

**Chapter 4. Lake Huron**

4.1.	Saginaw River and Bay AOC.....	217
4.1.1.	Hazardous Waste Sites Relevant to the Saginaw River and Bay AOC .....	217
4.1.2.	Summary and Conclusions for the Saginaw River and Bay AOC ...	242



## Chapter 4. Lake Huron

### 4.1. Saginaw River and Bay AOC

The Saginaw River and Bay AOC is Lake Huron's only U.S. Great Lakes AOC, comprising the following Michigan counties:

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

The Saginaw River and Bay AOC also includes all of Saginaw Bay to Lake Huron at an imaginary line drawn between up to 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 2).

#### ***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 any public health threat these sites might pose. For the 18 sites that either posed an urgent public health hazard, a public health hazard, or an indeterminate public health hazard at some point during their assessment history, Table 4.1A summarizes ATSDR's site conclusions, the site type and location, and the date and type of assessment document. Not all counties had waste sites in these health hazard categories.

Further evaluations of the site data are discussed in the following sections.

**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>Document Year</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	Ongoing
Berlin and Farro, Genesee, Swartz Creek MID000605717	HA HA	1985 1992	3 2	Deleted from NPL	Completed
Clare Water Supply, Clare, Clare MID980002273	HA SRU	1989 1993	3 3	NPL	Ongoing
Dow Chemical Co., MI Div., Midland Loc, Midland, Midland MID0007247242002	HC HC	2002 2004	3 3	Non NPL	Active site; RCRA supervised
Forest Waste Products, Genesee, Otisville MID980410740	HA HA	1988 1994	3 3	NPL	Completed
Gratiot County Landfill, Gratiot, St. Louis MID980506281	HA SRU	1982 1994	3 4	NPL	Completed
Hedblum Industries, Iosco, Oscoda MID980794408	HA	1989	3	NPL	Ongoing
Keit Property, Bay, Bay City MISFN0507867	HC	1998	3	Non NPL	Completed
Laingsburg, Shiawassee, Laingsburg MISFN0507944	HC	2000	3	Non NPL	Ongoing
Lufkin Rule, Saginaw, Saginaw MID985584598	HC	1997	2	Non NPL	Completed

<i>Site Name, City, and CERCLIS ID</i>	<i>ATSDR Document Type</i>	<i>Document Year</i>	<i>ATSDR Hazard Category</i>	<i>Site Type</i>	<i>Remedial Status</i>
Metamora Landfill, Lapeer, Metamora MID980506562	HA	1989	3	NPL	Completed
	HA	1992	3		
	SRU	1995	4		
Peet Packing MIN000508068	HC	2001	2	Non NPL	To be Determined
Shiawassee River, Livingston, Howell MID980794473	HA	1989	3	NPL	Completed
	SRU	1993	3		
	HC	2006	3		
Spiegelberg and Rasmussen Dump Sites, Livingston, Brighton MID980794481, MID95702210	HA	1989	3	NPL	Ongoing
	HA	1992	2		
Tittabawassee River, Saginaw, Midland MID980994354	HC	2004	3	Non-NPL	Ongoing
	HC	2005	2		
	HC	2005	2		
	EI	2007	N.S.		
Velsicol Chemical Corp., Gratiot, St. Louis MID000722439	HA	1988	3	NPL	Ongoing
	SRU	1993	3		
Wurtsmith Air Force Base, Iosco MI5570024278	HA	2001	3	Proposed to the NPL	Ongoing

2=Public Health Hazard, 3=Indeterminate Public Health Hazard, 4=No Apparent Public Health Hazard, N.S.= Not Stated.

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

#### 4.1.1.1 Bay City Middlegrounds

From 1956 to 1984, the 40-acre Bay City Middlegrounds site was an active landfill on Middleground Island, situated in the Saginaw River in southwestern Bay City (Bay County) MI. Today, Bay City Middlegrounds is abandoned. The landfill was partially capped and had a leachate collection system. Nevertheless, the cap and the lower cap were not fully sealed, thus leachate seeped out into ditches along the nearby roads. This site was proposed for the NPL in 1995. At the time of the 1996 ATSDR health assessment, the site was fenced on three sides but not on the fourth, the side that bordered the river.

**Demographic Data:** The 2000 U.S. Census reported the following demographic profile 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:** In response to community health concerns, the Michigan Department of Community Health 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. The study collected 1990–1993 cancer incidence data for the ZIP code area that included the Middlegrounds site, for that part of Bay City west of the Saginaw River (48706), and for the ZIP code area that included Bay City east of the Saginaw River (48708). For the entire 1990–1993 period in ZIP code 48706, the data indicated a slight, statistically significant elevation in the cancer incidence rate, as compared with age- and sex-specific cancer incidence rates for Michigan as a whole. None of the cancer incidences or rates for ZIP code 48708 reached statistically significant levels compared with Michigan as a whole.

**ATSDR Conclusions:** In 1996, ATSDR found surface soil, groundwater, and river sediment at or near the site were contaminated with metals and trace levels of pesticides. ATSDR further found volatile and semi-volatile organic chemicals at concentrations potentially of human health concern, incidental but recurring trespass incidents, and PCB-laden discharges from the landfill that contributed to PCB bioaccumulation in Saginaw River fish. For all of these reasons, ATSDR concluded this site posed a *Public Health Hazard* (Category 2).

In 1996, many organic and inorganic chemicals, including several IJC-critical pollutants, were found in onsite soil, in groundwater, and in 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 was not likely to occur. Soil and sediment PAH concentrations, 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 discharged from the site into the Saginaw River. Downstream of the site, PCBs were found in the river water and in sediment at higher concentrations than upstream. But methylene chloride, detected in ambient air—including upwind of the site—at concentrations of human health concern, may not be site-related.

ATSDR found that this site contributed and continued to contribute to the environmental burden of the IJC-critical pollutant PCBs that migrate from the landfill into the Saginaw River. PCBs were the major concern. PCB bioaccumulation through the food chain into fish ingested by humans was a pathway of considerable concern. Although this site was not the sole source of PCBs discharged to the river, it contributed to the contaminant burden, and the PCB levels in fish were high enough to pose a risk of adverse health effects.

**U.S. EPA Update:** In its August 2006 Fact Sheet regarding the Bay City Middlegrounds site, U.S. EPA stated in part

In order to protect human health and the environment the PRP has to address exceedances of PCBs and zinc that are above GSI [Groundwater Surface water Interface] criteria followed by long term monitoring to demonstrate GSI compliance. The PRP with their consultant met with MDEQ, and sampled the treatability study for Ammonia Evaluation Work

Plan of west channel of Saginaw River, and sampled the temperature and pH at the GSI well locations. In March 2006, on request of Michigan Department of Environment Quality (MDEQ), Conestoga-Rovers (consultants for Potential Responsible Parties) finished the treatability study for ammonia “Ammonia Work Plan” and 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 the MDEQ to discuss the ammonia matter.

Available at: <http://www.epa.gov/region5superfund/npl/michigan/MID981092935.htm>. 2008 Aug [cited 2008 14 Jul].

**IJC-critical Pollutants Identified within ATSDR Documents:** During ATSDR’s assessments of exposure-related issues, the IJC-critical pollutants PCBs, B(a)P, aldrin, dieldrin, hexachlorobenzene, lead, and mercury, were identified at this site. For a more complete listing of hazardous substances found at this site, please refer to [www.USEPA.gov/superfund/sites/npl/npl.htm](http://www.USEPA.gov/superfund/sites/npl/npl.htm).

#### 4.1.1.2 Berlin and Farro

From 1971 to 1978, Berlin and Farro (B & F), a licensed waste incineration facility, occupied this 40-acre site in Gaines Township near Swartz Creek (Genesee County) MI. Not long after commencing operations, the incoming volume of liquid industrial wastes overwhelmed the facility, and B & F owners and employees fell into violation of state and federal operating regulations. Waste liquids were stored in makeshift, unlined, and unlicensed lagoons and in unpermitted underground storage tanks. Some liquid waste-filled drums were simply buried. Onsite chemicals included organochlorine intermediates (hexachlorobenzene, hexachlorocyclopentadienes, and octachlorocyclopentene) used in the production of certain pesticides, as well as PCBs, benzene, and ethylbenzene.

**Demographic Data:** The 2000 U.S. Census reported the following demographic profile for vulnerable populations living within 1 mile of this site:

Children 6 years and younger	54
Females aged 15-44	148
Adults 65 and older	55

**Public Health Outcome Data:** In 1981, household health surveys were conducted within the approximate 2-square mile area 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 incinerator smoke exposure. Although these findings may have suggested a potential link between incineration of hazardous wastes at the site and health problems, they did not provide insight into the potential health hazard from exposure to site-related contaminants.

Indeed, 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 did not indicate a specific effect from the B & F incinerator site.

**ATSDR Conclusions:** In 1985, ATSDR released a public health assessment that classified the site as an *Indeterminate Public Health Hazard* (Category 3). After additional information became available in 1992, a subsequent public health assessment elevated that classification to *Public Health Hazard* (Category 2). The new information indicated that the risks to human health from exposure to contaminants included pesticides, PCBs, and other semivolatile VOCs—any or all of which could 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 was also 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, however, not available for hexachlorobenzene. Additionally, onsite soil and groundwater were contaminated with VOCs, including vinyl chloride and benzene. But as reported in ATSDR's 1992 health assessment, PCBs found in drums removed from the site were not detected in site media sampling. In fact, none of the offsite residential wells were contaminated with any of these compounds.

**U.S. EPA Update:** In its April 2008 Fact Sheet for the Berlin & Farro site, U.S. EPA stated in part that

Final cleanup at the site, including excavation of soils, sediments, and aquifer materials commenced on December 15, 1995, and was completed on April 12, 1996. Excavated volume from all areas was approximately 69,000 cubic yards. Excavated areas were backfilled and regraded, using uncontaminated site materials. All excavated material was transported to offsite facilities for disposal. The landfill meets the Resource Conservation and Recovery Act Subtitle D and Michigan Act 451 Part 115 requirements for solid waste landfills. The site, which has been graded to enhance development of a wetland, meets standards for unrestricted use. All soil and groundwater cleanup standards have been met at the site. No contamination was found in any off-site ground water. The Close Out Report was issued on September 18, 1996. This site was deleted from the National Priorities List on June 24, 1998 and no further cleanup activity or operation and maintenance is planned at the Site.

Available at: <http://www.epa.gov/region5superfund/npl/michigan/MID000605717.htm>. 2008 Apr [cited 2008 14 Jul].

**IJC-critical Pollutants Identified within ATSDR Documents:** During ATSDR's assessments of exposure-related issues, the IJC-critical pollutants hexachlorobenzene and PCBs were identified at this site. For a more complete listing of hazardous substances found at this site, please refer to [www.epa.gov/superfund/sites/npl.htm](http://www.epa.gov/superfund/sites/npl.htm).

#### 4.1.1.3 Clare Water Supply

Clare County Water supply is a municipal water supply wellfield in Clare (Clare County) MI. Information regarding this site is taken from the 1989 ATSDR public health assessment, the 1993 site review and update, and the 2007 U.S. EPA NPL site Fact Sheet.

**Demographic Data:** The 2000 U.S. Census reported the following demographic profile 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 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 industrial sites—the suspected contamination sources northwest of the wellfield—was removed, but at the time of the 1989 health assessment, updated monitoring data were not available.

Thus in 1989, ATSDR concluded that because VOCs, including TCE and PCE, were found in groundwater and because the status of area residential wells was unknown, this site presented an *Indeterminate Public Health Hazard* (Category 3). In its 1993 site review and update, ATSDR again concluded that this site presented an *Indeterminate Public Health Hazard* (Category 3). The site review conceded that a recently installed treatment system precluded any new exposures, and in-place institutional controls prevented construction of new private wells. Nevertheless, the extent of the contaminant plume had not been fully determined, and downgradient of the site operating private wells remained potentially vulnerable.

**U.S. EPA Update:** In its February 2007 Fact Sheet for the Clare Water Supply site, the U.S. EPA stated in part

In September 2004, U.S. EPA, after appropriate consultation with MDEQ has determined that an ESD [Explanation of Significant Differences] is appropriate to explain and document modifications made to the 3 aspects of the remedy mentioned above. Modification of the remedy has been implemented to include a permeable reactive barrier (PRB) wall on the Mitchell facility that will intercept contaminated groundwater moving away from the Mitchell facility, replacement of municipal well #2 and adoption of new GSI criteria for ethylbenzene and toluene. The PRB was installed in December 2004 and the new municipal well was completed and turned on in September 2006.

In April 2005 a site meeting was held among all of the PRPs, MDEQ, U.S. EPA and the City of Clare officials. The U.S. EPA explained U.S. EPA's objective of removing barriers created by Superfund to reuse and redevelop and how this might be worked into the agency's next five-year review. The City of Clare officials asked how parts of the Site, specifically that parcel that houses the soil treatment cell, might be re-used.

The region, with the help of Headquarter's Re-use contractor, E-squared, completed a detailed Re-Use report for the Clare site and with the help of headquarters and the Army Corps of Engineers completed a Long Term Monitoring and Optimization (LTMO) analysis which included both temporal and spatial statistical analysis to determine the optimum sampling frequency and monitoring well locations. This is very key to implementing the recommendations of the September 2006 five year review which found the remedy to be protective but it identified areas of uncertainty that could be used to develop the sitewide O&M [Operations and Maintenance] Plan.

Available at: <http://www.epa.gov/region5/superfund/npl/michigan/MID980002273.htm>. 2007 Feb [cited 2008 Jul 29].

**IJC-critical Pollutants Identified within ATSDR Documents:** During ATSDR's assessment of exposure-related issues, no IJC-critical pollutants were identified at this site. 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](http://www.usepa.gov/superfund/sites/npl/npl.htm).

#### 4.1.1.4 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 triggered by community concerns regarding high levels of PCDDs in Midland soil and in 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 plant site southern boundary 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. In some chlorinated phenolic chemicals— such as 2,4,5-trichlorophenol and 2,4,5-T— PCDDs and PCDFs are known impurities. Chlorophenol production began 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 was trucked from the Dow plant to local landfills. More recently, Dow constructed its own onsite wastewater treatment plant, but a 1986 flood overwhelmed the plant. Runoff flooded adjoining areas, contaminating soils with PCDDs. The runoff and untreated or partially treated chemical wastes then entered the Tittabawassee River. Today, Dow operates two incinerators for treatment of liquid and solid hazardous and nonhazardous wastes generated from onsite manufacturing processes. Incineration of chlorine-containing wastes, however, also produces PCDDs and PCDFs.

Information regarding this site is taken from the ATSDR's 2002 and 2004 health consultations. These consultations focused on soil contamination. Separate health consultations addressed contamination in the Tittabawassee River floodplain near the City of Saginaw, in Saginaw County.

**Public Health Outcome Data:** In 2006, U.S. EPA reported that for 1960–1969 and 1970–1978, respectively, 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. While the statistically significant excess cancer rates may have occurred by chance alone, that outcome was considered 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 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 of the site. But a similar increase was not seen in the ZIP code area downwind of the site, which, from the

Dow Chemical Company's onsite incineration of chemical wastes, was considered more highly contaminated with PCDDs and PCDFs. An interpretation of this data is problematic. For the same two ZIP code areas computed, age-adjusted incidence rates for thyroid cancer were considered statistically unreliable. The Michigan Department of Community Health documented this conclusion in a June 5, 2001, table, but did not include any supporting numeric values.

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, all of which had been reported as related to dioxin exposure.

In addition, In 2006, U.S. EPA 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 compared with 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 U.S. EPA 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 in soil concentrations (expressed as total toxic equivalent, TEQ) 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 contaminants other than PCDDs and PCDFs was scheduled for 2007. Fish contamination by PCDDs and PCDFs that have resulted in fish consumption advisories represent a completed exposure pathway

**U.S. EPA Update:** U.S. EPA 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.

Available at: <http://www.epa.gov/region5/sites/dowchemical/background.htm>. [cited 2008 Jul 29]. See also [http://www.michigan.gov/deq/0,1607,7-135-3311\\_4109\\_9846\\_9847-43808--,00.html](http://www.michigan.gov/deq/0,1607,7-135-3311_4109_9846_9847-43808--,00.html). [cited 2008 Jul 29].

**IJC-critical Pollutants Identified within ATSDR Documents:** During ATSDR's assessment of exposure-related issues, the IJC-critical pollutants PCDDs and PCDFs were identified at this site.

#### 4.1.1.5 Forest Waste Products

Forest Waste Products occupies 112 acres 2 miles northwest of Otisville (Genesee County) MI. The site includes an 11-acre landfill, which from 1972 to 1978 accepted general refuse and

industrial and liquid waste. Nine lagoons covering about 1 acre also held 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. Site information is from the 1994 ATSDR public health assessment and the 2007 U.S. EPA NPL site Fact Sheet.

**Demographic Data:** The 2000 U.S. Census reported the following demographic profile 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:** ATSDR's 1988 health assessment and its subsequent 1994 health assessment both categorized this site as an *Indeterminate Public Health Hazard* (Category 3). The 1994 assessment found that human exposure did not rise to levels of concern. But concerns remained regarding the large number of drums reportedly buried in the landfill and the unguarded lagoons. Drum contents—chromium, TCE and PCE, among others—could release into the environment and possibly into residential wells. Children could fall into the lagoons.

Yet the one completed exposure pathway involved arsenic—the one chemical found at levels of human health concern. Arsenic was found in residential wells near the site, but 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. Indeed, no known, current exposure of humans to site-related contaminants at levels of concern was identified. Moreover, additional remediation activities, as described in the U.S. EPA NPL site Fact Sheet, resulted in excavation and removal of buried drums and associated contaminated soil, and installation of a landfill cap. Monitoring of groundwater continues; in particular, U.S. EPA is watching a VOC plume known to have migrated northward off the property.

**U.S. EPA Update:** In its November 2007 Fact Sheet for the Forest Waste Products site, U.S. EPA stated in part that

The private parties initiated evaluation of groundwater treatment technologies to treat the groundwater north of the landfill in 2001. From 2003 - 2007, the private parties conducted sampling and testing for two cleanup technologies. In September 2005, U.S. EPA decided that the cleanup of the contamination north of the landfill should include: expanding the site to include the additional 80-acre parcel; applying the cleanup standards to the boundaries of the expanded site and using natural dilution and biodegradation to help achieve the cleanup standards; treatment of deep and shallow groundwater contamination near and beyond the expanded site boundaries by injecting chemicals; treatment of shallow groundwater near the landfill by injecting oxygen or by digging a trench through the shallow groundwater and injecting air to remove the contamination; shut-down criteria for the groundwater

treatment; and restricting installation of new monitoring wells near the site using the Genesee County Health Regulations.

From 2005 - 2006, U.S. EPA worked with the private parties, and Genesee County to better define the groundwater pumping restriction areas, and construction requirements for new wells in these areas. 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 concern about the chemicals entering the lake. After review of the most recent data, and modeling results, in November 2007 U.S. EPA decided that groundwater treatment near the landfill is not required at this time because VOC concentrations have significantly reduced near the landfill, and are at very low concentrations a short distance farther from the landfill.

Available at: <http://www.epa.gov/region5superfund/npl/michigan/MID980410740.htm>. 2007 Nov [cited 2008 Jul 14].

**IJC-critical Pollutants Identified within ATSDR Documents:** During ATSDR's assessment of exposure-related issues, the following IJC-critical pollutants were identified: 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). For a more complete listing of the hazardous substances found at this site, please refer to <http://www.epa.gov/superfund/sites/npl/npl.htm>.

#### 4.1.1.6 Gratiot County Landfill

The Gratiot County landfill is on a 40-acre parcel southeast of St. Louis, MI. The landfill accepted general refuse, but its owner, Michigan Chemical Company, also used the landfill to dispose of chemical wastes. Before 1977, Michigan Chemical dumped some 269,000 pounds of PBBs. The information regarding this site is from the 1982 ATSDR health assessment and the 2008 U.S. EPA NPL site Fact Sheet.

Because PBBs had been detected in groundwater at concentrations above health-based screening values, ATSDR's 1982 health assessment was primarily a review of a technical report regarding potential control strategies for onsite PBB contamination. No IJC-critical pollutants were mentioned in the health assessment or in the NPL Fact Sheet, but apparently, VOCs were nonetheless released from the site.

**Demographic Data:** The 2000 U.S. Census reported the following demographic profile 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 monitoring data in the support documents, the 1982 health assessment focused on PBBs. The assessment categorized the site as an *Indeterminate Public Health Hazard* (Category 3). Because subsequent remedial activities

apparently mitigated the hazard, a 1994 ATSDR site review and update found the site was *No Apparent Health Hazard* (Category 4).

**U.S. EPA Update:** In its April 2008 Fact Sheet for the Gratiot County Landfill site, U.S. EPA stated in part that

In 1996, as part of a second five-year review, an investigation to determine the extent of contamination outside the slurry wall/landfill began. Based on the investigation's results, the state of Michigan installed a groundwater extraction and treatment system (GETS) to contain contaminated groundwater southwest of the site. Construction of the GETS was completed in 1998. The GETS utilized air stripping as a form of groundwater treatment prior to discharge.

Following the third five-year review in September 2001, the following actions occurred: (1) the state of Michigan evaluated the GETS system and analytical data, determined that the GETS system contained the plume and lowered contaminant levels in the groundwater, and shut down the GETS system in 2005. If 2006 analytical results are consistent, the system will be shut down permanently; (2) five methane vents and 22 monitoring points were installed, (3) the landfill cap was evaluated and repaired, (4) the slurry wall was evaluated and monitoring wells have not indicated contamination leaching from the landfill.

The fourth five-year review in 2006 concluded that remedy is complete and is protective of human health and the environment at this time, and exposure pathways that could result in unacceptable risks are being controlled. However, in order for the remedy to remain protective in the long-term, the landfill cap must be maintained and effective institutional controls must be implemented, maintained, and monitored. Continued groundwater and methane monitoring is also necessary to ensure that the remedy remains protective.

The fifth five-year review is scheduled to be completed in September 2011.

Available at: <http://www.epa.gov/region5superfund/npl/michigan/MID980506281.htm>. 2008 Apr [cited 2008 Jul 14].

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

#### 4.1.1.7 Hedblum Industries

Occupying a 10-acre parcel in Oscoda (Iosco County) MI, the Hedblum Industries site is 1.2 miles west of Lake Huron. A series of leases to auto industry parts manufacturers resulted in the disposal of waste chemicals—including an estimated 4,000 gallons of spent trichloroethylene from a degreasing operation—into a pit near the main building. During 1973–1977, a number of residential wells in the area became contaminated, the result of a rupture in a connector pipe for an underground trichloroethylene storage tank. Although as an emergency measure in 1978 most of the affected residences were supplied with municipal water, a number were not.

Trichloroethylene also was found in the bayou into which groundwater from the site discharged and which fed into the Au Sable River.

**Demographic Data:** The 2000 U.S. Census reported the following demographic profile 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, in 1989 ATSDR categorized this site as an *Indeterminate Public Health Hazard* (Category 3). TCE was identified in residential well water, and up to eight households used contaminated well water for an indeterminate time before the homes were connected to municipal water. Data to measure the risks were, however, inadequate.

**U.S. EPA Update:** In its December 2007 Fact Sheet for the Hedblum Industries site, U.S. EPA stated in part that

The VAS [Vertical Aquifer Sampling] investigation and studies to optimize the groundwater extraction system were performed by MDEQ during summer 2005. In coordination with U.S. EPA, an investigation report was released in November 2005 indicating that the existing RA was not capturing the plume effectively, and that the groundwater extraction and treatment system must be expanded and operated more effectively. Additional data collection was independently performed in 2005 and 2006 by MDEQ and the PRPs. The sampling included the private wells of those residents still using the wells for drinking water or other purposes. To date, only one resident voluntarily uses a private well for drinking and other household needs. A few residents use a private well solely for outdoor activities. All residents have been notified and advised to discontinue use of these wells.

The U.S. EPA and MDEQ are currently reviewing a proposal by the PRPs to improve the groundwater cleanup. Their proposal is to install a large recirculation well system in the plume area that would operate in addition to the existing groundwater extraction and treatment system. The proposal also includes actions to improve the operation and maintenance of the current plume capture system. The goal of the PRPs, using the proposed system, is to clean up the groundwater contamination plume by the next five-year review in 2009.

Available at: <http://www.epa.gov/region5superfund/npl/michigan/MID980794408.htm>. 2007 Dec [cited 2008 Apr 14].

**IJC-critical Pollutants Identified within ATSDR Documents:** During ATSDR's assessments of exposure-related issues, no IJC-critical pollutants were identified at this site. For a more complete listing of the hazardous substances found at this site, please refer to [www.USEPA.gov/superfund/sites/npl/npl.htm](http://www.USEPA.gov/superfund/sites/npl/npl.htm).



#### 4.1.1.8 Keit Property

The Keit property comprises 18 acres of wetlands, grasslands, and woods in southwest Bay City (Bay County) MI. The property had been farmed since 1886, but during a 1980s sewer project a large part of it was filled in with waste material, including asbestos panels. In 1998, because the property was under consideration for brownfields redevelopment as a public park, ATSDR conducted a health consultation.

**ATSDR Conclusions:** ATSDR concluded that if the asbestos panels were not removed from the property before its rehabilitation as a public park, the potential exposure threat was an *Indeterminate Public Health Hazard* (Category 3). Soil concentrations of the IJC-critical pollutant B(a)P exceeded health based screening values in a few locations, but that was typical for urban soils. Although subsurface soil in one location contained PCBs above health-based screening values, this was not a generalized finding—surface soil PCBs concentrations were not of concern. The primary hazard was a pile of Transite panels that contained 40% chrysotile asbestos. Were the panels allowed to weather, or if they were not handled properly, they could release asbestos fibers.

On balance, however, this site did 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 might currently pose a health risk.

**U.S. EPA Update:** The Keit Property site is a state brownfields site and is not included in the CERCLIS database.

**Michigan Department of Community Health Update:** In 1998, the Michigan Department of Environmental Quality determined that the limited detections of PCBs and B(a)P would not present unacceptable risks to people using the property after it was redeveloped for recreational use. The asbestos panels were removed from the Keit Property and all physical hazards were addressed. This area has been redeveloped and is now the Euclid Linear Park (Rhonda Klann, Michigan Department of Environmental Quality, personal communication; 2008 Aug 19).

**IJC-critical Pollutants Identified within ATSDR Documents:** During ATSDR's assessment of exposure-related issues, the IJC-critical pollutants aldrin, dieldrin, PAHs, DDT, PCBs, lead, and mercury were identified at this site.

#### 4.1.1.9 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. Records indicated that three underground fuel storage tanks may have been on the property, but whether the tanks were ever removed was unclear. ATSDR's 2000 health consultation completed as part of a brownfields project is the source of information regarding this site.

**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, in 2000 ATSDR categorized this site as an *Indeterminate Public Health Hazard* (Category 3).

**U.S. EPA Update:** Laingsburg is a state brownfields site and is not included in the CERCLIS database.

**The Michigan Department of Community Health Update:** 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, monitor groundwater, and perform any interim response as needed (Superfund Section, Remediation and Redevelopment Division, Michigan Department of Environmental Quality, personal communication; 2008 Aug 21).

**IJC-critical Pollutants Identified within ATSDR Documents:** During ATSDR's assessment of exposure-related issues, the IJC-critical pollutants aldrin, lead, mercury, and furans were identified at this site.

#### 4.1.1.10 Lufkin Rule

The 14-acre Lufkin Rule site is a large, abandoned industrial property in a mostly residential area of Saginaw (Saginaw County) MI. After Lufkin sold the property, a number of tenants successively occupied it. In 1994, a dry cleaning establishment on the property burned, and the remnants were later demolished. Since that time no one has rented the property; it remained strewn with drums full of dry-cleaning solvents, and with PCB-laden transformers, capacitors, and other electrical equipment. The site contained 55 dangerous buildings, three USTs, six ASTs, and two large smokestacks. Some of the equipment had been scavenged, and the PCB-saturated fluids spilled on the ground. In 1995, the PCB-contaminated fluids and soil, the drummed solvents, and other waste materials were removed for disposal at an approved facility. Information regarding this site is from ATSDR's 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, in 1997 ATSDR categorized this site as a *Public Health Hazard* (Category 2). The site was not secured from trespassers, and evidence indicated extensive trespassing. Soil-contamination hot spots permeated with the IJC-critical pollutant PCBs and also with bis(2,3 ethylhexyl) phthalate. This contamination could have posed inadvertent ingestion hazards 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 was not a drinking water source. Nevertheless, levels of trichloroethylene and other VOCs in storm sewer water were above drinking water standards. Trichloroethylene's in the groundwater pointed to its release from the site through runoff.

Some 10 years ago, this site was redeveloped as part of the tax-free City of Saginaw and Saginaw County Renaissance Zone. See

<http://www.egr.msu.edu/tosc/saginaw/saginawoverview.shtml>. [cited 2008 Oct 20].

**U.S. EPA Update:** Lufkin Rule is a state brownfields site and is not included in the CERCLIS database.

**IJC-critical Pollutants Identified within ATSDR Documents:** During ATSDR's assessment of exposure-related issues, the IJC-critical pollutants PCBs, furans, DDT, lead, PAHs, aldrin, dieldrin, and mercury were identified at this site.

#### 4.1.1.11 Metamora Landfill

This 160-acre site near the village of Metamora (Lapeer County) MI, contained a 25-acre landfill and two drum disposal areas. This site may have received many thousands of drums mostly filled with 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 high as 1,200,000 ppb.

**Demographic Data:** The 2000 U.S. Census reported the following demographic profile 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 at the time of ATSDR's involvement with the site no exposures at levels of concern had been documented, the potential remained for future exposure through domestic groundwater use. 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, however, that the site posed *No Apparent Public Health Hazard* (Category 4).

In 1992, ATSDR was concerned that if in the future the shallow groundwater plume extended as far as the private wells that tapped the shallow aquifer, people could be exposed to VOCs and metals—particularly arsenic—at concentrations that could result in adverse health effects. 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. Remediation included incineration of approximately 35,000 drums and 10,000 tons of soil offsite, and covering minimally contaminated soil under a landfill cap onsite. Groundwater studies in 1997, 1999, and 2000 indicated the VOC groundwater plume had been stabilized. Monitored natural attenuation thus emerged as the preferred groundwater remedy. This site may have contributed to the environmental burden of VOCs, but it has been remediated. Extensive remediation of the site, including onsite incineration of wastes and disposal of the resulting ash in the landfill, capping, vegetating, and installing a runoff treatment system, and installing a groundwater extraction system, largely eliminated any contaminant releases from the site.

**U.S. EPA Update:** In its October 2006 Fact Sheet for the Metamora site, U.S. EPA stated in part that

The U.S. EPA has completed three Five-Year Reviews of the remedies selected for the Metamora Landfill Site. These reviews were completed in August 1993, September 1999, and September 2004. The latest Five-Year Review completed in 2004 determined that the selected remedies remained protective of human health and the environment. The next Five Year Review at the Metamora Landfill Site will begin in June 2009.

Available at: <http://www.epa.gov/region5superfund/npl/michigan/MID980506562.htm>. 2006 Oct [cited 2009 Jul 14].

**IJC-critical Pollutants Identified within ATSDR Documents:** During ATSDR's assessment of exposure-related issues, the IJC-critical pollutants lead, mercury, TCDD, PAHs, and PCBs, were identified at this site. For a more complete listing of the hazardous substances found at this site, please refer to [www.USEPA.gov/superfund/sites/npl/npl.htm](http://www.USEPA.gov/superfund/sites/npl/npl.htm).

#### 4.1.1.12 Peet Packing Company Property

The Peet Packing property was a former 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, after which the plant was abandoned. In 1992, the company had remediated a leaking underground storage tank under its building. In 2000, the U.S. EPA removed the hazardous wastes, hazardous chemicals, and friable asbestos insulation from the onsite buildings.

**ATSDR Conclusions:** In 2001, ATSDR concluded that under then-current site conditions the site posed no apparent health hazard due to chemical contaminants, but did pose a *Public Health Hazard* (Category 2) for future use. Although the site was proposed for future commercial or industrial use, if it were so redeveloped it could, because of high levels of lead in the soil, pose a public health hazard for workers. In addition, levels of aluminum, antimony, arsenic, lead, manganese, thallium, and vanadium that exceeded both state and federal drinking water standards were detected in groundwater. While in 2001, the groundwater was not a drinking water source, if drinking water wells were installed in the future, the contaminants would present a public health hazard. Finally, inside the remaining onsite buildings, asbestos material could release asbestos fibers into the air if the materials were exposed to ambient weather conditions or otherwise allowed to deteriorate.

**U.S. EPA Update:** Peet Packing Company is not a U.S. EPA site and does not appear in the CERCLIS database.

**The Michigan Department of Community Health Update:** To date, no additional regulatory actions have been taken (Patricia Williams, Michigan Department of Environmental Quality, personal communication; 2008 August 15).

**IJC-critical Pollutants Identified within ATSDR Documents:** During ATSDR's assessment of exposure-related issues, the IJC-critical pollutants lead, polychlorinated biphenyls (PCBs), and polyaromatic hydrocarbons (PAHs) including, phenanthrene, benzo[a]pyrene, and fluoranthene were identified.

#### 4.1.1.13 Shiawassee River

From 1969 to 1973, the Cast Forge Company discharged PCB-contaminated hydraulic fluid wastewater into the South Branch of the Shiawassee River. The Livingston County, MI, river became contaminated with PCBs and thereby became a public health problem. From 1973 to 1977, Cast Forge also discharged wastewater into a 400,000-gallon onsite lagoon. These discharges and overflows from the lagoon contaminated not only the Shiawassee River, but nearby wetlands as well. Beginning 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, resulting in the removal of some 2,600 pounds of PCBs in the first mile downstream from the plant. As of ATSDR's 1989 health assessment, 1993 ATSDR site review and update, and 2006 health consultation—from which information on this site is taken—both the company property and the river remained contaminated. Additional and updated information is from the 2008 U.S. EPA NPL site Fact Sheet.

**Demographic Data:** The 2000 U.S. Census reported the following demographic profile 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 from potential exposure to PCBs at levels that could result in adverse health effects, ATSDR's 1989 health assessment categorized this site as an *Indeterminate Public Health Hazard* (Category 3). A subsequent 1993 ATSDR site review and update reiterated that health hazard category. The 1993 site review and update found that potentially, people could potentially still come into contact with PCB-contaminated soil, sediment, or food. More recently, in 2006, ATSDR determined that data were insufficient to recategorize the site, although PCBs in some river sediment and floodplain soil samples exceeded Michigan's "action levels." The concern was for such exposure pathways as direct contact with PCB-contaminated river sediments or eating PCB-contaminated fish or wildlife. PCB levels in fish tissue downstream from Cast Forge were high; indeed, the State of Michigan in 1979 issued advisories against consumptions of contaminated-zone fish.

**U.S. EPA Update:** In its April 2008 Fact Sheet for the Shiawassee River site, U.S. EPA stated in part that

The RI [Remedial Investigation] report was finalized in January 1992. The final study of cleanup alternatives was submitted in December 1997, and a proposed plan was released to the public in August 1998. Because the data, used to develop cost estimates, were obtained as long ago as 1986, it was determined that additional data should be obtained to develop more accurate cost estimates for the site.

Additional sampling of the site began in November 1999 and was completed in April 2000. These sample data were released to the public in the data evaluation report in May 2000. The supplemental FS report was released in early 2001, and a Record of Decision (ROD) was signed on September 28, 2001. The ROD selected the floodplain and contaminated areas near the Cast Forge facility to be remediated to less than 10 ppm PCBs. The river was to be remediated to less than 5ppm PCBs for the first mile downstream of the facility. Remediation was completed in 2005, meeting all ROD requirements.

Available at: <http://www.epa.gov/region5superfund/npl/michigan/MID980794473.htm>. 2008 Apr [cited 2008 Jul 14].

**IJC-critical Pollutants Identified within ATSDR Documents:** During ATSDR's assessment of exposure-related issues, the IJC-critical pollutants dioxin PCBs, furans, TCDD, DDT, and PAHs were identified at this site. For a more complete listing of the hazardous substances found at this site, please refer to [www.USEPA.gov/superfund/sites/npl/npl.htm](http://www.USEPA.gov/superfund/sites/npl/npl.htm).

#### 4.1.1.14 Spiegelberg and Rasmussen Dump Sites

The 115-acre Spiegelberg Site and the 33-acre Rasmussen Dump are two separate Livingston County, MI sites 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. In 1984, many of the drums were removed, together with contaminated soil. Both sites contain a few residences. Information regarding these sites is taken from ATSDR's 1989 public health assessment, from the 1992 public health assessment addendum, and from the 2006 U.S. EPA NPL site Fact Sheet.

**Demographic Data:** The 2000 U.S. Census reported the following demographic profile 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 ATSDR categorized these sites as an *Indeterminate Public Health Hazard* (Category 3). In, 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 1992 health assessment recategorized the sites as *Public Health Hazards* (Category 2).

In 1989, chemicals of concern in potential exposure pathways at the sites 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. Remedial 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.

**U.S. EPA Update:** In its October 2006 Fact Sheet for the Spiegelberg site, U.S. EPA stated in part

The second five-year review report was issued on January 28, 2005. The review found that the confirmation monitoring period (post intermittent pumping monitoring) consisted of twelve monitoring events from September 1998 to December 2004. The monitoring results have demonstrated continued compliance with the 1998 Cleanup Standards, and has established that the Site has achieved groundwater cleanup goals. No contaminants of concern have been found above Maximum Contaminant Limits since 1998. In addition, no other Hazardous Substance List (HSL) compounds were detected above risk based levels for the final December 2004 monitoring event. The HSL analysis included all chemicals found during the Remedial Investigation (RI). Conducting the HSL analysis insured that all chemicals found during the RI were below health based values. The second five-year review concluded that the remedy remains protective of human health and the environment.

U.S. EPA will be ensuring that the PRPs have completed all response actions so that site conditions remain protective of human health and the

environment. Once this review is completed and all work is completed, U.S. EPA will begin the deletion process from the NPL.

Available at: <http://www.epa.gov/region5superfund/npl/michigan/MID980794481.htm>. 2006 Oct [cited 2008 Jul 14].

**IJC-critical Pollutants Identified within ATSDR Documents:** During ATSDR's assessment of exposure-related issues, the IJC-critical pollutants dioxin (TCDD), furans, lead, and PCBs were identified at this site. For a more complete listing of the hazardous substances found at this site, please refer to [www.usepa.gov/superfund/sites/npl/npl.htm](http://www.usepa.gov/superfund/sites/npl/npl.htm).

#### 4.1.1.15 Tittabawassee River

This site is so named because the ATSDR health consultation focused on the Tittabawassee River floodplain. The Tittabawassee flows through the City of Midland (Midland County) MI—home of the Dow Chemical Company. It continues southeast to the City of Saginaw, MI, where it joins the Saginaw River, which flows northeast through the cities of Saginaw and Bay City, ultimately emptying into Lake Huron. From Midland to Lake Huron, the Tittabawassee and Saginaw Rivers cover some 50 miles and pass through at least three major metropolitan areas.

Community concerns triggered the ATSDR health consultation. High levels of PCDDs had been detected in Midland city soil and in Tittabawassee River fish downstream of Midland. An additional concern arose following the sampling of the Tittabawassee floodplain near the confluence of the Tittabawassee and Saginaw Rivers over 20 miles southeast of Midland. Samples 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, discussed in Section 4.1.1.4, where plant location and releases to the environment are described. Contamination of the Tittabawassee River floodplain is considered in a separate 2004 ATSDR health consultation, summarized below.

The Tittabawassee floodplain area 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 that examined consumption of fish and wild game from the Tittabawassee River and flood plain areas. In 2004 and 2005, Michigan Department of Community Health, in cooperation with the Michigan Department of Environmental Quality and ATSDR, conducted a Pilot Exposure Investigation (PEI) in the Tittabawassee River flood plain. The report was released in 2007. The PEI tested exposure investigation methods and provided information about levels of DLC in soil, indoor dust, and human blood samples.

**Public Health Exposure Data:** In 2006, Dow Chemical Company funded a University of Michigan dioxin exposure study. Some key findings were

- 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 do 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 do persons who do not participate.

**ATSDR Conclusions:** In 2004, ATSDR concluded that because the data were insufficient to determine whether the dioxin-like compounds then contaminating floodplain soil in the Tittabawassee River watershed posed a public health risk, the site was an *Indeterminate Public Health Hazard* (Category 3). But in 2005, ATSDR found that the consumption of dioxin-like compounds (DLCs) 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). Moreover, consumption of DLCs in deer and squirrel muscle meat presented a public health hazard to women of childbearing age and to children under the age of 15. Finally, ATSDR determined in 2005 that 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).

**U.S. EPA Update:** Tittabawassee River is not a federal site—it has been deferred to RCRA. In 2004, however, the State of Michigan issued a Wild Game Advisory, advising that hunters and families should not eat deer liver or turkey meat harvested from the Tittabawassee River floodplain. 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. In its May, 2008, background discussion of the Tittabawassee River site, U.S. EPA stated

The highest dioxin concentrations detected to date are 110,000 parts per trillion TEQ in the Tittabawassee River and 1,600,000 parts per trillion TEQ in the Saginaw River. These high levels led to Dow's cleanup of four hot spots in 2007, with EPA oversight. Fish and invertebrates within the Tittabawassee and Saginaw Rivers are contaminated. The Michigan Department of Community Health has issued fish and game consumption advisories.

In fact, since the 1970s the Michigan Department of Community Health has issued fish consumption advisories for the Tittabawassee River.

Available at: <http://www.epa.gov/region5/sites/dowchemical/background.htm>. [cited 2008 Jul 29]. See also [http://www.michigan.gov/deq/0,1607,7-135-3311\\_4109\\_9846\\_9847-43808--,00.html](http://www.michigan.gov/deq/0,1607,7-135-3311_4109_9846_9847-43808--,00.html). [cited 2008 Jul 29].

**IJC-critical Pollutants Identified within ATSDR Documents:** During ATSDR's assessment of exposure-related issues, the IJC-critical pollutants PCDDs and PCDFs were identified at this site.

#### 4.1.1.16 Velsicol Chemical

Velsicol Chemical Corporation was previously known as the Michigan Chemical Company. This 52-acre production facility is within the city limits of St. Louis (Gratiot County) MI. It is surrounded on three sides by the Pine River, a tributary of the Tittabawassee River, which joins the Saginaw River near the City of Saginaw. From 1936 to 1978, the Velsicol St. Louis facility produced a variety of chemicals, including PBBs and DDT. In 1985, Velsicol completed construction of an onsite containment system: a slurry wall around the entire site and a clay cap over it.

**Demographic Data:** The 2000 U.S. Census reported the following demographic profile 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. To observe the long-term effects of PBB exposure, workers and their families were placed in a registry. The study was conducted in cooperation with the CDC, FDA, and U.S. EPA, and was ongoing at the time of the 1988 health assessment. Study findings included some evidence of an association between high PBB exposure and an elevated risk of breast and digestive system cancers and lymphomas. Because of the small number of cases, these findings yielded no definitive conclusions. In addition, higher rates of neurological, immunologic, dermatologic, and musculoskeletal health effects were observed in the registry cohort. Yet again, no consistent pattern surfaced of an association between these health effects and serum PBB levels. 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 available at [http://www.michigan.gov/documents/mdch\\_PBB\\_FAQ\\_92051\\_7.pdf](http://www.michigan.gov/documents/mdch_PBB_FAQ_92051_7.pdf) [cited 2006]

**ATSDR Conclusions:** Despite issuance of a fish consumption advisory, in the late 1980s exposure to PBBs through the food chain (fish and wildlife) was an ongoing public health threat. Thus in 1988, ATSDR categorized this site as an *Indeterminate Public Health Hazard* (Category 3). A subsequent 1993 site review and update similarly categorized the site.

In 1982, Velsicol began construction of the containment system at the main plant site, which was completed in 1985. System water levels, however, continued to rise, and with them the potential exposure of PBB bioaccumulation in fish and wildlife. Although at the time ATSDR noted that PBB concentrations were declining in fish, river water, and sediment, subsequent developments threatened that observation. By 1994, the slurry wall had deteriorated, admitting water into the containment system. High levels of DDT and metabolites were discovered in the sediment of the Pine River/St. Louis impoundment, and dense nonaqueous phase liquids (DNAPL) had migrated from the containment area into the glacial till underlying the river sediments.

**U.S. EPA Update:** In its April 2008 Fact Sheet for the Velsicol Chemical site, U.S. EPA stated in part

MDEQ released the RI Report for OU [Operable Unit] 1 in late November 2006 and held a public meeting to discuss the findings in early December 2006. A copy of the report is available at the St. Louis public library. The report includes the results of site investigation work at the main plant site, as well as at adjacent or nearby properties and at an area known as the “former burn area” on the Gratiot County Golf Course site located across the Pine River. The report concludes that soils and groundwater at the site are contaminated with a variety of chemicals. Soils are contaminated with volatile organic compounds, semi-volatile organic compounds, pesticides, specialty chemicals, and inorganics; the areas with the highest concentrations of contaminants and the most contaminant detections were in the shallow outwash unit soils on the former plant site. Groundwater is contaminated with volatile organic compounds, semi-volatile organic



compounds, pesticides, specialty chemicals, and inorganics. Volatile organic compounds are the predominant contaminants present in groundwater at the former plant site in terms of the frequency detected and the concentrations observed, with the highest concentrations detected in the northeast and western portions of the former plant site. The RI Report concluded that remedial activities will be needed to mitigate the soil and groundwater contamination at the site, and a feasibility study currently is underway to evaluate potential cleanup options for addressing the contamination at the site. The RI Report also recommended some additional investigational activities to more fully define the nature and extent of contamination at the site. MDEQ initiated additional RI fieldwork at the site in Fall 2007 and anticipates presenting the findings of the additional investigation in an addendum to the November 2006 RI Report.

Concurrently, MDEQ is conducting a feasibility study for OU1 of the Velsicol Chemical Corp. site to evaluate potential cleanup options. Based on the findings of the additional investigation activities at the “former burn area,” the FS will also include an evaluation of cleanup options for the Golf Course Site.

Available at: <http://www.epa.gov/region5superfund/npl/michigan/MID000722439.htm>. 2008 Apr [cited 2008 Apr 14].

**IJC-critical Pollutants Identified within ATSDR Documents:** During ATSDR’s assessment of exposure-related issues, the IJC-critical pollutants DDT and lead were identified at this site. For a more complete listing of the hazardous substances found at this site, please refer to [www.USEPA.gov/superfund/sites/npl/npl.htm](http://www.USEPA.gov/superfund/sites/npl/npl.htm).

#### 4.1.1.17 Wurtsmith Air Force Base, Oscoda

Wurtsmith Air Force Base (WAFB) is in Oscoda (Iosco County) Michigan, approximately 170 miles north of Detroit. In June 1993, the base closed after 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. Some contaminants migrated beyond the base boundaries.

The U.S. Air Force (USAF) Installation Restoration Program evaluated 58 WAFB areas for potential contamination. At or about 1993, ATSDR analyzed all 58 of these areas to determine whether past, current, or future public health hazards were associated with them. The majority of areas fit one or more of the following categories:

- no site-related contaminants were present,
- detected contaminant concentrations were too low to pose a hazard,
- past, current, and future exposures to the contaminated media were very infrequent or conducted with personal protective gear, and
- land use restrictions will prevent future exposures.

Accordingly, ATSDR identified no public health hazards.

During subsequent site visits in 1995 and 1998, ATSDR did identify 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. In its 2001 public health assessment, ATSDR evaluated these potential exposure pathways and addressed community health concerns.

**Demographic Data:** ATSDR estimated 8,000 persons lived and worked at WAFB while it was in operation. The 1990 U.S. Census reported that 7,700 persons resided in 2,961 households within 1 mile of WAFB.

**ATSDR Conclusions:** In 2001, ATSDR concluded that past TCE exposures in on-base and off-base water supplies posed an *Indeterminate Public Health Hazard* (Category 3) for people who before 1980 were exposed to the following potable water sources: 1) WAFB's main water supply wells and 2) the well located at 6504 West Shore Drive. Whether adverse health effects occurred, however, was unknown—many uncertainties surrounded the question of whether TCE was present for a sufficient time to pose past health hazards.

In any event, WAFB's contaminated groundwater plumes were not expected to pose a then-current or future public health hazard. The vast majority of on-base and off-base facilities, residences, and camps received their drinking water from the Huron Shores Regional Utility Authority, a source not located near WAFB and which met all federal and state drinking water quality standards. Although, in 2001, a few residential wells were still in service, exposure to this water was not expected to pose current or future health hazards. The wells did not contain high contaminant concentrations; they were rarely used, with only short exposure durations expected. Institutional controls were in place to ensure that in the future, new wells were not drilled in contaminated areas.

Similarly, exposures to surface water and sediment in Van Etten Lake, the Au Sable River, Duell Lake, and a wetland area in the southern portion of WAFB were not expected to pose health hazards to the populations who used these water bodies for recreational purposes. Again, contaminant concentrations were either too low, or exposures were too infrequent, or both.

ATSDR also concluded that exposures to volatilizing materials probably would not 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.

ATSDR further 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 people exposed to Lake Van Etten during or after 1990. Community members used Van Etten Lake and the Au Sable River for recreational fishing. Even after a review of limited data, ATSDR did not believe that fish consumption from these water bodies would pose human health hazards.

WAFB representatives were unaware of whether radioactive materials had ever been stored at the base. If such materials had been stored there, they would have been secured in igloos in the Weapons Storage Area. After the base closed, a radiologic survey detected no radioactive contamination.

**U.S. EPA Update:** In its September 2006 Fact Sheet for the Wurtsmith AFB site, U.S. EPA stated in part that

Groundwater contaminated in the Northern Landfill Area discharges into Van Etten Lake at the YMCA property boundary. An 80-well barrier air sparging curtain was installed at the base boundary downgradient of the landfills and commenced full-time operations in May 2002. The primary intent of the system is to inject/add oxygen to the subsurface as a means to help restore groundwater table aquifer. In-situ stripping of VOCs is a secondary outcome of air sparging operations. A small groundwater and extraction treatment system was also installed at the base boundary north of the air sparging curtain to capture groundwater contaminated with chlorinated solvents in a narrow plume originating at the landfills that is traveling offsite. Monitoring is being conducted to measure the performance of the systems.

Groundwater from the Northern Landfill area discharging to Van Etten Lake at the YMCA beachfront has caused aesthetic impacts (iron staining) at the beach. Remedial actions performed at the YMCA beach include one sand removal/replacement (April 1999), and three sand placements (January 2001, January 2002, and January 2003). Oxygen Release Compound (ORC) was injected slightly upgradient of the beach to increase the dissolved oxygen levels in the aquifer so that staining would not occur. 4,770 pounds of ORC were injected through 97 points in February 2001 and 4,860 pounds of ORC were injected through 109 points near the beach in October 2001. Monitoring is being conducted to determine the impacts of the ORC application.

The bioventing and biosparging systems were installed at the Base Operational Apron in 2003 to treat soil and groundwater contaminated with petroleum constituents. The system became operational in 2004.

A base wide five-year review was completed in September 2004.

Studies of the nature and extent of contamination at a few sites are still underway. These investigations will result in the selection of remedies for final cleanup of the site. Cleanup actions, including the operation of groundwater pump and treat systems, the connection to the potable water supply, the operation of the hydrocarbon skimmer, and the ex-situ bioremediation of the soil, have reduced the threat to human health and the environment while site investigations are underway.

Available at: <http://www.epa.gov/region5superfund/npl/michigan/MI5570024278.htm>. 2006 Sep [cited 2008 Jul 14].

**IJC-critical Pollutants Identified within ATSDR Documents:** During ATSDR's assessment of exposure-related issues, none of the IJC-critical pollutants were identified at this site. For a more complete listing of hazardous substances found at this site, please refer to [www.USEPA.gov/superfund/sites/npl/npl.htm](http://www.USEPA.gov/superfund/sites/npl/npl.htm).

## **4.1.2. Summary and Conclusions for the Saginaw River and Bay AOC**

### **4.1.2.1 Hazardous Waste Sites**

At some time during their assessment history, ATSDR categorized 18 sites in the counties relevant to the Saginaw River and Bay AOC as either a public health hazard or an indeterminate public health hazard.<sup>3</sup> Several of these sites had completed exposure pathways to the IJC-critical pollutants PCDDs, PCDFs, PCBs, or DDT and metabolites or had released these pollutants into rivers that ultimately flow into the Saginaw River.

A pathway of major concern for these chemicals is bioaccumulation through the food chain into fish ingested by humans. Incidental ingestion, direct dermal contact, and inhalation of soil and dust from PCDD- and PCDF-contaminated soil also were of concern. Seven of the sites have been remediated, and at nine sites remediation is ongoing. Dow Chemical is an active site, and as of the date of this report, remediation at Peet Packing was undetermined.

On June 25, 2008, Mr. Kory Groetsch of the State of Michigan Department of Community Health added

The dioxin contamination is widespread throughout the Tittabawassee River and flood plain, Saginaw River, Saginaw Bay and the tissues of fish and wild game living in these areas. Completed exposure pathways are well known and area a public health hazard. Further studies would be beneficial to understand the relationship between human behaviors and the amount of dioxin in people's bodies.

### **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.

### **4.1.2.2 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. See Table 4.1-B.

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). See Table 4.1-C.

The major releases ( $\geq 500,000$  pounds) of non-IJC-critical 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).

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<sup>3</sup> Although Spiegelberg and Rasmussen sites are listed here as one site, they are in fact two different sites.

#### 4.1.2.3 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 average annual permitted discharges in 2004 totaled 3,973,206 pounds, the majority of which was ammonia nitrogen, and also phosphorus. See Table 4.1-D.

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.

#### 4.1.2.4 Beneficial Use Impairment (BUIs)

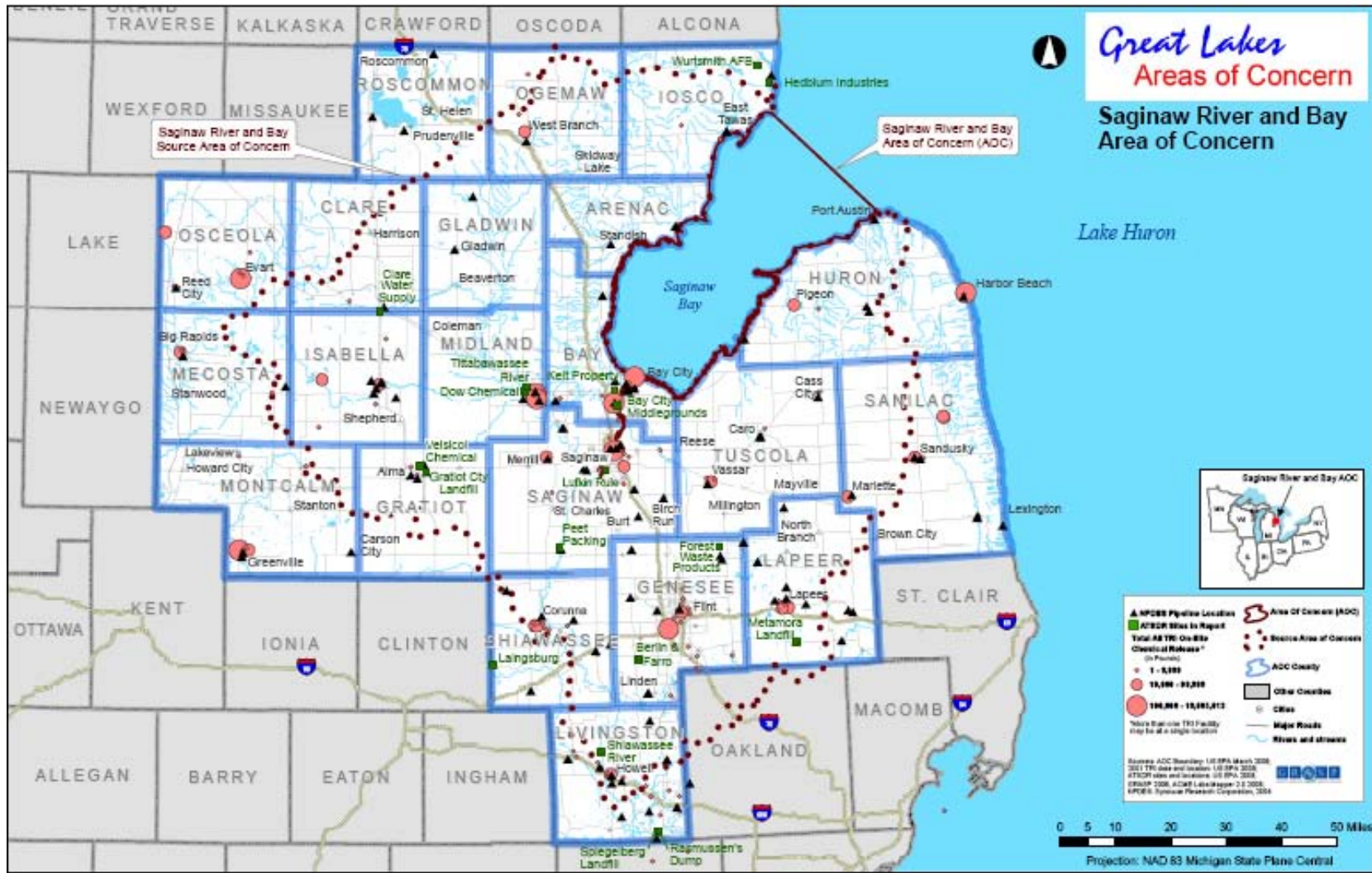
Restrictions on fish and wildlife consumption and drinking water are cited as impairments for this AOC.

Kory Goetsch of the Michigan Department of Community Health stated on June 28, 2008, that “The Saginaw River and Bay have some of the most restrictive fish consumption advisories in Michigan waters, because the fish are so abnormally highly contaminated.”

In 2007, the U.S. EPA issued emergency response clean-up action orders for the Tittabawasee River. 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 U.S. EPA 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 (PCDDs and PCDFs)	2 3	0.013254255	0.005655825	0	1.6102674	1.62917748	0.05532345	1.68450093
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
	<b>Total IJC</b>	<b>5045.593254</b>	<b>17.30565583</b>	<b>0</b>	<b>87079.4103</b>	<b>92142.30918</b>	<b>26700.05532</b>	<b>118842.3645</b>
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			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

<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>
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			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	3	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



<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>
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 TRANSVAAL 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

<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>
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		2755268	0	0	0	2755268	0	2755268

<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>
AFTER 'ACID AEROSOLS' ONLY)								
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

<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>
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			0	0	0	578	0	578

<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>
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
	<b>Total Non-IJC</b>	<b>5557404.2</b>	<b>146716</b>	<b>0</b>	<b>2034937</b>	<b>7739057.2</b>	<b>841457</b>	<b>8580514.2</b>
	<b>Total</b>	<b>5562449.793</b>	<b>146733.3057</b>	<b>0</b>	<b>2122016.41</b>	<b>7831199.509</b>	<b>868157.0553</b>	<b>8699356.564</b>

**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	48801CNTCH205NG	ALMA

<i>IJC-critical Pollutant</i>	<i>Number of Facilities</i>	<i>Facility Name</i>	<i>TRIF ID</i>	<i>City</i>
Huron County, MI	4	SPX CORP.		
		DETROIT EDISON CO. HARBOR BEACH POWER PLANT	48441DTRTD755NH	HARBOR BEACH
		MICHIGAN SUGAR CO. SEBEWAING PLANT	48759MCHGN763BE	SEBEWAING
		TOWER AUTOMOTIVE TECH. PRODS. INC.	48759TWRTM249NC	SEBEWAING
Iosco County, MI	2	TOWER AUTOMOTIVE TOOL L.L.C.	48731TWRTM81DRE	ELKTON
		ITT INDS. FHS	48750TTNDS4700N	OSCODA
Isabella County, MI	1	NEW NGC INC.	48748NTNLG2375N	NATIONAL CITY
		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

<i>IJC-critical Pollutant</i>	<i>Number of Facilities</i>	<i>Facility Name</i>	<i>TRIF ID</i>	<i>City</i>
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
	<b>Total IJC</b>	<b>86.05</b>
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
	<b>Total Non-IJC</b>	<b>3973120.50</b>
	<b>Total</b>	<b>3973206.55</b>

**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,	2	CARO WWTP	MI0022551	CARO

MI

CASS CITY WWTP

MI0022594

CASS CITY

