

Health Consultation

Evaluation of Health Concerns Associated with Grove Pond and Plow Shop Pond

FORT DEVENS

AYER, MIDDLESEX COUNTY, MASSACHUSETTS

CERCLIS NO. MA7210025154

DECEMBER 10, 1998

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES Public Health Service Agency for Toxic Substances and Disease Registry Division of Health Assessment and Consultation Atlanta, Georgia 30333

98121 ATSDRS

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation 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.

You May Contact ATSDR TOLL FREE at 1-800-447-1544 or

Visit our Home Page at: http://atsdr1.atsdr.cdc.gov:8080/

HEALTH CONSULTATION

Evaluation of Health Concerns Associated with Grove Pond and Plow Shop Pond

FORT DEVENS

AYER, MIDDLESEX COUNTY, MASSACHUSETTS

CERCLIS NO. MA7210025154

Prepared by:

Federal Facilities Assessment Branch Division of Health Assessment and Consultation Agency for Toxic Substances and Disease Registry

INTRODUCTION

The Agency for Toxic Substances and Disease Registry (ATSDR) is evaluating possible public health hazards from potential exposure to environmental contaminants at the Fort Devens site in Devens, Massachusetts. ATSDR has prepared this health consultation in response to community members' concerns about the past, current, and future potential for contaminants from the Fort Devens site to cause harm to people using Grove Pond and Plow Shop Pond. This health consultation addresses two specific concerns:

- Could persons be exposed to harmful levels of contaminants in Grove Pond or Plow Shop Pond surface water or sediment?
- Could persons be exposed to harmful levels of contaminants when eating fish from Grove Pond or Plow Shop Pond?

Following careful review of available environmental monitoring data and exposure information for the ponds, ATSDR findings are that past uses of Grove Pond and Plow Shop Pond, including eating fish and contact with surface water and sediment, posed *no apparent public health hazard*. As a precautionary measure, ATSDR recommends that people continue to follow the "catch and release fishing only and no swimming" advisory posted at each pond.

ATSDR reviewed current information from the Base Realignment and Closure Environmental Office at Fort Devens, the Massachusetts Department of Environmental Protection (MADEP), and the U.S. Environmental Protection Agency (EPA). Because community concerns are an important aspect of the public health assessment process, ATSDR also consulted residents about their health concerns. ATSDR is preparing a separate public health assessment that will review site-wide environmental information and public health concerns.

Both nontechnical discussions of site-related public health issues as well as some technical analyses of exposure dose calculations are discussed in this health consultation. To acquaint readers with terminology used in this report, a list of comparison values, a list of abbreviations, and a glossary are included in Appendices A, B, and C, respectively. In addition, Appendix D presents the methods and assumptions used to estimate exposures and support some of the report's conclusions. All figures and tables appear at the end of the health consultation.

For more information on ATSDR or this report, you may call the agency toll free at: 1-800-447-1544. Please mention the Fort Devens site when you call.

BACKGROUND

Fort Devens Site Description

The Fort Devens site is a former military base located 35 miles northwest of Boston, Massachusetts. The site covers approximately 9,311 acres in the towns of Ayer, Harvard, Lancaster, and Shirley. As Figure 1 indicates, Fort Devens is divided into three functionally distinct parts: the Main Post, the North Post, and the South Post (Fort Devens, 1995a).

Fort Devens was established in 1917 as Camp Devens, a temporary training camp for military personnel. By 1931, the camp had become a permanent installation, known as Fort Devens, for the training and induction of military personnel and the processing of military equipment. More recently, Fort Devens has "demobilized" and "out processed" equipment assigned to Army units in New England.

In support of its mission, the Army conducted operations (e.g., storage and distribution of fuel oil, maintenance of vehicles and air crafts, photographic processing, and landfilling) that caused accidental releases of chemicals to the surrounding soil. Some of these chemicals, including volatile organic compounds (VOCs), explosive compounds, fuels, and, perhaps, inorganic compounds (e.g., arsenic) moved through the soil into the underlying groundwater (BRAC, 1996).

In 1989, EPA placed Fort Devens on the National Priorities List of sites identified for possible long-term remedial response because of groundwater contamination. Today, the post is largely inactive. It is undergoing cleanup with MADEP and EPA oversight. Large portions of the post were transferred to the local redevelopment authority, Massachusetts Government Land Bank, in 1996. With state legislative approval, these portions will eventually be transferred to the local community for economic development and reuse (MADEP, 1998; Vanasse Hangen Brustlin, Inc., 1994). The military will retain the South Post for training.

Grove Pond and Plow Shop Pond

Grove Pond and Plow Shop Pond are shallow water bodies located along Fort Devens' northern boundary (see Figure 2). Grove Pond is a 60-acre pond that receives inflowing water from Balch Pond and Cold Spring Brook. Water from Grove Pond flows through a stone arch culvert beneath a railroad causeway and into Plow Shop Pond. Plow Shop Pond, the smaller of the two ponds (30 acres), receives most of its water from the upstream Grove Pond. Water from Plow Shop Pond eventually discharges from a dam at the northwest corner of the pond to Nonacoicus Brook, which flows about 1 mile north before joining the Nashua River (ABB, 1995).

Land use surrounding the ponds is diverse. Property along Grove Pond includes a mix of residential (along the northern shore), recreational (Pirone Park), and industrial, including an

active railyard and a former tannery. The tannery operated between the mid-1900s and the 1960s in the northeast corner of Grove Pond (east of the railroad). Until 1953, the tannery reportedly discharged much of its process wastewater into Grove Pond, often with little or no treatment. Plow Shop Pond is largely surrounded by industrial property. Over the years, the industrial uses included railroad operations to the east, an industrial park to the north, and Fort Devens' Shepley's Hill Landfill area to the west and southwest (ABB, 1995).

Grove Pond and Plow Shop Pond may have been used in the past for recreational activities, but today, little, if any, swimming or subsistence fishing occurs at either pond (ADPW, 1998). In 1992, the Army posted an advisory at Plow Shop Pond recommending that people not swim and eat pond fish. The Army took this precautionary measure because of concerns about contaminants in pond sediment and the possibility that these contaminants were accumulating in fish (ATSDR, 1992). Following this action, ATSDR advocated that similar precautions be followed for uses of the adjacent Grove Pond (ATSDR, 1992). It should be noted that people can still enjoy catch and release fishing at either pond.

In informing the community about the advisory, the Army coordinated outreach with other agencies (e.g., ATSDR, Massachusetts Department of Public Health [MDPH], MADEP, EPA, and local boards of health) and abutting landowners, including the B & M railroad. As one important aspect of the outreach effort, the advisory was posted at key access points to each pond. Over the years, however, vandals have removed some signs, leaving the ponds inadequately posted. During recent visits to the ponds, ATSDR staff noted that at least two of the original signs remain in place.

Acknowledging the need for continued posting of the advisory, the EPA will provide replacement signs, and the Ayer Department of Public Works and the Devens Commerce Center will maintain the signs along the ponds (Ayer DPW, 1998). In addition to the postings, information on these advisories (and all Massachusetts fish consumption advisories) is summarized and distributed with Massachusetts fishing licenses.

DISCUSSION

In this section, ATSDR evaluates whether community members have been (past), are (current) or could be (future) exposed to harmful levels of chemicals in Grove Pond or Plow Shop Pond surface water/sediment or fish. Figure 3 describes the conservative exposure evaluation process used by ATSDR. As the figure indicates, ATSDR considers how people might come into contact with, or be exposed, to contaminated media. Specifically, ATSDR determines whether an exposure could occur through ingestion, dermal (skin) contact with contaminated media, or inhalation of vapors, and also considers the likely length (duration) and frequency of the exposure.

If exposure was or is possible, ATSDR then considers whether chemicals were or are present at levels that might be harmful to people. ATSDR does this by screening the concentration of contaminants in an environmental medium against health-based comparison values. Comparison values are concentrations that health scientists have determined are not likely to cause adverse effects, even when assuming very conservative/safe exposure scenarios. Because comparison values are not thresholds of toxicity, environmental levels that exceed comparison values would not necessarily produce adverse health effects. Rather, if a chemical is found in the environment at levels exceeding its corresponding comparison value, ATSDR further evaluates exposure variables and the toxicology of the contaminant. ATSDR emphasizes that regardless of the level of contamination, a public health hazard exists only if people come in contact with, or are otherwise exposed to, harmful levels of contaminated media.

The following section evaluates two concerns raised by community members about Grove Pond and Plow Shop Pond. Following each concern, ATSDR describes in greater detail relevant environmental data and whether a public health hazard exists.

Concern: Could persons be exposed to harmful levels of contaminants in Grove Pond or Plow Shop Pond surface water or sediment?

A "catch and release fishing only and no swimming" advisory is posted at both ponds. As a result of the advisory, recreational activities that would allow significant contact with surface water and sediment are not likely to be occurring now, nor are they expected to occur in the future (U.S. F&W, 1993). People may have used the ponds in the past for swimming, and some individuals may continue to wade along the shoreline. Because of concerns about potential exposure to contaminants via dermal contact, ATSDR reviewed environmental monitoring data to determine whether contaminants were or are present in surface water or sediment at levels that might affect public health.

Review of the Surface Water and Sediment Quality Data

The Army conducted several rounds of surface water and shallow sediment sampling from the interior and along the shore of the ponds to characterize the environmental conditions of the pond. Samples were analyzed for metals, and selected samples were analyzed for pesticides, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs).

Tables 1 and 2 identify contaminant concentrations that were measured in the surface water and sediment, respectively.¹ Table 2 also indicates the level of contaminants in the sediment along the Grove Pond shoreline at Pirone Park, specifically. ATSDR examined sampling data for Grove

¹ Table 2 summarizes information on contaminants that exceeded comparison values only.

Pond and Plow Shop Pond and compared this information against current comparison values to identify contaminants present in high concentrations.

As the surface water results indicate, most contaminants were either not detected or detected at concentrations safely below ATSDR or EPA comparison values for drinking water. Arsenic and manganese were detected but infrequently or at concentrations only slightly above comparison values.

Of the compounds analyzed in sediment, metals, including arsenic, beryllium, cadmium, chromium, lead, manganese, and zinc, reached levels greater than ATSDR's comparison values for soil. For Grove Pond, the highest levels were generally found near the former tannery, suggesting that the tannery site is a likely source of metal contamination. In contrast, the distribution of metals in Plow Shop Pond sediment varies by chemical, and potential sources of metal contamination in this pond include Shepley's Hill Landfill (e.g., arsenic, barium, iron, and manganese) and inflow from Grove Pond (e.g., iron and manganese) (ABB, 1995). Much lower concentrations were detected along the shoreline of Pirone Park.

PAHs were also detected in sediment, but they were not nearly so widespread nor in as high concentration as metals. Most PAHs were located near the railroad corridor and are likely associated with railroad activities (ABB, 1995). Concentrations of individual PAHs were generally comparable to the comparison value (0.1 parts per million [ppm]) for the PAH compounds, benzo(a)pyrene.² Other tested compounds (i.e., PCBs, pesticides) were either not detected or were detected at concentrations below comparison values.

Evaluation of Potential Public Health Hazards

Past Exposures: No exposures are likely to have occurred in the past at levels of public health concern. The highest levels of contaminants were detected in pond sediment near the tannery and in the middle of the pond, but much lower levels were found in publicly accessible areas (shoreline along Pirone Park). The likelihood is remote, however, that swimmers were actually exposed to highly contaminated sediment frequently or for extended periods because 1) the highest levels of contaminants were located in an area not easily accessible by the public or at water depths (8 to 10 feet) that preclude lengthy contact and 2) sediment contacting the skin would have been washed away quickly by surrounding water. Therefore, exposure, if any, most likely was intermittent and brief, and not of public health consequence.

Current and Future Exposures: There are no indications that people use or will use the ponds for recreation in ways that would result in significant dermal contact with either surface water or

² Though likely not of health concern, it should be noted that detection levels for some of the individual PAHs were slightly higher (up to 0.8 ppm) than ATSDR's comparison value for benzo(a)pyrene.

sediment (i.e., swimming). Some community members have expressed concern, however, about exposure to contaminants while wading along the shoreline. In general, low of levels of contaminants were found in pond surface water and in sediment along the shoreline of Pirone Park. In response to community concern, ATSDR further evaluated this exposure pathway.

When evaluating the exposure, ATSDR estimated how much of a particular metal a person may contact and absorb. To do this, ATSDR developed exposure doses for dermal contact with sediment based on conservative or "safe" scenarios. This required making assumptions about what type of activities might occur; how often the activities might occur (exposure frequency); how long the activities typically may continue (exposure duration); and the characteristics of persons doing these activities (e.g., age, sex, weight). In estimating exposure doses for dermal contact, ATSDR assumed that individuals were exposed to the maximum concentration of contaminants detected in sediment taken in a publicly accessible area—that is, Grove Pond's shoreline at Pirone Park. As mentioned, much lower concentrations of contaminants were detected in sediment along the shoreline of Pirone Park than elsewhere.

ATSDR evaluated possible exposure via dermal contact assuming that people were exposed to the maximum detected concentration along the shoreline. It should also be noted that the chemicals found in the sediment are not readily absorbed through the skin, and would have to be present in very high concentrations to pose health effects via this exposure route. Appendix D describes the methods and assumptions used in ATSDR's evaluation in greater detail. In this appendix, ATSDR also compares noncancer exposure dose estimates (Table D-1) and cancer risk estimates (Table D-2) against ATSDR health guidelines for noncancer and cancer effects. The results of the comparison indicate that estimated exposure doses were all below ATSDR health guidelines. Also, the cancer risk estimates suggest that human exposure to the level of contaminants in shoreline sediment is not likely to lead to the development of cancer. Therefore, the contaminant levels in sediment are not harmful to adults or children who may wade along the shoreline, even when assuming people contact the sediment frequently (i.e., 140 days a year) over a long period of time (i.e., up to 30 years).

On the basis of its evaluation, *ATSDR* concludes that no exposures are likely to have occurred in the past (swimming and wading), are believed to be occurring now (wading), nor are they expected to occur in the future (wading) at levels of health concern.

Concern: Could persons be exposed to harmful levels of contaminants when eating fish from Grove Pond or Plow Shop Pond?

As mentioned previously, a "catch and release fishing only and no swimming" advisory is posted at both ponds. People who follow the recommendations in the advisory are minimizing their exposure, if any, to any possible contaminants in freshwater fish. Subsequent to the advisory being posted in 1992, fish monitoring data for Plow Shop Pond and Grove Pond have become available for ATSDR review. In the discussion that follows, ATSDR presents its evaluation of these data to determine whether contaminant concentrations, if any, in fish indicate a public health concern or that additional measures need to be taken.

Review of Fish Monitoring Data

Since the ponds were posted with the advisory, the Army and U.S. Fish and Wildlife Service collected fish samples from the Plow Shop Pond and Grove Pond, respectively (Fort Devens, 1995b; U.S. F&W, 1993; 1997). The fish samples (fillet and reconstructed whole body samples) were analyzed for metals, pesticides (i.e., 1,1-dichloro-2,2-*bis*(*p*-chlorophenyl)ethylene [DDD], 1,1-dichloro-2,2-*bis*(*p*-chlorophenyl)ethane [DDE]), and PCBs.³

Tables 3 and 4 provide the fish sampling results for Grove Pond and Plow Shop Pond, respectively. ATSDR reviewed these sampling data to determine what chemicals, if any, had actually accumulated in fish. As the results indicate, metals, PCBs, and pesticides were detected in the pond fish samples. ATSDR compared the concentrations to available health-based Food and Drug Administration (FDA) action levels or tolerance levels (see Tables 3 and 4). (Massachusetts has adopted these health-based levels as the basis for issuing fish consumption advisories.) Action or tolerance levels are available for mercury, PCB, and some pesticides (e.g., DDD and DDE) only, however. As Tables 3 and 4 indicate, mercury exceeded its FDA action level (1 milligram per kilogram [mg/kg]) in a few fish samples caught from the ponds, while concentrations of other compounds (i.e., PCBs, DDD, and DDE) were all safely below their respective FDA action or tolerance level.

Evaluation of Potential Public Health Hazards

Past Exposures: No public health hazard is likely associated with consumption of fish in the past. Although mercury was detected at concentrations greater than the FDA action level, exposure to these concentrations will not necessarily produce adverse health effects. To further evaluate potential exposure, ATSDR compared estimated exposure doses to health-based guidelines, such as ATSDR's minimal risk levels or EPA's reference dose (see Table D-3) and developed cancer risk estimates (Table D-4) for mercury and chemicals without an FDA action or tolerance level. Without knowing specific fish consumption patterns in the community, ATSDR assumed that an individual ate an average amount of freshwater fish (one 8-ounce fish meal a month for an adult and one 4-ounce fish meal a month for a child) containing the maximum concentration of a contaminant detected in fish from either pond. A further description of the methods and

³ Some samples were "reconstructed" using the fillet and the partial body sample. The concentration for the reconstructed whole body sample is the sum of the fillet concentration and the partial body sample concentration divided by the total body weight.

assumptions used in developing exposure doses and cancer risk estimates is presented in Appendix D.

As Tables D-3 and D-4 in Appendix D indicate, exposure doses and/or cancer risk estimates developed for arsenic, cadmium, manganese, selenium, zinc are below or just slightly higher than current health guidelines or below "acceptable" cancer risk ranges. Because of the conservative assumptions used in estimating exposure doses, these values do not indicate a health concern. Therefore, ATSDR considers that these contaminants are not likely to cause health effects or lead to the development of cancer.

The estimated dose for a child exposed to mercury slightly exceeds the MRL. The exposure dose, however, probably overestimates the actual exposure a child might have received because the likelihood that a child consumed the most contaminated fish frequently or for extended periods is remote. As noted, with the exception of a few samples of largemouth bass, most mercury concentrations were below the FDA action level. Rather, an individual who consumed moderate amounts of Grove Pond and Plow Shop Pond fish in a varied diet probably has not been exposed to high levels of mercury associated with adverse health effects.

Mercury found in Grove Pond and Plow Shop fish is probably associated with the low-level mercury-contaminated sediment found near the tannery and the railroad area. It should also be noted, however, that mercury is a widespread problem in Massachusetts freshwater rivers, ponds, and lakes. As a precautionary measure, MDPH issued a statewide advisory in September 1994 to urge pregnant women not to eat fish caught from freshwater bodies in Massachusetts because of the potential harmful effects of mercury on the fetus (MDPH, 1995).

Current and Future Exposures: No public health hazards are likely to be occurring now, nor are they expected to occur because an advisory recommends that people not eat fish caught at either pond. Some metals, such as mercury, are persistent in the environment and their levels in fish may have increased over time since the initial fish sampling. Therefore, as a precautionary measure, people should continue to follow the recommendations in the advisory until additional data suggest otherwise.

ATSDR concludes that likely past exposures via consumption of Grove Pond and Plow Shop Pond fish would not be expected to result in adverse health effects. As a precautionary measure, people can best protect themselves by continuing to follow the recommendations in the advisory.

ATSDR CHILD HEALTH INITIATIVE

ATSDR recognizes that infants and children may be more sensitive than adults to environmental exposure in communities faced with contamination of their water, soil, air, or food. This

sensitivity is a result of the following factors: (1) children are more likely to be exposed to certain media like soil when they play outdoors; (2) children are shorter and therefore may be more likely to breathe dust, soil, and vapors close to the ground; and (3) children are smaller than adults and therefore may receive a higher dose of chemical exposure relative to their body weight. Children also can sustain permanent damage if exposed to toxic substances during critical growth stages. ATSDR is committed to evaluating children's special interests at sites such as Fort Devens as part of the Child Health Initiative.

ATSDR identified no situations in which children are likely to be exposed to chemical contaminants associated with Grove Pond or Plow Shop Pond if they follow the precautions currently recommended in the Grove Pond and Plow Shop Pond advisory. ATSDR based its conclusion on the following factors:

- Children are urged to refrain from swimming in Grove Pond and Plow Shop Pond, but any limited use like wading is unlikely to cause harmful effects. Sediment quality sampling of these ponds indicate that metals and PAHs most likely related to the industry around the pond exist. As a precautionary measure, an advisory suggests that people do not swim in either Grove Pond and Plow Shop Pond. Exposure to contaminants, if any, that might occur during wading is likely brief and infrequent and not likely to lead to health effects.
- Children are urged to refrain from eating Grove Pond and Plow Shop Pond fish. ATSDR recommends that children do not eat freshwater fish from either pond. Children who do not heed this warning could be exposed to mercury, which can be harmful to the developing nervous system. The mercury contamination in the fish is likely from a number of sources, including a former tannery.

CONCLUSIONS

On the basis of its evaluation of available environmental information and discussions with representatives from EPA, MADEP, and the Army, ATSDR has reached the following conclusions:

Exposures, if any, to contaminants in Grove Pond or Plow Shop Pond are limited and unlikely to cause a public health hazard. No significant exposure has occurred, is occurring now, nor is expected in the future. A "no swimming" advisory has been posted at each pond to advise people against swimming there. Elevated levels of contaminants have been measured in pond sediment but not in the surface water. Any brief and infrequent contact with the ponds' sediment at public access areas (e.g., Pirone Park) is unlikely to produce adverse health effects.

- Consumption of Grove Pond and Plow Shop Pond fish may pose a health concern for certain individuals not adhering to the fish consumption advisory. Some Grove Pond and Plow Shop Pond fish contain elevated levels of mercury. Mercury in fish likely originates from various sources that may include the former tannery. An advisory has been posted urging people not to eat fish caught from Plow Shop Pond and Grove Pond at any time. ATSDR concludes that by following the precautions, people, particularly young children and pregnant women, can reduce their potential for exposure to mercury.
- ATSDR concludes that Grove Pond and Plow Shop Pond currently pose no apparent public health hazard as long as individuals follow the precautions outlined in the advisory.

RECOMMENDATIONS

Given the conclusions drawn in this health consultation, ATSDR has identified the following actions that are necessary to reduce any potential health hazards associated with use of Grove Pond and Plow Shop Pond near Fort Devens:

- Continue to characterize contamination in the ponds, particularly in the northwest cove of Grove Pond near the former tannery, and, if necessary, take appropriate measures protective of public health. EPA is currently conducting additional sampling of the surface water and sediment of each pond. If new data generated by these activities indicate that a potential health hazard exists, ATSDR will reevaluate the conclusions in the health consultation.
- Continue to support the current advisory and maintain the signs at the pond, particularly during fishing and swimming seasons. EPA will provide replacement signs, and the Ayer Department of Public Works and the Devens Commerce Center will maintain signs at key access points (e.g., boat ramps, Pirone Parks, public landings) along Grove Pond and Plow Shop Pond.

REFERENCES

ABB Environmental Services, Inc. (ABB). 1995. Fort Devens feasibility study for Group 1A sites. Draft Plow Shop Pond and Grove Pond sediment evaluation. Volume I. Sections 1.0-8.0. October 1995.

Agency for Toxic Substances and Disease Registry (ATSDR). 1992. Letters to local boards of health and abutting landowners. RE: Recommendation for "Catch and Release Fishing Only" and "No Swimming" Posting of Plow Shop and Grove Ponds. December 1992.

ATSDR. 1998. ATSDR Public Availability Session. Ayer, Massachusetts. March 1998.

Ayer Department of Public Works (Ayer DPW). 1998. Meeting at Ayer Department of Public Works with representatives from ATSDR, Environmental Protection Agency, Massachusetts Department of Environmental Protection, and Devens Commerce Commission. October 15, 1998.

Base Realignment and Closure Environmental Offices (BRAC). 1996. Cleanup Plan. Fort Devens, Fort Devens, Massachusetts. September 1996.

Fort Devens. 1995a. Fort Devens community relations plan for environmental restoration 1995 Update. May 1995.

Fort Devens. 1995b. Record of decision. Shepley's Hill Landfill operable unit areas of contamination 4, 5, & 18. Fort Devens, Massachusetts. September 1995.

Massachusetts Department of Environmental Protection (MADEP). 1998. Personal communication with John Regan, Central Regional Office. July 1998.

Massachusetts Department of Public Health (MDPH). 1995. Fish consumption advisories for mercury in freshwater fish. Massachusetts Department of Public Health. Presented to the Committee on Health Effects. May 1995.

PACE. 1998. Personal communication from People of Ayer Concerned About the Environment to ATSDR. March 26, 1998.

U.S. Fish and Wildlife Service (U.S. F&W). 1993. Concentrations of mercury and other environmental contaminants in fish from Grove Pond, Ayer Massachusetts. September 1993.

U.S. F&W. 1997. Letter from Kenneth Carr, Acting Supervisor of U.S. Fish & Wildlife New England Field Office, to Dennis Gagne, U.S. Environmental Protection Agency. RE: Review of the draft Plow Shop Pond and Grove Pond sediment evaluation. January 22, 1997. 1993.

Vanasse Hangen Brustlin, Inc. 1994. Devens Reuse Plan. Fort Devens, Massachusetts. November 14, 1994.

.

Figures

٠

ž

*

FIGURE 1. Fort Devens



Source: ABB, 1995.

FIGURE 2. Grove Pond and Plow Shop Pond

i.



Source: ABB, 1995.

.

15

18

FIGURE 3. ATSDR's Exposure Evaluation Process

REMEMBER: For a public health threat to exist, the following three conditions must all be met:

- People must come into contact with areas that have potential contamination
- · Contaminants must exist in the environment
- The amount of contamination must be sufficient to affect people's health

Are People Exposed To Areas With Potentially Contaminated Media? For exposure to occur, contaminants must be in locations where people can contact them.

People may contact contaminants by any of the following three exposure routes:

Inhalation Ingestion Dermal absorption Are the Environmental Media Contaminated?

ATSDR considers:

Soil Ground water Surface water and sediment Air Food sources For Each Completed Exposure Pathway, Will the Contamination Affect Public Health?

ATSDR will evaluate existing data on contaminant concentration and exposure duration and frequency.

ATSDR will also consider individual characteristics (such as age, gender, and lifestyle) of the exposed population that may influence the public health effects of contamination.



8.2

		4			ATSDR's Comparison Values (ppb)			
	Su	rface Water Co	ncentrations (p)	pb)	Non-Car			
	Grove	Grove Pond Plow Shop Pond		op Pond			Carcinogenic	
Contaminant	Range	Frequency	Range	Frequency	Adult	Child	e ne energemet	
Metals			4 5					
Arsenic	< 2.56 - 3.94	1/6	2.99 - 6.84	13/13	10 EMEG	3 EMEG	(0.02)	
Cadmium	nd	0/6	nd	0/13	20 EMEG	7 EMEG	-	
Chromium	< 6.02 - 39.8	2/6	< 4.47	0/13	100 MCL			
Lead	< 1.26 - 3.04	2/6	nd	0/13			-	
Manganese	39.9 - 1,000	6/6	7.81 - 139	13/13	200 RMEG	50 RMEG		
Mercury	nd	0/6	nd	0/13	8			
Zinc	nd	0/6	nd	0/13	10,000 EMEG	3,000 EMEG		

TABLE 1. Summary of Contaminants in Grove Pond and Plow Shop Pond Surface Water

Source: ABB, 1995.

Key: EMEG = environmental media evaluation guide; MCL = EPA's maximum contaminant level; RMEG = reference dose media evaluation guide;--- = not available; nd = analyte not detected; < = less than the value shown.

			2 and a second				Comparison Values (ppm)		
			Concentration R	ange (ppm)			Noncarc	inogenic	
	Grove P	ond ¹	Grove Pond near Pirone Park ²		Plow Shop Pond 3				
Contaminant	Range	Frequency	Range	Frequency	Maximum	Frequency	Adult	Child	Carcinogenic
Metals	1			- 7			×		
Arsenic	4.16 - 1,300	41/41	9.23 - 110	7/7	3,200	63/63	200 EMEG	20 EMEG	0.5
Beryllium	0.5 - 3.12	2/41	nd	0/7	2.72	8/63	4,000 RMEG	300 RMEG	0.2
Cadmium	< 0.7 - 110	2/41	< 0.7 - 23.3	3/7	60.2	21/63	500 EMEG	40 EMEG	-
Chromium	<4.05 - 49,800	40/41	35.3 - 2,680	7/7	10,000	60/63	4,000 RMEG	400 RMEG	_
Lead	3.21 - 1,760	12/41	11.4 - 232	7/7	1,000	62/63	_		
Manganese	14.4 - 1,730	41/41	145 - 792	7/7	54,800	59/63	4,000 RMEG	300 RMEG	
Mercury	< 0.5 - 220	34/41	<0.05 - 2.18	6/7	250	58/63	1,000 EMEG	100 EMEG	-
Zinc	< 8.03 - 755	40/41	125 - 482	7/7	743	39/63	200,000 EMEG	20,000 EMEG	-
PAHs ⁴	< 0.1 - 5	20/41	< 0.1 - 0.8	1/7	0.1 - 4.3	3/13			0.1

TABLE 2. Summary of Contaminants in Grove Pond and Plow Shop Pond Sediment

Source: ABB, 1995.

¹ Monitoring data from 1992 - 1995.

² Data subset includes samples (GRD-16x to GRD-22x) collected along the shoreline of Grove Pond at Pirone Park in 1995.

³ Data from the 1991 RI, the 1992-1993 SRI, and the 1994 PSP sediment evaluation. Only the maximum concentrations were presented for the RI and PSP data.

⁴ The values represent the highest recorded concentration for an individual PAH. Pyrene was detected in the highest levels. A comparison value for benzo(a)pyrene of 0.1 ppm was used.

Key: PAHs = polycyclic aromatic hydrocarbons; EMEG = environmental media evaluation guide; RMEG = reference dose media evaluation guide; < = less than the value shown; --- = not available; nd = analyte not detected.

TABLE 3. Summary of Contaminants in Grove Pond Fish

		Contaminant Concentrations (mg/kg)							
	Largemo (Recons Wholebody	uth Bass tructed Samples) ¹	Brown Bullhead (Reconstructed Wholebody Samples) ¹		Bluegill (Wholebody Samples)		Comparison Value		
Contaminant	Range	Frequency	Range	Frequency	Range	Frequency	(mg/kg)		
Metals	Metals								
Cadmium	0.03 - 0.88	3/10	0.01 - 0.19	2/8	0.05 - 0.24	10/10	no value		
Lead	0.14 - 4.32	4/10	0.18 - 1.12	3/8	0.16 - 1.38	10/10	no value		
Mercury	0.10 - 1.13	10/10	0.01 - 0.14	6/8	0.08 - 0.24	10/10	1 FDA action level		
Selenium	0.22 - 0.51	10/10	0.13 - 0.39	3/8	0.27 - 0.38	10/10	no value		
Zinc	11.0 - 16.4	10/10	10.0 - 20.5	8/8	16.7 - 26.3	10/10	no value		
PCBs	0.10 - 0.43	10/10	ND - 0.12	2/8	ND - 0.21	10/10	2 FDA tolerance level		
Pesticides				¥(
DDD	0.02 - 0.11	10/10	ND - 0.05	7/8	0.01 - 0.07	10/10	5 FDA action level		
DDE	0.05 - 0.25	10/10	0.01 - 0.10	8/8	0.02 - 0.13	10/10	5 FDA action level		

Source: U.S. Fish and Wildlife, 1993.

¹ Contaminant concentrations in reconstructed wholebody samples are presented because they were generally greater than concentrations detected in fillet samples. Key: mg/kg = milligram per kilogram; DDD = 1,1-dichloro-2,2-bis(p-chlorophenyl)ethane; DDT = 1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene; FDA = Food and Drug Administration.

TABLE 4. Summary of Contaminants in Plow Shop Pond Fish

		Contaminant Conc	entrations (mg/kg)		
	Largemouth Bass an (Fillet S	nd Brown Bullhead amples)	Blue (Wholebod)	gill Samples)	Comparison Value
Contaminant	Range	Frequency	Range	Frequency	(mg/kg)
Metals					
Arsenic	0.09 - 0.15	2/10	1.3	1/5	no value
Lead			0.16	1/5	no value
Manganese	0.3	1/10	39.1 - 94.7	5/5	no value
Mercury	0.12 - 4	8/10	0.19 - 0.54	5/5	1 FDA action level
Selenium	0.11 - 0.2	10/10	0.42 - 0.67	5/5	no value
Zinc	3.4 - 6.1	10/10	22.2 - 29.6	5/5	no value
Pesticides					
DDE	0.015 - 0.031	2/10	0.0121 - 0.0129	2/5	5 FDA action level

Source: Fort Devens, 1995b.

Key: ppb = parts per billion; mg/kg = milligram per kilogram; DDE = 1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene; FDA = Food and Drug Administration; --- = not available.

Appendix A: List of Comparison Values

Comparison values represent media-specific contaminant concentrations that are used to select contaminants for further evaluation to determine the possibility of adverse public health effects. The conclusion that a contaminant exceeds the comparison value does not mean that it will cause adverse health effects.

Cancer Risk Evaluation Guides (CREGs)

CREGS are estimated contaminant concentrations that would be expected to cause no more than one excess cancer in a million (10⁻⁶) persons exposed over their lifetime. ATSDR's CREGs are calculated from EPA's cancer potency factors (CPFs).

Environmental Media Evaluation Guides (EMEGs)

EMEGs are based on ATSDR minimal risk levels (MRLs) that consider body weight and ingestion rates. An EMEG is an estimate of daily human exposure to a chemical (in mg/kg/day) that is likely to be without noncarcinogenic health effects over a specified duration of exposure to include acute, intermediate, and chronic exposures.

Maximum Contaminant Level (MCL)

The MCL is the drinking water standard established by EPA. It is the maximum permissible level of a contaminant in water that is delivered to the free-flowing outlet. MCLs are considered protective of public health over a lifetime (70 years) for individuals consuming 2 liters of water per day.

Reference Media Evaluation Guides (RMEGs)

ATSDR derives RMEGs from EPA's oral reference doses. The RMEG represents the concentration in water or soil at which daily human exposure is unlikely to result in adverse noncarcinogenic effects.

APPENDIX B: List of Abbreviations

ŝ

ABS	absorption factor
AF	adherence factor
AT	averaging time
ATSDR	Agency for Toxic Substances and Disease Registry
BW	body weight
CF	conversion factor
CPF	cancer potency factor
CREG	ATSDR's cancer risk evaluation guide
DDD	1,1-dichloro-2,2-bis(p-chlorophenyl)ethane
DDE	1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene
EF	exposure frequency
ED	exposure duration
EMEG	ATSDR's environmental media evaluation guide
EPA	U.S. Environmental Protection Agency
FDA	Food and Drug Administration
FI	fraction ingested
IR	ingestion rate
kg	kilogram
MADEP	Massachusetts Department of Environmental Protection
MDPH	Massachusetts Department of Public Health
MCL	EPA's maximum contaminant level
MRL	ATSDR's minimal risk level
mg/kg	milligrams of contaminants per kilogram
mg/kg/day	milligrams of contaminant per kilogram per day
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
ppb	parts per billion
ppm	parts per million
RfD	EPA's reference dose
RMEG	ATSDR's reference dose media evaluation guide
SA	surface area
VOCs	volatile organic compounds

APPENDIX C: Glossary

Comparison Values

Estimated contaminant concentrations in specific media that are not likely to cause adverse health effects, given a standard daily ingestion rate and standard body weight. The *comparison values* are calculated from the scientific literature available on exposure and health effects.

Concentration

The amount of one substance dissolved or contained in a given amount of another. For example, sea water contains a higher concentration of salt than fresh water.

Contaminant

Any substance or material that enters a system (the environment, human body, food, etc.) where it is not normally found.

Dose

The amount of a substance to which a person is exposed. *Dose* often takes body weight into account.

Environmental Contamination

The presence of hazardous substances in the environment. From the public health perspective, *environmental contamination* is addressed when it potentially affects the health and quality of life of people living and working near the contamination.

Exposure

Contact with a chemical by swallowing, by breathing, or by direct contact (such as through the skin or eyes). *Exposure* may be short term (acute) or long term (chronic).

Health Consultation

A response to a specific question or request for information pertaining to a hazardous substance or facility (which includes waste sites). It often contains a time-critical element that necessitates a rapid response; therefore, it is a more limited response than an assessment.

Ingestion

Swallowing (such as eating or drinking). Chemicals can get in or on food, drink, utensils, cigarettes, or hands where they can be ingested. After *ingestion*, chemicals can be absorbed into the blood and distributed throughout the body.

Media

Soil, water, air, plants, animals, or any other parts of the environment that can contain contaminants.

C-1

Minimal Risk Level (MRL)

An *MRL* is defined as an estimate of daily human exposure to a substance that is likely to be without an appreciable risk of adverse effects (noncancer) over a specified duration of exposure. *MRLs* are derived when reliable and sufficient data exist to identify the target organ(s) of effect or the most sensitive health effect(s) for a specific duration via a given route of exposure. *MRLs* are based on noncancer health effects only. *MRLs* can be derived for acute, intermediate, and chronic duration exposures by the inhalation and oral routes.

No Apparent Public Health Hazard

This public health conclusion category is used for sites where human exposure to contaminated media is occurring or has occurred in the past, but the exposure is below a level of health hazard. This category is used when exposures do not exceed an ATSDR chronic MRL or other comparable value, data are available for all environmental media to which humans are being exposed, and there are no community-specific health outcome data to indicate that the site has had an adverse impact on human health

Potentially Exposed

The condition where valid information, usually analytical environmental data, indicates the presence of contaminant(s) of a public health concern in one or more environmental media contacting humans (i.e., air, drinking water, soil, food chain, surface water), and there is evidence that some of those persons have an identified route(s) of exposure (i.e., drinking contaminated water, breathing contaminated air, having contact with contaminated soil, or eating contaminated food).

Parts per Billion (ppb)/ Parts per Million (ppm)

Units commonly used to express low concentrations of contaminants. As example of each, one part per billion (ppb) of trichloroethylene (TCE) equals one drop of TCE mixed in a competition-size swimming pool and one part per million (ppm) equals one ounce of trichloroethylene (TCE) in one million ounces of water.

Reference dose

The value used by EPA as an estimate of daily exposure (mg/kg/day) to the general human population (including sensitive populations) that is likely to be without appreciable risk of harmful effects during a lifetime of exposure.

Risk

In risk assessment, the probability that something will cause injury, combined with the potential severity of that injury.

Route of Exposure

The way in which a person may contact a chemical substance. For example, drinking (ingestion) and bathing (skin contact) are two different *routes of exposure* to contaminants that may be found in water.

Volatile organic compounds (VOCs)

Substances containing carbon and different proportions of other elements such as hydrogen, oxygen, fluorine, chlorine, bromine, sulfur, or nitrogen; these substances easily become vapors or gases. A significant number of the *VOCs* are commonly used as solvents (paint thinners, lacquer thinner, degreasers, and dry cleaning fluids).

APPENDIX D: Estimated Exposures and Health Effects

Estimates of Human Exposure Doses and Determination of Health Effects

Deriving Exposures Doses

ATSDR estimated the human exposure doses dermal contact with Grove Pond sediment along Pirone Park and ingestion of fish. Deriving exposure doses requires evaluating the concentrations of the contaminants to which people may have been exposed and how often and how long exposure to those contaminants occurred. Together, these factors help influence the individual's physiological response to chemical contaminant exposure and potential noncancer (noncarcinogenic) or cancer (carcinogenic) outcomes. In the absence of exposure specific information, ATSDR applied several conservative exposure assumptions to define site-specific exposures as accurately as possible for area residents.

Evaluating Potential Health Hazards

The estimated exposure doses are used to evaluate potential noncancer and cancer effects associated with chemicals of concern. When evaluating *noncancer* effects, ATSDR uses standard toxicity values, including ATSDR's minimal risk levels (MRLs) and EPA's reference doses (RfDs), to determine whether adverse effects will occur. The chronic MRLs and RfDs are estimates of daily human exposure to a substance that are unlikely to result in adverse noncancer effects over a specified duration. ATSDR compares estimated exposure doses to conservative guidelines such as MRLs or RfDs for each contaminant. If the exposure dose is greater than the MRL or RfD, then a possibility exists for noncancer effects to occur.

To evaluate *cancer* effects, ATSDR sometimes uses cancer potency factors (CPFs) that define the relationship between oral exposure doses and the increased likelihood of developing cancer over a lifetime. The CPFs are developed using data from animal or human studies and often require extrapolation from high exposure doses administered in animal studies to the lower exposure levels typical of human exposure to environmental contaminants. CPFs represent the upper-bound estimate of the probability of developing cancer at a defined level of exposure; therefore, they tend to be very conservative (i.e., overestimate the actual risk) in order to account for a number of uncertainties in the data used in the extrapolation.

ATSDR estimated the potential for cancer to occur using the following equation. (The estimated exposure doses and CPF values for the contaminants of concern are incorporated into the equation):

Lifetime Cancer Risk = Estimated exposure dose (mg/kg/day) x CPF (mg/kg/day)⁻¹

Although no risk of cancer is considered acceptable, it is impossible to achieve a zero cancer risk. Consequently, ATSDR often uses a range of 10^{-4} to 10^{-6} estimated lifetime cancer risk (or 1 new case in 10,000 to 1,000,000 exposed persons), based on conservative assumptions about exposure, to determine the likelihood of excess cancer resulting from this exposure.

In addition to estimating the likelihood of noncancer and cancer effects, ATSDR reviewed the literature to evaluate possible health effects associated with exposure at the doses/concentrations estimated for the pathway described above.

Estimated Exposure Doses From Contact With Grove Pond Sediment at Pirone Park

Metal concentrations measured in Grove Pond sediment at Pirone Park exceeded ATSDR comparison values for soil. To determine whether exposure to contaminants in the sediment may be related to adverse health effects, if any, ATSDR estimated exposure doses for adults and children contacting sediment containing the highest measured levels detected at Pirone Park.

In estimating to what extent people might be exposed to contaminants, ATSDR used "conservative" assumptions about possible human exposure and the associated health effects. ATSDR assumed that an adult or child contacted the most contaminated Grove Pond sediment at Pirone Park while wading. ATSDR also used higher levels than actually expected about how often people contacted the sediment. These assumptions allow ATSDR to estimate the highest possible exposure dose and determine the corresponding health effects. Although ATSDR does not expect that most people at the park were exposed to the highest (most conservative) levels of contamination, the "conservative" estimates are used to protect public health.

ATSDR used the following equation to estimate human exposure doses for dermal contact with sediment:

 $Estimated Exposure Dose = \underline{Conc. x CF x SA x ABS x AF x EF x ED}$ BW x AT

where:

Conc.	=	Maximum contaminant concentration in the sediment near Pirone Park (ppm)
CF	=	Conversion factor: 10 ⁻⁶
SA	=	Skin surface area available for contact (cm ² /event):
		-For exposure to feet only: adult male $(M) = 1,310 \text{ cm}^2$ and child = 334 cm ²
ABS	=	Absorption factor= 1% for dermal exposure (EPA, 1995a)
AF	=	Skin to soil adherence factor = 0.6 mg/cm^2 -event (EPA, 1992)
EF	=	Exposure frequency, or number of exposure events per year of exposure:
		1 event/day x 7 days/week x 20 weeks/year or 140 events per year
ED	=	Exposure duration, or the duration over which exposure occurs: adult = 30 years;
		child = 6 years

- BW = Body weight (kg): adult = 70 kg (154 pounds); child = 10 kg (22 pounds)
- AT = Averaging time, or the time period over which cumulative exposures are averaged 30 years x 365 days/year or 6 years x 365 days/year) for noncancer effects; 70 years x 365 days/year for cancer effects)

Assumptions for Estimating Human Exposure Dose:

- ATSDR assessed exposure to contaminants from dermal contact with sediment using an approach similar to that described for surface water. That is, absorbed doses rather than intake were estimated as the amount of contaminant actually absorbed into the body rather than the amount that comes into contact with the outer skin. A dermal absorption factor (ABS-dermal) was used to approximate how much of the contaminant contacting the body is actually absorbed. The ABSdermal values represent the percent of the contaminant concentration contacted.
 - The surface skin area (SA) available for contact per exposure event was assumed to be the 50th percentile values for feet for adult males and children (2 to 3 years of age) (EPA, 1995).
- The amount of sediment adherence to skin (the adherence factor, AF) per exposure event was assumed to be 0.6 mg/cm², the midpoint of the range recommended by EPA for dermal exposure to soil (EPA, 1992).
- ATSDR reviewed local climatologic data to estimate the period of seasonal activity. ATSDR used a 20-week period—or the length of time average air temperatures meet or exceed 70 degrees—to approximate this period (NOAA, 1997).
- The averaging time (AT) for noncancer effects was assumed to be 30 years for 365 days/year (or 10,950 days) or 6 years for 365 days/year (or 2,190 days). It was assumed to be 70 years for 365 days/year (or 25,550 days) for cancer effects based on an average lifetime of 70 years (EPA, 1995b).

Determination of Human Health Effects

As Table D-1 indicates, the exposure doses estimated by ATSDR for dermal contact with sediment by adults and children were considerably lower than the MRL or RfD; therefore, noncancer effects for this pathway of exposure are not expected.

Because arsenic and beryllium are classified as carcinogens, ATSDR estimated the lifetime cancer risk from dermal contact with sediment containing the maximum concentration of these chemicals. Based on these estimated cancer risks presented in Table D-2, ATSDR

does not expect that contact with sediment containing arsenic or beryllium will result in an increased likelihood of developing cancer.

Estimated Exposure Doses for Ingestion of Fish

ATSDR used the following equation to estimate exposure doses for ingestion of Grove Pond and Plow Shop Pond fish:

Estimated exposure dose = $\underline{\text{Conc. x IR x FI x EF x ED}}$ BW x AT

where:

Conc	=	Maximum concentration in fish (mg/kg)
IR	=	Ingestion rate: 0.0065 kg/day (approximately one 8-ounce meal per month),
*e		average consumption of fish and shellfish from estuarine and freshwater by the
		general U.S. population (EPA, 1989). Because a child likely eat smaller fish meals,
		ATSDR assumed that a child eats a one 4-ounce meal per month.
FI ·	=	Fraction ingested from contaminant source (assumed 100%)
EF	=	Exposure frequency, or number of exposure events: 365 days per year
ED	=	Exposure duration, or the duration over which exposure occurs: $adult = 30$ years; $child = 6$ years
BW	=	Body weight (kg): adult = 70 kg (154 pounds); child = 10 kg (22 pound)
AT	=	Averaging time, or the time period over which cumulative exposures are averaged
		30 years x 365 days/year or 6 years x 365 days/year) for noncancer effects; 70
		years x 365 days/year for cancer effects)

Determination of Human Health Effects

Using maximum detected concentrations and other conservative assumptions about exposure, the doses estimated for ingestion of fish containing either arsenic, cadmium, manganese, selenium, and zinc are lower or very similar to the corresponding MRL or RfD (see Table D-3). The estimated dose for a child exposed to mercury exceeds the MRL, but only by a factor of 2. Conservative assumptions (e.g., maximum concentration) allow ATSDR to estimate the highest possible exposure dose, even though ATSDR does not expect that most people were exposed to the highest levels each time they ate fish. Based on these estimates, even when considering the highest levels detected in fish, exposures are very unlikely to lead to noncancer effects.

Because arsenic is classified as a human carcinogen, ATSDR estimated the lifetime cancer risk associated with consumption of fish containing the detected concentration of arsenic

and using very conservative assumptions about exposure. The cancer risk was approximately 8×10^{-5} , or 8 new cancer cases in 100,000 exposed persons (see Table D-4). Therefore, ATSDR does not expect that ingestion of fish containing arsenic will result in an increased likelihood of developing cancer.

Sources:

Environmental Protection Agency (EPA). 1989. Risk assessment guidance for Superfund. Volume 1. Human health evaluation manual (part A). U.S. Environmental Protection Agency. EPA/540/1-89-001. December 1989.

EPA. 1992. Dermal Exposure Assessment: Principles and Applications. Office of Health and Environmental Assessment. INTERIM Report. 1992.

EPA. 1995a. Assessing Dermal Exposure. Region III Technical Guidance Manual Risk Assessment. Office of Superfund Programs. December 1995.

EPA. 1995b. Exposure Factors Handbook-Final Report. Office of Health and Environmental Assessment. 1995.

NOAA. 1997. National Oceanic and Atmospheric Administration. Monthly summary of local climatological data. National Climatic Data Center. Asheville, NC.

Table D-1. Estimated Exposure Doses—Noncancer Effects Dermal Contact with Grove Pond Sediment at Pirone Park

	Maximum Detected	Estimated E: (mg/k	(posure Dose g/day)	Health Guideline	
Contaminant	Contaminant Concentration (ppm)	Adult	Child	Chronic Oral (mg/kg/day)	Basis for Health Guideline
Arsenic	110	0.000005	0.000009	0.0003	RfD
Beryllium	88.2	0.000004	0.000007	0.005	RfD
Cadmium	23.3	0.000001	0.000002	0.0002	MRL
Chromium	2,680	0.0001	0.0002	0.005	RfD
Manganese	793	0.00003	0.000006	0.05	MRL
Mercury	2.18	0.00000009	0.0000002	0.00051	MRL
Zinc	482	0.00002	0.00004	0.3	MRL

¹ The MRL for mercury is currently under review.

Key: ppb=parts per billion; mg/kg/day=milligrams contaminant per kilogram body weight per day; MRL=minimal risk level; RfD=reference dose; ma = not available.

Table D-2. Estimated Exposure Doses—Cancer Effects Dermal Contact with Grove Pond Sediment at Pirone Park

Contaminant	Maximum Detected Contaminant Concentration (ppm)	Estimated Exposure Dose - Cancer (mg/kg/day)	CPF	Lifetime Cancer Risk ¹
Arsenic	110	0.000002	1.5	3 x 10 ⁻⁶
Beryllium	88.2	0.000002	4.3	9 x 10 ⁻⁶

¹ Lifetime Cancer Risk = estimated dose (cancer) x CPF.

Key: CPF = cancer potency factor; ppb=parts per billion; mg/kg/day=milligrams contaminant per kilogram body weight per day.

Table D-3. Estimated Exposure Doses—Noncancer EffectsIngestion of Fish

	Maximum Detected	Estimated E (mg/l	xposure Dose (g/day)	Health Guideline		
Contaminant	Contaminant Concentration (ppm)	Adult	Child	Chronic Oral (mg/kg/day)	Basis for Health Guideline	
Arsenic	1.3	0.0001	0.0004 ¹	0.0003	RfD	
Cadmium	0.88	0.00008	0.0003 ¹	0.0002	MRL	
Manganese	94.7	0.009	0.03	0.05	MRL	
Mercury	4	0.0004	0.001 ¹	0.0005 ²	MRL	
Selenium	0.67	0.00006	0.0004	0.005	MRL	
Zinc	29.6	0.003	0.02	0.3	MRL	

¹ Because of the conservative assumptions used in estimating the exposure doses, the slightly higher values *do not* indicate a health concern. ² The MRL for mercury is currently under review.

Key: ppm=parts per million; mg/kg/day=milligrams contaminant per kilogram body weight per day; MRL=minimal risk level; RfD=reference dose.

D-4. Estimated Exposure Doses—Cancer Effects Ingestion of Fish

Contaminant	Maximum Detected Contaminant Concentration (ppm)	Estimated Exposure Dose - Cancer (mg/kg/day)	CPF	Lifetime Cancer Risk ¹
Arsenic	1.3	0:00005	1.5	8 x 10 ⁻⁵

¹ Lifetime Cancer Risk = estimated dose (cancer) x CPF.

Key: CPF = cancer potency factor; ppb=parts per billion; mg/kg/day=milligrams contaminant per kilogram body weight per day.

Attention users of Grove Pond and Plow Shop Pond.

Do not eat fish or swim in either pond!

> The Agency for Toxic Substances and Disease Registry (ATSDR) prepared a health consultation in response to community concerns about recreational uses of the ponds.

The Army, Environmental Protection Agency (EPA), Fish and Wildlife Service, and the Massachusetts Department of Environmental Protection (MADEP) collected fish and sediment samples for testing. ATSDR then compared the results with the Food and Drug Administration's safety levels, and only mercury was found at elevated levels in a few fish. An investigation of the environmental condition in and around the pond is ongoing.

You can still enjoy the areas around the ponds, and even fish in them. However, a "catch and release fishing only and no swimming" advisory is in effect. Signs have been posted as reminders. The EPA, Ayer Department of Public Works, and the Devens Commerce Center / Department of Public Works have agreed to replace any missing signs and maintain the posting along the ponds.

Past Exposures

Grove Pond and Plow Shop Pond have been used for recreational activities in the past, but no contaminants were found at high levels along the shoreline of the public areas. It is unlikely that swimmers or people wading in these areas came into contact with contaminated sediments because they were generally inaccessible to the public.

If you ate moderate amounts of fish in a varied diet, most likely you have not consumed levels that are harmful to your health. However, we still want to prevent, as much as possible, your exposure to mercury.

Current Exposures



exe provide all star is all and an

and the second s

An advisory has been posted; therefore, people should follow the precautions of the signs (*Do not eat fish from or swim in either pond*). By following these precautions, people, particularly young children and pregnant women, can reduce their exposure to mercury and still enjoy the areas around the ponds.



More detailed information can be found in the Health Consultation entitled, *"Evaluation of Health Concerns Associated with Grove Pond and Plow Shop Pond,"* which can be reviewed at the following repositories:

. . .

Ayer Public Library 26 East Main Street Street Ayer, MA 01432

Lancaster Public Library 717 Main Street Lancaster, MA 01523

and the second of the statement of

ingenerate servers a consequence of the end of the serverse of

فحرسر وربيت كفئك كسروبه المتهرستين سربيانا لتجد اسراكسوك والالر

Harvard Public Library Harvard Common / Fairbank Harvard, MA 01451

Hazen Memorial Library 3 Perimeter Road Shirley, MA 01464

Groton Library Fort Devens 2001 MacArthur Blvd Fort Devens, MA 01433

For more information contact:

Agency for Toxic Substances and Disease Registry Amanda Stoddard, Environmental Health Scientist; Loretta Bush, Health Communications Specialist; or Sandra Lopez, Health Education Specialist in Atlanta at 1-888-42-ATSDR (28737), or you can call Susanne Simon in Boston at (617) 918-1492.

Environmental Protection Agency Jim Byrne, Project Manager, **(617) 918-1389**.

Ayer Department of Public Works Gary Girouard, Superintendent, (978) 772-8240.

Devens Commerce Center / Department of Public Works Charlie Duval, (978) 772-1864.

Massachusetts Department of Environmental Protection John Regan, Project Manager, (508) 767-2840. Visit the ATSDR's Internet Homepage at: http://atsdr1.atsdr.cdc.gov:8080/

Fort Devens Site Fort Devens, Massachusetts



a side and all the Research