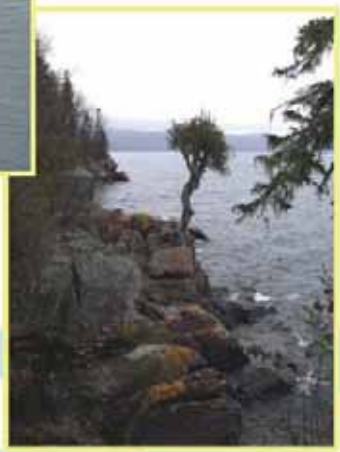
Appendix D:

MERCURY REDUCTION FOR LAKE SUPERIOR: *A MERCURY REDUCTION ASSISTANCE PROJECT FOR LAKE SUPERIOR REGION FACILITIES*

Grand Portage, Minnesota - the Witch Tree.
Photo Credit: John Marsden, Environment Canada.

Lake Superior Lakewide Management Plan
2006

MERCURY REDUCTION FOR LAKE SUPERIOR



LAKE SUPERIOR

BINATIONAL PROGRAM

2005

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A MERCURY REDUCTION ASSISTANCE PROJECT FOR LAKE SUPERIOR REGION FACILITIES

Why You Should Conduct a Mercury Inventory and Phase-Out at Your Facility and How to Receive Assistance

This booklet describes a project offering technical assistance to industries in the Lake Superior region to develop an inventory and phase-out plan for mercury. The project features special outreach to the Great Lakes shipping industry.

Technical assistance is available through a federally funded project available on the U.S. side of Lake Superior in 2005-2006. Canadian assistance is available starting in fall 2005.

This Lake Superior basin-wide mercury reduction project is a cooperative effort among environmental agencies in both countries and the Lake Superior Binational Program.

Many Lake Superior industries have already conducted mercury inventories and are offering to serve as "peer" mentors.

The last page of this booklet lists contacts for information and technical assistance

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THE LAKE SUPERIOR BINATIONAL PROGRAM AND THE ZERO DISCHARGE DEMONSTRATION CHALLENGE

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We all determine the future of our lake. As the first in the chain of Great Lakes, Lake Superior is the cleanest, with a smaller population and industrial base. This makes it the best place to pioneer projects to eliminate sources of toxic chemicals for all the Great Lakes.

In 1991, the governments around the lake announced the Lake Superior Binational Program, which included an important challenge—the Zero Discharge Demonstration. The goal of this challenge was to have zero discharge of mercury and eight other toxic and persistent chemicals by 2020.

Since that time several organizations around the Lake Superior Basin have set up programs to remove, prevent or recycle these toxic chemicals.

Cities, schools, Indian Tribes and First Nations, provinces, states, businesses, and other groups have developed unique programs to reduce mercury and other toxic chemicals. Each event and project helps achieve the zero discharge goal and the Binational Program vision —***that water is life and the quality of water determines the quality of life.***

What We Are Offering

This project offers non-regulatory pollution prevention technical assistance to conduct inventories, develop change-out plans and provide the opportunity to recycle all mercury.

Industry members of the Lake Superior Binational Forum, a multi-stakeholder group of U.S. and Canadian citizens serve as mentors for this mercury inventory and phase-out project. One-on-one assistance is available from pollution prevention specialists. We offer:

- Mentoring and advice from industry peers
- Guidance in conducting an inventory
- Information on potential mercury devices
- Information about disposal options
- Opportunities for mercury product collections
- Assistance in complying with laws
- Recognition as a mercury reduction partner

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THE MERCURY PROBLEM

Mercury In The Environment

Widespread mercury pollution has lead to consumption advisories for some fish taken from Lake Superior, and other waters in the basin, as well as for many waters throughout the U.S. and Canada. Mercury is found in the flesh and cannot be removed by trimming or cooking.

Mercury can harm the human nervous system. Young children, developing fetuses, and breast-fed babies are at most risk, because small amounts of mercury can damage a developing brain. People engaged in subsistence fishing have higher exposures than the rest of the population. Following health advisories minimizes risk. See the web site listing on the last page for more information.

Mercury Spills Endanger Employee Health and Require Expensive Cleanup

Worker exposure in the Great Lakes Fleet.
Several workers on Great Lakes ore boats experienced mercury poisoning from exposure to mercury-bearing equipment and spills of mercury used to fill pressure gauges.

New England Gas Company, Pawtucket, RI, 2004, total price tag: $6.6 million.
The company stored mercury collected from natural gas gauges without proper notification to state and local officials. Vandals spilled an estimated 20 pounds of that mercury (about 2.8 cups) on company property and spreading it in a parking lot and an apartment complex. Evacuation of 150 residents, at company expense, lasted for nearly a month while the apartment building was cleaned.

Nicor Gas, Chicago, Il, 2001, total price tag: $4.1 million.
The company settled a lawsuit by removing natural gas gauges and cleaning up homes where gauges had leaked mercury.

Mercury Poisonings, Particularly In Children Are Documented In Medical Literature

In 2003 a Utah boy playing with what he thought was silver paint developed mercury poisoning. Seventeen-year old Michael Coleman noted, "If I stood up – dizziness. If I sat up, it would be harder to breathe. I have to do everything really slow or it will mess me up -- hands stay numb all the time."

In Oklahoma, two-year-old Maya Bailey suffered a severe case of mercury poisoning after she was exposed to mercury spilled in a carpet. In 2002, *Family Circle* magazine reported "They watched helplessly as their once-vivacious toddler became a listless 18-month-old who stumbled and fell out of her chair. Her hands and feet turned bright red. Then the red splotches on her hands became deep sores, which also spread to her mouth. Her teeth started to fall out, as did her fingernails. Worst of all, breathing became excruciatingly painful, especially at night."

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INVENTORY AND PHASE OUT MERCURY AT YOUR FACILITY

Reduce Your Risk From Spills, Accidents, Worker Exposure, Lawsuits
Protect Community Health
Protect The Environment

Although widely used in the past, mercury is now known to be a threat to human health, fish, and wildlife when released into the environment.

Mercury has been used in thermometers, thermostats, monitors, manometers, and dilators to control electrical current and to measure and regulate temperature and pressure. Improper disposal at the end of product life can release significant amounts of mercury to the environment. In most cases, non-mercury alternatives are available.

Mercury devices with the highest spill risks:

- are portable and breakable, like thermometers
- spill mercury when tipped over, like many manometers
- require periodic refilling
- contain a large amount of mercury.

Mercury Reduction Supports Environmental Management Systems And Can Save Money

Many companies and public facilities have developed environmental management systems (EMS). An EMS is a holistic approach to evaluating and improving the environmental impact of business operations, following internationally accepted guidelines.

A mercury inventory and phase-out approach, with its emphasis on prevention, supports environmental management systems and can be incorporated into an existing EMS or other environmental program.

The insurance industry notes that industries with an EMS have fewer accidents and lower insurance costs. Adopting a preventive strategy reduces incidents that may result in liability.

The Mercury Bottom Line

A mercury spill can cause a plant evacuation, expose a company to liability, and in a worst case scenario cost millions of dollars. Mercury causes significant environmental and community health problems.

An effective approach is to:

- Inventory mercury bearing products
- Remove those products that can be conveniently and inexpensively replaced or that pose a high risk of causing a spill
- Tag the remaining equipment
- Train workers to properly handle and decommission the equipment at the end of service
- Implement a mercury-free purchasing policy
- Train staff to handle mercury spills appropriately and legally.
- Obtain mercury spill kits and report spills to authorities. In the U.S., mercury spills over two lbs (2 tablespoons) must be reported to the U.S. Environmental Protection Agency. http://www.epa.gov/mercury/

Lake Superior Businesses and Organizations Taking the Initiative to Reduce Mercury

Lakehead University, Thunder Bay ONT

Hugh Briggs, Mechanical/Electrical Systems Manager, reported: "Lakehead University recently removed mercury-containing boiler control panels as part of our Facility Renewal Project with Johnson Controls LP. The mercury removal was very straight-forward and easy with the assistance of local qualified contractors. The project assisted Lakehead University in dealing with a designated substance under the Occupational Health and Safety Act."

Cascades Fine papers, Inc. Thunder Bay ONT

"At Cascades, we have introduced procedures that have reduced the use of mercury-containing feedstocks. We are confident that we can eventually phase out our use of mercury-containing equipment," Nicholas Lewis, Environmental Coordinator.

Northshore Mining, Silver Bay MN

Nancy Smith, Senior Environmental Engineer at Northshore Mining described the company's Minnesota Voluntary Mercury Reduction project. Since 1992 Northshore has shipped for recycling over 405 kg (900 pounds) of elemental mercury used to run instruments such as manometers and 2,000 to 3,000 fluorescent and mercury vapor lamps.

In 1994 the company switched from a lab method using mercuric oxide to assay iron content in ore and pellets. This saved six to nine kg (15 – 20 pounds) of mercury compound wastes per year. Northshore also launched several community-wide mercury collection programs in Silver Bay, Beaver Bay, and the surrounding communities.

Sappi Fine Paper, Cloquet MN

In 1994, the former Potlatch paper mill (now owned by Sappi Fine Paper) in Cloquet, Minnesota and the Western Lake Superior Sanitary District teamed up with chemical engineering students from the University of Minnesota–Duluth to track down the source of mercury in its wastewater. They discovered that sulfuric acid delivered to the mill from a lead smelter had mercury levels as high as 10,000 ppb. Switching to an alternative source reduced the mill's wastewater mercury concentration by 98%.

The mill developed a certificate of analysis requirement for chemical suppliers to assure that future purchases of all feedstock chemicals would have low mercury content. In the last decade, Sappi has recycled more than 400 kg of mercury from instruments and devices in the plant and replaced many with mercury-free alternatives. Kevin Kangas, Environmental Manager for Sappi Fine Paper is a member of the Lake Superior Binational Forum.

Bad River Clinic Bad River Band of Lake Superior Chippewa Ashland, WI

"Bad River Clinic strives to be mercury free. 94 % of elemental mercury has been eliminated from the clinic. All mercury thermometers have been disposed of and the clinic is in the process of changing from mercury sphygmomanometers to digital ones. Bad River should be 100% mercury free by the year 2010." reported Dennis J. Sullivan, M.D., Bad River Health Director.

Ontario Power Generation, Thunder Bay ONT

Jane Todd, Program Manager Northwest, reported that the Thunder Bay Generating Station has removed about 100 kg of mercury. "In January 2005 we shipped out the last of the "removable" mercury on site: 27 kg [59 pounds] of liquid mercury, mercury relays and mercury switches. All our spent fluorescent lamps are collected and shipped to a recycler."

Minnesota Power, Duluth MN

Since 1990, Minnesota Power has removed at least 306 kg (681 pounds) of bulk mercury and 1,470 kg (3,265 pounds) of mercury bearing materials (e.g., thermometers, switches, batteries, chemicals, wetted contacts, floats, and other devices).

The company also recycles over 10,000 fluorescent lamps per year. Minnesota Power is testing mercury control technologies for their coal fired power plants and operates an energy efficient model home. Keith Hanson, Environmental Compliance Specialist for Minnesota Power, is also a member of the Lake Superior Binational Forum.

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MERCURY MANAGEMENT AT YOUR FACILITY

The following is based on a brochure, *Conducting an Internal Mercury Audit for Manufacturing Facilities,* prepared by the Solid and Hazardous Waste Education Center at Stevens Point, WI.
Environment Canada has a manual on mercury containing product stewardship for federal facilities, which contains information on facility audits, it is available at: **www.ec.gc.ca/MERCURY/ffmis-simif.**

Why conduct a mercury inventory?

- Comply with environmental regulations
- Identify opportunities for pollution prevention
- Prevent the release of mercury into the environment

How to best conduct an inventory?

- Obtain management approval
- Communicate goals to employees
- Set up teams to collect, interpret and communicate findings
- Conduct the inventory

What are the steps of an inventory?

- Understand the processes in the plant
- Inventory possible sources of mercury
- Identify discharges/emissions that could contain mercury

What are potential sources of mercury?

- Laboratory
- Electrical equipment
- Pressure gauges / Manometers
- Contaminant in feedstock
- By-products
- Elemental mercury
- Batteries
- Raw product
- Low points in sewer systems where mercury from historical spills may collect

What are methods of best managing and preventing mercury waste?

- Prevent spills and breakage
- Modify processes and close loops to prevent releases to the wastestream
- Investigate mercury-free alternatives and fuel sources
- Recycle fluorescent bulbs
- Manage removable sources, i.e. switches and instruments

What are the goals of a mercury inventory?

- Define sources, quantities and types of mercury in the facility
- Collect information on processes, products and waste generation
- Encourage development of effective release minimization and waste management
- Share reduction efforts with all employees to highlight proper management
- Prevent mercury spills and the related high cleanup costs
- Protect the environment

Regulatory Implications of Mercury at Your Facility

Establishing a mercury management plan that reflects relevant regulations can help assure that a business stay in compliance with regulations governing disposal of mercury-containing waste. By avoiding the purchase of new mercury-containing equipment, a company can reduce its future hazardous waste management burden.

In Canada all certified waste haulers and disposal facilities must abide by provincial and federal regulations. The hauler should be instructed to recycle the mercury that they collect rather than dispose of it in a landfill. In the United States, mercury-containing products may be classified as hazardous waste and regulated by federal and state government when they are disposed. Paperwork requirements may be reduced for certain items such as batteries, fluorescent bulbs, thermostats, and other mercury-containing equipment, when managed for recycling or proper disposal .

THE SHIPPING INDUSTRY and MERCURY

Shipping is a major industry on the Great Lakes. In addition to the usual measurement and control devices, ships and loading facilities may have mercury devices such as ballast gauges, belt scales, counterweights, and many switches. Each ship may have several pounds of mercury in the gauges that are used to control ballast and several pounds of elemental mercury to replenish these gauges. It is important to keep this mercury out of the environment as well as to purchase non-mercury alternatives.

Ballast gauges may contain two pounds or more of mercury each.

Today's Great Lakes fleet is aging: its youngest ships are over 25 years old. In May 2005, a preliminary survey of the *SS Irving*, a decommissioned ore boat built in 1938, found 19 manometers and several mercury thermometers, totaling an estimated 38 pounds of mercury.

Winter layover is the best time for an inventory and possible retrofitting on Great Lakes boats. In 2001, 16 vessels overwintered in Duluth-Superior and 10 in Thunder Bay. This project has the potential to collect hundreds of pounds of mercury. Removing this toxin will make these vessels a safer place to work and assure that this mercury will not end up in the Great Lakes

Shipping is a mainstay in the Lake Superior region. The Twin Ports of Duluth, Minnesota and Superior, Wisconsin, together with Thunder Bay, Ontario, ship over 49 million metric tons annually.

The Twin Ports host 1,100 calls annually from lakers and oceangoing salties. Principle cargos are ore (40%), coal (40%) and grain (10%). Fifteen cargo dock facilities handle coal, taconite/iron ore, grain, cement, lumber and other bulk cargo.

Thunder Bay is the largest Canadian outbound port in the St. Lawrence Seaway System, and handles over 400 vessels annually. Principal cargos are grain (70%) and coal (15%).

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LAKE SUPERIOR COMMUNITIES and MERCURY

Several rural communities in the Lake Superior basin have not had access to household hazardous waste collections. A surprisingly large number of citizens have substantial quantities of elemental mercury stored in their homes. Recent collections in communities in Michigan and Ontario netted over 100 pounds of elemental mercury.

Western Lake Superior Sanitary District (WLSSD), Duluth MN

The WLSSD developed the "Blueprint for Mercury Elimination" guide for wastewater treatment plants based on its proactive approach to preventing mercury from reaching the sewer. This pioneering work has received national recognition. WLSSD replaced mercury-bearing equipment, worked with dentists to properly dispose of waste amalgam, and set up the Clean Shop program, which took in 410 kg (910 pounds) of mercury between 2000 and 2003. Mercury in WLSSD effluent dropped from 0.58 ppb in 1990 to 0.015 ppb in 1996. Tim Tuominen, Sr Chemist

City of Superior, WI

Jane Edwards, pollution prevention specialist, reports that over 400 pounds of elemental mercury, over 10,000 fluorescent bulbs, and thousands of mercury devices have been collected and recycled. Thousands of mercury thermometers have been exchanged for digital thermometers.

The City of Superior received the National Pollution Prevention Roundtable's Most Valuable P2 Award for its outstanding Educational Outreach Programs. Wisconsin State Senator Russ Feingold met with Diane Thompson (Pretreatment/Safety Coordinator, Superior WWTP) in Washington D.C. shortly before the presentation during Pollution Prevention Week in September 2004.

City of Thunder Bay, ONT

"The City of Thunder Bay is striving to eliminate the use of mercury in its operations," states Ross Churchman, Chief Chemist, Environment Division. "We have removed 126 mercury switches. We also encourage the public to drop off mercury-containing consumer products at the special waste depot."

EcoSuperior, Thunder Bay ONT

""The number of mercury-switch thermostats collected at the depots we've set up with the co-operation of local heating equipment wholesale outlets and Honeywell Inc. is absolutely amazing," comments Jim Bailey of EcoSuperior. "We've now collected several kilograms through this program."

City of Ashland, WI

In 2002, the City of Ashland followed the City of Duluth, MN in banning the sale of all mercury fever thermometers. Ashland went one step further, banning the sale of any device that had over 50 milligrams of mercury and putting in place a requirement to remove all mercury devices from any building prior to demolition.

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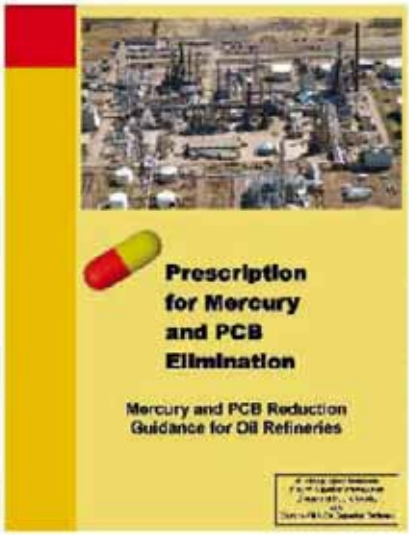
THE MURPHY OIL REFINERY CASE STUDY

MURPHY OIL USA, INC.
SUPERIOR REFINERY

In 2001, Murphy Oil USA and the city of Superior, Wisconsin, entered into a partnership to develop a pollution prevention guidebook for refineries and other industries interested in reducing the use of mercury and PCBs. Listed below are the steps taken to ensure a complete inventory.

STEPS TAKEN TO INVENTORY AND REDUCE MERCURY AT MURPHY OIL

1) Researched general information about mercury and oil refineries.
2) Learned about everyday procedures and mercury management practices at Murphy.
3) Conducted an inventory of all products and processes that contained or used mercury within the plant.
   a) Searched various resources and locations in the refinery with the help of Murphy Oil staff.
   b) Identified chemicals in use at the refinery that contained mercury. In some cases the supplier of the chemical had to be contacted to request a Certificate of Analysis detailing the concentration of mercury in their product.
   c) Identified mercury-containing devices or processes; logged them onto a data sheet.
4) Labeled mercury-containing equipment that remain in use. Labels notify employees to properly recycle end-of-life equipment.
5) Brought elemental mercury found on site to a recycling facility in Spooner, WI.
6) Identified cost-effective alternatives to many of the mercury-containing products and processes at the refinery.
7) Developed a mercury management policy and a mercury-free purchasing policy.
8) Developed a standardized mercury spill policy as part of the safety procedures at the plant.



Non-mercury switch (left) used to replace a mercury switch at Murphy Oil Refinery.

The final report, "Prescription for Mercury and PCB Elimination", was completed and printed in 2005. This project was funded by the U.S. EPA. To receive a copy of the "Prescription for Mercury" brochure, contact the City of Superior or visit their website at: http://www.ci.superior.wi.us/

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Contacts for Information and Technical Assistance

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Lake Superior Binational Program and Forum web sites

Lake Superior Binational Program

www.epa.gov/glnpo/lakesuperior/index.html

www.on.ec.gc.ca/greatlakes/

www.binational.net

Lake Superior Binational Forum

www.superiorforum.info/

Fish Consumption Advice

Ontario: www.ene.gov.on.ca/envision/guide/index.htm

Michigan: http://www.michigan.gov/documents/FishAdvisory03_67354_7.pdf

Wisconsin: http://dnr.wi.gov/org/water/fhp/fish/pages/consumption/index.shtml

Minnesota: http://www.health.state.mn.us/divs/eh/fish/index.html

Great Lakes Indian Fish and Wildlife Commission: http://www.glifwc.org

This document was developed through a grant under the Wisconsin DNR Great Lakes Protection Fund to the City of Superior with assistance by the Lake Superior Binational Program work group and the Lake Superior Binational Forum. Printing provided by the U.S. Environmental Protection Agency.

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