Chapter 4

Lake Superior Critical Pollutants

Pulp Mill Smokestack near Terrace Bay, ON
Photograph by: Patrick T. Collins, MN DNR

Lake Superior Lakewide Management Plan
2000

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Lake Superior Critical Pollutants

EXECUTIVE SUMMARY

Annex 2 of the 1987 amendments of Great Lakes Water Quality Agreement (GLWQA) commits the United States and Canada to a framework for the restoration and protection of beneficial uses through the development and implementation of Remedial Action Plans for specific Areas of Concern and Lakewide Management Plans (LaMPs) for open lake waters. Each LaMP is intended to identify the critical pollutants that affect the beneficial lake uses and to outline the strategies necessary to reduce loadings and restore those uses.

In 1991 the Lake Superior Binational Program (LSBP) was established for the lake in order to restore and protect the basin. The LSBP has a number of ecosystem objectives for the lake including a Zero Discharge Demonstration Project; which has as its primary goal the virtual elimination of the discharge and emission of nine persistent bio-accumulative toxic chemicals. While the LaMP for Lake Superior is formulated under the GLWQA and addresses the requirements of that agreement, the LaMP for critical pollutants also serves to carry out the goals and objectives of the Lake Superior Binational Program.

The Stage 2 Lake Superior LaMP mapped out a 20-year path for zero discharge by establishing load reduction schedules and targets. Stage 3 takes the next step by identifying the reduction strategies and actions needed to achieve the targets. Chapter 4 of the LaMP 2000 satisfies the Stage 3 GLWQA requirements for the Lake Superior LaMP.

Within Section 4.1 the nine chemicals targeted for reduction are organized into four groups: Mercury; PCBs; Pesticides; and, Dioxin, HCB and OCS. The 1990 base line inventories for each group are presented together with a report of the successes to date; and the types of strategies that will be pursued over the next 2 to 3 years to meet interim targets for zero discharge.

Section 4.2 of this chapter identifies the goals, strategies and actions that the binational partners have committed to undertake both individually or collectively for the nine chemicals. Section 4.3 organizes the strategies and actions by sector. Individually the agencies have made over 200 commitments including actions which maybe considered further into the future. Section 4.4 identifies strategies to restore contaminated sites. Section 4.5 outlines monitoring strategies to quantify the results from the proposed LaMP 2000 actions. Section 4.6 is a short summary of the planning and reporting activities which will be undertaken by the partners. Addendum A details the chemical inventories and assumptions which are used for load reduction estimates in Section 4.1.

Highlights

Chapter 4 documents significant improvements in all of the four major critical pollutant categories: Mercury, PCBs, pesticides, and dioxin, HCB and OCS. Although successes have been achieved over the past decade, significant challenges have also emerged for the future. These challenges must be addressed in order to achieve further reductions in some categories and to ultimately protect Lake Superior in the long term.

Releases of the nine designated chemicals have declined since the 1990 baseline year. Reductions have occurred as a result of: voluntary reduction efforts by facilities in the Basin; new competitive technologies and products; facility closures; and Federal, State and Provincial regulations.

Mercury

Significant reductions in mercury use and emissions in the Lake Superior Basin have occurred in the last decade as a result of ore smelting and processing plant closures in both Canada and the United States and a significant decline in mercury content in commercial products The largest contributing sources of mercury are from mercury-bearing products; emissions from the mining sector; and fuel combustion. While significant reductions have been achieved in the use of mercury in commercial products, mercury emissions continue at relatively high levels from mining operations and fuel combustion associated with electrical generation.

The 1999 estimate of 819 kg/yr of on-going mercury releases represents a 66 percent reduction from the 1990 estimate of 2,444 kg/yr. This reduction fulfills the year 2000 LaMP target of 60 percent reduction for mercury releases within the basin.

The major challenge for the long term protection remains the air emissions of mercury from sources both within and beyond the basin.

PCBs

The LaMP reduction goal calls for 100 percent destruction of PCBs in the Lake Superior basin by the year 2020. The concern with PCB reductions within the Lake Superior Basin is not their ongoing release; rather, the prevention of future releases through the removal of PCBs in use and the destruction of PCBs in storage.

Different reporting and classification standards between the two countries for PCB-bearing products remaining in use or in storage, makes it difficult to quantify whether or not the year 2000 target for 33 percent has been achieved. However, a comparison of estimates for products which remain in use or in storage and those which have been destroyed over the past decade, indicate that Canada and the United States are making progress to achieving a 60 percent destruction target set for the year 2005.

The PCBs which remain in storage or in use are within the municipal, utility, mining and industrial sectors. The challenge for regulatory authorities is to facilitate and encourage the continued decommissioning and destruction of PCB stores and equipment to meet the 2005 target.

Dioxin, HCB, and OCS

In 1990, most of the dioxin released to the atmosphere was produced by small incinerators in the U.S. associated with institutional, commercial and residential uses. Since the 1990 virtually all of these small, inefficient incinerators have been phased out, resulting in a very large reduction in dioxin air emissions. Closures of ore processing facilities and medical waste incinerators in both countries have also contributed to significant reductions in dioxin emissions.

The available data for HCB and OSC emissions are too sketchy to confidently predict the change in releases of these pollutants within the Lake Superior Basin since 1990. The available data suggest that the major sources of dioxin, such as incineration, are also sources of HCB and OSC. Until better monitoring data and assessments are available, dioxin trends will substitute for HCB and OSC trends. Estimates for 1999 indicate that reductions in emissions of dioxins are in the range of 75-95 percent. Although a more accurate estimate can not be made as a result of baseline variables, it is clear that significant progress has been made to meet the year 2005 target of 80 percent reduction.

As the major sources of dioxin come under control the new challenges for the future will come from smaller commercial and residential incineration emissions; from continuing long range atmospheric transport; and from commercial products containing trace level dioxin impurities.

Pesticides

The LaMP reduction goal for targeted pesticides is to retrieve and destroy all stockpiles by 2000. Documentation for collections has been inconsistent in the past. Not all collections have been reported by specific pesticide. Stores of these substances likely still remain in the Lake Superior Basin. It is not possible to determine with certainty that all stockpiled pesticides will be accounted for by 2000. Stockpiles of pesticides used in the past for agriculture, silviculture, and household purposes may still be held by residents, or may become orphaned when property is sold. Collection and outreach programs should continue into the future.

The challenges for the future remain: the continuation of collection efforts; the education of the public both within and outside of the basin; and the long term problem of atmospheric transport of pesticides.

Conclusions

As the chapter illustrates, the strategies to achieve future reduction targets are many and varied. Voluntary agreements and cooperative efforts among regulatory authorities and emitters are a common theme for all categories of pollutants. Outreach programs remain key to achieving long term reductions and are central strategies to each group of pollutants. Innovative strategies such as product stewardship and incentive programs are presented. Some regulatory strategies are also proposed for the future.

While the LaMP strategies will lead to further reductions in the near term from sources within the basin, the long term protection for Lake Superior will be dependent on expanding these regional initiatives to pollution sources outside of the basin. The challenge facing both federal governments is to deal with the long range transport of pollutants from outside the basin. All agencies will remain very active within the basin to deal with regional issues. Product stewardship programs and more environmentally benign products need to be addressed comprehensively. Locally partnerships will be required to provide the resources for major restoration projects, to deal with technological gaps and to undertake future monitoring requirements.

Figure 4-1. Action Summary

No.[a]	Project Description	Lead Agency/Commitment[b]										
		BR	EC	EPA	FDL	GP	KBIC	MI	MN	ON	RC	WI
		LEVEL										
1	Establish voluntary agreements to reduce use, discharge or emissions of the nine designated chemicals		1	1				1	1	1		1
2	Establish voluntary agreements to reduce the use or releases of PCBs			1								
3	Continue discussions with seven pulp and paper mills		1							1		
4	Evaluate economic incentives to promote reductions							2				
5	Provide financial support for pollution prevention projects	1		1				1	1			1
13	Develop purchasing policies to eliminate mercury or PCB equipment	1						1	2			
14	Introduce process chlorine-free paper products						1				1	
18	Develop depot and reverse distribution systems for citizens		1	1				2		2		
19	Encourage dialogue on import of mercury-bearing products and nationwide labeling of mercury products			2				1	2			
20	Establish depots for mercury-containing household products		1							1		
21	Investigate feasibility of redrafting legislation to accommodate product stewardship									2 PM		
22	Promote energy conservation programs	1	2	1				1	1	1		1
23	Home and industry energy audits	1	2					1		1		
24	Encourage municipal energy councils		2						2	1		
25	Establishment of mandatory “line charge” for demand side energy efficiency projects								2			
26	Incorporating energy conservation into new structures				1							
27	Encourage upgrades to energy-efficient thermostats					1						1
28	Re-lamping with fluorescent lamps						1					
32	Initiate or continue permanent household and agricultural hazardous waste collection depots	1	2	1	1		1	1	2	2 PM	1	1
33	Assist in conducting industrial clean sweeps and use economy of scale for collections and shipments of hazardous waste	2						2			1	1
34	Initiate and continue periodic abandoned “white goods” collections	1			1	1	1	2			1	

Figure 4-1. Action Summary

No.[a]	Project Description	Lead Agency/Commitment[b]										
		BR	EC	EPA	FDL	GP	KBIC	MI	MN	ON	RC	WI
		LEVEL										
35	Complete the PCB and mercury Clean Sweep pilot project and recycle PCB-free oil			1								
38	Increase awareness of the risk of pesticides use			1						2 PM		
47	Insist on highest standards and best available technology for new incinerators		2	2								
48	Prevent of remove chlorinated or mercury containing material from incinerator feedstocks		2					1		1		
49	Burn barrel outreach and local ordinances	1		1	1			1	1			1
50	Evaluate adoption of law prohibiting disposal of mercury-bearing waste							1				
51	Municipal source separation programs to divert household hazardous materials		1							1		
55	PCB “mentors” to assist small facilities		1	1				2	2			
56	Formation of PCB cooperatives		1						1	1		
57	Include PCBs in outreach and hazardous waste collections for small businesses	1	2	1				2		1		
58	Destroying PCBs in use or storage	2		1				2	2	1		
59	Training sessions for small PCB owners		1							1		
60	Monitoring and documentation of PCB-bearing equipment until removal		1							2 PM		
61	In-basin destruction capability for low level PCBs		1							1		
62	Testing of transformers and capacitors to identify remaining PCBs			1				2	1			
63	Removal of PCB-bearing equipment in lieu of fines	2		1				1				
64	Testing and removal of PCB-bearing equipment outreach	2							2			
65	Endorsement of PCB reduction goals by power generators			1				2				
66	Formalize the PCB Phasedown Program pilot project			1								
67	Identify federally-owned PCBs			1								
69	Provide training materials for appliance recyclers and auto salvage operators		2					1	1			

Figure 4-1. Action Summary

No.[a]	Project Description	Lead Agency/Commitment[b]										
		BR	EC	EPA	FDL	GP	KBIC	MI	MN	ON	RC	WI
		LEVEL										
71	Training sessions for demolition contractors	2		2				2	1			1
73	Seek out and dispose of mercury and PCBs on school property	1		1				1	1	1		1
75	Develop and distribute information on mercury reduction at schools through the Binational Toxics Strategy			1								
76	Basin-wide coordination of citizen and school monitoring programs	2			1							2
77	Use of a mercury-sniffing dog in schools								2			
78	Green school programs										1	
79	Supplement and develop new curricula aimed at reducing the nine designated chemicals		1									
87	Information on compliance with revisions to Underground Injection Control Regulations			1								
88	Funding for toxic reduction activities and networking	1										1
89	Small business utilization of hazardous waste depots		2							1		
93	Identify facilities using wet scrubbers and investigate control technology								1			
94	Mercury reduction technology for taconite and electric utility industries								2			
95	Conversion from coal burning to alternative sources								2			
96	Experiments to separate mercury-bearing pyrite fraction from coal								1			
100	Making facilities "mercury free" and pollution prevention projects	1	1	1			1	1	1	1		1
101	Partnerships with dental associations	2	1					1	1	1		
103	Voluntary agreements with the health care industry to reduce mercury and dioxin	1	2	1				1		1		1
104	Voluntary agreement with the American Hospital Association			1								
105	Mercury thermometer swap program				1	1						
106	Discontinue sending mercury thermometers home with new mothers and use non-mercury thermometers										1	
107	Apply results of the 1999 City of Toronto pilot to the Thunder Bay area		2							2 PM		
108	Regulatory exemption for mercury wastes reclaimed from dental offices									2 PM		

Figure 4-1. Action Summary

No.[a]	Project Description	Lead Agency/Commitment[b]										
		BR	EC	EPA	FDL	GP	KBIC	MI	MN	ON	RC	WI
		LEVEL										
114	Alternative energy sources	1				2			2	2 PM		
116	Determination on regulation of mercury emissions from electric utilities			1								
117	Funds to support mercury research in a number of priority areas			1								
118	Workshops on reduction of mercury-containing devices at utilities			1								
119	Utilities converting from coal burning to alternative sources								2			
120	Conversion from coal burning to natural gas for utilities; householders develop an energy conservation ethic										2	
125	Remove PCBs in storage at pulp and paper mills		1							1		
126	Clean up of mercury-contaminated sediments in Peninsula Harbour		1							2		
127	Reduce dioxin and furan discharges from pulp bleaching process									1		
128	Assessment of existing wood preservation facilities and voluntary programs		1									
137	Development of a mercury reduction plan at a manufacturing plant			1								
138	Use, generation, and environmental release of critical pollutants at oil refineries											2
141	Expand the Pollution Prevention Demonstration Site Program to include Canadian Federal facilities and First Nations		2									
144	Coordinate critical pollutants reduction strategies with TMDL reductions or limits under Ontario's Certificate of Approval process				1				1	1		
145	Technical and regulatory assistance on how to identify and address Class V wells that may endanger groundwater			1								
146	Priority review to priority Class V wells within source water protection areas			1								
147	Bans on non-essential uses of the nine persistent, bioaccumulative, toxic substances targeted for zero discharge	2						2	2			
148	Require toxic reduction plans in new or reissued NPDES permits	2						1				

Figure 4-1. Action Summary

No.[a]	Project Description	Lead Agency/Commitment[b]										
		BR	EC	EPA	FDL	GP	KBIC	MI	MN	ON	RC	WI
		LEVEL										
149	Include appropriate limits for persistent, bioaccumulative, toxic substance in air emission permits							1	2			
150	Pollution prevention components in enforcement settlements							1				
151	Identify opportunities to reduce storage, use, or release of mercury and PCBs			1				1				
152	Regulations to require monitoring and reporting emissions from industrial and commercial emission sources									1		
156	Applicability of ONRW designation in future reviews of water quality rules								1			
162	Provide sector-specific pollution prevention outreach	1	2	1				1				1
163	Source separation program to divert household hazardous material from landfills and burn barrels						1					
164	Partnerships between the Hearth Products Association for wood stove change-out program			1								
165	Public awareness campaign for community toxic reduction activities				1						1	
166	Recognition program for wastewater treatment plants that implement the Blueprint for Zero Discharge										2	
167	Reduce reliance on petroleum hydrocarbons for energy production and heating at First Nations		2									
168	Support First Nations on contaminated site assessment and remediation		1									
176	Pursue the Great Lakes Binational Toxics Strategy for mercury, PCBs, dioxins, HCB, OCS, and pesticides		1	1				1	2			
178	Require emission limits on pollutants for all operating medical waste incinerators			1								
179	Lowering the nationwide limits on sewage sludge and medical waste incinerators								2			
180	Close the RCRA Subtitle C loop that allows incineration of mercury-bearing hazardous waste								2			
181	Regulations providing cap and trade of mercury emissions											1

Figure 4-1. Action Summary

No.[a]	Project Description	Lead Agency/Commitment[b]										
		BR	EC	EPA	FDL	GP	KBIC	MI	MN	ON	RC	WI
		LEVEL										
182	Establish a national ambient air toxics monitoring network											1
183	Participation in the Great Lakes Regional Air Toxics Emissions inventory											2
184	Purse reductions of mercury, dioxin and hexachlorobenzene through source reduction elimination/segregation at medical waste incinerators	1										
187	Lower reporting limits on persistent, bioaccumulative, toxic chemicals under TRI and NPRI and for PCBs under TSCA	1	1	1					2			
188	Nationwide product stewardship and reverse distribution systems								2			
189	Provide incentives to the utility industry to develop mercury control technology								2			
190	Tighten reporting requirements on export shipments of pesticides								2			
191	Permanently retire U.S. government stockpile of mercury and other sources of elemental mercury			1				2	2			
194	Initiate necessary sediment remediation measures at AOCs		1						2	1		2
195	Complete remedies for Torch Lake and St. Louis River			1								

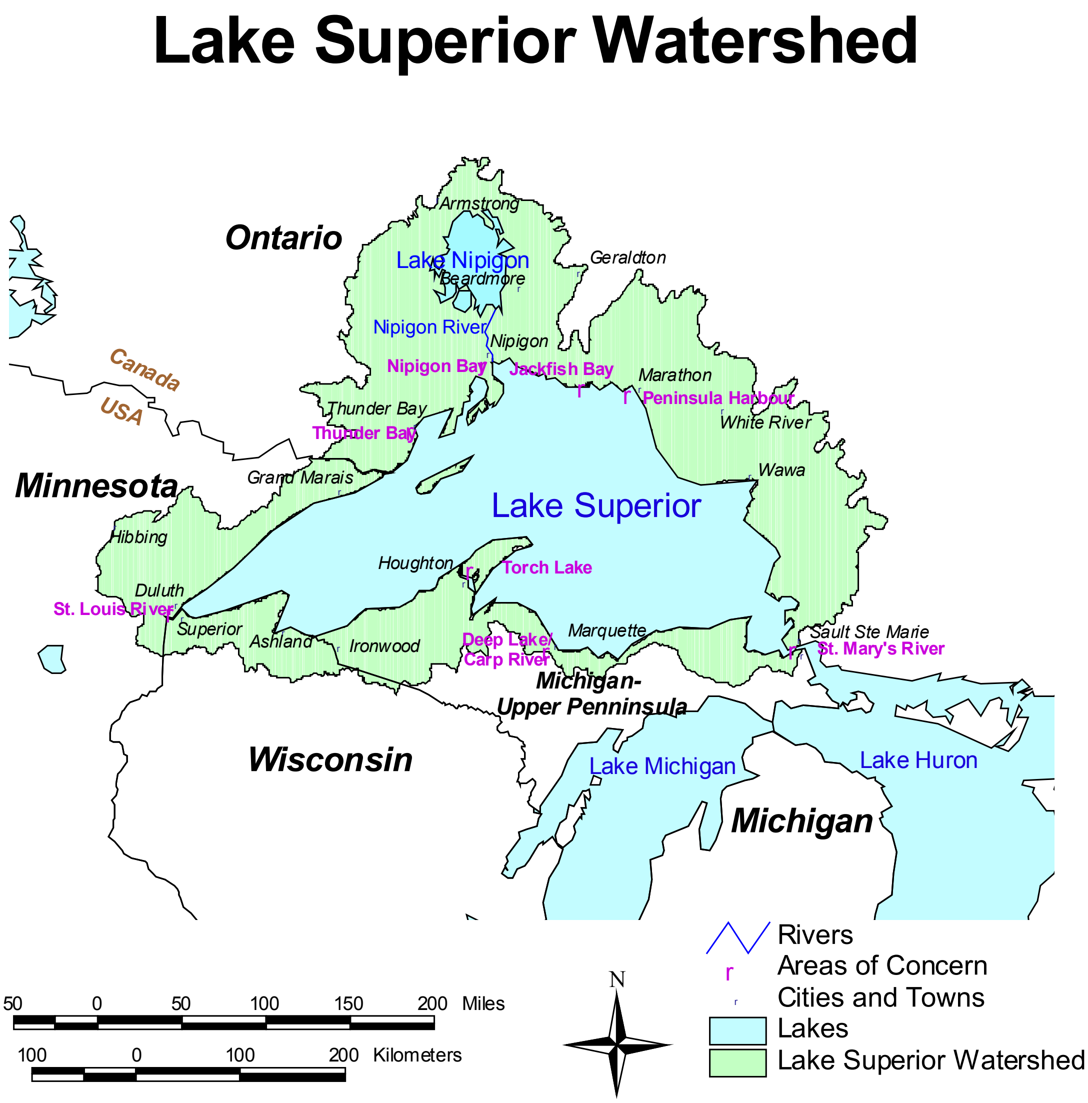
Notes:

a Numbers correspond to number assigned in this chapter of the LaMP.

b Level 1 commitments are actions currently supported or planned to be supported by agencies and member organizations within the next two to three years with funds and/or personnel. In some cases, the initial stages of those activities ranked at this level may already have been completed by some of the agencies or partner organizations such as municipalities. Level 2 commitments are actions that require additional resources or policy decisions in order to be accomplished or supported. In some cases these actions are as important as those in rank (1) to achieve zero discharge.

PM = Policy matter

Figure 4-2. Lake Superior Watershed



4.0 ABOUT THIS CHAPTER

The Lake Superior basin is one of the most unique and fragile ecosystems in North America. Hydrologically, the lake functions as the headwaters of the Great Lakes St. Lawrence basin. The waters are cold and the food chain of the lake is simple. The human populations are sparse and the economy is based on natural resources that require careful conservation.

Annex 2 of the 1987 Canada-U.S. Great Lakes Water Quality Agreement contains a framework for Lakewide Management Plans to restore beneficial uses and reduce the loadings of critical pollutants. In their 1990 biennial report the IJC commissioners called the two governments to establish a Zero Discharge Demonstration Area for Lake Superior. In response government agencies in 1991 established *The Binational Program to Restore and Protect the Lake Superior basin*, also known as the Lake Superior Binational Program (LSBP). Included in this program are a Zero Discharge Demonstration Project, where no point source discharge of any persistent, bioaccumulative, and toxic substance would be permitted, and a broader program that focuses on the non-chemical elements of the Lake Superior ecosystem. While the Lakewide Management Plan (LaMP) process is part of the GLWQA, the LaMP is also serving to carry out the goals and objectives of the Lake Superior Binational Program.

Stages 1 and 2 of the chemical portion of the LaMP, which describe the status of pollutants in the Lake Superior ecosystem and set load reduction targets and schedules for critical pollutants respectively, have been completed. This document, released in 1999 as the draft Stage 3 of the LaMP process, proposed remedial measures for Lake Superior critical pollutants. Based on considerable public and agency review this document was extensively revised and now forms the chemical part of the LaMP 2000.

Section 4.1 succinctly itemizes the quantities of reductions in each country required to meet program milestones established in the stage 2 LaMP for the years 2005 and 2010. This section also provides tabulations of the reductions achieved since our baseline year of 1990. In some cases the 2000 milestones have already been met. The activities needed to achieve the load reduction schedules are identified in Sections 4.2 and 4.3. Specifically, Section 4.2 identifies actions categorized by chemical pollutants while section 4.3 catalogues a larger set of actions arranged by socioeconomic sector. Section 4.4 describes the impairment and status of actions at contaminated sites most of which are within Great Lakes Areas of Concern (see Appendix A for more information on AOCs). Section 4.5 introduces monitoring activities that could be used to track progress toward the goal of zero discharge and zero emissions. Section 4.6 is a short summary of planned program activities.

The implementation activities described in this chapter on critical pollutants are recognized as near-term actions. That is, some of these activities will lead directly to load reductions, while others will prepare the way for more difficult and long-term reductions that are required if we are to demonstrate zero discharge in the basin. The Lake Superior environmental agencies recognize that reduction activities will be needed well into the future. However, it is not possible at this point to identify every action that needs to be taken. As a result, this document describes those activities that the agencies will undertake or encourage others to implement in the next two to three years. The LaMP is intended as a living plan for action that will be updated every two years by the LSBP agencies.

The iterative nature of the LaMP allows agencies to pursue short term load reductions and long term strategies concurrently. We are well aware that the commitment to zero discharge by 2020 will require the imagination and planning of all stakeholders.

In future iterations LaMP documents, additional commitments will be identified, progress will be tracked and additional evaluations of the lake and its critical elements will be presented. Like the Lake Superior ecosystem itself, the LaMP process is evolving and adapting to the needs of the lake and its people.

4.1 PROGRESS TOWARD ZERO DISCHARGE

Section 4.1 discusses the progress made in the Lake Superior basin for the nine virtual elimination pollutants. Section 4.1.1 discusses strategies for reduction and Section 4.1.2 describes load reductions for mercury, PCBs, dioxins, and pesticides.

4.1.1 Strategies for Reduction

The LaMP Stage 2 mapped out a path for zero discharge by establishing load reduction schedules and targets. Table 4-1 provides a summary for the nine virtual elimination pollutants. Stage 3 goes the next step by identifying the reduction strategies and actions needed to achieve the targets. While it is not possible to identify all the strategies considering that the timeline stretches until the year 2020, the following actions are needed in order to meet the next milestones coming up in either 2005 and 2010:

<u>Mercury:</u> in order to meet the 2010 target of an 80 percent reduction, discharges and emissions will need to be reduced from 2,444 kg/yr in 1990 to 489 kg/yr in 2010. The largest contributing sources are mercury from products, mercury emitted from the mining sector and fuel combustion.

<u>PCBs:</u> in order to meet the 2005 target of 60 percent reduction, both countries will need to destroy PCBs in use or in storage. In Canada, an additional 173,427 kg of high level PCBs should be destroyed and low level PCB destruction should be tracked. At present, the US inventory is insufficient to give an accurate estimate. Untested equipment must be tested, owners should begin decommissioning PCBs that are currently in use and the governments should assist the effort to test and decommission. The U.S. testing will lead to an improved inventory so progress towards the 2005 target can be better quantified.

<u>Dioxin/HCB/OCS:</u> While the US and Canada appear to already be ahead of the 80 percent reduction by 2005 target for dioxin/HCB/OCS, there are gaps in the inventory. As more information becomes available on the sources and loads from the basin, estimates for the base line year may change, which will also change our estimate of progress towards the 2005 goal. In the meantime, the remaining largest sources of dioxin within the basin, appear to be burn barrels, wood treatment with pentachlorophenol (PCP) and the disposal of fly ash from the

incineration of medical wastes. Reduction strategies that should be applied before 2005 include public education and aggressive identification of burn barrels and investigation of ongoing use of PCP and PCP contaminated sites.

Pesticides: The Stage 2 LaMP schedule is to retrieve and destroy all stockpiles in the basin by 2000. Although large amounts of stored pesticides have been collected from the basin, it is unlikely that all stockpiles have been found or properly destroyed. Beyond 2000, the reduction strategies for pesticides include continued or expanded collection opportunities coupled with public outreach. Numerical targets for pesticides are not possible since the amounts remaining in the environment are not quantifiable.

The remainder of Section 4.1 documents the progress towards zero discharge and zero emission between the baseline year of 1990 and the current year. It also shows the reductions that are needed from different sources in order to achieve the next milestones in 2005 and 2010. Addendum A details the inventories and assumptions used in Section 4.1.

Table 4-1 Summary of Reduction Goals for Lake Superior Virtual Elimination Pollutants

Pollutant	Goal for Lake Superior Environment	Reduction Schedule
Mercury	Virtual Elimination	60 percent reduction by 2000 80 percent reduction by 2010 100 percent reduction (zero discharge/zero emission) by 2020 (applies to in-basin sources) (1990 base line)
PCBs	Virtual Elimination	Destroy accessible/ in-control PCBs 33 percent destruction by 2000 60 percent destruction by 2005 95 percent destruction by 2010 100 percent destruction by 2020 (1990 base line)
Pesticides Aldrin/Dieldrin Chlordane DDT/DDE Toxaphene	Virtual Elimination	Retrieve and destroy all canceled pesticides in the basin by the year 2000
Dioxin [1] HCB OCS	Virtual Elimination	80 percent reduction by 2005 90 percent reduction by 2010 100 percent reduction by 2020 (1990 base line)

1 The Binational Program lists 2,3,7,8-TCDD (dioxin) for the Zero Discharge Demonstration Program. By convention, dioxin is measured and reported as toxic equivalents (TEQ)

4.1.2 Load Reductions

The Lake Superior basin is the focus of the Zero Discharge Demonstration Project, which has set a philosophical goal of zero l discharge and emissions from in-basin sources for nine persistent, bioaccumulative toxic chemicals. The complimentary goal is the virtual elimination of these chemicals form the environment although our understanding of all the inputs and fate is not complete. Because the sources of these chemicals are located throughout the world and deposition from the atmosphere to the basin is significant, the virtual elimination of these nine chemicals from the basin will require that both Lake Superior Binational Program (LSBP) agencies and citizens support and participate in state, provincial, national, and international efforts to reduce the use and emissions of these persistent bioaccumulative toxic chemicals. The Zero discharge demonstration program for Lake Superior is viewed as a challenge to society to develop pollution prevention innovations that go beyond "end-of pipe" pollution control solutions. It is a fundamental shift from reliance on control to prevention. This involves examination of how the target chemicals are used and formed in products and processes. The zero discharge demonstration program represents a societal goal for the Lake Superior basin. It is not a regulatory program.

The agencies of the LSBP have developed a set of principles to guide the load reduction schedules and activities to meet them. These "guiding principles" were developed as a result of public comment received during development of the Stage 2 LaMP and appear in that document as well (LSBP 1999).

- The parties of the Binational Program commit to move beyond the *status quo* (i.e., activities that go beyond regulatory compliance will be encouraged). Progress is more than meeting current regulations. Progress in some sectors will be difficult to quantify. Qualitative descriptions of progress will also be needed.
- The reduction schedules are planning targets for the entire basin and are not schedules for specific facilities, sectors, jurisdictions or sources.
- The endpoint of the load reduction schedules is zero discharge. The approach is staged reductions.
- The reductions will be achieved through maintenance of regulatory standards and through source reduction, new technologies, material substitution, pollution prevention, recycling, education and awareness programs, and development of new waste disposal and pollutant destruction capabilities. The pollution prevention approach is the preferred strategy.
- The LaMP addresses all in-basin sources. Other mechanisms will deal with out-of-basin sources.
- In going beyond regulatory control requirements, the solutions cannot create social or economic situations that regionally disadvantage the residents of the Lake Superior basin. Actions taken to fulfill the schedules must be consistent with a sustainable economy.
- The reduction of pollutants will not be based on removal from the Lake Superior basin to other basins (transference). In-basin solutions are preferred.

- Approaches are to be characterized by flexible implementation.
- While voluntary reductions are encouraged, incentives must also be developed to support the implementation of these approaches. Actions do not necessarily need to be legally-driven.
- Delivery of the Lake Superior Binational Program goes beyond the agencies directly involved. Other agencies and other parties have a role.
- The Lake Superior Binational Forum and other stakeholders are to be consulted on a continuous basis.
- The targets described in the LaMP for Critical Pollutants support the other theme areas of the Lake Superior Binational Program (human health, sustainability, habitat, aquatic and terrestrial communities, and communications).

In the last decade, it is not uncommon for pollutant reductions to be discussed with the broader context of social, economic and ecological sustainability. The process is much more complex and not limited to eliminating a specific chemical in the environment or rehabilitating a single stream. Perhaps the greatest challenge for achieving sustainability rests in its lack of a clear, agreeable definition. The true measure of a sustainable society is on the scale of generations rather than years. At the very least, we must conserve existing resources in the basin so that our descendants can enjoy the same quality of life as the present generation, if not a qualitatively better standard of living. Any plan for developing sustainability must be flexible and responsive to changes. The reductions cited below track one decade of progress.

Since the 1990 baseline year, releases of the nine designated chemicals have declined in the Lake Superior basin. The reductions have occurred for the following reasons:

1. Reduction efforts by facilities in the basin: For example, the Western Lake Superior Sanitary District pledged to become a zero discharge facility and succeeded in significantly reducing mercury in treated wastewater and sludge through aggressive source reduction and pollution prevention measures.
2. New competitive technologies have replaced old technologies: For example, most of the pulp and paper mills in the basin that used elemental chlorine before 1990 are now using 100 percent chlorine dioxide.
3. Facility closures: For example, due to market conditions and aging facilities, a copper smelter and paper mill in the U.S., and a zinc mine and iron smelter in Canada were closed.
4. National and regional regulations: For example, Canadian dioxin effluent limitations had a role in causing pulp and paper mills in the Lake Superior basin to switch to chlorine dioxide bleaching; in the U.S., mercury battery legislation passed in Minnesota was the impetus for a nationwide shift to mercury-free battery manufacturing; in the U.S., air toxics regulations have precluded continued operation of small waste incinerators, removing that major source of dioxin emissions.

This section describes load reduction estimates for 1990 to 1999. More details on the 1990 base line estimates can be found in Stage 2. The 1999 estimates are based in part on new Canadian estimates (Brigham 1999). The US and Canadian assumptions behind the 1999 numbers are explained in Addendum A. Data will be available in the coming year to better assess whether the year 2000 milestones have been met.

4.1.2.1 Mercury

Significant reductions in mercury use and emissions in the Lake Superior basin have occurred for two principal reasons. First, production at the White Pine Mine copper smelter in Michigan and Algoma Ore Division iron sintering facility in Ontario have ceased, resulting in a significant reduction in mercury air emissions. Second, mercury in products, such as batteries, paints, and fungicides, has been reduced, resulting in over an 80 percent decline in mercury content in commercial products. In contrast, mercury emissions continue at relatively high levels from mining operations and fuel combustion.

Mercury Reduction Goals

The reduction goals for mercury include the following: (1990 baseline)

- 60 percent reduction by 2000
- 80 percent reduction by 2010
- 100 percent reduction by 2020

The 1999 estimate of 819 kg/yr of on-going mercury releases is a 66 percent reduction from the 1990 estimate of 2,444 kg/yr (Table 4-2). An additional 330 kg/year (Table 4-2) must be reduced in order to meet 489 kg/yr, the 2010 80 percent reduction milestone. This estimate meets the year 2000 LaMP milestone of 60 percent reduction, however, other factors such as taconite production will have an effect on the final year 2000 release estimates.

Sources of Mercury

The mercury inventory, listed in Table 4-2 below, includes a variety of releases to air, water, and soil. The reduction estimates are expressed as ongoing releases, for example, mercury emissions resulting from product processes, and potential releases, such as mercury emissions resulting from product disposal. The estimated ongoing releases shown in Table 4-2 include air and water mercury releases in the Lake Superior basin. Estimated potential releases listed in Table 4-3 represent the mercury disposed in landfills or applied to land. Addendum A contains references and a detailed summary of estimated mercury release and disposal for U.S. and Canadian portions of the Lake Superior basin for 1990 and 1999.

Overall, mercury releases have declined from most sources in the basin The increase in the estimate of mercury releases from total sludge in Table 4-1 is because of the development of a new process technology at the Western Lake Superior Sanitary District (WLSSD) in Minnesota scheduled for completion in 2001. During the interim, half of the sludge generated is being applied to land while the other half is being incinerated at WLSSD. Once the new process is in place, sludge will no longer be incinerated and the overall volume of sludge generated will be reduced. In addition, the estimated emissions from small incinerators were added to the estimate of mercury in sludge because most small incinerators in the basin have closed since 1990.

The potential release estimates for mercury-containing products such as thermometers, thermostats, and dental products, may be lower than indicated in Table 4-3 due to state and community mercury-reduction activities in the basin that may be difficult to quantify at the basin level. For example, the Thermostat Recycling Corporation collected a total of about 9,660 mercury-switch thermostats in Michigan, Minnesota, and Wisconsin in 1998, diverting about 77 pounds of mercury from the municipal waste stream in those states (Erdheim 1999). The states and province have also developed mercury pollution prevention and reduction strategy programs, such as community clean sweeps and developing outreach materials.

Mercury in products which are disposed in landfills may be eventually released to the environment through volatilization. At the 5th International Conference on Mercury as a Global Pollutant in 1999, two researchers independently estimated that an average of 15 percent of the mercury contained in products is released during the disposal process (Andrews and Swain 1999, and Kindbom and Munthe 1999). Therefore, 15 percent of the potential release of mercury in Table 4-3 is re-emitted and is added to the ongoing release category (shown in Table 4-2).

Taconite production continues to be a substantial source of mercury emissions in the U.S. basin. Fuel combustion (for example, energy production) is a major release source in both countries. The mining and fuel combustion sectors have a combined estimated release of 654 kg/yr. These two sectors will need the most effort to achieve mercury reduction in the next 10 years. At present, there are no mercury emission limits and cost-effective technologies are still under development to limit emissions from taconite processing facilities and coal-fired utilities. In fact, the taconite industry is projected to grow in the next 10 years as is per capita consumption of electricity.

Table 4-2 Ongoing Release: Mercury to Air and Water from Sources in the Lake Superior Basin, 1990 and 1999 (kg/year)

Source	US 1990[a]	Canada 1990[a]	Total 1990[a]	US 1999[b]	Canada 1999[b]	Total Remaining 1999	Percent Reduction
Industrial	11	24	35	11	20	31	11 percent
Mining	912	604	1516	385	0.4	385.4	75 percent
Fuel Combustion	193	125	318	193	76	269	15 percent
Incineration	95	2	97	14	1	15	84 percent
Products[c]	150	44	194	1	14	15	92 percent
Municipal	61	11	72	40	11[d]	51	29 percent
Re-emission (15 percent of Table 4-2 total)	146	65	212	34	19	53	75 percent
Total	1568	875	2444	678	141	819	66 percent

[a] Stage 2 LaMP mercury release estimates (LSBP 1999).

[b] See Addendum A for assumptions and references for 1999 ongoing mercury release estimates.

[c] Data in common for the U.S. and Canada are electric lighting, paint and fungicides.

[d] This estimate does not include reductions from household hazardous waste collections or improved handling of waste amalgam in Ontario.

Table 4-3 Potential Release: Mercury to Landfills and Soils from Sources in the Lake Superior Basin, 1990 and 1999 (kg/year)

Source	US 1990	Canada 1990	Total 1990	US 1999	Canada 1999	Total Remaining 1999	Percent Reduction
Dry Cell Batteries	851	300	1151	85	15	100	91 percent
Other Products	117	100	217	74	84	158	27 percent
Medical/Dental	6	22[a]	28	6	22[a]	28	0 percent
Ash[b]		10	10		5	5	50 percent
Sludge[c]	4	2	6	61	2	63	+1,050 percent
Total	972	434	1412	226	128	354	75 percent

[a] This estimate is partially doublecounted in other categories and does not include reductions due to improved handling of waste amalgam.

[b] An estimate for U.S. potential release from ash is not available.

[c] Sludge is applied to land and landfilled. This estimate includes the estimate for materials previously being incinerated in small incinerators (48 kg/yr), the sludge from the Duluth WLSSD that is applied to land, and 10 percent of the mercury in total commercial/ municipal effluent. This does not include sludge burned at WLSSD, which is included under Incineration in Table 4-2.

A substantial portion of mercury also enters the basin as a component of commercial products. Voluntary bans on mercury-containing paints and fungicides in the early 1990s and reduced mercury content in batteries has resulted in over an 80 percent reduction of mercury from commercial products. In 1992 and 1993, the use of mercury in round cell, alkaline, and zinc carbon batteries was discontinued (NEMA 1999), resulting in a 90 percent reduction in mercury from batteries. The mercury content of products is expected to further decline, which will decrease the 354 kg/year contribution from potential releases (see Table 4-3) and the 112 kg/year from ongoing releases from municipal, incineration, products and industrial sources (see Table 4-2). The estimated 354 kg/year to landfills and soils is a source for an additional 53 kilograms of re-emitted mercury, bringing the total ongoing releases from all sources, except mining and fuel combustion, to an estimated 165 kg in 1999. In addition, the populations of the U.S. counties in the basin are generally projected to decrease, which should cause a decrease in consumption of mercury-bearing products.

Strategies for Reduction of Mercury

The mercury release target for 2010 is 489 kg/yr. To meet this, a further reduction of 330 kg/yr is required from current emission rates. Purposeful use of mercury in processes and products is the source of much of the mercury released from incineration and municipal sources. For example, if all ongoing releases from municipal, incineration, products, and industrial sources were eliminated (165 kg/yr), the total amount of reductions needed from the mining and energy production sectors would be about 165 kg/yr to meet the 80 percent reduction goal for the year 2010. Sections 3.1.4 and 3.1.5 discuss mercury reduction strategies through purchasing policies and product stewardship, which are some important strategies to address purposeful use of mercury.

However, it is unlikely that all municipal, incineration, products, and other industrial sources will be eliminated by the year 2010. An alternative example assumes that if half of the mercury from these sources were to be eliminated, the mining and energy production sectors would need to reduce mercury releases by about 248 kg/year by the year 2010. Sections 3.1.6 and 3.2.6 outline some reduction strategies that apply to energy conservation and production. Section 3.2.4 outlines reduction strategies specific to the mining sector. For mercury reduction in the mining sector, voluntary agreements and mercury emission control technologies offer the greatest potential for reductions. Currently there are four major utilities and seven taconite mines in the basin to share this responsibility.

Summarized goals for mercury reduction in 2010:

- The overall goal is an additional reduction of 330 kg/year to meet the 80 percent reduction milestone of 489 kg/yr.

This goal may be achieved by different combinations of reduction strategies. For example:

- Reduce the mercury released from municipal, incineration, products, and industrial sources by half between 2000 and 2010, resulting in a reduction of approximately 82 kg/year. For the most part, these sources ultimately originate with the purposeful use of mercury in products or processes. Important reductions from these sources have taken place between 1990 and 1999.

- Reduce mercury from the mining and energy production sectors by 248 kg/year, which is less than half of the 1999 estimated emissions. Significant reductions in mercury from these sectors have not taken place between 1990 and 1999 with the exception of facility closures.

4.1.2.2 PCBs

The LaMP reduction goals call for 100 percent destruction of PCBs in the Lake Superior basin by the year 2020. The main concern with PCB reductions within the Lake Superior basin is not their ongoing release, since PCBs are rarely found in permitted discharges and emissions. The PCB reduction goals for Lake Superior are aimed at preventing future release by destruction of PCBs in use and storage. The goals also address clean up and destruction of PCB contaminated soils and sediment, where accessible. Regionally, PCB volatilization from past releases and eventual atmospheric deposition is a significant pathway for PCBs to Lake Superior.

PCB Reduction Goals

The reduction goals for accessible PCBs include the following (1990 baseline)

- 33 percent destruction by 2000
- 60 percent destruction by 2005
- 95 percent destruction by 2010
- 100 percent destruction by 2020

Currently, in the U.S. portion of the Lake Superior basin, approximately 345 PCB transformers and 3,700 PCB capacitors remain in use (see Addendum A), primarily owned by large and small utilities and industries. These estimates are based on extrapolation from a Minnesota survey (Addendum A) No actual inventory exists for PCBs on the U.S. side of the Lake Superior basin. Though there are no PCB disposal facilities in the U.S. portion of the Lake Superior basin, the opening of a licensed facility in Michigan should result in increased disposal activity.

In the Canadian Lake Superior basin, approximately 157,977 liters of high-level PCB-contaminated liquid remained in use in 1997; 157,179 liters of PCB-contaminated liquids and 205,807 kg PCB-contaminated solids remained in storage. Between 1990 and 1997, 276,493 kg PCB-contaminated solids were destroyed and 138,657 liters of PCB-contaminated liquids were destroyed (Brigham 1999). These estimates indicate that the United States and Canada are making progress toward attaining the goal of 60 percent decommissioning and destruction of PCB-contaminated equipment by 2005.

Sources of PCBs

Although PCB production was banned over 20 years ago, PCBs are still found in old commercial, industrial, and electrical equipment. PCBs are also produced incidentally through as many as 200 chemical processes. However, it is estimated that 95 percent of the PCB load to the Lake Superior ecosystem is via air deposition (U.S. EPA 1998a). Volatilization of PCBs from soils and sediments is also a significant contributor to PCBs in the water column and the biota. In the Lake Superior basin, the majority of continuing releases are thought to be from electrical equipment oil spills, while small amounts could be released from fuel combustion, waste oil combustion, biomedical waste incineration, and wastewater treatment plants.

PCBs are also found in harbor sediments in some Lake Superior Areas of Concern. Total amounts have not been determined. The amount of PCBs in contaminated soil and landfills is also unknown.

Canadian facilities have made substantial progress in destroying PCB-contaminated equipment and materials throughout the basin. While the major utilities and some industrial facilities in the U.S. portion of the Lake Superior basin have made substantial progress in replacing and disposing of their PCB-contaminated transformers and capacitors, small utilities and other industrial facilities must begin to more aggressively identify and decommission their PCB-contaminated equipment.

The total PCB inventory for the entire Lake Superior basin is difficult to assess because of the differences between U.S. and Canadian reporting requirements. The U.S. has calculated the weight of pure PCBs in previous estimates. Canada requires facilities to report PCBs by weight of contaminated equipment and materials. Recent changes to the U.S. Toxic Substances Control Act (TSCA) require that owners of transformers containing greater than 500 ppm PCBs must register their equipment with the U.S. EPA. The two nations also have different definitions of "high level" PCBs (e.g., in the U.S. a concentration greater than 500 ppm is considering high and in Canada, a concentration greater than 10,000 ppm is reported as high).

The individual U.S. states are also beginning to compile more detailed inventories of PCB use. For example, the Minnesota Pollution Control Agency (MPCA) has recently completed a survey of PCB containing equipment used by northeastern Minnesota industries, utilities, schools, and municipalities. Michigan similarly has an ongoing Critical Materials Register that requires facilities to track PCBs. These new data and initiatives will improve the U.S. portion of the Lake Superior PCB inventory.

Current Use of PCBs

Table 4-3 lists the quantities of PCBs estimated to be in use in both the U.S. and Canadian portions of the basin in the baseline year of 1990 and in 1999. The current U.S. data are limited. As a result, several assumptions were made to estimate the amount of PCBs in use in the basin. Specifically, data from MPCA’s PCB inventory survey was analyzed and applied, on a per-capita basis, to the U.S. portion of the Lake Superior basin (see Addendum 4-A).

Table 4-4 Estimated PCB Use in the U.S. and Canada [kg]

Source	United States		Canada	
	1990[a]	1999[b]	1990[c]	1997[d]
Industrial	(637,346)	(7,369)	194,830	
Utilities	(26,618)		11,300	
Municipal			14,815	
Commercial			32,700	
Total	(663,964)	(7,369)	253,645	181,673

[a] Pure PCBs (LSBP 1999).
[b] Estimates based on MPCA's PCB Inventory Survey, 1999, extrapolated to Michigan and Wisconsin using population-based projections (see Addendum A) (Beadey 1999). This estimate method is not directly comparable to the 1990 method.
[c] LSBP 1999
[d] Brigham 1999. Data cannot be accurately desegregated for each sector.

While the estimate of PCBs in use on the U.S. side of the basin appears to show a large decrease, the base line year of 1990 and the 1999 estimate are based on methods different enough that accurate comparison is not possible. It is highly likely that the amount of PCBs in use on the U.S side of the basin in 1999 is significantly higher than reported. The Minnesota survey that the numbers are based on was not returned by every recipient and the equipment may have a greater volume or higher concentrations of PCBs than was assumed in Addendum A. Also, over half of the electrical equipment identified in the Minnesota survey has not been tested and some of this equipment may contain PCBs. Despite the lack of information on overall U.S. reductions, individual facilities in the basin are achieving reductions. For example, 173,952 kg of PCBs are being decommissioned as part of the closure of the Copper Range mine (Tetra Tech, Inc. 1996). Taconite mines have also decommissioned PCB-bearing equipment and so have the major U.S. electric utilities in the basin.

In Canada, seven facilities in the basin reported a total of 157,977 liters (181,673 kg) of high level PCB liquid in use in 1997 (Brigham 1999). Compared to the base line of 253, 645 kg in 1990, a 28 percent reduction in use has occurred on the Canadian side of the basin.

Table 4-5 shows the amount of high level PCBs destroyed in Canada between 1990 and 1997. Liquid PCBs includes the PCBs found in transformers and capacitors. Solid PCBs includes the PCBs in equipment such as ballasts and contaminated soils. High level PCB liquids and solid wastes have been reduced by 24 percent. Percentage reduction for the other categories cannot be calculated with any confidence given the changes that appear in the baseline as new data are reported. See Addendum A.2.2 for details of PCB use, storage, and destruction in Canada.

Table 4-5 Estimated High Level PCB Destruction in Canada (kg).[a]

Type of Waste	1990	Amount Destroyed
High Level Liquid (storage)	85,112	40,498
High Level Solid (storage)	146,563	77,267
Total (high level storage only)	231,675	117,765
High Level PCBs (use)	253,645	-
Total High Level (in use and storage)	485,320	117,765

[a] After Brigham 1999

In the Canadian Lake Superior basin, approximately 157,977 liters (181,674 kg) of high-level PCB-contaminated liquid remained in use in 1997; 128,001 liters (147,201 kg) of high level PCB-contaminated liquids and 69,296 kg of high level PCB-contaminated solids remained in storage. Between 1990-1997, 117,765 kg of high level PCB-contaminated solids and liquids were destroyed (Brigham 1999). In order to meet the targets of 33 percent reduction by 2000 and 60 percent by 2005, an additional 42,391 kg and 131,036 kg, respectively, of high level PCBs should be destroyed.

Strategies for Reduction of PCBs

Because of the inadequacy of the U.S. PCB data base in the Lake Superior basin, it is not possible to describe a numeric goal for the mass of PCBs that should be destroyed to meet the reduction milestones. However, this Stage 3 LaMP identifies a variety of strategies that would both improve the data base and bring about reductions. It is crucial that 1) untested equipment be tested, 2) owners of PCB-bearing equipment decommission that equipment and 3) governments assist their efforts to test and decommission. Section 3.2.11 lists PCB strategies that cover these areas. Section 4.2.1.2 identifies the PCB strategies that the agencies propose to emphasize in the next two to three years.

In order to meet the 2000 and 2005 PCB reduction goals, Canada will need to destroy a total of 42,391 kg and 131,036 kg, respectively, high level PCBs out of the original 485,320 kg in-use or in-storage in 1990. In addition, reduction estimates for low level PCBs should be improved. Sections 4.2 and 4.3 outline possible alternative reduction strategies that apply to PCB-contaminated equipment reductions in all sectors.

4.1.2.3 Pesticides

Pesticide Reduction Goals

Although the targeted pesticides continue to be collected in Minnesota, Wisconsin, Michigan, and Ontario, environmental concentrations have shown general decline in most media over the years (Pesticides Workgroup 1999). Based upon recent water concentration measurements, the quantities of these pesticides remaining in the water column of all five Great Lakes totals about 22,000 kg which is the equivalent of about 1 kg per cubic kilometer of Great Lakes water. Although concentrations of these pesticides have declined in the Great Lakes basin, current contamination levels remain a concern as reflected by water concentrations that exceed U.S. national water quality standards, sediment concentrations the exceed sediment guidelines, and fish consumption advisories based on unacceptable levels of these pesticides in sport and commercial fish (Pesticides Workgroup 1999).

The Lake Superior Binational Program goal is to retrieve and destroy all remaining stockpiles of the canceled pesticides including DDT, DDE, aldrin/dieldrin, and toxaphene, as well as dicofol (also known as Kelthane), hexachlorobenzene, mercury pesticides, hexachlorobenzene pesticides, and 2,4,5-T (Silvex) and other pesticides contaminated by dioxin or hexachlorobenzene in the basin by the year 2000.

Sources of Pesticides

DDT reached peak annual usage of some 80 to 85 million kg in the U.S. in 1962; toxaphene use peaked in 1972 to 1975 at close to 30 million kg per year; chlordane at 12 million kg in 1971; and aldrin plus dieldrin at 9 million kg in 1966. All of these chemicals were used as pesticides. All of these pesticides were canceled (production is legal, sale and distribution is illegal in the U.S.) by the 1980s for domestic use in the United States and by the 1990s for domestic use in Canada. All but chlordane have not been in production in the United States for many years. One U.S. manufacturer of chlordane, Velsicol Corporation, ceased production for export of chlordane and heptachlor in 1997 (U.S. EPA and Environment Canada 1998b).

Targeted pesticides have been detected in harbor sediments in the Duluth-Superior harbor (Schubauer, Beregan, and Crane 1997, Crane et al. 1997) Time trend atmospheric data from the Integrated Atmospheric Deposition Network (IADN) network for dieldrin, DDT and DDE, and three principal components of commercial chlordane project a decline in atmospheric concentrations to the detection limit (0.1 pg/cu meter) from about 2010 for DDT to about 2060 for DDE with dieldrin and chlordane declining between those years (U.S. EPA and Environment Canada 1998b).

Strategies for Reduction of Pesticides

Although U.S. and Canada domestic production has ceased and uses have been canceled, these pesticides continue to have an environmental presence. In addition, the level of toxaphene in Lake Superior has not shown a general decline over the years like the other pesticides. Collection programs in the Lake Superior basin continue to net these pesticides. Lake Superior strategies for pesticides include continued or expanded collection opportunities coupled with concerted public outreach. Sections 4.3.18, 4.4, and 4.5 discuss the strategies for reduction, contaminated sites and monitoring, respectively.

Out-of -basin strategies addressing pesticides would include support by the Great Lakes states and Canada for international efforts such as the Regional Treaty on Persistent Organic Pollutants, the UNEP Global Treaty on Persistent Organic Pollutants, the Commission for Environmental Cooperation Tri-lateral North American Regional Action Plans, and the NAFTA Technical Working Group on Pesticides to implement phased reduction and eventual elimination of the targeted pesticides in other countries.

The LaMP reduction goal for pesticides is to retrieve and destroy all stockpiles by 2000. The pesticides being targeted are chlordane, DDT, DDE, dicofol (also known as Kelthane), aldrin/dieldrin, hexachlorobenzene, mercury pesticides, toxaphene, Silvex, and other pesticides contaminated by dioxin or hexachlorobenzene. Collection of these pesticides is likely to have side benefits as other pesticides, including two other critical chemicals that are pesticides (hexachlorocyclohexane and heptachlor), are collected at the same time.

Minnesota, Wisconsin, Michigan and Ontario have collected significant amounts of these substances through collection programs in the Lake Superior basin. Unfortunately, the data from these collections are inconsistent, and not always reported by specific pesticide. Stores of these substances apparently still remain in the Lake Superior basin, and as a result, it is not possible to determine that all the stockpiled pesticides will be accounted for by 2000. For example, pesticides may be held by farmers or become orphaned when farm property is sold. Collections should continue in to the future.

Table 4-6 shows that aldrin, chlordane, and DDT have been collected in large amounts in the Lake Superior states from 1990 to 1998. More than 50 percent of the total pounds of pesticides collected was DDT (U.S. EPA and Environment Canada 1998b). The amount of canceled pesticides collected has begun to decline with the exception of DDT (U.S. EPA 1999).

In the early 1980s, Canadian pesticide collections were administered through two clean sweep programs. The last Ontario Ministry of Environment and Energy (OMEE) agricultural waste collection program was conducted in 1991 to 1992. Pesticides have been collected as household hazardous wastes at regional/municipal household hazardous waste depots in Thunder Bay. These depots will continue to collect these substances.

Table 4-6 Clean Sweep Collections Of Pesticides In The Lake Superior States (U.S. Programs)

State	Dates of Collection	Substances Collected - pounds					
		Aldrin/ Dieldrin	Chlordane	DDT	Silvex	Toxaphene	Total Pesticide
Michigan[a]	1995	147	25	193	Not estimated	0	365
Minnesota[b]	1992 – 1998	74	535	4,959	6,000	83	11,651
Wisconsin[c]	1996-1998	0	36	97	28	480	641

[a] Compiled by Michigan Department of Agriculture. The Lake Superior counties collect about 9 percent of the total substances collected in the state. The substances collected in the Michigan Lake Superior counties were calculated as 9 percent of the total for each substance collected.

[b] Compiled by Minnesota Department of Agriculture Waste Pesticide Collection Program. Data include all Lake Superior counties' waste pesticide collections.

[c] Compiled by Wisconsin Department of Agriculture, Trade, and Consumer Protection for 1996. Compiled from collection event summaries from the Northwest Regional Planning Commission for 1997 and 1998.

4.1.2.4 Dioxin, HCB, and OCS

In 1990, most of the dioxin estimated to be released to the atmosphere (370-2,400 g TEQ/year) was produced by small incinerators used at apartment buildings, nursing homes, schools, grocery stores and other small sources in the U.S. Since the 1990 base line estimates were completed, virtually all of these small, inefficient incinerators have been phased out, resulting in a very large reduction in dioxin air emissions. In addition, a significant reduction of about 22 g TEQ dioxin/year resulted from the closure of the Algoma iron sintering plant in Wawa, Ontario and the White Pine Mine smelter in Northern Michigan. Closure of all medical waste incinerators in the U.S. portion of the basin and all but three of the medical waste incinerators in the Canadian portion since 1990 has also resulted in a significant reduction in dioxin emissions in the basin.

For hexachlorobenzene (HCB) and octachlorostyrene (OCS), data are too sketchy to confidently predict the change in releases from sources in the Lake Superior basin since 1990. What little data are available suggest that some of the major sources of dioxin, such as incineration, are also sources of HCB and OCS. Until more and better monitoring data and emission factors are available, dioxin trends will substitute for HCB and OCS trends.

Dioxin, HCB, and OCS Reduction Goals

The goal for the virtual elimination of all dioxin, HCB, and OCS sources within the Lake Superior basin includes the following reduction schedule: (1990 baseline)

- Year 2005:80 percent reduction
- Year 2015:90 percent reduction
- Year 2020:100 percent reduction

The dioxin emission estimates reported in this section indicate that the U.S. and Canada have made significant progress in achieving the 2005 and 2015 goals. As of 1999, dioxin air emissions have declined by 75 to 95 percent, depending on the level of the 1990 baseline estimate. Although direct measurements of HCB and OCS sources are not available, control of dioxin emissions sources is likely to bring HCB and OCS under a similar level of control

Sources of Dioxin, HCB, and OCS

The term “dioxin” represents a class of halogenated aromatic hydrocarbon compounds including polychlorinated dibenzodioxins and dibenzofurans. (Tetra Tech Inc. 1996). There are a total of 210 possible congeners of dioxin, depending on the location and substitution of chlorine in the molecule . Those congeners with chlorine substitution in the 2,3,7, and 8 positions on the molecule are generally thought to be responsible for the greatest degree of toxicity associated with dioxin (U.S. EPA 1998b).

In humans, 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) has been shown to cause chloracne and liver damage. Based upon animal studies, dioxin is also a suspected carcinogen and is thought to be toxic to the immune system and may have detrimental reproductive and developmental effects (U.S. EPA 1995). Because of the high degree of toxicity associated with the 2,3,7,8-TCDD congener, the relative toxicity of other dioxin and furan congeners are assessed in terms of a toxicity equivalency factor (TEF), with 2,3,7,8-TCDD having a TEF value of 1.0. Throughout this document, concentrations of dioxins and furans are presented as a toxic equivalence quotient (TEQ). TEQs are determined by summing the products obtained from multiplying concentrations in grams (g) of individual dioxin-like compounds produced by a source by the corresponding TEF value for each compound (U.S. EPA 1996).

Unlike mercury and PCBs, there are no deliberate uses for dioxin. It occurs purely as a by-product in processes such as combustion and chlorination. In the context of the Lake Superior load reduction schedules, the “dioxin” that is targeted is 2,3,7,8-tetrachloro-dibenzo-p-dioxin because of the high degree of toxicity associated with that specific compound. Furthermore, most research completed to date has focused primarily on identifying sources of the 2,3,7,8-TCDD congener, rather than other forms of dioxins and furans. Nonetheless, to ensure that all potential dioxin congeners are addressed under the LaMP, and because many data are reported as TEQ, the parameter that is being tracked under the load reduction schedule is the TEQ.

In 1990, most of the dioxin produced in the Lake Superior basin was released to the atmosphere (about 400-2,430 g TEQ/year) (see Table 4-7). Roughly 128 g TEQ/year was disposed in soils and landfills, 46 g TEQ were in PCB equipment, 31 g TEQ were estimated to be in contaminated sediment, and only 1.6 g TEQ/year were released into water. Most of the dioxin released to the atmosphere (370-2,400 g TEQ/year) was produced by small incinerators used at apartment buildings, nursing homes, schools, grocery stores and other small sources.
Since the 1990 base line estimates were completed, virtually all of these small, inefficient incinerators have been phased out, resulting in a very large reduction in dioxin air emissions. In addition, a significant reduction of about 22 g TEQ dioxin/year resulted from the closure of the Algoma Ore Division iron sintering plant in Wawa, Ontario and the White Pine Mine smelter in Northern Michigan. Closure of all medical waste incinerators in the U.S. portion of the basin and all but three of the medical waste incinerators in the Canadian portion since 1990 has also resulted in a significant reduction in dioxin emissions within the Lake Superior basin. A summary of Lake Superior basin dioxin emissions from 1990 through 1999 is presented in the table below.

Table 4-7 Summary of Lake Superior basin Dioxin Discharge and Emission Estimates 1990 to 1999

	U.S.[a]		Canada[a]		Total	
Source	1990	1999	1990	1999	1990	1999
Industrial	1.5×10^{-7} - 0.7	0 - 0.3	23.88	2.08		
Fuel Combustion	3.43	0.93	1.04	1.04		
Incineration	369 - 2,408	90.2	0.13	0.07		
Municipal/ Residential	N/A	N/A	0.05	0.05		
Commercial Products	N/A	N/A	0.27	0.27		
TOTAL	374 - 2,413	91.1 – 91.4	25.4	3.5	399.4 – 2438.4	94.6 – 94.9

[a] Canada 1999 figures in g TCDD/yr; U.S. figures in g TEQ-TCDD/yr.
N/A estimates not available.

Although many dioxin sources are now under control in the basin, “backyard burning” by U.S. households and small businesses continues. It is believed that “rural burning” also occurs in Canada. No firm estimate can be made yet for the release of dioxin TEQs from these burn barrels, but preliminary calculations indicate that household waste burned in burn barrels can be a significant source of dioxin compounds. An initial estimate of 6.7 g TEQ/yr from household waste combustion in the U.S. portion of the basin is described in Addendum A.3.1 and is included under Incineration in Table 4-7.

Since the burn barrel estimates are incomplete and the range of the dioxin emitted from small incinerators is so wide, an estimate of progress made towards zero discharge is problematic. However, setting aside the unknown burn barrel contribution yields an approximately 75 to 95 percent reduction in dioxin emissions resulting from the closure of medical waste and other small incinerators and the White Pine and Algoma facilities. The assumptions built into these estimates are explained in Addendum 4-A.

Strategies for Reduction of Dioxin, HCB, and OCS

The significant, remaining sources of dioxin emissions in the basin include small industrial and other waste incinerators, backyard burning of household waste in burn barrels, and possibly the use of pentachlorophenol wood preservative. Because most large emission sources are now under control, the focus must now be placed on small, disperse sources. As a result, the control strategies applicable to these sources should include public education and outreach coupled with aggressive identification of these sources. Strategies should also include investigation of ongoing pentachlorophenol use and, in the long term, clean up of contaminated sites.

4.2 ACTIONS FOR THE NEXT 2 TO 3 YEARS BY CHEMICAL

Section 4.1 updated the pollutant reductions that have occurred since the baseline year of 1990 and made estimates of the reductions required to meet the next targets for each chemical. Sections 4.3 and 4.4 will discuss pollution prevention and reduction strategies utilizing multiple sector, sector specific, out of basin and contaminated site approaches; a total of 198 actions are listed. Section 4.5 explores approaches to source and environmental monitoring .

This section organizes the nine Lake Superior critical pollutants targeted for reduction into four groups, 1) Mercury, 2) PCBs, 3) Pesticides and 4) Dioxin, HCB and OCS. The reduction strategies that will be pursued in the next 2 to 3 years are presented for each chemical group . Under each strategy, the actions that have been committed to by different Lake Superior government agencies have been listed. These actions in turn are ranked by the number of government agencies that are committing to the action and the level of their commitment.

Accomplishing the pollution prevention and reduction goals that have been established for the nine Lake Superior critical pollutants requires commitment from many entities; tribal, local, state, provincial and federal governments, industry, trade associations and society as a whole, including each individual. This section presents the environmental actions and strategies for the near term that have been selected by the partner agencies involved in the Lake Superior Binational Program to achieve these pollution reductions. While many factors were involved in the selection process, the absence of an agency commitment for any particular agency does not preclude future action.

The bulleted actions listed in this chapter are commitments by the specified agency or organization and are identified by the presence of that organization's acronym following the action. In addition, a numerical ranking follows the organizational acronym to indicate the timeframe this action will be accomplished or initiated within that jurisdiction (for example, EPA(1)).

The agency/organization names and acronyms are:

- EC Environment Canada
- EPA United States Environmental Protection Agency-Region 5 (U.S. EPA)
- MI Michigan Department of Environmental Quality (MDEQ)
- MN Minnesota Pollution Control Agency (MPCA)
- ON Ontario Ministry of Environment (OMOE)
- WI Wisconsin Department of Natural Resources (WI DNR)
- BR Bad River Band of Lake Superior Chippewa
- FDL Fond du Lac Band of Lake Superior Chippewa
- GP Grand Portage Band of Lake Superior Chippewa
- KBIC Keweenaw Bay Indian Community
- RC Red Cliff Band of Lake Superior Chippewa

The ranking of actions that appears in this report is numerical and explained as follows:

(1) Commitments - actions currently supported or planned to be supported by agencies and member organizations within the next two to three years with funds and/or personnel. In some cases, the initial stages of those activities ranked at this level may already have been completed by some of the agencies or partner organizations such as municipalities.

(2) Explore - actions that require additional resources or policy decisions in order to be accomplished or supported. In some cases these actions are as important as those in rank (1) to achieve zero discharge.

Future possibilities - actions that merit inclusion in the LaMP for the purposes of planning, reference and/or future funding considerations.

Actions proposed for commitment at the ranking level of (1) or (2) appear in this chapter; other actions appear in the later sections of this chapter and are denoted as future possibilities. All actions are numbered so that the reader may cross-reference the actions listed in Sections 4.3 and 4.4, which are numbered consecutively.

This section groups actions by the LaMP critical pollutants. For example, the actions proposed to reduce mercury are listed together. Many actions would result in reductions of more than one of the targeted pollutants. These are often repeated in each of the chemical sections below. Some general actions, which could apply to all of the targeted pollutants are listed in Section 4.2.1.5.

4.2.1 Actions and Strategies by Chemical

4.2.1.1 Mercury

Reduction Goals for Mercury

The mercury reduction goals are set out with milestones for 2000, 2010 and 2020. As indicated in Section 4.1, the 2000 milestone for mercury has been met for the basin. In order to meet the 2010 target of 80 percent reduction, emissions and discharges of 2,445 kg/yr in 1990 must be reduced to 489 kg/yr in 2010). The largest emissions are from mining, fuel combustion and commercial products in landfills.

Mercury Commitments

The following seven strategies each include a subset of actions that are ranked as Level 1 or 2:

Strategy 1 - Encourage voluntary reductions of the use, discharge and emission of mercury.

(1) LSBP agencies will work with facilities in the Lake Superior basin to **establish voluntary agreements** to reduce the use, discharge or emissions of the nine designated chemicals in order to meet the goals stated in the stage 2 LaMP reduction schedule. EC(1), EPA(1), MI(1), MN(1), ON(1), WI(1)

(103) LSBP agencies will support and promote implementation of **voluntary agreements with the health care industry** to reduce use of mercury and formation of dioxin. BR(1), EC (2), EPA(1), MI(1), ON(1), WI(1)

(176) The **Great Lakes Binational Toxics Strategy** should be pursued to meet the short-term, interim goals of the Lake Superior Binational Program for mercury. EC(1), EPA(1), MI(1), MN(2)

(104) EPA will continue to contribute resources and expertise to the agency's **voluntary agreement with the American Hospital Association (AHA)**. Under the terms of this agreement, EPA will assist AHA in meeting its goals of virtual elimination of mercury from hospitals by 2005, and a reduction in total solid waste by 33 percent in 2005 and by 50 percent in 2010. EPA will help AHA to disseminate the guidance manuals on mercury and solid waste reduction for this effort by contributing resources to a series of at least six national workshops that will be held by the end of 2001, as well as making all materials available via the Internet. EPA (1)

(79) Assist school districts, education agencies, and youth organizations to **supplement existing curricula and develop new curricula** that are aimed at reducing the nine designated chemicals. This assistance may include training, providing teaching devices, or other necessary activities. EC(1)

(137) By the end of 2000, EPA will publicize, including through posting on its web site, information on how to develop a **mercury reduction plan** at a manufacturing plant. This information will include mercury reduction plans developed at three steel mills under a voluntary agreement between the mills, EPA, the Indiana Department of Environment, and the Lake Michigan Forum. EPA(1)

Strategy 2 - Develop incentives to reduce mercury.

(5) U.S. LSBP agencies will provide indirect or direct **financial support** to businesses, organizations and local governments for pollution prevention projects. Innovation will be encouraged. Possible projects include clean sweeps, bounties on mercury products, bounties or other mechanisms to reduce burn barrel use, mercury swaps for alternative products, education, purchasing policies, energy conservation, water conservation, pay-as-you-throw trash disposal fees and others. BR(1), EPA(1), MI(1), MN(1), WI(1)

(4) U.S. LSBP agencies will evaluate a variety of **economic incentives** or disincentives to promote verifiable or innovative reductions. Possible incentives include early reduction credits, tax relief, low-interest loans, grants, rebates and bounties for achievers. Possible disincentives include fees, taxes or caps on mercury-bearing products or uncontrolled sources of any of the nine designated chemicals. MI(2)

(189) Support federal and state initiatives to provide **incentives to the utility industry** to **develop mercury control technology** and to invest in alternative energy sources. MN(2)

Strategy 3 - The mining and electric utility sectors must reduce mercury by half in order to meet the 2010 milestone.

(22) LSBP agencies will promote **energy conservation programs** (e.g. U.S. Side: EPA Energy Star Program) within the Lake Superior basin, agencies will especially urge the publicly-owned facilities, schools and universities in the Lake Superior basin to participate in energy conservation programs. The agencies will also work with the utilities operating in the basin to coordinate government and utility energy conservation programs. BR(1), EC(2), EPA(1), MI(1), MN(1), ON(1), WI(1)

(114) LSBP agencies will encourage the investigation of **alternative energy** (e.g. low mercury fuels, natural gas, solar, wind) in the Lake Superior basin and encourage residents to purchase energy produced with lower polluting technologies. BR(1), GP(2), MN(2), ON(2)

(23) LSBP agencies will encourage home and industry **energy audits**. BR(1), EC(2), MI(1), ON(1)

(24) LSBP agencies will encourage **municipal energy councils** such as the Thunder Bay 2002 and the Duluth Citizen's Energy Council. EC(2), MN(2), ON(1)

(78) Encourage schools in the Lake Superior basin to commit to **green school programs**, including Energy Star, Blueprint for a Green Campus program, and others. RC(1)

(116) By December 2000, EPA will make a determination about whether to **regulate mercury emissions** from electric utilities. EPA(1)

(93) The Minnesota PCA will identify facilities that use **wet scrubbers** to treat emissions. The quantity of mercury removed by the scrubber will be estimated and the fate of the scrubber water will be investigated. Possible control technologies such as closed loop systems, hot lime precipitation, and others will also be investigated. MN(1)

(120) Promote the long-term goal of having energy utilities **convert from coal burning to a natural gas energy source**. In the medium-term, householders need to develop an energy conservation ethic that would extend to the purchase of clean fuel. RC(2)

(94) The Minnesota PCA will assist the **taconite and electric utility industries** in finding **mercury reduction technologies.** The concentrations of mercury in stack gases from these two sectors is similar enough that the same control technology might be used for both. Assistance may or may not take the form of funding. MN(2)

(96) U.S. LSBP agencies will support experiments to **separate the mercury-bearing pyrite fraction from coal** used in their boilers and stabilization of the resulting byproduct. MN(1)

(25) As part of utility deregulation, the state of Minnesota will consider establishment of a **mandatory "line charge"** for demand side management energy efficiency projects. MN(2)

(26) U.S. LSBP agencies will assist architects and builders in **incorporating energy conservation measures** into new structures being planned and built on the reservation. FDL(1)

(117) The EPA has committed approximately $6 million in FY2000 and FY2001 funds to **support mercury research** in a number of priority areas including transport, transformation and fate; and human health and wildlife effects of methyl mercury. These research activities are aimed at reducing the uncertainties currently limiting the Agency's ability to assess and manage mercury and methyl mercury risks. One particular target of research will be collection and analysis of information on mercury emissions and control options for coal-fired utilities in order to support OAR's mandate for a regulatory determination on mercury controls for utilities by December 15, 2000. EPA(1)

(118) By the end of 2000, EPA will provide funding to **support workshops** in at least one Lake Superior basin state on how to reduce the use of mercury-containing devices at electric utilities. EPA(1)

(95) U.S. LSBP agencies will assist facilities that produce their own electricity from coal-burning to **convert to alternate sources** such as gas turbines. MN(2)

(119) U.S. LSBP agencies will assist utilities in **converting from coal-burning technology**, which releases mercury, to renewable source energy or natural gas technology to produce electricity. MN(2)

Strategy 4 - Mercury-bearing products must be reduced in order to halve the amount of mercury in products by 2010.

(18) LSBP agencies will work with manufacturers within and outside the Lake Superior basin to develop **depots and reverse distribution systems for citizens**. Possible products to include in this strategy include batteries, paints, fluorescent lamps, thermostats, pressure testing equipment, dental amalgam, laboratory reagents and others. EC(1), EPA(1), MI(2), ON(2)

(19) U.S. LSBP agencies will encourage a nationwide dialogue on the import of mercury-bearing products. Nationwide **labeling of mercury products** will also be encouraged. EPA(2), MN(2), MI(1)

(13) U.S. LSBP agencies will evaluate and begin the development of **purchasing policies** to eliminate use of products that might include **mercury equipment or PCB equipment** (e.g., boilers, buildings, vehicles, electrical equipment and laboratory equipment). Policies will also examine phase-out of existing mercury or PCB-containing items. BR(1), MI(1), MN(2)

(105) U.S. LSBP agencies will institute **a mercury thermometer swap program** where mercury thermometers are exchanged for non-mercury-bearing ones. FDL(1), GP(1)

(106) Urge hospitals to discontinue the practice of **sending mercury thermometers home with new mothers** and instead use non-mercury thermometers and distribute information on the hazards of mercury in the home and the actions that families can take to limit their exposure. The agencies will assist in the preparation of these materials. RC(1)

(188) Foster **nationwide product stewardship** and reverse distribution systems with manufacturers. MN(2)

Strategy 5 - Proper identification, collection and disposal of mercury-bearing products in the basin.

(32) LSBP agencies will seek funding to initiate or continue permanent household and agricultural (e.g. pesticides) **hazardous waste (HAHW) collection depots** in the largest Lake Superior basin cities. Furthermore, U.S. LSBP agencies will seek funding to initiate and continue periodic or mobile collections for the more remote locations within the Lake Superior basin. Collections will not be limited to pesticides but will include a focus on mercury containing products (e.g. thermometers, abandoned appliances). U.S. LSBP agencies will seek funding to initiate and continue Lake Superior basin HAHW education programs that will include information about how individuals can practice home environmental stewardship; how to identify HAHW; and how to properly dispose of HAHW. BR(1), EC(2), EPA(1), FDL(1), KBIC(1), MI(1), MN(2), ON(2), RC(1), WI(1)

(100) LSBP agencies will encourage **pollution prevention projects at hospitals**, clinics, and medical, dental, and veterinary offices with an emphasis on removing mercury and making the offices "mercury free." BR(1), EC(1), EPA(1), KBIC(1), MI(1), MN(1), ON(1), WI(1)

(73) LSBP agencies will **assist schools** in seeking out and disposing of mercury and PCBs on school property. BR(1), EPA(1), MI(1), MN(1), ON(1), WI(1)

(101) LSBP agencies will support **partnerships with dental associations** to develop training materials and programs for dental offices regarding the proper handling, collection, and disposal of amalgam wastes. BR(2), EC(1), MI(1), MN(1), ON(1)

(162) LSBP agencies will work with communities to provide **sector-specific pollution prevention outreach** such as workshops for the medical and dental communities, and other important sectors. BR(1), EC(2), EPA (1), MI(1), WI(1)

(187) LSBP agencies will support federal initiatives to **lower the reporting limits on persistent, bioaccumulative toxics under the TRI (US) and the NPRI (Canadian)** and lower the reporting limit for PCBs under TSCA even further in order to track low level waste. BR(1), EC(1), EPA(1), MN(2)

(48) LSBP agencies will evaluate programs to prevent or remove chlorinated or mercury containing material from **incinerator feedstocks.** EC(2), MI(1), ON(1)

(191) The U.S. federal government should consider a plan to **permanently retire its mercury stockpile** and to retire other sources of elemental mercury instead of recycling. EPA(1), MI(2), MN(2)

(20) Canadian LSBP agencies will assist establishing through municipalities **depots for mercury-containing** thermometers, fluorescent tubes and other **household products** about to be discarded. EC(1), ON (1)

(27) Wisconsin and the KBIC will continue to work with local partners to encourage consumer upgrades to energy-efficient programmable electronic thermostats combined with proper disposal of old mercury thermostats. KBIC(1), WI(1)

(51) Canadian LSBP agencies will encourage municipalities to **establish source separation programs** to divert household hazardous materials including cleaners, batteries, and fluorescent lights from landfills or incinerators. EC(1), ON(1)

(107) Canadian LSPB agencies to follow up the 1999 City of Toronto **pilot** among Environment Canada, suppliers and the **Ontario Dental Association** and apply the results to the Thunder Bay area. EC(2), ON(2)

(105) U.S. LSBP agencies will institute a **mercury thermometer swap program** where mercury thermometers are exchanged for non-mercury-bearing ones. FDL(1), GP(1)

(4) U.S. LSBP agencies will evaluate a variety of **economic incentives** or disincentives to promote verifiable or innovative reductions. Possible incentives include early reduction credits, tax relief, low-interest loans, grants, rebates and bounties for achievers. Possible disincentives include fees, taxes or caps on mercury-bearing products or uncontrolled sources of any of the nine designated chemicals. MI(2)

(28) Encourage **re-lamping with fluorescent lamps** and the proper disposal and recycling of old lamps. In addition, the governments will emphasize the proper identification and disposal of PCB ballasts on old fluorescent lamps. KBIC(1)

(75) By the end of 2000, EPA will develop and distribute through the **Binational Toxics Strategy** mercury workgroup a package of information related to mercury reduction at schools, including advice on how to eliminate mercury from school laboratories. EPA(1)

(163) U.S. LSBP agencies will encourage a **source separation program** to divert household hazardous material such as cleaners, batteries, and fluorescent lights from landfills and burn barrels. KBIC(1)

(77) Minnesota will investigate the potential use of a mercury-sniffing dog to **identify mercury** in schools as part of the assistance to schools effort. MN(2)

(180) The U.S. EPA should close the **RCRA Subtitle C loop** that allows the incineration of mercury-bearing hazardous waste. MN(2)

(184) U.S. LSBP agencies will work with operators of **medical waste incinerators** to pursue reductions of mercury, dioxin and hexachlorobenzene through source reduction elimination/segregation, including the removal of noninfectious waste from the incinerator waste stream. BR(1)

Strategy 6 - New laws and regulations may be the most fair way of reducing releases.

(147) U.S. LSBP agencies will pursue **bans on non-essential uses of the nine** persistent, bioaccumulative, toxic substances targeted for zero discharge (e.g. light switches in running shoes). BR(2), MI(2), MN(2)

(149) The states and U.S. EPA will include appropriate limits for persistent bioaccumulative toxic substances in **air emission permits** to eliminate or further reduce the deposition of these substances in the Lake Superior basin. Also, lower emission rates should be used to define major source applicability for MACT standards. MI(1), MN(2)

(148) For toxic pollutants with effluent limitations that are below reliable levels of analytical detection (e.g. nine zero discharge pollutants), U.S. LSBP agencies will require **toxic reduction**

plans in each new or reissued NPDES permit for point sources discharges to the basin. U.S. LSBP agencies will require toxic reduction plans in new or reissued air permits for facilities that could reasonably be expected to emit any of the nine zero discharge pollutants based on knowledge of the process. BR(2), MI(1)

(50) Michigan will evaluate adoption of a law similar to Minnesota's **incinerator law** prohibiting disposal of mercury-bearing waste. MI(1)

(120) Promote the long-term goal of having energy utilities **convert from coal burning to a natural gas energy source**. In the medium-term, householders need to develop an energy conservation ethic that would extend to the purchase of clean fuel. RC(2)

(179) The U.S. Federal government should evaluate lowering the **nationwide limits on sewage sludge and medical waste incinerators**, especially for mercury. MN(2)

(116) By December 2000, EPA will make a determination about whether to **regulate mercury emissions** from electric utilities. EPA(1)

(178) EPA will promulgate regulations requiring **emission limits on pollutants** (such as mercury and dioxin) for all **operating medical waste incinerators** by the end of 2000. All medical waste incinerators that are not equipped to meet these requirements will be required to shut down by the end of 2001. EPA(1)

(108) Ontario will investigate a regulatory **exemption** to dispose of mercury wastes reclaimed from dental offices. ON(2)

(181) Wisconsin DNR will continue to pursue a statewide mercury reduction strategy, including proposed legislation providing for **cap and trade of mercury emissions** in the state. WI(1)

Strategy 7 - Remediation of mercury contaminated sediments.

(126) Pursue clean up of mercury-**contaminated sediments** in Peninsula Harbour through a partnership among public and private organizations. EC(1), ON(2)

4.2.1.2 PCBs

Reduction Goals for PCBs

Because of the inadequacy of the U.S. PCB database in the Lake Superior basin, it is not possible to describe a numeric goal for the mass of PCBs that should be destroyed on the U.S. side of the Lake Superior basin. However, there are a variety of strategies that would both improve the U.S. database and bring about reductions. It is crucial that 1) untested equipment be tested, 2) owners of PCB-bearing equipment decommission that equipment and 3) governments assist their efforts to test and decommission. Section 3.2.11 lists PCB strategies that cover these areas. The section below identifies four PCB strategies that the agencies propose to emphasize in the next two to three years.

In order to meet the 2000 and 2005 PCB reduction goals, Canada will need to destroy a total of 42,391 kg and 131,036 kg, respectively, high level PCBs out of the original 485,320 kg in-use or in-storage in 1990. In addition, reduction estimates for low level PCBs should be improved. Section 4.3.2 contains sector specific strategies that include actions for PCB reductions.

PCB Commitments

The following four strategies each include a subset of actions that are ranked as Level 1 or 2:

Strategy 1 - Encourage voluntary reductions of the use and storage of PCBs.

(1) LSBP agencies will work with facilities in the Lake Superior basin to **establish voluntary agreements** to reduce the use, discharge or emissions of the nine designated chemicals in order to meet the goals stated in the stage 2 LaMP reduction schedule. EC(1), EPA(1), MI(1), MN(1), ON(1), WI(1)

(55) LSBP agencies will encourage **PCB "mentors"**(i.e., facilities that have already removed their PCBs) to assist smaller facilities that do not have access to as much environmental expertise. EC(1), EPA(1), MI(2), MN(2)

(176) The **Great Lakes Binational Toxics Strategy** should be pursued to meet the short-term, interim goals of the Lake Superior Binational Program for PCBs. EC(1), EPA(1), MI(1), MN(2)

(56) LSBP agencies will encourage the formation of **PCB cooperatives** that allow PCB equipment owners to achieve economies of scale by using a common contractor to remove, transport and destroy PCBs from a region within the basin. EC(1), MN(1), ON(1)

(13) U.S. LSBP agencies will evaluate and begin the development of **purchasing policies** to eliminate use of products that might include **PCB or mercury equipment** (e.g., boilers, buildings, vehicles, electrical equipment and laboratory equipment). Policies will also examine phase-out of existing mercury or PCB containing items. BR(1), MI(1), MN(2)

(125) Through voluntary agreements, **remove PCBs** in storage so that all pulp and paper mills are PCB free. EC(1), ON(1)

(65) U.S. LSBP agencies will ask all the power generators in the basin to endorse the **PCB reduction goals** outlined in the Stage 2 LaMP and will provide Lake Superior steward awards to facilities that accept the challenge. EPA(1), MI (2)

(66) By the end of calendar year 2000, EPA will formalize the **PCB Phasedown Program** pilot project with the major electric utilities in the Great Lakes basin, which is designed to encourage the utilities to phase out their remaining PCB equipment. EPA(1)

(2) By the end of calendar year 2006, EPA will work with facilities that have not previously been approached in the Lake Superior basin to establish **voluntary agreements** or commitments to reduce the use or releases of PCBs. EPA(1)

(35) By the end of calendar year 2000, EPA will complete the PCB and Mercury **Clean Sweep pilot project** which includes a component to collect PCB-contaminated oil in the Great Lakes basin, treat the oil to remove the PCBs, and **recycle PCB-free oil**. EPA(1)

Strategy 2 - Untested equipment must be tested and the inventory must be kept current.

(187) LSBP agencies will support federal initiatives to **lower the reporting limits on persistent, bioaccumulative toxics under the TRI (US) and the NPRI (Canadian)** and lower the reporting limit for PCBs under TSCA even further in order to track low level waste. BR(1), EC(1), EPA(1), MN(2)

(62) LSBP agencies will encourage owners of transformers and capacitors to test their equipment to **identify any remaining PCBs**. EPA(1), MI(2), MN(1)

(60) Canadian LSBP agencies will encourage owners of PCB-bearing equipment to monitor and **document the ongoing status** of the equipment until the equipment is removed. EC(1), ON(2)

Strategy 3 - Decommissioning, removal and destruction of PCBs.

(34) U.S. LSBP agencies will seek funding to initiate and continue periodic abandoned **"white goods" collections**. BR(1), FDL(1), GP(1), KBIC(1), MI(2), RC(1)

(58) LSBP agencies will encourage PCB owners to **destroy PCBs** in use or storage. Encouragement could be done through voluntary agreements, economic incentives, or decommissioning in lieu of certain fines. BR(2), EPA(1), MI(2), MN(2), ON(1)

(73) LSBP agencies will **assist schools** in seeking out and disposing of PCBs and mercury that are present on school property. BR(1), EPA(1), MI(1), MN(1), ON(1)

(57) LSBP agencies will include **PCBs in outreach and hazardous waste collections** designed for small businesses since PCBs may be contained in light ballasts, paint, well pumps, small capacitors and white goods (e.g., refrigerators). BR(1), EC(2), EPA(1), MI(2), ON(1)

(63) U.S. LSBP agencies should consider **removal of PCB-bearing equipment** in lieu of some fines (e.g. Supplemental Environmental Projects). BR(2), EPA(1), MI(1)

(61) Canadian LSBP agencies will continue to seek **in-basin PCB destruction capability** for low level PCBs only. EC(1), ON(1)

(151) U.S. LSBP agencies will work with individual facilities in the basin to identify opportunities to **reduce storage, use or release of mercury and PCBs** (e.g., toxic reduction plans, voluntary audits, "check lists" to be included in the permit application.). EPA(1), MI(1)

(64) U.S. LSBP agencies will assist in the **testing and removal of PCB-**bearing equipment, especially for municipalities, schools, hospitals and small businesses. An explanation of the financial consequences of PCB contamination of property should be included in this outreach program. BR(2), MN(2)

(67) By the end of calendar year 2002, EPA **will identify federally-owned PCBs** in the Lake Superior basin and seek their removal by the departments of agencies that own the PCBs. EPA(1)

Strategy 4 - Governments to undertake PCB training programs.

(71) U.S. LSBP agencies will encourage **training sessions for demolition contractors.** Such training would preferably be associated with licensing requirements or other mandatory procedures. Opportunities to align the training with trade association outreach will be sought. BR(2), EPA(2), MI(2), MN(1), WI(1)

(69) LSBP agencies will provide **training materials for appliance recyclers and auto salvage operators** to assist compliance with applicable rules. EC(2), MI(1), MN(1)

(59) Canadian LSBP agencies will consider another round of **training sessions for small PCB owners**. Cooperation is promoted so that PCB owners can reduce the cost of contracted PCB services (e.g., treatment of PCB contaminated mineral oils, on-site decontamination of capacitors and transformers, shipment of PCBs to high temperature incineration facilities and carcass removal). EC(1), ON(1)

4.2.1.3 Pesticides

Reduction Goals for Pesticides

Although U.S. and Canada domestic production has ceased and uses have been canceled, these pesticides continue to have an environmental presence. In addition, the level of toxaphene in Lake Superior has not shown a general decline over the years like the other pesticides. Collection programs in the Lake Superior basin continue to net these pesticides. Lake Superior strategies for pesticides include continued or expanded collection opportunities coupled with concerted public outreach. Strategies for pesticides reductions are discussed in Sections 4.3 and 4.4.

Out-of -basin strategies addressing pesticides would include support by the Great Lakes states and Canada for international efforts such as the Regional Treaty on Persistent Organic Pollutants, the UNEP Global Treaty on Persistent Organic Pollutants, the Commission for Environmental Cooperation Tri-lateral North American Regional Action Plans, and the NAFTA Technical

Working Group on Pesticides to implement phased reduction and eventual elimination of the targeted pesticides in other countries.

Pesticide Commitments

The following three strategies each include a subset of actions that are ranked as Level 1 or 2:

Strategy 1 - Collection of remaining stockpiles of banned pesticides.

(32) LSBP agencies will seek funding to initiate or continue permanent household and agricultural (e.g. pesticides) **hazardous waste (HAHW) collection depots** in the largest Lake Superior basin cities. Furthermore, U.S. LSBP agencies will seek funding to initiate and continue periodic or mobile collections for the more remote locations within the Lake Superior basin. Collections will not be limited to pesticides but will include a focus on mercury containing products (e.g. thermometers, abandoned appliances). U.S. LSBP agencies will seek funding to initiate and continue Lake Superior basin HAHW education programs that will include information about how individuals can practice home environmental stewardship; how to identify HAHW; and how to properly dispose of HAHW. BR(1), EC(2), EPA(1), FDL(1), KBIC(1), MI(1), MN(2), ON(2), RC(1), WI(1)

(5) U.S. LSBP agencies will provide indirect or direct **financial support** to businesses, organizations and local governments for pollution prevention projects. Innovation will be encouraged. Possible projects include **clean sweeps**, bounties on mercury products, bounties or other mechanisms to reduce burn barrel use, mercury swaps for alternative products, education, purchasing policies, energy conservation, water conservation, pay-as-you-throw trash disposal fees and others. BR(1), EPA(1), MI(1), MN(1), WI(1)

(33) U.S. LSBP agencies will assist industries and business in the basin to conduct industrial **clean sweeps** and use economy of scale for collections and shipments of hazardous waste. Examples of successful business collection programs include Western Lake Superior Sanitary District's clean shop program and Northwest Wisconsin Regional Planning Commission's very small quantity generator collection program. BR(2), MI(2), WI(1)

Strategy 2 - Engage other programs that deal with banned pesticides.

(176) The **Great Lakes Binational Toxics Strategy** should be pursued to meet the short-term, interim goals of the Lake Superior Binational Program for pesticides. EC(1), EPA(1), MI(1), MN(2)

(190) The U.S. federal government should tighten **the reporting requirements on export shipments of pesticides**, especially pesticides that are no longer used in the United States. MN(2)

Strategy 3 - Educate residents about the use of pesticides.

(38) LSBP agencies will pursue urban initiatives that increase awareness, through outreach, of the risk of **pesticide use**. EPA(1), ON(2)

(89) Canadian LSBP agencies will encourage **small businesses** through an **education program** to utilize the permanent hazardous waste depots available to them. and coordinate the local **Chamber of Commerce or trade associations** to run pollution prevention education and training sessions for proper **waste management**. EC(2), ON(1)

4.2.1.4 Dioxin, HCB, and OCS

Reduction Goals for Dioxin, HCB, and OCS

While the US and Canada appear to already be ahead of the 80 percent reduction target by 2005 target for dioxin/HCB/OCS, there are gaps in the inventory. As more information becomes available on the sources and loads from the basin, the base line may change, and this may change our estimate of progress towards the 2005 goal. In the meantime, the remaining largest sources of dioxin appear to be burn barrel emissions and wood treatment with pentachlorophenol (PCP). Reduction strategies that should be applied before 2005 include public education and aggressive identification of burn barrels and investigation of ongoing use of PCP and PCP contaminated sites.

Dioxin, HCB, and OCS Commitments

The following five strategies each include a subset of actions that are ranked as Level 1 or 2:

Strategy 1 - Encourage voluntary reductions of the discharge and emission of dioxin/HCB/OCS.

(1) LSBP agencies will work with facilities in the Lake Superior basin to **establish voluntary agreements** to reduce the use, discharge or emissions of the nine designated chemicals in order to meet the goals stated in the stage 2 LaMP reduction schedule. EC(1), EPA(1), MI(1), MN(1), ON(1), WI(1)

(103) LSBP agencies will support and promote implementation of **voluntary agreements with the health care industry** to reduce use of mercury and formation of dioxin. BR(1), EC(2), EPA(1), MI(1), ON(1), WI(1)

(176) The **Great Lakes Binational Toxics Strategy** should be pursued to meet the short-term, interim goals of the Lake Superior Binational Program for dioxin, HCB and OCS. EC(1), EPA(1), MI(1), MN(2)

(178) EPA will promulgate regulations requiring **emission limits** on pollutants (such as mercury and dioxin) for all operating **medical waste incinerators** by the end of 2000. All medical waste

incinerators that are not equipped to meet these requirements will be required to shut down by the end of 2001. EPA(1)

(128) Operational practices and design of existing **wood preservation facilities** in the basin will be assessed in 2000 by third party auditors and Environment Canada will invite facilities to participate in a **voluntary program**. EC(1)

Strategy 2 - Develop incentives to reduce dioxin/HCB/OCS.

(5) U.S. LSBP agencies will provide indirect or direct **financial support** to businesses, organizations and local governments for pollution prevention projects. Innovation will be encouraged. Possible projects include clean sweeps, bounties on mercury products, bounties or other mechanisms to reduce burn barrel use, mercury swaps for alternative products, education, purchasing policies, energy conservation, water conservation, pay-as-you-throw trash disposal fees and others. BR(1), EPA(1), MI(1), MN(1), WI(1)

(166) Establish a recognition program for all wastewater treatment plants that implement the **Blueprint for Zero Discharge**. RC(2)

Strategy 3 - Pollution prevention is the preferred approach to inhibit the formation of dioxin/HCB/OCS in incineration.

(49) U.S. LSBP agencies will support **public education**/outreach campaigns regarding the health and environmental effects of **burn barrels** and small incinerators and encourage local units of government to pass ordinances banning burn barrels. BR(1), EPA(1), FDL(1), MI(1), MN(1), WI(1)

(48) LSBP agencies will evaluate programs to prevent or remove chlorinated or mercury containing material from **incinerator feedstocks.** EC(2), MI(1), ON(1)

(14) LSBP agencies will introduce **process chlorine-free paper products** whenever possible in their communication. KBIC(1), RC(1)

(47) LSBP agencies will insist on the highest standards and best available technology for **new incinerators**. EC(2), EPA(2)

(184) U.S. LSBP agencies will work with operators of **medical waste incinerators** to pursue reductions of mercury, dioxin and hexachlorobenzene through source reduction elimination/segregation, including the removal of noninfectious waste from the incinerator waste stream. BR(1)

(164) EPA has initiated and will continue to work with **developing partnerships between the Hearth Products Association** and any appropriate parties (i.e., state, tribal, local) towards participation in the wood stove change-out program in the Great Lakes basin. This exchange

program allows for the consumer switch from older, less-efficient wood-burning stoves to new more combustion-efficient stoves, which reduces the amount of air toxic emissions. EPA(1)

Strategy 4 - There is a continuing role for the pulp and paper industry to play in dioxin reductions.

(3) Canadian LSBP agencies will continue discussions with the seven **pulp and paper facilities**: to address purchasing policies to eliminate the nine critical pollutants; to review energy reduction practice thereby reducing dependence on purchased energy that is generated from coal burning facilities which release mercury and dioxin; introduce water conservation to reduce energy use; recycle fluorescent tubes. EC(1), ON(1)

(127) Reduce dioxin and furan discharges from the pulp bleaching process by **reducing AOX** to less than 0.8 kg/tonne. ON(1)

Strategy 5 - Identify sources of dioxin/HCB/OCS.

(187) LSBP agencies will support federal initiatives to **lower the reporting limits on persistent, bioaccumulative toxics under the TRI (US) and the NPRI (Canadian)** and lower the reporting limit for PCBs under TSCA even further in order to track low level waste. BR(1), EC(1), EPA(1), MN(2)

4.2.1.5 General Strategies (applicable to several targeted pollutants)

The following four strategies each include a subset of actions that are ranked as Level 1 or 2:

Strategy 1 - Lake Superior goals must be taken into account by other programs.

(199) The EPA and EC will lead efforts to develop a coordinated monitoring strategy for the Lake Superior basin. All of the LSBP agencies will assist in the development of the monitoring strategy and seek resources for implementation. The monitoring strategy will be peer reviewed and presented in LaMP 2002. BR(1), EC(1), EPA(1), FDL(1), GP(1), KBIC(1), MI(1), MN(1), ON(1), RC(1), WI(1)

(176) The **Great Lakes Binational Toxics Strategy** should be pursued to meet the short-term, interim goals of the Lake Superior Binational Program for mercury, PCBs, dioxin, hexachlorobenzene, octachlorostyrene, and pesticides. EC(1), EPA(1), MI(1), MN(2)

(144) LSBP agencies will coordinate LaMP critical pollutant reduction strategies with **Total Maximum Daily Load requirements** or limits under Ontario's Certificate of Approval process. FDL(1), MN(1), ON(1)

(145) EPA will provide technical and regulatory assistance to Lake Superior basin States, Tribes, and local governments on how to **identify and address Class V** wells that may endanger

groundwater within the Lake Superior basin and therefore pose a contamination threat to the waters of Lake Superior. EPA(1)

(146) EPA will provide priority review to potentially endangering and **high priority Class V well types** identified within delineated source water protection areas for Lake Superior public drinking water system intakes in Michigan and Minnesota. EPA(1)

(156) Minnesota will consider the applicability of the **Outstanding National Resource Water (ONRW) designation** in future reviews of water quality rules. MN(1)

(78) Encourage schools in the Lake Superior basin to commit to **green school programs** including Energy Star, Blueprint for a Green Campus program and others. RC(1)

(182) U.S. LSBP agencies will work on a cooperative basis to establish a **national ambient air toxics monitoring network.** This network can be used to determine atmospheric deposition of toxics and assess multi-pathway exposures to air emissions such as the bioaccumulation of methylmercury in fish resulting in exposures to people who eat fish. WI(1)

(183) U.S. LSBP agencies will continue to participate in the **Great Lakes Regional Air Toxics Emissions Inventory** to compile a database of point, area, and mobile source emissions for the Great Lakes region. WI(2)

(152) Ontario will actively pursue the development of regulations to require **monitoring and reporting emissions**, of public concern, from significant industrial and commercial emission sources. ON(1)

Strategy 2 - Sites contaminated by the nine designated chemicals must be identified and cleaned up.

(194) LSBP agencies will **initiate necessary sediment remediation measures at AOCs** and other impaired sites known to contribute persistent, bioaccumulative substances to the Lake Superior ecosystem. EC(1), MN(2), ON(2), WI (2)

(168) Canadian LSBP agencies will support First Nations on contaminated **site assessment and remediation** (primarily petroleum hydrocarbon contamination). EC(1)

(195) The Superfund program is currently working to **complete remediation** at two sites in the Lake Superior basin. These include **Torch Lake** in Michigan and the **St. Louis River** in Minnesota. Superfund commits to completing the remedies for these two sites by the end of FY 2005. EPA(1)

Strategy 3 - Pollution prevention is the preferred approach to achieving the goal of zero discharge.

(165) Pursue funding for a public awareness campaign in support of the community toxic reduction activities. The **P2 awareness campaign** should focus on preventing pollution in the home, conserving energy, using alternative products, encouraging use of clean sweep collections and other proper disposal of household hazardous wastes. Elements of the campaign could include a brochure for owners of old homes on how to dispose of banned and outdated products, and a "Get rid of it" brochure for the "nasty nine" chemicals. Consumer groups will be sought as partners in this strategy. FDL(1), RC(1)

(141) Canadian LSBP agencies will **expand the Pollution Prevention Demonstration Site Program** to both Canadian Federal facilities and First Nations in the Lake Superior drainage basin. The program addresses the generation of hazardous waste through such activities as identification and demonstration of alternative products, practices and technologies. EC(2)

(87) By the end of 2000, EPA will publicize through posting on its web site, information on how owners and operators of motor vehicle **waste disposal wells** can comply with the revisions to the Underground Injection Control Regulations that become effective on April 5, 2000. This information will assist these small businesses located in the Lake Superior basin to reduce or eliminate discharges that may adversely impact area groundwater that may ultimately flow into the lake. EPA(1)

(167) Canadian LSBP agencies will support initiatives to **reduce reliance on petroleum hydrocarbons for energy production** or space heating purposes at First Nations (use of alternative technologies/green power). EC(2)

(150) States and U.S. EPA will include **pollution prevention components in enforcement settlements** as appropriate. MI(1)

(21) The province of Ontario will investigate the **feasibility of redrafting existing legislation** to accommodate product stewardship strategies involving waste disposal. ON(2)

(78) Encourage schools in the Lake Superior basin to commit to **green school programs** including Energy Star, Blueprint for a Green Campus program, and others. RC(1)

(26) U.S. LSBP agencies will assist architects and builders in incorporating **energy conservation measures into new structures** being planned and built on the reservation. FDL(1)

(163) U.S. LSBP agencies will encourage a **source separation program** to divert household hazardous material such as cleaners, batteries, and fluorescent lights from landfills and burn barrels. KBIC(1)

U.S. Action:

(138) WDNR will work with the region's oil refining industry to evaluate use, generation, and environmental release of Lake Superior critical pollutants and investigate options for pollution prevention and control. WI(2)

Strategy 4 - Lake Superior communities must be supported in their pursuit of the zero discharge demonstration program and encouraged to share their expertise to help others protect the Lake.

(76) U.S. LSBP agencies will support basin-wide coordination of citizen and school monitoring programs such as "**Lake Superior Lakewatch**." U.S. LSBP agencies will support continuations of existing programs and formation of new programs based on local interest. These programs will be used as outreach activities for the Binational Program and will increase a sense of stewardship in the Lake Superior basin. BR(2), FDL(1), WI(2)

(88) U.S. LSBP agencies will pursue **funding for community and regional toxic reduction activities** and networking between Lake Superior communities. In particular, the toxic reduction committees working in Marquette, Michigan; Superior, Wisconsin; and through the Western Lake Superior Sanitary District (WLSSD) in Duluth, MN, should be supported. Innovative and alternative funding should also be pursued for these and expanded efforts in communities throughout the Lake Superior basin. BR(1), WI(1)

(79) Assist school districts, education agencies, and youth organizations to **supplement existing curricula and develop new curricula** that are aimed at reducing the nine designated chemicals. This assistance may include training, providing teaching devices, or other necessary activities. EC(1)

4.3 REDUCTION STRATEGIES BY SECTOR

The previous section presented strategies and actions organized by critical pollutants. This section is organized by socioeconomic sectors. The purpose of the Lake Superior Stage 3 LaMP is to identify strategies that will reduce critical pollutants in accordance with Stage 2 load reduction schedules, with the ultimate goal being the virtual elimination of critical pollutant inputs to the environment. There are several broad categories of strategies, including Contaminated Sites Strategies (Section 4.4) and Monitoring Strategies (Section 4.5). This section covers strategies aimed primarily to reduce loads from sources within the Lake Superior basin. They are grouped into the following sections: Multiple Sector Strategies, Sector Specific Strategies, and Out-of-basin Strategies. The latter identifies actions that could be taken on a broader scale to protect Lake Superior from airborne contaminants.

This section presents actions that were selected as agency commitments, as well as actions that have been discussed through the Lake Superior Binational Program, but are not proposed as commitments at this time. These actions are included and denoted under the heading "future possibilities." Some of these are important if load reduction goals in 2005 and 2010 are to be met.

The government agencies working on the Binational Program are selecting various actions to pursue in the coming two to three years. Strategies listed in this section are denoted as commitments by the following acronyms.

EC	Environment Canada (EC)
EPA	United States Environmental Protection Agency – Region V (U.S. EPA)
MI	Michigan Department of Environmental Quality (MDEQ)
MN	Minnesota Pollution Control Agency (MPCA)
ON	Ontario Ministry of Environment (OMOE)
WI	Wisconsin Department of Natural Resources (WI DNR)
BR	Bad River Band of the Lake Superior Chippewa
FDL	Fond du Lac Band of the Lake Superior Chippewa
GP	Grand Portage Band of the Lake Superior Chippewa
KBIC	Keweenaw Bay Indian Community
RC	Red Cliff Band of the Lake Superior Chippewa

Lake Superior Binational Program agencies are indicated in the text as LSBP agencies. Some of these strategies can be pursued with existing resources, although many would require additional resources in order to be accomplished. In this chapter, strategies that are not accompanied by agency acronyms in the listing are included for future reference but are not proposed as commitments at this time.

4.3.1 Multiple Sector Strategies

Some reduction strategies are applicable to nearly all sectors of society (industry, business, government, and communities). For example, energy conservation can be applied to every sector. Similarly, the same pollution control technology may be used by different sectors, and the same government programs may apply to a variety of sectors. The following reduction strategies are recognized for their broad applicability to multiple sectors.

4.3.1.1 Voluntary Agreements

Regulatory measures provide only part of the reductions needed to meet the zero discharge and zero emission challenge. Voluntary agreements to reduce discharges and emissions beyond the legally required limits are needed to fill the gap between mandatory reductions and virtual elimination (e.g., zero release). The voluntary agreement approach is already being used in several LSBP agencies and it is proposed that this effort be emphasized in the Lake Superior Binational Program. Industries in the basin would be asked to respond to the goals of the zero discharge program. The success of voluntary agreements could be evaluated in three ways: 1) the reduction in releases of mercury, dioxin, HCB and OCS beyond the compliance limits; 2) the amount of PCBs decommissioned from a voluntary agreement facility; or 3) the number of facilities that participate in a voluntary agreement.

Binational Action:

(1) LSBP agencies will work with facilities in the Lake Superior basin to establish voluntary agreements to reduce the use, discharge or emissions of the nine designated chemicals in order to meet the goals stated in the Stage 2 LaMP reduction schedule. (EC, EPA, MI, MN, ON, WI)

U.S. Action:

(2) By the end of calendar year 2006, EPA will work with facilities that have not previously been approached in the Lake Superior basin to establish voluntary agreements or commitments to reduce the use or releases of PCBs. (EPA)

Canadian Action:

(3) Canadian LSBP agencies will continue discussions with the seven pulp and paper facilities: to address purchasing policies to eliminate the nine critical pollutants; to review energy reduction practice thereby reducing dependence on purchased energy that is generated from coal burning facilities which release mercury and dioxin; introduce water conservation to reduce energy use; recycle fluorescent tubes. (EC, ON)

4.3.1.2 Economic Incentives, Evaluation and Assistance

There can be an economic cost associated with zero discharge and zero emission. Some sources will be easier and cheaper to reduce while others will be more difficult and expensive. Developing and compiling information on the cost effectiveness would be beneficial in choosing reduction activities because the most cost-effective reductions should be implemented first. In addition, the governments should consider what economic incentives could be used to encourage reductions and how to provide sector- specific support and guidance to sources that have significant releases, but lack the resources to implement reductions. Progress on these economic strategies could be measured in a variety of ways. Some examples of measurement could be: 1) cost effectiveness information compiled for the strategies in this Stage 3; 2) quantity of the nine designated chemicals that are avoided through implementation of strategies; or 3) number and size of loans or grants in some jurisdictions for programs that reduce the nine designated chemicals.

U.S. Actions:

(4) U.S. LSBP agencies will evaluate a variety of economic incentives or disincentives to promote verifiable or innovative reductions. Possible incentives include early reduction credits, tax relief, low-interest loans, grants, rebates and bounties for achievers. Possible disincentives include fees, taxes or caps on mercury-bearing products or uncontrolled sources of any of the nine designated chemicals. (MI)

(5) U.S. LSBP agencies will provide indirect or direct financial support to businesses, organizations and local governments for pollution prevention projects. Innovation will be encouraged. Possible projects include clean sweeps, bounties on mercury products, bounties or other mechanisms to reduce burn barrel use, mercury swaps for alternative products, education, purchasing policies, energy conservation, water conservation, pay-as-you-throw trash disposal fees and others. (BR, EPA, MI, MN, WI)

Future possibilities:

(6) Compile a running list of the cost effectiveness of the reduction strategies. Sources of information pertaining to cost effectiveness include the Minnesota Mercury Initiative Strategies Report, the Canadian Pollution Prevention Centre in Sarnia, the Lake Superior Energy Efficiency report (Wisconsin Energy Conservation Corporation 1998), and facility-specific environmental review documents.

(7) Investigate the establishment of a fund to assist in reduction, remediation, treatment, disposal and safe storage of the nine designated chemicals. The source of the funding could be from both the public and private sectors.

(8) Undertake an assessment of the utility of various economic instruments for the municipal and industrial sectors of the Lake Superior watershed.

(9) Continue to explore alternative financing arrangements for environmental protection and restoration (e.g. revolving loan funds).

(10) In Canada, investigate the feasibility of a program to waive the federal GST or Provincial sales tax on environmentally friendly products.

4.3.1.3 Other Incentives

While economic incentives are important, there are other types of incentives that should be used in the Zero Discharge Demonstration Project. Examples of other incentives include awards and credit for beyond-compliance reductions. Possible measures of success for this strategy could include the total pounds of pollution avoided during a given year, or the number of facilities each year that meet established criteria.

Future possibilities:

(11) In cooperation with the Lake Superior Binational Forum, LSBP agencies will establish a Lake Superior steward project. A special effort will be made to identify suppliers of products that are free of mercury, dioxin, and HCB.

(12) Acknowledge credit for beyond-compliance reductions, in order to provide an incentive for basin facilities to voluntarily reduce the use and emissions of the nine critical pollutants. The purpose of these credits is to avoid penalizing facilities that have already achieved reductions before nation-wide reduction programs are established.

4.3.1.4 Purchasing Policies

Much of the effort to reduce the nine designated chemicals will take place at the chemical's point source. However, the role of consumers should not be underestimated. Consumer purchases can influence the production and use of the nine designated chemicals. The governments themselves are significant consumers and government purchasing policies can set an example. Measuring progress towards this strategy could be determining the number of entities that develop purchasing policies on a before-and-after comparison of purchases. Also, calculations of quantities of critical pollutants avoided due to product switching could be estimated.

U.S. Action:

(13) U.S. LSBP agencies will evaluate and begin the development of purchasing policies to eliminate use of products that might include mercury equipment or PCB equipment (e.g., boilers, buildings, vehicles, electrical equipment and laboratory equipment). Policies will also examine phase-out of existing mercury or PCB containing items. (BR, MI, MN)

(14) LSBP agencies will introduce process chlorine-free paper products whenever possible in their communication. (KBIC, RC)

Future possibilities:

(15) Canadian LSBP agencies will work with pulp and paper mills to develop purchasing policies that require the certification of feedstock materials and confirm that levels of the nine critical pollutants are extremely low (concentration to be determined).

(16) Encourage facilities that use feedstock chemicals such as caustic soda, potassium hydroxide, sodium hypochlorite, sulfuric acid, chlorinated solvents, pesticides, analytic reagents or preservatives to develop purchasing policies to avoid purchasing chemicals that contain mercury, dioxin or hexachlorobenzene, even in trace amounts. Facilities would develop strategies to purchase products proven to be free of the nine critical pollutants. The nine critical pollutants should not be used or discharged in the manufacture of purchased products. Chemical suppliers who provide clean chemical products could get an award through the proposed Lake Superior steward program.

(17) Contract to print Lake Superior Binational Program documents with printers who participate in the Great Printers Project.

4.3.1.5 Product Stewardship

Product stewardship includes designing, manufacturing, transporting, retailing and disposal of products with the intent to minimize the impact of products to the environment. A variety of product stewardship programs are already in use by manufacturers. At this time these programs focus on the waste management portion of the product life cycle. Examples include programs that provide for thermostats to be returned to manufacturers for mercury recycling. Other possible product stewardship strategies include disposal depots maintained by manufacturers and labeling of products that contain critical pollutants. Of the nine designated chemicals, this strategy will be most applicable to mercury because of its many different uses. Possible measures of success for product stewardship include the number of companies labeling mercury-bearing products used in the Lake Superior basin, the weight of products brought into depots or returned through a reverse distribution system.

Binational Action:

(18) LSBP agencies will work with manufacturers within and outside the Lake Superior basin to develop depots and reverse distribution systems for citizens. Possible products to include in this strategy include batteries, paints, fluorescent lamps, thermostats, pressure-testing equipment, dental amalgam, laboratory reagents and others. (EC, EPA, MI, ON)

U.S. Action:

(19) U.S. LSBP agencies will encourage a nationwide dialogue on the import of mercury -bearing products. Nationwide labeling of mercury products will also be encouraged. (EPA, MN, MI)

Canadian Actions:

(20) Canadian LSBP agencies will assist in establishing depots for old mercury-containing thermometers, fluorescent tubes and other products for households. (EC, ON)

(21) The province of Ontario will investigate the feasibility of redrafting existing legislation to accommodate product stewardship strategies involving waste disposal. (ON)

4.3.1.6 Energy Conservation

Burning fossil fuels, particularly coal, to produce energy releases mercury and dioxin into the atmosphere. Fuel combustion is the second largest source of mercury emissions within the Lake Superior basin, but it is a relatively small source of dioxin. Control technologies are not currently available to substantially reduce mercury emissions from this source. Energy conservation would decrease the demand for energy, lower the amount of fuel burned, and thus reduce mercury emission. An additional significant benefit of this strategy is that it provides economic savings for the participants.

However, since energy is not necessarily used where it is produced, a decrease in energy used in the basin will not automatically result in decreased emissions. The Lake Superior utilities will still be able to sell their energy to other customers outside the basin. Despite this drawback, energy conservation in the basin is still valuable as a demonstration to be emulated outside the region.

The area of energy conservation and demand side management has been explored through the Lake Superior Energy Efficiency Work Group (Wisconsin Energy Conservation Group 1998). Energy conservation is also recommended in the Lake Superior Binational Program P2 Strategy (1996). A variety of other programs deal exclusively with the use of energy conservation to lower bills and promote environmentally friendly homes and businesses. One such program is the U.S. EPA Energy Star program. Several organizations in the Lake Superior basin are current participants in this program.

Water efficiency can also affect energy conservation. Work in the U.S. and Canada has shown that water conservation programs can have a beneficial impact on wastewater treatment plant performance. Water conservation can lead to increased performance and efficiency of treatment plants and decreased energy use, leading to reduction in operation and maintenance costs.

Measures of progress for energy conservation could include: 1) tracking trends in per capita electrical consumption in the basin compared to other regions; 2) the number of businesses enrolled in programs such as Energy Star; and 3) the ratio of fluorescent lamps to incandescent lamps sold in the basin. This type of information can often be translated into amount of energy saved, dollars saved and amount of mercury emissions that were prevented.

Binational Actions:

(22) LSBP agencies will promote energy conservation programs (e.g. on the U.S. side: EPA Energy Star Program) within the Lake Superior basin, agencies will especially urge the publicly-owned facilities, schools and universities in the Lake Superior basin to participate in energy conservation programs. The agencies will also work with the utilities operating in the basin to coordinate government and utility energy conservation programs. (BR, EC, EPA, MI, MN, ON, WI)

(23) LSBP agencies will encourage home and industry energy audits. (BR, EC, MI, ON)

(24) LSBP agencies will encourage municipal energy councils such as the Thunder Bay 2002 and the Duluth Citizen's Energy Council. (EC, MN, ON)

U.S. Action:

(25) As part of utility deregulation, the state of Minnesota will consider establishment of a mandatory "line charge" for demand side management energy efficiency projects. (MN).

(26) U.S. LSBP agencies will assist architects and builders in incorporating energy conservation measures into new structures being planned and built on the reservation. (FDL)

(27) Wisconsin and the KBIC will continue to work with local partners to encourage consumer upgrades to energy-efficient programmable electronic thermostats combined with proper disposal of old mercury thermostats. (KBIC, WI)

(28) Encourage re-lamping with fluorescent lamps and the proper disposal and recycling of old lamps. In addition, the governments will emphasize the proper identification and disposal of PCB ballasts on old fluorescent lamps. (KBIC)

Future possibilities:

(29) Encourage large electrical consumers (facilities) to use federal and provincial energy audit programs.

(30) Encourage utilities to conduct special promotions of their energy conservation programs within the Lake Superior basin.

(31) Encourage utilities to send mercury awareness and energy conservation information to consumers with monthly utility bills.

4.3.1.7 Waste Collection

Many household and agricultural products contain mercury and/or other LSBP defined critical pollutants, which could be eventually released to the environment. Within the Lake Superior basin, collection of household and agricultural products that contain mercury or other critical pollutants should be reasonably available to all basin residents. In addition, the Stage 2 LaMP reduction goals for pesticides are based on the operation of agricultural product collections. Most collections are publicly funded programs to collect household and agricultural hazardous waste and recycle or dispose of it properly.

In 1998, the City of Superior, Wisconsin Toxic Reduction Committee evaluated the availability and effectiveness of household hazardous waste and agricultural pesticide collection programs in the Lake Superior basin. This work is summarized below. Collection programs in the Lake Superior basin face challenges of funding and efficiency in serving a largely rural and scattered population. Generally single-event collections are the most expensive. Mobile collection programs have been found to be more cost-effective in some parts of the Lake Superior basin, such as in Wisconsin where a program is operated by the Northwest Wisconsin Regional Planning Commission. Permanent collection facilities operate in some of the larger population centers of the basin. Some areas of the basin are under-served.

In Michigan, Minnesota, and Wisconsin, household hazardous waste collection programs are usually coordinated in some way by county government. In both Minnesota and Wisconsin, all Lake Superior basin counties have ongoing collection programs. In Duluth, Minnesota there is also a permanent collection program operated by Western Lake Superior Sanitary District. Except for Marquette County, Michigan's Lake Superior counties do not have on-going collection programs. The upper peninsula of Michigan has two permanent collection locations in

Marquette and Escanaba. Canadian residents of the Lake Superior basin experience a lesser availability of household hazardous waste collection programs. In Canada, two clean sweeps were attempted in the early 1980s for recently banned organochlorine pesticides. They were found to be an inefficient way to collect these materials and the initiative was replaced with permanent household hazardous waste depots operating seasonally in Thunder Bay. Thunder Bay is the only Canadian municipality within the basin that has an ongoing collection program.

Usage statistics from ongoing programs indicate that collection events are well attended and that participation has increased from year to year. In addition, local government officials report that they receive many inquiries for proper household hazardous waste disposal in areas where collections are not available.

Agricultural "clean sweeps" are an important element of these collections. Surprising volumes of DDT, chlordane, and toxaphene have been collected at events in the U.S. portion of the basin, even though it is not an agriculture-intensive area.

In 1995, Northwest Wisconsin Regional Planning Commission, a local planning organization, developed a mobile household and agricultural hazardous waste collection program. It is funded by a combination of state and local monies, user fees, and pesticide assessment fees. In 1999, an EPA grant provided additional funds for outreach and expansion activities. The goal of this outreach was to educate people on how their personal actions affect the Lake Superior ecosystem. Preliminary indications are that the expanded outreach has doubled participation in the program.

In the late 1990s several tribes (Bad River Band, Fond Du Lac Band, Keweenaw Bay Indian Community, Grand Portage Band) have conducted collections in communities in and around reservation lands. A strong advertising and educational campaign prior to initiating a collection was found to be a valuable tool. Some tribes offered a limited pick-up service for individuals (e.g. elders) unable to leave their home to deliver material. Household hazardous waste collections implemented by tribes have been funded by a combination of federal and tribal government funding.

A broad indication of success for collection programs is whether collection opportunities are reasonably available to most basin residents. Success of individual programs can be monitored using collection quantities and number of households using the service.

Binational Action:

(32) LSBP agencies will seek funding to initiate or continue permanent household and agricultural (e.g. pesticides) hazardous waste (HAHW) collection depots in the largest Lake Superior basin cities. Furthermore, U.S. LSBP agencies will seek funding to initiate and continue periodic or mobile collections for the more remote locations within the Lake Superior basin. Collections will not be limited to pesticides but will include a focus on mercury containing products (e.g. thermometers, abandoned appliances). U.S. LSBP agencies will seek funding to initiate and continue Lake Superior basin HAHW education programs that will include information about how individuals can practice home environmental stewardship; how to identify HAHW and properly dispose of HAHW, and how this protects the Lake Superior basin. (BR, EC, EPA, FDL, KBIC, MI, MN, ON, RC, WI)

U.S. Actions:

(33) U.S. LSBP agencies will assist industries and business in the basin to conduct industrial clean sweeps and use economy of scale for collections and shipments of hazardous waste. Examples of successful business collection programs include Western Lake Superior Sanitary District's clean shop program and the Northwest Wisconsin Regional Planning Commission's very small quantity generator collection program. (BR, MI, WI).

(34) U.S. LSBP agencies will seek funding to initiate and continue periodic abandoned "white goods" collections. (BR, FDL, GP, KBIC, MI, RC)

(35) By the end of calendar year 2000, EPA will complete the PCB and mercury Clean Sweep pilot project, which includes a component to collect PCB-contaminated oil in the Great Lakes basin, treat the oil to remove PCBs, and recycle PCB-free oil. (EPA)

Future possibilities:

(36) Investigate the use of a surcharge or assessment at the wholesale or retail level on mercury-containing consumer items to fund collection programs.

(37) Develop a more holistic approach to waste collection on the reservation. (FDL)

4.3.1.8 Pesticide Use

In the United States, the pesticides designated for the Lake Superior zero discharge demonstration program (aldrin/dieldrin, chlordane, DDT and toxaphene) have been canceled (i.e., production is legal, sale and distribution is illegal, but application/use of designated pesticides purchased prior to cancellation is legal). In addition, these designated pesticides, with the exception of chlordane, have not been in production in the U.S. for many years. In 1997, the only remaining U.S. manufacturer of chlordane announced that their production would cease.

In Canada, federal registration for production of aldrin/dieldrin and chlordane has been discontinued in 1990 with the whole and retail sale of end-use products being permissible until 1995. Federal registration for DDT was discontinued in 1985 with permissible use until 1990.

The use of toxaphene was suspended in 1980 with retail sale permitted until 1985. Provincially these pesticides have been banned.

While both countries have ceased production, sale and distribution of these pesticides, these pesticides continue to have an environmental presence. Their continued presence in the environment can be attributed to the pesticides' persistence in the environment and the large amounts of these pesticides that were used during the 1960's and 1970's. Furthermore, pesticide collection activities in the basin have found that these canceled pesticides are still in the possession of some individuals. Global and residual regional usage will continue to contribute to the atmospheric deposition of these pesticides in the Lake Superior basin. Current contamination levels of the designated pesticides remain a concern as reflected by water concentrations that exceed U.S. national water quality standards, sediment concentrations that exceed sediment guidelines, and fish consumption advisories in both countries.

Although approximately 75 percent of the usage of registered pesticides (which can contain, as a contaminant, small amounts of dioxin or hexachlorobenzene) is for agricultural purposes, non-agricultural uses of pesticides also impact the basin. Pesticides are universally applied to urban landscaping, residential and commercial property, golf courses, university property and governmental property. The information regarding land-usage and pesticide application is complicated by the fact that research does not suggest a precise relationship between the amount of pesticides applied and the environmental fate of these pesticides.

A broad approach to the virtual elimination of the designated pesticides would combine community education, outreach, cooperation, promotion of clean sweeps, and information regarding available alternatives with respect to the targeted pesticides. Measures of progress could include the amount of pesticides collected, the number of people participating in collections, and the use of pesticide educational materials.

Binational Actions:

(32) LSBP agencies will seek funding to initiate or continue permanent household and agricultural (e.g. pesticides) hazardous waste (HAHW) collection depots in the largest Lake Superior basin cities. Furthermore, U.S. LSBP agencies will seek funding to initiate and continue periodic or mobile collections for the more remote locations within the Lake Superior basin. Collections will not be limited to pesticides but will include a focus on mercury containing products (e.g. thermometers, abandoned appliances). U.S. LSBP agencies will seek funding to initiate and continue Lake Superior basin HAHW education programs that will include information about how individuals can practice home environmental stewardship; how to identify HAHW and properly dispose of HAHW, and how this protects the Lake Superior basin. (EC, EPA, MI, MN, ON, WI, BR, FDL, KBIC, RC)

(38) LSBP agencies will pursue urban outreach initiatives that increase awareness, through outreach, of the risk of pesticide use. (EPA, ON)

Future possibilities:

(39) Work with the USDA to promote the environmental benefits of the agricultural use of low risk pesticides in protecting the soil and water.

(40) Distribute information from the EPA's Pesticide Environmental Stewardship Program including:

- Acceleration of the registration of low risk pesticides, the use of naturally-occurring biologically produced pesticides and the use of plants genetically engineered with resistance to pests are also viable options.

- Annual grants to researchers to develop low risk pesticides or to reduce the use of pesticides.

- An urban initiative that increases awareness, through outreach, of the risk of pesticide use. (EPA, ON)

(41) Address continued international production and usage of these pesticides through existing global/international initiatives.

(42) Continue communication and encourage reporting between the LSBP and the Binational Toxics Strategy on the issue of the long-range transport of pesticides.

(43) Confirm that pesticides of concern are no longer used in the basin and eliminate any illegal uses.

(44) Develop disposal projects for pesticides used for snow mold control at golf courses.

(45) Assist municipalities in improving pretreatment programs to detect and help eliminate trace sources of mercury, PCBs, and pesticide releases discharging into sewerage systems.

(46) Encourage dialogue with sectors using chlorinated pesticides regarding the practice of burning vegetative residues.

4.3.1.9 Solid Waste Management

Proper solid waste (garbage) management can decrease release of zero discharge chemicals like dioxin and mercury. Mercury containing products disposed with other solid waste has a high potential of being released into the environment either by vaporization, leaching, or incineration. Solid waste incineration is also a source of dioxin. According to the Stage 2 LaMP, small inefficient waste incinerators were estimated to be a major source of dioxin to the atmosphere. Examples of these incinerators include those used in grocery stores, apartment buildings, and schools. Since 1990, restrictions on air emissions have precluded the legal operation of most inefficient incinerators in the Lake Superior basin. Backyard garbage burn barrels are another source that is estimated to be a major contributor of dioxin to the atmosphere. Burn barrels may be a particularly important dioxin source in the primarily rural Lake Superior basin. Burn barrel use has been curtailed in some areas through public education and local ordinances. One example of which is within the Red Cliff Indian reservation located on the Bayfield Peninsula of the Wisconsin portion of the Lake Superior basin the Red Cliff tribe's Housing Authority has a policy in place that prohibits the use of burn barrels by Housing Authority tenants. Compliance depends on the availability of inexpensive and convenient alternatives. Enforcement depends on local desires. Public education is an important step.

The solid waste management philosophy of "reduce, reuse, recycle," serves to help accomplish the pollutant load reduction targets for Lake Superior. Progress on the Lake Superior goals related to solid waste management could be judged in the following ways: 1) the number of local units of government with burn barrel ordinances, 2) estimates of actual burn barrel use; 3) availability of recycling programs to basin residents, and 4) the amount of mercury-containing waste disposed in landfills.

Binational Actions:

(47) LSBP agencies will insist on the highest standards and best available technology for new incinerators. (EC, EPA)

(48) LSBP agencies will evaluate programs to prevent or remove chlorinated or mercury containing material from incinerator feedstocks. (EC, MI, ON)

U.S. Actions:

(49) U.S. LSBP agencies will support public education/outreach campaigns regarding the health and environmental effects of burn barrels and small incinerators and encourage local units of government to pass ordinances banning burn barrels. (BR, EPA, FDL, MI, MN, WI)

(50) Michigan will evaluate adoption of a law similar to Minnesota's incinerator law prohibiting disposal of mercury-bearing waste. (MI)

Canadian Action:

(51) Canadian LSBP agencies will encourage municipalities to establish source separation programs to divert household hazardous materials including cleaners, batteries, and fluorescent lights from landfills or incinerators. (EC, ON)

Future possibilities:

(52) Develop a universal waste rule under RCRA authority that applies to a wider variety of mercury-bearing products.

(53) Encourage a nationwide ban on small incinerators.

(54) Develop a plastics recycling program in the basin.

4.3.1.10 PCB Phaseout

Although manufacture of PCBs was banned in 1977, the pressure and heat tolerance characteristics of PCBs results in old PCB-bearing equipment (capacitors and transformers) still being used in the Lake Superior basin. This includes high level equipment (>500 ppm in the US, >10,000 ppm in Canada) where PCBs were deliberately used and low level equipment (>500 ppm in Canada) where PCBs contaminated the oil during testing, refilling or maintenance. In addition, considerably smaller quantities of PCBs can be found in older household products and some other types of equipment.

This equipment is used by a variety of sectors including industry, electric utilities and municipal utilities. The U.S. EPA has urged Great Lakes utilities to accelerate phase-out of PCB-bearing equipment. In Canada, the Canadian Environmental Protection Act gives consideration to the legislative phase-out of in-use electrical equipment containing PCBs. The Province of Ontario has encouraged all PCB owners to decommission the large amount of PCB equipment that was in storage in the Lake Superior basin. Large amounts of PCBs are still contained in the basin, however precise quantities have been difficult to establish. Progress can be measured by monitoring the number of facilities that have tested their equipment and by the amount of PCB equipment that has been decommissioned.

Binational Actions:

(55) LSBP agencies will encourage PCB “mentors” (i.e., facilities that have already removed their PCBs) to assist smaller facilities that do not have access to as much environmental expertise. (EC, EPA, MI, ON, MN)

(56) LSBP agencies will encourage the formation of PCB cooperatives that allow PCB equipment owners to achieve economies of scale by using a common contractor to remove, transport and destroy PCBs from a region within the basin. (EC, MN, ON)

(57) LSBP agencies will include PCBs in outreach and hazardous waste collections designed for small businesses since PCBs may be contained in light ballasts, paint, well pumps, small capacitors and white goods (e.g., refrigerators). (BR, EC, EPA, MI, ON)

(58) LSBP agencies will encourage PCB owners to destroy PCBs in use or storage. Encouragement could be done through voluntary agreements, economic incentives, and decommissioning in lieu of certain fines. (BR, EPA, MI, MN, ON)

Canadian Actions:

(59) Canadian LSBP agencies will consider another round of training sessions for small PCB owners. Cooperation is promoted so that PCB owners can reduce the cost of contracted PCB services (e.g. treatment of PCB contaminated mineral oils, on-site decontamination of capacitors and transformers, shipment of PCBs to high temperature incineration facilities and carcass removal). (EC, ON)

(60) Canadian LSBP agencies will encourage owners of PCB-bearing equipment to monitor and document the ongoing status of the equipment until it is removed. (EC, ON)

(61) Canadian LSBP agencies will continue to seek in-basin destruction capability for low-level PCBs. (EC, ON)

U.S. Actions:

(62) LSBP agencies will encourage owners of transformers and capacitors to test their equipment to identify any remaining PCBs. (EPA, MN, MI)

(63) U.S. LSBP agencies should consider removal of PCB-bearing equipment in lieu of some fines (e.g. Supplemental Environmental Projects). (BR, EPA, MI)

(64) U.S. LSBP agencies will assist in the testing and removal of PCB-bearing equipment, especially for municipalities, schools, hospitals and small businesses. An explanation of the financial consequences of PCB contamination of property should be included in this outreach program. (BR, MN)

(65) U.S. LSBP agencies will ask all the power generators in the basin to endorse the PCB reduction goals outlined in the Stage 2 LaMP and will provide Lake Superior steward awards to facilities that accept the challenge. (EPA, MI)

(66) By the end of calendar year 2000, EPA will formalize the PCB Phasedown Program pilot project with the major utilities in the Great Lakes basin, which is designed to encourage the utilities to phaseout their remaining PCB equipment. (EPA)

(67) By the end of calendar year 2002, EPA will identify federally-owned PCBs in the Lake Superior basin and seek their removal by the departments or agencies that own the PCBs. (EPA)

(2) By the end of calendar year 2006, EPA will work with facilities that have not previously been approached in the Lake Superior basin to establish voluntary agreements or commitments to reduce the use or releases of PCBs. (EPA)

(35) By the end of 2000, EPA will complete the PCB and mercury Clean Sweep pilot project, which includes a component to collect PCB-contaminated oil in the Great Lakes basin, treat the oil to remove PCBs, and recycle PCB-free oil. (EPA)

Future possibility:

(68) Consider PCB identification and collection in other activities. For example, a mercury collection in an industrial facility could also target PCBs, contractor training for mercury-bearing equipment could include PCBs and voluntary agreements could cover mercury, dioxin and PCBs.

4.3.2 Sector-Specific Strategies

While some reduction strategies apply across multiple sectors, others are sector specific. Recommendations for reduction strategies have been developed for the following specific sectors. Facilities within these sectors vary greatly regarding the amount of the nine critical chemicals they use. Thus, the following recommendations are to be considered sector-wide, but may not apply to every facility, equally.

4.3.2.1 Demolition, Salvage and Recycling

Appliances, vehicles and a variety of products that are recycled can contain significant amounts of mercury and PCBs. PCBs are found in ballasts in only the oldest refrigerators. Buildings can also contain mercury and PCBs. Burning scrap materials from buildings, appliances and vehicles can produce dioxin and possibly hexachlorobenzene. For mercury, it is estimated that 4,000 to 20,000 pounds (1,800 to 9,000 kg) of mercury in products is removed from use each year in the state of Minnesota. Based on the Minnesota data, an estimate for the Lake Superior would be approximately 389 to 1,900 pounds (235 to 1,180 kg) of mercury in products per year. A significant portion of discarded mercury-bearing products will pass through the demolition, salvage and recycling sector.

There is a continued need to inform and assist people in the demolition, salvage and recycling sector about PCB and mercury-bearing equipment and how to prevent it from entering the regular solid waste stream. Since the early 1990s, salvage yard operators, appliance recycling operators, and demolition contractors have been becoming more aware of mercury and PCB-bearing equipment. Possible measures of progress towards this strategy could include the quantity of mercury- or PCB-bearing equipment removed from demolished buildings, PCB decommissioning records under TSCA or the Canadian inventory or the number of demolition contractors or salvage yard operators trained in PCB and mercury disposal.

Binational Actions:

(69) LSBP agencies will provide training materials for appliance recyclers and auto salvage operators to assist compliance with applicable rules. (EC, MI, MN)

(70) There are a variety of multiple sector strategies that are also applicable to this sector, including economic incentives, the Lake Superior Steward program and participating in hazardous waste collections. See Section 4.2 for additional strategies.

U.S. Action:

(71) U.S. LSBP agencies will encourage training sessions for demolition contractors. Such training would preferably be associated with licensing requirements or other mandatory procedures. Opportunities to align the training with trade association outreach will be sought. (BR, EPA, MI, MN, WI)

Future Possibility:

(72) Examine successful models (e.g., Great Printers Project) so that critical pollutants can be recovered from salvage and demolition waste streams.

4.3.2.2 Schools

When the twenty-year time-span of the Stage 2 load reduction schedule is considered, it is obvious that Lake Superior basin schools have a critical role. Not only can the school foster a conserver attitude rather than a consumer attitude in its students, but the school campus itself can become a model of the zero discharge philosophy in action. No school in the basin should be incinerating anymore, so their contribution to dioxin production has significantly dropped since 1990. Other sources of the designated chemicals remain and include mercury and PCB-bearing equipment, chemical reagents, solvents and cleaning products. Some schools run their own boilers. Examples of progress in the strategies geared towards schools might be measured by the number of schools enrolling in energy conservation programs, number of students attending environmental learning centers, number of mercury thermometers collected during swaps or the payback periods identified for energy improvements.

Binational Actions:

(73) LSBP agencies will assist schools in seeking out and disposing of mercury and PCBs that are present on school property. (BR, EPA, MI, MN, ON)

(74) There are a variety of multiple sector strategies that are also applicable to this sector, including energy conservation and purchasing policies. See Section 4.2 for additional strategies.

U.S. Action:

(75) By the end of 2000, EPA will develop and distribute through the Binational Toxics Strategy mercury workgroup a package of information related to mercury reduction at schools, including advice on how to eliminate mercury from school laboratories. (EPA)

(76) U.S. LSBP agencies will support basin-wide coordination of citizen and school monitoring programs such as "Lake Superior Lakewatch." LSBP agencies will support continuation of existing programs and formation of new programs based on local interest. These programs will be used as outreach activities for the Binational Program and will increase a sense of stewardship in the Lake Superior basin. (BR, FDL, WI)

(77) Minnesota will investigate the potential use of a mercury-sniffing dog to identify mercury in schools as part of this effort. (MN)

(78) Encourage schools in the Lake Superior basin to commit to green school programs including Energy Star, Blueprint for a Green Campus program and others. (RC)

Canadian Action:

(79) Assist school districts, education agencies, and youth organizations to supplement existing curricula and develop new curricula that are aimed at reducing the nine designated chemicals. This assistance may include training, providing teaching devices, or other necessary activities. (EC)

Future possibilities:

(80) Encourage "Sister school" and "twinning" environmental projects between schools in the basin and with green schools that are outside the basin.

(81) In cooperation with the Lake Superior Binational Forum, a category of the proposed Lake Superior steward program could be developed for schools. Possible activities include developing a curriculum on toxic chemicals, adopting a nearby water-body or certification from the appropriate agency that the school is PCB- and mercury-free.

(82) Encourage Universities to adopt "Zero Discharge Campus" programs.

(83) Establish a Michigan Energy Bank to do energy audits and improve state buildings, including schools.

(84) Encourage pollution prevention projects such as the mercury thermometer swap at Marshall School in Duluth.

(85) Develop a computerized, interactive program that demonstrates how to "prune the use trees." ("Use trees" are a graphic representation of the myriad ways in which the target chemicals are used and formed. They appear in the Stage 2 LaMP.)

4.3.2.3 Small Business

Small businesses are sometimes not regarded as a significant source of hazardous waste. However, a study on northeastern Minnesota small business found that this sector was responsible for roughly a quarter of the area's hazardous waste. Small businesses are an important part of the hazardous waste stream and a special effort is needed to educate them to recognize and properly dispose of hazardous waste, including mercury and PCB-bearing equipment, pesticides and solvents. Small businesses in the Lake Superior basin can face higher per unit costs for hazardous waste transportation and disposal because of their small quantities generated and distances involved. In some parts of the basin small business waste collection programs have been established. Two examples are the Western Lake Superior Sanitary District's Clean Shop program in Duluth and the Northwest Wisconsin Regional Planning Commission very small quantity generator collection program. Recent expansions of the Clean Shop program include mobile collections in northeastern Minnesota and "coupons" to defray the cost to customers. Possible measures of progress would be the number of businesses who participate small businesses collection programs, the quantity of the nine designated chemicals that are collected at sites that are geared towards small business, or the number of inquiries made to such collection sites.

Binational Action:

(86) There are a variety of multiple sector strategies that are also applicable to this sector, including energy conservation, economic incentives, the Lake Superior Steward award and purchasing policies. See Section 4.2 for additional strategies.

U.S. Actions:

(87) By the end of 2000, EPA will publicize, including through posting on its web site, information on how owners and operators of motor vehicle waste disposal wells can comply with the revisions to the Underground Injection Control Regulations that become effective on April 5, 2000. This information will assist these small businesses located in the Lake Superior basin to reduce or eliminate discharges that may adversely impact area ground water that may ultimately flow into the lake. (EPA)

(33) U.S. LSBP agencies will assist industries and business in the basin to conduct industrial clean sweeps and use economies of scale for collections and shipments of hazardous waste. Examples of successful business collection programs include Western Lake Superior Sanitary District's clean shop program and the Northwest Wisconsin Regional Planning Commission's very small quantity generator collection program. (BR, MI, WI).

(88) U.S. LSBP agencies will pursue funding for community and regional toxic reduction activities and networking between Lake Superior communities. In particular, the toxic reduction committees working in Marquette, Michigan; Superior, Wisconsin; and through the WLSSD in Duluth, MN, should be supported. Innovative and alternative funding should also be pursued for these and expanded efforts in communities throughout the Lake Superior basin. (WI)

Canadian Action:

(89) Canadian LSBP agencies will encourage small businesses through an education program to utilize the permanent hazardous waste depots available to them and coordinate the local Chamber of Commerce or trade associations to run pollution prevention education and training sessions for proper waste management. (EC, ON)

Future Possibilities:

(90) Evaluate the potential for adopting or expanding the U.S. federal universal waste rule in order to simplify collection and disposal of hazardous waste from small businesses.

(91) Encourage and coordinate local household hazardous collection sites to take elemental mercury waste from small businesses in a one-time sweep. These sweeps will also involve an educational component to address additional disposal needs.

4.3.2.4 Mining

Although the mining sector has contributed significant reductions in toxic chemicals since 1990, these reductions have mostly occurred due to mines and processing facilities shutting down in Ontario and Michigan. Through a combination of old, outdated facilities, ore bodies playing out and market forces driving down the value of their products, these facilities were no longer economically viable. Algoma Ore Division iron sintering plant, formerly the largest mercury emitter in Canada, was closed in 1998; Copper Range, the largest mercury emitter in the U.S. portion of the basin, was shut down in 1995. For the remaining mines and processing facilities, new technologies can make lower value ore bodies more economical and other factors can extend (or shorten) the life of a facility.

Remaining mining and ore beneficiation still represent a sizable source on the basin. Estimates of mercury from sources in the basin as compared to the reduction schedules indicate that reductions of mercury from mining emissions are needed in order to meet the schedule (see section 5.2.1). Most of these mercury emissions are from the Minnesota taconite industry, which represents seven facilities. Since some facilities generate their own electricity by burning coal, some portion of the mercury emitted is from the coal.

Concerning PCBs, both the U.S. and Canadian PCB data bases indicate that the majority of the PCB equipment still in use in the basin is found in industry and certainly mining is a significant portion of the basin's industrial sector. A 1997 survey of electrical equipment owners in the Minnesota portion of the basin found PCB transformers still in use at Minnesota taconite mines. However, these mines have made progress since 1990 in decommissioning PCB-bearing equipment. PCB-bearing equipment is also being decommissioned as part of the closure plan at the Copper Range mine in Michigan.

For dioxin, the closure of the Algoma Ore Division iron sintering plant in 1998 brought about a significant reduction in dioxin emissions. However, the technologies used at the remaining U.S. and Canadian mines and processing facilities are not known to release dioxin.

Possible measures of progress in tracking reductions from these facilities would include stack testing, amount of PCB equipment removed and tons of ore processed combined with an emission factor.

Binational Action:

(92) There are a variety of multiple sector strategies that are applicable to the mining industry. Energy conservation is especially appropriate given the industry's large demand for power (e.g., an energy audit has benefited at least one of the Minnesota taconite mines). Other strategies that are especially applicable are purchasing policies, incentives and collections.

U.S. Actions:

(93) The Minnesota PCA will identify facilities that use wet scrubbers to treat emissions. The quantity of mercury removed by the scrubber will be estimated and the fate of the scrubber

mercury will be investigated. Possible control technologies such as closed loop systems, hot lime precipitation, and others will also be investigated. (MN)

(94) The Minnesota PCA will assist the taconite and electric utility industries in finding mercury reduction control technologies. The concentrations of mercury in stack gases from the two sectors is similar enough that the same control technology might be used for both. Assistance may or may not take the form of funding. (MN)

(95) U.S. LSBP agencies will assist facilities that produce their own electricity from coal burning to convert to alternative sources such as natural gas turbines. (MN)

(96) U.S. LSBP agencies will support experiments to separate the mercury-bearing pyrite fraction from coal used in their boilers and stabilization of the resulting byproduct. (MN)

Future possibilities:

(97) Encourage facilities to accelerate their destruction program for PCBs. The Canadian Environmental Protection Act gives consideration to the legislative phase out of in-use PCB equipment.

(98) Create a better reporting system for PCBs in U.S. mining operations.

(99) Investigate the fate of mercury during the beneficiation process for the purpose of identifying higher mercury waste streams that could be treated separately.

4.3.2.5 Health Care

The ethics and objectives of the health care sector to do no harm and improve patients health fits well with eliminating the release of highly toxic chemicals to the environment. The health care sector, including clinics, hospitals and dental and veterinary facilities, use mercury in a variety of ways (e.g., instruments, thermometers, lab chemicals, preservatives and dental amalgam). PCBs may also be found in some equipment at facilities with physical plants (i.e., maintenance work shops). Since alternatives exist for many of the mercury-bearing products, this sector has an opportunity to switch to less toxic products. For example, a new state-of-the-art hospital under construction in Thunder Bay is planning not to use mercury-bearing equipment.

The health care sector also releases some toxic substances such as mercury, dioxin and hexachlorobenzene through medical waste incineration. In the Canadian portion of the basin, reductions in dioxin emission from Canadian hospitals have occurred due to hospital and four incinerator closures. A long term problem is the shipping of frozen hospital wastes out of the basin presumably for incineration elsewhere. Currently the two remaining hospitals are looking at alternatives to the incineration of their medical wastes. On the U.S. side, the medical waste incinerators in the basin have been shut down and their waste is shipped to facilities outside the basin.

Measures of progress could include the amount of mercury and PCB-bearing equipment decommissioned, the amount of mercury lab chemicals avoided through purchase of alternative products, the amount of waste dental amalgam diverted from the wastewater stream as well as other changes in the purchasing and disposal methods.

Binational Actions:

(100) LSBP agencies will encourage pollution prevention projects at hospitals, clinics, and medical, dental, and veterinary offices with an emphasis on removing mercury and making the offices "mercury free". (BR, EC, EPA, KBIC, MN, MI, ON, WI,)

(101) LSBP agencies will support partnerships with dental associations to develop training materials and programs for dental offices regarding the proper handling, collection, and disposal of amalgam wastes. (BR, EC, MI, MN, ON, WI)

(102) There are a variety of multiple sector strategies that are also applicable to this sector, including voluntary reduction agreements, energy conservation, economic incentives, the Lake Superior Steward award and purchasing policies. See Section 2.1 for additional strategies.

(103) LSBP agencies will support and promote implementation of voluntary agreements with the health care industry to reduce use of mercury and formation of dioxin. (BR, EC, EPA, MI, ON, WI)

U.S. Actions:

(104) EPA will continue to contribute resources and expertise to the agency's voluntary agreement with the American Hospital Association (AHA). Under the terms of this agreement, EPA will assist AHA in meeting its goals of virtual elimination of mercury from hospitals by 2005, and a reduction in total solid waste by 33 percent in 2005 and by 50 percent in 2010. EPA will help AHA to disseminate the guidance manuals on mercury and solid waste reduction for this effort by contributing resources to a series of at least six national workshops that will be held by the end of 2001, as well as making all materials available via the Internet. (EPA)

(105) U.S. LSBP agencies will institute a mercury thermometer swap program where mercury thermometers are exchanged for non-mercury-bearing ones. (FDL, GP)

(106) Urge hospitals to discontinue the practice of sending mercury thermometers home with new mothers and instead use non-mercury thermometers and distribute information on the hazards of mercury in home and the actions that families can take to limit their exposure. The agencies will assist in the preparation of these materials. (RC)

Canadian Actions:

(107) Canadian LSBP agencies will follow up on the 1999 City of Toronto pilot among Environment Canada, suppliers and the Ontario Dental Association and apply the results to the Thunder Bay area. (EC, ON)

(108) Ontario will investigate a regulatory exemption to dispose of mercury wastes reclaimed from dental offices. (ON)

Future possibilities:

(109) Work with the health care sector to properly identify and dispose of batteries, fluorescent lamps, thermometers, pressure testing equipment, dental amalgam collection and recovery, preservatives and laboratory chemicals.

(110) Evaluate lowering medical waste incinerator mercury limits.

(111) Support implementation of the American Hospital Association memorandum of understanding which includes three voluntary goals: 1) virtual elimination of mercury containing waste from the health care waste stream by 2005, 2) plan to reduce total volume of all wastes generated by hospitals by 33 percent by 2005 and 3) establishment of a stakeholders council.

(112) Establish an incentive program for Ontario dentists that encourage them to switch to using non-mercury containing materials.

(113) Work with hospitals to reduce and eliminate the use of PVC products. This will reduce dioxin emissions from the incineration of hospital waste.

4.3.2.6 Energy Production

Fuel combustion, particularly coal combustion, releases new mercury and dioxin into the atmosphere. Fuel combustion is estimated as the second largest source of mercury emissions within the Lake Superior basin, but it is a relatively small source of dioxin. A variety of facilities burn fuel, including electrical utilities (e.g., Ontario Hydro and Northern States Power), industrial utilities (e.g., power plants at taconite mills and burning Kraft liquors at pulp and paper mills) and municipal utilities (e.g., municipal steam plant in Virginia, Minnesota).

PCBs were used in electrical equipment such as transformers and capacitors. According to the 1998 EPA data base, there are 57 transformers owned by utilities in the U.S. portion of the basin that contain high levels of PCBs or that have not been tested. Other inventories show that large numbers of high PCB capacitors are still in use by utilities.

Currently there is no commercially available control equipment that has demonstrated the ability to substantially reduce mercury emissions from coal-fired plants. Several on-going efforts address the issue of mercury from energy production. These broader efforts have the potential to affect the Lake Superior basin in the long term, particularly the mercury strategies in Minnesota, Michigan, Wisconsin, and Ontario, as well as implementation of the Great Lakes Binational

Toxics Strategy, U.S. federal efforts such as implementation of MACT air standards and recent U.S. requirements for utilities to report the mercury content of the coal they burn, and research and development by the utilities themselves.

Progress towards mercury reductions in this sector can be monitored by measuring mercury emissions, changes in control technology, mercury content in coal, and the amount of energy produced by alternative methods. PCB phase-out strategies in Section 2.2.11 are also applicable to this sector.

Binational Actions:

(114) LSBP agencies will encourage the investigation of alternative energy (e.g. low mercury fuels, natural gas, solar, wind) in the Lake Superior basin and encourage residents to purchase energy produced with lower polluting technologies. (BR, GP, MN, ON)

(115) There are a variety of multiple sector strategies that are also applicable to this sector, including voluntary agreements, economic incentives, the Lake Superior Steward award, purchasing policies and PCB phase-out. See Section 4.2 for additional strategies.

U.S. Actions:

(66) By the end of calendar year 2000, EPA will formalize the PCB Phasedown Program pilot project with the major utilities in the Great Lakes basin, which is designed to encourage the utilities to phaseout their remaining PCB equipment. (EPA)

(116) By December 2000, EPA will make a determination about whether to regulate mercury emissions from electric utilities. (EPA)

(117) The U.S. EPA has committed approximately $6 million in FY2000 and FY2001 funds to support mercury research in a number of priority areas including transport, transformation and fate; and human health and wildlife effects of methyl mercury. These research activities are aimed at reducing the uncertainties currently limiting the Agency's ability to assess and manage mercury and methylmercury risks. One particular target of research will be collection and analysis of information on mercury emissions and control options for coal-fired utilities in order to support OAR's mandate for a regulatory determination on mercury controls for utilities by December 15, 2000. (EPA)

(118) By the end of 2000, EPA will provide funding to support workshops in at least one Lake Superior basin state on how to reduce the use of mercury-containing devices at electric utilities. (EPA)

(65) U.S. LSBP agencies will ask all the power generators in the basin to endorse the PCB reduction goals outlined in the Stage 2 LaMP and will provide Lake Superior steward awards to facilities that accept the challenge. (EPA, MI)

(94) The Minnesota PCA will assist the taconite and electric utility industries in finding mercury reduction technologies. The concentrations of mercury in stack gases from the two sectors is

similar enough that the same control technology might be used for both. Assistance may or may not take the form of funding. (MN)

(119) U.S. LSBP agencies will assist utilities in converting from coal-burning technology, which releases mercury, to renewable source energy or natural gas technology to produce electricity (MN).

(120) Promote the long-term goal of having energy utilities convert from coal burning to a natural gas energy source. In the medium-term, householders need to develop an energy conservation ethic that would extend to the purchase of clean fuel. (RC)

Future possibilities:

(121) Encourage utilities to conduct special promotions of their energy conservation programs within the Lake Superior basin. Examples of activities in this effort could include home and industry energy audits, sending mercury awareness and energy conservation information to consumers along with monthly utility bills and offers of assistance to customers in PCB decommissioning.

(122) Hold an energy production workshop for public and industrial utilities and LSBP agencies to seek common ground, provide mentors and partners for small facilities and develop mercury reduction recommendations for this sector.

(123) Canadian LSBP agencies will communicate the long-term goal for energy utilities is to convert from coal burning to a natural gas energy source. In the medium-term, communicate an energy conservation ethic to households that would extend to the purchase of clean fuel.

4.3.2.7 Forest Products

The sub-sectors of the forest products industry considered here are pulp and paper mills, sawmills and wood treatment facilities. Dioxins are released from chlorine-based bleaching processes associated with some pulp and paper mills in the basin. Pulp and paper mills and sawmills can emit dioxins when burning waste wood. Pentachlorophenol (PCP), which contains dioxins, is used in wood treatment facilities (i.e., Northern Wood Preservers site in Thunder Bay). PCP has the potential to leach into soil. In addition, there are sites in the basin where wood preserving was conducted historically which now have soils contaminated with PCP. Significant load reductions of the nine critical pollutants have occurred in this industry. In the past, the Canadian pulp and paper industry produced chlorine on-site using the mercury cell chlor-alkali process that released mercury into the environment. In the 1970s, the Canadian chlor-alkali industry was regulated and mercury cells plants were shut down. While U.S. legislation does not prohibit mercury cell chlor-alkali processes, there are no chlor-alkali facilities operating in the U.S. side of the basin.

Dioxins and furans were also associated with the pulp and paper industry. In response to Canadian regulations in the 1990s on the releases of dioxins and furans from effluents, all mills have a capacity for 100 percent chlorine dioxide substitution and are functioning at near capacity.

This process virtually eliminates dioxins and furans. All the US mills in the basin either use chlorine dioxide or do not use any chlorine in their bleaching process.

Sawmills have reduced emissions through equipment changes allowing for the sale rather than incineration of wood chips, therefore, avoiding the release of dioxins and HCB. The Northern Wood Preservers facility has prevented the release of additional PCP through structural changes and through a clean-up program to collect, confine and eventually treat contaminants.

As part of the recommendations made to the Canadian Ministers of Environment and Health under the Strategic Options Process (SOP), existing wood treating facilities will be assessed against recommended good practices for the design and operation of heavy duty wood treatment facilities. Under the SOP recommendations, a wood preservation facility could participate in a voluntary program. Participants in the voluntary program will have their facilities assessed by a third-party auditor in the year 2000 and will submit implementation plans by June 2001. A facility that does not participate in the voluntary program will be mandated under federal legislation to complete an assessment and submit an implementation plan by the end of the year 2002 using an approved third party auditor. Annual progress reports will be submitted by all facilities and follow-up assessments conducted to track progress in meeting the technical recommendations.

Binational Action:

(124) There are a variety of multiple sector strategies that are also applicable to this sector, including purchasing policies and energy conservation. See Section 4.2 for additional strategies.

Canadian Actions:

(3) Canadian LSBP agencies will continue discussions with the seven pulp and paper facilities: to address purchasing policies to eliminate the nine critical pollutants; to review energy reduction practices thereby reducing dependence on purchased energy that is generated from coal burning facilities which release mercury and dioxin; introduce water conservation to reduce energy use; recycle fluorescent tubes. (EC, ON)

(125) Through voluntary agreements, remove PCBs in storage so that pulp and paper mills are PCB free. (EC, ON)

(126) Pursue clean up of mercury-contaminated sediments in Peninsula Harbour through a partnership among public and private sector organizations. (EC, ON)

(127) Reduce dioxin and furan discharges from the pulp bleaching process by reducing AOX to less than 0.8kg/tonne. (ON)

(128) Operational practices and design of existing wood preservation facilities in the basin will be assessed in 2000 by third party auditors and Environment Canada will invite facilities to participate in a voluntary program. (EC)

Future possibilities:

(129) All sectors of this industry require improved combustion technology to reduce the formation of dioxin.

(130) Conduct materials audit and replace equipment containing mercury and PCBs.

(131) Conduct energy audits of sawmills and discourage burning of wood wastes for energy and encourage use of energy efficient wood kilns.

(132) In the long term, cease the use of pentachlorophenol (PCP) in wood preserving.

(133) Encourage facilities that burn chips and waste wood for energy or heat to use the most efficient furnace possible.

(134) Encourage saw mills to use energy efficient drying kilns.

(135) Encourage forest sector facilities to inventory PCB and mercury-bearing equipment and replace it with benign alternatives.

(136) Promote and encourage research into zero discharge technologies in place elsewhere in the world for effluents and emissions.

4.3.2.8 Other Industrial Sectors

The sector specific sections of this chapter address most of the industries operating in the Lake Superior basin that have a sector-specific role in reducing zero discharge pollutants. Although not heavily industrialized, the Lake Superior basin has several other large industrial facilities that are not covered specifically elsewhere in the document. These facilities include ship repair, lime processing, grain elevators, other shipping concerns, an oil refinery, and various manufacturing facilities. Generally, there are few sector-specific strategies applicable to these facilities. This "other industry" section of the document houses strategies applicable to industrial or manufacturing facilities in the Lake Superior basin that are not covered in other sections of the Stage 3 Lakewide Management Plan. Large industrial facilities in particular can contribute to the reduction goals for the zero discharge pollutants through PCB phase-outs, mercury-containing equipment phase-outs, purchasing policies, energy conservation, packaging choices and solid waste management, hazardous waste management, and attention to contaminants in feedstock chemicals. In addition, stormwater from industrial facilities and urbanized areas can serve as a significant source of Lake Superior critical pollutants in the lakewide and local remediation category.

Industrial and manufacturing sectors outside of the Lake Superior basin are addressed in the "Out of Basin Strategies" section of the plan.

Manufacturing:

U.S. Action:

(137) By the end of 2000, EPA will publicize, including through posting on its web site, information on how to develop a mercury reduction plan at a manufacturing plant. This information will include mercury reduction plans developed at three steel mills under a voluntary agreement between the mills, EPA, the Indiana Department of Environment, and the Lake Michigan Forum. (EPA)

Oil Refining:

The oil refining process is recognized as a likely source of mercury emissions that has yet to be quantified. Mercury is found as a contaminant in crude oil. This mercury then may be emitted via air emissions, water discharges, other wastes, or may end up in products. Minnesota estimates that more than 50 lbs. of mercury per year enter its two refineries (not in the Lake Superior basin) via crude oil. Murphy Oil USA's Superior, Wisconsin refinery is the only oil refinery within the Lake Superior basin.

U.S. Action

(138) WDNR will work with the region's oil refining industry to evaluate use, generation, and environmental release of Lake Superior critical pollutants, and investigation options for pollution prevention and control. (WI)

Binational Action:

(139) There are a number of multiple sector strategies particularly applicable to large industrial facilities including PCB phase-outs, PCB mentoring with smaller facilities, mercury equipment replacement, purchasing policies, energy conservation, participation in regional pollution prevention initiatives, attention to chemical feedstock contamination, solid and hazardous waste management.

Future possibility:

(140) Continue to work with industrial facilities on stormwater management and best management practices for storage piles.

4.3.2.9 Public Sector

The public sector can take several types of action to reduce loads of pollutants to the Lake Superior basin. Federal, state, and provincial regulatory agencies can encourage pollution prevention, mandate special protection for the basin and promulgate new rules to minimize or eliminate pollutant loads. In addition, the public sector has many of the same opportunities as the private sector to participate in energy conservation programs as well as adopting environmentally friendly purchasing policies. Many of the important pollution prevention strategies applicable to the public sector are listed in the energy conservation, communities and households, and solid waste management sections.

Universities and schools can serve an important role in developing curricula and municipalities can implement action at a local level more efficiently than other levels of government.

Municipalities and other local units of government have responsibilities and functions (i.e., solid waste management) that can influence pollutant load reductions.

The measures of progress will be as varied as the range of potential actions and could include indirect measures such as the number of U.S. communities adopting burn barrel ordinances as well as direct measures of mercury loads reduced through local or regional reduction strategies.

Pollution Prevention

Most of the pollution prevention actions are covered in other sections of this chapter. This section lists actions not addressed elsewhere.

Canadian Action:

(141) Canadian LSBP agencies will expand the Pollution Prevention Demonstration Site Program to both Canadian Federal facilities and First Nations in the Lake Superior drainage basin. The program addresses generation of hazardous wastes through such activities as identification and demonstration of alternative products, practices, and technologies. (EC)

Future possibilities:

(142) Canadian LSBP agencies will link company websites to Lake Superior websites in order to publicize and promote positive actions.

(143) Sustain and expand pollution prevention technical assistance programs for facilities in the Lake Superior basin. Programs include the Retired Engineer Training and Assistance Program (RETAP), Minnesota Small Quantity Generator Program, Wisconsin's SHWEC technical assistance program. LSBP agencies will use these programs to work with trade associations and individual facilities in the basin to identify opportunities to reduce use, generation, storage, and release of Hg and PCBs and other persistent toxic substances (e.g. toxic reduction plans, voluntary audits).

Control and Regulation

There are significant differences in the regulatory regimes of the U.S. and Canada. Generally regulatory measures are not specific to the Lake Superior basin. Many regulatory measures that could be used by state, provincial, or federal governments to reduce pollutant loads to Lake Superior would apply across the jurisdiction enacting them. Many regulatory actions, particularly those addressing air emissions are addressed in Section 4.3.3, Out of Basin strategies. Actions involving clean up of contaminated sites are addressed in Section 4.4.

Binational Action:

(144) LSBP agencies will coordinate LaMP critical pollutant reduction strategies with Total Maximum Daily Load Reductions or limits under Ontario's Certificate of Approval process. (FDL, MN, ON)

U.S. Actions:

(116) By December 2000, EPA will make a determination about whether to regulate mercury emissions from electric utilities. (EPA)

(145) EPA will provide technical and regulatory assistance to Lake Superior basin States, Tribes and local governments on how to identify and address Class V wells that may endanger ground water within the Lake Superior basin and therefore pose a contamination threat to the waters of Lake Superior. (EPA)

(146) EPA will provide priority review to potentially endangering and high priority Class V well types identified within delineated source water protection areas for Lake Superior public drinking water system intakes in Michigan and Minnesota. (EPA)

(147) U.S. LSBP agencies will pursue bans on non-essential uses of the nine persistent, bioaccumulative, toxic substances targeted for zero discharge (e.g. light switches in running shoes). (BR, MI, MN)

(148) For toxic pollutants with effluent limitations that are below reliable levels of analytical detection (e.g. nine zero discharge pollutants), U.S. LSBP agencies will require toxic reduction plans in each new or reissued NPDES permit for point sources discharges to the basin. U.S. LSBP agencies will require toxic reduction plans in new or reissued air permits for facilities that could reasonably be expected to emit any of the nine zero discharge pollutants based on knowledge of the process. (BR, MI)

(149) The states and U.S. EPA should include appropriate limits for persistent bioaccumulative toxic substances in air emission permits to eliminate or further reduce the deposition of these substances in the Lake Superior basin. Also, lower emission rates should be used to define major source applicability for MACT standards. (MI, MN)

(150) States and U.S. EPA will include pollution prevention components in enforcement settlements as appropriate. (MI)

(151) U.S. LSBP agencies will work with individual facilities in the basin to identify opportunities to reduce storage, use, or release of mercury and PCBs (e.g., toxic reduction plans, voluntary audits, “check lists” to be included in the permit applications). (EPA, MI)

Canadian Action:

(152) Ontario will actively pursue the development of regulations to require monitoring and reporting air emissions, of public concern, from significant industrial and commercial emission sources. (ON)

Future possibilities:

(153) Require new industrial facilities to demonstrate they will not release dioxin, HCB or OCS.

(12) Acknowledge credit for beyond-compliance reductions, in order to provide an incentive for basin facilities to voluntarily reduce the use and emissions of the nine critical pollutants. The purpose of these credits is to avoid penalizing facilities that have already achieved reductions before nation-wide reduction programs are established.

(154) Encourage local units of governments to pass ordinances banning burn barrels.

(155) The State of Minnesota will evaluate its burn barrel law and revise if necessary.

Special Designation

The 1991 agreement establishing the Lake Superior Binational Program included the following three actions in the U.S. action plan.

- Initiate appropriate state procedures to designate all waters of the Lake Superior basin as Outstanding International Resource Waters.

- Initiate appropriate state procedures to designate certain areas of the Lake Superior basin as Outstanding National Resource Waters.

- Evaluate the possibility of pursuing and/or supporting other special designations of areas in the Lake Superior basin.

The first action item has been completed by the states of Michigan and Minnesota, which have adopted an Outstanding International Resource Water (OIRW) designation for Lake Superior. The effect of this designation is to prohibit new or increased water discharges of the nine zero discharge pollutants unless best technology in process and treatment is employed. In 1996, Wisconsin initiated rulemaking procedures for the OIRW designation and invited public comment on other possible designations, including an Outstanding National Resource Water (ONRW) designation that would prohibit discharge of an expanded list of pollutants to Lake Superior. Due to polarized public opinion, special designation rulemaking in Wisconsin was suspended in 1997. Currently the special designation issue is being explored in Wisconsin by a public advisory group established by WDNR.

The second action item from the 1991 Binational Program is an Outstanding National Resource Water (ONRW) designation with the purpose of prohibiting new or increased point source discharges of the nine target chemicals in certain areas such as national and state parks and refuges. The ONRW designation for certain areas within the basin has not been pursued, however designations with equivalent results have been implemented. In 1984, Minnesota adopted a special designation that prohibits new or expanded discharges in certain waters in the basin. A portion of the Lake Superior shoreline was included in this designation in 1998 as part of an agreement with the Grand Portage Band of Lake Superior Chippewa. In 1989, Wisconsin designated certain tributaries to Lake Superior such that discharges would not be allowed to lower background water quality. Michigan adopted an Outstanding State Resource Water (OSRW) designation in 1997. The OSRW designation prohibits the lowering of water quality in certain waters of the basin.

Tribes with reservations in the basin have used special tribal designations to protect those waters. The Grant Portage tribe, the Fond du Lac tribe, the Keweenaw Bay Indian Community and the Red Cliff tribe have designated certain reservation waters Outstanding Reservation Resource Waters. This designation prohibits discharges of certain bioaccumulative chemicals.

Some tribes in the U.S. have also supported an ONRW designation for Lake Superior. The Great Lakes Indian Fish and Wildlife Commission, an organization representing the off-reservation interests of eleven tribes with harvesting rights in Lake Superior and portions of the basin, has passed a resolution strongly urging a federal ONRW designation for Lake Superior. In addition, the Red Cliff tribe has expressed its support for an ONRW designation for Lake Superior.

The following actions are carried forward from the 1991 Binational Program Agreement into the LaMP Stage 3.

U.S. Action:

(156) Minnesota will consider the applicability of the Outstanding Natural Resource Water (ONRW) designation in future reviews of water quality rules. (MN)

Canadian Actions:

(157) Canada and Ontario will evaluate the possibility of pursuing a special designation for the waters of Lakes Superior and Nipigon. (EC, ON)

(158) Ontario will provide special designations, including protected areas, under the Ontario Living Legacy Program for a significant portion of the Canadian Lake Superior shoreline. (ON)

(159) Canada and Ontario agree to undertake the necessary requirements to establish a National Marine Conservation Area in the Lake Superior basin. (EC, ON)

Future possibilities:

(160) Evaluate the possibility of pursuing and/or supporting other special designations (regulatory or non-regulatory) in the Lake Superior basin in the future.

(161) Tribes may consider additional special designations in the future.

4.3.2.10 Communities and Households

Actions by individuals influence release of the nine critical chemicals to the environment. For instance, many products found in households and used throughout communities contain mercury. Because of the many potential sources, education and outreach to individuals is an important activity for the zero discharge demonstration program. Community and household pollution prevention may address most of the nine zero discharge chemicals. However, mercury is a prime chemical of concern. Because communities and local units of government have responsibilities for the management of wastewater and solid waste, they are an important audience for pollution prevention education and technical assistance.

Communities also have been effective leaders and mentors in pollution prevention. Since 1990, several communities in the Lake Superior basin have undertaken community-based toxic reduction projects. In the U.S., federal funding was provided to the Western Lake Superior Sanitary District (WLSSD) to develop a document titled "Blueprint for Zero Discharge", which is a guide for wastewater treatment plants in conducting pollution prevention to reduce discharge of the zero discharge chemicals. The WLSSD has been able to lower its mercury discharge significantly, as a result of pollution prevention they have conducted in their community. The WLSSD has served as a mentor for other communities in the basin. The Wisconsin Mercury Sourcebook is another guide that was developed to help communities implement source reduction. Marquette, Michigan and Superior, Wisconsin both have active community-based toxic reduction committees with a strong focus on outreach and education. In all of these efforts, staff at the municipal wastewater treatment plants have been key to the effort's success. In many respects, communities can be much more effective than government agencies with pollution prevention and outreach to households, business, and industry.

In Canada, the community group Thunder Bay 2002 with the support of the provincial government has established a button battery recycling program in Thunder Bay and Sault Ste. Marie. Button batteries are found in watches and other small electronic equipment. Each battery can contain as much as 2.5 grams of mercury. The initiative demonstrated that significant quantities of mercury can be removed from the waste stream by using colorful collection depots placed on the counters of major retailers. The button battery recovery project has also been a very effective means of raising public awareness around Lake Superior about the problem of mercury contamination.

Solid waste management is also another area where actions by households and communities influence release of the zero discharge chemicals. (See Section 4.3.1.9, Solid Waste Management).

Quantifying the amount of pollutants reduced through implementing a community toxics reduction program is expensive. In the case of the WLSSD Blueprint for Zero Discharge project, a substantial budget provided for detailed mercury sampling in the collection system. This enabled documentation of the reduced mercury discharge as a result of implementing the p2 program. Similar documentation in all communities implementing toxic reduction activities would not be cost effective. A measure of progress could be the number of communities participating in similar "zero discharge" toxic reduction programs.

Binational Actions:

(162) LSBP agencies will work with communities to provide sector-specific pollution prevention outreach such as workshops for the medical and dental communities, and other important sectors. (BR, EC, EPA, MI, WI)

U.S. Actions:

(88) U.S. LSBP agencies will pursue funding for community and regional toxic reduction activities and networking between Lake Superior communities. In particular, the toxic reduction committees working in Marquette, Michigan and Superior, Wisconsin, and through the Western Lake Superior Sanitary District (WLSSD) in Duluth, MN, should be supported. Innovative and alternative funding should also be pursued for these and expanded efforts in communities throughout the Lake Superior basin. (WI, BR)

(163) U.S. LSBP agencies will encourage a source separation program to divert household hazardous material such as cleaners, batteries and fluorescent lights from landfills and burn barrels. (KBIC)

(164) EPA has initiated and will continue to work with developing partnerships between the Hearth Products Association and any appropriate parties (i.e. state, tribal, local) towards participation in the wood stove change-out program in the Great Lakes basin. This exchange program allows for the consumer switch from older, less efficient wood-burning stoves to new more combustion efficient stoves that reduce the amount of air toxic emissions. (EPA)

(165) Pursue funding for a public awareness campaign in support of the community toxic reduction activities. The P2 awareness campaign should focus on preventing pollution in the home, conserving energy, using alternative products, encouraging use of clean sweep collections and other proper disposal of household hazardous wastes. Elements of the campaign could include a brochure for owners of old homes on how to dispose of banned and outdated products, and a “Get rid of it” brochure for the “nasty nine” chemicals. Consumer groups will be sought as partners in this strategy. (FDL, RC)

(166) Establish a recognition program for all wastewater treatment plants that implement the Blueprint for Zero Discharge. (RC)

Canadian Actions:

(167) Canadian LSBP agencies will support initiatives to reduce reliance on petroleum hydrocarbons for energy production or space heating purposes at First Nations (use of alternative technologies/green power). (EC)

(168) Canadian LSBP agencies will support First Nations on contaminated site assessment and remediation, (primarily with petroleum hydrocarbon contamination). (EC)

Future possibilities:

(169) Encourage municipalities to enforce sewer use by-laws to discourage illegal release of toxic substances into the sewer system. At the same time conduct education programs for householders and small businesses for alternative disposal or pretreatment of wastes.

(170) Encourage retailers in Thunder Bay and Sault Ste. Marie, Ontario (Radio Shack, Wal-Mart, and Japan Camera) to form a partnership with environmental organizations (Thunder Bay 2002 and Clean North of Sault Ste. Marie), the Great Lakes renewal Foundation and other community partners to recycle button batteries.

(171) Encourage Thunder Bay 2002, Clean North of Sault Ste. Marie, and the Great Lakes Renewal Foundation to form a partnership to retrieve and recycle the mercury in fluorescent lamps and thermostats from households, industries, and institutions.

(172) Work with municipalities to improve pretreatment programs to detect and help eliminate trace sources of mercury, PCBs, and pesticides discharging into sewage systems.

(173) Provide technical and financial assistance to municipalities and schools to remove and properly dispose of equipment, materials, and wastes containing mercury and PCBs.

(174) Fund a sewer cleaning demonstration project to remove historic deposits of mercury and pesticides.

(175) Support a PVC awareness campaign with the purpose of reducing PVC consumption in the basin.

(123) Canadian LSBP agencies will communicate the long-term goal for energy utilities is to convert from coal burning to a natural gas energy source. In the medium-term, communicate an energy conservation ethic to households that would extend to the purchase of clean fuel.

Also see Sections 4.3.1.9, Solid Waste Management, and 4.3.1.7, Waste Collections

4.3.3 Out-Of-Basin Strategies

Via the St. Mary's River at Sault Ste. Marie, the Lake Superior basin drains into the other Great Lakes and the St. Lawrence River. The Lake Superior basin is also connected to the rest of the world through the import and export of products and the emissions it generates and receives. While the focus of the Lake Superior Binational Program remains on protecting and restoring the basin, action is needed outside the basin in order to protect it. The primary responsibility for out-of-basin reductions will depend on actions taken by the federal governments. State or provincial-wide programs can also affect pollutant reductions important for Lake Superior. States can also support U.S. federal agencies to affect changes in federal programs. In addition, tools such as emission inventories and monitoring programs are important components of government agency efforts to reduce emissions of toxic pollutants to Lake Superior.

4.3.3.1 Atmospheric Deposition

The primary route by which the nine designated chemicals enter the Lake Superior basin is from atmospheric deposition. Mercury, dioxins and furans, PCBs, pesticides and other chemicals are released into the atmosphere from sources both within and outside the basin. The Zero Discharge Demonstration Project will continue to focus on sources within the basin. However, the following broader efforts are important for meeting the Lake Superior goals. The challenges to U.S. and Canadian agencies by the Great Lakes Binational Toxics Strategy is in Addendum 4-B.

Binational Actions:

(176) The Great Lakes Binational Toxics Strategy should be pursued to meet the short-term, interim goals of the Lake Superior Binational Program for mercury, PCBs, dioxin, hexachlorobenzene, octachlorostyrene, and pesticides. (EC, EPA, MI, MN)

(177) The federal governments should ensure the protection of Lake Superior during negotiations and implementation of international agreements and protocols (e.g., ECE, UN POPs, NARAPs, NAFTA).

U.S. Actions:

(178) EPA will promulgate regulations requiring emission limits on pollutants (such as mercury and dioxin) for all operating medical waste incinerators by the end of 2000. All medical waste incinerators that are not equipped to meet these requirements will be required to shut down by the end of 2001. (EPA)

(179) The U.S. federal government should evaluate lowering the nationwide limits on sewage sludge and medical waste incinerators, especially for mercury. (MN)

(180) The U.S. EPA should close the RCRA Subtitle C loop that allows the incineration of mercury-bearing hazardous waste. (MN)

(181) Wisconsin DNR will continue to pursue a statewide mercury reduction strategy including proposed legislation providing for cap and trade of mercury emissions in the state. (WI)

(182) U.S. LSBP agencies will work on a cooperative basis to establish a national ambient air toxics monitoring network. This network can be used to determine atmospheric deposition of toxics and assess multi-pathway exposures to air emissions such as the bioaccumulation of methylmercury in fish resulting in exposures to people who eat fish. (WI)

(183) U.S. LSBP agencies will continue to participate in the Great Lakes Regional Air Toxics Emissions inventory to compile a database of point, area and mobile source emissions for the Great Lakes region. (WI)

(184) U.S. LSBP agencies will work with operators of medical waste incinerators to pursue reductions of mercury, dioxin and hexachlorobenzene through source reduction elimination/segregation, including the removal of noninfectious waste from the incinerator waste stream. (BR)

Future Possibilities:

(12) Acknowledge credit for beyond-compliance reductions, in order to provide an incentive for basin facilities to voluntarily reduce the use and emissions of the nine critical pollutants. The purpose of these credits is to avoid penalizing facilities that have already achieved reductions before nation-wide reduction programs are established.

(185) The LSBP agencies support the U.S. EPA and STAPPA – ALAPCO (State and Territorial Air Pollution Program Administrators - Association of Local Air Pollution Control Officials) in developing a nationwide program to reduce and eventually eliminate backyard burning.

(186) Consider dioxin releases from the transportation sector.

(53) Encourage a nationwide ban on small incinerators.

4.3.3.2 Manufacturing

The Lake Superior basin is not self-sufficient and its residents must purchase products manufactured outside the basin. Products that contain or generate any of the nine designated chemicals are of concern because the manufacturing of these products may release these contaminants into the air. The product itself may contain these chemicals when it is brought into or disposed of in the basin. While the Zero Discharge Demonstration Project will continue to focus on sources within the basin, the following broader actions would support the Lake Superior goals.

Binational Action:

(187) LSBP agencies will support federal initiatives to lower the reporting limits on persistent, bioaccumulative toxic chemicals under the TRI (US) and the NPRI (Canadian) and lower the reporting limit for PCBs under TSCA (US) even further in order to track low level waste. (BR, EC, EPA, MN)

U.S. Actions:

(188) Foster nationwide product stewardship and reverse distribution systems with manufacturers. (MN)

(19) U.S. LSBP agencies will encourage a nationwide dialogue on the import of mercury-bearing products. Nationwide labeling of mercury products will also be encouraged. (EPA, MN, MI)

(189) Support federal and state initiatives to provide incentives to the utility industry to develop mercury control technology and to invest in alternative energy sources. (MN)

(190) The U.S. federal government should tighten the reporting requirements on export shipments of pesticides, especially pesticides that are no longer used in the United States. (MN)

(191) The U.S. federal government should consider a plan to permanently retire its mercury stockpile and to retire other sources of elemental mercury instead of recycling. (EPA, MI, MN)

Future possibilities:

(192) Follow the example of the Canadian government by accelerating the decommissioning of the remaining US mercury cell chlor-alkali plants.

(193) Increase dialogue with industries and manufacturers who import mercury-bearing products or products contaminated by dioxin or HCB.

(53) Encourage a nationwide ban on small incinerators.

4.4 CONTAMINATED SITES STRATEGIES

Although Lake Superior is the most pristine of the Great Lakes, the Lake Superior basin has a history of resource extraction and heavy industry. The legacy of the region's industrial history remains in areas of contaminated soils and sediments. Although the extent and magnitude of sediment contamination in Lake Superior is much less than in the other Great Lakes, Lake Superior has eight Areas of Concern (AOC) where Remedial Action Plans are underway. There are also other localized areas of contaminated sediment and soils. Decisions concerning evaluation and management of contaminated sites or sediments usually occur at a local, state, or provincial levels. However, the LaMP can serve to integrate these activities toward common lake-wide goals where appropriate. Table 4-8 lists and describes several contaminated sites in the Lake Superior basin. The table focuses on areas of contaminated sediment in the basin and lists some upland sites where the nine zero discharge pollutants have been detected or are suspected.

4.4.1 Overview of Lake Superior basin Contamination

Several of the nine zero discharge pollutants have been detected in sediments from the Lake Superior AOCs. Mercury is a contaminant of concern in the St. Louis River (Duluth-Superior Harbor) AOC; Thunder Bay, Jackfish Bay, and Peninsula Harbor in Canada; St. Marys River (Michigan-Ontario), and Deer Lake in Michigan. Mercury contamination in the sediment in these areas is due in part to historical discharges of mercury used as a fungicide or slimicide in industrial applications, use of mercury reagents, and discharge by chlor-alkali plants. In general, mercury contamination is also a result of the varied ubiquitous activities that have made mercury globally distributed in the environment. Dioxins, furans, and PCBs are also among the sediment contaminants found in several Lake Superior AOCs. The extent to which contaminated sediments serve as a source for zero discharge pollutants entering the food chain in the Lake Superior ecosystem has not been determined. Loading of sediment-derived contaminants into Lake Superior from the Duluth-Superior Harbor was examined by the Minnesota Pollution Control Agency (MPCA, 1999). Although the study was based on a small number of samples, the results generally indicate a net flux of dieldrin, DDT metabolites, PCBs and PAHs into Lake Superior. Similar types of loading studies at other Lake Superior AOCs could provide important information to assess the importance of contaminated sediments in harbors and bays to the contaminant picture of the Lake as a whole.

4.4.2 Objectives

Restoration of impaired uses is the goal outlined in the Great Lakes Water Quality Agreement to guide development of RAPs and LaMPs. For the Lake Superior LaMP, the zero discharge demonstration program for nine target pollutants adds an additional goal. Zero discharge is the management goal for the nine target pollutants. The Stage 2 LaMP reduction targets apply to this goal. Virtual elimination from the environment is the “environmental goal” stated in the Stage 2 LaMP for these pollutants. Like zero discharge of sources, virtual elimination from the environment is a conceptual goal.

Although Remedial Action Plans address contaminated sediment cleanup on a local scale, the Lake Superior LaMP puts forward a more aggressive lake-wide goal for sediment contaminated with zero discharge pollutants. In practical terms, the virtual elimination goal for Lake Superior should serve two main purposes. It brings contaminated sediment issues into the scope of the LaMP. It also means that management decisions regarding contaminated sites and sediments should take into account how the site impacts the overall Lake Superior ecosystem rather than taking a purely local view.

Dioxin is one of the nine zero discharge / virtual elimination pollutants that is found at sites contaminated with pentachlorophenol. Pentachlorophenol contaminated soils and sediment were estimated as a Lake Superior basin dioxin source in the Stage 2 LaMP. Pentachlorophenol has 2,3,7,8-TCDD as a potential contaminant, particularly in pre-1971 formulations. The Stage 2 LaMP included estimates of potential dioxin in soils based on pentachlorophenol data from two sites in the basin: Northern Wood Preservers in Thunder Bay, ON and Crawford Creek / Koppers Co. site in Superior, WI. Three other wood preserving sites in Michigan, which have pentachlorophenol contamination, are listed in the Stage 1 LaMP update (1995). Again, the virtual elimination goal for Lake Superior should serve to expand the scope of clean up decisions for any of these sites, beyond local impacts.

4.4.3 Strategies

The nine zero discharge pollutants are the primary focus of this Stage 3 LaMP. However, other critical pollutants are responsible for sediment contamination in many AOCs and other contaminated sites in the Lake Superior basin. These chemical groupings are found in the Stage 2 LaMP. Many of the lake-wide remediation chemicals were listed as critical pollutants for Lake Superior because they contaminate sediments at several sites in the Lake Superior basin. PAHs are a particular case in point. This group of organic chemicals is found at levels that degrade habitat in several nearshore sediment “hot spots” around the basin. The environmental goal for lake-wide remediation pollutants is to remove impairments and restore beneficial uses. In practical terms, the LaMP serves to highlight the cumulative impacts of lake-wide remediation pollutants such as PAHs in the Lake Superior basin.

Local remediation pollutants (listed in the Stage 2 LaMP) are the other group of critical pollutants responsible for sediment contamination in the Lake Superior basin. This group consists of primarily metals that are responsible for localized sediment contamination, addressed through Remedial Action Plans. The role of the LaMP is more limited for this group of pollutants.

General measures of progress regarding contaminated sites include: determining the amount of contaminant removed from the environment through sediment or site remediation; and, assessing the number of contaminated areas undergoing characterization monitoring.

Binational Action:

(194) LSBP agencies will initiate necessary sediment remediation measures at AOCs and other sites known to contribute persistent bioaccumulative toxic substances to the Lake Superior ecosystem. (EC, MN, ON, WI)

(195) The Superfund program is currently working to complete remediation at two sites in the Lake Superior basin. These include Torch Lake in Michigan and the St. Louis River in Minnesota. Superfund commits to completing remedies for these two sites by the end of FY 2005. (EPA)

Canadian Action:

(126) LSBP agencies pursue clean up of mercury contaminated sediments in Peninsula Harbour through a partnership among public and private sector organizations. (EC, ON)

Future possibilities:

(196) LSBP agencies consider cumulative impacts on the Lake Superior basin when making clean up decisions about sites or sediments contaminated with zero discharge or lake-wide remediation pollutants.

(197) LSBP agencies support coordination among Lake Superior RAP committees and other local remediation and monitoring efforts to share information and work toward lake-wide goals.

(198) LSBP agencies develop sediment quality criteria and guidance for use in identifying contaminated sediments.

Table 4-8 Contaminated Sites in the Lake Superior Basin

Location / Description	Sources	Pollutants	Status
St. Louis River AOC (MN-WI) 13,000 acre estuary and upstream areas in watershed. Sediment contamination in hot spots. Some diffuse contamination	Historical discharges: steel mill, coal gasification, wood preserving, coal and oil shipment, oil refining, shipbuilding, pulp and paper, tar and chemical, POTWs.	Mercury, PAHs, diesel range organics, PCBs, metals, dioxins/furans	Sediment characterization studies of AOC in 1992-1996. Status of hotspots varies.
USX Site (Superfund)	Steel mill operated until 1979	1993 sampling of St. Louis River sediments adjacent to site found PAHs, Mercury, Arsenic, Lead, other Metals, PCBs, Dioxin	Cleanup on land. No sediment clean- up to date.
Interlake / Duluth Tar Site (Superfund)	Coking, tar and chemical plant historical discharges	PAHs, Mercury, other metals in bay sediments	Cleanup on land. Sediment cleanup options under consideration.
Minnesota slip	Boat slip in lower harbor	PAHs, PCBs, Mercury, other Metals, pesticides	Further characterization recommended in 1994 sediment study.
Howards Bay	Shipyard and other possible waterfront activities	Lead, Arsenic, Mercury other metals, PCBs, PAHs, pesticides	On-land cleanup complete. Enforcement action continues.
Newton Creek / Hog Island Inlet	Murphy Oil refinery historical discharge	Diesel range organics, oil and grease, PAHs, lead, chromium, mercury	Murphy Oil refinery 1997 cleanup of 1.4 acres/1600 cubic yards in upstream impoundment. About 18,000 cubic yards contaminated sediment remains downstream.

Table 4-8 Contaminated Sites in the Lake Superior Basin

Location / Description	Sources	Pollutants	Status
Crawford Creek wetland	Wood preserving historical discharge	PAHs, penta-chlorophenol, creosote in soils and sediment in wetland	RCRA Corrective action – characterization studies continue.
WLSSD / Coffee Creek and Miller Creek embayment	Historical and current POTW, urban stormwater	Mercury, PCBs, PAHs, pesticides, heavy metals, dioxins detected in embayment sediments.	Source control. No sediment action under consideration currently.
Wisconsin Point landfill	Former municipal and industrial dump in wetland on L. Superior	Volatile and Semi-volatile Organic Compounds in old landfill.	Clay capped with monitoring wells. Possible net loading to L. Superior.
DM&IR, Proctor (MN) Upland site in St. Louis River AOC	Railyard since 1880s. Landfills, landfarms, repair and fueling facilities.	PCBs, other contaminants.	Activity under RCRA. PCBs up to 50 mg/kg were landspread as part of an old remedy agreement with MPCA.
Kotula Iron and Metal Near Hibbing, MN. Upland site in St. Louis River watershed.	Scrapyard, transformers.	PCBs, metals, semi-volatile organic compounds, PCE	Characterization studies for Superfund.
Ashland waterfront site Ashland, WI: 10 acre contaminated sediment area in Chequamegon Bay, upland and groundwater contamination.	Historical coal gasification plant	PAHs in bay sediments	Cleanup options under consideration.

Table 4-8 Contaminated Sites in the Lake Superior Basin

Location / Description	Sources	Pollutants	Status
Torch Lake AOC (MI) (Superfund site) Includes Keweenaw waterway, Torch Lake, and various upland sites.	200 million tons copper ore tailings deposited 1860s-1960s	Copper, Arsenic, Lead, Chromium, other metals	Superfund 1994 Record of Decision calls for capping and re-vegetation of above-water contaminated areas. The phased project was initiated in 1999 and is expected to be completed in 2004.
Hubbell "hotspot" on western shore of Torch Lake	Smelter site and bulk coal handling	Copper, PAHs	Part of Superfund site
Gay Mill Stamp Sands, 200+ acres deposited in Lake Superior, of unknown depth, extending approximately four miles along the shoreline to the Little Traverse River	Copper ore tailings deposited decades ago	Numerous metals	Not included in the EPA Superfund site. The DEQ-ERD is evaluating whether to request USACoE assistance in evaluation and analysis of alternatives.
Freda/Redridge Stamp Sands, approximately 80 acres deposited in Lake Superior, of unknown depth, approximately 13 miles along the shoreline to the North Entry	Copper ore tailings deposited decades ago	Numerous metals	Not included in the EPA Superfund site. The DEQ-ERD is evaluating whether to request USACoE assistance in evaluation and analysis of alternatives.
Assinins Stamp Sands, approximately 30 acres deposited in Lake Superior, of unknown depth, approximately 2 miles along the shoreline to near Sand Point	Copper ore tailings deposited decades ago	Numerous metals	Not included in the EPA Superfund site. The DEQ-ERD is evaluating whether to request USACoE assistance in evaluation and analysis of alternatives.
Deer Lake AOC (MI) 906 acre impoundment of Carp River	Historic mine lab discharge of Hg reagents to WWTP	Mercury	Source addressed in 1981.

Table 4-8 Contaminated Sites in the Lake Superior Basin

Location / Description	Sources	Pollutants	Status
MI wood preserving sites Sites of 3 wood preserving plants in watershed: Wakefield, Munising, Newberry		Penta-chlorophenol	*Listed in Stage 1 LaMP update.*
St. Mary's River AOC (ON-MI)	Steel mill, paper mill, historic discharge from tannery, WWTPs	Mercury, Heavy metals, PAHs, oil-grease, PCBs	Status of contaminated sites varies. Source control improvements in 1990s. However, an overall contaminated sediment management plan, including delineation and mapping, is needed.
Algoma slip	Steel mill-coking	PAHs	20,000 cubic yards contaminated sediment removed; unknown amount remaining.
Cannelton Industries (Superfund site)	Historical tannery	Chromium, Mercury	Remediation work completed summer 1999. Contaminated sediments remain Tannery Bay. Site monitoring will be carried out on an ongoing basis.
Peninsula Harbor AOC (ON)	Pulp mill and chlor-alkali plant historic discharge.	Mercury, PCBs, oil-grease, heavy metals	Pulp mill waste treatment upgrade to full secondary treatment. RAP/PAC recommends removal and confinement of highest mercury contaminated sediments, natural recovery for lesser contaminated areas.
Jackfish Bay AOC (ON) Includes 14 km of Blackbird Creek from mill discharge to Jackfish Bay.	Pulp / paper mill discharge	Resin, fatty acids, tetrachloro-dibenzofurans, PCBs, HCB, phenolic compounds, Cadmium, Zinc	Full secondary treatment of all effluent installed- mill has capability to operate at 100 percent chlorine dioxide bleaching, decreasing AOX discharge.

Table 4-8 Contaminated Sites in the Lake Superior Basin

Location / Description	Sources	Pollutants	Status
Moberly Bay (Lake Superior)	Receiver for mill effluent	Same as above	Secondary treatment has resulted in improvements in sediment and biota in the bay- natural recovery is proposed by the RAP Stage 2.
Nipigon Bay AOC (ON) Localized areas of sediment contaminants in bay/AOC	Pulp-paper mill and municipal WWTPs	Metals	Secondary treatment has been installed at the mill. No sediment remediation is planned.
Thunder Bay AOC (ON)	Forest products industry (pulp-paper and wood preserving) historic discharge from chlor-alkali plant, municipal WWTP	Metals including Hg, persistent chlorinated organics, PCBs, PAHs, pentachlorophenol	The City of Thunder Bay has committed to completing a secondary sewage treatment facility by 2002.
Inner Harbor	Northern Wood Preservers, historical chlor-alkali plant discharge	Mercury, Penta-chlorophenol, creosote, PAHs, dioxins, furans	Chlor-alkali plant shut down 1968. Northern Wood Preservers sediment remediation and site contaminant project began 1997. Work is still underway.
Lower Kaministiqua River	Pulp and paper mills	Persistent chlorinated organics, metals	Secondary treatment of all mill discharges. River sediments have been dredged and placed in confined dredge spoils site.

Notes:

AOC = Great Lakes Area of Concern for Remedial Action Plans

AOX = Adsorbable Organic Halides

PAHs = Polycyclic Aromatic Hydrocarbons – a class of organic compounds. PAHs are Lakewide Remediation Critical Pollutants for Lake Superior.

POTW = Publicly Owned Treatment Works (wastewater treatment)

RAP = Remedial Action Plan for Great Lakes Areas of Concern

RCRA = Resource Conservation and Recovery Act (U.S.)

WLSSD = Western Lake Sanitary District in Duluth, MN

WWTP = Wastewater Treatment Plant

4.5 MONITORING STRATEGIES

This LaMP proposes the strategies and actions that LSBP agencies, businesses, and citizens would be required to take in order to reduce and eventually eliminate the load of critical pollutants to Lake Superior. Measures for assessing progress in implementing the reduction strategies and actions are described in Chapters 2 and 3. In addition to implementing these actions, however, pollutant sources and ambient pollutant levels in Lake Superior should also be monitored to assess progress in achieving the goals of the LaMP.

This section provides a menu of possible monitoring activities that could be pursued to evaluate progress toward Lake Superior goals. These ideas are taken from the Chemical Contaminants Chapter (LSBP 1998) of the "Ecosystems Principles and Objectives, Indicators, and Targets for Lake Superior" discussion paper (LSBP 1995). More work is needed to develop a coordinated monitoring program that will enable the LSBP agencies to evaluate progress toward the Lake Superior goals. This effort should include source monitoring to determine and track releases of toxic pollutants as well as environmental monitoring for the Lake Superior ecosystem. The agencies will undertake the following:

Binational Action:

(199) The EPA and EC will lead efforts to develop a coordinated monitoring strategy for the Lake Superior basin. All of the LSBP agencies will assist in the development of the monitoring strategy and seek resources for implementation. The monitoring strategy will be peer reviewed and presented in LaMP 2002. (BR, EC, EPA, FDL, GP, KBIC, MI, MN, ON, RC, WI)

In addition to environmental and source monitoring for critical pollutants, research is needed on important questions related to toxic substances and their fate in the Lake Superior ecosystem. Research needs will be addressed in future iterations of the LaMP.

4.5.1 GOALS

The purpose of monitoring is to document progress toward the following:

- The virtual elimination of inputs of the designated nine pollutants,
- The virtual elimination of the designated nine pollutants from Lake Superior basin ecosystems, and
- The elimination of critical pollutant based impairments to the beneficial uses of environmental resources.

Monitoring, with regard to chemicals, is divided into source monitoring and environmental monitoring. Each is discussed below.

4.5.1.1 Source Monitoring

Source monitoring includes the measurement of the amount of a critical pollutant being released into the environment from an anthropogenic source, documenting the human activities that contribute to the release of critical pollutants, and documenting the locations and amounts of the critical pollutants within the basin. Source monitoring is the method for documenting the virtual elimination of inputs to the environment of the nine designated pollutants.

4.5.1.2 Environmental Monitoring

Environmental monitoring is the analytical quantification of contaminant concentrations in various biotic and abiotic entities in the environment. These measured concentrations can be used to determine contaminant trends over time. This monitoring activity is designed to document the virtual elimination of the nine designated pollutants from Lake Superior basin ecosystems.

4.5.2 STRATEGIES

4.5.2.1 Source Monitoring

Options for source monitoring programs include the following:

- (M1) Concentrations and loads in discharges to water from permitted facilities
- (M2) Concentrations and loads in emissions to air from permitted facilities
- (M3) Continued atmospheric emission estimates for the program using the RAPIDS system
- (M4) Concentrations and loads in biosolids (sludge) from permitted facilities
- (M5) Quantity of mercury-bearing products such as thermometers, switches, thermostats, paint, and batteries purchased in the basin
- (M6) Quantity of mercury recovered in sweeps, including household hazardous waste, commercial hazardous waste, and sweeps done within a facility
- (M7) Quantity of mercury used and disposed of by medical and dental facilities
- (M8) Use of mercury- or dioxin-contaminated feedstock chemicals
- (M9) Production of electricity
- (M10) Quantity of PCB-bearing equipment phased out in the basin
- (M11) Mass of PCBs, HCB, mercury, and dioxin included in sediment remediation projects
- (M12) Quantity of chlordane, DDT, dieldrin, HCB, mercury, toxaphene, and dioxin-contaminated pesticides gathered in agricultural waste pesticide collections in the basin

- (M13) Quantity of chlordane, DDT, dieldrin, HCB, mercury, toxaphene, and dioxin-contaminated pesticides gathered in household hazardous waste collections
- (M14) Combustion of different fuels (for example, wood, coal, gas, railroad ties, or tires) for energy and the amounts of dioxin and mercury released
- (M15) Mining production and the amount of mercury, dioxin, and HCB released through beneficiation processes
- (M16) Amount of solid waste burned in residential or small business incinerators or backyard burn barrels and the amounts of dioxin, HCB, and mercury released
- (M17) Amount of solid waste and medical waste incinerated in the basin and the amounts of dioxin, HCB, OCS, and mercury released
- (M18) Inventory of all PCBs in use and storage in the Lake Superior basin
- (M19) Survey of Very Small-Quantity Generators (VSQG) designed to identify critical pollutants in use or storage
- (M20) Sample sewer mains outside dental clinics with cooperation of the city public works
- (M21) Review hospital purchasing policies and replace mercury-bearing equipment with alternatives
- (M22) Remaining PCBs stored in hospitals to be removed and sent for destruction
- (M23) Review hospital purchases and conduct site inspections
- (M24) Continue STAC program inventory of worst emitters
- (M25) Continue Environmental Effects Monitoring Program (impacts on organisms and biodiversity of receiving waters) as required under federal pulp and paper regulations and continue to monitor the cleanup of the Northern Wood Preservers site using in situ and bioassay results

The following actions support those listed above:

- (M26) “Use trees” for the prevention/investigate chemicals based on the literature search on analytical methods and media, the chemicals will be integrated into the monitoring schedule
- (M27) Look for opportunities to develop common sample collection methodologies and data reporting formats
- (M28) Look for opportunities to develop common databases for data storage and retrieval
- (M29) Develop a web site to report monitoring data to the public; include an e-mail address to allow individuals to report possible sources of pollutants, and then post the messages on the web site
- (M30) Encourage Ontario pulp and paper mills to continue self-monitoring
- (M31) Model for the aggregate impact of pulp and paper mills
- (M32) Amend Ontario MISA monitoring program to include mercury, HCB, and OCS
- (M33) Mass of mercury per BTU in fuel
- (M34) Mass of mercury per ton in taconite ore
- (M35) Use low level detection methods such as mercury method 1631 when sampling discharges
- (M36) Improve estimates of the mercury balances at the taconite facilities

4.5.2.2 Environmental Monitoring

- (M37) Water concentrations of zero discharge chemicals and lake-wide remediation chemicals should be monitored in the offshore waters of Lake Superior and compared to appropriate yardsticks. Samples should be collected at 2-year intervals as described in the Chemical Contaminants Chapter of the EPO (1998).
- (M38) Contaminant concentrations in key fish species will be monitored and compared to "yardsticks." Predetermined sizes of fish will be collected every 5 years. Fish contaminant monitoring objectives and methods should be coordinated with other SWG "theme teams".
- (M39) Sediment concentrations of zero discharge and lake-wide remediation chemicals should be compared to standards and yardsticks. Sediment concentrations of local remediation chemicals in AOCs would be compared to appropriate standards or guidelines used by the jurisdiction. Sediment cores would be collected at 10-year intervals as described in the Chemical Contaminants of the EPO (1998).
- (M40) Concentrations of the designated chemicals will be monitored annually in air and precipitation and at 2-year intervals in water.
- (M41) At 10-year intervals, sediment cores will be taken in depositional offshore zones, sectioned, dated, and analyzed for designated chemicals.
- (M42) Monitor critical pollutants (see Table 2-1 of the Stage 2 LaMP) in a range of organisms that are found in terrestrial, terrestrial/aquatic interface, and aquatic habitats within the Lake Superior basin for the purpose of establishing baseline concentrations, determining chemical trends both temporally and spatially, and evaluating potential toxic effects to organisms by comparing chemical body residues in field organisms to chemical body residues in laboratory organisms that have been correlated to toxic effects.
- (M43) Monitor and assess the nine designated zero discharge chemicals and the lakewide remediation chemicals prior to dredging
- (M44) Monitor and assess the nine designated zero discharge chemicals as part of the environmental review process at sites where the use trees show the potential for their presence or pesticides have been used or stored.
- (M45) As part of Oil Response work on the Great Lakes, the Oil program in Superfund is currently developing maps of the Great Lakes shoreline using GIS technology. The maps include detailed data on location of sensitive species, tribal lands, natural areas and managed lands, economic resources and potential spill sources. The completed maps will be a valuable resource for identification of important habitat in the Lake Superior basin. Superfund commits to completing these maps and providing them to LaMP/RAP partners by the end of FY 2001.

The following actions support those listed above:

- (M46) Total load would be calculated using estimates of wet deposition, dry deposition, and gas exchange collected annually as described in the Chemical Contaminants of the EPO (LSBP 1998).
- (M47) Change in the rate of loading and whether the rate of loading is from the atmosphere to the lake or from the lake to the atmosphere.

- (M48) Look for opportunities to develop common sample collection methodologies and data reporting formats.
- (M49) Look for opportunities to develop common databases for data storage and retrieval.
- (M50) In Canada, a cohesive federal provincial air monitoring program would need to be in place to track load reductions from air emissions.
- (M51) Develop more standardized trace-level sampling and analytical techniques

4.6 PLANNING ACTIVITIES

The focus of efforts over the next two to three years will be on the implementation actions described in this document. However, the Lake Superior LaMP process is iterative and resources will be allocated to the development and implementation of new actions as appropriate until the goals have been achieved. Additional planning activities will be ongoing, and the results will be presented biennially. In addition, progress toward achieving the load reduction milestones will be monitored and reported.

Actions will include the following:

- Biennial preparation of LaMP updates that will (1) identify trends based on monitoring information, (2) detail actions completed; (3) outline commitments for new actions; and (4) document progress toward achieving goals of zero discharge and emission of certain persistent, bioaccumulative or toxic pollutants
- Additional analyses of source categories and prioritization of future load reduction actions
- Preparation and distribution of progress reports for special events such as the State of the Lakes Ecosystem Conference and International Joint Commission biennial meetings
- Preparation and distribution of concise "issue papers" to deal with specific topics of interest (for example, layperson summaries of progress reports, LaMP documents, and success stories)
- Coordination with RAPs and other local monitoring and remediation efforts
- Public outreach to describe steps that basin residents may take to further the goal of zero discharge
- Development of load reduction schedules and reduction strategies for other critical pollutants; remediation of sites already contaminated by these chemicals will be given priority

REFERENCES

Andrews, C.A and Swain, E.B. 1999. *A Comprehensive Mercury-Reduction Policy in Minnesota.* Abstract. Mercury as a Global Pollutant: Fifth International Conference. Rio de Janeiro.

Battelle. 1998. *Assessment of Current Inventories of Sources of Dioxin as Background for the Binational Toxics Strategy Dioxin Workgroup.* October 15.

Battelle. 1999. *PBT National Action Plan for Level 1 Pesticides Work Group Review.* Preliminary Working Draft. June.

Beady, Gene. 1999. Personal Contact Regarding Polychlorinated Biphenyl Equipment Standards for Minnesota Power. Minnesota Power. October 26 and 28.

Benazon Environmental Inc. 1998. Historical Mercury Consumption and Release Estimates for the Province of Ontario. Prepared for Environment Canada, Ontario Region.

Brigham, Deneen. 1999. *Zero Discharge: How Far Have We Come?* Environment Canada and Ontario Ministry of Environment.

Cabrera-Rivera, Orlando. 1999. Personal Contact Regarding Mercury Emissions for Wisconsin Sources in the Lake Superior basin. Wisconsin Department of Natural Resources. October 25.

City of Marquette. 1997. *Community Mercury Reduction Project*. Final Report. Marquette, Michigan.

Cohen, Mark. Personal Communication. October 14, 1999.

Commoner, Barry. 1999. *Comments on the Applicability of Dioxin Source Inventories to Developing Countries.* Center for the Biology of Natural Systems. Queens College. Flushing, New York. August 30.

Commoner, Barry, et al. 1996. *Zeroing Out Dioxin in the Great Lakes: Within Our Reach*. Queens College. Center for the Biology of Natural Systems. Flushing, New York. June.

Environment Canada. 1999. Draft Canadian Emissions Inventory of Mercury 1990 and 1995. Pollution Data Branch.

Erdheim, Ric. 1999. Personal Contact Regarding Thermostat Recycling Corporation (TRC) in Michigan, Minnesota, and Wisconsin. October 19.

Hagley, Tim. 1999. Personal Contact Regarding Mercury Emissions for Minnesota Power. ML Hibbard. October 27.

Jackson, Anne M. 1993. Technical Work Paper: Control of Emissions from Onsite Waste Combusters. Minnesota Pollution Control Agency.

Jiang, Hongming. 1999. *History of Taconite Emissions*. Minnesota Pollution Control Agency (MPCA), St. Paul, MN. Provided by Carri Lohse-Hanson, MPCA. October 20.

Kim, Paul. 1999. Personal Contact Regarding Mercury Emissions for Energy-Producing Facilities in the Minnesota Portion of the Lake Superior basin. Minnesota Pollution Control Agency. November 1 and 8.

Kindbom, K. and Muthe, J. 1999. *Mercury in Products - A Source of Transboundar Pollutant Transport.* Mercury as a Global Pollutant: Fifth International Conference. Rio de Janeiro.

Lake Superior Binational Program (LSBP). 1995. *Ecosystem Principles and Objectives, Indicators, and Targets for Lake Superior*. Discussion paper.

LSBP. 1998. *Indicators and Targets for the Chemical Contaminants Objective for Lake Superior*.

LSBP. 1999. *Protecting Lake Superior - Lakewide Management Plan, Stage 2, Load Reduction Targets for Critical Pollutants.*

Larson, Nancy. 1999. Personal Contact Regarding Mercury Emissions for Wisconsin Lake Superior basin. Wisconsin Department of Natural Resources. October 20.

Lemieux, Paul M. 1998. *Evaluation of Emissions from the Open Burning of Household Waste in Barrels.* U.S. Environmental Protection Agency. National Risk Management Research Laboratory. Cincinnati, OH. March.

Lohse-Hanson, Carri. 1999. Personal Contact Regarding Mercury Emissions for Wisconsin. Minnesota Pollution Control Agency. October 19.

Michaud, Dave. 1999. Personal Contact Regarding Mercury Emissions for Wisconsin Electric Presque Isle Power Plant. Wisconsin Electric. October 29.

Michigan Department of Environmental Quality (MDEQ). 1999. *Burning Household Waste: A Source of Air Pollution in Michigan.* Air Quality Division. August. (http://www.deq.state.mi.us/aqd/publish/burnhousehold.htm)

Michigan Mercury Pollution Prevention Task Force. 1996. *Mercury Pollution Prevention in Michigan; Summary of Current Efforts and Recommendations for Future Activities.* April.

Minnesota Pollution Control Agency (MPCA). 1999. *Report on the Mercury Contamination Reduction Initiative Advisory Council's Results and Recommendations*. March.

MPCA. 1999. *Lake Superior/Duluth-Superior Harbor Toxics*. Submitted to U.S. EPA, Region 5 under Grant X995402-01. September.

National Electrical Manufacturers Association (NEMA). 1999. *Summary Report of Analyses of Mercury from Consumer Batteries in the Waste Stream*. June.

Oliaei, Fardin. 1999. *Toxic Air Pollutant Update*. Report to the Environment and Natural Resources Policy Committee of the Minnesota Legislature. Minnesota Pollution Control Agency, St. Paul, Minnesota. February.

Pieper, Cindy Kay. 1996. *Open Burning in Rural Northeastern Wisconsin: an Analysis of Potential Air Pollution.* Masters Thesis, University of Wisconsin-Green Bay. May.

Pesticides Workgroup of Binational Toxics Strategy. 1999. *Quarterly Update.* April.
Pesticides Workgroup of Binational Strategy. 1998. *Pesticide Workgroup Meeting Minutes.* November 16.

Ross and Associates. 1994. *Background Information on Mercury Sources and Regulations*. A report for the Virtual Elimination Pilot Project Prepared for the U.S. Environmental Protection Agency Great Lakes National Program Office. September 12.

Taylor, Joy. 1999. Personal Contact Regarding Medical Waste Incinerators in the Michigan Portion of the Lake Superior basin. October 29.

Tetra Tech Inc. 1996. *Estimates of Mercury, PCBs, Dioxins, and HCB Releases in the U.S. Lake Superior basin.* September.

Thompson, Shirley. 1994. *Zero Discharge Strategy for Lake Superior: Fishing for Sources of Contaminated Waters.* Environment Canada. Toronto, ON.

Tuominen, Tim. 1999. Personal Contact Regarding Mercury Emissions for Western Lake Superior Sanitary District (WLSSD). October 15.

Troutman, Jerry. 1999. Personal Contact Regarding Medical Waste Incinerators in the Michigan Portion of the Lake Superior basin. November 5 and 8.

Two Rivers Regional Council of Public Officials and Patrick Engineering Inc. 1994. *Emission Characteristics of Burn Barrels.* June.

U.S. Census Bureau. 1998. *State Population Estimates and Demographic Components of Population Change: July 1, 1997 to July 1, 1998*. ST-98-1. (http://www.census.gov/population/estimates/state/st-98-1.txt)

U.S. Environmental Protection Agency. 1995f. An SAB Report: A Second Look at Dioxin. Review of the Office of Research and Development's Reassessment of Dioxin and Dioxin-Like

Compounds by the Dioxin Reassessment Review Committee. Science Advisory Board (1400). September 1995. EPA-SAB-EC-95-021.

U.S. Environmental Protection Agency. 1996d. National Dioxin Emission Estimates from Municipal Waste Combustors. Research Triangle Park, NC. U.S. EPA, Office of Air Quality Planning and Standards. June 1996.

U.S. Environmental Protection Agency. 1997a. *Locating and Estimating Air Emissions from Sources of Dioxins and Furans*. Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. EPA 454/R-97-003.

U.S. Environmental Protection Agency. 1997b. *Locating and Estimating Air Emissions from Sources of Mercury and Mercury Compounds*. Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. EPA 454/R-97-012.

U.S. Environmental Protection Agency. 1997c. *United States Great Lakes Program Report on the Great Lakes Water Quality Agreement.* Great Lakes National Program Office. Chicago, IL. December.

U.S. Environmental Protection Agency. 1998a. *Draft Options Paper: Virtual Elimination of PCBs.* Binational Toxics Strategy. Great Lakes National Program Office. Chicago, IL. October.

U.S. Environmental Protection Agency. 1998b. *The Inventory of Sources of Dioxin in the United States (Draft).* Office of Research and Development. Washington D.C. April.

U.S. Environmental Protection Agency. 1999. *State of the Environment Report*. Region 5 Pesticides and Toxics Branch. July.

U.S. Environmental Protection Agency and Environment Canada. 1998a. *Great Lakes Binational Toxics Strategy 1998 Progress Report*. Great Lakes National Program Office. Chicago, IL. (www.epa.gov/grtlakes/bns/stakeholders1198/minutes/progpart3.html)

U.S. Environmental Protection Agency and Environment Canada. 1998b. *The Level 1 Pesticides in the Binational Strategy.* Draft Final Great Lakes Pesticide Report. December 30.

U.S. Environmental Protection Agency and Environment Canada. 1998c. *Mercury Reduction Activities Reported from Around the Great Lakes.* Great Lakes National Program Office. Chicago, IL. (www.epa.gov/bns/stakeholders1198/mercsuccess.html).

Western Lake Superior Sanitary District. 1992. *Burn Barrel Dioxin Test.* August.

Wisconsin Energy Conservation Group. 1998. *Lake Superior Energy Efficiency Work Group: Report of Initial Findings*. Wisconsin Department of Natural Resources and Great Lakes Protection Fund.

ADDENDUM 4-A
COMPOUND ESTIMATES AND ASSUMPTIONS

This addendum documents the data sources and assumptions used to characterize the compound emission, use, and disposal estimates provided in chapters 1 and 5 of this report. The addendum is organized in three subsections:

Addendum A.1: Mercury Emission and Disposal Estimates
Addendum A.2: PCB Use Estimates
Addendum A.3: Dioxin Emission and Disposal Estimates

The assumptions and data sources underlying the pesticide collection information are documented in chapters 1 and 5.

A.1 Mercury Emission and Disposal Estimates

This section is organized into two subsections: A.1.1, U.S. mercury emission and disposal estimates and A.1.2, Canadian mercury emission and disposal estimates. Following the tabular summaries of the emission and disposal estimates (Tables A.1 and A.2) in each section is a description of the specific data sources and assumptions supporting each estimate.

A.1.1 Mercury Emission and Disposal Estimates for the U.S. Lake Superior basin

Table A.1 1990 and 1999 Mercury Emission Estimates For The U.S. Lake Superior basin

Source/Use Category	**1990 Emissions (kg/yr)**			**1990 Use, Disposal, Soils (kg/yr)**	**1999 Emissions (kg /yr)**			**1999 Use, Disposal, Soils (kg/yr)**
	Water	Air	Total Releases		Water	Air	Total Releases	
Industrial								
General industrial activity	0.04	8.9	8.94		0.04	8.9	8.94	
Petroleum refining	0.0006	1.85	1.856		0.006	1.85	1.86	
Industrial Total	**0.05**	**10.8**	**10.85**		**0.05**	**10.75**	**10.8**	
Mining								
Copper		550	550					
Iron		362	362			384.64	384.64	
Mining Total		**912**	**912**			**384.64**	**384.64**	
Fuel Combustion								
Oil		22.6	22.6			22.6	22.6	
Natural Gas		24.8	24.8			24.8	24.8	
Wood		1	1			2.4	2.4	

Table A.1 1990 and 1999 Mercury Emission Estimates For The U.S. Lake Superior basin

Source/Use Category	1990 Emissions (kg/yr)			1990 Use, Disposal, Soils (kg/yr)	1999 Emissions (kg /yr)			1999 Use, Disposal, Soils (kg/yr)
	Water	Air	Total Releases		Water	Air	Total Releases	
Coal		88.5	88.5			142.73	142.73	
Fuel Combustion Total		**136.9**	**136.9**			**192.53**	**192.53**	
Incineration								
WLSSD		11.2	11.2			10.95	10.95	
Small incinerators		48	48					48
Other sludge		1	1			1	1	
Medical waste		22.7	22.7			0	0	
Cremation		2.5	2.5			1.50	1.50	
Incineration Total		**85.4**	**85.4**			**13.45**	**13.45**	**48**
Commercial Products								
Dry cell batteries				851				85.1
Electric lighting		14.6	14.6	37.9		0.82	0.82	20.1
Fever thermometers				22.9				22.9
Thermostats				15.9				15.9
Light switches				0.57				0.57
Pigments				14.1				14.1
Paint		131.9	131.9	25.6				
Fungicides		3.8	3.8					
Commercial Products Total		**150.3**	**150.3**	**968**		**0.82**	**0.82**	**158.67**
Commercial/ Municipal Activities								
WLSSD	21.5		21.5		0.46		0.46	9.19
Landfills		38.8	38.8			38.8	38.8	
Dental uses, hospitals, and labs	0.08	0.48	0.56	6.2	0.08	0.48	0.56	6.2
Residential, Other	0.32		0.32		0.32		0.32	
Commercial/Municipal Total	**21.9**	**39.3**	**61.2**	**6.2**	**0.86**	**39.28**	**40.14**	**15.39**
ANTHROPOGENIC TOTAL	21.95	1334.7	1356.65	974.2	0.91	642.4837	643.3937	222.06

It is assumed that the final disposition of 10 percent of mercury in total Commercial/Municipal effluent is in sludge (Lohse-Hanson 1999). Therefore, not including the WLSSD, there was 4 kg/yr of mercury in sludge in 1990 and 4 kg/yr of mercury in sludge in 1999.

Industrial

- General and Petroleum refining: The 1990 estimates were used (LSBP 1999).

Mining

- Copper: White Pines closed (Michigan Mercury Pollution Prevention Task Force 1996)
- Iron: Taconite production estimates for Minnesota (Jiang 1999)

Fuel Combustion

- Oil: 1990 estimates were used (LSBP 1999).
- Natural Gas: 1990 estimates were used (LSBP 1999). The following facilities use natural gas: Hibbing Public Utility, Duluth Steam Plant, GLT-Cloquet, NNG-Carlton, NNG-Wrenshall, USG, Georgia Pacific, and Louisiana Pacific.
- Wood
  - ⇒ The 1999 estimate is 1 pound/year (LSBP 1999)
  - ⇒ MN Power ML Hibbard estimate (3 pounds/year) is based on 1995 emission estimates (Hagley 1999).
  - ⇒ Louisiana Pacific and Georgia Pacific emission estimates based on 1998 estimates for the amount of wood burned and emission factor for wood-burning unit with electrostatic precipitators (ESP) control devices. Louisiana Pacific has ESP and catalytic afterburner for 14,289 tons of wood and a centrifugal collector and fabric filter for 5,026 tons of wood. Georgia Pacific has a multiclone and ESP for 6,327 tons of wood and a ESP on 8,789 tons of wood (Kim 1999). An emission factor was only available for ESP control ($2.6 * 10^{-6}$ pound/ton) (EPA 1997).

    Louisiana Pacific: ($2.6 * 10^{-6}$ pound mercury/ton) * 19,315 tons/year = 0.502 lb mercury/year = 0.023 kg mercury/year

    Georgia Pacific: ($2.6 * 10^{-6}$ pound mercury/ton) * 15,116 tons/year = 0.039 lb mercury/year = 0.018 kg mercury/year
- Coal
  - ⇒ 1990 estimates were based on Minnesota statewide figures, extrapolated to the population of the Lake Superior basin (Tetra Tech Inc. 1996)
  - ⇒ 1999 estimates are based on facility-specific information for the Lake Superior basin
  - ⇒ 1997 mercury emissions for LTV Mining (50 lb/yr), MN Power Laskin Units 1 (17 lb/yr) and 2 (16 lb/yr), Northshore Mining Company (26 lb/yr), and Potlach Corporation (<3 lb/yr) (Oliaei 1999)
  - ⇒ 1998 emissions for NSP Bayfront (2.3 lb/yr) and University of Wisconsin Superior (1.215 lb/yr) (Cabrera-Rivera 1999)
  - ⇒ 1995 emissions for City of Marquette (16 lb/yr) (City of Marquette 1997) and 1998 emissions for Wisconsin Electric (150 lb/yr) (Michaud 1999)

⇒ 1998 emissions for Hibbing Public Utility based on amount of subbituminous coal used in cyclone and spreader stoker units (Kim 1999) multiplied by an emission factor for ESP control (EPA 1997)

64,931 tons/year * (0.052 * 10-3 lb mercury/ton coal) = 3.38 lb

mercury/year = 1.53 kg mercury/year

⇒ 1998 emissions for the Duluth Steam Plant based on amount of pulverized coal used in a dry bottom unit that has a multiclone with a fabric filter (Kim 1999). An emission factor was used for bituminous coal with multiclone control (EPA 1997).

38,198.26 tons of coal/year * (0.78 *10-3 lb mercury/ton coal) = 29.79 lb

mercury/year = 13.51 kg mercury/year

Incineration

- WLSSD: 1999 estimates were provided by the WLSSD (Tuominen 1999).
- Small incinerators: 1990 estimated emissions were moved to the use and disposal category for 1999, since most incinerators in this category have ceased operating since 1990.
- Other sludge: 1990 estimates were used (LSBP 1999).
- Medical waste: Michigan has no medical incinerators remaining in the Lake Superior basin (Troutman 1999), Minnesota has no medical incinerators remaining in the basin (Lohse-Hanson 1999), and Wisconsin has no medical incinerators remaining in the basin (Larson 1999). The 1999 emission estimate was determined by multiplying the amount of medical waste burned by the emission factor for medical waste with combustion control (EPA 1997). This emission factor was the most conservation emission factor available.
- Cremation: The 1999 estimate was determined by calculating what percentage the basin population [425,548] (Tetra Tech Inc. 1996) is of the total Michigan, Minnesota, and Wisconsin 1998 population [19,766,161] (U.S. Census 1998). This percentage (2.15 percent) was multiplied by the number of total projected cremations in Michigan, Minnesota, and Wisconsin for 2000 [46,569] (EPA 1997) to obtain the total number of cremations in the basin. The number of cremated bodies [1,002.6] was multiplied by the emission factor of 1.50E-03 kg/body for cremation (EPA 1997).
  ⇒ 425,548/19,766,161 = 2.15 percent

  ⇒ .0215 * 46,569 = 1,002.6

  ⇒ 1,002.6 bodies/yr * 1.50E-03 kg mercury/body = 1.50375 kg mercury/yr

Commercial Products

- Batteries: A Hennepin County study showed about a 90-94 percent decrease since the early 90's (NEMA 1999). In addition, the volume of mercury used in batteries has declined by over 95 percent (Ross & Associates 1994). Battery sorting studies have shown about a 95 percent decrease in mercury content since the late 1980's (Erdheim 1999). Therefore, 1990 estimates were decreased by 90 percent.
- Electric lighting :

⇒ *Air emissions*: The 1999 estimates are based on a population extrapolation and Minnesota mercury emission estimates from fluorescent lamp breakage for 2000 [9.07 kg/yr], which are based on the proportion of lamps not recycled and industry figures on mg/lamp (MPCA 1999). A U.S. basin population of 425,548 was used (Tetra Tech Inc. 1996).

⇒ 9.07 kg/yr/ 4725419 people in MN = 0.816966 kg/person/yr

⇒ 0.816966 * 425,548 = 0.82

⇒ *Disposal/use*: The average mercury content of a four foot lamp in 1994 was 22.8 mg; the National Electric Manufacturers Association expects the mercury content of a four foot lamp to be < 12 mg [47 percent decrease] by 2000 (EPA and Environment Canada 1998c). Therefore, 1990 estimates were decreased by 47 percent to obtain 1999 estimates.

- Thermometers, thermostats, light switches, pigments: 1990 estimates were used (LSBP 1999).
- Paint and Fungicides: Paint registrations were canceled in 1991 and fungicides were canceled in 1993 (Ross and Associates 1994).

Commercial/Municipal

- WLSSD: 1999 estimates provided by the WLSSD. Half of sludge being generated is applied to land (Tuominen 1999).
- Landfills; dental uses, hospitals, and labs; and residential and other: 1990 estimates were used (LSBP 1999).

Table A.2 1990 and 1999 Mercury Emission Estimates For The Lake Superior Canadian Basin

Source/Use Category	**1990 Emissions (kg/yr)**			**1990 Use, Disposal, Soils (kg/yr)**	**1999 Emissions (kg /yr)**			**1999 Use, Disposal, Soils (kg/yr)**
	Water	Air	Total Releases		Water	Air	Total Releases	
Industrial								
Forest Products	10.99	11	21.99	0.001	10.99	7.86	18.85	0.001
Mining	0.4	604	604.4		0.4	0.015	0.415	
Metal Finishing	1.53		1.53		1.53		1.53	
Photoprocessing	0.003	0.0004	0.003					
Industrial Total	**12.9**	**614**	**627.9**	**0.001**	**12.9**	**7.9**	**20.8**	**0.001**
Fuel Combustion								
Ontario Hydro – Thunder Bay	0.44	100	100.4	10	0.5	50.33	50.83	5

Table A.2 1990 and 1999 Mercury Emission Estimates For The Lake Superior Canadian Basin

Source/Use Category	**1990 Emissions (kg/yr)**			**1990 Use, Disposal, Soils (kg/yr)**	**1999 Emissions (kg /yr)**			**1999 Use, Disposal, Soils (kg/yr)**
	Water	Air	Total Releases		Water	Air	Total Releases	
Oil		8	8			8	8	
Natural Gas		12	12			12	12	
Wood		0.34	0.34			0.34	0.34	
Coal		5	5			5	5	
Fuel Combustion Total	**0.4**	**125.3**	**125.7**	**10**	**0.5**	**75.7**	**76.2**	**5**
Incineration								
Municipal incinerators		0	0			0	0	
Medical waste		0.77	0.77	0.02		0.41	0.41	
Cremation		1.1	1.1			0.7	0.7	
Incineration Total		**1.9**	**1.9**	**0.02**		**1.1**	**1.1**	
Commercial Products								
Batteries				300				15
Electric lighting		1	1	15.8*		0.5	0.5	7.8*
Fever thermometers				11.2*				11.4*
Thermostats				7.0*				5.8*
Light switches				1.2*				1.2*
Pigments				5.6				5.6
Paint	21.2	0.12	21.32		0	0	0	0
Fungicides	0.8	8	8.8	7.2	0	0	0	0
Instruments (other)		13.1	13.1	52.35		13.1	13.1	52.35
Commercial ProductsTotal	**22.0**	**22.2**	**44.2**	**400.4**		**13.6**	**13.6**	**99.2**
Commercial/ Municipal Activities								
Wastewater treatment plants	3.89	4.63	8.52	2.08	3.89	4.63	8.52	2.08
Runoff	0.7		0.7		0.7		0.7	
Dental		0.18	0.18	22.5**		0.18	0.18	22.5**
Pharmaceutical		1.26	1.26			1.26	1.26	
Commercial/Municipal Total	**4.59**	**6.07**	**10.66**	**24.6**	**4.59**	**6.07**	**10.66**	**24.6**
ANTHROPOGENIC TOTAL	**39.95**	**769.5**	**810.4**	**435.0**	**18.0**	**104.3**	**122.3**	**128.7**

* Estimates of the amount of mercury in these products disposed in landfills
** Part of this estimate is a doublecount under wastewater treatment plants.

A.1.2 Mercury Emission and Disposal Estimates for the Canadian Lake Superior Basin

Industrial

- Forest Products: The 1999 estimate includes 1995 estimates for Kimberly Clark, Avenor-Thunder Bay, Abitibi Price - Prov. Paper, Abitibi Price Fort William, Northern Wood Preserves, Norampac Packaging-RR, Weldwood of Canada Ltd., and Fort James-Marathon (Brigham 1999)
- Mining : The Algoma Steel Plant in Wawa, Ontario closed. The 1999 estimate includes the 1995 estimate for Williams Operations gold ore (Brigham 1999).
- Metal Finishing and Photoprocessing: The 1990 estimates were used (Thompson 1994).

Fuel Combustion

- Oil, Natural Gas, Wood, and Coal: The 1990 estimates were used (LSBP 1999).

Incineration

- There is no municipal incineration in the Lake Superior basin
- Medical waste: The 1990 estimates are for hospitals open in 1993 (Brigham 1999). The 1999 estimate includes 1995 estimates for the hospitals that continue to operate incinerators: St. Joseph's General and McClausland hospitals (Brigham 1999).
- Cremation: The 1990 estimate is from Thompson (1994). The 1999 estimate includes 1995 estimates for Riverside Cemetery and Sunset Crematorium (Brigham 1999).

Commercial Products

- Batteries - A Hennepin County (in Minnesota) study showed about a 90-94 percent decrease since the early 90's (NEMA 1999). In addition, the volume of mercury used in batteries has declined by over 95 percent (Ross & Associates 1994). Battery sorting studies have shown about a 95 percent decrease in mercury content since the late 1980's (Erdheim 1999). Therefore, 1990 estimates were decreased by 95 percent.
- Electric lighting, fever thermometers, thermostats and light switches estimates are from Benazon (1998)
- Paint and fungicide estimates are from Benazon (1998). Turf fungicides and mercury in paint are now banned and releases are assumed to be zero (Benazon 1998)
- Pigments: 1990 estimates were used (LSBP 1999).

Commercial/Municipal Activities

- Wastewater Treatment Plants, Runoff, Pharmaceuticals: 1990 estimates were used (LSBP 1999).
- Dental: The losses to the atmosphere are due to placement and removal of amalgams (Benazon 1998). The draft *Canadian Emissions Inventory of Mercury* assumes a weight of 0.2 g mercury in each amalgam. The estimate for amalgam disposal comes from Thompson (1994).
- Pharmaceutical emissions are from the mercury in skin preparations and diuretics. Estimates used are from Thompson (1994)

A.2 PCB USE ESTIMATES

This section is organized into two sections. Section A.2.1 summarizes PCB use estimates for the U.S. portion of the Lake Superior basin, and section A.2.2 provides documentation for PCB use in the Canadian portion of the basin.

A.2.1 PCB Estimates for the U.S. Lake Superior basin

- Methods used to extrapolate MPCA capacitor and transformer data to Lake Superior basin:

Population of Minnesota in Lake Superior basin:	232,928
Minnesota MPCA data:	
Number of capacitors > 500 ppm (Minnesota Power)	2935
Number of capacitors > 500 ppm (other industry/utilities)	418
Number of transformers and capacitors < 500 ppm	195
Capacitors > 500 ppm PCB per capita (industry/utilities other than MN Power), 1.79x10-3	
Transformers and capacitors < 500 ppm PCB per capita, Minnesota	8.73x10-4
Capacitors > 500 ppm PCB in basin (1.79x10-3 x 232,928 + 2935 MN Power)	**3353**
Transformers and capacitors < 500 ppm PCB in basin (8.73x10-4 x 232,928)	**195**

- Method for determining the mass of PCB in U.S. portion of basin from transformers > 500 ppm PCB and all capacitors:

*Assumptions re: volume and concentrations**

Capacitors > 500 ppm	3 gallons & 175,000 ppm each
Transformers < 500 ppm**	
95.5 percent	15 gallons & 150 ppm each
0.5 percent	2500 gallons & 250 ppm each
Transformers > 500 ppm	15 gallons & 550 ppm each

* Equipment volume and concentration estimates based on personal communication with Gene Beadey, Minnesota Power PCB Program Manager (Beadey 1999)

** also applied to capacitors < 500 ppm

Calculations to find mass of PCBs

# caps > 500 ppm		326
Volume of caps > 500ppm	(3353 x 3 gal)	10,059 gal
Volume of caps > 500ppm	(10,059 gal x 3.785 liters/gal)	38,077 liters
Mass PCB***	(38,077 liters x 175,000 ppm [mg/l] / 1000000 mg/kg)	**6664 kg**
# caps & tfs < 500 ppm		195
Volume of tfs < 500 ppm, 15 gal	(195 caps x .955 x 15 gal)	2793 gal
Volume of tfs < 500 ppm, 15 gal	(2793 gal x 3.785 liters/gal)	10,574 liters
Mass PCB***, 15 gal	(10,574 liters x 150 ppm [mg/l]/ 1000000 mg/kg)	**1 kg**
Volume tfs < 500 ppm, 2500 gal	(195 caps x .005 x 2500 gal)	2438 gal

Volume tfs < 500 ppm, 2500 gal	(2438 gal x 3.785 liters/gal)	9227 liters
Mass PCB***, 2500 gal	(9227 liters x 150 ppm [mg/l]/ 1000000 mg/kg)	**2 kg**

*** assuming ppm = mg/l, thus density of oil = 1

TOTAL **6667 kg**

- Note regarding U.S. treatment of PCB generating processes

U.S. EPA has concluded that the quantity of PCBs inadvertently generated and released into the environment is inconsequential compared to releases from items with intentional PCBs and, therefore, did not ban these processes. However, U.S. EPA did add certification, recordkeeping and reporting requirements to the facilities that inadvertently produce PCBs. (EPA 1998a)

A.2.2 PCB Estimates for the Canadian Lake Superior basin

- 1997 data for Canada are from Brigham (1999)
- In Canada, quantities are reported as PCB contaminated materials and fluids. Liquids are generally reported in liters. Conversion to kilograms was made assuming 1.15 kg/liter.
- 1990 data for Canada were taken from the Stage 2 LaMP.
- Data for total quantity destroyed in Canada are from pgs 30 and 37 of the Zero Discharge report, adding all of the data for the provincially monitored sites and the total for the federally monitored sites. However, pg 36 of the Zero Discharge report provides higher quantities for provincially monitored sites (in the summary table) and would result in a total of 435,949 kg destroyed between 1990-1997, a difference of 91,918 kg. The data presented are for provincially monitored and federally monitored sites and are not presented by sector.
- The total amount of PCBs in use in Canada in 1997 is drawn from the Zero Discharge report, pg 31, indicating the total quantity of high level PCB liquids only. It is not known whether there is an additional quantity of low level PCB liquids still in use in 1997.
- Though it would appear that Canada has already exceeded the reduction goals for 2005 based upon the quantity destroyed 1990- 1997 (as presented in the Zero Discharge report) and the baseline quantity in use and storage in 1990 (as presented in the Stage 2 LaMP), there is an additional 96,012 kg in use and storage in 1997 (as presented in the Zero Discharge report). The reason for this discrepancy is not known, though it may be the result of the discovery of additional PCB storage and use since completion of the 1990 inventory.
- High level liquid and solid PCB materials are defined as containing greater than 10,000 ppm PCBs.
- Low level liquid and solid PCB materials are defined as containing 50-10,000 ppm PCBs.
- The federally monitored sites do not report whether the stored materials are high or low level waste and, therefore, it is all classified as high level waste.

A.3 DIOXIN EMISSION AND DISPOSAL ESTIMATES

This addendum is organized in two sections. Addendum A.3.1 summarizes dioxin emission and disposal estimates for the U.S. portion of the basin, and Addendum A.3.2 provides estimates for the Canadian portion of the basin.

A.3.1 Dioxin Emission Estimates for the U.S. Lake Superior basin

Table A.3.1 summarizes U.S. estimates for the 1990 baseline and 1999.

Table A.3.1 U.S. Lake Superior basin Dioxin Emission and Disposal Estimates

Source/Use Category	**1990 Emissions (g TEQ/yr)**			**1990 Use, Disposal, Soils (g TEQ/yr)**	**1999 Emissions (g TEQ/yr)**			**1999 Use, Disposal, Soils (g TEQ/yr)**
	Water	Air	Total Releases		Water	Air	Total Releases	
INDUSTRIAL								
Forest products	0 – 0.6		0 – 0.6		0-0.3		0 - 0.3	
Petroleum refining	1.5×10^{-5}		1.5×10^{-5}					
Wood preserving				2.9×10^{-3} [a]				2.9×10^{-3}
Mining		0.1	0.1					
Industrial Total	**1.5×10^{-5}- 0.6**	**0.1**	**0.1-0.7**	**2.9×10^{-3}**	**0-0.6**		**0 - 0.6**	
FUEL COMBUSTION								
Coal		0.73	0.73			0.53	0.53	
Wood		2.7	2.7			0.40	0.40	
Fuel Combustion Total		**3.43**	**3.43**			**0.93**	**0.93**	
INCINERATION								
Burn barrels						6.97	6.97	
Medical and industrial		134	134			83	83	
Small incinerators		235 – 2,274	235 – 2,274					
WLSSD		0.19	0.19			0.19	0.19	
Incineration Total		**369 - 2408**	**369 – 2,408**			**90.2**	**90.2**	
MUNICIPAL/ RESIDENTIAL								
Wastewater treatment plant sludge				0.014				0.014

Table A.3.1 U.S. Lake Superior basin Dioxin Emission and Disposal Estimates

Source/Use Category	**1990 Emissions (g TEQ/yr)**			**1990 Use, Disposal, Soils (g TEQ/yr)**	**1999 Emissions (g TEQ/yr)**			**1999 Use, Disposal, Soils (g TEQ/yr)**
	Water	Air	Total Releases		Water	Air	Total Releases	
Municipal/Residential Total				**0.014**				**0.014**
COMMERCIAL PRODUCTS								
Pentachlorophenol use				18.0				18.0
PCB spills				0.0006				0.0006
Commercial Products Total				**18.0**				**18.0**
TOTAL	**0.8**	**373 – 2,412**	**374 – 2,413**	**18**	**0.06**	**90.2**	**90.2**	**18.0**

[a] Estimate of dioxin presence in soils at one site in the U.S. portion of the basin. This is not an annual release.

Summary of Sector Assumptions

Industrial

- Forest products: Dioxins are generated in pulp and paper mills from the paper bleaching process, especially in plants using elemental chlorine as a bleaching agent. In recent years, pulp mills in the basin have modified their bleaching processes by substituting chlorine dioxide for elemental chlorine, thereby virtually eliminating dioxins from pulp and paper mill effluents (Stromberg et. al. 1996). However, low level monitoring data were not available to assess the degree to which dioxin effluent concentrations have declined since 1990 for the five pulp and paper mills in the U.S. portion of the basin (two of which discharge directly to the lake). As a result, the 1990 baseline estimate of 0 to 0.6 g TEQ/yr included only the two facilities discharging to Lake Superior, one of which has since closed. The other three mills discharge to Western Lake Superior Sanitary District (WSLSSD). The 1999 estimate has been reduced to 0 to 0.3 TEQ/yr.
- Petroleum refining: Dioxins can be formed when catalysts used in petroleum refining are reactivated by burning off coke deposits at 380 degrees C to 525 degrees C in the presence of chlorinated compounds (Bear et. al. 1993). The Stage 1 LaMP (1995) reported an estimate of 1.5 x 10-5 TEQ/yr discharged in the Murphy Oil refinery wastewater effluent prior to 1991. The refinery is located in Superior, Wisconsin. The dioxin estimate was based on the results of one sample detection. Since 1991 the wastewater discharge permit has prohibited discharge of catalytic reformer regeneration wastewater, which is generated periodically and

is a potential source of dioxin. This waste is segregated and disposed off site at an approved facility. Subsequent permit reissuance and compliance monitoring of refinery wastewater effluent has not detected dioxin (detection limit less than 10 pg/l).

- Wood preserving: Past industrial use of pentachlorophenols (PCP) to treat timber, railroad ties, and utility poles are a potential source of dioxins in the basin (Tetra Tech 1996). The estimate of dioxin contamination in soil is based on an estimate of pentachlorophenol present in soils in the vicinity of the Koppers Inc. facility in Superior, Wisconsin. The facility used PCP to treat railroad ties until 1979. Characterization studies under Resource Conservation and Recovery Act (RCRA) corrective action are ongoing at the site.
- Mining: Non-ferrous metal, especially copper, smelting and refining are a known source of dioxin emissions accounting for approximately 1.36×10^{-2} lb/yr TEQ air emissions in the United States (EPA 1997). In the U.S. portion of the Lake Superior basin, the Copper Range, White Pine Mine smelter operated in Northern Michigan until 1995. With the closure of the White Pine mine smelter, dioxin emissions from copper smelting were eliminated from the U.S. portion of the basin.

Fuel Combustion

The combustion of wood and coal as an energy source for industrial and residential use is a known source of dioxins (EPA 1997). Increased attention has been devoted over the past several years to estimate the dioxin emission factors associated with these processes. Table A.3.2 provides estimates of the wood and coal combustion rates in the U.S. portion of the LSB and the current emission factors used to estimate dioxin TEQ emissions from those sources.

Table A.3.2 Estimated Dioxin Emissions from Wood and Coal Combustion

Fuel and Combustion Type	Quantity of Fuel Burned in U.S. Lake Superior basin (kg)[a]	Emission Factor (ng TEQ/kg fuel combusted)	Dioxin Emissions (g TEQ/yr)[d]
Coal, coal fired utilities and industrial boilers	1.8×10^9	0.087[b]	0.16
Coal, commercial and residential boilers	1.7×10^7	22[c]	0.37
Wood, industrial wood furnace	1.2×10^8	0.82[b]	0.10
Wood, commercial and residential	1.5×10^8	2[b]	0.30
TOTAL			0.93

[a] Adapted from Tetra Tech (1996).
[b] EPA 1998
[c] Tetra Tech 1996
[d] 1 ng = 10^{-9} g

Incineration

- Burn Barrels: In the 1990 baseline estimate, private household waste incineration was not assessed as a source of dioxin air emissions because of an absence of data to characterize the source. In the past several years, additional research has found that household "burn barrels" may be a significant dioxin source. WLSSD (1992) estimated that burn barrels produce 20 times more 2,3,7,8-TCDD per unit of household garbage burned than a controlled incinerator (e.g., a municipal waste combustor (MWC)). Lemieux (1998) estimated that 1.5 to 4 households that burn their waste in the open (e.g., in burn barrels) equal the dioxin generating potential of a fully-operational MWC. Overall, household waste combustion in burn barrels appears to be an overlooked, but potentially significant source of dioxin and other toxic air emissions.
  The average person in the U.S. generates between 800 and 1,350 pounds of household waste in a year (MDEQ 1999). The U.S. EPA estimates that 40 percent of people living in non-metropolitan areas burn their waste and that 63 percent of their daily waste is burned in burn barrels. Nationally, this amounts to over 1.8 billions pound of household waste burned in burn barrels every year. Normalized for the U.S. Lake Superior basin population, this amounts to over 4.5 million pounds of household waste openly burned in the basin each year. While such household waste burning is suspected to be a significant source of dioxin and other toxic air emissions, research findings differ as to the rates of dioxin emission per unit of household waste burned (Cohen 1999). Table A.3.3 summarizes dioxin generation emission factors for several recent studies. The table illustrates that emission rate estimates vary over several orders of magnitude. As a result, these emission factor estimates are provided to illustrate the potential significance of the source. Much additional work remains to be completed to properly estimate the dioxin emissions from household waste burning that is occurring in the basin.

Table A.3.3 Emission Factors for Household Waste Combustion in Burn Barrels

Source	Emission Factor (g TCDD/lb household waste burned)
Cohen (1999)	3.6×10^{-8} [b]
Lemieux (1998) (recycler)[a]	1.04×10^{-7}
Lemieux (1998) (non-recycler)	7.4×10^{-6}
Two Rivers Regional Council (1994)	6.2×10^{-10}
WLSSD (1992)	1.8×10^{-9}

[a] Recyclers were assumed to reduce the proportion of newspaper, plastic, and some metals in their household waste.

[b] Expressed as grams TEQ/yr.

To illustrate the potential magnitude of household hazardous waste burning in the U.S. portion of the basin, Table A.3.4 applies the Cohen (1999) emission factor to potential household hazardous waste burn rates in the U.S. Lake Superior basin counties to generate an annual TEQ dioxin emission estimate. Extrapolation of national estimates on burning rates to the Lake Superior basin yields an estimate of about 7g TEQ/yr.

Table A.3.4 Estimates of Dioxin Generated from Household Waste Combustion in Burn Barrels

County Name	State Name	Population 1996	Estimated Annual Waste Generation (pounds)	Estimated Annual Pounds Burned	Estimated g TEQ/yr Emissions
St. Louis	Minnesota	196,101	264,736,350	66,184,087.	2.38
Lake	Minnesota	10,500	14,175,000	3,543,750	0.13
Bayfield	Wisconsin	15,037	20,299,950	5,074,987	0.18
Carlton	Minnesota	30,554	41,247,900	10,311,975	0.37
Douglas	Wisconsin	43,015	58,070,250	14,517,562	0.52
Ashland	Wisconsin	16,534	22,320,900	5,580,225	0.20
Iron	Wisconsin	6,616	8,931,600.00	2,232,900	0.08
Cook	Minnesota	4,546	6,137,100	1,534,275	0.06
Keweenaw	Michigan	1,988	2,683,800	670,950	0.02
Houghton	Michigan	36,853	49,751,550	12,437,887	0.45
Ontonagon	Michigan	8,625	11,643,750	2,910,937	0.10
Baraga	Michigan	8,182	11,045,700	2,761,425	0.10
Marquette	Michigan	70,457	95,116,950	23,779,237	0.86
Gogebic	Michigan	18,158	24,513,300	6,128,325	0.22
Luce	Michigan	5,548	7,489,800	1,872,450	0.07
Alger	Michigan	9,859	13,309,650	3,327,412	0.12
Schoolcraft	Michigan	8,806	11,888,100	2,972,025	0.11
Iron	Michigan	13,209	17,832,150	4,458,037	0.16
Mackinac	Michigan	11,077	14,953,950	3,738,487	0.13
Chippewa	Michigan	37,587	50,742,450	12,685,612	0.46
Total		653,753	882,566,550	220,641,637	6.72

- Medical and industrial: In the 1990 baseline estimate, medical and industrial incinerators were estimated to contribute 134 g TEQ/yr in dioxin air emissions. As of 1999, all medical incinerators have been closed in the U.S. portion of the basin. The remaining industrial incinerators are estimated to account for approximately 83 g TEQ/yr (after Jackson 1993) in air emissions. As a result, dioxin air emissions are estimated to have declined to 83 g TEQ/yr for this sector in 1999.
- Small incinerators: In the 1990 baseline, small incinerators (e.g., those operated by schools, apartment buildings , and retailers) were estimated to contribute 235 to 2,274 g TEQ/yr in dioxin air emissions. As of 1999, all small incinerators are assumed to be closed in the U.S. portion of the basin. As a result, no dioxin air emissions are estimated for this sector in 1999.
- WLSSD: The Western Lake Superior Sanitary District (WLSSD) operates the only municipal solid waste incinerator in the basin (Stage 2 LaMP 1999). Estimated dioxin releases of 0.19 g TEQ/yr are based on stack testing. This incinerator is expected to close in 2000.

Municipal/Residential

- Wastewater treatment plant sludge: The WLSSD receives indirect discharges from three pulp and paper mills, as well as other industrial and commercial facilities. In addition, new cotton clothing and other household items have also been found to contain dioxins, which come out in the wash and are discharged to the wastewater treatment facility (Horstmann and McLachlan 1994). In 1990, WLSSD treatment plant sludge contained 0.014 g TEQ. Dioxin TEQ concentrations are assumed to remain constant in 1999.

Commercial Products

- Pentachlorophenol use: Pentachlorophenol has been used to preserve a variety of commercial products, including textiles and leather goods in the United States and abroad. In the past, pentachlorophenol was widely used as a pesticide although most of those uses are now restricted. Dioxin contamination in pentachlorophenol could contribute as much as 10,500 g TEQ dioxins/yr in the United States (Slants and Trends 1995). Based upon the normalized population of the LSB, approximately 18.0 g TEQ/yr of dioxin are assumed to be found in the basin. The 1990 estimate was based on this national figure. A 1999 estimate should probably show a decrease because of declining use of pentachlorophenol. However, no updated estimates are available.

A.3.2 Dioxin Emission Estimates for the Canadian Lake Superior basin

Table A.3.5 summarizes the estimated dioxin emissions in the Canadian portion of the Lake Superior basin 1990 to 1999. The assumptions used to generate these estimates are presented in the following section.

Table A.3.5 Canadian Lake Superior basin Dioxin Emission and Disposal Estimates

Source/Use Category	1990 Emissions (g/yr)			1990 Use, Disposal, Soils (g /yr)	1999 Emissions (g /yr)			1999 Use, Disposal, Soils (g /yr)
	Water	Air	Total Releases		Water	Air	Total Releases	
INDUSTRIAL								
Forest products	0.47	0.09	0.56	13.18	0.47	0.09	0.56	13.18
Mining/Sintering		21.8	21.8					
Wood preserving	1.52		1.52	1.53	1.52		1.52	1.53
Contaminated Soils			**0.1**	**31.38**[a]				
Industrial Total	**1.99**	**21.89**	**23.88**	**14.71**	**1.99**	**0.09**	**2.08**	**14.71**
FUEL COMBUSTION								
Coal		0.89	0.89	0.001		0.89	0.89	0.001
Wood		0.08	0.08			0.08	0.08	
Natural Gas		0.05	0.05			0.05	0.05	
Gasoline		0.02	0.02			0.02	0.02	
Fuel Combustion Total		**1.04**	**1.04**			**1.04**	**1.04**	
INCINERATION								
Medical		0.13	0.13	94		0.13	0.13	94
Small incinerators		NA						
Incineration Total		**0.13**	**0.13**	**94**		**0.13**	**0.13**	**94**
MUNICIPAL/RESIDENTIAL								
Wastewater treatment plant sludge	0.04	0.01	0.05		0.04	0.01	0.05	
Municipal/Residential Total	**0.04**	**0.01**	**0.05**		**0.04**	**0.01**	**0.05**	
COMMERCIAL PRODUCTS								
Pentachlorophenol use		0.27	0.27			0.27	0.27	
PCB spills			0.003	70[b]			0.003	70[b]
Commercial Products Total		**0.27**	**0.27**			**0.27**	**0.27**	
TOTAL	**2.03**	**23.34**	**25.37**	**108.71**	**2.03**	**1.48**	**3.51**	**108.7**

[a] Contaminated soils – not an annual rate of disposal.

[b] Resulting from spills – not included in annual disposal estimate.

All 1990 estimates are drawn from the Stage 2 LaMP (LSBP 1999) and are expressed in terms of dioxins and furans, rather than TEQs. As a result, the values are not directly analogous to the U.S. estimates reported in Table A.3.1, unless specifically noted .

Emissions and dioxin/furan levels in soil and disposal are assumed to remain constant through 1999 except for the following changes:

Industrial

- Forest Products: Yearly average dioxin concentrations in the wastewater effluent form the Kraft mills in the Thunder Bay Region have generally declined form 1990 to 1994, although information on total dioxin load has not been reported. As a result, dioxin load in wastewater from this sector is assumed to remain constant from 1990 to 1999 (Brigham 1999).
- Mining/Sintering: The Algoma Ore Division iron sintering plant in Wawa, Ontario closed in 1998, thereby eliminating the 21.8 g/yr in dioxin emissions estimated for this sector in 1990.

Incineration

- Medical: The number of medical incinerators in the Canadian Lake Superior basin has declined from seven in 1990 to three in 1999 (Brigham 1999). As a result, dioxin emissions are assumed to have declined proportionally to 0.07 g dioxin/yr.

ADDENDUM 4-B
CHALLENGES BY THE GREAT LAKES BINATIONAL TOXICS STRATEGY

Addendum 4-B contains the challenges section of the Great Lakes Binational Toxics Strategy.

Challenges

EC and U.S. EPA, working in cooperation with their partners, accept the following challenges as significant milestones on the path toward virtual elimination. These milestones will be achieved by implementing voluntary efforts to achieve reductions of particular Level I substances and through currently anticipated regulatory actions under environmental laws in both countries. In Canada, the baseline used for these milestones will be 1988, in keeping with the Accelerated Reduction and Elimination of Toxics Program (ARET) baseline and the 1987 GLWQA. For the U.S., the baseline from which reductions will be measured is unique for each substance, the best available data will be used, which in most cases is the most recent baseline.

As new information and data on opportunities, and their associated costs and benefits become available, EC and U.S. EPA may revise the milestones, using a public consultation process involving their partners. In some cases, the challenges may differ between EC and USEPA based on different start dates for their respective domestic toxics reduction programs, different regulatory and legislative authorities, and different chemical data bases, baselines and inventories.

EC and U.S. EPA will work with their partners to:

- U.S. Challenge: Confirm by 1998 that there is no longer use or release from sources that enter the Great Lakes basin of five bioaccumulative pesticides (chlordane, aldrin/dieldrin, DDT, mirex, and toxaphene), and of the industrial byproduct/contaminant octachlorostyrene. If ongoing, long-range sources of these substances from outside of the U.S. are confirmed, work within international frameworks to reduce or phase out releases of these substances.
  Canadian Challenge: Report by 1997, that there is no longer use, generation or release from Ontario sources that enter the Great Lakes of five bioaccumulative pesticides (chlordane, aldrin/dieldrin, DDT, mirex, and toxaphene), and of the industrial byproduct/contaminant octachlorostyrene. If ongoing, long-range sources of these substances from outside of Canada are confirmed, work within international frameworks to reduce or phase out releases of these substances.

- U.S. Challenge: Confirm by 1998, that there is no longer use of alkyl-lead in automotive gasoline. Support and encourage stakeholder efforts to reduce alkyl-lead releases from other sources.
  Canadian Challenge: Seek by 2000, a 90 percent reduction in use, generation, or release of alkyl-lead consistent with the 1994 COA.

- U.S. Challenge: Seek by 2006, a 90 percent reduction nationally of high-level PCBs (>500 ppm) used in electrical equipment. Ensure that all PCBs retired from use are properly managed and disposed of to prevent accidental releases within or to the Great Lakes basin.
  Canadian Challenge: Seek by 2000, a 90 percent reduction of high-level PCBs (>1 percent PCB) that were once, or are currently, in service and accelerate destruction of stored high-level PCB wastes which have the potential to enter the Great Lakes basin, consistent with the 1994 COA.

- U.S. Challenge: Seek by 2006, a 50 percent reduction nationally in the deliberate use of mercury and a 50 percent reduction in the release of mercury from sources resulting from human activity. The release challenge will apply to the aggregate of releases to the air nationwide and of releases to the water within the Great Lakes basin. This target is considered as an interim reduction target and, in consultation with stakeholders, will be revised if warranted, following completion of the Mercury Study Report to Congress.
  Canadian Challenge: Seek by 2000, a 90 percent reduction in the release of mercury, or where warranted the use of mercury, from polluting sources resulting from human activity in the Great Lakes basin. This target is considered as an interim reduction target and, in consultation with stakeholders in the Great Lakes basin, will be revised if warranted, following completion of the 1997 COA review of mercury use, generation, and release from Ontario sources.

- U.S. Challenge: Seek by 2006, a 75 percent reduction in total releases of dioxins and furans (2,3,7,8-TCDD toxicity equivalents) from sources resulting from human activity. This challenge will apply to the aggregate of releases to the air nationwide and of releases to the water within the Great Lakes basin. Seek by 2006, reductions in releases, that are within, or have the potential to enter the Great Lakes basin, of hexachlorobenzene (HCB) and benzo(a)pyrene [B(a)P] from sources resulting from human activity.
  Canadian Challenge: Seek by 2000, a 90 percent reduction in releases of dioxins, furans, HCB, and B(a)P, from sources resulting from human activity in the Great Lakes basin, consistent with the 1994 COA. Actions will focus on the 2,3,7,8 substituted congeners of dioxins and furans in a manner consistent with the TSMP.

- U.S. and Canadian Challenge: Promote pollution prevention and the sound management of Level II substances, to reduce levels in the environment of those substances nominated jointly by both countries, and to conform with the laws and policies of each country, including pollution prevention, with respect to those substances nominated by only one country. Increase knowledge on sources and environmental levels of these substances.

- U.S. and Canadian Challenge: Assess atmospheric inputs of Strategy substances to the Great Lakes. The aim of this effort is to evaluate and report jointly on the contribution and significance of long-range transport of Strategy substances from world-wide sources. If ongoing long-range sources are confirmed, work within international frameworks to reduce releases of such substances.

- U.S. and Canadian Challenge: Complete or be well advanced in remediation of priority sites with contaminated bottom sediments in the Great Lakes basin by 2006.