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 108 hazardous waste sites with health hazard categories of 1-3 in the 54 counties that encompass the 26 U.S. AOCs. TRI and NPDES 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, TRI reporting facilities, NPDES discharge sites, and demographic information on vulnerable populations. These maps are available on a CD accompanying this document. County-wide health outcome data were shown to demonstrate general health status of residents living in the counties where the AOCs were located.

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. 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 impacted by the continuing presence and release of waste-site-related contaminants, particularly the AOCs on Lake Michigan. The following summary takes into account remaining problems with regard to pollutant releases, the size of nearby vulnerable populations, and health outcome data, if applicable. Chapters 2-6 of this document provide detailed information on the waste sites and issues for follow up to include contaminant releases and potential adverse health outcome.

Lake Ontario (Chapter 2)

There are no ATSDR-evaluated hazardous waste sites located in **Oswego River AOC** and **Eighteen Mile Creek AOC**. **Oswego River AOC** was officially delisted from the list of AOCs on 6/19/06. The single ATSDR-evaluated hazardous waste site in the **Rochester Embayment AOC** (Rochester City of APCO) has been remediated through the joint efforts of local, county, and state governments.

Lake Erie (Chapter 3)

Ashtabula River AOC: The four waste sites in this county that had health hazard categories of 1-3 have been remediated.

Black River AOC: The **Ford Road Industrial Landfill** requires follow up regarding the ATSDR recommendation of more extensive monitoring to characterize the extent of contamination. No demographic data were reported for this site.

Buffalo River AOC: The **Abby Street/Hickory Woods Subdivision** requires follow up with regard to arsenic in playground soil. Demographic data are not available for this site. A cancer study by the New York Department of Health at the **Diarsenol Company** also needs a follow-up investigation. The total population for this site is 9,517 residing in the involved census tracts.

Clinton River AOC: The South **Macomb Disposal Authority** site requires monitoring of residential wells to determine if the chemical plume is contaminating these wells. Vulnerable populations living within one mile of the site total 867 residents.

Cuyahoga River AOC: The **Cady Road** site has had dissolved gases in well water which poses a hazard. The residents are being switched to municipal water. Vulnerable populations living within one mile of the site total 654 residents.

Maumee River AOC: This AOC has no ATSDR-evaluated hazardous waste sites.

Presque Isle Bay AOC: The **Foamex Products** site is an active manufacturing site. For the area near the manufacturing site, further investigation is required for the methylene chloride emission (peak air concentration) exceeding the ATSDR acute MRL for this substance. The **Hammermill-Scott Run** site requires follow up for 50 deteriorating drums at the site. No demographic data were reported for these sites.

River Raisin AOC: The **Consolidated Packaging Corporation** requires additional monitoring data for soil and groundwater contamination. No demographic data were reported for this site.

Rouge River AOC: The **Continental Aluminum Company** is an active manufacturing site and requires stack monitoring data during high release events. No demographic data were reported for this site. **Rose Township Dump** requires follow up for monitoring of groundwater near the site. Vulnerable populations living within one mile of the site total 245 residents.

Lake Huron (Chapter 4)

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**
- **Velsicol Chemical Corp**.
- **Shiawassee River**
- **Dow Chemical Co., Midland Location**
- **Tittabawassee River**
- **Laingsburg**

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 three listed sites.

Lake Michigan (Chapter 5)

Muskegon Lake AOC and White Lake AOC: Most of the 12 hazardous waste sites of concern in this AOC have been remediated or in the process of being remediated. The exception is the **Ruddiman Creek Area**. The sediments of the main branch of this creek are contaminated with PCBs and lead at levels of concern for human exposure (and for ecological effects). The sources of this contamination were not discussed and it was concluded that additional sampling was needed to better define the extent of contamination, including sampling of fish, and that warning signs were needed. Data on vulnerable populations were not reported for this site, but the contaminated branch of the creek is located less than 100 feet from several apartment complexes and an elementary school.

Kalamazoo River AOC: Most of the six hazardous waste sites of concern in this AOC have been remediated or are in the process of being remediated. The exception is the **Allied Paper/Portage Creek/Kalamazoo River site**, 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. As of 2000, ATSDR reports that the state was creating a study cohort of anglers, examining their fish consumption patterns, and obtaining medical histories and blood specimens for analysis. No other information was available from the state. Vulnerable populations within one mile of the site total approximately 33,000 residents.

Grand Calumet AOC: Most of the 14 hazardous waste sites of concern in this AOC have been remediated or are in the process of being remediated. One exception is the **Celotex Corporation.** As of 1999, this site posed a health threat for incidental ingestion of soil containing the critical IJC pollutant B(a)P, together with other carcinogenic PAHs [as B(a)P equivalents]. Although the site itself had been covered with clean soil, and had undergone measures to reduce flooding, the residential properties had not been remediated as of 1999. It is unclear whether the measures taken onsite were adequate to prevent migration of the contamination or how high the onsite contamination was. The extent of offsite contamination, however, is not great, involving only four residential properties. Data on vulnerable populations were not reported for this site. The second exception is the **Electro Finishers.** This site has contributed in a limited manner to the environmental burden of and human exposure to lead but more so to chromium. The site is small. Although lead concentrations in soil were high (3,700 ppm maximum concentration in soil outside the building), the total impact is probably not that large. However, the chromium at this site is of concern. Chromium contamination of soil was very high, and migration offsite had occurred, with some of the chromium still present as chromium (VI) in the sump water and on the inner walls of a next door basement. ATSDR concluded that evaluation of additional residential properties was needed. Data on vulnerable populations were not reported for this site. The third exception is the **Estech General Chemical Company** which had contamination of the soil. Lead, an IJC critical pollutant, was found in soil at the site at levels of health concern for

the adult men living on the site who dig for scrap metal. There may have been some migration of contaminants offsite to sediment but details were not provided. Demographic profiles for vulnerable populations living within one mile of this site were not reported. The total population living within a one mile radius of the site is approximately 13,500.

Waukegan Harbor AOC: Most of the eight sites had been remediated or were in the process of being remediated. One exception is the **Diamond Scrap Yard.** The Diamond Scrap Yard poses a health hazard for people currently living in an abandoned foundation onsite due to elevated levels of lead in soil. Groundwater also is contaminated with lead but is not in use. The direction of groundwater flow was not reported. The demographic profile for vulnerable populations living within one mile of this non-NPL site was not reported. The total population within a one mile radius of the site is 15,155. A second exception is the **Precision Chrome** site. Groundwater that is used as a source of drinking water is contaminated with lead, manganese, and chromium, including chromium (VI). Drinking water wells in the vicinity have not been monitored adequately and no remedial activities were taking place at the time of the 1998 assessment by ATSDR. In a Health Consultation of Precision Chrome (dated March 8, 2006 on the HazDat web site), the Illinois Department of Public Health indicated that it was not known whether private and public drinking water wells on and near the site had been contaminated. The department has recommended that the public and private drinking water wells in the area be sampled. Sampling was done but ATSDR was unable to obtain more information from the state of Illinois about sampling results (June 1, 2006). Data on vulnerable populations residing near this site were not reported. The **Outboard Marine Corporation** has contributed to the environmental burden and to human exposure from PCBs in fish. The EPA reports that the site and sediments are undergoing clean up. The site has also been designated as an Environmental Justice Revitalization Project which will enable the area to receive funding for redevelopment and for educating vulnerable populations (e.g., women of child bearing age) about consuming PCB-contaminated fish. The total population within a one mile radius of the site is 7,040.

Milwaukee Estuary AOC, Milwaukee County WI: Three of the nine sites in this AOC continue to contribute to the burden of ICJ critical pollutants and to human exposure. The **Boerke Property** is one. No IJC critical pollutants have been associated with the site, but the nature and extent of contamination has not been well characterized. The site is highly contaminated with arsenic, some of which is migrating to Lake Michigan, but the amount of arsenic waste was not estimated. Data on vulnerable populations for this site were not reported.

The **Former Tannery** site is another. Although a small, non-NPL site, it is heavily contaminated with PCBs in soil and waste onsite and appears to have contributed to PCB loading of the Kinnickinnic River, and therefore, probably to fish contamination. Fish consumption advisories have been issued for a number of fish species on this river due to PCB contamination. In addition, the concentration of PCBs in onsite soil and waste are a public health threat. 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 **St. Francis Auto Wreckers** is the third. The contamination at this site has not been adequately characterized. Lead and PCBs in soil were at levels of health concern but surface soil data were lacking. There were no data to indicate that the site is a major contributor to environmental burdens of IJC critical pollutants or to human exposure. However, children playing in the unfenced vacant lot

could be potentially exposed. Demographic profiles for populations living within one mile of this site were not reported for this site. Approximately 100 people live within 300 meters of the property and about 750 live within 600 meters.

Sheboygan River AOC: Of the two waste sites, t**he Sheboyagan Harbor & River,** extending from Sheboygan Falls to Lake Michigan and into the harbor is an NPL site of concern. PCB-contaminated media have been removed or immobilized and additional extensive remediation of sediments is planned. However, the site may be contributing to PCB contamination of Lake Michigan. In addition, PCBs, primarily from the **Tecumseh Products Company**, contaminate river bank soil, sediments, fish, and waterfowl at levels that may be associated with adverse health effects. Health outcome data indicate that infants of mothers who ate two meals per month of fish from the Sheboygan River or Lake Michigan gave birth to infants with a higher rate of infectious illnesses. This finding was published by Smith in 1984. Vulnerable populations living with one mile of the site include about 17,300 people.

Lower Green Bay and Fox River AOC: Two existing hazardous waste sites are of concern. The **Better Brite Plating Company** is one. The 1996 and 2002 documentations from HazDat on chromium, and particularly chromium (VI), demonstrate that chromium remains a problem at this site. ATSDR has recommended that residents and workers have restricted contact to chromium (VI) in order to prevent exposure to this substance. A vulnerable population of approximately 5,000 residents lives within one mile of this site. The second site, **Fox River NRDA/PCB Releases** site, 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 along the Fox River. Fish from the Fox River and wildlife in the area are contaminated with PCBs. Other IJC critical pollutants also contaminate the sediment but do not contribute significant health risk relative to that posed by PCBs. The site is in the process of being remediated. Although the site was proposed for the NPL, it has yet to be officially designated as an NPL site. No public health outcome data were reported for this site. No reports were available for vulnerable populations residing within one mile of this site. However, approximately 270,000 residents live in communities along the Fox River itself.

Lake Superior (Chapter 6)

St. Louis River and Bay AOC: Of the three hazardous waste sites, two are of concern. The major site in this AOC is the approximately 900-acre **St. Louis River Site,** which actually comprises two very large sites located on the river. These sites were involved in steel, coke, and tar manufacturing. Soil and river sediments were heavily contaminated with PAHs (likely including B(a)P). HazDat documentation for 2001 shows dioxin, furans, mercury, PCB, and PAHs contaminating sediment onsite. Offsite, methylmercury has contaminated fish. ATSDR recommended the cleanup of sediments and other remedial action and evaluating human health risks from these remedial actions. Removal of sediments at this site has occurred. No public health outcome data were reported for the site. Vulnerable populations living within one mile of the site total about 2,000 residents. The second site is the **Koppers Company Superior Plant.** The Koppers facility has contaminated the Crawford Creek basin with PAHs, including the IJC critical pollutant B(a)P, and other creosote-related chemicals at levels of public health concern. Whether PCDDs and PCDFs have accumulated in fish to levels of concern could not be

determined. Demographic profiles for vulnerable populations living within one mile of this site were not reported.

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 released 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-land filled 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 ANALYSIS OF THE GIS MAPS AND THE TRI AND NPDES DATA

The GIS maps of these AOCs are discussed in this section because of the numerous TRI and NPDES sites shown on the maps for these sites. The areas within the AOCs where releases of chemicals have occurred are densely populated with schools and hospitals in proximity to these sites.

Black River AOC

The GIS map for the Black River AOC shows a number of TRI onsite chemical releases (2001), NPDES surface water discharges (2004), and CERCLIS sites in the northern part of the AOC. These discharge sites are located in populated areas (i.e., up to 15,000 residents per square mile) where numerous schools and nearby hospitals are located. In addition, there are numerous TRI, NPDES, and CERCLIS sites in the populated southeast area (and outside of the AOC) where many schools and hospitals are located.

The TRI onsite releases numbered approximately 3 million pounds of chemicals, mostly to air with smaller amounts to water. Lead and mercury (mostly to air) were the most common IJC critical pollutants released. Hydrochloric acid and sulfuric acid were the most common non-IJC pollutants released to air.

Approximately 250,000 pounds of chemicals were discharged to surface waters at this site, as documented in the NPDES data, with lead as the most common IJC critical pollutant. Phosphorus and ammonia nitrogen were the two non-IJC pollutant most frequently discharged at this site.

Vulnerable populations residing within the AOC county totaled approximately 124,000 residents.

Clinton River Area of Concern

The GIS map for the Clinton River AOC shows a number of TRI onsite chemical releases (2001), some NPDES surface water discharges (2004), and CERCLIS sites in the southern part of the AOC. These discharge sites are located in populated areas (i.e., up to 15,000 residents per square mile) where numerous schools and some hospitals are located. There are numerous TRI and CERCLIS sites outside the boundaries of the AOC in the southwest and southeast sections of the area.

TRI onsite releases numbered around 4 million pounds of chemicals, primarily to air. Only a small portion of the releases were IJC critical pollutants (lead to land and air and mercury to air). Non IJC pollutants most often released at this site included xylenes and glycol ethers to air.

NPDES permitted discharges to surface water numbered around 1 million pounds. The IJC critical pollutant most often discharged at this site was lead. Ammonia nitrogen and phosphorus were the two most common non-IJC pollutants discharged.

The vulnerable population residing within the AOC counties totaled approximately 500,000 residents in Oakland County and 300,000 residents in Macomb County.

Cuyahoga River AOC

The GIS map for the Cuyahoga River AOC shows numerous TRI onsite chemical releases (2001) and also a number of NPDES surface water discharges (2004) in populated areas (i.e., up to 15,000 to 40,000 residents in a square mile area) in the northern part of the AOC. CERCLIS sites can also be seen in the same northern area where numerous schools and hospitals are located in proximity to the discharge sites. There are also numerous TRI, NPDES, and CERCLIS sites situated in populated areas (i.e., up to 15,000 residents in a square mile) south and outside of the AOC.

The TRI chemical releases numbered around 5 million pounds for the two AOC counties (Cuyahoga and Summit) dispersed mainly to air, secondarily to soil, and then to water. Lead was the most common IJC critical pollutant released at this site (released mainly to air). Zinc compounds (to land) and 1-chloro-1,1-difluoroethane (mainly to air) were the primary non-IJC pollutants released.

The NPDES data revealed almost 5 million pounds of permitted discharges to surface water for 2004, mostly ammonia nitrogen, phosphorus, and nickel (non-IJC pollutants). Of the IJC critical pollutants, lead was the most frequent chemical discharged to surface waters with a small

amount of mercury also being discharged. The demographic profile for the two counties encompassing the AOC show a relatively densely populated area of around 900,000 residents (Cuyahoga 600,000 and Summit almost 250,000 residents).

Maumee River AOC

The GIS map for the Maumee River AOC shows numerous TRI onsite chemical releases (2001), NPDES surface water discharges (2004), and CERCLIS sites in populated areas (i.e., up to 15,000 residents in a square mile area) in the north central part of the AOC. These sites are located in proximity to numerous schools and a number of hospitals.

Onsite TRI releases in the AOC counties (Lucas, Ottawa, and Wood) totaled almost 17 million pounds of chemicals, mostly in Lucas County (to air). Lead (mainly to land) was the chief IJC critical pollutant released with the most common non-IJC pollutants being manganese and zinc (mainly to land).

The NPDES data revealed over 7 million pounds of permitted discharges to surface water for 2004, mostly ammonia nitrogen and phosphorus (non-IJC pollutants). Of the IJC critical pollutants, lead was the most frequent chemical discharged to surface waters with a small amount of mercury also being discharged. Total vulnerable populations were approximately 200,000 residents in Lucas County, 18,000 for Ottawa County, and 53,000 for Wood County.

Rouge River AOC

The GIS map for the Rouge River AOC, located in the Wayne and Oakland Counties, shows numerous TRI onsite chemical releases (2001) and CERCLIS sites in populated areas (i.e., up to 15,000 residents in a square mile area) within the southern part of the AOC. There were fewer NPDES sites in this AOC. In addition, numerous TRI and CERCLIS sites can be seen to the east and outside of the AOC. All these sites are located in proximity to numerous schools and a number of hospitals.

Onsite TRI releases in the AOC counties totaled almost 25 million pounds of chemicals, mostly to air and land and to Wayne County. PCBs and lead were the chief IJC critical pollutant released totaling almost 2 million pounds of the 25 million. The most common non-IJC pollutants were hydrochloric acid, xylenes, glycol ethers, n-butyl alcohol, and toluene (mainly to air). Nickel, selenium, and arsenic were the other non-IJC pollutants released mainly to land.

The NPDES data revealed around 5 million pounds of permitted chemical discharges to surface water for 2004. Of the IJC critical pollutants, lead was the most common chemical discharged to surface waters with a smaller amount of mercury. Phosphorus and ammonia nitrogen were the most common non-IJC pollutant. Vulnerable populations residing in the AOC counties included almost one million residents in Wayne County and around 500,000 residents in Oakland County.

Lower Green Bay and Fox River AOC's

The GIS map for the Lower Green Bay and Fox River AOCs does not show the numerous TRI, NPDES, and CERCLIS sites (as seen in the other AOC sites discussed above). However, the Fox River NRDA/PCB Releases site located in this AOC is the greatest contributor of PCBs to Lake Michigan. Although PCB releases to the river stopped in 1970, the contamination persists and has bioaccumulated in the food chain. The site has not been remediated. Fish advisories have been issued for contaminated fish. The total population residing along the Fox River is approximately 270,000 residents.

7.4 HEALTH OUTCOME DATA

Health outcome data for the counties that immediately encompass and surround the 26 U.S. AOCs were obtained from *Community Health Status Reports* (http://www.phf.org/data-infra.htm) produced in 2000 by the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services. The county represents the smallest geographic area for which health outcome data are available. The Community Health Status Reports compare measures of birth and death (e.g., morbidity outcomes of low birth weight and mortality rates from infant deaths and from diseases such as cancer) for a county with peer counties and were utilized because of their availability. These statistics are used for research studies and to set health policy based on the observed health outcomes for a given community.

The peer counties are other counties and county-like geographic areas (usually 20 or more) that are similar in population size and density, poverty, and age structure to the counties of interest. The health measures also are compared with the U.S. rates. The AOC county health measures (health status indicators) that compare unfavorably with the median of the peer counties and also with the U.S. population data merit further attention. Differences between the peer counties, the U.S. population data, and the U.S. AOC counties indicate elevated rates of disease beyond the norm (norm being the peer counties and the U.S. population data). Health status indicators that exceed the upper limit of the 90% confidence limit of the median for the peer county range and the median of the U.S. rates are reported.

According to analysis of ATSDR's HazDat database for 2003, there were over 15,000 instances where contaminants of concern were found at levels above health–based screening values in a variety of media (i.e., water, air, and soil). While no causal inferences or associations are made in this report of the 26 AOCs, elevated rates were observed for infant mortality in 21 AOCs, low birth weight in 6 AOCs, and premature births in 4 AOCs. Elevated cancer mortality was also seen for breast cancer in 17 AOCs, colon cancer in 16 AOCs, and lung cancer in 12 AOCS (see Table 7.2).

The U.S. AOC county health data are an appropriate reflection of the population health characteristics of the impacted U.S. AOC. The selected health outcome data are health indicators that could be influenced by external conditions. In addition, outcomes, such as unmarried mothers or no first trimester care are indicators of socio-economic status. The U.S. Census Bureau reports that half of the unmarried mothers giving birth in the last year (2004) lived below the poverty level. Studies have shown that persons in the lower socio-economic

groups do not have access to medical care as those in the higher socio-economic groups. In instances where low birth weight (LBW) and no first trimester care (or unmarried mother status) occurred simultaneously, the lack of medical care in the first trimester of pregnancy (or unmarried mother status) could be responsible for the low birth weight infant. Further analysis of this data addressing differences based on race and income may further contribute to our understanding of these patterns of morbidity and mortality.

Great Lakes research has shown an association between prenatal exposure to PCBs and LBW. If PCBs have been detected at sites with health outcomes of LBW, the association between the potential exposure to PCBs and LBW at a site might be real or confounded by the simultaneous presence of lack of medical care during the first trimester of pregnancy (or unmarried mother status). Medical care during the first trimester of pregnancy is important to facilitate the birth of a healthy infant. Ecological biases may also be possible.

7.5 LIMITATIONS OF THE REPORT

Since this study is not an epidemiologic study, adjusting for confounding factors is not considered a limitation since no causal relationships or associations are inferred. Nevertheless, this report has certain limitations that would tend to underestimate patterns of contamination as well as potential health effects to vulnerable populations. These are:

- Since county-wide data are used to ascertain health outcomes, a dilution or underestimation of effects may result since it includes residents that are not among those most highly exposed.
- Elevated rates of certain health outcomes may be due statistically to chance alone. Chance alone may not be responsible in instances such as the association between potential exposure to PCBs at an AOC site and the simultaneous elevated occurrence of low birth weight. The association may be real, given the epidemiologic research that suggests this linkage.
- The U.S. AOCs may be located across more than one county or be confined within a much localized area in a county. In these instances, the county data may not be totally representative of the population residing in proximity to the site.
- County-wide data would not differentiate between rural or urban industrial area populations or among lower socioeconomic or affluent areas.
- Use of existing health outcome data (rather than more sensitive health outcomes) that may miss subtle health conditions, such as functional deficits, fertility, cognition, or immune function.
- Elevated rates of certain health outcomes may be due to chance alone.
- Both the TRI, as required under TSCA, and NPDES information rely on self-reporting mechanisms. Neither source of information reflects the potential for human exposure.

7.6 SUMMARY

Based upon concern regarding pollutant burdens and health effects in the Great Lakes, Congress directed ATSDR, through the Great Lakes Critical Programs Act 1990, to evaluate the health status of the citizens of the Great Lakes states from the pollutants in the waters. Current insights

derived from this evaluation effort regarding the potential for such health effects are summarized in peer reviewed literature and an Expert Panel Report (Appendix).

This report should not be construed as a traditional analytic epidemiologic evaluation. Instead, it should be viewed as an assessment to identify the co-occurrence of elevated patterns of morbidity and mortality and environmental contamination that may merit further hypothesis-based epidemiologic study. ATSDR makes no causal inferences or associations with regard to the contaminants found at these sites and certain health outcomes. The report does, however, give an overview of the pollution at these sites and the health status of residents, when contrasted to comparable populations. The AOC county health measures (health status indicators) that compare unfavorably with the median of the peer counties and also with the U.S. population data merit further attention. Differences between the peer counties, the U.S. population data, and the U.S. AOC counties indicate elevated rates of disease beyond the norm (norm being the peer counties and the U.S. population data).

Future studies investigating the associations between potential exposures to contaminants found within the AOCs and health outcomes should consider examination of smaller, targeted areas near waste sites and/or other sources of contamination. These prospective analytic epidemiologic studies should address sensitive health outcomes (e.g., functional deficits in cognition, immune function, and fertility); confounding factors; critical exposure periods and disease latency; and the effect of mixtures of chemicals. Ecological studies are not being proposed. The proposed studies would use actual exposure data.

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

Section in Document	Great Lake	AOC	State	County Name	Lead and Lead Compound	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**

[1]2001 Total onsite releases, in pounds. Details are provided in the TRI tables in Chapters 2-6. Zero values indicate no releases were reported

Table 7.2. Elevated Rates of Morbidity[1] and Mortality[1] within 26 U.S. Great Lakes AOCs [2]

LAKE Area of Concern	MORBIDITY		MORTALITY			
	Low Birth Weights	Premature Births	Infant	Breast Cancer	Colon Cancer	Lung Cancer
LAKE ONTARIO						
Oswego River			X		X	
Rochester Embayment			X			
Eighteen Mile Creek			X	X		X
LAKE ERIE						
Buffalo River			X	X	X	X
Presque Isle Bay			X	X		
Ashtabula River				X	X	
Cuyahoga River	X	X	X	X	X	X
Black River			X	X	X	X
Maumee River			X	X	X	X
River Raisin			X		X	X
Rouge River	X	X	X	X	X	X
Clinton River			X		X	X
LAKE HURON						
Saginaw River and Bay	X		X	X		X
LAKE MICHIGAN						
Muskegon and White Lakes[3]			X	X		
Kalamazoo River	X		X		X	
Grand Calumet	X	X	X	X	X	X
Waukegan Harbor				X	X	X
Milwaukee Estuary	X	X	X		X	
Sheboygan River					X	
Lower Green Bay / Fox River			X	X		
Menominee River			X	X	X	
Manistique River			X	X		X
LAKE SUPERIOR						
Deer Lake			X	X		
Torch Lake						
St Louis River and Bay			X	X	X	
TOTALS	**6**	**4**	**21**	**17**	**16**	**12**

Source: Community Health Status Reports (http://www.phf.org/data-infra.html) , Health Resources Services Administration (HRSA), U.S. Department of Health and Human Services.

[1] The morbidity and mortality rates are derived from data for the county in which the AOC is located. Blank cells indicate that the morbidity or mortality condition was not reported. Limitations of the report are in text.

[2] AOCs: Area of Concern

[3] Muskegon Lake and White Lake AOCs are combined because they are both in Muskegon County