



1.0 MERCURY

Canadian Workgroup co-chair: Robert Krauel, Edwina Lopes (acting co-chair during 2006)
U.S. Workgroup co-chair: Alexis Cain

Progress Toward Challenge Goals

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.

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.

Both Canada and the U.S. have achieved reductions of mercury from sources resulting from human activity, and continue to pursue their challenge goals outlined in the Strategy. A description of the progress made by each country is provided below. The GLBTS Mercury Workgroup is active. Numerous mercury reduction activities are occurring in Canada to meet the goal of reducing releases of mercury in the Great Lakes Basin, and in the U.S. to meet the goal of reducing the deliberate use of mercury and releases of mercury nationwide.

Ontario: Progress Toward the GLBTS Challenge

In Ontario, releases of mercury have been reduced by approximately 85 percent between the 1988 baseline and 2003. Figure 1-1 illustrates the progress made toward the Canadian 90 percent reduction target.² This figure shows that releases in Ontario have been cut by more than 11,900 kg since 1988, based on Environment Canada's 2003 mercury inventory. Note that some sources listed in the legend of Figure 1-1 (e.g., paint, pesticides, pulp and paper) refer to the baseline year of emissions and are no longer current sources. Figure 1-2 illustrates the 2003 sources of mercury releases in Ontario. This figure shows that

the primary sources of releases are electric power generation, iron and steel, municipal (primarily land application of biosolids), cement and lime, and incineration.

United States: Progress Toward the GLBTS Challenge

Because of the potential for mercury releases to air to be transported to the Great Lakes, the Mercury Workgroup has focused on nationwide atmospheric mercury emissions in the U.S. The U.S. release challenge applies to the aggregate of air releases nationwide and of releases to water within the Great Lakes Basin.³

According to the most recent estimates from the National Emissions Inventory (NEI), U.S. mercury emissions decreased approximately 47 percent between 1990 and 2002 (see Figure 1-3).⁴ However, actual emissions reduction has likely been larger than this estimate would indicate, because two of the biggest 2002 emissions source categories—electric arc furnaces and gold mining—are not included in the 1990 inventory. US EPA's Roadmap for Mercury (July 2006) includes preliminary 1990 emissions estimates for these categories. If these preliminary estimates are added to the 1990 baseline, mercury emissions declined from 219.9 tons in 1990 to 111.4 tons in 2002, a reduction of 49 percent. It is very likely that actions taken since 2002 have resulted in a total reduction of more than 50 percent since 1990; in particular, emissions from chlor-alkali plants have been reduced as a result of plant closures and implementation of Maximum Available Control Technology (MACT) standards since 2002, and emissions from gold mines have been reduced by additional control technology installations under a voluntary partnership among Nevada's major gold mining companies, the Nevada Department of Environmental Protection, and US EPA.

² 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.

³ 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.

⁴ Note that there is uncertainty associated with all emissions inventories. For more discussion, see Murray and Holmes (2004).

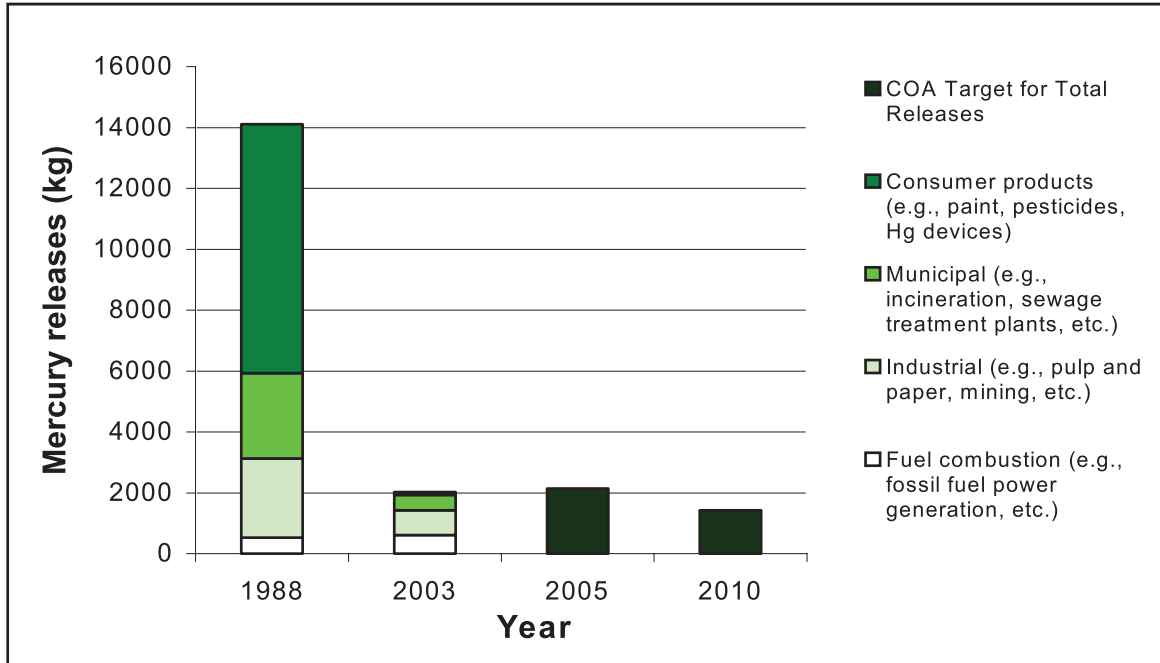


Figure 1-1. Mercury Releases (to air and water) in Ontario from 1988 to 2003, by Sector.
Source: Environment Canada, Ontario Region (2005)

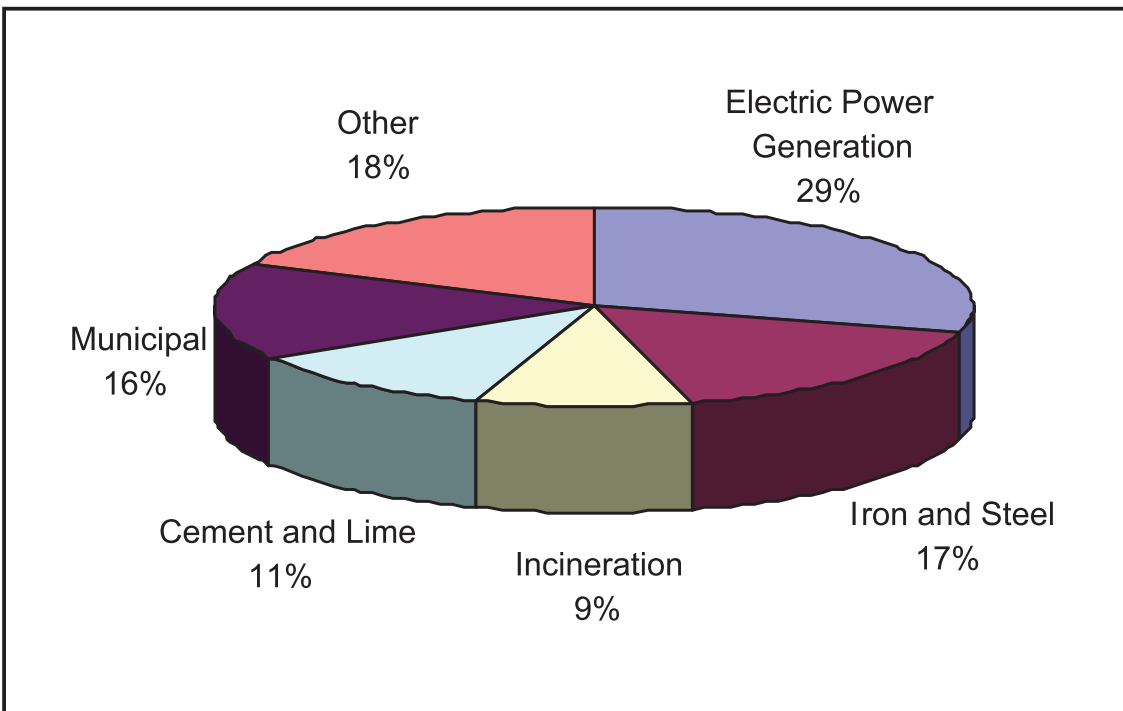


Figure 1-2. Sources of Mercury Releases in Ontario (2003).
Source: Environment Canada, Ontario Region (2005)



Although it is clear that mercury use has decreased since 1995, the trend is difficult to quantify because the U.S. Geological Survey (USGS) stopped reporting estimated U.S. mercury consumption after 1997. However, on the basis of data reported by the chlor-alkali, lamp, and dental industries, it appears that total mercury use declined more than 50 percent between 1995 and 2003, assuming that mercury use by other sectors has remained constant since 1997 (see Figure 1-4). The chlor-alkali industry accounted for an estimated 35 percent of mercury use in 1995, and its total mercury use decreased 76 percent between 1995 and 2003 (including the impact of plant closures), and a total of 92 percent between 1995 and 2004. The fluorescent lamp industry has reported that mercury use in 2003 was six tons, compared with 32 tons estimated by the USGS for 1997 (see Table 1-1). These reductions are the result of reductions in the mercury content of lamps sold in the U.S., as well as an increase in lamp imports and a decline in U.S. fluorescent lamp production. Lamp manufacturers use mercury both in lamps themselves and in the production process.

It is likely that mercury use has declined even more than portrayed in Figure 1-4, because mercury use in other categories also has decreased. For instance, evidence suggests that use of mercury in measurement and control devices and switches and relays has decreased.⁵ These reductions cannot be quantified and are not visible in Figure 1-4.

Workgroup Activities

Workgroup Meetings

On December 6, 2005, the Mercury Workgroup meeting focused on improving characterization of mercury sources and on international activities to reduce mercury emissions. Presentations on source characterization included information on mercury emissions in China, global emissions from primary metals production, U.S. emissions from crematoria and from the use of mercury-containing products, and the development of a mercury emissions inventory for Michigan. In addition, the group discussed the development of global partnerships for mercury reduction in the chlor-alkali, artisanal mining, coal combustion, and mercury product sectors. The

Table 1-1. U.S. Mercury Use (tons)

Industry/Product Category	1995*	1997*	2003*
Chlor-alkali Production**	160	116	38
Wiring Devices and Switches	92	63	63
Measurement and Control Devices	47	26	26
Dental***	35	44	35
Lighting****	33	32	6
Other	102	40	40
Total	469	321	208

*Source for 1995 and 1997 (except chlor-alkali data): U.S. Geological Survey, Minerals Yearbook, 1995 and 1997 – converted to short tons. For 2003, assume that use has not changed, except in chlor-alkali, lighting, and dental categories.

**Chlorine Institute, Seventh Annual Report to EPA, July 22, 2004. Mercury “used” rather than mercury “purchased.” Under this definition of “use,” mercury purchased and placed in inventory or added to cells to increase working stock of mercury does not count as “use,” although mercury added to maintain previous levels of mercury in cells does count as “use.” The chlor-alkali industry has achieved additional reductions in mercury use beyond 2003, as discussed below.

*** Vandeven J, McGinnis SL. An Assessment of Mercury in the Form of Amalgam in Dental Wastewater in the United States. *Water, Air and Soil Pollution* 2005; 164:349-366.

**** Source of 2003 estimate: E-mail from Ric Erdheim, National Electrical Manufacturers Association, May 27, 2004.

⁵ For instance, in the period since 1997, mercury switches have been phased out of automobiles and many appliances, and the widespread use of mercury-containing fever thermometers has ended.

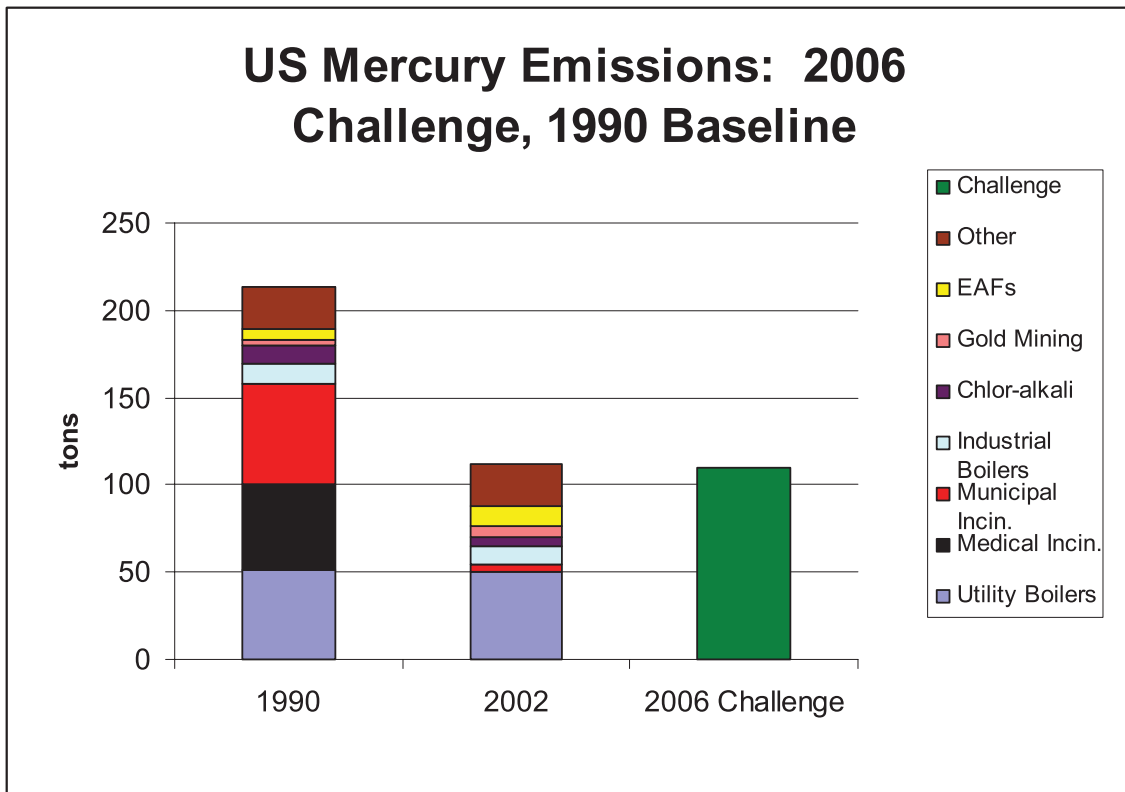


Figure 1-3. U.S. Mercury Emissions: 2006 Challenge, 2002 Estimates, and 1990 Baseline. Source: US EPA, Office of Air Quality Planning and Standards, 2002 National Emissions Inventory, EPA's Roadmap for Mercury, July 2006

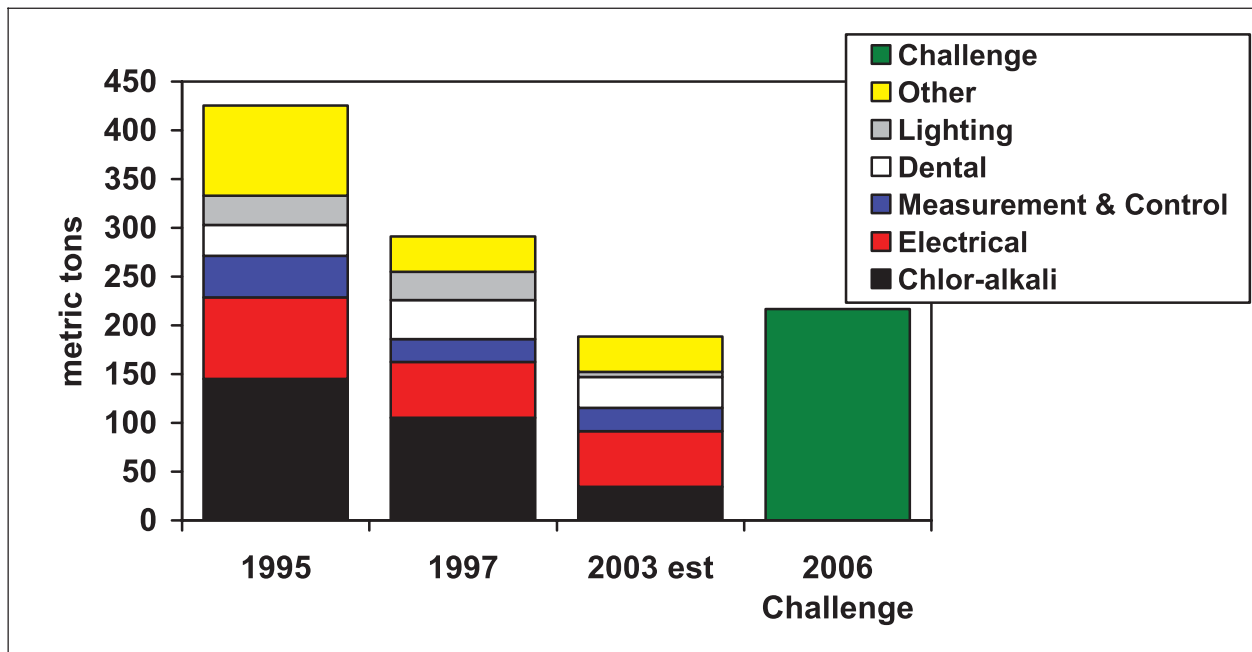


Figure 1-4. U.S. Mercury Use: 2006 Challenge, 2003 and 1997 Estimates, 1995 Baseline. Source: USGS, Minerals Yearbook, 1995, 1997; Chlorine Institute Annual Report to EPA, 2004; National Electrical Manufacturer's Association, direct communication, 2004



workgroup also learned about reduction efforts by the electrical products industry, a demonstration of mercury controls at a WE Energies' power plant, and a compendium of state mercury reduction activities.

At the May 17, 2006, meeting, the Mercury Workgroup continued its focus on international activities with presentations on Canada's and the Commission for Environmental Cooperation's international mercury reduction activities. In addition, there were presentations on the chlor-alkali industry's mercury reduction accomplishments, and on emissions controls for the Canadian cement and base metal smelting sectors. The workgroup also discussed mechanisms for improved recovery of mercury-containing lamps, auto switches, dental amalgam waste, and mercury-containing devices in use by industry within the Lake Superior Basin. Other presentations focused on research conducted by Canada's Collaborative Mercury Research Network, and on trends in atmospheric mercury concentrations according to the Canadian Atmospheric Mercury Measurement Network.

Management Assessment for Mercury Completed

The workgroup co-chairs completed a Management Assessment for Mercury that incorporated comments from workgroup members. The Management Assessment for Mercury concludes that mercury should remain in Level 1 status with periodic reassessment by the GLBTS. It also finds that the Mercury Workgroup should: 1) disseminate information about removal of mercury devices in auto scrap, appliances, and industrial equipment, and on assisting state, provincial, and local governments identify cost-effective reduction approaches for mercury releases from dental offices, and 2) participate in national and international mercury reduction programs.

U.S. Reduction Activities

National Vehicle Mercury Switch Recovery Program

This program was established by an August 2006 agreement among vehicle manufacturers, steelmakers, vehicle dismantlers, automobile shredders, brokers, the environmental community, state representatives, and US EPA. Under this program, vehicle manufacturers must provide automobile dismantlers with information and supplies for mercury switch removal, collect and transport switches to retorters for proper recycling or disposal, assume liability for the switches once collected, and establish a database to track switch

recovery by program participants. Dismantlers will recover mercury switches and submit them to the program. Steelmakers will encourage their suppliers to participate in the program, and will match a \$2 million donation from vehicle manufacturers, establishing a three-year, \$4 million implementation fund that will be used to provide incentives for switch removal to auto dismantlers.

Chlorine Industry Implements Voluntary Mercury Reductions

The Chlorine Institute released its Ninth Annual Report to EPA, showing a 91 percent capacity-adjusted reduction in mercury consumption by the U.S. chlor-alkali industry between 1995 and 2005. This accomplishment exceeds the sector's commitment to reduce mercury use by 50 percent by 2005. Including shutdowns of mercury cell factories, mercury use has decreased by 94 percent. The report also describes specific industry actions taken to minimize mercury releases, for instance through the use of more durable equipment that minimizes intrusive maintenance activities that cause mercury emissions and through equipment that is more successful in keeping mercury contained within the process. It also describes actions taken to meet the industry's 2004 commitments to enhance cell room mercury monitoring and to fully account for their mercury inventory. The industry could not account for 30 tons of mercury in 2003 and seven tons in 2004; this amount was reduced to three tons in 2005.

Honeywell Ceases Manufacture of Mercury Switches for Thermostats

Honeywell, the leading manufacturer of mercury thermostats, committed to US EPA's National Partnership for Environmental Priorities to end production of mercury switches for thermostats in July 2006. Honeywell had previously used more than 12 tons of mercury per year in thermostats. Manufacture of mercury-containing Honeywell thermostats will cease after Honeywell's existing stockpile of switches has been used.

Manufacturers Improve Success of Thermostat Recycling

In 2005-2006, thermostat manufacturers increased collections through the Thermostat Recycling Corporation (TRC), which seeks to limit disposal of mercury-containing thermostats in solid waste landfills. The TRC enables wholesalers and contractors across the country to collect and ship mercury thermostats without charge to an industry facility for disassembly and recycling. In 2005, the



TRC recovered nearly 88,000 thermostats and thereby removed 820 pounds of mercury from the solid waste stream. If 2006 collections continue at the same pace reported for the first half of the year, TRC will be on track for a 37 percent increase in thermostat collections and a 40 percent increase in recovered mercury, relative to 2005. The number of mercury thermostats coming out of service has been estimated at more than two million annually.⁶ Mercury thermostats that are not managed by the TRC or by household hazardous waste programs are either discarded in the trash or as part of construction and demolition waste.

US EPA Reaffirms Clean Air Mercury Rule

In response to petitions filed by States, Tribes, industry, and environmental groups, US EPA agreed to reconsider its regulatory determination that it was not necessary or appropriate to regulate mercury emissions from electric utility steam generating units under section 112 of the Clean Air Act, and to reconsider its decision to regulate these emissions under section 111(d) instead. This reconsideration re-affirmed these decisions, and the deadline for submission of state plans controlling mercury emissions from electric utilities was November 17, 2006.

Hospitals for a Healthy Environment Program Enlists New Partners

The Hospitals for a Healthy Environment (H2E) program, a joint project of the American Hospital Association, Health Care Without Harm, the American Nurses Association, and US EPA, is a voluntary program with 1,249 partners representing 6,064 facilities: 1,443 hospitals, 3,138 clinics, 665 nursing homes, and 818 other types of facilities. These partners are health care facilities that have pledged to eliminate mercury and reduce waste, consistent with the overall goals of H2E. This program is continuing to grow and has enlisted 171 new partners in the last year.

City of Superior Cooperates with Lake Superior Shipping Industry to Raise Awareness and Reduce the Use of Mercury

In 2006, the City of Superior, Wisconsin, began working with business owners and managers to reduce mercury use within the Lake Superior shipping industry. Examples of mercury use in the shipping industry include mercury-filled manometers

to monitor ballast levels, and mercury-containing conveyor belt scales in on-shore loading facilities. With financial support from the US EPA Great Lakes National Program Office and programmatic help from the Lake Superior Binational Forum, the City offers assistance with conducting mercury inventories, developing mercury reduction plans, establishing mercury management policies and procedures and collecting, recycling, and disposing of elemental mercury and mercury-containing equipment. To date, 105 leaders representing 52 companies have been offered assistance. Three have requested additional information and/or assistance. In addition, five general information and business-specific guidance documents have been produced. As the project grows, the City and the Forum will continue to collaborate on outreach activities aimed at spreading awareness of industrial mercury use and increasing the number of inventoried facilities.

Bowling Green State University Elemental Mercury Collection and Reclamation Program

Bowling Green State University's (BGSU, located in northwestern Ohio) Elemental Mercury Collection and Reclamation Program formally began in January 1998. The program involves the collection and recycling of uncontaminated elemental mercury that is present in a variety of devices. These sources include thermometers, manometers, barometers, sphygmomanometers (blood pressure measurement devices), mercury-containing heating thermostats, and mercury switches, as well as individual containers of elemental mercury. The program is available and free to individuals, academic institutions, small businesses, industries, medical and dental facilities, emergency response and other governmental agencies, spill response companies, and any additional entity having unwanted, uncontaminated elemental mercury.

Collaborative partners in the program include Bowling Green State University, Ohio EPA (Division of Emergency and Remedial Response), Rader Environmental Services, Toledo Environmental Services, and ESCO (Elemental Services and Consulting). The Wood County Emergency Management Agency and the Wood County Health Department have also assisted in this effort.

Since the program began, mercury has been removed from numerous sources throughout Ohio as well as

⁶ Product Stewardship Institute. Thermostat Stewardship Initiative: Final Background Research Summary. October 18, 2004.



from locations in Michigan, Indiana, Pennsylvania, West Virginia, Kentucky, Tennessee, Illinois, Wisconsin, Nebraska, Texas, and Georgia. Thus far, over 14,600 pounds of elemental mercury have been collected and recycled.

A more detailed explanation of BGSU's collection and reclamation program as well as a sample of a mercury vapor video filmed at BGSU can be found at the following web site: <http://www.bgsu.edu/offices/envhs/page18364.html>.

Development of Standards for Storing and Shipping Amalgam Waste

The American Dental Association Standards Committee on Dental Products developed American National Standards Institute/American Dental Association (ANSI/ADA) Specification No. 109, Procedures for Storing Dental Amalgam Waste and Requirements for Amalgam Waste Storage/Shipment Containers. The specification describes procedures for storing and preparing amalgam waste for delivery to recyclers or their agents for recycling. In addition, it gives requirements for containers for storing and/or shipping amalgam waste. The specification, approved by ANSI in October 2006, was developed by a working group consisting of users, general interest participants, and industry, with representation from US EPA, dental societies, dentists, parcel shipping companies, and amalgam waste recyclers. One purpose behind the ADA's efforts on this standard was to encourage amalgam recycling by making amalgam recycling easier and more effective for the dental office.

Development of a Mercury Product Stewardship Strategy

The Great Lakes Regional Collaboration Strategy, released on December 12, 2005, by a host of collaborators calls for: "By 2015, full phase-outs of intentionally added mercury bearing products, as possible." The strategy also states that "a basin-wide mercury product stewardship strategy should be developed to complete phase-outs of mercury uses, including a mercury waste management component, as practicable." The Council of Great Lakes Governors and the Great Lakes and St. Lawrence Cities Initiative endorsed this effort in a December 12, 2005, letter to President Bush.

In response to these recommendations, a Great Lakes Regional Collaboration Mercury Phase-Down Strategy workgroup was created in May 2006 to draft a basin-wide phase-down strategy for mercury in

products and waste. The workgroup is facilitated by the Illinois Waste Management & Research Center, with a grant from the Great Lakes National Program Office. Representatives from each Great Lakes State and from Tribes are participating in the workgroup, as are representatives from US EPA. The workgroup is meeting regularly through conference calls to draft a phase-down strategy that will identify priority mercury-containing products and sectors that use mercury-containing products. Moreover, the strategy will recommend appropriate actions for each of the priority products and sectors. A draft strategy should be completed by the end of 2006.

Canadian Reduction Activities

Canada-wide Standard for Mercury Emissions from Coal-Fired Electric Power Generation Plants and Other Initiatives

On October 11, 2006, the Canadian Council of Ministers of the Environment endorsed a Canada-wide Standard (CWS) for Mercury Emissions from Coal-Fired Electric Power Generation Plants. Under the CWS, Canadian provincial and territorial jurisdictions have committed to reduce mercury emissions from coal-fired power plants by at least 60 percent by 2010 (from a 2003/2004 baseline). Ontario has been working on several other mercury reduction initiatives, including the development of CWSs for incinerators, base metal smelters, fluorescent lamps, and waste dental amalgam. Ontario continues to support several other initiatives for the diversion of mercury-containing wastes from landfills. These initiatives include collecting mercury-containing switch pellets from vehicles before they enter the waste stream. The Recycling Council of Ontario is about to launch a fluorescent lamps recycling project by the end of 2006, which aims to collect over 48,000 lamps from Toronto schools, equivalent to 0.56 kg of mercury.

Detroit River Canadian Cleanup Household Mercury Collection

A household mercury collection program was held in 2004 for residents of Windsor and Essex County, Ontario. The Detroit River Canadian Cleanup (DRCC) partnered with the City of Windsor, Town of LaSalle, EC, Ontario Ministry of the Environment (MOE), and the Essex-Windsor Solid Waste Authority to collect household mercury from residents in April 2004, during spring cleanup. The project was a resounding success, with about 200 pounds, or 90 kilograms, of mercury collected. This included about



750 thermometers, 1000 household fluorescent light bulbs, 100 thermostats, and 20 jars of mercury. As a result of the project, more members of the public are now aware that a Household Chemical Waste Depot collects household mercury along with other household hazardous waste. The scope of the project has been expanded to educate business owners about the steps they can take to ensure that they are not potential contributors of mercury to the Detroit River.

Municipal Actions to Reduce Mercury

A Municipal Waste Integration Network Conference was held in the Town of Blue Mountains, Ontario, on June 21, 2006. Approximately 50 participants received information on how municipalities can reduce mercury to the environment. The conference primarily focused on extended producer responsibility (EPR) programs and opportunities for adjacent municipalities to work together for cost efficiency in operating blue box programs⁷ and other recycling strategies for non blue box recyclables. A Municipal Actions to Reduce Mercury booklet was given to each participant at the conference as part of workshop materials.

Mercury Clean Sweep Pilot Program for Schools in Ontario

EC, in collaboration with the MOE, launched the Mercury Clean Sweep Pilot Program for Schools in Ontario (February 20, 2006, to March 31, 2006). Over 40 secondary schools voluntarily enlisted in the program and were given the opportunity to safely dispose of mercury-containing items. A total of 9.32 kg of mercury waste was collected, which included over 1,150 mercury lab thermometers. Schools that turned in mercury lab thermometers received alcohol-filled thermometers to replace each one collected through the program.

EcoSuperior Initiatives in Thunder Bay and Surrounding Areas

The MOE is working with EcoSuperior to support educational and communication efforts to reduce mercury levels in secondary schools. The initiative includes reducing the use of mercury-containing products, using safe and proper collection and recycling methods, and encouraging the use of alternatives to mercury products (e.g., digital thermometers and thermostats). In addition, Ontario

Power Generation Thunder Bay Generating Station will be involved in sponsoring the EcoSuperior program to identify mercury in schools in 2006/2007.

EcoSuperior, with support from MOE, produced a best management practices guide for mercury which was distributed to Canadian Lake Superior Basin dentists. This work built upon the Dental Wastes Best Management Practices Guide for the Dental Community, which provides a guide for the disposal of dental amalgam and mercury wastes, that was developed by EC, MOE, and stakeholders, including dental associations, universities and colleges, and the City of Toronto.

With funding from EC's Great Lakes Sustainability Fund and MOE, EcoSuperior leads a Thermostat Recycling Project and a Fluorescent Light Recycling Program to collect conventional fluorescent lamps from 14 industries, institutions, and municipalities located in Thunder Bay, Red Rock, Terrace Bay, and Marathon.

"Switch Out" Program – A Canadian Success Story

The Clean Air Foundation's "Switch Out" program was launched in 2001 to recover mercury switches from end-of-life vehicles before they enter the waste stream. Though the use of mercury switches for convenience lighting has been phased out, a large number of switches remain in vehicles not yet retired. The Switch Out program works with automotive recyclers across Canada to educate them on the use of mercury switches in vehicles and to instruct them on how to extract the switches. An important component of the program is a free collection and disposal infrastructure for participating automotive recyclers. To date, voluntary actions by participating auto recyclers has resulted in the collection of approximately 130,000 switches (equivalent to approximately 109 kilograms of mercury).

Environment Canada Mercury Take Back Events

EC organized two in-house Mercury Take Back Events in Downsview, Ontario, on April 20-21 as a kick-off to Earth Day, and in Burlington on June 9-10, 2005, as a wrap up to Earth Week.⁸ The events were intended to provide all EC employees with a convenient site to drop off mercury-containing household items, such as fever thermometers, thermostats, and button batteries for safe disposal. Information on mercury

⁷ Municipalities in Ontario are encouraged to establish "blue box programs" to achieve a 60 percent waste diversion rate from landfills (see www.ene.gov.gov.ca). Blue box waste refers to glass, metal, paper, plastic, textiles, or any combination of them, which can be recycled curbside in plastic blue boxes.

⁸ Events that occurred in 2005 are reported because collection totals did not become available until 2006.



was provided to employees. In addition, a brief survey was conducted to gauge staff knowledge on mercury. Both events proved to be great successes. In Downsview, 120 mercury-containing items (over 970 grams of mercury) were collected. Well over 100 employees visited the booth. At the Burlington event, 200 mercury-containing items (over 530 grams of mercury) were collected, and over 50 employees visited the booth.

Next Steps

The Mercury Workgroup will consider, and potentially help implement, the recommendations of the forthcoming Great Lakes mercury product stewardship strategy. In addition, the workgroup will continue to share information about cost-effective opportunities for mercury reduction, including opportunities at the international level.

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Isle Royale National Park, Michigan
Photograph by Patrick T. Collins
Minnesota Department of Natural Resources