SUPERFUND

Cleaning Up New England

TECHNICAL FACT SHEET

Human Health Implications for Native (Resident) Fish Consumption in the Blackstone River

Peterson/Puritan Inc. Superfund Site, Operable Unit 2

U.S. EPA | HAZARDOUS WASTE PROGRAM AT EPA NEW ENGLAND

THE SUPERFUND PROGRAM *protects human health and the environment by investigating and cleaning up often-abandoned hazardous waste sites and engaging communities throughout the process. Many of these sites are complex and need long-term cleanup actions. Those responsible for contamination are held liable for cleanup costs. EPA strives to return previously contaminated land and groundwater to productive use.*

BACKGROUND:

The U.S. Environmental Protection Agency (EPA) is guiding the Remedial Investigation (RI) and Feasibility Study (FS) to assess potential human health risks related to Operable Unit 2 of the Peterson/Puritan Inc. Superfund Site in Cumberland and Lincoln, Rhode Island (the Site). As a component of the RI, in 2005, EPA conducted a fish study to determine the levels of contamination within resident fish in sections of the Blackstone River in the vicinity of the Site.

The study's findings indicated that the public should be advised of the potential risks associated with consuming certain species of fish in the Blackstone River, and that additional efforts should be taken to promote a recreational "catch and release" strategy for the impacted segments of the Blackstone River watershed identified. The results of this study prompted the RI Department of Health in January 2008 to post a consumption advisory for the Rhode Island segment of the Blackstone River and for the RI Department of Environmental Management, Office of Water Resources to list the river as impaired for mercury and polychlorinated biphenyls (PCBs) in fish tissue on the 2008 Section 303(d) List of Impaired Waters. The State of Massachusetts also maintains a freshwater fish advisory for PCBs, in the upper portion of the Blackstone River. This fact sheet summarizes the results of the fish study conducted on a portion of the Blackstone River and in associated reference areas located in northwest Rhode Island.

Figure 1 Blackstone River at Martin Street

The Site encompasses over two miles of mixed industrial/residential properties in the towns of Cumberland and Lincoln, Rhode Island. The Site is situated in the north-central portion of Rhode Island along the Blackstone River. It includes a portion of the Blackstone River Valley National Heritage Corridor between the Ashton Dam to the north, and the Pratt Dam to the south, along the River's course. To efficiently address the various environmental issues, the Site is broken into sub-areas, or Operable Units (OU-1 and OU-2).

Remedial investigations were performed at OU-1 in the 1990s. A subsequent groundwater treatment system was built on the Site and is currently in operation. Remedial investigations are now concluded at OU-2 and cleanup alternatives are currently being developed.

OU-2 contains parcels associated with the J.M. Mills Landfill, and is surrounded by commercial, residential, and semi-rural properties. Bordering OU-2 to the north is the Hope Global Company, located at 88 Martin Street, Cumberland, RI. Hope Global is part of OU-1. OU-2 is bounded by the Stop and Shop Market (and strip mall) on Mendon Road, Cumberland, RI (Route 122) to the south; wetlands which form a boundary and terraced buffer for Berkeley Commons and River Ridge new housing developments along Mendon Road

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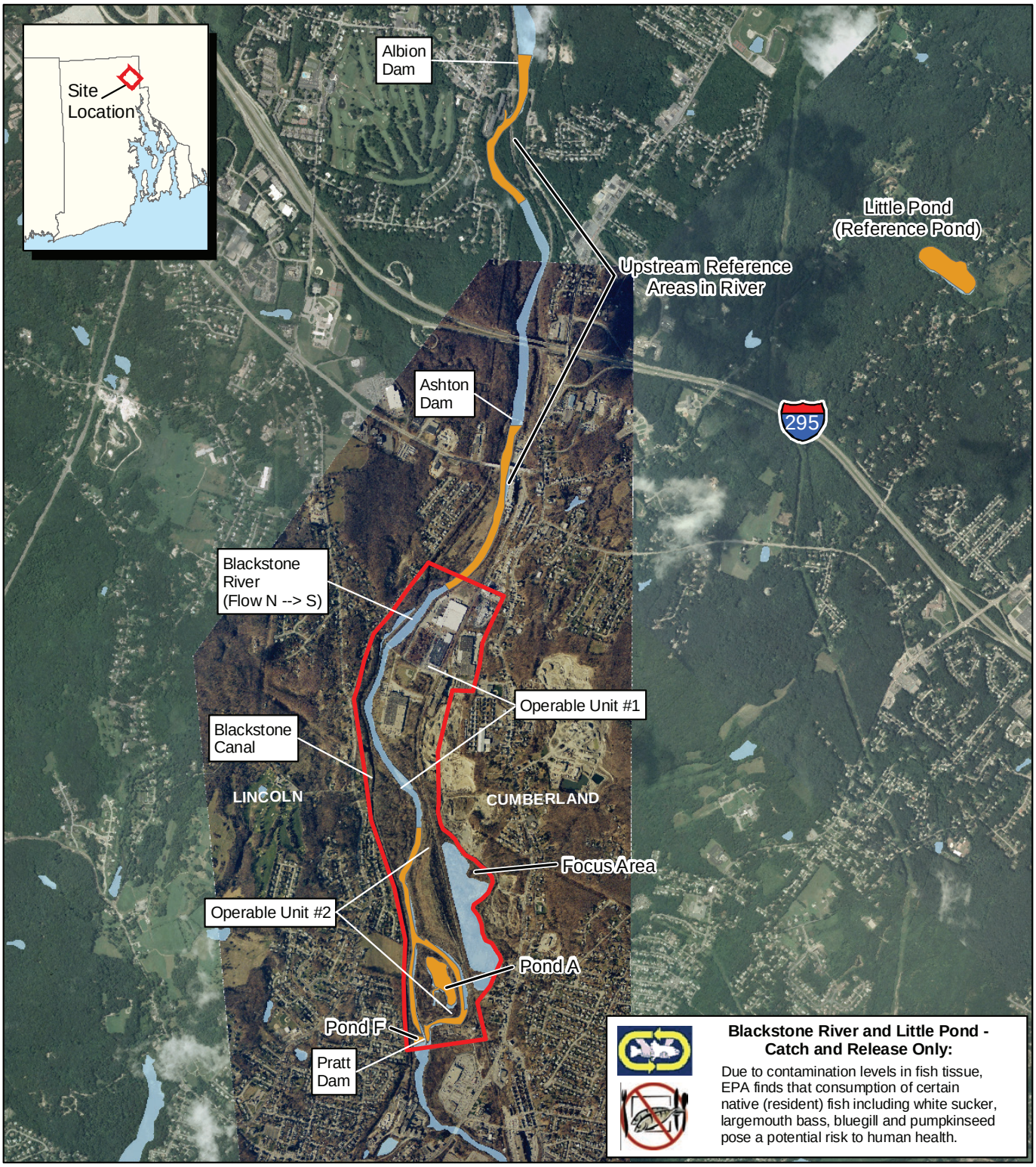


0 1 Miles

Blackstone River Fish Sampling Locations Peterson/Puritan, Inc. Superfund Site Cumberland/Lincoln, Rhode Island

Fish Survey Locations

Area Under Investigation

EPA United States Environmental Protection Agency New England

Produced By The EPA Region 1 GIS Center
January 31, 2008
Note: Study area and fish survey boundaries are approximate and are for presentation purposes only.
Data Sources: Background aerial photo, RIGIS Waterbodies, TeleAtlas

to the east; and the Blackstone River and canal to the west.

The Blackstone River is a valuable recreational resource, and in the vicinity of OU-2, is a popular fishing area due to the Pratt Dam and the abundance and variety of "resident" (native to the river) fish species. Resident fish species include largemouth bass, white sucker, bluegill, and pumpkinseed. In the fall of 2006, EPA began collecting fish samples along the Blackstone River within the Site above the Pratt Dam (see Reference Map). In addition to the resident fish, twice a year the Blackstone River is stocked with farm-raised trout. The focus of the fish evaluation is on resident fish species present in the vicinity of the Site and consequently, information on stocked fish was not gathered as part of this effort. Further, anadromous fish (those species which live in the sea mostly and travel up rivers to breed in fresh water) were also not included in this study due to their transient nature and incomparability to the resident fish species sampled for this study.

At OU-2, collection and chemical analysis of fish were performed in addition to sampling groundwater, surface water, soil, and sediment. Fish were collected from (1) the Blackstone River and several ponds within OU-2, and (2) from upstream "reference" areas of the river and a "reference" pond, where the Site would not have contributed contaminants. Sampling of reference areas was performed to separately evaluate the effects of Site-related contamination from river-wide effects. The results of the fish analyses were used to prepare this technical fact sheet, which addresses the human health effects associated with eating fish from those water bodies.

SUMMARY:

A comparison of tissue concentrations measured in fish from reference areas and from OU-2 showed that fish from all the studied areas have a similar distribution of chemicals. The most common contaminants in the fish tissue include polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), pesticides, and arsenic. Tissue concentrations vary depending on the species and chemical of interest in reference area fish and fish from within the boundary of OU-2.

In general, maximum detected concentrations of metals and PAHs detected in largemouth bass caught from the J.M. Mills Landfill area were higher than those from the reference areas, while maximum detected concentrations of PCBs and pesticides were generally higher in the reference areas compared to the landfill area. White sucker has the highest contaminant concentrations in their edible tissue and small pan fish (e.g., pumpkinseed) has the lowest contaminant concentrations. Using two different fish ingestion rates (two 8-ounce fish meals/week or two 8-ounce fish meals/month), both maximum and average fish tissue concentrations exceed risk-based concentrations. Assuming the higher fish consumption rate, contaminants present in fish tissue in excess of risk-based concentrations include PCBs, a number of PAHs and pesticides, bis(2-ethylhexyl)phthalate (BEHP), hexachlorobenzene, arsenic, chromium, and mercury. Using the lower fish consumption rate, PCBs, two PAHs, dieldrin, and arsenic are found in fish at levels exceeding their risk-based concentrations. Both OU-2 and the reference areas show similar exceedances in fish.

For the areas tested, PCBs, PAHs, dieldrin, and arsenic appear to be ubiquitously present in edible resident fish in the Blackstone River, the reference pond, and associated ponds at concentrations that exceed risk-based values. This result further indicates that the potential cause for the associated risk in eating fish may be due to many sources within the watershed.

Based on the results of this study, EPA finds that eating contaminated fish may pose a risk to public health and therefore recommends against the taking of resident fish for consumption from the water bodies identified in these investigations. EPA also emphasizes that progress in water quality improvements continues to be made throughout the watershed and supports non-contact recreational uses within the Blackstone River.

The Rhode Island Department of Health also advises that, as in other urban rivers and ponds, with the exception of stocked trout, fish should not be eaten from the Blackstone River. However, people can still enjoy "catch-and-release" sport fishing in these studied waters and other urban rivers and ponds within the State.

Investigation activities are now concluded at the OU-2. Based on these activities and other watershed–wide findings, the potential cause(s) for associated risks in consuming fish from the river may be likely due to known sources and conditions observed throughout the watershed potentially requiring further evaluation by the region's water quality program(s). Watershed-wide remediation goals and a wide application of clean-up approaches need to be developed with the emphasis for attaining water quality standards for designated uses, including aquatic life support. Once cleanup goals for the river are achieved, these improvements collectively may, over time, help to further reduce the concentrations of contaminants taken up by fish and thus stored in their edible tissue.

Figure 2 Fish Sampling Team in the Blackstone River

BACKGROUND:

The investigation to assess the potential impacts of OU-2, including the J.M. Mills Landfill, on the river and surrounding areas consisted of collecting fish for analysis in September 2005 in the following areas: (1) the vicinity of the landfill upstream of the Pratt Dam; (2) the large pond ("Pond A") on the unnamed island just south of the J.M. Mills Landfill; (3) the pond (Pond F) just upstream of the Pratt Dam; (4) reference areas upstream of OU-2, both above and below the Ashton Dam; and (5) a reference pond not influenced by OU-2. See the map for exact locations. A total of 224 fish, representing a variety of resident fish species and sizes, were collected from the river and ponds in the vicinity of the landfill and from reference areas. Of the fish collected, 88 samples were obtained from fish of edible size (i.e., large enough to be filleted). Only these edible fish, most likely to be consumed by people, are discussed further.

Fish of edible size were analyzed for a wide range of chemicals known to be present at the J.M. Mills Landfill including PAHs, BEHP, pesticides, PCBs, and metals. The health-based evaluation performed for the fish tissue chemical concentrations consists of the following steps:

- Step 1: Concentrations of chemicals in fish tissue near the landfill are discussed in

comparison to tissue concentrations in fish from reference areas.

- Step 2: Maximum concentrations of chemicals are discussed relative to risk-based concentrations developed by EPA as concentrations in fish that, if ingested, would not be associated with significant human health impacts (USEPA, 2007). Risk-based concentrations are developed assuming the ingestion of approximately two 8-ounce fish meals/week, which is a greater amount of fish consumption than typically associated with the ingestion of recreationally caught fish in New England, estimated as approximately two 8-ounce fish meals/month (Ebert and Harrington, 1993).

- Step 3: Any chemical noted as being present in fish at a maximum concentration greater than its risk-based concentration is further discussed by comparing average tissue concentrations to an "adjusted risk-based concentration," based on ingestion levels typical for recreational fishing in New England. Average concentrations are used in this comparison to provide a more realistic estimate of exposure, since it is unlikely that anyone would ingest fish containing the maximum detected concentration on a daily basis and for an extended period of time. It is more likely that fish containing a range of concentrations, estimated by the average, would be ingested over time.

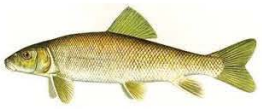
A summary of the results of the evaluation for the Blackstone River and the ponds is presented below. For more information, see the Baseline Human Health Risk Assessment (USEPA, 2009)

BLACKSTONE RIVER FISH SAMPLING RESULTS:

Fish species caught from the upstream reference areas include bluegill, pumpkinseed, white sucker, and largemouth bass. Of these species, white sucker and largemouth bass were also captured from the Blackstone River in the vicinity of the J.M. Mills Landfill.

Overall, the most frequently detected chemicals in fish from both the reference areas upstream of the J.M. Mills Landfill and in the vicinity of the landfill include PCBs, pesticides, and metals. BEHP was more frequently detected in fish at the upstream reference locations than in fish collected from the vicinity of the J.M. Mills Landfill. PAHs were infrequently detected in both the reference and J.M. Mills Landfill area fish.

Chemical concentrations in fish, relative to risk-based concentrations and adjusted risk-based concentrations, are discussed below, by species.



White Sucker

White sucker, as bottom feeders, are anticipated to display the highest concentrations of chemicals accumulated from their environment due to their exposure to sediment and their consumption of sediment-dwelling organisms. Chemicals detected in reference fish fillets at maximum concentrations greater than risk-based concentrations include PCBs, PAHs, BEHP, a variety of pesticides (e.g., DDD, DDE, DDT, dieldrin, chlordanes, and heptachlors), and the metals arsenic and mercury. In fish from the vicinity of the J.M. Mills Landfill, PCBs, a similar list of pesticides to those noted in the reference samples, and arsenic were identified as exceeding risk-based concentrations. In general, maximum detected concentrations in fish caught from the reference areas were higher than those from the landfill area. A comparison of average chemical concentrations to "adjusted risk-based concentrations" indicates exceedances for PCBs, dieldrin, and arsenic in both reference and J.M. Mills Landfill area samples. In addition, average concentrations of two PAHs exceed "adjusted risk-based concentrations" in reference fish.

Largemouth Bass

Chemicals detected in reference fish fillets at maximum concentrations greater than risk-based concentrations include PCBs, one PAH, hexachlorobenzene, a variety of pesticides (e.g., DDE, dieldrin, and heptachlors), and arsenic. In fish from the vicinity of the J.M. Mills Landfill, PCBs, a variety of PAHs, a similar list of pesticides to those noted in the reference samples, and the metals arsenic, chromium, and mercury were identified as exceeding risk-based concentrations. Maximum detected concentrations of metals and PAHs detected in largemouth bass caught from the J.M. Mills Landfill area were generally higher than those from the reference areas, while maximum detected concentrations of PCBs and pesticides were higher in the reference areas compared to the landfill area. A comparison of average chemical concentrations to "adjusted risk-based concentrations" indicates exceedances for PCBs, PAHs, dieldrin, and arsenic in both reference and J.M. Mills Landfill area samples.

Bluegill and Pumpkinseed

Bluegill and pumpkinseed were only caught at the reference areas upstream of the J.M. Mills Landfill. The concentrations of detected chemicals were approximately 10-fold lower in these two species, compared to other species sampled. Despite the overall lower concentrations noted in bluegill and pumpkinseed, maximum detected concentrations of PCBs, dieldrin, heptachlor epoxide, arsenic, chromium, and mercury were greater than risk-based concentrations. A comparison of average chemical concentrations to "adjusted risk-based concentrations" indicates exceedances for PCBs, dieldrin, and arsenic, consistent with the results of other species from both the reference and J.M. Mills Landfill areas.

POND FISH SAMPLING RESULTS:

Fish species caught from the ponds in the vicinity of the J.M. Mills Landfill include white sucker, largemouth bass, bluegill, and pumpkinseed. Of these species, largemouth bass and bluegill were captured from the reference pond influenced neither by the Site, nor the river.

Similar to fish caught in the Blackstone River, the most frequently detected chemicals from both the reference pond and in ponds in the vicinity of the J.M. Mills Landfill include PCBs, pesticides, and metals. PAHs were infrequently detected in fish from both the reference and J.M. Mills Landfill area ponds.

Chemical concentrations in fish species, relative to risk-based concentrations and adjusted risk-based concentrations, are discussed below:

Largemouth Bass

Chemicals detected in reference fish fillets at maximum concentrations greater than risk-based concentrations include PCBs, PAHs, hexachlorobenzene, and mercury. Except for hexachlorobenzene, these chemicals plus a small number of pesticides and arsenic exceed risk-based concentrations in fish caught from ponds in the vicinity of the J.M. Mills Landfill. In general, maximum detected concentrations in fish caught from the J.M. Mills Landfill area ponds were higher than those from the reference pond with the exception of mercury and hexachlorobenzene. A comparison of average chemical concentrations to "adjusted risk-based concentrations" indicates exceedances for PCBs and PAHs in both reference and J.M. Mills Landfill area samples. In addition, average dieldrin and arsenic concentrations exceed "adjusted risk-based concentrations" in fish from J.M. Mills Landfill area ponds.

Bluegill

Maximum detected concentrations of PCBs, DDE, and arsenic in fish filets were above risk–based concentrations in the reference area and in J.M. Mills Landfill area ponds. Dieldrin and chromium also exceeded risk-based concentrations in fish caught from J.M. Mills Landfill area ponds. However, J.M. Mills Landfill area pond concentrations were greater than those noted in the reference pond for both PCBs and arsenic. A comparison of average chemical concentrations to "adjusted risk-based concentrations" indicates exceedances for PCBs and arsenic in both reference and J.M. Mills Landfill area samples. In addition, average dieldrin concentrations exceed "adjusted risk-based concentrations" in fish from J.M. Mills Landfill area ponds.

White Sucker and Pumpkinseed

White sucker and pumpkinseed were only caught in J.M. Mills Landfill area ponds. Consistent with the results reported for fish species captured from the Blackstone River, maximum concentrations in white sucker were overall the highest and displayed the largest number of risk-based concentration exceedances, while pumpkinseed displayed the lowest concentrations and fewest risk-based concentration exceedances. Maximum detected concentrations of PCBs, pesticides, and arsenic exceeded risk-based concentrations in both species. In addition, chromium and mercury risk-based concentration exceedances were noted for white sucker. A comparison of average chemical concentrations to "adjusted risk-based concentrations" indicates exceedances for PCBs, dieldrin, and arsenic in both species captured from J.M. Mills Landfill area ponds.

WHERE CAN I FIND OUT MORE?

USEPA Fish Consumption web site:
http://water.epa.gov/scitech/swguidance/fishshellfish/outreach/advice_index.cfm

RIDOH Fish Advisory web site:
http://www.health.ri.gov/healthrisks/poisoning/mercury/about/fish http://www.health.ri.gov/publications/brochures/FishIsGoodMercuryIsBad.pdf

ATSDR PCB facts:
http://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=140&tid=26

EPA Region 1 Site Fact Page:
http://www.epa.gov/region1/superfund/sites/peterson

Blackstone River Do's and Dont's Brochure:
http://www.epa.gov/ne/superfund/sites/peterson/236978.pdf

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