALS	**86.00**	**107.00**	**ND(0.05)**	**64**	**11.17**	**0.4 CREG**

Surface PCB Levels for GE Recreational Floodplain Soil Reach 6

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Mean	Comparison Values
Reach 6	Use Area 19 & 20	Recreational	3.00	3.00	0.05	1.4	0.66	0.4 CREG

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Mean	Comparison Values
Reach 6	Use Area 21	Recreational	3.00	5.00	ND(0.05)	20	7.59	0.4 CREG
		TOTALS	**6.00**	**8.00**	**ND(0.05)**	**20**	**7.59**	**0.4 CREG**

Surface PCB Levels for GE Residential Floodplain Soil Reach 6

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Mean	Comparison Values
Reach 6	Use Area 22	Residential	1.00	3.00	ND(0.05)	0.54	0.2	0.4 CREG
		TOTALS	**1.00**	**3.00**	**ND(0.05)**	**0.54**	**0.2**	**0.4 CREG**

Surface PCB Levels for GE Recreational Floodplain Soil Reach 7

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Mean	Comparison Values
Reach 7	Transect FP8	Recreational	6.00	10.00	ND(0.05)	4	0.87	0.4 CREG
Reach 7	Transect FP8A	Recreational	8.00	11.00	ND(0.045)	13	2.53	0.4 CREG
Reach 7	Transect F9	Recreational	7.00	10.00	ND(0.05)	1.4	0.47	0.4 CREG
Reach 7	Transect FP9A	Recreational	7.00	10.00	ND(0.051)	1.7	0.69	0.4 CREG
Reach 7	Transect FP9B	Recreational	8.00	9.00	ND(0.069)	6.1	2.55	0.4 CREG
Reach 7	Transect FP9C	Recreational	6.00	13.00	ND(0.05)	7.6	1.3	0.4 CREG
		TOTALS	**42.00**	**63.00**	**ND(0.045)**	**13**	**2.53**	**0.4 CREG**

Surface PCB Levels for GE Residential Floodplain Soil Reach 7

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Mean	Comparison Values
Reach 7	Bradley Street	Residential	6.00	10.00	ND(0.130)	6.87	1.79	0.4 CREG
Reach 7	Golden Hill Road	Residential	16.00	16.00	1.9	33.4	11.02	0.4 CREG
		TOTALS	**22.00**	**26.00**	**ND(0.130)**	**33.4**	**11.02**	**0.4 CREG**

Surface PCB Levels for GE Recreational Floodplain Soil Reach 8

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Mean	Comparison Values
Reach 8	Transect FP9D	Recreational	7.00	10.00	ND(0.043)	4.2	0.52	0.4 CREG
		TOTALS	**7.00**	**10.00**	**ND(0.043)**	**4.2**	**0.52**	**0.4 CREG**

Surface PCB Levels for GE Recreational Floodplain Soil Reach 9

Reach	Parcel	Property Type	Number Samples	Number Detects	Minimum	Maximum	Mean	Comparison Values
Reach 9	Transect FP10	Recreational	8.00	13.00	ND(0.05)	0.8	0.22	0.4 CREG
Reach 9	Transect FP10A	Recreational	4.00	4.00	0.13	1.1	0.54	0.4 CREG
Reach 9	Transect FP10B	Recreational	2.00	4.00	ND(0.044)	0.65	0.3	0.4 CREG
Reach 9	Transect FP10C	Recreational	3.00	4.00	ND(0.055)	0.63	0.3	0.4 CREG
Reach 9	Transect FP10D	Recreational	10.00	14.00	ND(0.057)	1.7	0.45	0.4 CREG
Reach 9	Transect FP11	Recreational	9.00	13.00	ND(0.05)	0.3	0.11	0.4 CREG
		TOTALS	**36.00**	**52.00**	**ND(0.044)**	**1.7**	**0.54**	**0.4 CREG**

Surface PCB Levels for GE Sediment

Reach	Parcel	Type	Number Samples	Number Detects	Minimum	Maximum	Mean	Comparison Values
Reach 5	**Sediment**	**Recreational**	**161**	**162**	**ND(0.193)**	**200**	**25.85**	**0.4 CREG**
Reach 6	**Sediment**	**Recreational**	**154**	**154**	**0.04**	**190**	**46.12**	**0.4 CREG**
Reach 7	**Sediment**	**Recreational**	**70**	**70**	**0.06**	**210**	**15.37**	**0.4 CREG**
Reach 8	**Sediment**	**Recreational**	**26**	**26**	**0.46**	**26**	**4.4**	**0.4 CREG**
Reach 9	**Sediment**	**Recreational**	**34**	**35**	**ND(0.05)**	**2.8**	**0.82**	**0.4 CREG**

Appendix C
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. Two 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.

Appendix D
Chemical-Specific Toxicity Information

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, 1991; as cited in ATSDR 2000d). 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. 1993; as cited in ATSDR 2000d) as well as in their offspring (Arnold et al. 1995; as cited in ATSDR 2000d). 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 2000d). A panel of international experts cited support for this chronic oral MRL from human studies (ATSDR 2000d).

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 2000d).

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/Furans

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 like (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 1998b). This was based on a 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 U.S. Environmental Protection Agency (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 1998b).

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 1998b).

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, 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 1995b).

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.

Appendix E
ATSDR Plain Language 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 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 organism

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 adjushort-term measuresents 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 F
US FDA Tolerance for PCBs in Fish

The US Food and Drug Administration (US FDA) promulgated a regulation lowering the tolerance level for PCBs in the edible portion of fish and shellfish destined for interstate commerce from 5 mg/kg to 2 mg/kg in 1979 (US FDA 1979), which became effective in 1984. This tolerance level of 2 mg/kg remains in effect today (US FDA 1996). The tolerance level was based on weighting the results of a risk assessment against the magnitude of potential food loss resulting from a lowered tolerance level. It is important to point out that the methodology for the US FDA risk assessment precludes application of its results to the Housatonic River "Rest of River" Human Health Risk Assessment risk assessment for fish ingestion. The US FDA limit was developed under different legislation and regulatory responsibilities in 1979 using US FDA guidance. Additionally, the US FDA specifically states that this tolerance level is intended to apply to fish entering interstate commerce, and that this level may not be protective for locally caught fish from contaminated areas (EPA 2005).

To arrive at a tolerance of 2 mg/kg, the US FDA considered national per capita fish consumption, looking at the general distribution of PCB levels in fish for sale across the United States. The US FDA risk assessment was performed by assuming that the tolerance level of 2 mg/kg would be the maximum concentration in fish encountered by a heavy fish consumer, and that PCB concentrations in fish consumed would be distributed below 2 mg/kg in a manner reflecting a mix of fish from diverse sources (Cordle 1982). The tolerance level is not based on the assumption that all fish consumed contain 2 mg/kg PCBs. Because the distribution of PCB concentrations in fish caught in the Housatonic River by local anglers is likely to be different from the distribution of PCB concentrations in fish for sale across the United States, the risk associated with regularly eating Housatonic River fish will differ from the risks associated with the US FDA assessment for a 2 ppm tolerance, even if the Housatonic River fish do not exceed 2 mg/kg (EPA 2005).

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 H

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[30] (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

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

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 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.

Appendix I

Responses to Public Comments on the General Electric (GE) – Housatonic River Public Health Assessment (PHA).

The public comment period for the GE Housatonic River Public Health Assessment closed December 31, 2007 and no written comments were received. What follows is a summary of comments provided during the Housatonic River Area Advisory Committee (HRAAC) meeting held on November 13, 2007 when the report was released for public comment and discussed with committee members.

1. **Comment:** Committee member asked for clarification regarding what reaches constitute "the river" in the MDPH PHA and how this compares with what the U.S. Environmental Protection Agency (EPA) designates "rest of river." Additionally the member commented that, although the West Branch of the Housatonic River is not considered to be part of the GE site (and is therefore not included in the PHA), there are nonetheless contamination concerns associated with the West Branch, stemming from contamination at Dorothy Amos Park. The member indicated that the West Branch should therefore be considered when evaluating the Housatonic River.

   Response: The MDPH GE Housatonic River PHA uses language consistent with EPA's reach designation for the Housatonic River. The PHA addresses reaches 1 through 9 of the river. When EPA uses the term the "river" they are referring to reaches 1 through 4 and when using "rest of the river", this refers to reaches 5 through 9. The West Branch of the Housatonic River is not included in the EPA designated reaches 1 through 9. MDEP is the lead agency related to investigations and remedial actions and can best address this riverbank soil and sediment contamination in the West Branch of the Housatonic River. MDPH will share this comment with MDEP. However, MDPH is responsible for issuing fish consumption advisories statewide, and our current fish consumption advisory for the Housatonic River states that "the general public should not consume any fish, frogs, or turtles from this water body and fish taken from feeder streams to the Housatonic River should be trimmed of fatty tissue prior to cooking." Data on PCBs in fish tissue collected since 1982 (Table 19) support the need to continue

the current fish advisory and strengthen the advisory for tributaries of the Housatonic River. This PHA concludes and recommends that it is prudent to extend the existing fish consumption advisory to the tributaries of the Housatonic River [as summarized in the Background Data, Conclusions and Public Health Action Plan sections of the PHA]. The West Branch is considered a tributary of the Housatonic River and therefore covered in the extension of the fish advisory. MDPH has inserted additional clarification on pages 14 and 65 and specifically names the West Branch in the report recommendations (#8).

2. **Comment (Conclusions):** Committee member expressed concern regarding the potential for recontamination in Reach 3 of the River stemming from the capped area that is referred to as "the Newell St. parking lot." Member stated that there is evidence (including video) and witnesses attesting that there are a large number of PCB and TCE barrels beneath that cap and expressed concern that they will, over time, re-contaminate the nearby river. The member is also concerned about potential impacts on nearby residences and indicated that "the cap is two feet deep and full of cracks."

   Response: MDPH will share this comment with EPA as they are the lead government agency related to GE site investigations.

3. **Comment**: Committee member asked that we post the Housatonic River advice along tributaries as well as the main river. Committee member requested that more fish sampling be done in the Housatonic River (including down into Connecticut) and also the Konkapot River.

   Response: Committee member's request to post the Housatonic River advisory along the tributaries is addressed in the Conclusions (#3), Public Health Action Plan (Future Action #1), and Recommendations (#8) sections of the Housatonic River PHA. Table 19 in the PHA summarizes available data on PCBs in fish tissue collected from the Housatonic River and its tributaries in Massachusetts from 1982 until this PHA was conducted. These data support the need to continue the MDPH's no-consumption advisory for the river and strengthen the advisory

for the tributaries. Additional fish sampling is thus not required for public health purposes, as there is already a no-consumption advisory in place. Additionally, MDPH is currently reviewing data on fish from the Konkapot River and will report back to the HRAAC and other interested parties, including local health officials, on results of this review. MDPH would be happy to review any other fish data that may be generated upon request.

4. **Comment:** Committee member mentioned that there is a Spanish-speaking population in Pittsfield and some of them fish in the Housatonic River. Committee member expressed a need for spreading the word about the fish advisory among this population and the member has been in touch with community groups regarding this effort. Member would like the fish consumption advisory for the Housatonic River Area translated into Spanish and posted. Member would like to see/develop a pamphlet for the Spanish community, specific to the Housatonic fish advisory. The areas which the member thinks would need such a posting are: Woods Pond, Great Barrington, and other places in the Tri-town area. This member has received a grant to fund such efforts and would like to work with MDPH in this effort (reference to recommendation #1 in the PHA).

   Response: MDPH will work with our Health Education Program to translate the advisory and make available to the Boards of Health along the Housatonic River Area. The MDPH would also be happy to work with any committee member or local Board of Health to develop education and outreach materials specific to certain populations [as mentioned in the Public Health Action Plan (Future Action #3) section of the Housatonic River PHA].

5. **Comment:** Committee member has concerns about PCBs in the water column, coming from storm drains. Member indicated that there are 26 drains with PCB levels that exceed aquatic standards, but reported that EPA is not concerned because the standard is very low. The member would like to see special drain filters ("separators") put on those drains to be safe. "The technology exists, why

not use it?" This is an issue for source control and preventing recontamination of the River.

Response: MDPH will share this comment with EPA as they are the lead agency related to site investigations.