

Chapter 4. Lake Huron

Lake Huron has only one U.S. Great Lakes AOC: the Saginaw River and Bay AOC.

4.1. Saginaw River and Bay AOC, Arenac, Bay, Clare, Genesee, Gladwin, Gratiot, Huron, Iosco, Isabella, Lapeer, Livingston, Mecosta, Midland, Montcalm, Ogemaw, Osceola, Roscommon, Saginaw, Sanilac, Shiawassee, and Tuscola Counties, MI

The Saginaw River and Bay AOC includes all of Saginaw Bay to where it meets open Lake Huron at an imaginary line drawn between Au Sable Point and Point Aux Barques, as well as the entire 35 km length of the Saginaw River, which flows into Saginaw Bay (see AOC map at end of chapter and in Appendix 1).

4.1.1. Hazardous Waste Sites Relevant to the Saginaw River and Bay AOC

ATSDR has evaluated the data for hazardous waste sites in the 21 counties relevant to this AOC, and reached conclusions regarding the public health threat posed by these sites. These conclusions, along with information regarding the type and location of the site, and the date and type of assessment document, are summarized in Table 4.1A, for sites that had public health hazard categories of 1-3 at some point during their assessment history. Not all counties had waste sites in these categories.

Further evaluations of the data for the sites are discussed in the following subsections.

Table 4.1-A Hazardous Waste Sites in Counties Relevant to the Saginaw River and Bay AOC

<i>Site Name, City, and CERCLIS ID</i>	<i>ATSDR Document Type</i>	<i>Year of Document</i>	<i>ATSDR Hazard Category</i>	<i>Site Type</i>	<i>Remedial Status</i>
Bay City Middlegrounds, Bay City MID98102935	HA	1996	2	Proposed to the NPL	To be Determined
Keit Property, Bay, Bay City MISFN0507867	HC	1998	3	Non NPL	Completed
Clare Water Supply, Clare, Clare MID980002273	HA	1989	3	NPL	Completed
	SRU	1993	3		
Berlin and Farrow, Genesee, Swartz Creek MID000605717	HA	1985	3	Deleted from NPL	Completed
	HA	1992	2		
Forest Waste Products, Genesee, Otisville MID980410740	HA	1988	3	NPL	Completed
	HA	1994	3		
Gratiot County Landfill, Gratiot, St. Louis MID980506281	HA	1982	3	NPL	Completed
	SRU	1994	4		
Velsicol Chemical Corp., Gratiot, St. Louis MID000722439	HA	1988	3	NPL	Completed
	SRU	1993	3		
Hedblum Industries, Iosco, Oscoda MID980794408	HA	1989	3	NPL	Ongoing
Wurtsmith Air Force Base, Iosco MI5570024278	HA	2001	3	Proposed to the NPL	Completed
Metamora Landfill, Lapeer, Metamora MID980506562	HA	1989	3	NPL	Completed
	HA	1992	3		
	SRU	1995	4		
Spiegelberg and Rasmussen	HA	1989	3	NPL	Completed

Dump Sites, Livingston, Brighton MID980794481, MID95702210	HA	1992	2		
Shiawassee River, Livingston, Howell MID980794473	HA SRU HC	1989 1993 2006	3 3 3	NPL	Completed
Dow Chemical Co., MI Div., Midland Loc, Midland, Midland MID0007247242002	HC HC HC	2002 2004 2008	3 3 3	Non NPL	To be Determined
Tittabawassee River, Saginaw, Midland MID980994354	HC HC HC HC HC EI	2004 2005 2005 2005 2002 2007	3 2 2 2 3 n.s.	Non-NPL	Ongoing
Lufkin Rule, Saginaw, Saginaw MID985584598	HC	1997	2	Non NPL	Completed
Laingsburg, Shiawassee, Saingsburg MISFN0507944	HC	2000	3	Non NPL	Ongoing
Peet Packing MIN000508068	HC	2001	2	Non NPL	To be Determined

2=Public Health Hazard, 3=Indeterminate Public Health Hazard, 4=No Apparent Public Health Hazard

HA=Public Health Assessment, HC=Health Consultation, SRU=Site Review and Update

EI = Exposure Investigation

n.s.=Not stated

4.1.1.1 Bay City Middlegrounds

The Bay City Middlegrounds site is an abandoned 40-acre landfill located on Middleground Island in the Saginaw River in southwestern Bay City, Bay County, MI. It operated as a landfill from 1956 to 1984. The landfill is partially capped, and has a leachate collection system. The cap was not fully sealed to the lower cap, and leachate has seeped out into ditches along the nearby roads. This site was proposed for the NPL in 1995. It was fenced on three sides, but not on the fourth, which borders the river, at the time that the 1996 health assessment was prepared by ATSDR.

Demographic Data: Demographic profile from the 2000 U.S. Census for vulnerable populations living within 1 mile of this site:

Children 6 years and younger	793
Females aged 15-44	1,662
Adults 65 and older	1,000

Public Health Outcome Data: Because of community health concerns, the Michigan Department of Community Health has evaluated cancer incidence data for the area. Data for 1990–1992 showed no statistically significant difference in cancer incidence or mortality between Bay County and Michigan as a whole. Cancer incidence for the ZIP code area including the site and Bay City west of the Saginaw River (48706) and for the ZIP code area including Bay City east of the Saginaw River (48708) for 1990 through 1993 indicate a slight, statistically significant elevation in the cancer incidence and rate for the entire period 1990–1993 in ZIP code 48706, as compared with age- and sex-specific cancer incidence rates for Michigan. None of the cancer incidences or rates for ZIP code 48708 increased to a level of statistical significance.

ATSDR Conclusions: In 1996, ATSDR concluded that this site presented a *Public Health Hazard* (Category 2) because the surface soil, groundwater, and river sediment, at or near the site were contaminated with metals, trace levels of pesticides, and volatile and semi-volatile organic chemicals at concentrations potentially of human health concern; trespassing occurs; and, because the PCB-containing discharge from the landfill contributed to PCB contamination in the fish of the Saginaw River. At that time, many organic and inorganic chemicals, including several IJC critical pollutants were found in onsite soil, groundwater, and sediment at concentrations exceeding health-based screening values. Actual exposure doses, however, were not judged likely to be of health concern for trespassers on the site, except upon frequent or prolonged exposure, which is not likely to occur. Soil and sediment concentrations of PAHs, including B(a)P, were typical of urban soils. Lead concentrations in soil were well above background, but lower than 400 ppm. Groundwater contaminated with PCBs discharges from the site into the Saginaw River, and PCBs were found in the river water and sediment at higher concentrations downstream of the site than upstream. Methylene chloride, detected in air at concentrations of human health concern including upwind of the site, may not be site-related.

This site has contributed and continues to contribute to the environmental burden of the IJC-critical pollutants PCBs, which are discharging from the landfill into the Saginaw River. PCBs are the major concern. Bioaccumulation of the PCBs through the food chain into fish that are ingested by humans is considered a pathway of great concern. Although this site was not the only source of PCBs discharged to the river, it contributes to the contamination, and levels of PCBs in fish are high enough to pose a risk of adverse health effects.

In March 2006, on request of Michigan Department of Environmental Quality (MDEQ), Conestoga-Rovers (consultants for Potential Responsible Parties) finished the treatability study for ammonia “Ammonia Work Plan” and is awaiting response from MDEQ. In July 2006, Conestoga-Rovers provided results for the semi-annual monitoring event and the quarterly monitoring of the West Channel of the Saginaw River (River) for ammonia; collected additional pH and temperature data from the River; and met with MDEQ to discuss the ammonia matter.

IJC Critical Pollutants Identified within ATSDR Documents: The IJC critical pollutants PCBs, B(a)P, aldrin, dieldrin, hexachlorobenzene, lead, and mercury, as well as other contaminants previously discussed were identified at this site during ATSDR’s assessments of exposure related issues. For a more complete listing of hazardous substances that were found at this site, please refer to www.USEPA.gov/superfund/sites/npl/npl.htm.

4.1.1.2 Keit Property

The Keit property is approximately 18 acres of wetlands, grasslands, and woods in southwest Bay City, Bay County, MI. It was used for agriculture since 1886. A large portion of the property has been filled in with material reportedly generated during a 1980s sewer project. ATSDR performed a health consultation on this site in 1998, as part of a Brownfields project.

ATSDR Conclusions: In 1998, ATSDR concluded that this site presented an *Indeterminate Public Health Hazard* (Category 3), due to the potential threat to human health from exposure to asbestos if the asbestos panels were not removed from the property before it was to be used for a park. It was determined that soil concentrations of the IJC critical pollutant B(a)P exceeded health based screening values in a few locations, but was considered typical for urban soils. Subsurface soil in one location contained PCBs above health-based screening values. This was not a generalized finding, and surface soil concentrations of PCBs were not considered of concern. The primary hazard was a pile of Transite panels containing 40% chrysotile asbestos. If the panels were allowed to weather or were not handled properly, they could release asbestos fibers.

This site does not appear to have contributed significantly to the environmental burden of IJC-critical pollutants or other chemicals, or to direct human exposure at levels that currently pose a health risk. The asbestos panels have been removed and physical hazards were addressed. This area is now the Euclid Linear Park.

IJC Critical Pollutants Identified within ATSDR Documents: The IJC critical pollutants aldrin, dieldrin, PAHs, DDT, PCBs, lead, and mercury, as well as other contaminants previously discussed were identified at this site during ATSDR’s assessment of exposure related issues.

4.1.1.3 Clare Water Supply

This site, a municipal water supply wellfield, is in Clare, Clare County; MI. Information regarding this site is taken from the 1989 ATSDR public health assessment, and the 2003 USEPA NPL fact sheet for this site.

Demographic Data: Demographic profile from the 2000 U.S. Census for vulnerable populations living within 1 mile of this site:

Children 6 years and younger	323
Females aged 15-44	718
Adults 65 and older	640

ATSDR Conclusions: In 1989, ATSDR concluded that this site presents an *Indeterminate Public Health Hazard* (Category 3) because VOCs, including TCE and PCE, were found in groundwater; and the status of the area residential well was unknown. In its 1993 site review and update, ATSDR again concluded that this site presented an *Indeterminate Public Health Hazard* (Category 3). No current exposures were occurring because of the treatment system, and institutional controls were in place to prevent construction of new private wells. However, the extent of the contaminated plume had not been fully determined, and private wells were downgradient of the site.

In 1985, VOCs, including trichloroethylene and other chlorinated compounds as well as benzene and xylenes at concentrations of public health concern were present in the groundwater used as the municipal water supply. Past completed exposure pathways included ingestion, inhalation, and dermal contact with the water. Contaminated soil from the suspected industrial sites northwest of the wellfield was then removed, but updated monitoring data were not available at the time of the 1989 health assessment.

USEPA prepared an Interim ROD in August 1990 for wellhead treatment of the water supply until the RI/FS was completed and the overall site remedy was implemented. Air strippers were installed and began operating in March 1991. A second ROD, signed September 1992, selected a combined remedy of deed and or access restrictions as necessary. Soil vapor extraction and groundwater extraction and treatment were accomplished using ultraviolet photochemical oxidation (amended to air stripping). In July 1996 the groundwater collection and treatment system was installed. Phase II of the RA, long term soil remedy, was constructed in March 1999. A chlorinated hydrocarbon groundwater source has been treated by in-situ ozonation, and contamination levels decreased. The PRP installed additional ozone sparge wells in mid May 2002. A permeable reactive barrier wall was installed in December 2004 on the Mitchell facility, and replacement of municipal well #2 was completed in September 2006. The September 2006 five year review found the remedy to be protective but identified areas of uncertainty that could be used to develop the site-wide O&M Plan.

IJC Critical Pollutants Identified within ATSDR Documents: No IJC critical pollutants were identified at this site during ATSDR's assessments of exposure related issues. For a more complete listing of hazardous substances that were found at this site, please refer to www.USEPA.gov/superfund/sites/npl/npl.htm.

4.1.1.4 Berlin and Farrow

From 1971 to 1978 a licensed waste incineration business occupied this 40-acre site in Gaines Township near Swartz Creek, Genesee County, MI. Owners and employees violated several operating regulations, including construction of and storing waste liquids in unlicensed lagoons and underground storage tanks, and burying liquid wastes. Information regarding this site is taken from the 1992 public health assessment performed by ATSDR, and the 2003 USEPA NPL fact sheet. Onsite chemicals included organochlorine intermediates (hexachlorobenzene, hexachlorocyclopentadienes, and octachlorocyclopentene) used in the production of certain pesticides, and also PCBs, benzene, and ethylbenzene.

Demographic Data: Demographic profile, from the 2000 U.S. Census, for vulnerable populations living within 1 mile of this site:

Children 6 years and younger	54
Females aged 15-44	148

Public Health Outcome Data: In 1981 health surveys of households were conducted within the approximately 2 square miles surrounding the site. Surveys of a random sampling of the population, followed by a survey of all 122 households (418 persons), found that respiratory symptoms were statistically, significantly higher among those who reported exposure to incinerator smoke as compared with those who reported no exposure to incinerator smoke. This information may suggest that the former industrial activity (incineration of hazardous wastes) at the site was potentially linked to health problems, but it does not provide insight into the potential health hazard from waste site-related contaminants.

Laboratory analyses of blood samples from 52 local residents revealed the presence of PCBs, DDT, and DDE at concentrations within the ranges generally found in Michigan residents, and thus do not indicate a specific effect from the waste site.

ATSDR Conclusions: In 1985 ATSDR released a Public Health Assessment with an *Indeterminate Public Health Hazard* (Category 3). After additional information became available in 1992, a public health assessment was released with a *Public Health Hazard* (Category 2) because of the risk to human health from exposure to contaminants that included pesticides, PCBs, and other semivolatile VOCs that may have caused adverse health effects. Heavy metals including arsenic were also found in residential well water. Onsite soil and sediment contained high levels of the IJC-critical pollutant hexachlorobenzene; onsite surface water also was contaminated. Offsite sediment in the Slocum Drain, a stream draining the site, was contaminated with high levels of hexachlorobenzene. Offsite garden soil also contained hexachlorobenzene, but at much lower concentrations. Comparisons with health-based screening values were not presented for hexachlorobenzene. Onsite soil and groundwater were contaminated with VOCs, including vinyl chloride and benzene. PCBs, found in drums removed from the site, were not detected in sampling of site media as reported in the 1992 ATSDR health assessment. None of the offsite residential wells were contaminated with any of these compounds.

Since that time, however, remediation of the site has been completed. From 1995 to 1996 final cleanup of the site was accomplished by excavation and removal of all remaining contaminated materials (i.e., soils, sediments, and aquifer materials), for disposal in a RCRA landfill. The site has since met standards for unrestricted use and was deleted from the NPL in 1998.

IJC Critical Pollutants Identified within ATSDR Documents: The IJC critical pollutants hexachlorobenzene and PCBs, as well as other contaminants previously discussed were identified at this site during ATSDR's assessments of exposure related issues. For a more complete listing of hazardous substances that were found at this site, please refer to www.USEPA.gov/superfund/sites/npl/npl.htm.

4.1.1.5 Forest Waste Products

This 112-acre site is 2 miles northwest of Otisville, Genesee County, MI. It includes an 11-acre landfill, which from 1972 to 1978 accepted general refuse and industrial and liquid waste. Nine lagoons in another area of the site, covering a total of about 1 acre, also were used for disposal of industrial waste. Wastes included sludge and residues from a chemical warehouse fire, PCB-contaminated roofing material, and PBB-contaminated cattle feed. In 1978, the landfill was covered with soil. An estimated 3,000 waste drums may have been buried in the landfill. As of ATSDR's 1994 public health assessment, the site had been fenced, the lagoon waste material

excavated and removed, and some of the drums removed and disposed of offsite. The information on this waste site is taken from the 1994 ATSDR public health assessment, and the 2003 USEPA NPL fact sheet for this site.

Demographic Data: Demographic profile from the 2000 U.S. Census for vulnerable populations living within 1 mile of this site:

Children 6 years and younger	34
Females aged 15-44	81
Adults 65 and older	48

ATSDR Conclusions: In a 1988 health assessment, as well as, in the 1994 health assessment, this site was categorized as an *Indeterminate Public Health Hazard* (Category 3). The rationale in the 1994 assessment was that although human exposure did not appear to be occurring at levels of concern, uncertainty existed regarding the large number of drums reported as buried in the landfill, the contents of which could release into the environment and possibly residential wells (including chromium, TCE and PCE.) There was also concern that children could fall in the lagoons.

The only chemical found at levels of concern for human health in a completed exposure pathway was arsenic, found in residential wells near the site, but the arsenic was thought to be of natural origin rather than site-related.

Whether this site contributed to environmental contamination with IJC-critical pollutant PCBs in the past is uncertain. No current exposure of humans to site-related contaminants at levels of concern is known to be occurring. Additional remediation activities, as described in the USEPA NPL fact sheet, included excavation and removal of buried drums and associated contaminated soil, and installation of a landfill cap. Monitoring of groundwater continues—in particular, a VOC plume that is migrating northward off the property.

In August 1984 USEPA installed a fence around the site. From the fall of 1996 – spring 1997, private parties constructed a cap over the landfill. In 1997, the private parties purchased an 80 acre property north of the landfill. Annual sampling of nearby residential wells was initiated in 2001. The private parties initiated evaluation of the groundwater treatment technologies to treat groundwater north of the landfill in 2001. In September 2007, the private parties initiated the chemical injections in accordance with approved plans, but injections near a lake are being delayed because of concerns about chemicals entering the lake. In November 2007, USEPA decided that ground water treatment near the landfill is not required at this time because VOC concentrations are at very low concentrations a short distance from the landfill.

IJC Critical Pollutants Identified within ATSDR Documents: The IJC critical pollutants lead, dioxins, furans, mercury, 4,4' –DDE, polychlorinated biphenyls (PCBs) and polyaromatic hydrocarbons (PAHs – including acenaphthylene, chrysene, dibenz[a,h] anthracene, phenanthrene, benzo[a]pyrene, benzo[g,h,i]perylene, benzo[k]fluoranthene, ideno[1,2,3-c,d]pyrene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene), as well as other contaminants previously discussed, were identified during ATSDR's assessment of exposure related issues. For a more complete listing of the hazardous substances that were found at this site, please refer to www.USEPA.gov/superfund/sites/npl/npl.htm.

4.1.1.6 Gratiot County Landfill

This 40-acre landfill site is in Gratiot County, southeast of St. Louis, MI. The landfill accepted general refuse. Its owner, however, was a chemical corporation (Michigan Chemical Company), which disposed of chemical wastes in the landfill, including before 1977 some 269,000 pounds of PBBs. The information regarding this site is taken from the 1982 ATSDR health assessment and the 2003 USEPA NPL fact sheet for this site.

The 1982 health assessment was primarily a review of a technical report regarding potential control strategies for the PBB contamination at the site. PBBs were detected in groundwater at concentrations above health-based screening values. No IJC critical pollutants were mentioned in the health assessment or the NPL fact sheet, but VOCs were apparently released from the site.

Demographic Data: Demographic profile from the 2000 U.S. Census for vulnerable populations living within 1 mile of this site:

Children 6 years and younger	170
Females aged 15-44	390
Adults 65 and older	252

ATSDR Conclusions: Because of the potential threat to human health from exposure to contaminants and because of the poor quality of the support documents that contained the monitoring data, the 1982 health assessment focused on PBBs. The assessment categorized the site as an *Indeterminate Public Health Hazard* (Category 3). Possibly because subsequent remedial activities mitigated the hazard, a later 1994 ATSDR site review and update ranked the site as *No Apparent Health Hazard* (Category 4). By 1984 remedial actions had included construction of a slurry wall and clay cap and regrading of the landfill to minimize contaminant migration. A 1992 monitoring review indicated that the slurry wall was ineffective in halting groundwater flow. In fact, VOCs (but not PBBs) were detected outside the slurry wall. The state installed a groundwater extraction and treatment system (GETS) to contain contaminated groundwater. Remedial construction of the GETS was completed in 1998. As a result of the September 2001, 5-year review: 1) the state of Michigan evaluated the GETS system and analytical data and determined that the GETS system contained the plume and lowered contaminant levels in the groundwater, and shut down the GETS system in 2005; 2) five methane vents and 22 monitoring points were installed; 3) the landfill cap was evaluated and repaired; and 4) the slurry wall was evaluated, and monitoring wells indicate the wall is effective. The 2006 5-Year Review Report concluded that the remedy is complete and is protective of human health and the environment. The fifth-5-year review is scheduled for completion in 2011.

IJC Critical Pollutants Identified within ATSDR Documents: The IJC critical pollutants PCBs, PAHs, DDT, aldrin, and dieldrin were identified at this site during ATSDR's assessment of exposure related issues. For a more complete listing of the hazardous substances that were found at this site, please refer to www.usepa.gov/superfund/sites/npl/npl.htm

4.1.1.7 Velsicol Chemical

This 5-acre site is in the City of St. Louis, Gratiot County, MI, and is surrounded on three sides by the Pine River, which drains into the Tittabawassee River, which in turn joins the Saginaw River near the city of Saginaw. Velsicol Chemical Corporation, previously known as the Michigan Chemical Company, produced a variety of chemicals at the Velsicol Chemical site plant from 1936 to 1978, including PBBs and DDT. In 1985 Velsicol completed construction of a containment system at this site. This system consisted of a slurry wall around the entire site and a clay cap over it.

Demographic Data: Demographic profile from the 2000 U.S. Census for vulnerable populations living within 1 mile of this site:

Children 6 years and younger	365
Females aged 15-44	821
Adults 65 and older	676

Public Health Outcome Data: In 1976, the Michigan Department of Public Health recruited many Velsicol workers for a PBB health study. The study placed workers and their families in a registry to observe the long-term effects of PBB exposure. The study was conducted in cooperation with the CDC, FDA, and USEPA, and was ongoing at the time of the 1988 health assessment. Study findings included some evidence of an association between high PBB exposure with an elevated risk of breast and digestive system cancers and of lymphomas. Because of the small number of cases, however, no definitive conclusions may be drawn from these findings. In addition, higher rates of neurological, immunologic, dermatologic, and musculoskeletal health effects were also observed in the registry cohort; yet no consistent pattern of an association between these health effects and serum PBB levels have been determined. The study results were drawn from a fact sheet of Frequently Asked Questions about PBBs in Michigan, published by the Michigan Department of Community Health (accessed in 2006 at http://www.michigan.gov/documents/mdch_PBB_FAQ_92051_7.pdf)

ATSDR Conclusions: In 1988, because exposure to PBBs through the food chain (fish and wildlife) had occurred and was possibly still occurring despite issuance of a fish consumption advisory, ATSDR categorized this site as an *Indeterminate Public Health Hazard* (Category 3). A subsequent 1993 site review and update also placed the site in this same health hazard category.

In 1982 Velsicol started construction of the containment system at the main plant site which was completed in 1985, but water levels continue to rise in the system. The potential exposure of concern was PBB bioaccumulation in fish and wildlife. ATSDR noted that concentrations of PBBs were declining in fish, river water, and sediment. Subsequent developments included deterioration of the slurry wall in 1994, admitting water into the containment system; discovery of high levels of DDT and metabolites in sediment of the Pine River/St. Louis impoundment; and the migration of dense nonaqueous phase liquids (DNAPL) from the containment area into the glacial till underlying the river sediments. The sediment and DNAPL were, according to the 2003 USEPA NPL fact sheet, in the process of removal and treatment. On June 1998, a time critical removal action began to address the highly contaminated sediments in the Pine River. The removal action also included building necessary infrastructure such as roads, a staging pad, and a water treatment plant. Construction of the infrastructure was substantially completed by November 1998. Sediment removal began and was completed in October 1999. Phase I cleanup activities were completed during the 2003 construction season. USEPA began dewatering and sediment removal in the northern half of the river (Phase II) in the summer of 2004 and completed the work in 2005. The remedial action work in the river was completed by the end of 2006. USEPA also constructed a clay cap over the areas of the river bottom with the residual DNAPL to isolate the contaminants from the river. Remedial activities will be needed to mitigate the soil and groundwater contaminants.

IJC Critical Pollutants Identified within ATSDR Documents: The IJC critical pollutant DDT and lead were identified at this site during ATSDR's assessment of exposure related issues. For a

more complete listing of the hazardous substances that were found at this site, please refer to www.USEPA.gov/superfund/sites/npl/npl.htm.

4.1.1.8 Hedblum Industries

The Hedblum Industries site is a 10-acre parcel located in Oscoda, Iosco County, MI, and 1.2 miles west of Lake Huron. The site was leased to a series of industrial firms that manufactured parts for the automotive industry. Waste chemicals, including an estimated 4,000 gallons of spent trichloroethylene from a degreasing operation, were dumped in a pit near the main building. Following a rupture in a pipe connecting an underground storage tank for trichloroethylene, in 1973–1977 a number of residential wells in the area were contaminated. In 1978 most of the residences in the contamination area were supplied with municipal water, but a number were not. Trichloroethylene also was found in the bayou into which groundwater from the site discharges; the bayou feeds into the Au Sable River.

Demographic Data: Demographic profile from the 2000 U.S. Census for vulnerable populations living within 1 mile of this site:

Children 6 years and younger	135
Females aged 15-44	331
Adults 65 and older	349

ATSDR Conclusions: Because of the potential threat to human health from exposure to trichloroethylene and other VOCs, this site was categorized as an *Indeterminate Public Health Hazard* (Category 3). TCE was identified in residential well water. Eight households were estimated to have used contaminated well water at their household for an indeterminate time before they were switched to municipal water, but data were not adequate to measure the risks.

To date, over 7 billion gallons of contaminated groundwater have been treated. The first 5-year review was completed in September 1999. The site remedy was protective but the RA was not being performed effectively, thus requiring more than the projected five years restoring the groundwater. A second review was completed in September 2004, and further investigation was needed. All residents were notified and advised to discontinue use of wells, even for outdoors watering purposes. USEPA and MDEQ are currently reviewing a proposal to install a large recirculation well system in the plume area in addition to the existing groundwater extraction and treatment system. The goal is to clean up the groundwater contaminated plume by the next 5-year review in 2009.

IJC Critical Pollutants Identified within ATSDR Documents: No IJC critical pollutants were identified at this site during ATSDR's assessments of exposure related issues. . For a more complete listing of the hazardous substances that were found at this site, please refer to www.USEPA.gov/superfund/sites/npl/npl.htm.

4.1.1.9 Wurtsmith Air Force Base, Oscoda

Article III. Wurtsmith Air Force Base (WAFB) is in Oscoda (Iosco County), Michigan, approximately 170 miles north of Detroit. The base was closed in June 1993, following seven decades of service as an aviation support facility. While the base was operational, hazardous materials were released to the environment, resulting in environmental contamination at a number of locations. Contaminants from some of these areas have migrated beyond the base's boundaries.

To date, 58 areas of potential contamination have been evaluated under the U.S. Air Force (USAF) Installation Restoration Program. ATSDR analyzed all 58 areas to determine whether

past, current, or future public health hazards are associated with them. For the vast majority of sites, no public health hazards were identified because of one or more of the following reasons: (1) no site-related contaminants were present, (2) detected contaminant concentrations were too low to pose a hazard, (3) past, current, and future exposures to the contaminated media were very infrequent and/or conducted with personal protective gear, and (4) future exposures will be prevented by land use restrictions.

In 1995 and 1998, during a visit to WAFB, ATSDR identified two pathways by which on-base residents and the surrounding community might have come into contact with contaminants originating at WAFB: (1) exposures to drinking water from on-base and off-base water supply wells and (2) exposures to on-base and off-base surface water bodies. ATSDR evaluated these potential exposure pathways in this public health assessment and addressed community health concerns.

Demographic Data: ATSDR estimated 8,000 people lived and worked at WAFB while it was in operation. According to the 1990 U.S. Census, for locations within one mile of WAFB, 7,700 people resided in 2,961 households in 1990.

Article IV. **ATSDR Conclusions:** In 2001, ATSDR concluded that past exposures to TCE in on-base and off-base water supplies posed an *Indeterminate Public Health Hazard* (Category 3) to people who were exposed to the following water supplies before 1980: (1) USAF's main water supply wells and (2) the well located at 6504 West Shore Drive. Whether actual adverse health effects occurred, however, is unknown because there were many uncertainties about whether TCE was present for long enough duration to pose health hazards.

Article V. Contaminated groundwater plumes that originated at WAFB were not expected to pose a current or future public health hazard. The vast majority of on-base and off-base facilities, residences, and camps receive their drinking water from the Huron Shores Regional Utility Authority, a source that is not located near WAFB and which meets all federal and state drinking water quality standards. A few wells were still in service, but exposure to this water was not expected to pose current or future health hazards because the wells do not contain high contaminant concentrations, they were only rarely used, and/or exposure durations were expected to be short. Institutional controls were in place to ensure that new wells were not drilled in contaminated areas in the future.

Article VI. Exposures to surface water and sediment in Van Etten Lake, the Au Sable River, Duell Lake, and a wetland area located in the southern portion of the base were not expected to pose health hazards to the populations that use these water bodies for recreational purposes because contaminant concentrations were too low and/or exposures were too infrequent.

ATSDR concluded that exposures to volatilizing materials were not expected to pose public health hazards. In the absence of actual indoor air measurements, indoor air contaminant levels were estimated using conservative mathematical models. The results suggested that indoor air levels were too low to be of health concern.

Article VII. ATSDR concluded that vinyl chloride concentrations had not been high enough to pose health hazards to people exposed to on base drinking water wells during or after 1983 or to Lake Van Etten during or after 1990.

Article VIII. Community members use Van Etten Lake and the Au Sable River for recreational fishing. Based on limited data, ATSDR does not believe that consuming fish from these water bodies will pose health hazards. Base representatives did not know if radioactive materials had been stored at WAFB. If they were, these materials would have been stored in secure igloos in the Weapons Storage Area. A radiologic survey was conducted in this area after the base closed; no radioactive contamination was detected.

As of March 2008, remediation of this site has been completed .

Article IX. **IJC Critical Pollutants Identified within ATSDR Documents:** None of the IJC critical pollutants were identified at this site during ATSDR's assessment of exposure related issues. For a more

complete listing of hazardous substances that were found at this site, please refer to www.USEPA.gov/superfund/sites/npl/npl.htm.

4.1.1.10 Metamora Landfill

This 160-acre site, located near the village of Metamora, Lapeer County, MI, contains a 25-acre landfill and two drum disposal areas, which may have received many thousands of drums believed to contain primarily paint and solvents. Testing of the drum wastes revealed that they in fact did contain VOCs, SVOCs, PAHs, and metals, at concentrations as high as 15% and PCBs at as much as 1,200,000 ppb.

Demographic Data: Demographic profile from the 2000 U.S. Census for vulnerable populations living within 1 mile of this site:

Children 6 years and younger	98
Females aged 15-44	205
Adults 65 and older	93

ATSDR Conclusions: Although no current exposures at levels of concern had been documented, the potential remained for future exposure through groundwater use as household water. Consequently, a 1992 health assessment categorized this site as an *Indeterminate Public Health Hazard* (Category 3). A subsequent 1995 ATSDR site review and update concluded that the site posed *No Apparent Public Health Hazard* (Category 4).

In 1992 ATSDR was concerned about the potential for exposure to VOCs and metals (particularly arsenic) at concentrations that may result in adverse health effects if, in the future, the shallow groundwater plume extends as far as private wells that tap the shallow aquifer. Although the IJC-critical pollutant PCBs was found at high concentrations in drums at the site, no further mention was made of this pollutant in the health assessment—an implication that PCBs had not significantly contaminated the environment. Site remediation has included the incineration of approximately 35,000 drums and 10,000 tons of soil offsite, and inclusion of minimally contaminated soil under a landfill cap. Groundwater studies in 1997, 1999, and 2000 indicate the VOC groundwater plume is stabilized. Therefore, monitored natural attenuation has been adopted as the remedy for groundwater. This site may have contributed to the environmental burden of VOCs, but it has been remediated. As reported in the USEPA fact sheet, extensive remediation of the site, including onsite incineration of wastes and disposal of the resulting ash in the landfill, capping, vegetating, installation of a runoff treatment system, and installation of a groundwater extraction system, has largely eliminated releases of contaminants from the site.

Cap construction was started in spring 2001 and completed in the fall of 2001. Implementation of the monitored natural attenuation cleanup of the groundwater is underway. USEPA completed three five years reviews in 1993, 1999, and 2004. The latest 5-year review reported that the selected remedies remained protective of human health and the environment. The next 5-year review will begin in June 2009.

IJC Critical Pollutants Identified within ATSDR Documents: The IJC critical pollutants lead, mercury, TCDD, PAHs, and PCBs, as well as other contaminants previously discussed, were identified at this site during ATSDR's assessment of exposure related issues. For a more complete listing of the hazardous substances that were found at this site, please refer to www.USEPA.gov/superfund/sites/npl/npl.htm.

4.1.1.11 Spiegelberg and Rasmussen Dump Sites

The 115-acre Spiegelberg Site and the 33-acre Rasmussen Dump are two separate sites in Livingston County, MI, that share a common property line. In ATSDR health assessments they are considered together. Both sites were used for the disposal of municipal and industrial wastes. Paint wastes were disposed on the Spiegelberg Site, and drummed industrial wastes were disposed on the Rasmussen site. Many of the drums were removed, together with contaminated soil, in 1984. A few residences are located on both sites. Information regarding these sites is taken from the 1989 public health assessment and the 1992 public health assessment addendum prepared by ATSDR, and from the 2003 USEPA NPL fact sheets for the sites.

Demographic Data: Demographic profile, from the 2000 U.S. Census, for vulnerable populations living within 1 mile of these sites:

	<i>Spiegelberg</i>	<i>Rasmussen</i>
Children 6 years and younger	119	59
Females aged 15–44	223	21
Adults 65 years and older	73	54

ATSDR Conclusions: Because of the potential threat to human health from exposure to contaminants at levels that may result in adverse health effects and because of incomplete monitoring data, in 1989 these sites were categorized as an *Indeterminate Public Health Hazard* (Category 3). In the 1992 health assessment, because of the threat of exposure to contaminated groundwater that was likely to occur unless the remedial actions indicated for this site were carried out, the sites were recategorized as *Public Health Hazards* (Category 2).

In 1989, chemicals of concern in potential exposure pathways included the IJC-critical pollutants PCBs (groundwater and soil) and lead (groundwater and soil). Other contaminants of concern in potential exposure pathways were VOCs in groundwater, including vinyl chloride and methylene chloride. In 1992, additional testing supported the findings from the 1989 health assessment. Subsequent actions included the removal of additional drums and contaminated soil with disposal offsite, installation of a landfill cap, and installation of groundwater treatment. These actions were found to be protective of public health and the environment.

The first 5-year review report for the site was issued in 2000 and the remedy was deemed protective. The second 5-year review report was issued in 2005 and results demonstrated continued compliance with the 1989 Cleanup Standards. No contaminants of concern have been found above Maximum Contaminant Limits (MCL) since 1998.

IJC Critical Pollutants Identified within ATSDR Documents: The IJC critical pollutants dioxin (TCDD), furans, lead, PCBs, as well as other contaminants previously discussed, were identified at this site during ATSDR's assessment of exposure related issues. For a more complete listing of the hazardous substances that were found at this site, please refer to www.usepa.gov/superfund/sites/npl/npl.htm.

4.1.1.12 Shiawassee River

The Shiawassee River site, Livingston County, MI was contaminated by the Cast Forge Company, which from 1969 to 1973 discharged into the South Branch of the Shiawassee River wastewater contaminated by PCBs in hydraulic fluids. From 1973 to 1977, wastewater was also

discharged into a 400,000-gallon onsite lagoon. Discharges and overflows from this lagoon contaminated both nearby wetlands and the Shiawassee River. Starting in 1982, the company removed the lagoon, cleaned up the PCB-contaminated soil and sediment from its property, and provided funds for restoration of the river. Dredging of the South Branch began in 1982, but only the first mile downstream from the plant was treated, removing approximately 2,600 pounds of PCBs. Both the company property and the river were still contaminated as of the ATSDR 1989 health assessment, from which information on this site is taken. Additional and updated information is taken the 2003 USEPA NPL fact sheet for this site.

Demographic Data: Demographic profile from the 2000 U.S. Census for vulnerable populations living within 1 mile of this site:

Children 6 years and younger	397
Females aged 15-44	885
Adults 65 and older	615

ATSDR Conclusions: Because of the risk to human health that could result from potential exposure to PCBs at levels that may result in adverse health effects, the 1989 health assessment categorized this site as an *Indeterminate Public Health Hazard* (Category 3). A subsequent 1993 ATSDR site review and update continue to identify this site as an *Indeterminate Public Health Hazard* (Category 3). Briefly, it was determined that the wetlands required sampling in 1989, and that people could possibly contact PCB-contaminated soil, sediment, and or food in 1993. More recently in 2006, ATSDR determined that data were insufficient to make a health call, although PCBs in some river sediment and floodplain soil samples exceeded Michigan’s “action levels.” The concern was for exposure pathways, including direct contact with PCB-contaminated river sediments or by eating PCB-contaminated fish or wildlife. PCB levels in fish tissue downstream from Cast Forge were very high; in 1979 the State of Michigan issued advisories against consumptions of fish from the contaminated zone. The remediation was completed in 2005 meeting all USEPA ROD requirements.

IJC Critical Pollutants Identified within ATSDR Documents: The IJC critical pollutants dioxin PCBs, furans, TCDD, DDT, and PAHs, as well as other contaminants previously discussed, were identified at this site during ATSDR’s assessment of exposure related issues. For a more complete listing of the hazardous substances that were found at this site, please refer to www.USEPA.gov/superfund/sites/npl/npl.htm.

4.1.1.13 Dow Chemical Co., Michigan Division, Midland Location

The Dow Chemical Company plant in the city of Midland, Midland County, MI was the subject of an ATSDR health consultation that was triggered by community concerns regarding high levels of PCDDs in Midland soil and fish in the nearby Tittabawassee River downstream of Midland. The Dow plant encompasses approximately 1,900 acres on the southern perimeter of the city. The Tittabawassee River forms the southern boundary of the plant site and flows southeast to join with the Saginaw River in the vicinity of the city of Saginaw. In the late 1800s the Dow plant began production of chlorine from brine using an electrolytic cell process. PCDDs, PCDFs; and octachlorostyrene are known byproducts. A variety of chemicals have been produced at this Dow plant, including Agent Orange [which contains 2,4,5-trichlorophenoxyacetic acid (2,4,5-T)], and 2,4,5-trichlorophenol. PCDDs and PCDFs are known impurities in some chlorinated phenolic chemicals such as 2,4,5-trichlorophenol and 2,4,5-T. Chlorophenol production started in 1915. Wastes generated from this process were initially

transferred to 600 acres of onsite waste ponds. During high flow periods in the early 1900s, wastes from these ponds were intentionally released to the Tittabawassee River. Some site waste has been and is taken by truck from the Dow plant to local landfills. Dow has more recently operated its own wastewater treatment plant onsite, but a 1986 flood overwhelmed the wastewater treatment plant and flooded areas of the plant where soils were contaminated with PCDDs. The runoff and untreated or partially treated chemical wastes entered the Tittabawassee River. Dow also operates two incinerators for treatment of liquid and solid hazardous and nonhazardous wastes generated from manufacturing at the plant. Incineration of chlorine-containing wastes also produces PCDDs and PCDFs. Information regarding this site is taken from the 2002 health consultation prepared by ATSDR. This health consultation focused on contamination of Midland soil. A separate health consultation addressed contamination in the Tittabawassee River floodplain near the city of Saginaw, in Saginaw County.

Public Health Outcome Data: USEPA reported (2006) that mortality rates from soft and connective tissue cancers among white females from Midland County were confirmed to be 3.8 and 4.0 times the national average for the periods of 1960–1969 and 1970–1978, respectively. While the statistically significant excess cancer rates may have occurred by chance alone, it was believed unlikely, thus suggesting involvement of other exposure factors.

An analysis of cancer incidence data for ZIP codes 48640 (southwest area of Midland including the Dow plant site) and 48642 (area northeast of the Dow plant) as compared with Midland County, Bay County, and the state of Michigan showed no elevated incidences of specific cancer types in these two ZIP code areas. A higher-than-expected incidence of all cancers combined in 48640 (but not 48642) as compared with Midland County, Bay County, and the state of Michigan did occur for individual years 1994 through 1998 and for all years combined. A higher-than-expected incidence of all cancers combined was seen in this ZIP code area upwind and including the site, but not the ZIP code area downwind of the site, which was considered more highly contaminated with PCDDs and PCDFs from the Dow Chemical Company's onsite incineration of chemical wastes. An interpretation of this data is not easily gained. Age-adjusted incidence rates for thyroid cancer in the two ZIP code areas were also computed and were considered statistically unreliable. This was documented in a table from the Michigan Department of Community Health (June 5, 2001), but without numeric values to justify this conclusion.

A Dow Cohort mortality study of workers in the Midland plant compared 2,187 male employees who at any time between 1940 and 1983 worked in areas of the plant where exposure to dioxin was possible with exposure classified on the basis of job history. Causes of death were compared with those of the U.S. population and with an internal "unexposed" group of employees. Rates for all causes of death were lower in the exposed cohort than in the U.S. population—likely due to the healthy worker effect (i.e., workers were healthy or they would not be working). A slightly higher rate, however, did appear for some cancers when the workers were compared with a group of unexposed employees. Still, the relevance of this study to the non-Dow-employee residents of the community was considered questionable given that the exposure situation was probably very different for workers as compared to the area residents.

An analysis of birth defects data for 1992 through 1996 from the Michigan Birth Defects Registry did not show any consistent pattern of excesses in any particular category or for birth defects overall for Midland County (about 1,000 births/year). No excess was seen for types of birth defects, such as anencephaly, spina bifida, and cleft lip, which had been reported as related to dioxin exposure.

In addition, in 2006 USEPA reported that the Michigan Department of Public Health evaluation of congenital malformation rates and soft and connective tissue cancer mortality rates found higher than expected birth defects and cancer in Midland. Specifically, data from birth and fetal death records showed significantly higher rates in Midland County for four anomalies when the number of these anomalies was contrasted to those documented for the entire State of Michigan. The data were for grouped years 1970 to 1975. The defects included cleft lip with or without cleft palate, cleft palate without cleft lip, hypospadias, and hip dislocation without CNS defects.

ATSDR Conclusions: Because the necessary data are not available to determine whether dioxin-contaminated soil in the Midland area poses a public health risk, this site was categorized as an *Indeterminate Public Health Hazard* (Category 3). ATSDR and the USEPA concluded that the dioxin contamination (as PCDDs and PCDFs) found in some Midland residential soils and in fish presents an unacceptable public health risk. The IJC-critical pollutants PCDDs and PCDFs were found at concentrations (expressed as total toxic equivalent, TEQ) concentrations in soil at the Dow plant. The residential areas to the northeast are expected to have the highest impact from past incinerator emissions, but no data are available concerning dioxin concentrations in these areas of Midland. Most of the TEQ concentration data for the community fall within the range (>50 but <1000 ppt TEQs). Those levels trigger additional ATSDR evaluation, including consideration of background and bioavailability data to evaluate the incremental contribution of soil exposure, but the necessary information was not available. An initial investigation for other contaminants besides PCDDs and PCDFs was scheduled for 2007. Fish contamination by PCDDs and PCDFs, which have resulted in fish consumption advisories, represent a completed exposure pathway

USEPA reports that the remedial investigation is ongoing. Some source area removals have been conducted and other interim measures to limit human exposures are underway. Dow-funded sampling has been conducted in support of a risk assessment.

IJC Critical Pollutants Identified within ATSDR Documents: The IJC-critical pollutants PCDDs and PCDFs as well as other contaminants previously discussed, were identified at this site during ATSDR's assessment of exposure related issues.

4.1.1.14 Tittabawassee River

The Dow Chemical Company plant in the city of Midland, Midland County, MI was the subject of an ATSDR health consultation that was triggered by community concerns regarding high levels of PCDDs in soil in the city of Midland and in fish in the nearby Tittabawassee River downstream of Midland. An additional concern arose when sampling of the Tittabawassee floodplain near the confluence of the Tittabawassee and Saginaw Rivers revealed higher than background levels of dioxin contamination. The soil contamination issue was considered in the ATSDR health consultation on the Dow Chemical Co. site, presented in Section 4.1.1.12, which provides a description of the plant location and releases to the environment. The issue of contamination of the floodplain of the Tittabawassee River is considered in a separate 2004 ATSDR health consultation, summarized below. The Tittabawassee floodplain area that is potentially of concern extends from the City of Midland in Midland County to the City of Saginaw in Saginaw County. The sampling sites were within Saginaw County. In 2005, ATSDR also conducted two health consultations looking at consumption of fish and wild game from the Tittabawassee River and flood plain areas. In 2007, Michigan Department of Community Health, in cooperation with the Michigan Department of Environmental Quality and ATSDR, conducted a Pilot Exposure Investigation (PEI) in the flood plain of the Tittabawassee River. The purpose

of the PEI was to test exposure investigation methods and to provide information about levels of DLC in soil, indoor dust, and human blood samples.

Public Health Outcome Data: In 2006, the University of Michigan conducted a dioxin exposure study funded by Dow. Some of the key initial findings of the study as:

- Residents living in regions with expected dioxin contamination (Midland/Saginaw) have higher concentrations of dioxins in their blood than do residents in a control area without dioxin contamination.
- Residents in areas with higher levels of dioxins in soil have a higher TEQ (total dioxin-like activity) in their blood.
- Populations consuming fish from the Tittabawassee River, Saginaw River, and Saginaw Bay waterways have higher concentrations of dioxins in their blood than people who do not eat fish from these waterways.
- Populations participating in recreational activities in the Tittabawassee River, Saginaw River, and Saginaw Bay have higher concentrations of dioxins in their blood than persons who do not participate.

Article X. **ATSDR Conclusions:** In 2004, ATSDR concluded that the data were insufficient to determine whether dioxin-like compounds contaminated floodplain soil in the Tittabawassee River watershed posed a public health risk; therefore, the site posed an *Indeterminate Public Health Hazard* (Category 3). In 2005, the consumption of dioxin-like compounds (DLCs) found in the liver of white-tail deer and in turkey meat, with and without skin, harvested from the Tittabawassee River downstream of Midland presented a *Public Health Hazard* (Category 2). Consumption of DLCs found in the muscle meat of deer and squirrels presented a public health hazard to women of childbearing age and children under the age of 15. Past and current dioxin and dioxin-like chemical exposure from the consumption of certain fish diets of Tittabawassee River fish were and are a *Public Health Hazard* (Category 2).

Article XI. USEPA reports the remedial investigation is ongoing. Some source area removals have been conducted, and other interim measures to limit human exposures are underway. These measures includes the State of Michigan issuance of a Wild Game Advisory in 2004, advising hunters and families should not eat deer liver or turkey meat harvested from the flood plain of the Tittawassee River. The advisory further cautioned women of child bearing age and children under the age of 15 to eat only one meal a week of deer or squirrel muscle meat. Since the 1970s, the Michigan Department of Community Health has had a fish consumption advisory on the Tittawassee River.

Article XII. **IJC Critical Pollutants Identified within ATSDR Documents:** The IJC critical pollutants PCDDs and PCDFs were identified at this site during ATSDR's assessment of exposure related issues.

4.1.1.15 Lufkin Rule

The 14-acre Lufkin Rule property is a large abandoned industrial property in a mostly residential area of Saginaw, Saginaw County, MI. After Lufkin sold the property it was rented to a large succession of tenants. In 1994, a dry cleaning establishment on the property burned, and the remnants were later demolished. Since that time, the entire property has been vacant. Drums of dry-cleaning solvents, transformers, capacitors, and other electrical equipment containing PCBs were found on the property. Some of the equipment had been scavenged, and the PCB-containing oil spilled on the ground. The PCB-containing oil and soil, drummed solvents, and other waste materials were removed in 1995 for disposal at an approved facility. Information regarding this site is taken from the ATSDR 1997 health consultation.

ATSDR Conclusions: Because of the physical hazards in the abandoned and decrepit buildings on the property, and because contaminants in soil would pose health hazards to anyone working on the property for long periods, this site was categorized as a Public Health Hazard (Category 2). The site was not secured from trespassers, and evidence indicated extensive trespassing. Soil-

contamination hot spots contaminated with the IJC-critical pollutant PCBs and also with bis(2,3 ethylhexyl) phthalate could pose health hazards through inadvertent ingestion to anyone working in those areas for long periods or visiting those areas daily over a long period of time. Such a scenario was, however, considered unlikely. Levels of the IJC-critical pollutants B(a)P and lead in soil and storm sewer sediment were within ranges typically found in urban areas. Groundwater was contaminated with trichloroethylene, but is not used as a drinking water source. Nevertheless, levels of trichloroethylene and other VOCs in storm sewer water were above drinking water standards and indicate release from the site through runoff. As of March 2008 site remediation had been completed.

IJC Critical Pollutants Identified within ATSDR Documents: The IJC critical pollutants PCBs, furans, DDT, lead, PAHs, aldrin, dieldrin, and mercury, as well as other contaminants previously discussed, were identified at this site during ATSDR's assessment of exposure related issues.

4.1.1.16 Laingsburg

The Laingsburg property is a former gasoline and automotive service station in the city of Laingsburg, Shiawassee County, MI. The service station ceased operations in 1984; since then the building had been used for automotive repair and body shop work. A 2000 ATSDR health consultation completed as part of a Brownfields project is the source of information regarding this site. Records indicate that three underground fuel storage tanks may have been on the property, but whether the tanks were ever removed is unclear.

ATSDR Conclusions: This was a Brownfields site where no data were available except for some VOC-contaminated soil samples collected from outside the perimeter fence. Access to the site was denied, thus no onsite monitoring data are available. Subsurface soil sampled around the site perimeter contained trimethylbenzene and xylenes above screening values for industrial or commercial use. Shallow groundwater at the site perimeter was similarly contaminated—one monitoring well had a floating oily layer liquid containing trimethylbenzenes and other VOCs. Concentrations exceeded drinking water standards or screening levels. The contamination was consistent with gasoline leaking from the underground storage tanks.

Because of the potential threat to human health from exposure to contaminants and because of the lack of adequate monitoring data, this site was categorized as an *Indeterminate Public Health Hazard* (Category 3).

This site may have released gasoline from underground storage tanks, but because of the denial of site access any available monitoring data were inadequate to assess the potential threat to public health. Michigan Department of Environmental Quality plans to remove underground storage tanks in 2008, monitoring groundwater, and perform any interim response as needed.

IJC Critical Pollutants Identified within ATSDR Documents: The IJC critical pollutants aldrin, lead, mercury, and furans, as well as other contaminants previously discussed, were identified at this site during ATSDR's assessment of exposure related issues.

4.1.1.17 Peet Packing Company Property

Article XIII. The Peet Packing property was an abandoned meat-packing plant at the north village limits of Chesaning, Michigan. The plant operated from the late 1800s until the company declared bankruptcy in 1995. The plant has been abandoned since then. In 1992, the company remediated a leaking underground storage tank under its building. In 2000, the U.S. Environmental Protection Agency (USEPA) removed hazardous wastes, hazardous chemicals, and friable asbestos insulation from the buildings on the property.

Article XIV. **ATSDR Conclusions:** In 2001 ATSDR concluded that under then-current site conditions the site posed *no apparent health hazard* due to chemical contaminants but a Public Health Hazard (Category 2) for future use. The site is proposed to be used for commercial or industrial purposes in the future. If redeveloped for commercial or industrial use the site could pose a public health hazard for workers due to high levels of lead in the soil. In addition, aluminum, antimony, arsenic, lead, manganese, thallium, and vanadium have been detected in groundwater levels that exceed both state and federal drinking water standards. While no one is currently using the groundwater as a source of drinking water, the contaminants would present a public health hazard if drinking water wells were installed in the future. Finally, the existing onsite buildings contain asbestos containing material that could release asbestos fibers into the air if the materials were exposed to ambient weather conditions or otherwise allowed to deteriorate. To date, no known regulatory actions have been taken.

Article XV. **IJC Critical Pollutants Identified within ATSDR Documents:** The IJC critical pollutants lead, polychlorinated biphenyls (PCBs), and polyaromatic hydrocarbons (PAHs) including, phenanthrene, benzo[a]pyrene, and fluoranthene, as well as other contaminants previously discussed, were identified during ATSDR's assessment of exposure related issues.

4.1.2. TRI Data for the Saginaw River and Bay AOC

The TRI onsite chemical releases for the 21 counties (combined) relevant to this AOC are summarized in Table 4.1-B. Total onsite releases for the 21 counties in 2001 were 7,831,200 pounds, the majority of which were released to air, followed by releases to soil. Considerably less was released to surface water.

The IJC-critical pollutants accounted for 92,142 pounds or 1.2% of the total onsite releases. The IJC-critical pollutants released were PCDDs and PCDFs (primarily to land), lead and lead compounds (primarily to land); and mercury and mercury compounds (primarily to air and land). The facilities that released these pollutants are listed in Table 4.1-C. PCDDs (and PCDFs) were the focus of ATSDR health consultations for soil contamination by the Dow Chemical Co. in the city of Midland, Midland County, MI (Section 4.1.1.13) and for contamination of the Tittabawassee River Flood Plain south of Midland (Section 4.1.1.14). The major TRI releases of these chemicals in the counties relevant to the Saginaw River and Bay AOC were by the Dow Chemical Company in Midland County (1,618 pounds total onsite releases, primarily to land). Much smaller amounts were reported released by other facilities in Bay County and in Saginaw County.

The major releases ($\geq 500,000$ pounds) of non-IJC chemicals were of hydrochloric acid aerosols to air and barium compounds (primarily to land). Other non-IJC chemicals released in substantial onsite quantities (300,000–499,999 pounds) were toluene (primarily to air); and barium compounds, manganese compounds, and zinc compounds (primarily to land); and ammonia (to air, water and land).

Looking at total onsite releases of all chemicals combined, the counties with the highest (500,000–1,000,000 pounds) reported releases were Midland and Saginaw Counties. Counties with total onsite releases of 250,000–499,999 pounds were Bay, Genesee, and Huron counties. Counties in the range of 100,000–249,000 pounds total onsite releases were Montcalm, Osceola, and Sanilac. Counties in the range of 10,000–99,000 pounds total onsite releases were Gratiot, Isabella, Lapeer, Livingston, Mecosta, Ogemaw, Shiawassee, and Tuscola. Counties in the range of 0–9,999 pounds total onsite releases were Arenac, Clare, Gladwin, Iosco, and Roscommon

4.1.3. NPDES Data for the Saginaw River and Bay AOC

The NPDES permitted discharges for the counties that encompass and surround the Saginaw River and Bay AOC are summarized in Table 4.1-D. The total average annual permitted

discharges in 2004 were 3,973,206 pounds, the majority of which were ammonia nitrogen, and also phosphorus.

The IJC-critical pollutants PCBs (0.004 pounds), DDT (0.00007 pounds), lead (84 pounds), and mercury (2 pounds) were permitted to be discharged. Facilities permitted to release these pollutants are listed in Table 4.1-E.

4.1.4. Summary and Conclusions for the Saginaw River and Bay AOC

4.1.4.1 Hazardous Waste Sites

Seventeen sites in the counties relevant to the Saginaw River and Bay AOC have been categorized by ATSDR in health hazard categories 2–3 at some time in their assessment history. Several of these sites have completed exposure pathways to the IJC-critical pollutants PCDDs, PCDFs, PCBs, or DDT and metabolites or have released these pollutants into rivers that ultimately flow into the Saginaw River. Sites that have not yet been completely remediated and may be continuing to serve as a source of exposure are

- Bay City Middlegrounds
- Hedblum Industries
- Dow Chemical Co., Midland Location
- Tittabawassee River– lack of data on possible exposures.
- Laingsburg– Possible release of gasoline from underground storage tanks.
- Peet Packing

A pathway of major concern for these chemicals is bioaccumulation through the food chain into fish that are ingested by humans. Incidental ingestion, direct dermal contact, and inhalation of soil and dust from PCDD- and PCDF-contaminated soil also were of concern.

Public health outcome data, available for several of the sites, generally did not indicate unusual rates of health conditions or consist of occupational data that were considered of questionable relevance to the general population. An analysis of cancer incidence data for the Dow Chemical Co. site found no elevated incidences of specific cancer types in the two ZIP code areas studied, as compared with county and state. A higher-than-expected incidence of all cancers combined was seen in the ZIP code area upwind and including the site, but not the ZIP code area downwind of the site, which was considered more highly contaminated with PCDDs and PCDFs from the Dow Chemical Company's onsite incineration of chemical wastes. The dioxin contamination may be widespread throughout the Tittabawassee River watershed below Midland, but data were lacking on possible exposures.

Issues for Follow-Up

The sites listed as still possibly contributing to environmental contamination and human exposure may need follow-up to determine whether the potential hazards have been mitigated. Additional monitoring data and other data also were needed to more fully assess the hazard.

4.1.4.2 TRI Data

Onsite TRI releases in the 21 counties (combined) of the Saginaw River and Bay AOC totaled 7,831,200 pounds, the majority of which were released to air, followed by releases to soil. Considerably less was released to surface water.

The highest release counties, Midland and Saginaw Counties, accounted for 10.5 and 12.3%, respectively, of the total onsite releases. The lowest release counties, Arenac, Gladwin, and Roscommon, had zero reported releases.

The IJC-critical pollutants accounted for 92,142 pounds or 1.2% of the total onsite releases. The IJC-critical pollutants released were PCDDs and PCDFs (primarily to land); lead and lead compounds (primarily to land); and mercury and mercury compounds (primarily to air and land).

The major releases ($\geq 500,000$ pounds) of non-IJC chemicals were of hydrochloric acid aerosols, xylenes, certain glycol ethers, n-butyl alcohol, and toluene (primarily to air); and nickel compounds, selenium, and arsenic compounds (primarily to land).

4.1.4.3 NPDES Data

The NPDES permitted discharges for the counties that encompass and surround the Saginaw River and Bay AOC are summarized in Table 4.1-D. The total average annual permitted discharges in 2004 were 3,973,206 pounds, the majority of which was ammonia nitrogen, and also phosphorus.

The IJC-critical pollutants PCBs (0.004 pounds), DDT (0.00007 pounds), lead (84 pounds), and mercury (2 pounds) were permitted to be discharged. Facilities permitted to release these pollutants are listed in Table 4.1-F.

4.1.4.4 Beneficial Use Impairment (BUIs)

Restrictions on fish and wildlife consumption and drinking water are cited as impairments for this AOC. The *Targeting Environmental Restoration for the Saginaw River/Bat Area of Concern (AOC) 2001 Remedial Action Plan Update* states that PCB and dioxin levels in walleye taken from the Saginaw River and Bay are similar to those found in similar fish from non-AOC areas in Great Lakes. There is also an indication from studies of caged fish that former sources of contaminants have been effectively controlled and/or remediated. At the same time, it states that fish consumption restrictions are likely to continue because of the slow degradation of these contaminants in the sediments and upland soils.

Taste and odor problems in drinking water are cited. The problem is attributed to blue-green algal blooms that have been caused unfavorable environmental conditions in Saginaw Bay. This problem is reported as in resolution but requiring further monitoring. Further information is available at the USEPA Web site (<http://www.USEPA.gov/glnpo/aoc/>).

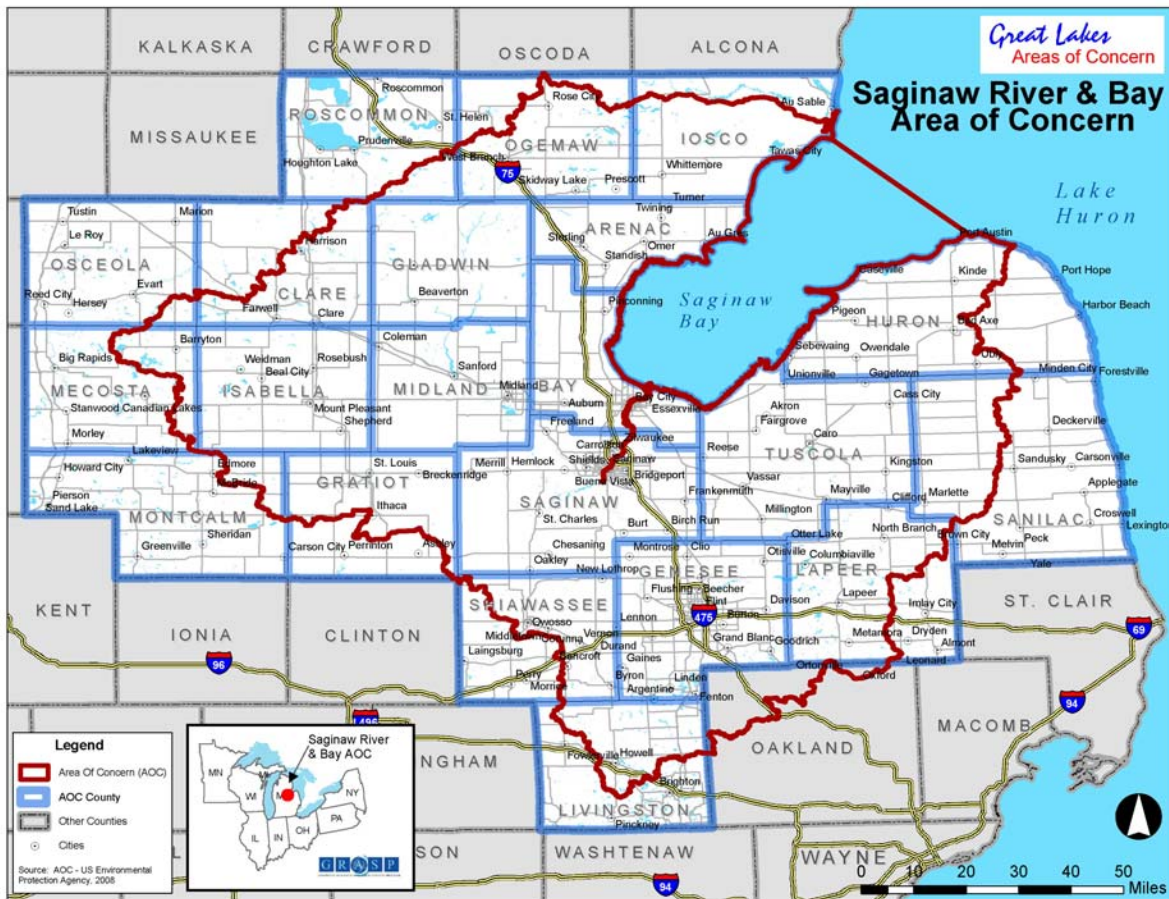


Table 4.1-B TRI Releases (in pounds, 2001) for the Saginaw River and Bay AOC

<i>Chemical</i>	<i>IJC Tracking Number</i>	<i>Total Air Emissions</i>	<i>Surface Water Discharges</i>	<i>Under-ground Injection</i>	<i>Releases to Land</i>	<i>Total Onsite Releases</i>	<i>Total Offsite Releases</i>	<i>Total On- and Offsite Releases</i>
DIOXIN AND DIOXIN-LIKE COMPOUNDS	2	0.013254255	0.005655825	0	1.6102674	1.62917748	0.05532345	1.68450093
<i>(PCDDs and PCDFs)</i>	3							
LEAD	8	243.18	15.2	0	0	258.38	20665.9	20924.28
LEAD COMPOUNDS	8	4521.6	1.1	0	86883.8	91406.5	6029.6	97436.1
MERCURY	9	10.2	0	0	44	54.2	0.8	55
MERCURY COMPOUNDS	9	270.6	1	0	150	421.6	3.7	425.3
	Total IJC	5045.593254	17.30565583	0	87079.4103	92142.30918	26700.05532	118842.3645
1,1,1,2-TETRACHLOROETHANE		588	0	0	0	588	0	588
1,1-DICHLORO-1-FLUOROETHANE		101906	0	0	0	101906	250	102156
1,2,4-TRIMETHYLBENZENE		97955	0	0	0	97955	0	97955
1,2-DICHLOROETHANE		472	0	0	0	472	0	472
1,2-DICHLOROPROPANE		7	0	0	0	7	0	7
1,3-BUTADIENE		2751	0	0	0	2751	0	2751
2,4,6-TRICHLOROPHENOL		41	64	0	1	106	0	106
2,4-D		167	0	0	0	167	0	167
2,4-D BUTYL ESTER		1	1	0	0	2	0	2
2,4-DICHLOROPHENOL		181	0	0	1	182	0	182
2-METHOXYETHANOL		4524	0	0	0	4524	0	4524
2-PHENYLPHENOL		1	0	0	0	1	0	1
3-CHLORO-2-METHYL-1-PROPENE		68	0	0	0	68	0	68
4,4'-ISOPROPYLIDENE-DIPHENOL		754	0	0	0	754	4215	4969
ACETONITRILE		40902	3252	0	7	44161	0	44161
ACROLEIN		1700	0	0	0	1700	0	1700
ACRYLAMIDE		18	7	0	0	25	0	25
ACRYLIC ACID		12018	2	0	0	12020	0	12020
ACRYLONITRILE		7453	0	0	0	7453	0	7453
ALLYL ALCOHOL		630	0	0	0	630	0	630
ALLYL CHLORIDE		2128	0	0	0	2128	0	2128

ALLYLAMINE	3	0	0	0	3	0	3
ALUMINUM (FUME OR DUST)	1060	5	0	0	1065	11497	12562
AMMONIA	168025	116434	0	60000	344459	0	344459
ANTIMONY	250	0	0	0	250	750	1000
ANTIMONY COMPOUNDS	568	0	0	11011	11579	0	11579
BARIUM COMPOUNDS	2494	249	0	947010	949753	41012	990765
BENZENE	37544	1	0	101	37646	0	37646
BENZO(G,H,I)PERYLENE	0.3898	0	0	0	0.3898	0	0.3898
BIPHENYL	146	0	0	0	146	0	146
BROMINE	388	0	0	0	388	0	388
BUTYL ACRYLATE	1	0	0	0	1	0	1
CARBON DISULFIDE	515	0	0	2	517	0	517
CERTAIN GLYCOL ETHERS	265755	3100	0	4000	272855	11670	284525
CHLORINE	33689	0	0	0	33689	0	33689
CHLOROACETIC ACID	34	0	0	0	34	0	34
CHLOROBENZENE	56	0	0	0	56	0	56
CHLORODIFLUORO-METHANE	75572	0	0	0	75572	0	75572
CHLOROETHANE	36655	0	0	0	36655	0	36655
CHLOROFORM	273	0	0	0	273	0	273
CHLOROMETHANE	10073	0	0	0	10073	0	10073
CHLOROMETHYL METHYL ETHER	1091	0	0	0	1091	0	1091
CHLOROPHENOLS	4	27	0	1	32	0	32
CHROMIUM	2777	1	0	6205	8983	110366	119349
CHROMIUM COMPOUNDS (EXCEPT CHROMITE ORE MINED IN THE TRANSSVAAL REGION)	4973	130	0	53452	58555	33085	91640
COBALT	750	5	0	0	755	11265	12020
COBALT COMPOUNDS	754	250	0	41700	42704	0	42704
COPPER	2249	270	0	5	2524	37338	39862
COPPER COMPOUNDS	2675	2400	0	68400	73475	351	73826
CUMENE	116	0	0	0	116	0	116
CUMENE HYDROPEROXIDE	800	0	0	0	800	560	1360
CYCLOHEXANE	2584	0	0	0	2584	0	2584

DECABROMODIPHENYL OXIDE	3741	0	0	23600	27341	0	27341
DICHLOROMETHANE	10667	1	0	0	10668	0	10668
DIISOCYANATES	1529	0	0	0	1529	12351	13880
DIMETHYLAMINE	2185	131	0	0	2316	0	2316
DINITROBUTYL PHENOL	36	0	0	0	36	0	36
EPICHLOROHYDRIN	6	0	0	0	6	0	6
ETHYL ACRYLATE	45	0	0	0	45	0	45
ETHYLBENZENE	54591	1	0	5	54597	0	54597
ETHYLENE	40179	0	0	0	40179	0	40179
ETHYLENE GLYCOL	4455	283	0	0	4738	51500	56238
ETHYLENE OXIDE	904	0	0	0	904	0	904
FORMALDEHYDE	28051	21	0	7000	35072	242	35314
FORMIC ACID	252	118	0	0	370	0	370
HYDROCHLORIC ACID (1995 AND AFTER 'ACID AEROSOLS' ONLY)	2755268	0	0	0	2755268	0	2755268
HYDROGEN FLUORIDE	200090	0	0	0	200090	0	200090
MANGANESE	1795	1	0	0	1796	108939	110735
MANGANESE COMPOUNDS	9347	9190	0	341800	360337	36335	396672
METHACRYLONITRILE	945	0	0	0	945	0	945
METHANOL	100222	0	0	2	100224	0	100224
METHYL ACRYLATE	759	0	0	0	759	0	759
METHYL ETHYL KETONE	102164	0	0	0	102164	0	102164
METHYL ISOBUTYL KETONE	24110	0	0	0	24110	0	24110
METHYL METHACRYLATE	1018	0	0	0	1018	0	1018
METHYL TERT-BUTYL ETHER	854	0	0	0	854	0	854
N,N-DIMETHYLFORMAMIDE	16	0	0	0	16	0	16
NAPHTHALENE	20055	0	0	191	20246	0	20246
N-BUTYL ALCOHOL	86571	1	0	0	86572	0	86572
N-HEXANE	2982	0	0	0	2982	0	2982
NICKEL	2974	266	0	1905	5145	168144	173289
NICKEL COMPOUNDS	11309	12	0	32000	43321	18922	62243
NITRATE COMPOUNDS	500	10000	0	0	10500	21	10521

NITRIC ACID		3331	5	0	5	3341	0	3341
N-METHYL-2-PYRROLIDONE		9766	0	0	0	9766	0	9766
PHENOL		105740	0	0	1903	107643	3935	111578
PHOSGENE		23	0	0	0	23	0	23
PICLORAM		1	257	0	0	258	0	258
POLYCHLORINATED ALKANES		0	0	0	0	0	63100	63100
POLYCYCLIC AROMATIC COMPOUNDS		2.81	0	0	53	55.81	0.8	56.61
PROPYLENE		240	0	0	0	240	0	240
PROPYLENE OXIDE		1234	0	0	0	1234	0	1234
PYRIDINE		201	0	0	0	201	0	201
QUINOLINE		3	0	0	0	3	0	3
SODIUM NITRITE		0	0	0	0	0	720	720
STYRENE		188607	23	0	38959	227589	498.2	228087.2
SULFURIC ACID (1994 AND AFTER 'ACID AEROSOLS' ONLY)		144005	0	0	0	144005	0	144005
TETRACHLORO-ETHYLENE		22458	0	0	1	22459	0	22459
TOLUENE		373364	2	0	32	373398	0	373398
TOLUENE-2,4-DIISOCYANATE		578	0	0	0	578	0	578
TRICHLOROETHYLENE		11319	0	0	0	11319	0	11319
TRIETHYLAMINE		18928	0	0	4	18932	0	18932
VANADIUM COMPOUNDS		12011	0	0	106700	118711	0	118711
VINYL ACETATE		92	0	0	0	92	0	92
VINYL CHLORIDE		969	0	0	1	970	0	970
VINYLDENE CHLORIDE		21474	3	0	0	21477	0	21477
XYLENE (MIXED ISOMERS)		228329	33	0	0	228362	0	228362
ZINC (FUME OR DUST)		5400	0	0	0	5400	2900	8300
ZINC COMPOUNDS		15569	170	0	288880	304619	111490	416109
	Total Non-IJC	5557404.2	146716	0	2034937	7739057.2	841457	8580514.2
	Total	5562449.793	146733.3057	0	2122016.41	7831199.509	868157.0553	8699356.564

Table 4.1-C TRI Facilities Releasing IJC Critical Pollutants Onsite for the Saginaw River and Bay AOC

<i>IJC Critical Pollutant</i>	<i>Number of Facilities</i>	<i>Facility Name</i>	<i>TRIF ID</i>	<i>City</i>
Dioxin and dioxin-like compounds (PCDDs and PCDFs)	4			
Bay County, MI	1	DE KARN - JC WEADOCK GENERATING PLANT	48732DKRNJNWEAD	ESSEXVILLE
Midland County, MI	1	DOW CHEMICAL CO. MIDLAND OPS.	48667THDWCMICHI	MIDLAND
Saginaw County, MI	2	ALCHEM ALUMINUM INC.	48601LCHML2600N	SAGINAW
		GMC SAGINAW METAL CASTING OPS.	48605SGNWG1629N	SAGINAW
Lead and lead compounds	27			
Bay County, MI	1	DE KARN - JC WEADOCK GENERATING PLANT	48732DKRNJNWEAD	ESSEXVILLE
Genesee County, MI	6	DELPHI ENERGY & CHASSIS SYS. FLINT WEST	48555CFLNT300NO	FLINT
		GMC GRAND BLANC METAL FAB	48439CDLLC10800	GRAND BLANC
		GMC MFD FLINT METAL CENTER	48553GMCTRG2238	FLINT
		GMC POWERTRAIN FLINT ENGINE SOUTH	48552GMPWR2100B	FLINT
		GMC POWERTRAIN FLINT NORTH	48550BCFLN902EH	FLINT
		GMVM - FLINT ASSEMBLY PLANT	48551GMCTRG3100	FLINT
Gratiot County, MI	1	CONTECH DIV. OF SPX CORP.	48801CNTCH205NG	ALMA
Huron County, MI	4	DETROIT EDISON CO. HARBOR BEACH POWER PLANT	48441DTRTD755NH	HARBOR BEACH

		MICHIGAN SUGAR CO. SEBEWAING PLANT	48759MCHGN763BE	SEBEWAING
		TOWER AUTOMOTIVE TECH. PRODS. INC.	48759TWRTM249NC	SEBEWAING
		TOWER AUTOMOTIVE TOOL L.L.C.	48731TWRTM81DRE	ELKTON
Iosco County, MI	2	ITT INDS. FHS	48750TTNDS4700N	OSCODA
		NEW NGC INC.	48748NTNLG2375N	NATIONAL CITY
Isabella County, MI	1	EP HILLSDALE TOOL DIVISION-MT. PLEASANT	48858PHLLS1799G	MOUNT PLEASANT
Livingston County MI	1	PROGRESSIVE METAL FORMING INC.	48139PRGRS10850	HAMBURG
Montcalm County, MI	1	FEDERAL MOGUL GREENVILLE	48838FDRLM510EG	GREENVILLE
Saginaw County, MI	3	GMC SAGINAW METAL CASTING OPS.	48605SGNWG1629N	SAGINAW
		GMPT SAGINAW MALLEABLE IRON	48605GMCSG77WCE	SAGINAW
		MICHIGAN SUGAR CO.	48724MCHGN341SU	CARROLLTON
Sanilac County, MI	2	MICHIGAN SUGAR CROSWELL FACTORY	48422MCHGN159SO	CROSWELL
		TRELLEBORG YSH INC. SANDUSKY PLANT	48471YLRBB180ND	SANDUSKY
Shiawassee County, MI	1	MOTOR PRODS. - OWOSSO CORP.	48867MTRPR201SD	OWOSSO
Tuscola County, MI	4	GENERAL CABLE INDS.	48726GNRLC6285G	CASS CITY
		GREDE FOUNDRIES INC. VASSAR FNDY.	48768GRDVS700EH	VASSAR
		MICHIGAN SUGAR CO. - CAROFACTORY	48723MCHGN725AL	CARO
		WALBRO ENGINE MANAGEMENT	48726WLBRN6242G	CASS CITY

Mercury and mercury compounds	5			
Bay County, MI	1	DE KARN - JC WEADOCK GENERATING PLANT	48732DKRNJNWEAD	ESSEXVILLE
Genesee County, MI	2	DELPHI ENERGY & CHASSIS SYS. FLINT EAST	48556CSPRK1300N	FLINT
		GMC GRAND BLANC METAL FAB	48439CDLLC10800	GRAND BLANC
Huron County, MI	1	DETROIT EDISON CO. HARBOR BEACH POWER PLANT	48441DTRTD755NH	HARBOR BEACH
Saginaw County, MI	1	GMC SAGINAW METAL CASTING OPS.	48605SGNWG1629N	SAGINAW

Table 4.1-D NPDES Permitted Average Annual Discharges (in pounds, 2004) to Surface Water, Saginaw River AOC

<i>Chemical</i>	<i>IJC Tracking Number</i>	<i>Discharge</i>
POLYCHLORINATED BIPHENYLS (PCBS)	1	0.004
DDT	5	0.00007
LEAD, TOTAL (AS PB)	8	83.95
MERCURY, TOTAL (AS HG)	9	2.10
	Total IJC	86.05
CADMIUM, TOTAL (AS CD)		91.25
CHROMIUM, HEXAVALENT (AS CR)		21.90
CHROMIUM, TOTAL (AS CR)		109.50
COPPER, TOTAL (AS CU)		1142.45
CYANIDE, FREE (AMEN. TO CHLORINATION)		135.05
FLUORIDE, TOTAL (AS F)		6570
LINDANE		0.04
NICKEL, TOTAL (AS NI)		219
NITROGEN, AMMONIA TOTAL (AS N)		3159182.73
PHOSPHORUS, TOTAL (AS P)		798934
POLYBROMINATED BIPHENYLS		0.001
SELENIUM, TOTAL (AS SE)		167.90
SILVER, TOTAL (AS AG)		250.97
THALLIUM, TOTAL (AS TL)		1788.50
TIN, TOTAL (AS SN)		657
TOLUENE		12.05
XYLENE		3.10
ZINC, TOTAL (AS ZN)		3835.06
	Total Non-IJC	3973120.50
	Total	3973206.55

Table 4.1-E NPDES Facilities Permitted to Discharge IJC Critical Pollutants, Saginaw River and Bay AOC

<i>IJC Critical Pollutant</i>	<i>Number of Facilities</i>	<i>Facility Name</i>	<i>NPDES</i>	<i>City</i>
Polychlorinated Biphenyls (PCBs)	4			
Bay County, MI	2	GM-BAY CITY PLANT	MI0001121	BAY CITY
		BAY CITY WWTP	MI0022284	BAY CITY
Saginaw County, MI	2	SAGINAW TWP-CENTER ROAD LF	MI0054739	SAGINAW
		SAGINAW WWTP	MI0025577	SAGINAW
DDTs	1			
Gratiot County, MI	1	US USEPA-VELSICOL	MIU990020	ST LOUIS
Lead	1			
Montcalm County, MI	1	FEDERAL MOGUL CORP- GREENVILLE	MI0002836	GREENVILLE
Mercury	11			
Genesee County, MI	1	GENESSEE COUNTY #3 WWTP	MI0022993	LINDEN
Gratiot County, MI	2	ALMA WWTP	MI0020265	ALMA
		ST LOUIS WWTP	MI0021555	ST LOUIS
Livingston County, MI	1	NORTHFIELD TWP WWTP	MI0023710	WHITMORE LAKE
Mecosta County, MI	1	BIG RAPIDS WWTP	MI0022381	BIG RAPIDS
Montcalm County, MI	1	FEDERAL MOGUL CORP- GREENVILLE	MI0002836	GREENVILLE
Saginaw County, MI	2	FRANKENMUTH WWTP	MI0022942	FRANKENMUTH
		SAGINAW TWP WWTP	MI0023973	SAGINAW
Sanilac County, MI	1	CROSWELL WWTP	MI0021083	CROSWELL
Tuscola County, MI	2	CARO WWTP	MI0022551	CARO
		CASS CITY WWTP	MI0022594	CASS CITY