7. CONCLUSIONS

To identify hazards posed by the continuing presence of hazardous substances in the 26 U.S. Great Lakes' AOCs, the IJC has requested that ATSDR identify evaluated waste sites, their hazard categories, relevant demographic information on populations at risk, and IJC critical pollutants in completed exposure pathways. This document has provided that information for the approximately 115 hazardous waste sites with health hazard categories of 1-3 in the 54 counties that encompass the 26 U.S. AOCs. TRI release data were reviewed to assess the impact of other sources of IJC critical pollutants on the AOCs. Geographic Information Systems (GIS) maps were created, identifying the approximate boundaries of the AOCs, as well as locations of waste sites and TRI reporting facilities, and demographic information on vulnerable populations. These maps are available in the appendix to this document. County-wide health outcome data were evaluated to screen for possible associations between pollutant release and adverse health outcomes. Sources of information were discussed in Chapter 1 and are listed in Chapter 8.

7.1 ATSDR PUBLIC HEALTH ASSESSMENTS FOR THE 26 GREAT LAKES AOCs

Many of the hazardous waste sites that, in the past, contributed to human exposure or to the environmental burden of the IJC critical pollutants and other contaminants have been remediated, as discussed in the site descriptions and AOC summaries in Chapters 2-6 of this document. Thus, some U.S. AOCs do not appear to be significantly burdened by the continuing release of contaminants from hazardous waste sites. Other U.S. AOCs are strongly impacted by the continuing presence and release of waste-site-related contaminants, particularly the AOCs on Lake Michigan. The following summary takes into account the potential magnitude of pollutant releases and the sizes of nearby vulnerable populations in order to focus on the AOCs of high concern. For the high concern AOCs, listed in bold type, the problematic hazardous waste sites are identified and discussed, together with pertinent health outcome data and vulnerable population data. Brief summaries are provided for Great Lakes with U.S. AOCs of lesser concern. Chapters 2-6 of this document provide detailed information on the waste sites, and issues for follow up, including issues of contaminant release and issues of potential adverse health outcome.

Lake Ontario

No U.S. AOCs of high concern: The only unremediated sites are a small Brownfields site with no current exposure (Rochester Embayment AOC─ Rochester, City of, APCO site, Section 2.2.1.1) and an inadequately characterized waste site that was formerly engaged in fungicide and herbicide manufacture (Eighteen Mile Creek AOC─Barker Chemical, Section 2.3.1.1).

Lake Erie

Ashtabula River AOC, Ashtabula County, OH: Most of the four waste sites in this county that had health hazard categories of 1-3 have been remediated. The exception is the **Fields Brook Site** (Section 3.3.1.2), the six square-mile watershed of Fields Brook, which flows through the city of Ashtabula into the Ashtabula River. The brook flows through an industrial area that is one of the largest areas of chemical plants in Ohio, and is the principal receiving stream for many industrial discharges. This site has contributed to the environmental burden of the IJC critical pollutants PCBs, mercury, and lead. Although partially remediated by removal and treatment or containment of PCB-contaminated soil and sediment, and of mining residuals, it may still be a reservoir of these chemicals for release to the Ashtabula River. In addition, recontamination may be occurring. Sediment and fish contain high levels

of PCBs. An epidemiological study in 1988 reported no evidence for excess cancer mortalities associated with the Fields Brook Site. Vulnerable populations within 1 mile of this site number close to 6,000.

Lake Huron

Only one U.S. AOC, The Saginaw River and Bay AOC, is located on Lake Huron. This AOC has five hazardous waste sites that may be continuing to release IJC critical pollutants (PCDDs, PCDFs, PCBs, and/or DDT and metabolites), but as discussed in Chapter 4, additional data are needed to assess their impacts, and some of the sites are under remediation.

- Bay City Middlegrounds (Section 4.1.1.1)
- Velsicol Chemical Corp. (Section 4.1.1.7)
- Shiawassee River (Section 4.1.1.11)
- Dow Chemical Co., Midland Location (Section 4.1.1.12)
- Tittabawassee River (Section 4.1.1.13)

Vulnerable populations residing near the first three listed sites consisted of about 3,000 or fewer people per site. Data on vulnerable populations were not reported for the last two listed sites.

Lake Michigan

Kalamazoo River AOC, Allegan and Kalamazoo Counties, MI: Most of the six hazardous waste sites of concern in this AOC have been remediated or institutional controls have been put in place to eliminate completed exposure pathways. The exception is the **Allied Paper/Portage Creek/Kalamazoo River site** (Section 5.2.1.2), which is heavily contaminated with PCBs from the paper industry, and constitutes a major source of continuing exposure and potential loading to Lake Michigan. The site covers a very large geographical area, including 75 acres in the city of Kalamazoo, and also Portage Creek and at least 35 miles of the Kalamazoo River. Remediation of PCB-contaminated soil and sediment was in the early phases. Public health outcome data are not available. Because human exposure to PCBs at levels of public health concern may be occurring, the site (as of ATSDR's 1991 public health assessment) was being considered for a study to investigate fish ingestion and serum PCB levels. Vulnerable populations within 1 mile of the site are large, totaling nearly 33,000 people.

Waukegan Harbor AOC, Lake County, IL: One hazardous waste site in this AOC, the **Outboard Marine Corp.** (Section 5.4.1.4), has been characterized as one of the major sources of PCBs discharging into Waukegan Harbor, contributing to the contamination of sediment and fish. This site is under remediation, together with contaminated sediments in the harbor. Dredged sediments are being treated on-site. No public health outcome data were reported for the site. Vulnerable populations within 1 mile of this site total about 7,000 people.

Milwaukee Estuary AOC, Milwaukee County WI: Two sites in this AOC continue to contribute to the burden of ICJ critical pollutants and to human exposure. The **Former Tannery** site (Section 5.5.1.3), although a small, non-NPL site, is heavily contaminated with PCBs in soil and waste on-site, and appears to have contributed to PCB loading of the Kinnickinnic River, and therefore, probably to fish contamination. The site had not been remediated as of 1996, when ATSDR performed a health consultation. No public health outcome data were reported for this site. Vulnerable populations were not discussed, but over 100 families live within a short walk to the site. The **Moss-American Co., Inc.** (Kerr-McGee Oil Co., Section 5.5.1.4), an 88-acre wood preserving site, contaminated on-site soil and the sediments of the Little Menominee River with PAHs, including B(a)P, and with PCDDs, PCDFs, and lead. The site itself has been remediated, and some of the contaminated sediment was removed. Remediation of the remaining sediment, principally contaminated with PAHs, is under design. No public

health outcome data were reported for this site. Vulnerable populations within 1 mile of the site number about 5,600 people.

Sheboygan River AOC, Sheboygan County, WI: The **Sheboyagan Harbor & River** itself, from Sheboygan Falls to Lake Michigan and extending into the harbor, is an NPL site. PCBs, primarily from the Tecumseh Products Company, contaminate river bank soil, sediments, and fish and waterfowl is at levels that may be associated with adverse health effects, even though some of the PCB-contaminated media have been removed or immobilized. The site may be contributing to PCB contamination of Lake Michigan. Additional, extensive remediation of sediments is planned. Health outcome data indicate that infants of mothers who ate two meals per month of fish from the Sheboygan River or Lake Michigan had higher birth weights and a higher rate of infectious illnesses. Vulnerable populations living with 1 mile of the site include about 17,300 people.

Lower Green Bay and Fox River AOC, Brown County, WI: The **Fox River NRDA/PCB Releases** site (Section 5.7.1.2) is reported to be the greatest contributor of PCBs to Lake Michigan. Sediments are heavily contaminated with PCBs released from seven pulp and paper companies located on the river. Fish and other wildlife are contaminated. Other IJC critical pollutants also contaminate the sediment, but do not contribute significant health risk relative to that posed by PCBs. The site has not been remediated, but has been proposed for the NPL. No public health outcome data were reported for this site. Vulnerable populations were reported only for those living with 1 mile of the Fox River Paper Company, and thus do not represent the entire site. The total population residing in the communities along the river is approximately 270,000, so vulnerable populations will be large.

Lake Superior

St. Louis River and Bay AOC, St. Louis and Carlton Counties, NM, and Douglas County, WI: The major site in this AOC is the approximately 900-acre **St. Louis River Site** (Section 6.3.1.2), which actually comprises two very large sites located on the river. These sites were involved in steel, coke, and tar manufacturing. Heavy contamination of the soil and river sediments with PAHs, probably including B(a)P, occurred. The sites are partially remediated, but additional sediment requires remediation, and groundwater is under evaluation. No public health outcome data were reported for the site. Vulnerable populations living within 1 mile of the site total about 900 people.

7.2 TRI DATA FOR THE 26 U.S. GREAT LAKES AOCs

Estimated annual chemical releases by certain industries and federal facilities are reported through the TRI (http://www.epa.gov/tri/). The following IJC critical pollutants are included: PCBs, PCDDs, and PCDFs, aldrin, lead and lead compounds, mercury and mercury compounds, toxaphene, and hexachlorobenzene.

The TRI data for IJC critical pollutant releases in the counties encompassing the 26 U.S. Great Lakes AOCs are summarized in Table 7-1. All of the 26 U.S. Great Lakes AOCs, except for the Manistique River AOC (Lake Michigan) continue to be impacted by the release of IJC critical pollutants from industrial facilities. The disproportionately large estimated releases of lead and lead compounds (2,200,000 pounds) in the Maumee River AOC, lead and lead compounds (430,000 pounds), mercury and mercury compounds (14,000), and PCBs (1,200,000) in the Rouge River AOC, and dioxin and dioxin-like compounds in the Saginaw River and Bay AOC, were primarily releases to land. Further investigation of these releases to land indicated that they represented disposal in Resource Conservation and Recovery Act (RCRA) Subtitle C landfills, which are authorized to accept hazardous waste for disposal and operate

under very stringent guidelines. Although these RCRA-landfilled releases may serve as reservoirs of these chemicals, they should not be contributing to exposure. No portion of the large release of lead and lead compounds in the Grand Calumet AOC (430,000 pounds to surface water and land) was disposed in a RCRA landfill. Further information regarding the TRI release data was provided in Chapters 2-6 of this document.

7.3 POSSIBLE ASSOCIATIONS

Health outcome data for the counties encompassing the U.S. Great Lakes AOCs were obtained from the 2000 HRSA *Community Health Status Reports* (http://www.phf.org/data-infra.htm). No particular patterns among the TRI release data, waste site contaminant data, and county-wide health outcome data were observed in terms of possible associations for follow up. This result is not surprising, for the following reasons:

- Health impacts may be restricted to much smaller areas located near specific waste sites or industrial facilities.
- Impacts may be reflected in more sensitive or specific health outcomes, such as central nervous system birth defects.
- Critical exposure periods and latency for different types of health outcome data (such as developmental effects or cancer) complicate the detection of possible associations when using health outcome data and contaminant data from discrete time periods.
- Potential confounding factors, such as smoking, drinking, and occupational exposures, were not taken into account in the county-wide health outcome data.

A few of the public health outcome evaluations in ATSDR's public health assessments and health consultations, however, did identify possible associations with waste-site-related exposures in the U.S. AOCs. These possible associations included:

- Buffalo River AOC, Erie County, NY—Abby Street/Hickory Woods Subdivision: In a 2001 health consultation, ATSDR concluded that the prevalence of thyroid disease (primarily hypothyroid) in the residents of this subdivision (as compared with the U.S. populations) was unusually high, and needed follow up. Contaminants of concern in past or current completed exposure pathways included the IJC critical pollutants lead and PAHs [as B(a)P equivalents], and also arsenic.
- Muskegon Lake AOC, Muskegon County, MI—Bofors Nobel Incorporated: Health outcome data, evaluated in 1992 and 1996 ATSDR public health assessments, suggest that the site-related exposure to the bladder carcinogens benzidine and 3,3'-dichlorobenzidine (non-IJC pollutants) may have been associated with a slight increase in bladder cancer incidence (for 1 year only) and in total invasive cancer incidence (for 1 year only). ATSDR, in cooperation with Michigan and local health departments, has initiated a health study of workers, their families, and exposed community members for the Bofors Nobel site and two other facilities in Michigan where similar chemicals were manufactured or used. Data are not yet available from this study.
- Sheboygan River AOC, Sheboygan County, WI—Sheboyagan Harbor & River: Health outcome data indicate that infants of mothers who ate two meals per month of fish from the Sheboygan River or Lake Michigan had higher birth weights and a higher rate of infectious illnesses. PCBs contaminate the fish at levels of concern.

Table 7-1. TRI Releases of IJC Critical Pollutants in the 26 U.S. AOCs*

Section in Document	Great Lake	AOC	State	County Name	Lead and Lead Compounds	Mercury and Mercury Compounds	Dioxin	PCBs	Hexa-chloro-benzene	Toxa-phene	Aldrin
2.1	ONTARIO	OSWEGO RIVER	NY	OSWEGO	130	25	0.006	0	0	0	0
2.2	ONTARIO	ROCHESTER EMBAYMENT	NY	MONROE	1,900	160	0.015	0	0	0	0
2.3	ONTARIO	EIGHTEEN MILE CREEK*	NY	NIAGARA	61,000	570	0.007	226	0.3	0	0
3.1	ERIE	BUFFALO RIVER	NY	ERIE	9,100	320	0.0006	0	0	0	0
3.2	ERIE	PRESQUE ISLE BAY	PA	ERIE	7,900	47	0.002	0	0	0	0
3.3	ERIE	ASHTABULA RIVER	OH	ASHTABULA	440	1,500	0.29	0	0	0	0
3.4	ERIE	CUYAHOGA RIVER	OH	CUYAHOGA, SUMMIT	75,000	59	0.007	0	0	0	0
3.5	ERIE	BLACK RIVER	OH	LORAIN	9,300	330	0.005	0	0.23	0.1	0.03
3.6	ERIE	MAUMEE RIVER	OH	LUCAS, OTTAWA, WOOD	2,200,000	560	0.008	51	0	0	0
3.7	ERIE	RIVER RAISIN	MI	MONROE	65,000	1,300	0.008	0	14	0	0
3.8	ERIE	ROUGE RIVER	MI	OAKLAND, WAYNE	430,000	14,000	0.004	1,200,000	4,300	1,700	0
3.9	ERIE	CLINTON RIVER	MI	MACOMB, OAKLAND	290	12	0	0	0	0	0
4.1	HURON	SAGINAW RIVER AND BAY	MI	21 COUNTIES	92,000	470	1.6	0	0	0	0
5.1	MICHIGAN	MUSKEGON LAKE, WHITE LAKE	MI	MUSKEGON	12,000	200	0.001	0	0	0	0
5.2	MICHIGAN	KALAMAZOO RIVER	MI	ALLEGAN, KALAMAZOO	2,200	30	0.0003	0	0	0	0
5.3	MICHIGAN	GRAND CALUMET	IL	COOK/LAKE	430,000	1,800	0.028	0	4.9	0	0
5.4	MICHIGAN	WAUKEGAN HARBOR	IL	LAKE	4,300	320	0.003	0	0	0	0
5.5	MICHIGAN	MILWAUKEE ESTUARY	WI	MILWAUKEE	10,000	150	0.005	0	0	0	0
5.6	MICHIGAN	SHEBOYGAN RIVER	WI	SHEBOYGAN	9,500	230	0.009	0	0	0	0
5.7	MICHIGAN	LOWER GREEN BAY& FOX RIVER	WI	BROWN	15,000	170	0.014	2.2	0	0	0
5.8	MICHIGAN	MENOMINEE RIVER	WI	MARINETTE, MENOMINEE	970	22	0.001	0	0	0	0
5.9	MICHIGAN	MANISTIQUE RIVER	MI	SCHOOLCRAFT	0	0	0	0	0	0	0
6.1	SUPERIOR	DEER LAKE	MI	MARQUETTE	3,000	160	0.002	0	0	0	0
6.2	SUPERIOR	TORCH LAKE	MI	HOUGHTON	0.33	0	0	0	0	0	0
6.3	SUPERIOR	ST LOUIS RIVER & BAY	MN	CARLTON, DOUGLAS, ST. LOUIS	4400	35	0.004	0	0	0	0
				Total	**3,400,000**	**22,000**	**2.02**	**1,200,000**	**4,300**	**1,700**	**0.03**

*2001 Total on-site releases, in pounds, rounded to 1-2 significant figures. Details are provided in the TRI tables in Chapters 2-6.