Great Lakes Mercury in Products Phase-Down Strategy Progress Report

July 31, 2013




by

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PREFACE

The Great Lakes Mercury in Products Phase-Down Strategy was finalized in June 2008. The Phase-Down Strategy was developed in response to the Great Lakes Regional Collaboration (GLRC) Strategy to Restore and Protect the Great Lakes. The Phase-Down Strategy outlined 60 recommendations (56 recommendations plus 1 recommendation that was subdivided into 4 parts) for reducing mercury in five selected products, five selected sectors, and across the sectors and products. One of these recommendations a) directed the Great Lakes states, tribes, and cities to form a workgroup that would meet periodically to evaluate and discuss progress being made in mercury reductions and b) directed the workgroup to prepare and submit a progress report to the Council of Great Lakes Governors every two years, through 2015. In accordance with the Phase-Down Strategy, the Great Lakes Mercury in Products Phase-Down Implementation Workgroup was formed and has met quarterly since September 2010. Representatives from Great Lakes states, tribes, and cities, as well as Environment Canada and Ontario Ministry of the Environment, were invited to participate in the implementation workgroup. Canada and Ontario were not part of the GLRC or the team that developed the Phase-Down Strategy, and they are not obligated to implement the Phase-Down Strategy's recommendations. However, Environment Canada and the Ontario Ministry of the Environment have participated in the workgroup in order to encourage cross-border coordination and sharing of lessons learned and best practices across the Great Lakes region.

This report serves as the first report of progress in implementing the Phase-Down Strategy. The report was prepared with information provided by the U.S. Great Lakes states, Ontario, and Environment Canada, in coordination with the U.S. Environmental Protection Agency (USEPA) Region 5. Ontario's progress is reported for information purposes but is not included in the aggregate compilation of progress achieved by the eight Great Lakes states.

EXECUTIVE SUMMARY

Progress to Date

The Great Lakes Mercury in Products Phase-Down Strategy, finalized in June 2008, contains eleven categories of recommendations for reducing mercury in products (Great Lakes Regional Collaboration, 2008). Overall, much progress has been made in implementing the recommendations by the eight U.S. Great Lakes states. Table 1 summarizes the number of recommendations currently completed or ongoing by the Great Lakes states.

Overall, the Great Lakes states have been most successful in implementing the recommendations related to thermometers (79%), followed by households (71%) and schools (70%). The Great Lakes states have completed 69% of the recommendations for steel manufacturing, scrap metal melting facilities, and scrap yards; 68% of the recommendations related to thermostats; and 66% of the recommendations related to lamps. Collectively, the Great Lakes states have implemented 58% of the recommendations for heavy industry; 53% of the recommendations related to cross-cutting strategies; 50% of the recommendations for switches, relays, and measurement and control devices; and 42% of the recommendations for dental amalgam. The states have had limited success in implementing the three recommendations for health care, however, with only 25% of the recommendations completed for this sector.

Future Priorities

Priorities for future action in the Great Lakes states were determined using two separate methods. First, the Great Lakes states determined priorities by voting on the state's high, medium, and low priorities for future action, taking into account progress already made. Using this method, with six states submitting ballots, the top three product categories are: thermostats; lamps; and steel manufacturing, scrap metal melting facilities, and scrap yards.

The second method for evaluating priorities involved an analysis of mercury reduction strategies based on the cost per kilogram of reducing mercury air emissions. This method indicates that management of mercury-containing products in general is a cost-effective strategy for mercury control because the costs for recycling various mercury-containing products (with the exception of lamps) are lower than costs of air emissions controls at sources such as power plants, Portland cement plants, and sludge incinerators. The most cost-efficient mercury reduction strategy evaluated was collecting elemental mercury through Household Hazardous Waste (HHW) programs, followed by collecting mercury auto switches, and collecting mercury thermostats through the Thermostat Recycling Corporation (TRC) program. Collection of compact fluorescent light bulbs (CFLs) was the least cost-effective strategy evaluated. Despite this poor cost effectiveness, many states consider lamp recycling a high priority due to the growing number of CFLs in household use that are projected for disposal and the public perception of a potential environmental challenge associated with safe disposal of CFLs.

Table 1. Number of Mercury in Products Phase-Down Strategy Recommendations Currently Completed or Ongoing

Product Category/Sector	Total Number of Recs	Number of Recommendations Currently Completed or Ongoing									
		IL	IN	MI	MN	NY	OH	PA	WI	Total	Total (%)*
Thermometers	3	3	2	3	3	2	3	0	3	**19**	**79%**
Households	3	2	2	2	2	2	3	2	2	**17**	**71%**
Schools	7	2	6	6	6	5	4	4	6	**39**	**70%**
Steel Manufacturing, Scrap Metal Melting Facilities, and Scrap Yards	4	3	4	2	4	3	2	2	2	**22**	**69%**
Thermostats	7	6	4	4	6	4	4	7	3	**38**	**68%**
Lamps	4	2	2	2	3	3	3	3	3	**21**	**66%**
Heavy Industry	3	0	2	3	3	1	3	1	1	**14**	**58%**
Cross-Cutting Strategies	15	9	7	9	12	11	4	4	7	**63**	**53%**
Switches, Relays, and Measurement and Control Devices	5	2	2	4	5	3	2	0	2	**20**	**50%**
Dental Amalgam	6	1	2	4	4	5	2	1	1	**20**	**42%**
Health Care	3	0	1	1	0	0	1	0	3	**6**	**25%**
Total**	**60**	**30**	**34**	**40**	**48**	**39**	**31**	**24**	**33**	**279**	**58%**
Total (%)***		**50%**	**57%**	**67%**	**80%**	**65%**	**52%**	**40%**	**55%**		

*Percent total by recommendation was calculated by dividing the sum of the recommendations currently completed or ongoing by the total number of recommendations to be implemented in a category by all eight states. For example, 19 recommendations are currently completed or ongoing in the Thermometers category. This number was divided by 24 (3 recommendations multiplied by 8 states equals 24 Thermometers recommendations to be implemented) and multiplied by 100 to obtain the percent total.

**The total number of recommendations (60) includes four subdivisions of one recommendation (Schools: 6.1.3.4).

***Percent total by state was calculated by dividing the sum of the recommendations currently completed or ongoing for that state by the total number of recommendations.

Challenges to Implementation

Three challenges to implementing the Phase-Down Strategy recommendations include: 1) difficulties with the legislative process, 2) limited resources, and 3) new uses of mercury. Changing political climates and competing interests, such as economics and industry, make it difficult for states to successfully pass and implement legislation to achieve mercury reduction goals. In some cases, the recommendations can be implemented by state regulatory agencies without additional authority from the state legislature. This is especially true for outreach and informational actions. However, state governments' limited resources make it difficult to initiate new programs without obtaining additional funding, which often must be appropriated by the state legislature. Grants, federal funding, or other funding sources may be sought to support mercury reduction activities. Another challenge to the ultimate goal of preventing mercury releases into the environment is new uses of mercury that have been introduced in recent years.

Future Outlook

Overall, 58% of the Phase-Down Strategy recommendations are currently completed or ongoing across the Great Lakes states, as shown in Table 1. Completion rates by state range from approximately 40% to 80%. Fifty percent or more of the recommendations in 9 of the 11 product and sector categories are currently completed or ongoing. Thermostats have been identified as a top priority, and several states are moving forward with programs to collect and recycle mercury-containing thermostats. Five years after the Phase-Down Strategy was finalized in 2008, states have made significant progress in implementing the Phase-Down Strategy recommendations, but many challenges remain in order to reach near-100% implementation. Overcoming the challenges to successfully implement the remaining 42% of Phase-Down Strategy recommendations will require collaboration among the Great Lakes states and with other entities, such as national or regional clearinghouses (e.g., Interstate Mercury Education and Reduction Clearinghouse [IMERC], Quicksilver Caucus).

LIST OF ACRONYMS AND ABBREVIATIONS

ABS	Anti-Lock Brake System
ADA	American Dental Association
ARC	Automotive Recyclers of Canada
ASTM	American Society for Testing and Materials
BGSU	Bowling Green State University
BMP	Best Management Practice
CARI	Canadian Association of Recycling Industries
CFL	Compact Fluorescent Light bulbs
CQM	Canadian Quality Milk
CRT	Cathode-Ray Tube
CSDP	Chemical Safety Days Program
CSPA	Canadian Steel Producers Association
CVMA	Canadian Vehicle Manufacturers' Association
CWS	Canada-Wide Standard
DEED	Dedicated to Environmental Excellence in Dentistry
DEM	Department of Environmental Management
DEP	Department of Environmental Protection
DNR	Department of Natural Resources
ELVS	End of Life Vehicle Solutions
EPA	Environmental Protection Agency
GLNPO	Great Lakes National Program Office
GLRC	Great Lakes Regional Collaboration
GLRI	Great Lakes Restoration Initiative
H2E	Hospitals for a Healthy Environment
HASTI	Hoosier Association of Science Teachers, Inc.
HEA	House Enrolled Act
HHW	Household Hazardous Waste
HRAI	Heating, Refrigeration, and Air Conditioning Institute
HVAC	Heating, Ventilation, and Air Conditioning
HVAC-R	Heating, Ventilation, Air Conditioning, and Refrigeration
IL	Illinois
IMERC	Interstate Mercury Education and Reduction Clearinghouse
IN	Indiana
LRTAP	Convention on the Long-range Transboundary of Air Pollution
MACT	Maximum Achievable Control Technology
MAP	Mercury Awareness Program
MDE	Minnesota Department of Education
MFZ	Mercury-Free Zone
MHSW	Municipal Hazardous or Special Waste
MI	Michigan
MN	Minnesota
MOU	Memorandum of Understanding
MPCA	Minnesota Pollution Control Agency
NEWMOA	Northeast Waste Management Officials' Association

NIST	National Institute of Standards and Technology
NO_x	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NVMSRP	National Vehicle Mercury Switch Recovery Program
NY	New York
NYPSC	New York Product Stewardship Council
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OCAPP	Office of Compliance Assistance and Pollution Prevention
ODA	Ohio Dental Association
OH	Ohio
ON	Ontario
P2	Pollution Prevention
PA	Pennsylvania
PDA	Pennsylvania Dental Association
PGH	Practice Green Health
POTW	Publicly Owned Treatment Works
PPI	Product Policy Institute
PSI	Product Stewardship Institute
RCRA	Resource Conservation and Recovery Act
RFP	Request for Proposal
SO_x	Sulfur Oxides
TCLP	Toxicity Characteristic Leaching Procedure
TPCH	Toxics in Packaging Clearinghouse
TMDL	Total Maximum Daily Load
TRC	Thermostat Recycling Corporation
TSDF	Treatment, Storage, and Disposal Facility
UNEP	United Nations Environment Programme
USEPA	U.S. Environmental Protection Agency
VDD	Video Display Device
VSQG	Very Small Quantity Generator
WI	Wisconsin
WLSSD	Western Lake Superior Sanitary District
WWTP	Waste Water Treatment Plant

SECTION 1: PROGRESS TO DATE

The Great Lakes Mercury in Products Phase-Down Strategy, finalized in June 2008, contains eleven categories of recommendations for reducing mercury in products. Overall, much progress has been made in implementing the Phase-Down Strategy recommendations by the eight U.S. Great Lakes states.

In general, each state has had different successes and difficulties in implementing the Phase-Down Strategy recommendations. All states have initiated actions to implement the recommendations, but no states have completed all of the recommendations. Some categories of recommendations have had high levels of success in implementation, such as households and thermometers. The recommendations for health care have had the lowest implementation success.

Recommendations in the Phase-Down Strategy are organized by product category or sector area, with an additional category of cross-cutting strategy recommendations. An overview of progress to date in each category is presented below in order of most success in implementation. The states' progress in implementing the recommendations is represented by a bar chart for each product/sector category. The bar chart indicates the level of progress using three status levels: "not begun," "incomplete," and "completed or ongoing." "Not begun" indicates that a state has not begun to implement or has not made progress on a recommendation. "Incomplete" means that a state has begun but not completed implementing a particular recommendation, or that a state began implementation but abandoned its efforts due to a lack of funding or a change in priorities. "Incomplete" also is used for actions that do not fully comply with a recommendation, such as implementing voluntary programs for recommendations that require or mandate specific actions. "Complete or ongoing" status indicates that a state has either fully implemented the recommendation or is conducting ongoing activities associated with the recommendation. The numbered recommendations refer to the recommendations as presented in the original Phase-Down Strategy (Great Lakes Regional Collaboration, 2008). For each individual recommendation, a detailed summary of progress is provided in Appendix A.

Thermometers

Progress on the mercury thermometer recommendations is strong, with six states completing all three recommendations (Figure 1). Six states ban the sale and/or distribution of mercury fever thermometers (recommendation 5.5.3.1) and one state restricts sales (sold behind the pharmacy counter only). Six states support funding and provide guidance for local thermometer exchange programs (recommendation 5.5.3.2). Seven states are increasing public awareness of the hazards of thermometer breakage and the appropriate cleanup techniques for household mercury spills (recommendation 5.5.3.3).

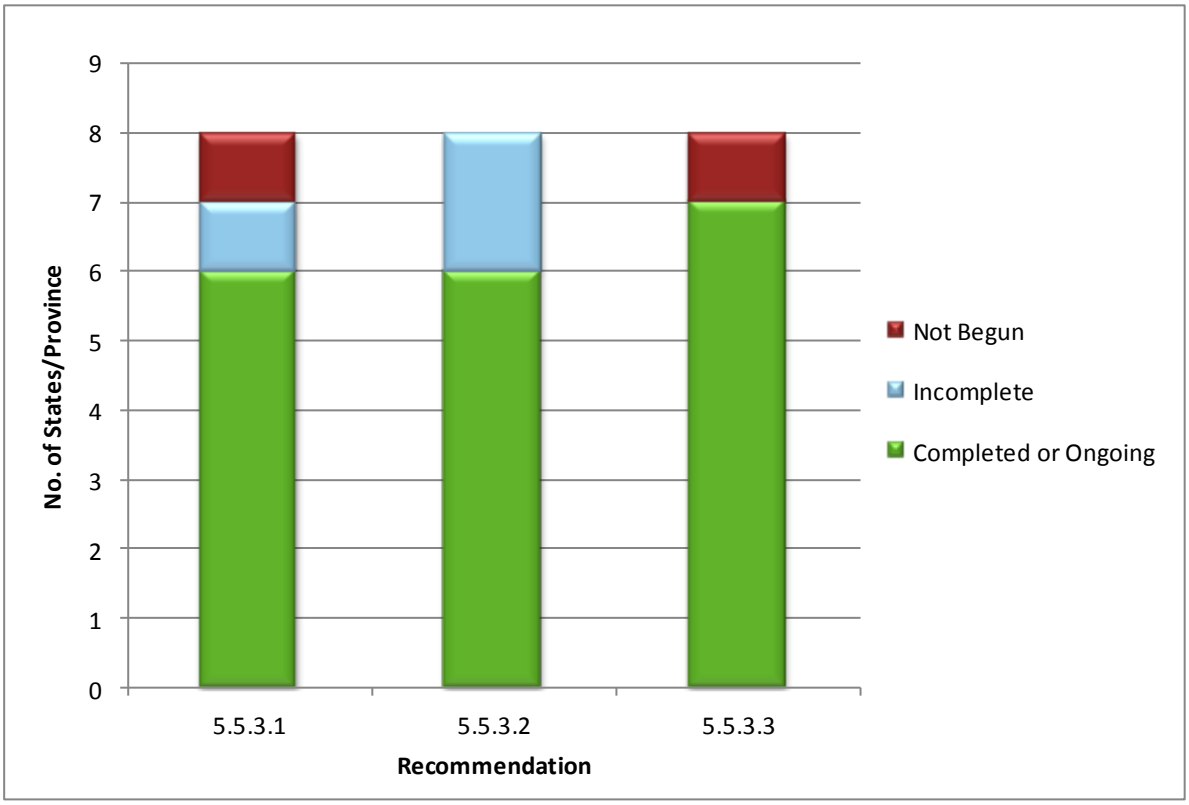

Figure 1 - Status of Recommendations for Thermometers

Households

The Great Lakes states have made significant progress in implementing the recommendations related to households, other than banning mercury-added button cell batteries (Figure 2). All eight states have completed two of the three recommendations related to reducing mercury from households. The states offer programs to educate the general public on mercury hazards and proper management (recommendation 6.5.3.1) and provide free collection of mercury and mercury-containing products for households (recommendation 6.5.3.2). The third recommendation has proven much harder to achieve. Only one state has implemented legislation to ban the sale of mercury-added button cell batteries (recommendation 6.5.3.3), and the ban only applies to novelties; however, three states have introduced legislation to ban the sale of mercury-added button cell batteries.

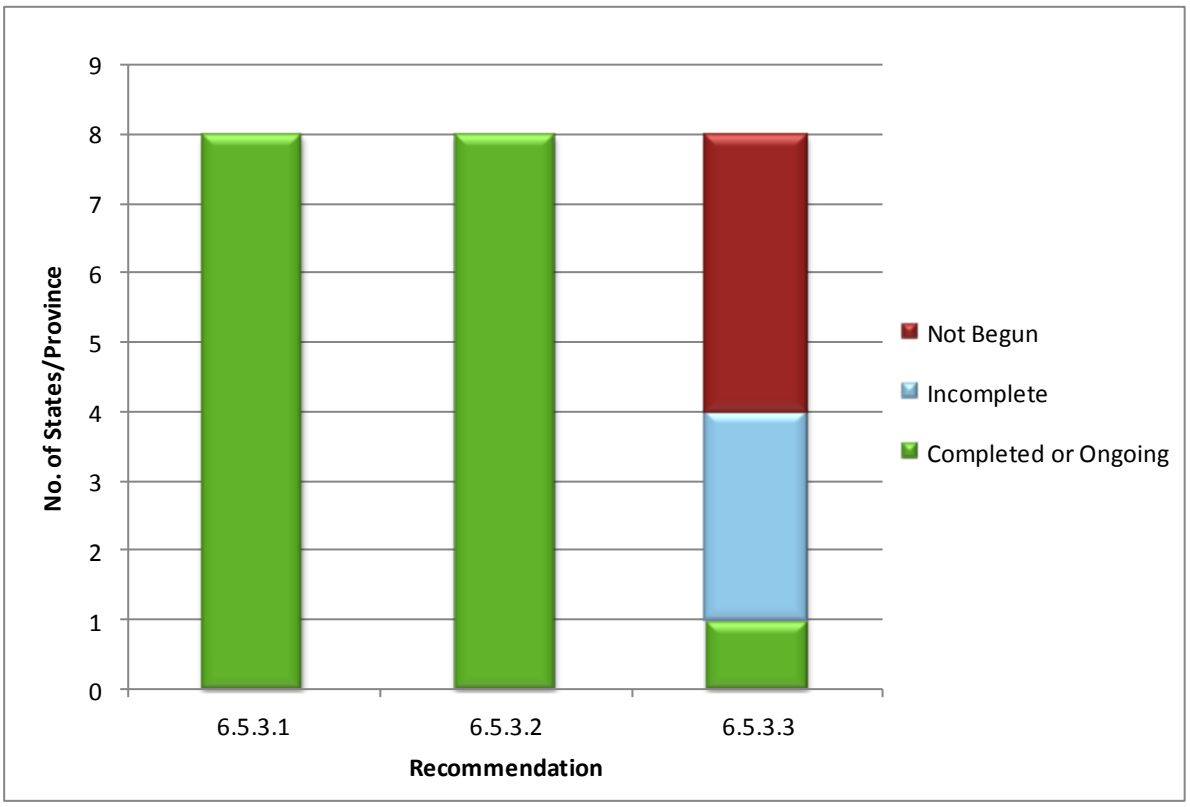

Figure 2 - Status of Recommendations for Households

Schools

Much progress has been made on most of the recommendations related to schools (Figure 3). Of seven recommendations related to mercury in schools, five have been completed by six or more states. Five states prohibit the purchase, use, and storage of elemental mercury, mercury compounds, and mercury-containing laboratory and medical equipment in schools (recommendation 6.1.3.1). Eight states provide education/outreach regarding mercury to schools (recommendation 6.1.3.2). One state began a program to provide education/outreach to college and university students majoring in education, particularly future science teachers, but the program was discontinued due to a lack of resources; a second state provides some education through a statewide teachers' association, and a third state offers training to university students majoring in education (recommendation 6.1.3.3). Seven states facilitate schools' access to low-cost collection programs (recommendation 6.1.3.4, part a) and provide technical assistance to schools for clean-outs (recommendation 6.1.3.4, part b). Six states advocate the proper disposal of worn or broken mercury-containing gauges, switches, and relays, and replacement with mercury-free devices (recommendation 6.1.3.4, part c) and ensure the availability of mercury collection programs for schools (recommendation 6.1.3.4, part d).

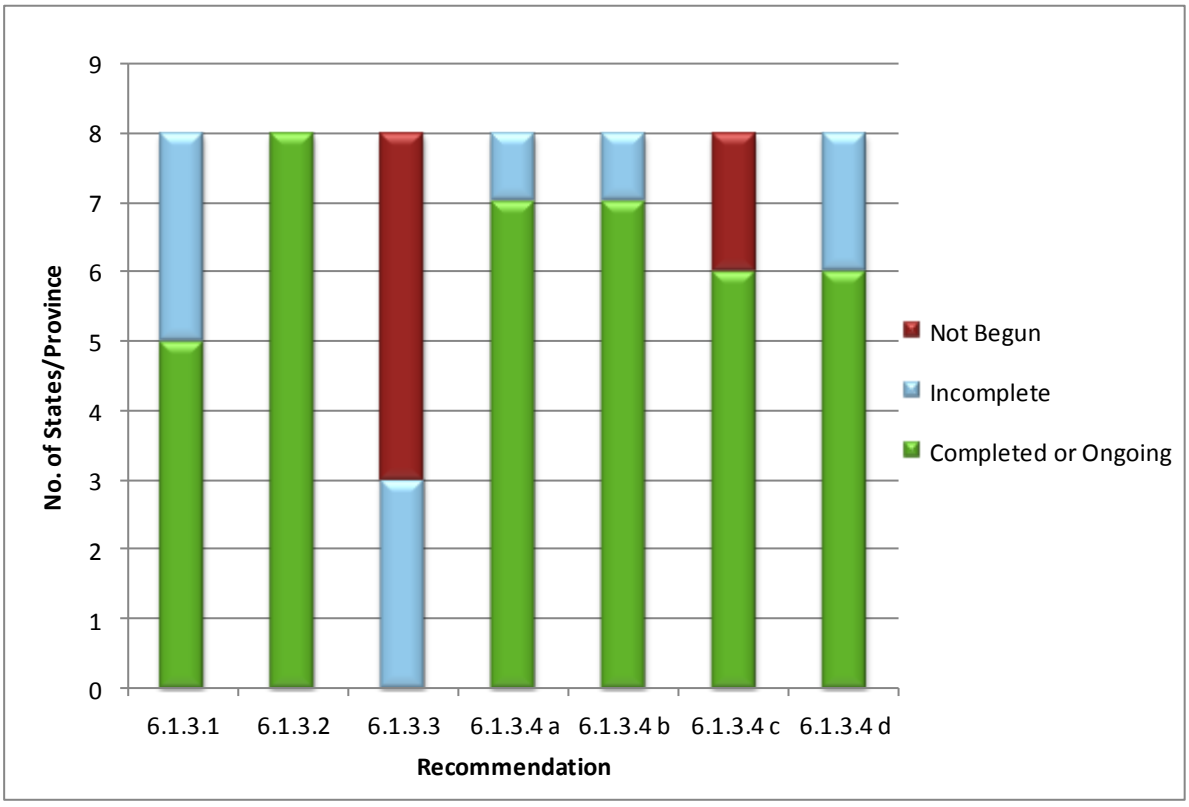

Figure 3 - Status of Recommendations for Schools

Steel Manufacturing, Scrap Metal Melting Facilities, and Scrap Yards

All eight states have completed one of the recommendations in this category, and at least half of the states have completed the remaining recommendations (Figure 4). All Great Lakes states facilitate recycling of auto mercury switches and conduct outreach to auto recyclers about the need to remove mercury switches (recommendation 6.2.3.1). Six states conduct outreach to steel mills and iron foundries (recommendation 6.2.3.2). Four states have taken actions to ensure continued achievement of auto switch recycling goals (recommendation 6.2.3.3), including three states that enacted laws requiring the removal and management or recycling of mercury-containing components from vehicles. Four states have also implemented requirements for the removal and proper management of all mercury-containing components from vehicles, appliances, and other products that are likely to end up in steel scrap (recommendation 6.2.3.4).

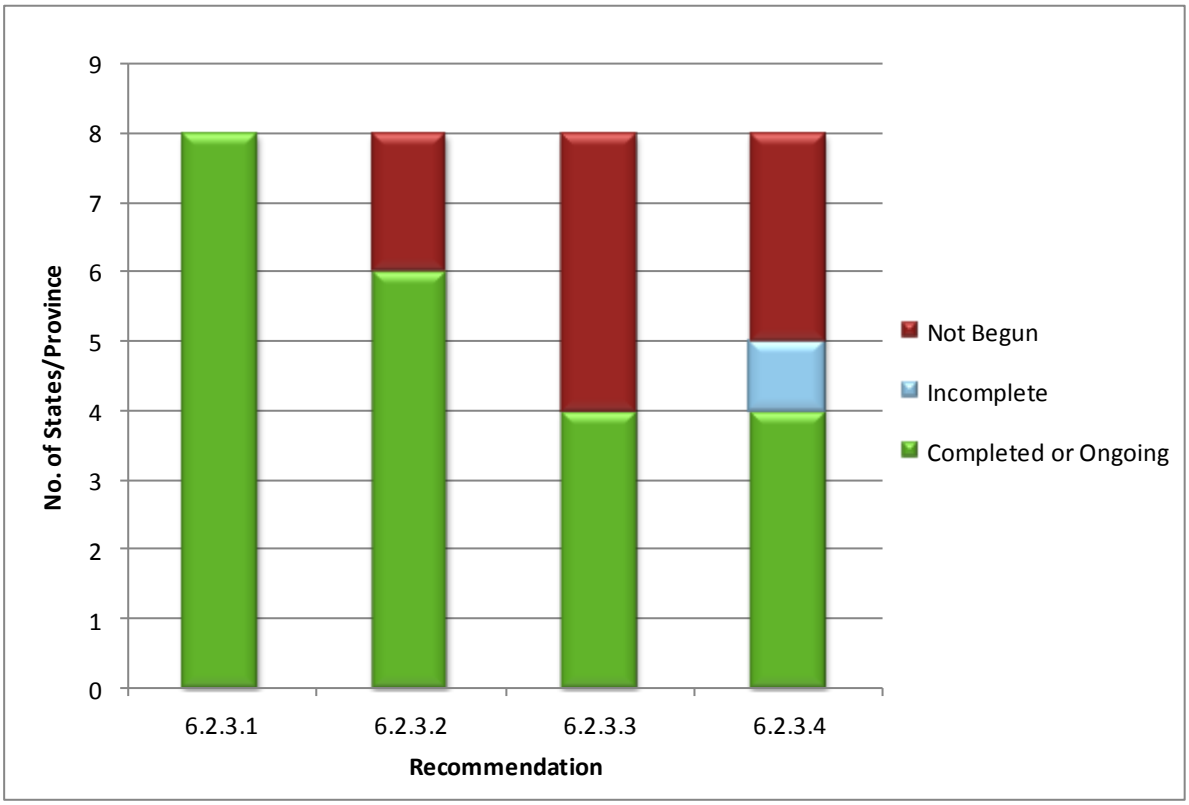

Figure 4 - Status of Recommendations for Steel Manufacturing, Scrap Metal Melting Facilities, and Scrap Yards

Thermostats

The states are making progress on most of the thermostat recommendations (Figure 5). Seven states have state-wide bans on the sale and/or distribution of new mercury-containing thermostats (recommendation 5.2.3.1). Three states mandate the collection and proper management of thermostats at the end of the product's life (recommendation 5.2.3.2) and require manufacturers or wholesalers to offer incentives to consumers and contractors for the collection and recycling of mercury thermostats (recommendation 5.2.3.3). Seven states promote the use of Energy Star qualified programmable thermostats (recommendation 5.2.3.4). All states are increasing the awareness of thermostat recycling options (recommendation 5.2.3.5) and are including thermostat collection in HHW collections (recommendation 5.2.3.6). Two states encourage retailers to offer thermostat collection programs (recommendation 5.2.3.7).

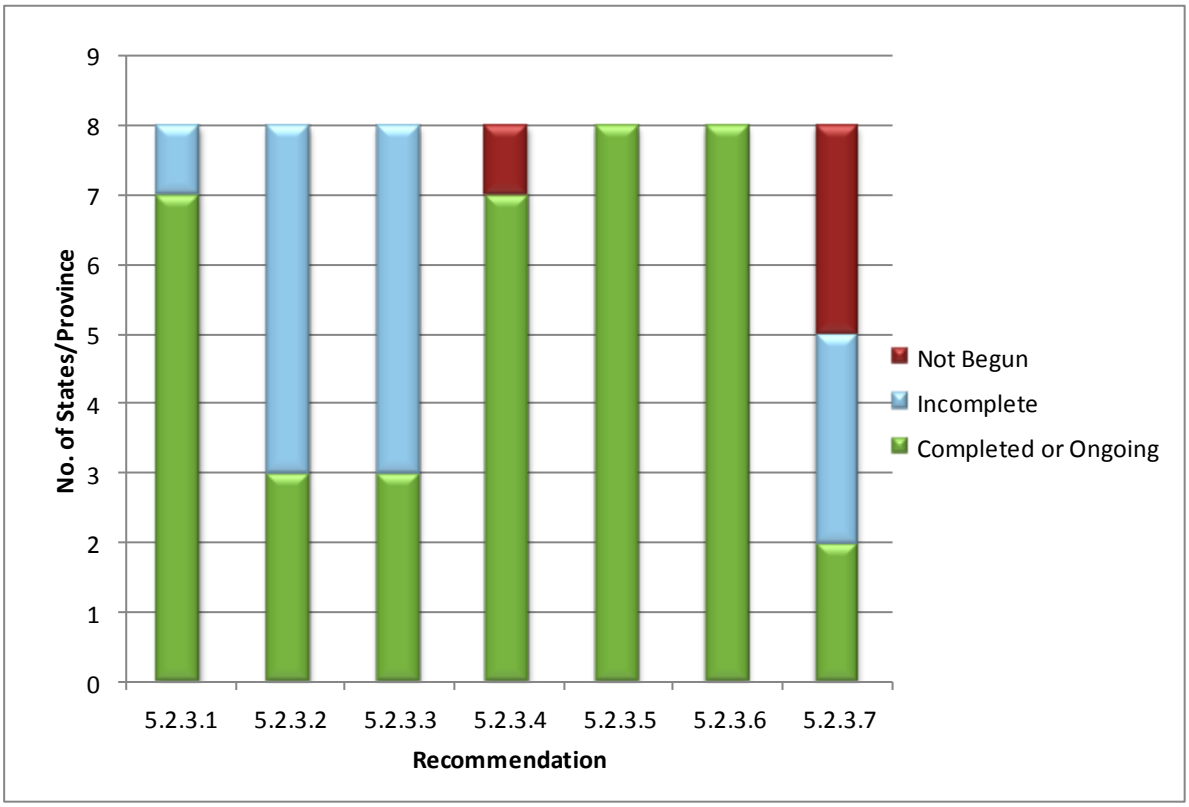

Figure 5 - Status of Recommendations for Thermostats

Lamps

The states have made significant progress in most of the recommendations for reducing mercury emissions from lamps (Figure 6). Two of the four lamp recommendations have been completed by all eight states. Five states require recycling of lamps containing mercury (recommendation 5.4.3.1). All eight states have ongoing programs to collect spent fluorescent bulbs from households and small businesses, many through HHW collections (recommendation 5.4.3.2). No states have succeeded in implementing bans on the sale of mercury lamps (recommendation 5.4.3.3), but all eight states regulate drum top crushers (recommendation 5.4.3.4), either through hazardous waste rules or air permits.

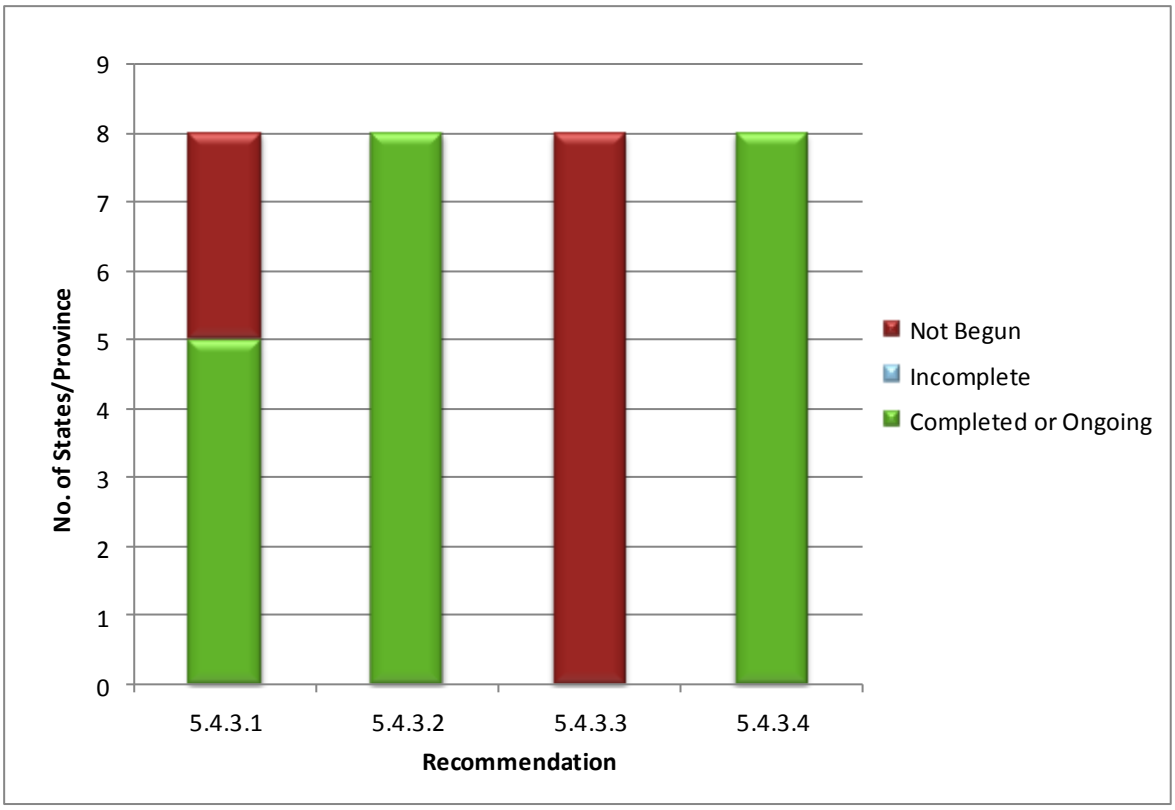

Figure 6 - Status of Recommendations for Lamps

Heavy Industry

Half of the Great Lakes states have made excellent progress in implementing the three recommendations related to heavy industry (Figure 7). Six states conduct outreach programs to promote mercury reduction projects (recommendation 6.3.3.1). Four states promote the development of mercury-containing industry equipment phase-out plans (recommendation 6.3.3.2). Four states work with wastewater treatment authorities to encourage large-volume users of commodity chemicals to obtain certificates of analysis for these chemicals and procure lower-mercury chemicals when contamination is an issue (recommendation 6.3.3.3).

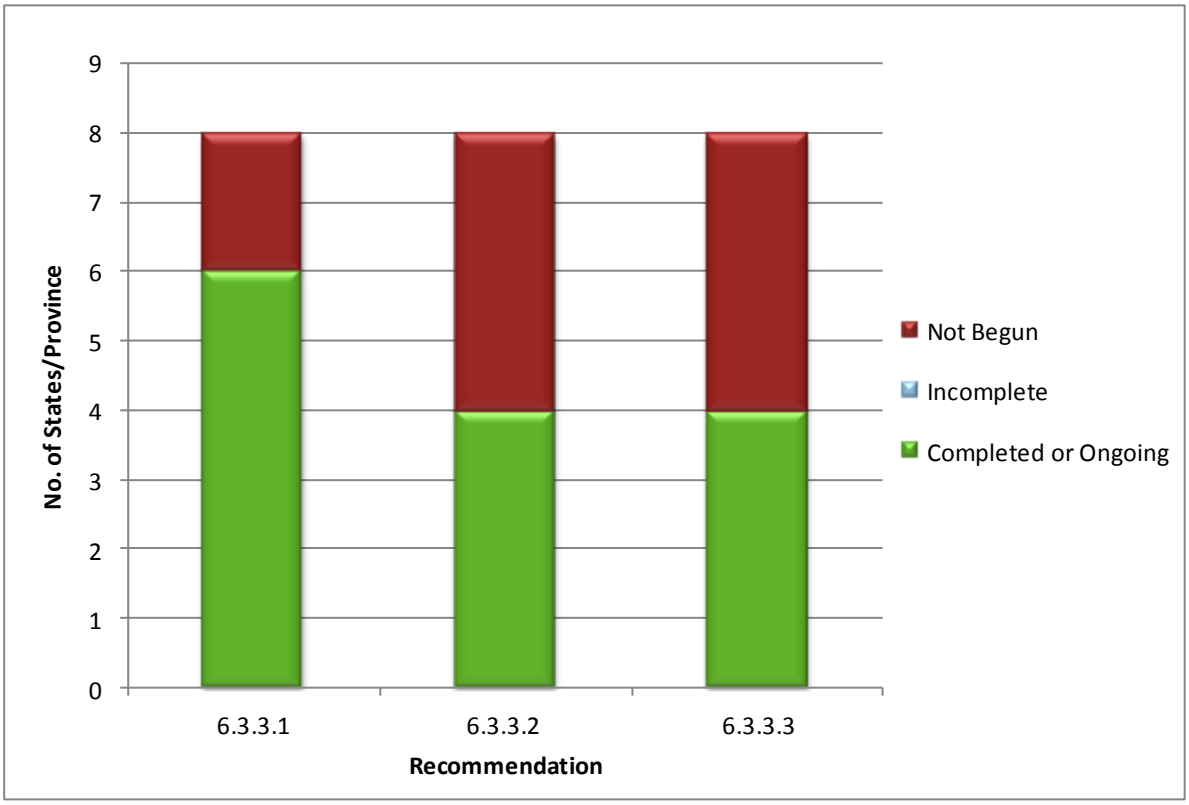

Figure 7 - Status of Recommendations for Heavy Industry

Cross-Cutting Strategies

The Great Lakes states have had varied success in implementing the 15 cross-cutting strategies (Figure 8). Seven or more states have been successful in implementing several of the recommendations, including providing education on proper disposal of mercury-containing products and offering collection programs at the local level (recommendation 7.6.1), supporting extended producer responsibility approaches (recommendation 7.6.2), sharing their expertise on methods of mercury reduction (recommendation 7.10.1), and tracking progress in implementing the Phase-Down Strategy (recommendation 8.1). Five states have made progress in providing significant additional support for mercury reduction activities (recommendation 7.2.1), participating in national or regional clearinghouse efforts (recommendation 7.4.2) and discouraging the export of mercury collected from within their boundaries (recommendation 7.8.1). Four states have made progress in implementing legislation that phases out the sale of mercury-added products by 2015 (recommendation 7.1.1), supporting end-of-life management programs (recommendation 7.6.3), and publicly identifying implementation priorities (recommendation 8.2). Two states have made progress in ensuring that mercury in state-owned facilities is managed properly (recommendation 7.7.2). Only one state has made progress in implementing and enforcing mercury product labeling requirements (recommendation 7.3.1), implementing product notification requirements (recommendation 7.4.1), and adopting state policies on the purchase of non-mercury products (recommendation 7.7.1). No states have considered targeting research and development funding toward mercury-free alternatives (recommendation 7.2.2).

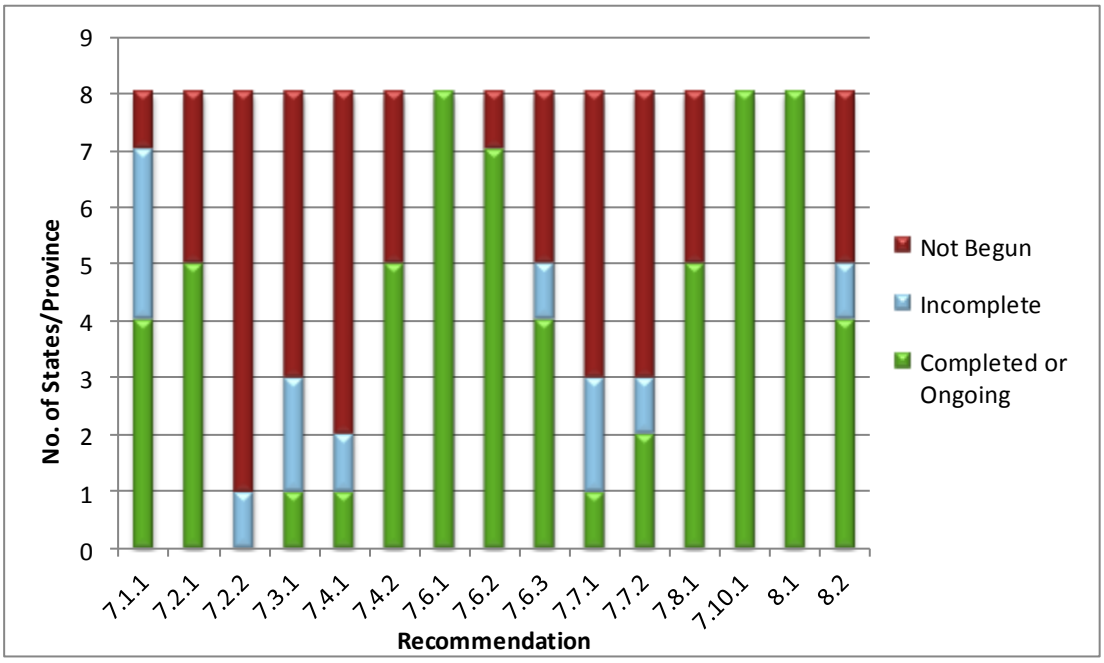

Figure 8 - Status of Recommendations for Cross-Cutting Strategies

Switches, Relays, and Measurement and Control Devices

Progress on switches, relays, and measurement and control devices is mixed (Figure 9). Seven states have implemented legislation to phase out the sale and/or distribution of measurement devices (recommendation 5.3.3.1). One state has developed product labeling requirements to promote the proper management of mercury-containing switches, relays, and measurement and control devices (recommendation 5.3.3.2). Five states conduct outreach to users of mercury-containing switches to notify them of proper end-of-life disposal and identify alternative mercury-free products (recommendation 5.3.3.3). Four states encourage national and international standard-setting bodies to establish standards that utilize non-mercury technology for measuring devices (recommendation 5.3.3.4). Three states provide dairy farms with information on the proper management for disposal of mercury manometers and offer financial assistance to assist in the disposal of mercury manometers and other mercury-containing devices (recommendation 5.3.3.5).

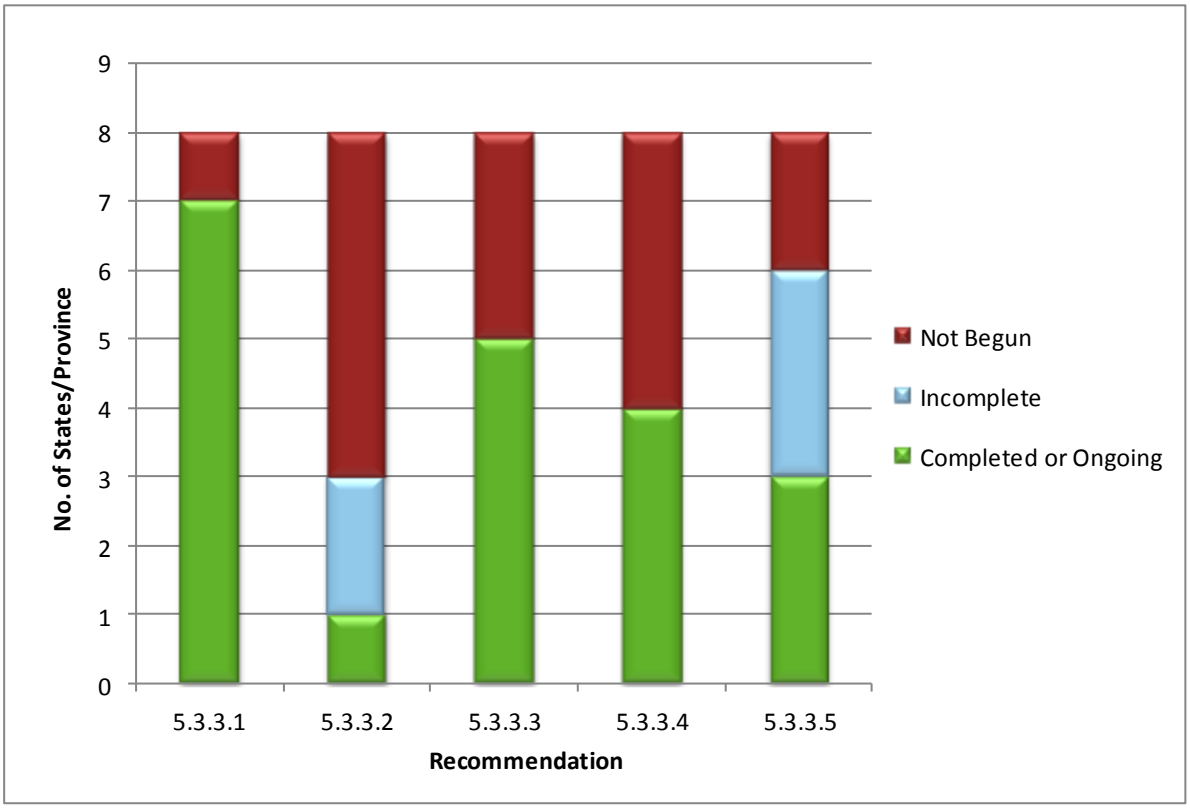

Figure 9 - Status of Recommendations for Switches, Relays, and Measurement and Control Devices

Dental Amalgam

The states have made varied progress toward completing the dental amalgam recommendations (Figure 10). Three states require dental offices that place or remove amalgam to implement best management practices (BMPs), including installation of amalgam separators (recommendation 5.1.3.1). Four states have implemented programs to promote inclusion of instruction in dental office BMPs in training for dentists and hygienists (recommendation 5.1.3.2). Five states support joint efforts with the dental community to ensure removal of remaining bulk elemental mercury from dental facilities (recommendation 5.1.3.3). Six states engage in joint efforts with the dental community to ensure that adequate options for safe disposal of dental waste are available (recommendation 5.1.3.4). No states require dental insurance plans to allow the use of non-mercury restorative materials (recommendation 5.1.3.5). Two states promote and distribute literature for dental patients explaining alternative tooth restorative materials that are available (recommendation 5.1.3.6).

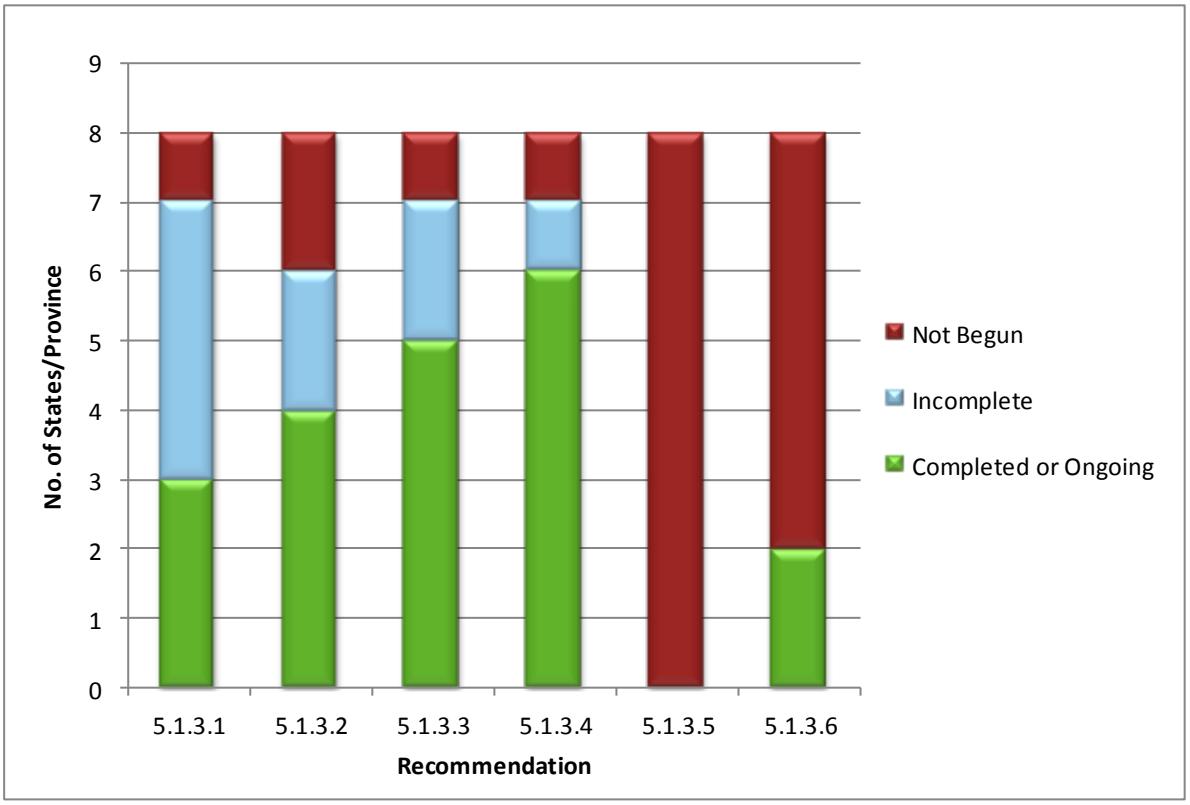

Figure 10 - Status of Recommendations for Dental Amalgam

Health Care

The Great Lakes states have had limited success in implementing the three Phase-Down Strategy recommendations to reduce mercury from the health care sector (Figure 11). Three states continue to implement and promote Practice Green Health (PGH) programs, formerly known as Hospitals for a Healthy Environment (H2E), to reduce mercury in hospitals, clinics, and nursing homes (recommendation 6.4.3.1). Two states have become PGH partners (recommendation 6.4.3.2). One state engaged other health care facilities, such as independent medical research laboratories and veterinary care facilities, in mercury pollution prevention efforts (recommendation 6.4.3.3).

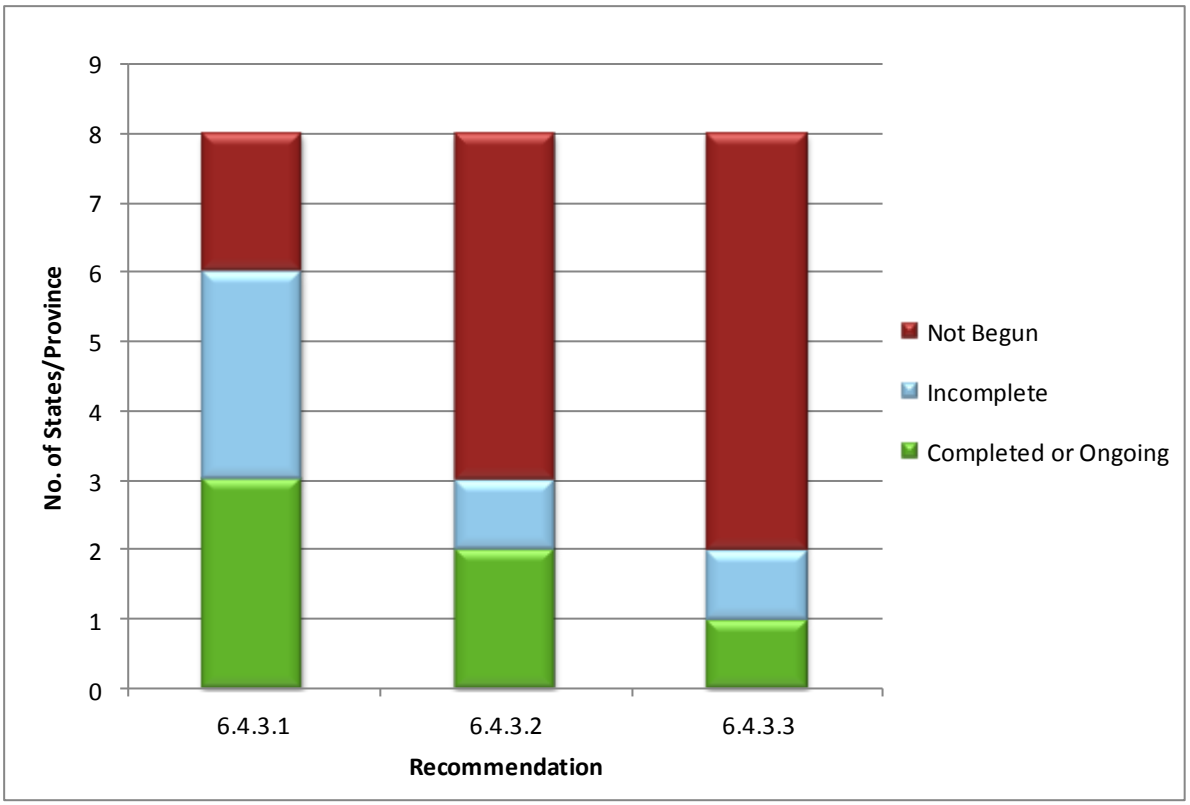

Figure 11 - Status of Recommendations for Health Care

SECTION 2: PRIORITIES

State Priority Voting

In late 2010 and early 2011, representatives of the Great Lakes states voted on the relative priorities for further reduction of mercury in products. The purpose of the ballots was to identify priorities for actions moving forward. Therefore, a category where substantial progress has been made may be rated as a lower priority than other categories where further actions are needed. Six Great Lakes states submitted ballots. Table 2 lists the results of the states' priority voting for future actions. A summary of the results is as follows:

- No categories were a high priority for all six states that responded.
- Thermostats and Lamps were the only categories identified as a high priority for future actions by greater than 50% of states, with five and four states ranking these categories as a high priority, respectively.
- Steel Manufacturing, Scrap Metal Melting Facilities, and Scrap Yards was the third highest priority, followed closely by Households.
- The lowest priority for future actions was Schools, with five states ranking it as a low priority and one state ranking it as medium priority. Several states have already established bans in schools, and several mercury programs related to schools have been in place for many years.

Table 2. Results of States' Priority Voting for Future Actions

Product Category	Number of Votes		
	High Priority	Medium Priority	Low Priority
Thermostats	5	0	1
Lamps	4	1	1
Steel Manufacturing, Scrap Metal Melting Facilities, and Scrap Yards	3	2	1
Households	3	1	2
Heavy Industry	1	2	3
Dental Amalgam	1	1	4
Switches, Relays, and Measurement and Control Devices	1	1	4
Thermometers	1	1	4
Health Care	0	2	4
Schools	0	1	5

States consider thermostat recycling to be a high priority because the millions of mercury thermostats in use contain a large mass of mercury that must be managed properly, and while mercury thermostats are no longer being sold, large numbers are still in use and will be coming out of service in the coming decades. An infrastructure for thermostat recycling exists through the TRC, and there are significant prospects for improving collection rates under this program. The choice of thermostats as a high priority is supported by an evaluation of cost effectiveness (below), which shows that thermostat recycling is a highly cost-effective mercury reduction strategy.

All of the Great Lakes states are working to reduce and recycle mercury thermostats. Pennsylvania, Illinois, and Minnesota mandate the collection and management of mercury-containing thermostats and are promoting recycling efforts through the TRC program. The collection and disposal of thermostats in Wisconsin is regulated by municipalities, and many contractors and wholesalers in the state participate in the TRC program. New York prohibits the disposal of mercury thermostats and supports the collection of thermostats through the TRC program. Indiana and Michigan have been successful in collecting thermostats through local voluntary programs, as well as the TRC program. Ohio encourages regional solid waste management districts to collect and recycle thermostats, and participation in the TRC is encouraged. In Canada, a not-for-profit organization manages a successful, industry-funded thermostat exchange program called Switch the 'Stat. Additional details of states' thermostat recycling efforts are discussed in Appendix A.

Cost Effectiveness

Alexis Cain, of USEPA Region 5, evaluated the cost per kilogram of reducing mercury air emissions by a variety of mercury reduction strategies. These estimates were based upon publicly available documents, literature, and models. The methodology is described in detail below, followed by the results of the analysis. Similar results have been published by Cain et al. (2011).

For the product waste management strategies evaluated, published estimates of the cost of collecting and recycling various types of mercury-containing products were located. The Mercury Product Flow Model (described in Cain et al., 2007) was used to estimate the quantity of mercury air emissions that would be avoided by collecting a given amount of each mercury-containing product. To obtain estimates of avoided air emissions, the model was utilized to compare mercury emissions when a product is disposed of incorrectly to emissions when a product is properly collected and recycled. These two estimates, the collection cost estimate and the mercury emissions avoided estimate, were then combined to produce a cost per kilogram estimate of avoided air emissions.

It is important to note that reducing the analysis to a cost-per-kg of air emissions metric ignores the potential impacts on direct water discharges and the amount of mercury in landfills. The estimates do include avoided air emissions from landfills and from the collection system. This limitation is mitigated by the knowledge that direct water discharge impacts of collection and recycling or disposal are likely to be small for these products. Moreover, reducing mercury air emissions is generally a higher priority policy goal than reducing the amount of mercury in landfills. Strategies that focus on preventing releases of mercury to water, such as the use of dental amalgam separators, were not evaluated in this analysis. Table 3 presents a summary of the analysis of the cost effectiveness of mercury reduction strategies.

Table 3. Summary of Mercury Emissions Reduction Cost-Effectiveness Analysis

Method	Emissions Prevented	Cost/kg*	Reference
Collect Elemental Mercury through HHW Programs	1%	$840	Oregon Department of Environmental Quality estimates that elemental mercury collection costs $4 per pound collected, or $8.40/kg (Lane County Lamp Recycling Coalition 2006).
Collect Auto Mercury Switches	94%	$2,660	$3/switch; switches contain 1.2 g mercury each (New Jersey Department of Environmental Protection 2004).
Thermostat Recycling by TRC	5%	$6,267	$1.41 per thermostat, under TRC thermostat recycling program; devices contain 4.5 g mercury each (Mercury Policy Project 2010).
Collect Household Mercury-containing Devices through HHW Programs	5%	$12,000	Oregon Department of Environmental Quality estimates that HHW mercury collection costs $565/kg collected ($269 per lb). This cost represents only contract costs for local governments. Add roughly 5% for program administration and advertising, yielding $600 per kg collected (Lane County Lamp Recycling Coalition 2006).
Sewage Sludge Incinerator Controls		$13,228	For activated carbon injection at sewage sludge incinerators (USEPA 2010).
Coal-fired Utility Boiler Controls		$40,000-$150,000 currently	Feeley, et al. 2008. [U.S. Department of Energy's goal is to develop technology that achieves reductions for less than $21,000/kg from coal-fired power plants.]
Collect CFLs through HHW Programs	11%	$727,000 to $2,700,000	$0.40 to $1.50 per lamp collected; bulbs contain 5 mg mercury each (Maine Department of Environmental Protection 2010).

* Cost per kilogram of preventing mercury emissions through a collection effort or control.

Some of the results of the analysis may appear to be contradictory at first glance (Table 3). For instance, for collection of household mercury-containing devices and for thermostat collection, the analysis shows that mercury emissions would be reduced by an amount equivalent to only 5% of the amount collected. That may appear small, but it is appropriate for several reasons. Most mercury from a thermostat that is not recycled would go instead to a landfill, where only a small percentage would be released. For the fraction of mercury that would go to an incinerator, most would be controlled. Only a small fraction of thermostats would be disposed of in burn barrels. There would likely be emissions from breakage of thermostats during use and transport within the solid waste disposal system, but these would not be a large percentage and would be partly offset by emissions that would occur in the recycling system. For bulk mercury collection, the results suggest that collection prevents emissions of only 1% of the mercury collected. There is a great degree of uncertainty with this estimate. However, the reason for the low estimated percentage is that the model assumes that if the mercury is not collected, most of it will remain in basements or other areas where it is currently stored. The model also assumes that small amounts of mercury would be periodically spilled or disposed of improperly. Even with this 1% estimate, elemental mercury collection is among the most cost-effective strategies available for reducing mercury emissions, according to this analysis. For lamps, the model indicates an 11% emissions reduction, which is higher than the other types of devices, since lamps are more likely to break during use or during disposal. For auto switch collection, the estimate is a much larger 94% of emissions reduced, since auto switches not collected are likely to be incinerated in steel furnaces, resulting in most of the mercury within them being emitted.

Given the uncertainties involved in these estimates, small differences in the estimated costs of different strategies should not be overemphasized. For example, while the analysis seems to show that thermostat collection by the TRC is more cost-effective than collection of mercury-containing devices through HHW programs, the estimated costs for TRC recycling ($6,267/kg) are approximately half the estimated costs of HHW collection of mercury-containing devices ($12,000/kg). This cost difference is not significant enough to confidently state that TRC collections are more cost-effective than collecting mercury-containing devices through HHW programs. There are some large differences among a few of the cost estimates, however, to allow the following tentative conclusions:

- Most mercury product collection strategies (with the exception of CFLs collected through HHW programs) are cost-effective.
- Collection of elemental mercury through HHW programs is highly cost-effective compared to other mercury reduction strategies analyzed.
- Collecting auto switches is at least as cost-effective as collecting household mercury-containing devices, and possibly even more effective. Despite a high cost per kilogram of mercury collected, collecting a given amount of mercury from auto switches prevents a larger amount of mercury emissions than collecting household mercury-containing devices.
- Collection of CFLs through HHW programs seems to be by far the least cost-effective strategy evaluated; it is much less cost-effective than the cost of controlling coal-fired power plants and hundreds to thousands of times less cost-effective than other product-related strategies.

These conclusions should be considered in light of the following limitations. Potential co-benefits of controls for the removal of mercury, such as reductions of particulate matter, sulfur oxides (SO_x), and nitrogen oxides (NO_x) from coal-fired utility boiler controls, are not included in the analysis. In addition, there may be varying concerns depending on the form of mercury that a source releases into the environment. The mercury emitted by coal-fired power plants, for example, is in a different form than the mercury released when an automobile switch is shredded. Also, depending on the form of mercury released, it may undergo different chemical transformations that have varying impacts in the environment. These impacts may be localized (e.g., direct exposure from a spill) or may be regional or global in scale (e.g., atmospheric transport of gaseous mercury).

This methodology indicates that one of the most cost-efficient methods of reducing mercury emissions into the air is by collecting elemental mercury through HHW programs, followed by collecting mercury auto switches. The least cost-efficient method is collecting CFLs through HHW programs, although there is significant uncertainty in the estimated costs of these programs. Even though recycling of CFL lamps is not a cost-effective option, the extremely large number of CFL lamps in circulation, both currently and projected in the future, in addition to public concern over potential breakage, increases the overall priority for this mercury source.

This cost analysis provides information that the states can use to develop priorities for reducing mercury in products, particularly in the current climate of state funding shortages and competing priorities for limited resources.

SECTION 3: CHALLENGES TO IMPLEMENTATION

Development of the Phase-Down Strategy was a collaborative effort involving the participation of representatives from all eight U.S. Great Lakes states. However, the ability of each state to implement the strategy's recommendations may be compromised due to various challenges. Challenges include legislative obstacles, limited resources for mercury reduction activities, and new uses of mercury.

Legislative Obstacles

Each of the eight U.S. states involved in the Great Lakes Mercury in Products Phase-Down Implementation Workgroup has its own legislative process and political climate. Implementation of the recommendations may continue over many years, during which states may pass through several legislatures and governors. Therefore, it is possible that actions may be taken only to be reversed or modified under a different political climate. Additionally, competing interests such as economics, industry, and political concerns may prevent implementation of certain recommendations, and some recommendations may have different priorities in each state.

For example, legislation to implement several of the recommendations, such as mercury labeling requirements and phasing out mercury-added products, have been proposed in Michigan but have failed to pass the legislature. A potential solution to legislative challenges is to identify or seek out a champion within the political system who will support the passage of legislation and its subsequent implementation to achieve mercury reduction goals.

Some recommendations can be implemented by environmental agencies using existing authority, which will avoid the difficulties involved in trying to pass legislation. For example, several recommendations involve outreach and related activities, which in most instances can be accomplished without the need for additional regulatory authority, unlike product restrictions or bans, new permits, and other regulatory actions, which require new authority from the state legislature. Voluntary programs have also been successfully implemented in place of mandatory requirements, with the end result of achieving mercury reductions without new legislative or regulatory authority. If the climate for mercury legislation is not favorable in a given state, voluntary measures are an option for states to make progress in reducing mercury.

Limited Resources

Lack of adequate resources is another major challenge to progress in implementing the Phase-Down Strategy recommendations. Although there may be both the political will and momentum to implement certain recommendations, states have extremely limited funding and staff resources available. It is not unusual for a program to be delayed due to funding or staff shortages. In New York, for example, legislation was passed with certain requirements, but the requisite regulations to implement the provisions have been delayed due to limited staff. Additionally, cuts in funding can limit the number of staff available to manage state programs. A few states have lost key staff in recent years due to retirements, leaving a void that has been difficult to fill.

In some instances, grants can be used to fund state initiatives, although the funding is usually limited to a few years. For example, in Illinois, funding for several programs has been cut, and as a result, these programs have been either discontinued or severely limited. Additionally, Michigan is implementing several recommendations on a grant that will end in 2013. New sources of funding will be needed for Michigan to continue to make progress in these areas (e.g., white goods collection). Finally, some states have reported problems with restrictions on how funding can be spent, due to prohibitions or strict regulations on the use of printed materials and advertising campaigns, such as billboards.

Lack of resources is a common challenge that may require novel sources of funding, grant opportunities, or industry partnerships. As an example of industry cooperation, Canadian Tire stores across Ontario started accepting used fluorescent light bulbs from their customers in May 2010. The Canadian Tire program is a free service provided to all residents and small businesses (with the limitation of no more than 24 compact fluorescent lamps or 16 linear fluorescent tubes at a time). Canadian Tire recycles the used bulbs through the Take Back The Light program that was launched in 2008 by the Recycling Council of Ontario with initial funding from the government of Ontario. The Take Back The Light program itself is a unique stewardship program and is aimed at the industrial, institutional, and commercial sectors as a convenient way to recycle used lamps at the same time that new lamps are supplied. By joining the program, Canadian Tire can offer the service to its own (residential) customers. (Canadian Tire is not funding the entire Take Back The Light program; it is only covering its own costs associated with staffing and miscellaneous expenses to enable acceptance of used bulbs at its stores). The Take Back The Light program allows bulb purchasers (e.g., industrial, institutional, and commercial customers, including Canadian Tire) to select those sellers and suppliers that participate in the Take Back The Light by accepting used bulbs in their trucks when they deliver a new supply. The used bulbs are delivered to Aevitas, in Ayr, Ontario, for recycling.

The Great Lakes Restoration Initiative (GLRI) provides another opportunity for states to obtain funding for mercury reduction projects. With Congressional funding, USEPA offers GLRI grants and cooperative agreements for projects related to toxic substances and other areas. The Great Lakes states and Ontario are eligible for GLRI funding. For example, Ohio has submitted a grant application to reduce mercury from dental facilities. Michigan was awarded a GLRI grant for work on several mercury recommendations included in the Phase-Down Strategy.

New Uses of Mercury

Another challenge to the ultimate goal of preventing mercury releases into the environment is new uses of mercury. Although suitable alternatives exist in most situations, new uses of mercury have been introduced in recent years. For example, while mercury switches in automobiles were eliminated by the 2012 model year, mercury has been introduced in some automotive headlamps. Wheel and driveshaft/flywheel balancing products are examples of new uses of mercury in the transportation sector, for applications that have long used non-mercury products. Mercury in novelty items has become a serious issue in recent years as well. Because of the extensive resources that will be required to prevent mercury in these new uses from entering the environment, it is counterproductive to allow new uses to gain hold. Therefore, it is important that legislation banning mercury in products be as broad as possible, and not limited to existing uses.

SECTION 4: FUTURE OUTLOOK

States have identified thermostats as a top priority for future action (Section 2: Priorities). The Great Lakes states have made significant progress in reducing mercury-added thermostats, collectively implementing 68% of the seven Phase-Down Strategy recommendations related to thermostats. These results support the highest priority rating voted by the U.S. Great Lakes states. Progress has been made, but work to reduce mercury-containing thermostats is not finished. Three states mandate the collection and proper management of mercury-containing thermostats at the end of the product's life (recommendation 5.2.3.2) and require manufacturers or wholesalers to offer incentives for mercury thermostat collection and recycling (recommendation 5.2.3.3). Only two states encourage retailers to offer thermostat collection programs (recommendation 5.2.3.7); however, all states increase awareness of thermostat recycling options and promote recycling through voluntary programs. Thermostats will likely continue to be a high priority as the Great Lakes states work to complete the remaining thermostat recommendations.

In contrast, health care was the least successful category in terms of implementing the Phase-Down Strategy recommendations, and it was ranked as one of the lowest future priorities by the U.S. Great Lakes states. This finding suggests that removing mercury from the health care sector has been and will continue to be a low priority for the Great Lakes states. Implementing the health care recommendations is generally a low priority due to the great success in the decade prior to development of the Phase-Down Strategy in reducing the use of mercury and improving mercury waste management in this sector. Moreover, many hospitals have assumed responsibility for reducing mercury in products and have institutionalized mercury reduction measures. Some states have banned mercury in health care uses. Although work remains to be done to remove mercury from clinics, doctor's offices, and veterinary facilities, it is not a high priority for states.

Five years after the Phase-Down Strategy was finalized in 2008, 58% of recommendations are currently in progress or have been completed across the Great Lakes states (279 of 480 recommendations, consisting of 60 recommendations to be implemented by 8 states), as shown in Table 1. Minnesota achieved the highest rate of implementation, with 48 of 60 (80%) recommendations either in progress or completed, followed by Michigan (67%) and New York (65%). The lowest percentages of implementation achieved by sector were for health care (25%); dental amalgam (42%); and switches, relays, and measurement and control devices (50%). The highest percentages of implementation achieved by sector were for thermometers (79%); households (71%); and schools (70%). Overall, the Great Lakes states have made significant progress in implementing the 60 recommendations in the Phase-Down Strategy, but many challenges remain in order to reach near-100% implementation.

Overcoming the challenges, such as limited resources and legislative obstacles, to successfully implement the remaining 42% of Phase-Down Strategy recommendations will require collaboration among the Great Lakes states and with other entities. Suggestions for continuing the progress achieved to date include:

- The Great Lakes Mercury in Products Phase-Down Implementation Workgroup should continue to meet periodically to share experiences and strategies and to track

progress in implementing the Phase-Down Strategy recommendations. The next progress report is scheduled to be submitted to the Council of Great Lakes Governors in two years (2015).

- States should share resources and model other states' successes. For example, by:
  - Tailoring products developed by one state for another state's use (mercury product legislation, phase-out plans for heavy industry, etc.),
  - Establishing industry-supported collection and recycling programs (like the Take Back The Light program in Ontario), and
  - Implementing rules that stop the introduction of new uses of mercury, similar to a proposed regulation in Canada to ban the manufacture, import, and sale of mercury-containing products.
- States should seek grant funding opportunities, for example through the GLRI, for mercury collection and recycling programs, outreach, staff and resources, research and development into mercury-free product alternatives, and other efforts that achieve the Phase-Down Strategy recommendations. Grant funding can help states to enhance ongoing programs, for example, by providing funds to offer incentives for auto switch removal.
- Participation in national or regional clearinghouse efforts (e.g., IMERC, Quicksilver Caucus) can facilitate states' mercury reduction efforts, such as implementing mercury product labeling requirements and discouraging the export of mercury collected from within a state's boundaries.

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APPENDIX A: SUMMARY OF RECOMMENDATIONS

Details of the Great Lakes states' progress in implementing the Phase-down Strategy recommendations are presented by product category or sector area in the order of greatest progress achieved to date. The numbered recommendations refer to the recommendations as presented in the original Phase-Down Strategy (Great Lakes Regional Collaboration, 2008).

Thermometers

5.5.3.1. Ban the sale and distribution of mercury fever thermometers except by prescription.

Ohio, Illinois, New York, and Wisconsin ban the sale and distribution of mercury fever thermometers except by prescription. Michigan bans mercury fever thermometers unless specified by a doctor's prescription. Minnesota bans mercury fever thermometer sales, including by prescription. Indiana also restricts the sale of mercury fever thermometers, but rather than a ban, mercury thermometers must be sold behind the pharmacy counter only.

Environment Canada published a proposed regulation on February 26, 2011 (which covers the Province of Ontario), to ban the manufacture, import, and sale of mercury-containing products. The purpose of this regulation is to reduce mercury releases from products to the lowest level possible. These products include thermometers. Please refer to the proposed regulation (http://www.gazette.gc.ca/rp-pr/p1/2011/2011-02-26/html/reg4-eng.html) for more details.

Pennsylvania has not begun to implement this recommendation.

5.5.3.2. Support funding and provide guidance for local thermometer exchange programs.

Michigan supported funding and provided guidance for local thermometer exchange programs, but that funding has expired. A few counties have continued the program at their own expense, but after numerous exchanges in the past, and with the state's ban on the sale of mercury thermometers now eight years old, the state believes this source of household mercury has been adequately addressed.

Minnesota and Wisconsin also previously had programs that have since been discontinued. In Minnesota, these programs were conducted by the local HHW programs and in some cases by pharmacies or health care providers, and they were considered successful by the level of participation and interest. Initially, the state provided the replacement non-mercury thermometers to the HHW programs. HHW programs around the state still conduct exchanges periodically as part of their outreach program when they have funds to purchase non-mercury thermometers.

Indiana, Ohio, and Illinois have ongoing implementation programs. However, most of Ohio's thermometer exchanges were discontinued in December 2010 with the end of Ohio's Bowling Green State University (BGSU) Elemental Mercury Collection and Reclamation Program. Ohio continues to provide guidance on how to hold thermometer exchanges, which can be held by other entities. Illinois' program utilizes HHW collections, which are limited due to budget

constraints. In Indiana, mercury thermometer exchanges have been held across the state, collecting over 8,000 mercury thermometers. Most of the thermometers collected in Indiana were exchanged for free digital thermometers provided through a cooperation of the task force, Eli Lilly, and Cinergy. Additionally, all counties in Indiana have had household collection programs in place since 1998, which collected over 2,100 pounds of mercury in the first few months and have collected 4,500 pounds total. Finally, Indiana has created a comprehensive education program, including brochures, posters, spill clean-up guidance and promotional items, but funding to this component has since been discontinued due to budget cuts.

In Ontario, Environment Canada and the Ontario Ministry of Environment piloted a mercury fever thermometer take-back program with participating retail pharmacies in Ottawa, London, and Thunder Bay from February 15 to March 15, 2002. The purpose of the program was to educate the public about mercury products in the home, recover and properly dispose of household mercury thermometers, and determine the feasibility of a national program. In addition, the Canadian Coalition for Green Health Care has held periodic thermometer exchanges in partnership with Ontario hospitals. One such exchange, a "Mercury Thermometer Round Up Day," was held in 2003. The Canadian Coalition for Green Health Care partnered with six Ontario hospitals to invite staff, patients' families and visitors to exchange their mercury thermometers from home or office with a digital thermometer.

New York and Pennsylvania do not have thermometer exchanges, but thermometer disposal is available through HHW collections.

5.5.3.3. Increase public awareness of the hazards of thermometer breakage and the appropriate cleanup techniques for household mercury spills through outreach mechanisms such as placing information brochures in doctors' offices and booths at county fairs as a supplement to online information.

Programs in Michigan, Illinois, Indiana, Ohio, and New York are ongoing. Michigan provides information that includes brochures and videos on two websites and provides workshop training for local health and fire departments or anyone interested in spill information. The workshops are limited to 2-4 per year. There are plans to develop a recorded tutorial or webinar on mercury spills and recycling in general. Indiana's website is regularly updated and includes information about cleanup techniques. However, Indiana has been unable to print brochures because of budget cuts. In Ohio, online information and fact sheets are available, and presentations are given upon request. All of New York's materials are available on its state websites.

Minnesota and Wisconsin previously had programs designed to increase public awareness of the hazards of thermometer breakage and appropriate cleanup techniques.

In Ontario, Environment Canada and the Ontario Ministry of Environment piloted a mercury fever thermometer take-back program with participating retail pharmacies in Ottawa, London, and Thunder Bay from February 15 to March 15, 2002. In addition to recovering and properly disposing of household mercury thermometers, the program sought to educate the public about mercury products in the home.

Pennsylvania has not begun to implement this recommendation but anticipates developing fact sheets that identify potential mercury sources in the home, the hazards associated with mishandled mercury, and tips for cleaning up spills, and will build on these outreach efforts over time.

Households

6.5.3.1. Educate the general public on mercury hazards and proper management.

All Great Lakes states have continuing programs focused on educating the public on mercury hazards and proper management of mercury-containing products. In Illinois and Wisconsin, public education is achieved through state websites. In Michigan, public education is accomplished through local programs, the Michigan Department of Environmental Quality, and Department of Community Health, as well as state and non-profit mercury websites. Michigan is also developing public service announcements for outreach on a variety of mercury issues.

In New York State, HHW collection programs are 50% grant funded by the state through its Environmental Protection Fund and cover the outreach materials to inform the public of the materials accepted at these events, which include all mercury-containing household items. While the grants require reporting, the amount of mercury collected is not usually separately reported.

Pennsylvania has a HHW program that provides 50% reimbursement to local governments sponsoring events for the collection, transportation, and recycling of HHW. Funding is supported by the state's Hazardous Sites Cleanup Fund. Currently, there are nearly 100 regularly scheduled HHW collection programs operating in the Commonwealth, and many of them include the collection of mercury-containing devices. In addition, through the Pennsylvania Department of Environmental Protection (DEP) Emergency Response office, Pennsylvania has had an ongoing program for door-to-door collection of elemental mercury since 1997. Trained staff from the Pennsylvania DEP's six regional offices schedule collections on an as-needed basis from homeowners and ensure that the mercury is properly recycled rather than disposed of in a municipal waste landfill.

Indiana's Mercury Awareness Program (MAP) was created in October 1998 as a joint effort with the Regional Household Hazardous Waste Task Force and Solid Waste Management Districts. October 1998 was declared Mercury Month in Indiana and was the start of the MAP. Indiana provided mercury recycling grants and set up a mercury hub system around the state for collecting and properly recycling mercury. Health and safety training was conducted, and posters, brochures, magnets, and other informational materials that identify sources of mercury around the household were distributed. In partnership with numerous organizations, mercury collection sites were established in every county of the state. Indiana's MAP provided funding for 75% of the cost of recycling mercury, mercury-containing products, and debris through a network of mercury hubs. Mercury collected through the seven local community and solid waste management district programs that served as hubs are recycled through a contractor. As of the end of fiscal year 2005, the MAP had recycled 6,296 pounds of mercury. House Enrolled Act 1901of 2002 (HEA 1901) added a new chapter to Indiana state law that requires solid waste management districts to implement public education on the reuse and recycling of mercury in mercury commodities and mercury-added products, effective July 1, 2001. The Indiana

Department of Environmental Management (DEM) provided financial and technical support to the districts for the implementation of the education and collection programs. However, funds are currently halted due to budget cuts.

Environment Canada maintains a "Mercury and the Environment" website (http://www.ec.gc.ca./mercure-mercury/) with information about environmental and health concerns related to mercury, mercury-containing products and their alternatives, and disposing of mercury-containing products. In addition, the thermometer Take Back and Round Up programs included an educational component with regard to mercury. The Take Back The Light program and associated retail drop-off opportunities also seek to educate the general public about the importance of proper handling and disposal of used mercury-containing lamps.

6.5.3.2. Ensure access to free collection of mercury and mercury-containing products for households.

All U.S. Great Lakes states and Ontario have ongoing programs to ensure access to free collection of mercury and mercury-containing products for households. In Illinois, one-day collection events have not been held in three years due to funding issues, but six one-day events are planned for 2012. Also in Illinois, the Illinois EPA provides some funding for three permanent collection locations in northern Illinois. In Indiana, the collection of mercury and mercury-containing products is not free in all circumstances. In Michigan, the state funds mercury collections at about 20 clean sweep sites, mostly HHW. Pending state budget impacts funding for this program is expected to continue. From 2001 to 2010, these sites collected over 111,634 mercury devices and 5,237 pounds of elemental mercury at a cost of less than $5,000 per year.

6.5.3.3. Implement legislation to ban the sale of mercury-added button cell batteries, including imported batteries, on a schedule consistent with the U.S. industry commitment to phase out mercury by 2011.

Ohio is the only state with a law to ban mercury-added button cell batteries, and it applies only to novelties. Indiana has some restrictions on mercury-added batteries, but they are not banned. They are also not specifically banned in New York, but New York has continued to pursue changes to existing mercury product law related to this recommendation. A bill to ban the sale of mercury-added button cell batteries was introduced in Illinois in 2012. At the time this report was written, the bill was proceeding through the Illinois General Assembly.

Environment Canada published a proposed regulation on February 26, 2011, to ban the manufacture, import, and sale of mercury-containing products. The purpose of this regulation is to reduce mercury releases from products to the lowest level possible. These products include batteries. Please refer to the proposed regulation (http://www.gazette.gc.ca/rp-pr/p1/2011/2011-02-26/html/reg4-eng.html) for more details.

Michigan, Minnesota, Pennsylvania, and Wisconsin have not begun to pursue legislation to ban the sale of mercury-added button cell batteries. As discussed in the Mercury in Products Phase-Down Strategy published in 2008, states and municipalities have chosen not to implement button

cell battery collection and recycling efforts. Cost effectiveness is a consideration, because of the small amount of mercury in each button cell. Safe storage of button cell batteries is also a concern. For these reasons, the Phase-Down Strategy did not recommend development of button cell battery collection programs.

Schools

6.1.3.1. Prohibit the purchase, use, and storage of elemental mercury, mercury compounds, and mercury-containing laboratory and medical equipment in schools.

Michigan and Minnesota prohibit the purchase, use, and storage of elemental mercury, mercury compounds, and mercury-containing laboratory and medical equipment in schools. Although mercury was banned from Michigan schools in 2004, it is still being discovered. All Michigan schools are allowed to dispose of mercury (excluding cleanup debris and lamps) for free through HHW or "Clean Sweep" collection programs.

In Minnesota, pre-kindergarten through grade 12 public and private schools, including vocational center schools, are advised annually of Minn. Stat § 121A.33 (which prohibits the purchase, use, and storage of elemental mercury and instruments that contain mercury) through the Minnesota Department of Education (MDE) Health and Safety Revenue Application materials. Only K-12 public school districts that have a board-adopted policy that is consistent with applicable environmental health and safety standards and state and federal requirements (including Minn. Stat. § 121A.33) are eligible to propose health and safety projects to MDE. Qualifying projects include hazardous waste management and remediation activities for the disposal of mercury. After a positive department review, MDE provides the authority for public school districts to receive Health and Safety Revenue through state aid (for qualifying districts) and local property tax levy. Minnesota Department of Health staff are available to perform mercury assessments in schools on request, and the Minnesota Pollution Control Agency (MPCA) provides guidance to schools searching for mercury and mercury-containing items in their facilities.

In 2001, Indiana restricted and in some instances banned the distribution, use, and disposal of mercury-containing products, including mercury commodities, mercury compounds, and other mercury-added instructional aids in primary and secondary classrooms. There are exceptions to Indiana's ban for measuring devices and thermometers for which no adequate substitute exists, as well as for thermostats and fluorescent lamps inside buildings.

Illinois bans the purchase or receipt of bulk elemental mercury, chemicals containing mercury compounds, and instructional equipment or materials containing mercury in their manufacture for use in a primary or secondary school classroom.

Ohio previously prohibited all of these activities, but the law prohibiting storage has since been rescinded and now only bans purchases. In 2005, Ohio passed Jarod's Law, a comprehensive law meant to protect schoolchildren from safety hazards. The law expanded the list of items requiring regular safety checks at public and private schools, both internally and externally. The law also included requirements for removing certain hazards, including mercury from classroom

settings. Ohio lawmakers voted to rescind the law in 2009 because of complaints that it was too burdensome and costly.

In Wisconsin, the ban of sales to schools and storage of mercury in schools applies only to K-12 institutions. New York also bans the use and purchase of elemental mercury in schools.

Environment Canada's proposed ban on the manufacture, import, and sale of mercury-containing products (see 5.5.3.1) would restrict the purchase of mercury-containing products by schools in Ontario.

While Pennsylvania has not banned the sale or use of mercury and mercury equipment in schools, Pennsylvania schools are taking steps to eliminate mercury from their campuses. For example, during the recently completed Chemical Management Training provided by the Pennsylvania DEP to teachers, administrators and building/grounds staff, all participants indicated that their respective school district has replaced mercury thermometers in laboratories and the teachers are eliminating mercury compounds from their chemical inventories because of the risks of mercury exposure. The Pennsylvania DEP is helping the schools to safely dispose of mercury items and substances through the School Chemical Cleanout Campaign.

6.1.3.2. Provide education/outreach regarding mercury spill management, health impacts, sources of exposure, handling, and disposal to school administrators, teachers, and students.

Minnesota and Wisconsin previously conducted outreach and education to schools. Minnesota MPCA staff educated K-12 students through the Mercury-Free Zone (MFZ) program from 2001 to 2009, when the program was terminated with no plans to reinstate it. Educational outreach is now conducted to elementary school students through several annual events focusing on water and natural resource conservation.

In Michigan, mercury education and outreach to schools are conducted through the state's department of community health. Outreach to Michigan schools was focused prior to the mercury ban in schools in 2004. Illinois conducted outreach through its Greening Schools Program, which ended in 2006 due to budget constraints.

Indiana, Ohio, and New York have ongoing education and outreach activities. In Indiana, school outreach is ongoing through the internet and conferences. In 2010 and 2011, Indiana conducted educational trainings to schools on how to properly dispose of chemicals, including mercury, from schools. Indiana is currently in discussions with partners to offer additional trainings. Additionally, Indiana is developing mercury spill cleanup guidance specific to schools and has several initiatives to reduce environmental health threats to children attending day care. Ohio offers a fact sheet and a guidance manual, and provides presentations on request. The Ohio Environmental Protection Agency (EPA) has also worked with USEPA to arrange for mercury spill response trainings. A significant amount of outreach and educational materials on mercury management issues has been developed in New York State through cooperation of the New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH). These materials are available online and were presented to schools through a statewide outreach and education series of workshops.

Pennsylvania has a broad initiative working with K-12 schools to reduce excess, out-of-date, and dangerous chemicals, including mercury. Pennsylvania is currently offering integrated chemical management training for high school teachers and administrators, and will continue funding chemical cleanouts (including mercury) at selected schools in summer 2013.

In Ontario, the Take Back The Light program began as a pilot in January 2007 with the Toronto District School Board (575 schools) with funding from the Ontario government. In addition to recycling used mercury-containing lamps, the Take Back The Light program seeks to educate participants about the importance of proper handling and disposal of used mercury-containing lamps. Many other school boards in Ontario are participants in the Take Back The Light program.

6.1.3.3. Provide education/outreach to college and university students majoring in education, particularly future science teachers.

Michigan began a program to provide education and outreach to college and university students majoring in education but later ended it due to lack of resources.

New York has not provided specific education/outreach to college and university students, but still intends to do so in the future.

Although Indiana does not have a formal program to pursue this goal, some education occurs through the Hoosier Association of Science Teachers, Inc. (HASTI).

Pennsylvania, in an effort to provide education and outreach to college and university students majoring in education (particularly the sciences), will be inviting those students to participate in Chemical Management Training to be offered by the Pennsylvania DEP in November 2012.

Minnesota, Ohio, Illinois, and Wisconsin have not begun to implement this recommendation. Ontario will take action as appropriate considering Ontario's priorities and federal actions.

6.1.3.4. Assist schools to eliminate mercury by:

- *Facilitating access to lower-cost management services, for instance by allowing schools free access to household hazardous waste collection programs*
- *Providing technical assistance for clean-outs*
- *Advocating the proper disposal of worn or broken mercury-containing gauges, switches, and relays (e.g., boiler gauges, thermostats). If replaced, new devices such as switches and relays should be mercury-free*
- *Ensuring the availability of a collection program for schools to dispose of unwanted chemicals, including mercury and mercury-containing equipment*

Facilitating access to lower-cost management services, for instance by allowing schools free access to household hazardous waste collection programs.

Pennsylvania, Indiana, New York, and Wisconsin also have ongoing programs that provide schools access to mercury collection programs.

The Ohio EPA helped to organize and support management through December 2010 by working in cooperation with Ohio's Elemental Mercury Collection program administered through BGSU. When BGSU discontinued their program, the Ohio EPA's Administration indicated that this activity would be managed by solid waste management districts in Ohio. The Ohio EPA continues to offer assistance in the case of a spill and to provide outreach materials and written guidance on how to manage mercury. Ohio state law prohibits K-12 schools from purchasing new mercury containing equipment and chemicals for classroom use.

Michigan allows schools to access HHW collections and provides assistance in getting support from USEPA. Minnesota utilizes the University of Minnesota's Chemical Safety Days disposal program for schools.

The Illinois Environmental Protection Agency is mandated by law to collect hazardous educational waste from schools for free. The program has been discontinued due to lack of funding.

In Ontario, the Take Back The Light program began as a pilot project in January 2007 with the Toronto District School Board (comprised of 575 schools) with funding from the Ontario government. The Take Back The Light program continues to provide a convenient way for schools to recycle mercury-containing lamp bulbs.

Providing technical assistance for clean-outs.

Technical assistance programs are in place for schools in Michigan, Pennsylvania, Ohio, New York, and Wisconsin. Schools were included in Wisconsin's Green Tier Charter program's outreach efforts, which eliminated a large portion of mercury from schools. Michigan accomplishes this recommendation through a staff member who provides support to schools for chemical cleanouts. The Ohio EPA continues to offer assistance for clean-ups. For non-spill chemical removal, as indicated, schools should contact their solid waste management district. For other cases, it is the school's responsibility to manage the spill.

Minnesota started its school mercury cleanout program, the MFZ program, in November of 2000. Originally, 33 schools were assessed to determine the amount of mercury and mercury-containing instruments each had on site. On average, more than two pounds of mercury were found in each school, either in storage containers or as a component of instruments. In 2001, the MPCA took the MFZ program statewide, offering building assessments for mercury, equipment exchanges, and education to schools that pledged to work toward the goals of the program. Pledging schools agreed to inventory their facilities for mercury and mercury-containing equipment, and some schools also elected to allow MPCA staff to search their buildings for mercury spills and unknown or hidden elemental mercury and mercury-containing chemicals and

equipment. During the assessments, MPCA staff used Clancy, a mercury-detecting dog, and a Lumex unit, an instrument that measures the amount of mercury in the air, with the understanding that any mercury spill that was found would be cleaned up and any mercury-containing equipment would be removed at the school's expense. The MPCA gave mercury-free barometers, thermometers, blood pressure units, and psychrometers to each school that agreed to recycle its mercury-containing equipment. Educational presentations about mercury and its dangers were also offered to the schools, and MPCA staff gave educational presentations to students and school staff during most site visits. Teachers were also given a mercury curriculum and an educational video. In addition, students were given educational brochures to share with their families. In 2007, the Minnesota Legislature passed a law banning mercury in all public and private pre-K through 12 schools, with the goal of having schools mercury free by the end of 2009. At that time, MFZ program staff undertook the "Get the Mercury Out Now!" effort, offering schools free disposal of their mercury and mercury-containing items, as well as free replacement mercury-free equipment. Clancy the dog was retired in December 2009, after assessing 330 schools. The MFZ program came to an end and was declared a success, having been instrumental in removing over a ton of mercury from Minnesota schools.

Indiana started the Mercury in Schools Pledge Program, in which K-12 schools conducted inventories of all their mercury-containing items and pledged to purchase non-mercury alternatives. The pledge also committed to a phase-out plan for existing mercury devices. In exchange, the local solid waste management districts accepted the mercury at no cost for proper recycling. At least 402 schools in Indiana took the pledge. The participating schools were then eligible for a complete laboratory clean out to remove old, unwanted chemicals from laboratories and to properly dispose of those items at no cost. This program has ended, and currently school outreach is ongoing through the internet and conferences.

Illinois needs funding to be restored to ensure continuation of its technical assistance program. Ontario will take action as appropriate considering Ontario's priorities and federal actions.

Advocating the proper disposal of worn or broken mercury-containing gauges, switches, and relays (e.g., boiler gauges, thermostats). If replaced, new devices such as switches and relays should be mercury-free.

New York and Wisconsin have ongoing implementation programs. In New York, the outreach and education program provided for schools by NYSDEC and NYSDOH, mentioned above under recommendation 6.1.3.2, provided this information and was funded by a grant administered through the NYSDOH. Additionally, New York now prohibits the sale of mercury-containing switches and relays, with some minor exceptions.

Indiana, Minnesota, and Michigan previously had programs that have ended. Michigan's program ended due to the state's ban on mercury in schools, which went into effect in 2004. Minnesota's MFZ program ended in 2009 for the same reason.

In Ohio, schools are legally responsible for correctly managing mercury-containing wastes as hazardous or universal waste. The Ohio EPA provides written guidance on managing mercury-containing materials at the end of their life. The Ohio EPA Division of Air Pollution Control,

Office of Compliance Assistance and Pollution Prevention (OCAPP) encourages schools to use mercury-free alternatives in its outreach materials.

Illinois and Pennsylvania have not begun to implement this recommendation. Ontario will take action as appropriate considering Ontario's priorities and federal actions.

Ensuring the availability of a collection program for schools to dispose of unwanted chemicals, including mercury and mercury-containing equipment.

Michigan, Indiana, New York, Minnesota, Pennsylvania, and Wisconsin have ongoing programs. In Wisconsin, schools may take advantage of the state's hazardous waste contract to manage mercury, which often provides a lower-cost option. Michigan has HHW sites open to schools, and Minnesota has a disposal program through the University of Minnesota's Chemical Safety Days Program (CSDP), which is funded by its participants (the generators). The chemicals are disposed of by CSDP at a reasonable cost of about $12 per kilogram or liter. As described above, qualifying districts may use Health and Safety Revenue for this purpose.

Pennsylvania has a broad initiative working with K-12 schools to reduce excess, out-of-date, and dangerous chemicals, including mercury. The Pennsylvania DEP is currently offering integrated chemical management training for high school teachers and administrators and will be funding chemical cleanouts (including mercury) at selected schools in summer 2012. In addition, through the Pennsylvania DEP's six regional offices, elemental mercury has been collected from schools since 1997. Trained Pennsylvania DEP staff schedule collections with school personnel on an as-needed basis and ensure that the mercury collected is properly recycled rather than disposed of in a municipal waste landfill.

Ohio's program, which was part of BGSU's elemental mercury collection program, was discontinued as of December 2010, and the state no longer provides free mercury collection.

Illinois cannot resume this activity without funding. Ontario will take action as appropriate considering Ontario's priorities and federal actions.

Steel Manufacturing, Scrap Metal Melting Facilities, and Scrap Yards

6.2.3.1. Facilitate proper recycling of auto mercury switches, consistent with state and federal law and regulations, including RCRA regulations and USEPA air emissions standards for steel producers, educate scrap recyclers about the need to remove mercury devices from autos and other equipment. State efforts should incorporate or complement the NVMSRP and should ensure that letters are sent to dismantlers about the need to recycle mercury switches and the advantages of participating in the NVMSRP.

The National Vehicle Mercury Switch Recovery Program (NVMSRP) was initiated in August 2006 through an agreement among vehicle manufacturers, steelmakers, vehicle dismantlers, auto shredders, brokers, the environmental community, state representatives, and USEPA. The program was designed to recover an estimated 40 million mercury-containing light switches from scrap vehicles by promoting a voluntary program and providing incentives for removal of mercury switches from automobiles at the end of life. In February 2008, the program collected

its millionth mercury-containing automotive switch, which represents more than 1 ton of mercury that has been removed from the environment. In July 2009, the program's voluntary incentive fund was depleted. Incentive payments continue in Illinois, where they are required by law, but have ceased in voluntary states, including all of the other Great Lakes states. All other aspects of the switch collection program continue, and participants are encouraged to continue removing switches. The program was originally scheduled to operate until the end of 2017, based on an estimate that approximately ten percent of installed vehicle mercury switches would remain on the road at that time. Cars are being driven longer due to the economic recession, so the "ten percent remaining on the road" milestone date will occur later than 2017 and the program may be extended. The NVMSRP continues to accept switches at no cost to participants, and with financial incentives in legislated states.

All U.S. Great Lakes states participate in the NVMSRP. Table 4 lists the number of mercury-containing switches recycled by state through the NVMSRP from 2006 through 2011. Illinois requires the removal of lighting switches prior to disposal of automobiles until January 2017, and there are also switch removal and handling requirements in Illinois' National Pollutant Discharge Elimination System (NPDES) general industrial permits.

New York requires that all mercury switches be removed from vehicles before the vehicles can be crushed or shredded. In addition, New York has proposed product stewardship legislation to require that manufacturers develop, implement, and fully fund a take back of mercury-containing components from vehicles.

Minnesota legislation (1995) requires "good faith effort" to remove all switches before a vehicle is crushed. Minnesota operated a salvage yard outreach and training program from 1994 to 2000 that covered vehicle switch removal and provided prepaid recycling containers to yards in 1999-2000. In addition, Minnesota's electric arc furnace facility educated its suppliers about vehicle mercury switches and operated its own switch collection and recycling program from around 1997 until 2007, when the national program was fully operational.

From 2001 to 2005, Wisconsin initiated a voluntary mercury switch recycling program with the auto and scrap recycling industry under a grant from the USEPA Great Lakes National Program Office (GLNPO). While the key intent was to recover automotive mercury switches, auto and scrap recyclers were allowed to contribute any mercury containing device generated by the activities at their operations. The voluntary effort resulted in an estimated 100,000 switches recovered in the 4-year period. In addition, the variety of mercury-containing devices collected was an indication that the sector provided a means to recover much more than just automotive switches. In 2006, the Wisconsin Department of Natural Resources (DNR) began working with the sector to move its efforts to the national program established as the NMVSRP.

In Ohio, outreach for compliance continues through the air permitting program.

Michigan's state grant partnerships ended in 2005, although outreach for compliance through air permits continues in the state. Michigan's partnership with the auto recycler association remains strong. Michigan issued articles on mercury auto switch recycling which were shared with the auto recycler and dealers associations and posted within the state's Environmental Bulletin. On

March 13, 2012, letters were issued to the 290 Michigan sites registered with End of Life Vehicle Solutions (ELVS). The goal was to increase recycling and reduce the number of sites that never recycled switches (205).

Indiana received a State Innovation Grant that ensures that auto salvage recyclers understand the need to remove mercury switches from vehicles prior to crushing and disposal. The grant also provides auto salvage recyclers with the tools and resources necessary for proper removal, management, and recycling of mercury-containing switches. As of 2006, motor vehicle recyclers in Indiana are required to remove all mercury switches from each end-of-life vehicle they receive.

Ontario's Switch Out programs, described in 5.3.3.1 and 5.3.3.3, also apply to this recommendation. The Canadian Steel Producers Association (CSPA) and Canadian Vehicle Manufacturers Association (CVMA) are jointly supporting the Switch Out program to remove mercury from steel scrap. As a further commitment to environmental performance improvements, CSPA member companies have adopted a policy to require that all steel mill scrap is mercury free. All member companies have voluntarily included these new requirements in their scrap purchasing policies. Scrap suppliers are required to demonstrate that they have programs in place to identify, remove, track, and properly dispose of all sources of mercury in the scrap sold to CSPA member companies. Additionally, Environment Canada published a Pollution Prevention Notice for Mercury Switches in End-of-Life Vehicles in 2007. It requires participation in a national switch management program until 2017. Mercury switches have not been used in vehicles in Canada since 2003.

Table 4. Vehicle Mercury-Containing Switches Recycled by State, 2006 to 2011

State	IL	IN	MI	MN	NY	OH	PA	WI
Number of Switches Recycled	198,273	139,541	223,452	240,739	360,229	141,817	91,006	197,541

Source: http://www.eqonline.com/Services-We-Provide/Recycling/ELVS-Mercury-Switch-Program.aspx

6.2.3.2. Conduct outreach to steel mills and iron foundries designed to encourage participation in the NVMSRP.

In 2006, the Wisconsin DNR began working with the iron and steel sector to move its efforts to the national program established as the NVMSRP.

Michigan conducted a major outreach effort to steel mills in 2006. Pennsylvania, Indiana, Ohio, Ontario, and Minnesota have ongoing outreach activities. Current activities in Ohio are performed by the Ohio EPA's OCAPP. Steel mills and foundries must certify that the steel scrap that they use is mercury-free to meet Maximum Achievable Control Technology (MACT) requirements. OCAPP in previous years sent letters to the steel mills to encourage and remind them that they needed to certify their scrap was mercury-free and the best way to do this was by removing mercury switches, etc. from vehicles prior to crushing and shredding. Minnesota began working with its electric arc furnace facility in 1994 to promote switch removal in the supply chain, conduct a facility mercury mass balance, and estimate emissions and releases.

Indiana conducted most of its outreach activities in the late 1990s and early 2000s, and now requires that all mercury switches be removed from each end-of-life vehicle. Ontario's Switch Out program, described in 5.3.3.3, also fulfills this recommendation. Additionally, Environment Canada published a Pollution Prevention Notice for mercury switches in End-of-Life vehicles in 2007. It requires participation in a national switch management program until 2017.

Illinois and New York have not begun to implement this recommendation.

6.2.3.3. In addition, states should consider programs or legislation to ensure continued achievement of auto switch recycling goals after the expiration of the three-year implementation fund for providing incentives for switch removal under the NVMSRP.

Illinois has extended its auto switch recycling law through January 1, 2017, and also has switch removal and handling requirements in its NPDES general industrial permit. Indiana has also completed this recommendation through the requirement that auto mercury switches be recycled.

Minnesota and New York have implemented laws requiring the removal and management of mercury-containing components from vehicles, appliances, and other products that are likely to end up in steel scrap. New York also passed legislation in 2006 that limits the quantity of mercury in vehicle components to 15 mg and has proposed product stewardship requirements for all mercury-added components from vehicles.

Ontario's Switch Out program, described in 5.3.3.3, addresses this recommendation, as does Environment Canada's Pollution Prevention Notice, described in 6.2.3.2.

Indiana requires motor vehicle recyclers to remove all mercury switches from end-of-life vehicles as they are received. Indiana pays a bounty of $3 per mercury switch recycled under the program, and also pays $5 for each anti-lock brake system (ABS) sensor recycled under the program. As of fiscal year 2011, 19,000 switches and 1,000 ABS sensors had been removed in Indiana.

Michigan, Ohio, Pennsylvania, and Wisconsin have not begun to implement this recommendation.

6.2.3.4. In addition, states should consider laws requiring the removal and proper management of all mercury-containing components from vehicles, appliances, and other products that are likely to end up in steel scrap. For example, states may use stormwater permit authority to regulate removal and management.

Minnesota and New York have implemented laws requiring the removal and management of mercury-containing components from vehicles, appliances, and other products that are likely to end up in steel scrap. Minnesota also includes those requirements in stormwater permits for Sector M and N facilities.

Illinois and Indiana have requirements for removing mercury from products, with Indiana's applying to vehicles only. Indiana requires motor vehicle recyclers to remove mercury switches from end-of-life vehicles, as described in 6.2.3.3. Illinois' requirement is for appliances only.

Michigan and Wisconsin have not implemented any laws, but Michigan has developed a mercury brochure that stormwater staff can distribute during site inspections to encourage mercury switch removal and participation in ELVS. Wisconsin continues voluntary efforts to remove mercury from products that are likely to end up in steel scrap.

In Canada, a Final Notice requiring the preparation and implementation of Pollution Prevention (P2) Plans with respect to mercury releases from mercury switches in end-of-life vehicles processed by steel mills was published in the *Canada Gazette* Part I in December 2007. The P2 Notice requires targeted vehicle manufacturers and steel mills to prepare and implement P2 Plans to reduce mercury releases from the mercury switches in end-of-life vehicles. The targeted companies must consider the participation of each vehicle manufacturer for 15 years after the last model year in which mercury switches were installed, and it requires the participation of targeted steel mills until December 31, 2017. The P2 Notice also requires that a P2 Plan be prepared by June 2008 and implemented by December 2011. Canadian steel mills are asked to develop a purchasing policy that requires that end-of-life steel purchased has had the accessible mercury switches removed. In addition, some Ontario municipalities have included mercury switch removal service in their "white goods" programs (i.e., home appliance disposal).

Ohio and Pennsylvania have not begun to implement this recommendation.

Thermostats

5.2.3.1. Implement state-wide bans on sale and/or distribution of mercury thermostats.

Michigan, Pennsylvania, Ohio, Illinois, Minnesota, and Wisconsin have banned the sale and/or distribution of mercury thermostats. New York recently revised its Mercury-Added Consumers Product law to ban mercury thermostats except for the blind or visually impaired.

In lieu of legislation, Indiana operates a voluntary thermostat reduction and recycling program.

Environment Canada published a proposed regulation on February 26, 2011, to ban the manufacture, import, and sale of mercury-containing products. The purpose of this regulation is to reduce mercury releases from products to the lowest level possible. These products include thermostats. Please refer to the proposed regulation (http://www.gazette.gc.ca/rp-pr/p1/2011/2011-02-26/html/reg4-eng.html) for more details.

5.2.3.2. Mandate collection and proper management of mercury-containing thermostats at the end of the product's life.

In states that mandate collection and management at the end of the product's life, thermostat manufacturers are required to develop and maintain a collection program for managing the thermostats. Manufacturers use the TRC to manage the collection program. TRC was founded as a non-profit organization by three thermostat manufacturers in the late 1990s to manage out-

of-service mercury thermostats. TRC currently consists of 30 manufacturers. The TRC program is available in the 48 contiguous states. The TRC program is open to wholesalers, large urban contractors, rural contractors, and HHW programs. For more information on the TRC program, see www.thermostat-recycle.org.

Illinois, Minnesota, and Pennsylvania mandate the collection and management of mercury-containing thermostats at the end of the product's life. These states also prohibit the disposal of mercury thermostats in solid waste and heating, ventilation, and air conditioning (HVAC) units. Contractors in Illinois and Minnesota are required to recycle all mercury thermostats that they remove from service. Illinois requires only thermostat wholesalers to act as collection locations. HHW collection facilities, retailers and some units of local government may serve as collection locations in Illinois. There is a one-time fee for each collection bin. Out-of-service thermostats are taken to these collection locations. Containers are shipped to Honeywell's facility in Golden Valley, Minnesota, for recycling. TRC pays for shipping and management of the thermostats and for recycling the mercury. Illinois' disposal ban and recycling requirements went into effect July 1, 2011. Approximately 7,200 thermostats were collected in 2011, which is an increase of approximately 2,300 over the number collected in 2010. In Minnesota, the TRC program operates primarily through wholesalers. Most of the state's HHW programs are enrolled in TRC, and some larger contractors are also enrolled. Minnesota relies on TRC to report thermostat collection data. In Pennsylvania, the TRC recovered 133.21 pounds of mercury from 14,411 intact mercury thermostats and 623 mercury switches in 2011, achieving a 52% increase over 2010 totals. In addition, thermostat collections in Pennsylvania have increased 97% since implementation of state-mandated collections began in 2009.

In Wisconsin, the collection and disposal of thermostats is regulated in various municipalities but not statewide. Many contractors and wholesalers in the state participate in the TRC program.

Programs in Ontario, New York, Ohio, Michigan, and Indiana fulfill some portions of this recommendation, but because they are not mandatory, they are not considered complete. This is not to indicate that voluntary programs are not effective or useful, only that they do not comply with the specifics of this recommendation. For Ontario's status, see the description listed in 5.2.3.5. New York prohibits the disposal of mercury thermostats and supports the inclusion of these products in HHW collections and through the TRC program. Additionally, there are two legislative proposals in New York to require product stewardship for mercury thermostats. The Ohio EPA does not have a mandate for the collection of thermostats. The Ohio EPA is encouraging solid waste management districts to collect household thermostats, including the use of the TRC. Indiana has a voluntary thermostat reduction and recycling program, which also includes the use of the TRC.

As an alternative to this recommendation, Michigan issued a $50,000 grant in 2009 designed to increase voluntary thermostat collection. The funding source was Michigan's Community P2 grant, which is funded by money left unclaimed under the state's bottle deposit law. This grant is used to assist community recycling and other P2 efforts. Before the program began, the state had 16 participating locations, and the total annual collection averaged about 3,000 thermostats per year. There are now about 80 sites that continue to dramatically increase collections each year. In 2011, Michigan collected over 15,939 units, which is equivalent to 131.7 pounds of

mercury. The grant focus is on outreach and funds to pay for the initial "bucket fee" of $25. The grant will end in 2013. To make the program as sustainable as possible, the grantee, Michigan Energy Options, created a website (www.michiganenergyoptions.org) that lists the collection sites so even residents or retailers can participate. Although funding for the direct outreach and bucket fees will end when the grant funding ends, participation will continue to be "encouraged" through site postings on the website. Some relatively new efforts may also help with sustainability. Outreach has begun to encourage collections by municipalities and demolition contractors addressing blight control, landfills controlling mercury inputs, and utility companies promoting energy efficiency incentives. In addition, Michigan encourages the use of the TRC.

5.2.3.3. Require manufacturers or wholesalers to offer financial and/or non-financial incentives to motivate consumers and contractors to collect and return mercury thermostats for recycling.

Illinois, Indiana, Ohio, Pennsylvania, Michigan, Minnesota, New York, and Wisconsin participate in the TRC program for thermostat recycling. The TRC program offers a non-financial incentive by providing a system that is free and convenient to wholesalers, contractors, and HHW programs. While participation in the TRC program is not required, some manufacturers use it to meet state requirements for recycling programs.

Minnesota's thermostat law requires manufacturers to "provide incentives for and sufficient information to purchasers and consumers of the thermostats for the purchasers or consumers to ensure that mercury in thermostats being removed from service is reused or recycled." However, the law does not require the manufacturers to meet any recovery goals or provide a mechanism for increasing recovery by providing additional financial or non-financial incentives. Illinois requires manufacturers to establish a collection and recycling program and can require manufacturers to offer incentives in the future if the state's collection goals are not met, with reviews in 2013, 2015, and 2017.

New York has introduced two separate product stewardship proposals in its legislature to require thermostat manufacturers to fund and implement take-back collection and recycling of mercury thermostats.

In October 2010, Ontario announced that its industry-funded waste diversion program for mercury-bearing wastes (Municipal Hazardous or Special Waste (MHSW) Program) was being discontinued. These wastes were removed from the program as of October 1, 2012.

Pennsylvania requires retail outlets to post notice of mercury thermostat recycling locations, which is an incentive to the consumer.

5.2.3.4. Promote the use of Energy Star qualified programmable thermostats.

Michigan, Pennsylvania, Indiana, and Ohio have ongoing actions promoting Energy Star programmable thermostats. Michigan's promotion of Energy Star qualified programmable thermostats is based upon the grant discussed under 5.2.3.2. Michigan has about six Energy Demonstration Centers where the public can tour and see energy efficiency and renewable energy applications in use. These are non-profit organizations that receive partial funding from

the state's energy office. The thermostat grantee, Michigan Energy Options, is one of these centers. They routinely promote Energy Star-rated products and will continue to do so after the thermostat grant ends in 2013. Pennsylvania's thermostat law encourages the use of Energy Star programmable thermostats but does not require active promotion of them. In Indiana, Energy Star programmable thermostats were promoted through Indiana's Office of Energy Development, including tax credits in 2010. Ohio promotes the use of Energy Star programs in newsletters, web pages, and presentations.

New York had a program, but it is no longer in operation due to program costs and state fiscal priorities. In Illinois and Minnesota, Energy Star thermostats are promoted through public and private energy efficiency programs.

In Ontario, "saveONenergy" conservation programs for home and business are designed to make it easier to manage electricity use. These programs are offered through Ontario's local electric utilities and funded through the Ontario Power Authority, which is an agency of the Ontario government. The "saveONenergy" website (www.saveonenergy.ca) includes information on installing and using programmable thermostats to save energy.

Wisconsin has not begun to implement this recommendation.

5.2.3.5. Increase awareness of recycling options by encouraging do-it-yourselfers as well as HVAC building contractors to return thermostats to Thermostat Recycling Corporation (TRC) or other collection centers.

Michigan, Pennsylvania, Illinois, Ohio, Minnesota, Ontario, and Wisconsin have implemented programs to increase awareness of thermostat recycling options. Michigan conducted a statewide outreach program to HVAC contractors throughout 2010 and 2011. Through a grant initiated in 2009, as discussed under 5.2.3.2, Michigan operates a thermostat collection program for HVAC building contractors throughout the state. When the grant funding ends in 2013, the grantee has agreed to continue to maintain the program's website, which includes educational materials developed under the grant.

Illinois and Pennsylvania have passed legislation that requires thermostat manufacturers to establish collection programs for contractor and consumer-generated mercury thermostats. All HVAC wholesale distributors with facilities in Illinois and Pennsylvania are required to act as collection points for waste mercury thermostats. TRC enables HVAC wholesale distributors, thermostat retailers, and HVAC contractors to easily comply with Illinois and Pennsylvania law. Over 100 TRC collection locations in Illinois and over 250 TRC collection locations in Pennsylvania currently accept mercury-containing thermostats. Illinois mailed letters to thermostat wholesale distributors and HVAC contractors in May and June 2011 to make them aware of their requirements. Illinois is also visiting some thermostat wholesalers to make sure they are aware of their responsibilities to act as collection locations (under Illinois law), and to make sure they have the materials needed for collection locations. Letters were sent to contractors and state weatherization programs making them aware of the state's thermostat disposal ban and recycling opportunities. Illinois is considering working with industry trade associations, electric utilities, and local housing authorities to educate contractors.

In Ohio, regional solid waste management districts collect and recycle thermostats from do-it-yourselfers and HVAC building contractors. Minnesota promotes a program to thermostat wholesalers through direct telephone communication with wholesalers on a regular basis. Minnesota has been communicating with thermostat wholesalers to promote participation in the TRC program, and the state is currently developing outreach to contractors to remind them of the state's thermostat disposal ban and recycling requirement. However, Minnesota has had difficulty identifying contractors for the purpose of issuing a mailing. Minnesota is also considering how to replicate parts or all of Indiana's successful voluntary thermostat recycling program (discussed below).

In Canada, Summerhill Impact, a Canadian environmental not-for-profit organization, manages Switch the 'Stat (www.switchthestat.ca), a residential and commercial thermostat exchange program. Switch the 'Stat is administered in partnership with the Heating, Refrigeration, and Air Conditioning Institute (HRAI) of Canada and their member contractors, and it is also supported by Canadian Institute of Plumbing & Heating. Contractors encourage the installation of energy-efficient programmable thermostats while simultaneously recovering older mercury-containing thermostats. Since the launch of the project in April 2006, over 45,000 thermostats (containing approximately 179 kg of mercury) have been collected in Ontario and British Columbia. The program was recently extended to Manitoba. The public can also search the Switch the 'Stat website for addresses of closest drop off locations. The mercury-containing thermostats are transported to Aevitas Inc. (formerly Fluorescent Lamp Recyclers) for recycling. Switch the 'Stat is funded by the manufacturers and distributors that sell and/or import or have historically sold and/or imported mercury-containing thermostats into Canada.

As noted above under recommendation 5.2.3.1, Indiana operates a voluntary thermostat reduction and recycling program, in lieu of legislation. In the winter of 1996, a Mercury Thermostat Reduction and Recycling Program was developed in Indiana for the heating, ventilation, air conditioning and refrigeration (HVAC-R) industry. As part of the program, HVAC-R contractors and suppliers agreed to a pledge indicating the company's commitment to protecting customers and the environment from the dangers of mercury. Participating suppliers and contractors recycled mercury thermostats through the free program offered by the TRC. Approximately 200 HVAC-R contractors and 50 HVAC-R suppliers participated in this voluntary program. Although the voluntary program ended in 2007, HVAC-R suppliers and contractors throughout the state continue to participate in the TRC program. From 1998 to 2007, Indiana suppliers and contractors recycled approximately 36,980 thermostats containing a total of approximately 333 pounds of elemental mercury.

New York's efforts to increase awareness of recycling options for thermostats specifically have been discontinued. New York has previously informed HVAC contractors about the TRC program through letter correspondence, but due to a lack of resources, the state was not able to measure the success of the effort. Outreach to homeowners/do-it-yourselfers is provided through HHW collection programs.

5.2.3.6. Include thermostat collection in HHW collections, potentially in partnership with TRC.

Ohio, Michigan, Indiana, Illinois, Minnesota, Pennsylvania, New York, and Wisconsin include thermostat collection in HHW collection programs. In Ohio, thermostat collections are conducted through regional solid waste management districts (all mercury-containing products are considered hazardous waste). Before 2010, HHW thermostat collections were tracked and disposed of separately from TRC and funded by a separate Community P2 grant. Annually, they collected a total of about 800 thermostats. Since 2010, most HHW sites have enrolled in the TRC program and maintain collection buckets. From 2000 to 2009, Michigan HHWs collected 4,431 mercury thermostats and sent them for disposal or recycling. These are not included in the TRC totals for the state. HHW collections since 2010 are being sent to TRC and are included in the state total. TRC notes that Michigan collected 43,439 thermostats between when the pilot program began in 1998 through December 31, 2010. Adding in the previous HHW collections, Michigan has collected 47,870 mercury thermostats. In Indiana, approximately 36,980 thermostats have been recycled, containing about 333 pounds of elemental mercury. Statewide outreach in Michigan is being done to HVAC contractors from 2010 through 2013 via a GLRI grant and state funding. In Illinois, HHW programs are encouraged to participate in TRC. Illinois does not track the number of thermostats collected through HHW programs, only mercury waste in aggregate. In Wisconsin, it is up to the individual communities to include thermostat collection in community clean sweeps.

In Ontario and some other parts of Canada, the Switch the ‘Stat program is available to collect residential and commercial thermostats (see 5.2.3.5). In addition, the MHSW program accepted mercury-containing wastes, such as thermostats, discarded in the residential stream and small quantities in the business stream until September 30, 2012. On October 1, 2012, these wastes were no longer included in the MHSW program, and the provincial government is providing funding to municipalities for the continued collection and management of six wastes, including mercury-containing thermostats, for a 3-year period.

5.2.3.7. Encourage retailers to offer collection program, if available, or in partnership with state.

Indiana previously had programs to encourage retailers to offer thermostat collection. In Indiana, many retailers voluntarily collect thermostats.

In Pennsylvania, HVAC contractors and retailers are required to either participate as collection points or provide notice to customers that recycling of mercury thermostats is required under state law and identify nearby collection locations.

Michigan initially had a few retailers participating, but none are believed to remain active due to the concern about spill liability. With the expansion of contractors accepting thermostats, retailers can refer other contractor or residential contacts to the website www.michiganenergyoptions.org to find a collection near them. This website was created as part of the grant discussed under recommendation 5.2.3.2. Also, Michigan has issued a grant to increase voluntary thermostat collections, which ends in 2013.

Minnesota has participated in the Product Stewardship Institute (PSI) and other discussions with national retailers, but those efforts have not resulted in the development of retailer collection programs. TRC has also been hesitant to establish retail collection programs for a variety of reasons, including employee training, collection site safety, and concerns about the other items being put into the TRC bins.

New York is proposing to complete this recommendation through a product stewardship program that will be designed, implemented, and funded by thermostat manufacturers.

In general, Ontario encourages retailers and contractors to collect mercury-containing devices, such as thermostats, for recycling.

Illinois, Ohio, and Wisconsin have not begun to implement this recommendation.

Lamps

5.4.3.1. Require recycling of mercury-containing lamps by all generators (except households) regardless of whether lamps are TCLP compliant.

All U.S. Great Lakes states except Illinois, Michigan, and Indiana require recycling of all mercury-containing lamps, with the exception of household lamps in some cases. Minnesota law prohibits disposal and requires recycling of household lamps as well as all business lamps. In Ohio and Wisconsin, households are exempt, but recycling is encouraged. Additionally, in Ohio, businesses must manage fluorescent lamps as a universal waste or possible hazardous waste unless they are recycled, and most lamps are recycled in the state. New York law prohibits disposal by all entities but small businesses and households. New York has also worked with hardware chains, including Ace, True Value, Lowe's, and Home Depot, to encourage and promote their voluntary collection programs and proper management of mercury-containing lamps. New York has also proposed product stewardship take-back legislation that would require manufacturers to develop, implement, and fully fund a statewide mercury-containing lamp collection and management program. On a voluntary basis, some retailers, such as Home Depot, accept CFLs (but not commercial tube fluorescent lamps) for recycling nationally.

In Indiana and Michigan, bulb recycling is not required but is encouraged. Both states reduce the regulatory burden for recycled mercury and related materials under universal waste regulations. If a company in either state chooses not to recycle bulk mercury, mercury-containing lamps or any mercury-containing device, the company must comply with more stringent hazardous waste handling, storage and disposal requirements. This approach is intended to facilitate increased recycling of mercury-containing lamps and other devices.

Environment Canada is considering approaches to help manage the recycling and disposal of CFLs and ensure that the mercury will be managed in an environmentally sound manner. In Ontario, the Recycling Council of Ontario manages a fluorescent lamp stewardship program called Take Back The Light that works with both sellers and buyers of fluorescent lamps in the institutional, commercial, and industrial sectors. The program offers the convenience of having new lamps delivered at the same time as spent lamps are removed. The goal of the program is to

recover and recycle 10 million fluorescent lamps by 2012 in Ontario. A total of 2,392,579 fluorescent lamps had been recycled as of July 2011.[1]

5.4.3.2. Work with household hazardous waste programs, utilities, retailers, manufacturers and others to provide collection of small quantities of spent fluorescent bulbs, and work with these stakeholders to consider regulatory programs for households and small businesses and others who need to dispose of and programmatic options for increasing lamp recycling from households and small businesses.

All nine Great Lakes states have ongoing programs to collect spent fluorescent bulbs from households and small businesses. Ohio, Michigan, Pennsylvania, New York, and Indiana are working through HHW programs. Ohio's BGSU Elemental Mercury Collection and Reclamation Program was discontinued in December 2010 due to the retirement of the program's manager and champion, as well as the subsequent change in the university's priorities. The Ohio EPA's division of Material and Waste Management expects the state's solid waste management districts to take over residential mercury waste management through HHW programs. In operation since 1998, the Elemental Mercury Collection and Reclamation Program at BGSU offered free collection and recycling of uncontaminated elemental mercury that is present in a variety of devices, as well as individual containers of elemental mercury. In addition to HHW programs, Michigan's Energy Office has both funded CFL collections through energy demonstration centers and encouraged collections by utility companies.

Illinois has worked with electric utility companies and hardware stores. New York continues to pursue legislation that would ban the disposal of mercury-containing lamps from all households and small businesses, since they are presently exempt from New York's disposal ban, and would require manufacturers to establish a product stewardship program that fully funds and implements a statewide take-back program for these products at the end of their useful life. The Wisconsin DNR's Hazardous Waste program works with the Public Service Commission through the Focus on Energy program as well as county governments through clean sweeps and retailers to recycle fluorescent bulbs.

Minnesota law requires large electric utilities to promote and support lamp recycling for households and small businesses, and it also encourages other utilities to do so. Utilities promote and support a collection and recycling program operated through small/independent retail hardware stores by a lamp recycler located in the state. Utilities also promote and support HHW programs in their service areas. Most of Minnesota's HHW programs provide event, seasonal, or year-round lamp collection.

In Ontario, Canadian Tire has partnered with the Take Back The Light program (see 5.4.3.1) and offers a recycling program that will accept standard and specialty CFLs, fluorescent tubes, incandescent bulbs, and other types of bulbs. All of its stores in Ontario are offering this free service to all residents and small businesses. Additionally, other Ontario retailers, such as Rona and IKEA, accept spent mercury-containing lamps from their customers for recycling, but their programs are not associated with the Take Back The Light program. Finally, the MHSW program accepted mercury-containing wastes such as fluorescent bulbs, discarded in the

[1] Take Back The Light 2010. http://www.takebackthelight.ca/.

residential stream and small quantities in the business stream, until September 30, 2012. On October 1, 2012, these wastes were no longer allowed to be included in the MHSW program, and the provincial government provided funding to municipalities for the continued collection and management of six wastes, including fluorescent bulbs, for a 3-year period.

5.4.3.3. Ban the sale of mercury lamps for which adequate energy-efficient, mercury-free alternatives are available, such as car headlights, while providing an exception for replacement parts.

No states have implemented bans on the sale of mercury lamps for which efficient mercury-free alternatives are available. Illinois pursued legislation banning the sale of mercury lamps in automobiles, but it did not pass the legislature.

In Canada, by 2006, the Canada-Wide Standard (CWS) for mercury-containing lamps had resulted in a decrease in the mercury content of all types of lamps (fluorescent, compact fluorescent and high-intensity discharge lamps) sold in Canada by Electro-Federation Canada members by nearly 82% from the base year of 1990. Additionally, Environment Canada published a proposed regulation on February 26, 2011, to prohibit the manufacture, import, and sale of mercury-containing products. The purpose of this regulation is to reduce mercury releases from products to the lowest level possible. However, essential products with no viable alternatives, such as lamps, would be exempt, but with content limits that could not be exceeded, and labeling requirements. Please refer to the proposed regulation (http://www.gazette.gc.ca/rp-pr/p1/2011/2011-02-26/html/reg4-eng.html) for more details.

5.4.3.4. Require permits for the use of drum top crushers in order to ensure that only those that meet emissions requirements are used. States can do this by classifying crushing as treatment of hazardous waste or universal waste, or by regulating it under their state air quality standards.

All Great Lakes states regulate drum top crushers through either hazardous waste rules or air permits. Only Michigan requires an air permit for drum top crushers. All other states have classified crushing as treatment of hazardous waste.

New York considers crushing of hazardous waste lamps to be treatment of a hazardous waste. A facility that treats hazardous waste in New York must obtain a Treatment, Storage, and Disposal Facility (TSDF) permit unless they meet the requirements for an exemption from permitting. Exemptions in New York's regulation 6 NYCRR 373-1.1(d) are similar to federal exemptions contained in 40 CFR 264 and 265, although New York has more stringent requirements in some cases. One exemption that is frequently claimed for bulb crushers is 6 NYCRR 373-1.1(d)(1)(viii), which may apply if the crushing is the beginning of a recycling process.

In Minnesota, lamp crushing by the generator/handler is considered hazardous waste treatment as specified in the federal universal waste rule. Crushers are not allowed except under a full hazardous waste TSDF permit and there are no provisions for exemption or exception. In 2003, the Minnesota Department of Health released a Health Consultation on a Drum-Top Bulb Crusher Demonstration. A link to the report can be found on this webpage: http://www.health.state.mn.us/divs/eh/hazardous/topics/mercury/bulbs.html.

In Ontario, drum top crushers require approvals before they can be installed and operated, but there is no predetermined emission limit. Approval is issued if the estimated emission levels for all contaminants comply with the air standards based on dispersion modeling for the proposed site.

Heavy Industry

6.3.3.1. Conduct outreach to heavy industry to promote mercury reduction projects, focusing on sectors within the state that use significant amounts of mercury.

Ohio and Minnesota have completed outreach programs to heavy industry. Michigan has ongoing outreach to targeted industries with surface water or waste water treatment plant (WWTP) discharge permits. Pennsylvania also has ongoing outreach activities. As a requirement for variance in Wisconsin NPDES permits, WWTPs must conduct outreach to industry to reduce mercury loads and meet mercury effluent levels.

In September 1998, three northwest Indiana steel mills—Bethlehem Steel Burns Harbor, Ispat Inland Inc. Indiana Harbor Works, and U.S. Steel Gary Works—signed a voluntary agreement with the Lake Michigan Forum, USEPA, and the Indiana DEM to reduce the use of mercury at their facilities. As a result of lessons learned from the mercury reduction effort, the Forum published *A Guide to Mercury Reduction in Industrial and Commercial Settings* in June 2001 for distribution to steel facility suppliers and other interested parties.

Ontario's Switch Out program, described in 5.3.3.3, includes both the automotive and steel sectors.

Illinois and New York have not begun to implement this recommendation.

6.3.3.2. Promote the development of industry mercury-containing equipment phase-out plans. The plans should include:

- *Purchasing policies that avoid mercury-containing devices where feasible and appropriate,*
- *Internal inventories of mercury and mercury-containing devices, and*
- *Measures to ensure proper disposal of these devices at end of life, including labeling of equipment that incorporates mercury-containing devices.*

Ohio previously had programs, which are no longer ongoing, for all three components of this regulation, plus the recommendation as a whole. The Ohio EPA gave presentations, sent out letters, and worked with industry stakeholders on this recommendation. Minnesota also previously promoted the development of phase-out plans targeted to several industry sectors, but the program has been superseded by the agency's mercury Total Maximum Daily Load (TMDL) implementation plan.

Michigan continues to promote the development of phase-out plans for mercury-containing equipment, targeting industries with surface water or WWTP discharge permits. New York's

existing laws already require labeling of any mercury-containing products sold in the state and prohibit many of the mercury-containing products that are used by heavy industry, including switches, relays, thermometers, thermostats, and other measurement devices.

Illinois, Indiana, Pennsylvania, and Wisconsin have not begun to implement this recommendation. Ontario will take action as appropriate considering Ontario's priorities and federal actions.

6.3.3.3. Work with wastewater treatment authorities to encourage large volume users of commodity chemicals to routinely obtain certificates of analysis for these chemicals and, in cases where mercury contamination is a problem, to procure lower-mercury chemicals.

Michigan, Minnesota, and Ohio currently have programs working toward this recommendation. Ohio has very conservative mercury water limits. Publicly Owned Treatment Works (POTWs) in the state that pursue mercury variances must perform a mercury pollutant minimization program. Trainings have been offered to POTWs. Michigan's program is similar. POTWs that have regulated mercury discharges must develop mercury minimization plans that require identifying the source of the mercury. Confirmed mercury sources must eliminate the discharge, which is usually accomplished by utilizing mercury-free alternative chemicals.

In 1994, in Minnesota, after finding excessive mercury in influent from a paper mill to the Western Lake Superior Sanitary District's (WLSSD's) wastewater treatment plant in Duluth, the district worked with the University of Minnesota – Duluth and the company to find the source, which turned out to be a feedstock chemical. The excessive amounts of mercury were easily removed by switching to a different source of the feedstock chemical. The WLSSD developed a "certificate of analysis" for companies to use for their suppliers. In 1995, the MPCA responded by advising certain permittees in the Lake Superior basin to request certificates of analysis from their chemical suppliers. In 1996, the agency also identified all the boilers in the Lake Superior basin and surveyed a small group of boiler operators. In 2000, the MPCA completed a report on Mercury Grade Caustic Soda containing recommendations for possible state and federal actions to reduce mercury from the use of caustic soda or feedstock chemicals made with caustic soda. More recently, the City of Hibbing will be required to investigate a commercial laundry for mercury contamination as part of their NPDES permit. WLSSD's Blueprint for Mercury Elimination has additional information on mercury in caustic soda, commercial laundry chemicals such as bleach, and how to prepare a certificate of analysis at www.wlssd.com/WLSSD_Blueprint_Mercury_Reduction.pdf.pdf.

Through a grant from USEPA Region 5, Indiana developed materials and held training workshops for POTWs and industry that have NPDES permits that are affected by mercury limits. The materials assisted regulated entities with meeting requirements in their Mercury Pollutant Minimization Plan. Information is available on the web at: http://www.in.gov/idem/your_environment/mercury/potw/.

Illinois, New York, Pennsylvania, and Wisconsin have not begun to implement this recommendation. Ontario will take action as appropriate considering Ontario's priorities and federal actions.

Cross-Cutting Strategies

7.1.1. Adopt legislation that phases out the sale of mercury-added products no later than 2015, with exceptions for fluorescent lamps and dental amalgam, and a mechanism to allow for use of a mercury device when a suitable alternative is not available.

Beginning November 1, 2010, Wisconsin banned the sale of the following mercury-containing devices:

- Fever thermometers, unless prescribed by a practitioner
- Manometers of the type used in milking machines on dairy farms
- Thermostats
- Instruments or measuring devices (unless required under federal law or the only mercury-added component is a button cell battery), including:
  - Barometers
  - Esophageal dilators, etc.
  - Flowmeters
  - Hydrometers
  - Hygrometers/psychrometers
  - Other manometers
  - Pyrometers
  - Sphygmomanometers
- Mercury switches and relays (individually or as a product component, unless that component in a larger product is in use prior to the effective date of the ban)
- Household items, unless the only component is a button cell battery, including:
  - Toys or games
  - Jewelry
  - Clothing or shoes
  - Over-the-counter pharmaceuticals for human use
  - Cosmetic, toiletry, and fragrance products

Illinois' laws ban the same mercury-containing devices as Wisconsin, in addition to cosmetics, wheel weights, rings, bearings, pressure transducers, and sensors. Minnesota law prohibits the sale of most categories of mercury products. Minnesota may accept an approved exemption from a sale prohibition in another state that is a member of a multistate clearinghouse.

Indiana has implemented a ban that applies only to novelties. New York has just recently expanded its mercury products ban to include thermostats, thermometers, flame sensors, wetted relays, and sphygmomanometers.

Michigan banned the sale and sometimes the use of mercury-containing thermometers, thermostats, blood pressure devices, esophageal dilators, and bougie and gastrointestinal tubes. Michigan's attempts to create legislation for other products have failed.

Minnesota law prohibits the sale of most categories of mercury products. Minnesota may accept an approved exemption from a sale prohibition in another state that is a member of a multistate clearinghouse.

In Ohio, the sale of mercury-containing thermometers, wall thermostats, and batteries in novelty items is banned.

Environment Canada published a proposed regulation in the *Canada Gazette* Part I on February 26, 2011. The proposed regulation prohibits the import, manufacture, and sale of mercury-added products. It contains exemptions for essential products that do not currently have viable alternatives, such as fluorescent lamps and dental amalgam.

Pennsylvania has not begun to implement this recommendation.

7.2.1. Provide significant additional support, funding and staff for existing and new state and local mercury reduction activities.

Illinois has significantly increased support, funding, and staff for thermostat and dental amalgam programs. The Illinois EPA and Illinois State Dental Society are implementing a Memorandum of Understanding (MOU) to promote use of amalgam separators and other best management practices in dental facilities. Michigan has obtained a USEPA GLRI grant that will fund several mercury efforts. The grant focus is on eliminating mercury in wastewater and scrap metal. A major project is the installation of dental amalgam separators. This grant provides incentives of $300 per separator, and the fund is expected to be exhausted in less than one year. Through this grant, over 850 separators will be installed that would not have been installed otherwise until 2014. Most of the remaining projects are primarily outreach to increase removal, collection, and recycling of mercury equipment from, for example, white goods recycling, building demolition, POTW operations, the boating industry, and auto switches.

In 1997, Wisconsin established a "sector specialist" to work with key sectors on voluntary waste reduction activities. The sector specialist assigned to the auto and scrap recycling industry was vital in helping to establish the network between government and industry that ultimately led to one of the leading voluntary mercury switch recovery efforts in the U.S. It is important to note that the auto and scrap industry in Wisconsin is represented by two key organizations that played a significant role in helping with outreach activities and membership participation in the voluntary switch recovery programs.

Minnesota has a statewide mercury TMDL that has been approved by USEPA. The state has a TMDL implementation plan that includes a comprehensive multimedia approach to reductions in all types of mercury releases, including product use, disposal and recycling.

Indiana previously provided significant additional support through grants to conduct education on mercury in CFLs. However, due to state budget cuts, these grants have been eliminated.

New York, Ohio, and Pennsylvania have not begun to implement this recommendation. Ontario will take action as appropriate considering Ontario's priorities and federal actions.

7.2.2. Consider targeting research and development funding toward mercury-free alternatives to products.

Indiana previously had programs working toward this recommendation, but they were halted due to state budget cuts. The remaining Great Lakes states have not begun to implement this recommendation.

7.3.1. Implement and enforce mercury product labeling requirements.

Minnesota has implemented a law with mercury product labeling requirements, and its enforcement is ongoing. Minnesota's law is descriptive, not prescriptive, and it is not interpreted or implemented through regulation. Minnesota's law is as follows:

MN Mercury product labeling legislation, Minn. Stat. § 116.92, subd. 3

§ 116.92 MERCURY EMISSIONS REDUCTION.

Subd. 3. **Labeling; products containing mercury.**

(a) A manufacturer or wholesaler may not sell and a retailer may not knowingly sell any of the following items in this state that contain mercury unless the item is labeled in a manner to clearly inform a purchaser or consumer that mercury is present in the item and that the item may not be placed in the garbage until the mercury is removed and reused, recycled, or otherwise managed to ensure that it does not become part of solid waste or wastewater:
  (1) a thermostat or thermometer;
  (2) an electric switch, individually or as part of another product, other than a motor vehicle;
  (3) an appliance;
  (4) a medical or scientific instrument;
  (5) an electric relay or other electrical device;
  (6) a fluorescent or high-intensity discharge lamp, individually or as part of another product; and
  (7) laboratory chemicals, reagents, fixatives, and electrodes.

(b) Labeling of items in accordance with mercury product labeling plans approved by another state that is a member of the Interstate Mercury Education and Reduction Clearinghouse (IMERC) shall be considered to be in compliance with this section. The manufacturer shall provide a copy of the labeling plan to the agency and shall notify the agency if the approval is modified.

(c) Manufacturers of products that contain a mercury-containing lamp not intended to be replaceable by the user or consumer shall meet the product labeling requirements of this section by placing the label on the product or in the care and use manual or product instructions.

Attempts to pass legislation in Michigan have so far failed but may be attempted again in the future. New York legislation requiring mercury product labeling and clarifying regulations are under development.

A proposed regulation on products containing mercury was published in Canada on February 26, 2011. This proposed regulation included labeling requirements so that consumers are informed about the presence of mercury, safe handling procedures, measures to take in case of accidental breakage, and options available for disposal and recycling.

Ohio, Illinois, Indiana, Pennsylvania, and Wisconsin have not begun to implement this recommendation.

7.4.1. Implement mercury product notification requirements.

In 2004, New York adopted legislation that requires manufacturers to notify the state if any mercury-containing products are sold or offered for sale into the state. New York implements this requirement through its participation with IMERC since a number of IMERC states have the same or similar requirements regarding manufacturer notification.

In Michigan, legislation to implement this recommendation failed to pass the state legislature. Minnesota does not have mercury product notification requirements but is a member of IMERC.

Illinois, Indiana, Ohio, Pennsylvania, and Wisconsin have not begun to implement this recommendation.

7.4.2. Participate in national or regional clearinghouse efforts for coordination on mercury product stewardship initiatives.

Michigan, Indiana, Illinois, New York, and Minnesota are participating in national and regional clearinghouse efforts for coordination on mercury product stewardship initiatives. Illinois, Michigan, and Minnesota participate in IMERC, PSI, Toxics in Packaging Clearinghouse (TPCH), and the Quicksilver Caucus. Michigan's participation in IMERC is through a grant until 2012. New York participates in IMERC, PSI, Product Policy Institute (PPI), TPCH, and the New York Product Stewardship Council (NYPSC).

Ohio, Pennsylvania, and Wisconsin have not begun to implement this recommendation. Ontario will take action as appropriate considering Ontario's priorities and federal actions.

7.6.1. Continue providing education on proper disposal of mercury-containing products and continue providing collection programs at the local level that accept any type of mercury or mercury-containing product.

Michigan, Indiana, Wisconsin, Pennsylvania, Minnesota, Ohio, and New York have ongoing educational efforts. Michigan's program is conducted through its website and at HHW and cleansweep collection sites. Michigan is also partnering with Michigan State University to provide public service announcements for several media outlets. In Indiana, educational information continues to be available on the Indiana DEM's website, but due to state budget cuts, grants supporting collection programs have been halted. Wisconsin also provides education via its website. Pennsylvania provides education through the state's website, as well as through its HHW collection events (described under recommendation 6.5.3.1). Minnesota provides

information on its website and provides technical and outreach support to the state's HHW programs, which educate residents about mercury products, mercury-free alternatives, and management options through the HHW Education Toolkit.

Illinois provides education via websites and in conjunction with HHW collection events, although the frequency of HHW collection events has decreased recently due to funding issues.

In Ontario, the MHSW program accepted mercury-containing wastes, such as thermostats, switches, measuring devices, and fluorescent bulbs, discarded in the residential stream and small quantities in the business stream, until September 30, 2012. On October 1, 2012, these wastes were no longer included in the MHSW program, and the provincial government is providing funding to municipalities for the continued collection and management of six wastes, including mercury-containing wastes, for a 3-year period.

7.6.2. Support extended producer responsibility approaches in the development of voluntary end-of-life management programs and consider mandatory manufacturer funded take-back programs for mercury-containing products, where feasible and appropriate.

Effective July 1, 2009, the Indiana Electronic Waste Program requires manufacturers of computers, laptops, and televisions (video display devices or VDDs) to collect and recycle (or arrange for collection and recycling) of at least 60% of VDDs they manufacture and sell to households, public schools, and small businesses within the state.

Illinois is a full member of the PSI, which is a national non-profit group that works with stakeholders (e.g., manufacturers, retailers, federal/state/ local governments, environmental groups) to reduce health and environmental impacts of products, mainly through end-of-life management. Illinois enacted the Thermostat Collection Act in 2010, which requires thermostat manufacturers to create and maintain a program for collecting and recycling out-of-service mercury thermostats. Thermostat wholesale distributors must act as collection locations. In addition, Illinois bans the disposal of mercury thermostats in solid waste. Illinois also passed product stewardship laws for computer collection that established a statewide system for recycling and/or reusing computers, monitors, televisions, printers, electronic keyboards, facsimile machines, videocassette records, portable digital music players with memory capability and battery power, digital video disc players and recorders, video game consoles, electronic mice, scanners, digital converter boxes, cable receivers, satellite receivers, and small-scale servers sold at retail by requiring electronic manufacturers to participate in the management of discarded and unwanted electronic products.

Michigan's Electronic Waste Takeback Program was established in 2008 and requires manufacturers to provide free recycling for computer and TV wastes.

New York supports this recommendation through PSI, PPI, and NYPSC efforts and has proposed several mercury-containing product stewardship laws. In addition, New York recently updated its state solid waste management plan, entitled "Beyond Waste," to include product stewardship as one of the main initiatives for future efforts to reduce and manage many problem waste products/ materials, including all mercury-containing product categories.

Wisconsin's electronics recycling law took effect on January 1, 2010, when manufacturers of certain consumer electronics were required to collect and recycle electronics from Wisconsin household and schools under the E-Cycle Wisconsin program. Beginning September 1, 2010, certain electronics, including televisions, computers, printers, fax machines, VCRs and DVD players, could no longer be put in the trash or sent to landfills and incinerators in Wisconsin.

Minnesota's Electronic Recycling Act took effect on July 1, 2007. Manufacturers are responsible for recycling 80% of the weight of VDDs sold to Minnesota households. VDDs include television and computer monitors, including laptop computers that contain a cathode-ray tube (CRT) or a flat panel screen with a screen size that is greater than nine inches measured diagonally and that is marketed by manufacturers for use by households. To meet their obligation, manufacturers work with registered collectors and recyclers to purchase Minnesota household covered electronic devices, which includes VDDs. Manufacturers, collectors, and recyclers report and register annually. Minnesota has a landfill ban on CRTs and mercury containing devices, including VDDs.

Environment Canada is currently analyzing approaches for the environmentally sound management of end-of-life mercury-containing lamps.

Pennsylvania's Mercury-Free Thermostat Act (Act No 97), which was signed into law on October 9, 2008, requires manufacturers of mercury thermostats that have been sold in Pennsylvania to establish and maintain a collection and recycling program for out-of-service mercury thermostats from wholesalers, contractors, retailers, service technicians, and homeowners. The Pennsylvania DEP also participates in the NVMSRP.

Ohio has not begun to implement this recommendation.

7.6.3. Design end-of-life management programs to ensure that product users are made aware of the program and its operating requirements; are motivated to participate via monetary or other incentives; and have convenient and easy access to collection services or sites.

Minnesota, Illinois, New York, and Indiana have ongoing programs to support end-of-life management of products. In Minnesota, mercury thermostat and relay manufacturers are responsible for end-of-life management of their products, and the state periodically communicates with manufacturers to remind them of their obligations and request program updates. Electronics manufacturers in Minnesota are responsible for recycling 80% of the weight of VDDs sold to Minnesota households. They work with registered collectors and recyclers to purchase eligible pounds to meet their obligation and report this data annually to the Minnesota Department of Revenue. Manufacturers also register annually and pay a registration fee based upon sales from the previous program year. The MPCA maintains an updated list of electronics collectors and recyclers on the agency website for households and businesses to locate e-waste collection services and sites.

The vehicle mercury switch program in Illinois includes a $2 switch recovery incentive payment. In addition, if thermostat collection goals are not met, Illinois can require mercury thermostat

manufacturers to provide incentives for collecting mercury thermostats. In New York, this recommendation is supported through NYPSC's efforts.

Michigan has conducted outreach to dealerships and recyclers about mercury auto switches. Michigan is also developing outreach materials for white goods repair and recycling facilities, POTWs, the boating industry, demolition contractors, and others.

Ohio, Pennsylvania, and Wisconsin have not begun to implement this recommendation.

7.7.1. Adopt state purchasing policies that ensure purchase of non-mercury products where appropriate—where such products are available and equivalent in performance.

Michigan has adopted state purchasing policies that ensure the purchase of non-mercury products where appropriate.

Minnesota and New York are working to implement this recommendation. Minnesota incorporates mercury disclosure and mercury-related purchasing specifications in Requests for Proposals (RFPs) and state purchasing contracts when new RFPs are issued by the state. In New York, a review has been underway for the past few years to green the state's purchasing program. This effort has included the review of several product categories, including some mercury-containing products. These revised purchasing specifications reflect the bans or prohibited sale of certain mercury-containing products and include the consideration of collection programs for mercury-containing products that are still allowed to be purchased in New York, such as mercury-containing lamps.

Where applicable, ministries of the Ontario government consider environmentally responsible alternatives, such as bio-based or recycled content alternatives; energy, fuel or water efficient alternatives; or reduced toxin alternatives. Additionally, as noted in other parts of this report, the Ontario Ministry of the Environment funded both the pilot study and the program development of Take Back The Light. The Ontario government has committed to full participation in Take Back The Light, which was formed on the principles of green procurement.

Illinois, Indiana, Ohio, Pennsylvania, and Wisconsin have not begun to implement this recommendation.

7.7.2. Adopt policies to ensure that mercury in state-owned facilities is managed properly at end-of-life.

New York, Michigan, and Minnesota have ongoing programs to ensure that mercury in state-owned facilities is managed properly at end-of-life. Michigan's program covers only lamps. The lamps are collected from remote buildings and recycled centrally at the state's cost. Minnesota has two state contracts covering mercury lamps and other mercury wastes that all state agencies must use. HHW programs must also use them if they want state indemnification for liability. Agencies are responsible for the costs of managing their wastes under those contracts. Other units of government that are part of the Cooperative Purchasing Venture may use the contracts.

Where applicable, ministries of the Ontario government take measures to ensure that mercury in government facilities is managed properly at end-of life. For instance, the Ontario Ministry of the Environment has reduced the amount mercury in its laboratory and manages all of its laboratory wastes as hazardous waste in accordance with Ontario's legislation. Additionally, as noted in other parts of this report, the Ontario Ministry of the Environment funded both the pilot study and the program development of Take Back The Light. The Ontario government has committed to full participation in Take Back The Light, which is designed to function advantageously for lamp manufacturers, distributors, and end users.

Illinois, Indiana, Ohio, Pennsylvania, and Wisconsin have not begun to implement this recommendation.

7.8.1. States should periodically check on what happens to mercury collected from within their boundaries. If it turns out that substantial quantities of mercury or mercury-containing products are being shipped overseas, states should adopt measures to discourage this practice.

Michigan, Minnesota, Illinois, New York, and Wisconsin are active through the Quicksilver Caucus to help accomplish this recommendation. As of January 2013, mercury export will be banned from all states by the U.S. Mercury Export Ban Act of 2008.

Indiana, Ohio, and Pennsylvania have not begun to implement this recommendation. Ontario will take action as appropriate considering Ontario's priorities and federal actions.

7.10.1. States should share their expertise on methods of mercury reduction.

Michigan, New York, Ohio, Illinois, Minnesota, Wisconsin, Pennsylvania, and Indiana share their expertise on mercury reduction through the Quicksilver Caucus, IMERC, PSI, and local product stewardship organizations. The states also share information through meetings, websites, and conferences. Illinois, Minnesota, and New York also share information and expertise through participation in TPCH. New York also shares its expertise through the PPI and NYPSC.

Canada shares information through its Mercury and the Environment website, conferences, meetings, and international forums such as the United Nations Environment Programme (UNEP) and the Heavy Metals Protocol of the Convention on the Long-range Transboundary of Air Pollution (LRTAP).

8.1. Great Lake state environmental agencies, Great Lakes Tribes (or tribal organizations), the Great Lakes and St. Lawrence Cities Initiative, and the USEPA should appoint a representative to a workgroup tasked with tracking progress on implementation of recommendations of the GLRC.

All U.S. Great Lakes states have representatives on the Great Lakes Mercury in Products Phase-Down Implementation Workgroup. Ontario and Environment Canada also have representatives.

Great Lakes Tribes and the Great Lakes and St. Lawrence Cities Initiatives were invited but are not currently participating in the Workgroup.

8.2. We further recommend that each of the Great Lakes state environmental agencies and Great Lakes Tribes (or Tribal organizations) and the Great Lakes and St. Lawrence Cities Initiative publicly identify its implementation priorities and the organizations responsible for achieving them.

Ohio, New York, Minnesota, and Michigan have identified their implementation priorities. In Ohio, legislation that passed in 2007 addressed priorities. New York has further identified mercury-containing products as a major priority under their Beyond Waste Plan to pursue product stewardship programs. Minnesota's mercury reduction activities and priorities are identified in the statewide Mercury TMDL. Additional information is available at:

- Michigan's Mercury Strategy Staff Report: www.michigan.gov/deq/0,1607,7-135-3307-184041--,00.html
- Minnesota Mercury TMDL page: http://www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/phosphorus-and-mercury-issues/statewide-mercury-tmdl-pollutant-reduction-plan.html
- Minnesota Mercury TMDL Implementation page: http://www.pca.state.mn.us/index.php/topics/mercury/minnesota-s-plan-to-reduce-mercury-releases-by-2025.html?menuid=&redirect=1.

Indiana has not determined if one recommendation is a higher priority than another. Indiana evaluates each recommendation and how it ties into the resources and other program area's priorities based on funded and unfunded mandates that are already in place.

Illinois, Pennsylvania, and Wisconsin have not begun to implement this recommendation. Ontario will take action as appropriate considering Ontario's priorities and federal actions.

Switches, Relays, and Measurement and Control Devices

5.3.3.1. Implement legislation to phase out the sale and distribution of electrical switches and relays and measurement and control devices, including thermometers.

Illinois, Indiana, Michigan, Minnesota, New York, Wisconsin, and Ohio have implemented legislation banning the sale and distribution of mercury fever thermometers. Illinois and Michigan ban all mercury thermometers, including laboratory and industrial thermometers, unless required by state or federal law. The exemption is intended to refer to requirements issued by USEPA and American Society for Testing and Materials (ASTM), as well as other analytical or monitoring method requirements that specify mercury thermometers. Minnesota bans all mercury thermometer sales, including by prescription; however, Minnesota law has limited exemptions for certain replacement parts for which a non-mercury thermometer is not available and for primary calibration standards for which a non-mercury thermometer is not approved for the application by the National Institute of Standards and Technology (NIST). New York recently revised its Mercury-Added Consumer Product Law, which now includes a

ban for mercury thermometers starting January 1, 2012. Indiana's legislation (IC 13-20-17.5-3) bans mercury-added thermometers and certain other devices with some exceptions.

Illinois, Minnesota, New York, and Wisconsin have also banned the sale of switches, relays, and measurement devices containing mercury. In 2011, Illinois added mercury pressure transducers, seals, sensors, and rings to its list of banned products. A ban on the sale, distribution, and use of mercury wheel weights went into effect in Illinois on January 1, 2012. Mercury seals are used in motors for deep well pumps and deep drinking water wells. Minnesota and Ohio include measurement devices in their bans. Minnesota also bans the sale and installation of mercury manometers, and New York bans the sale of mercury manometers. Michigan, Minnesota, and New York banned mercury sphygmomanometers. Michigan banned mercury use in other medical equipment but has failed in repeated attempts to ban mercury switches or relays in general. Wisconsin bans the sale of mercury fever thermometers (unless prescribed), as well as relays and other measurement devices containing mercury. Minnesota banned the sale of diostats, or mercury flame sensors, used in gas-fired ovens and similar products.

Environment Canada published a proposed regulation on February 26, 2011, to ban the manufacture, import, and sale of mercury-containing products. The purpose of this regulation is to reduce mercury releases from products to the lowest level possible. These products include switches and relays. Please refer to the proposed regulation (http://www.gazette.gc.ca/rp-pr/p1/2011/2011-02-26/html/reg4-eng.html) for more details.

Pennsylvania has not begun to implement this recommendation.

5.3.3.2. Develop product labeling requirements to promote proper management of products and products that are exempted from the phase-out.

Minnesota law requires the labeling of mercury products that continue to be sold in the state. The package and product must be labeled to inform the consumer of the presence of mercury and the disposal ban at the time of purchase and at the time of disposal. This typically means that the package and the product must be clearly labeled, the component(s) must be identified, and sales and promotional literature must also make the disclosure.

New York still needs to develop regulations as required under its Mercury-Added Consumer Products Law. However, New York is currently using IMERC labeling plans to determine if manufacturers are in compliance with the state's labeling legislation.

A proposed regulation was published in Canada on February 26, 2011, to prohibit or limit mercury levels in mercury-containing products. This regulation would include labeling requirements so that consumers are informed about the presence of mercury, safe handling procedures, measures to take in case of accidental breakage, and options available for disposal and recycling. Please refer to the proposed regulation (http://www.gazette.gc.ca/rp-pr/p1/2011/2011-02-26/html/reg4-eng.html) for more details.

Michigan's attempts to pass legislation related to this recommendation have failed. Illinois, Indiana, Ohio, Pennsylvania, and Wisconsin have not begun to implement this recommendation.

5.3.3.3. Conduct outreach to users of equipment that contains mercury switches to notify them of proper end-of-life disposal and identify alternative mercury-free products.

Minnesota continues to implement this recommendation and to provide mercury product and alternative information to consumers through the regional HHW programs and Minnesota's Living Green program. Indiana, Ohio, and New York had past programs that are no longer ongoing. Efforts by New York to update or provide further outreach and educational materials beyond the materials already placed on the NYSDEC website have ended due to a lack of staff resources. However, New York continues to participate in IMERC to provide some outreach and education on alternatives.

Michigan issued articles on mercury auto switch recycling, which were shared with the auto recycler and dealers associations and posted within the state's Environmental Bulletin. More outreach efforts aimed at white goods repairs and other users is planned for 2011-2012.

In Canada, Summerhill Impact operates a national program, Switch Out, designed to remove, collect and manage mercury-containing convenience lighting switches and ABS sensor modules in end-of-life vehicles before they are flattened, shredded and recycled into new steel. This program is funded and supported by Canada's steel and automotive industries through the CSPA and CVMA. It currently works in partnership with the Automotive Recyclers of Canada (ARC) and the Canadian Association of Recycling Industries (CARI) to deliver Switch Out to all provinces and territories in Canada. All recyclers and dismantlers in Canada are encouraged to join this program (http://www.switchout.ca). The Switch Out program works directly with automotive recyclers and dismantlers and also provides training materials and educational resources to them.

Illinois, Pennsylvania, and Wisconsin have not begun to implement this recommendation.

5.3.3.4. Encourage national and international standard-setting bodies to establish standards that utilize non-mercury technology for measuring devices

Minnesota is encouraging national and international standard-setting bodies to establish standards that utilize non-mercury technology for measuring devices. Michigan is working with the Quicksilver Caucus while New York, Illinois, and Minnesota are working with the Quicksilver Caucus and IMERC on this recommendation.

Through the Quicksilver Caucus, the states are encouraging and supporting USEPA's efforts to eliminate national mercury thermometer requirements and participate in international discussions. Information on USEPA's effort is available at www.epa.gov/hg/thermometer.htm.

Indiana, Ohio, Pennsylvania, and Wisconsin have not begun to implement this recommendation. Ontario will take action as appropriate considering Ontario's priorities and federal actions.

5.3.3.5. Provide dairy farms with information on cost-effective, non-mercury-containing gauges, and on proper management options available for disposal of mercury manometers. Seek funding initiatives to assist dairy farmers in the removal of mercury manometers, including manometers no longer in use. Continue to include and promote the collection of dairy manometers and other mercury-containing devices in HHW and "Clean Sweep" programs.

Michigan and Minnesota have provided dairy farms with information about non-mercury-containing gauges and options for disposal of mercury manometers. A 1997 Minnesota law required the removal of all dairy mercury manometers by December 31, 2000. The state provided free recycling/disposal of the mercury manometers and financial assistance for the purchase of non-mercury devices. The program was administered by the Dairy Division of the Department of Agriculture. Michigan's outreach occurred in 2000, and its Department of Agriculture believes that approximately 95% of mercury was collected from those sites.

New York allows dairy farmers to include unwanted dairy manometers in its "Clean Sweeps" collection program for unused/unwanted pesticides. This program rotates among counties of the state over several years, is funded from penalties collected through pesticide management violations, and provides the collection and proper end-of-life management of the materials collected. Annual reporting is provided through the contracting for this program, and in addition to the pesticides collected, a few hundred pounds of mercury are usually collected per year.

In 2005, the Wisconsin DNR's Dairy Mercury Manometer Replacement project focused on contacting the remaining 46 farms in the Lake Michigan Drainage Basin that still may have a mercury manometer on site. The project collected a total of 532 mercury manometers, which equates to the removal of 400 pounds of mercury from Wisconsin dairy farms. Ohio conducted outreach to dairy farms in 2001 but offered no financial incentives.

Dairy Farmers of Ontario confirm that mercury manometers have long since been replaced with analog or digital gauges. The current Canadian Quality Milk (CQM) standard does not allow any mercury temperature or manometer gauges in milk houses. All Ontario dairy producers have to be CQM compliant in the next couple of years. Thus, the use of mercury-containing equipment in the dairy industry in Ontario is no longer a concern.

Pennsylvania currently does not conduct outreach specifically to dairy farmers, but the Pennsylvania DEP includes dairy farmers in door-to-door elemental mercury collections on an as-requested basis. Pennsylvania's collections ensure that the collected mercury is properly recycled rather than disposed of in a municipal waste landfill.

Illinois and Indiana have not begun to implement this recommendation.

Dental Amalgam

5.1.3.1. Require dental offices that place or remove amalgam to implement ADA BMPs including separator installation.

Michigan passed legislation that requires separator installations and implementation of BMPs. The pending rules incorporate the American Dental Association's (ADA's) BMPs. These

requirements are not effective until December 31, 2013, but some dentists have already started complying. Michigan was awarded an USEPA grant from the GLRI to provide incentives to dentists that install separators. Under this program alone, 870 separators were installed by March 1, 2012. Michigan is concerned that dentists in rural locations, who generally use septic systems, will remain in violation of state ground water discharge laws, even with the separator requirement.

In Minnesota, the state dental association and the Twin Cities area wastewater authority Metropolitan Council Environmental Services reached an agreement in 2002 calling for all dental practices to install approved amalgam separators and take other actions to minimize release of dental mercury. In 2007, the MPCA signed an MOU with the state's dental association. The MOU includes a goal that 100% of dental offices will install and maintain approved amalgam separators and adhere to established best practices.

New York began requiring dental amalgam separators to be installed in new dental facilities on May 12, 2006. The requirement was phased in to existing dental facilities through May 12, 2008.

In Canada, Environment Canada published a Notice in the *Canada Gazette* Part I regarding Pollution Prevention (P2) planning with respect to mercury releases from dental amalgam waste. The P2 Notice requires targeted dental facilities, which had not yet implemented best management practices (BMPs), to prepare and implement P2 plans. The BMPs include, but are not limited to: installing an ISO-certified or equivalent amalgam separator; contacting a waste carrier for recycling or disposal of the amalgam waste; staying abreast of advances in restorative materials; and avoiding the disposal of amalgam waste in the trash, down the drain, in the sharps container, or with bio-medical wastes. These facilities must consider implementing BMPs to reduce mercury releases to the environment in order to contribute to a 95% national reduction in mercury releases from dental amalgam waste relative to a base year of 2000.

In Ontario, as a result of implementation of Regulation 205/94 – General under the Dentistry Act, 1991, 100% of dentists in Ontario had installed amalgam separators by October 2008 to capture waste mercury (98% of dentists had already complied in 2006). The Regulation also requires dentists to comply with the Standard of Practice of the Profession for Amalgam Waste Disposal. The Royal College of Dental Surgeons of Ontario monitors compliance with the Regulation. In addition to the actions of the provincial government, several municipalities in Ontario such as Toronto, Ottawa, and North Bay have proactively passed bylaws that address mercury releases from dental clinics.

The Ohio Dental Association (ODA) announced the creation of its Good Dedicated to Environmental Excellence in Dentistry (DEED) program on May 31, 2010. The Good DEED program uses a tiered approach for recognizing dental offices that minimize the environmental impact of their practices on Ohio's environment. Participants receive certificates from the ODA designating the tier for which they qualify. The Gold tier recognizes dentists that meet Ohio's environmental regulations and have incorporated the ADA's BMPs, including the installation of amalgam separators. The Gold and Green tiers recognize dental offices that are pursuing additional environmentally sustainable activities. The Ohio EPA maintains support information,

including a web page that tracks participation, at http://epa.ohio.gov/ocapp/mercury_reduction_dental.aspx. As of June 1, 2011, 67 dentists from 25 dental practices at 31 locations were registered as participating at the Gold Tier, and of those, 16 dental offices were also participating in the Gold and Green Tier.

Wisconsin has been working with municipalities to reduce the amount of mercury that finds its way to WWTPs. In 2008, Wisconsin established a Green Tier Charter, a voluntary program with 27 municipalities throughout the state. These municipalities had total daily water discharges between 900,000 and 5 million gallons per day. The Charter was designed to provide the opportunity for WWTPs to work on conducting outreach and BMP implementation to suspected key contributing sectors within their community. Dental offices, industries, schools and medical facilities conducted elimination actions and/or implemented mercury controls. Over 3 years, municipalities reported a 31% reduction in mercury levels in effluent streams; 67% of the municipalities reported they were at or below the mercury effluent standard of 1.3 ng/L. Most significantly, 62% of all dental offices had either eliminated mercury discharges or had installed amalgam separators at their operations. Twelve of the 27 municipalities reported 100% mercury elimination in their community schools. Higher education institutions, community colleges, and universities were included in the analysis, but their refusal to participate skewed the data. Fifteen municipalities reported 100% BMP implementation with medical facilities in their community. Total outreach to participating sectors included 209 dental offices, 168 industries, 185 medical facilities, and 126 schools. Though the Pilot Charter ended in 2011, mercury BMP and outreach has been ongoing in newly issued permits and will continue to be recognized as an alternative means of meeting effluent limits at WWTPs.

Indiana has conducted outreach to dentists through educational materials developed under a pollution prevention grant and distributed the information through partnerships with municipalities.

Legislation in Illinois requiring dental offices to install amalgam separators and follow all of the other ADA BMPs was introduced in 2011. A decision was made to withdraw the legislation because USEPA is developing effluent guideline rules for dental facilities. The federal rules will likely not go into effect until 2015. To encourage adoption of all of the ADA's BMPs prior to the federal rule going into effect, the Illinois EPA and the Illinois State Dental Society signed and are implementing an MOU.

Pennsylvania has not begun to implement this recommendation.

5.1.3.2. Implement a program to promote inclusion of instruction in dental office BMPs, in training for dentists and hygienists.

Michigan, New York, and Minnesota have implemented programs to promote the inclusion of instruction in dental office BMPs in training for dentists and hygienists. Since 1997, Michigan has worked with municipalities to conduct outreach to dentists on proper mercury management. The last effort was a conference on April 22, 2009. Michigan also included training as a BMP requirement within the draft dental separator rules. Minnesota created a training video and provides continuing dental education credit for viewing the video.

Ohio has ongoing implementation actions that offer trainings to dentists at their workshops and conferences. Indiana created a fact sheet in 2003 to assist dental offices in identifying where mercury can be found in their offices. Additionally, Indiana municipalities are required to develop mercury minimization plans, including using this fact sheet, for dental offices.

In Ontario, the regulation that mandates installation of amalgam separators also references "Standard of Practice of the Profession for Amalgam Waste Disposal," the purpose of which is to reduce the amount of dental amalgam which directly or indirectly enters the sewage system through wastewater from dental offices. The Standard of Practice is published by the Royal College of Dental Surgeons of Ontario, and the College also monitors compliance with the regulation and the Standard of Practice.

Wisconsin conducts outreach to dental offices to implement training for dentists and hygienists, and many dental offices conduct training through national ADA efforts.

Illinois and Pennsylvania have not begun to implement this recommendation.

5.1.3.3. Support joint effort with dental community to ensure removal of remaining bulk elemental mercury from dental offices.

Joint efforts with the dental community are underway or complete in several states to remove bulk elemental mercury from dental offices. Indiana and New York have worked with the dental community to remove bulk mercury and provide options for safe disposal. New York provides information and guidance on the state's website, through meetings, and through other outreach efforts. Although no statistics are available, it is suspected that many dentists utilize HHW collection sites in New York. An elemental mercury sweep in 2003 in Indiana removed more than 240 pounds of elemental mercury from 52 dentists at no cost or for a nominal fee.

In Minnesota, dentists can use the state's very small quantity generator (VSQG) waste collection programs or can make their own arrangements for the management of bulk elemental mercury. Most VSQG programs are publicly operated and charge a nominal fee for their services.

In Pennsylvania, bulk mercury collections occurred from 2006 through 2008 from dental facilities across the state. These collections were a collaborative effort between the Pennsylvania DEP and the Pennsylvania Dental Association (PDA). The program was free to dentists; the PDA covered the transportation and mercury recycling costs, while trained Pennsylvania DEP

staff collected and temporarily stored the mercury at three of its six regional offices. During this three-year period, a total of 1,062 pounds of mercury were recovered. Pennsylvania's program was discontinued due to its success in exhausting this pool of mercury.

Ohio initially completed a series of outreach efforts working with the ODA, targeted specifically to collect bulk elemental mercury from dental offices. After the initial program, the BGSU elemental mercury program was promoted to handle mercury from dental offices, until it was discontinued in December 2010. Currently, the Ohio EPA maintains a list of mercury recyclers and shares that information with the ODA. In 2010, the Ohio EPA met with the ODA and POTWs as a means to distribute information to dental offices.

Michigan has funded local mercury collections, primarily through a limited number of HHW collections, for 10 years. These sites accept bulk mercury from dentists and other small businesses in addition to most household mercury sources.

In Ontario, the Royal College of Dental Surgeons of Ontario mandates proper disposal of excess elemental mercury. Additionally, Canada's Pollution Prevention Notice on Dental Amalgam Waste (described in detail under 5.1.3.1) requires dental clinics to develop and implement a pollution prevention plan which considers the BMPs, including proper procedures on handling the elemental mercury.

In 2004, the Illinois EPA offered free disposal of mercury from dental offices through its HHW infrastructure. There are no plans to offer this service again in Illinois, mainly due to lack of funding.

Wisconsin has not begun to implement this recommendation.

5.1.3.4. Undertake joint effort with dental community to ensure that adequate options for safe disposal of dental waste are available throughout state.

Michigan, Indiana, New York, Minnesota, Ohio, and Wisconsin have all taken actions to implement this recommendation. In Minnesota, the state and the dental association have provided dentists with lists of vendors, including the state VSQG waste programs. In New York, dental offices are required to recycle their amalgam wastes by law, and the state has provided outreach and educational materials to the dental community. Additionally, dental offices in New York are required to maintain records on their waste management for audit purposes. In Michigan, legislation requires that dentists document proper recycling or disposal. Pending rules require recycling of mercury and amalgam wastes. Many of the separator vendors provide a shipping service for the separators. Ohio's actions are described under recommendation 5.1.3.3. Companies in Wisconsin that offer amalgam separators also provide a list of mercury recyclers/handlers.

Canada's Pollution Prevention Notice on Dental Amalgam Waste requires dental clinics to develop and implement a pollution prevention plan which considers BMPs. The BMPs ask the dental clinics to contact a licensed waste carrier to dispose the amalgam waste properly. Refer to information under recommendation 5.1.3.1 for details. In addition, in Ontario, biomedical waste

carriers are licensed to carry mercury wastes for recycling, which are segregated by the generator.

Illinois is undertaking this recommendation under the MOU with the Illinois State Dental Society.

Pennsylvania has not begun to implement this recommendation.

5.1.3.5. Require dental insurance plans provided to the general public allow use of non-mercury restorative materials, with full cost coverage of most appropriate prescribed restoration material.

Only Ontario currently requires dental insurance to cover non-mercury restorative materials. In addition, Canada's Pollution Prevention Notice on Dental Amalgam Waste requires dental clinics to develop and implement a pollution prevention plan that considers BMPs. The BMPs ask the dental clinics to stay abreast of advances in restorative materials and provide patients with complete information about the benefits and risks associated with the various restorative materials available. Many dental clinics in Ontario use composite resin in lieu of dental amalgam, which is covered by the insurance company. Refer to the information under recommendation 5.1.3.1 for details.

Illinois, Indiana, Ohio, Michigan, New York, Pennsylvania, and Wisconsin have not begun to implement this recommendation. Minnesota is planning to require coverage of non-mercury restorative materials as a state responsibility under the MOU with the state dental association, but has not yet implemented actions.

5.1.3.6. Promote and distribute literature for dental patients explaining alternative tooth restorative materials available.

New York is accomplishing this recommendation through a joint effort with the Northeast Waste Management Officials' Association (NEWMOA). This effort developed posters for dental offices that have been provided throughout the state to inform staff and patients about the program's requirements. Minnesota provided a patient notice to dental offices through the Department of Health dental program.

The Royal College of Dental Surgeons of Ontario has a policy posted on its website addressing the safety of amalgam fillings. The policy mandates dentists to fully discuss all available treatment options, including use of non-amalgam fillings, so the patient can make an informed decision regarding the treatment chosen. Additionally, Canada's Pollution Prevention Notice on Dental Amalgam Waste requires dental clinics to develop and implement a pollution prevention plan that considers the BMPs. The BMPs ask the dental clinics to stay abreast of advances in restorative materials and provide patients with complete information about the benefits and risks associated with the various restorative materials available. Many dental clinics in Ontario use composite resin, which is mercury-free, in lieu of dental amalgam. Refer to the information under recommendation 5.1.3.1 for details.

Indiana, Illinois, Ohio, Michigan, Pennsylvania, and Wisconsin have not begun to implement this recommendation. Indiana reports that receiving approval for printed literature is rare due to budget cuts. Illinois is considering taking action in the future.

Health Care

6.4.3.1. Continue to implement and promote state Hospitals for a Healthy Environment (H2E) programs that include participation by hospitals, clinics, and nursing homes. Assist health care facilities in keeping mercury out of the environment by:

- *Adopting mercury-free purchasing policy,*
- *Maintaining proper mercury spill clean-up procedures,*
- *Conducting an internal mercury audit, and*
- *Establishing proper handling and disposal of mercury-containing materials.*

Note that at the time the recommendation was written, the program was known as Hospitals for a Health Environment (H2E), but the name has been changed to Practice Green Health (PGH).

Michigan, Ohio, and Wisconsin are currently promoting PGH programs within their respective states. In Michigan, hospitals have reported that they are mercury free. Outside of PGH, Michigan is now focusing outreach to doctors', dentists', and clinic offices. In Ohio, the state's hospital association is leading this effort, with the Ohio EPA assisting. As of 2006, 42 medical organizations in Wisconsin, representing more than 165 facilities, had joined with the DNR as partners in H2E/PGH. The program focuses on hospitals and other medical facilities.

Illinois and Indiana previously promoted H2E programs but are no longer doing so. Minnesota had a statewide program for 15 years, coordinated by the MPCA and the Minnesota Technical Assistance Program at the University of Minnesota, but it is not active at this time due to personnel changes.

The Canadian Coalition for Green Health Care promotes environmentally responsible health services, similar to PGH programs. The Ontario health care community has adopted BMPs for the management of mercury-containing devices, and several hospitals continue to voluntarily reduce and eliminate the use of mercury devices. In addition, waste management companies continue to provide training to the healthcare sector to ensure that mercury is removed from the waste stream and is managed appropriately (i.e., recycled) prior to final disposal. Additional information can be found on the Green Health Care website: www.greenhealthcare.ca.

New York and Pennsylvania have not begun to implement this recommendation.

6.4.3.2. Become H2E partners and develop programs that implement mercury reduction activities at state-operated facilities.

Note that at the time the recommendation was written, the program was known as Hospitals for a Health Environment (H2E), but the name has been changed to Practice Green Health (PGH).

Indiana and Wisconsin are currently H2E/PGH partners. In Ohio, the state hospital association is leading the effort to become a PGH partner, with the Ohio EPA serving on the environmental leadership council. Currently, Michigan facilities cannot afford the membership costs to participate in PGH.

In Ontario, the Canadian Coalition for Green Health Care, funded with support of the Ontario Trillium Foundation, an agency of the Ontario government, promotes mercury-reduction activities at Ontario's health care facilities. The majority of Ontario's hospitals have phased out mercury-based products.

Illinois, Minnesota, New York, and Pennsylvania have not begun to implement this recommendation.

6.4.3.3. Seek to engage other health care facilities such as independent medical research labs and veterinary care facilities, in mercury pollution prevention efforts, using existing work with hospitals as a model.

Indiana previously reached out to other health care facilities, such as research laboratories, using existing work with hospitals as a model, but the effort was discontinued. As a requirement for variance in Wisconsin NPDES permits, WWTPs are required to conduct outreach to industry, including medical and veterinary facilities, to reduce mercury loads and meet mercury effluent levels.

Michigan, New York, Ohio, Minnesota, Pennsylvania, and Illinois have not begun to implement this recommendation. Ontario will take action as appropriate considering Ontario's priorities and federal actions.

APPENDIX B: RESOURCES

Great Lakes Mercury Program Websites

Illinois
Illinois Environmental Protection Agency Mercury Information
http://www.epa.state.il.us/mercury/

Illinois EPA Mercury and Clean Air Interstate Rule Rulemaking
http://www.epa.state.il.us/air/cair/

Indiana
Indiana Department of Environmental Management Mercury Information
http://www.in.gov/idem/4149.htm

Indiana Mercury Recycling Information
http://www.in.gov/recycle/5723.htm

Michigan
Michigan Department of Environmental Quality Mercury Homepage
http://www.michigan.gov/deq/0,1607,7-135-3307-184041--,00.html

Michigan Mercury Pollution Prevention
http://www.michigan.gov/mercuryp2

Michigan Department of Community Health: Mercury and Your Health
http://www.michigan.gov/mercury

Minnesota
Minnesota Pollution Control Agency: Mercury
http://www.pca.state.mn.us/index.php/topics/mercury/mercury.html

Minnesota's Plan to Reduce Mercury Releases by 2025
http://www.pca.state.mn.us/air/mercury-reductionplan.html

Minnesota Department of Health Environmental Health Division Mercury Home Page
http://www.health.state.mn.us/divs/eh/hazardous/topics/mercury/index.html

New York
New York Department of Environmental Conservation: Mercury
http://www.dec.ny.gov/chemical/285.html

New York Guidelines for Cleanup of Mercury Spills
http://www.health.state.ny.us/environmental/chemicals/hsees/mercury/brochures/cleanup.htm

Ohio
Ohio Environmental Protection Mercury Reduction
http://epa.ohio.gov/ocapp/p2/mercury_pbt/mercury.aspx

Bowling Green State University Elemental Mercury Collection Program (discontinued)
http://www.bgsu.edu/offices/envhs/page18364.html

Ontario
Ontario Ministry of the Environment: Business Hazardous Waste
http://www.ene.gov.on.ca/environment/en/subject/hazardous_waste/STDPROD_080435.html

Ontario Ministry of the Environment: Efforts to Reduce Mercury
http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_079199.pdf

Pennsylvania
Pennsylvania Mercury-Free Thermostat Act
http://www.portal.state.pa.us/portal/server.pt/community/universal/14083/mercury-free_thermostat_act/623272

Wisconsin
Wisconsin Department of Natural Resources: Mercury
http://dnr.wi.gov/topic/Mercury/

Environment Canada
Environment Canada: Mercury and the Environment
http://www.ec.gc.ca/mercure-mercury/

Proposed Regulation of Mercury-containing Products in Canada
http://www.ec.gc.ca./mercure-mercury/default.asp?lang=En&n=7EB39FAC-1

Risk Management Strategy for Mercury – Highlights
http://www.ec.gc.ca/mercure-mercury/default.asp?Lang=En&n=26BC75F2-1

USEPA
U.S. Environmental Protection Agency: Mercury
http://www.epa.gov/hg/

U.S. Environmental Protection Agency, Region 5: Mercury
http://www.epa.gov/region5/mercury/index.html

Other Relevant Mercury Program Websites

Interstate Mercury Education and Reduction Clearinghouse (IMERC)
http://www.newmoa.org/prevention/mercury/imerc.cfm

New York Product Stewardship Council (NYPSC)
http://www.nypsc.org/

Northeast Waste Management Officials' Association (NEWMOA)
http://www.newmoa.org/

Product Policy Institute (PPI)
http://www.productpolicy.org/

Product Stewardship Institute (PSI)
http://www.productstewardship.us/

Quicksilver Caucus
http://www.ecos.org/section/committees/cross_media/quick_silver

Toxics in Packaging Clearinghouse
http://www.toxicsinpackaging.org/