PART 9. DETAILED STRATEGY DESCRIPTIONS

9.1 Summary list of strategies

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- Tax Electricity to Reduce Mercury Emissions Along With Other Pollutants
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- Create a Mercury-Related Outreach Position for Minnesota
- Lower Emission Limits for Medical Waste Combustors
- Lower Emission Limits to 28 ug/dscm for Municipal Waste
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9.2.2.2 Mandatory strategies

9.2.2.2.1 Strategies applicable to many source types
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- Cap mercury emissions from the largest four source sectors
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- Clean air investment fund
- Revenue-neutral fees - a clean air investment fund example
- Establish a total mercury content hazardous waste limit
- Apply the "outstanding water resources" laws on a wider scale – MPCA staff
- Apply the "outstanding water resources" laws on a wider scale – NWF proposal

9.1 Summary List of Strategies (continued)

9.2.2.2.2 Strategies related mainly to products

Deposit and refund system
Sales fee on mercury containing products
Mercury reduction plan for all primary sources
Require use of best management practices by primary sources
Improve compliance with existing mercury product labeling requirements
Label existing "installed" mercury-containing products
Mercury equipment recordkeeping requirements
Increase compliance with existing state disposal bans related to mercury
Expand existing mercury product disposal bans
Mandatory product stewardship for all mercury products sold in Minnesota
License bulk mercury sellers and buyers
License sellers and buyers of encapsulated mercury

9.2.2.2.3 strategies related mainly to utilities

Fee on coal-fired power plants, proceeds to mercury control technology jackpot
Fee on coal-fired power plants; proceeds to mercury control technology projects
Require electric companies to publicly disclose mercury emission rates
State buys environmentally-preferable electricity

9.2.2.3 information/research

Minnesota mercury research
Minnesota mercury research - fee funded
Develop a comprehensive Minnesota mercury inventory

9.2 Strategies defined and described

Strategies are policy changes or other actions that would encourage implementation of one or more mercury reduction options. Strategy proposers were asked to answer the questions shown below, which, for the purpose of this document, serve as an explanation of the different headings used under the individual strategy descriptions.

Strategies have been grouped based on whether they would be instituted on a national basis (or regional or international) or if they are proposed as state-level strategies. Divisions into these categories are not hard and fast. That is, many strategies proposed at the state level could also be pursued on a regional, national, or even international level. Under the headings of National or State, strategies are further subdivided based on whether participation would be voluntary or mandated, which may influence how a strategy is implemented and the type of program development needed (e.g., establishing rules vs. creating guidance documents). The final subdivisions are based on the types of sources affected by proposed strategies.

Questions to be answered for each strategy description

Affected sources: Which industrial sector(s) would the strategy apply to?

Geographic scope: Would the strategy be implemented at a state, regional, national or international level?

Description of the strategy: How would reductions in mercury release or contamination be encouraged or required? Would compliance be voluntary or required by law? What would be the approximate timeline for implementing the strategy?

Associated options: What options are expected to be employed when this strategy is implemented? How would affected sources reduce mercury releases?

Cost-effectiveness: What would be the expected cost per pound of mercury abatement?

Cost: What would be the estimated total cost per year or range of expected costs to the sources affected by strategy?

Financing: How would costs be covered, particularly government administrative costs?

Reduction Potential: By how many pounds would mercury releases be reduced? Note whether:

a) the reduction is a one-time reduction or annual (ongoing),
b) the reduction would change over time,
c) expected reductions are permanent,
d) the reductions lower releases to air, water or land, and
e) reduction potential will directly or indirectly result from a strategy

Two reduction potential estimates are made for many strategies. "Reductions to air" refers to the estimated amount by which air emissions will be reduced. "Reductions to all media" refers to the estimated amount by which all mercury releases (air, water and land) will be reduced.

For all voluntary strategies, reduction potential depends on the rate of participation, which can be difficult to predict. Therefore the reduction potential typically shows a range from zero to the best possible result for voluntary strategies.

Implementation issues: This section addresses the questions shown below. In addition, secondary environmental benefits and costs are also noted under this heading, although such lists are not exhaustive.

Are there potential roadblocks to implementing the strategy or details that would need to be worked out? Such issues could relate to the strategy itself or to the options expected to be implemented under the strategy. Does the strategy rely on options that are not technically feasible? Other implementation questions include:

- What needs to be done to make this strategy implementable?
- Is this strategy compatible with existing regulations?
- For product bans, are there reasonable substitutes?

SRFRS Discussion: The committee decided that when there was not group consensus on the statements made or data used for projecting costs or reduction potential of an

individual strategy, then it would be noted in the Strategies Report under "SRFRS Discussion Notes." This heading also is a catchall for SRFRS comments that don't fit elsewhere.

A "NIKE list" of strategies was developed in late 1998. The name was taken from the phrase, "Just do it!" which occurs in advertising for NIKE products. Strategies in the NIKE list are those that SRFRS committee members believed would be readily accepted by all Advisory Council members. In fact, in committee members' judgment, NIKE strategies were so reasonable that Advisory Council members would recommend that stakeholders "Just do it!" and not wait for detailed analysis. The NIKE list was forwarded to a Screening and Evaluation Committee for consideration before the list was passed on to the full Advisory Council.

9.2.1 National Strategies

National Mercury Research Recommendations
Main Authors: Minnesota Chamber of Commerce, MPCA Staff

Affected sources: All mercury sources.

Geographic scope: National

Strategy: Recommend to EPA that more emphasis be placed on mercury research. Research should address national and international needs such as the following:

- Better predictive modeling capabilities for:
  - Source apportionment, atmospheric transport, and deposition.
  - Mercury bioaccumulation in fish, and effects on fish-eating wildlife and humans.
  - The benefits of reducing mercury emissions and deposition (is mercury in fish linearly related to mercury deposition?)
- Are there other anthropogenic factors contributing to mercury contamination of fish aside from mercury pollution (e.g. sulfate deposition, global warming)?
- Mercury control options for coal combustion.
- Continuous emission monitors (CEM) for mercury.
- Quantify relative environmental impact of different mercury releases (e.g. direct discharge to surface water vs. air emission; discharge of methylmercury vs. inorganic mercury; land application vs. air emission).
- Disposal or storage options for retired mercury.
- Understanding of impact of anthropogenic mercury already circulating in the environment (Legacy Mercury):
  - How fast will mercury loading to lakes decrease if anthropogenic emissions decrease?
  - Because previously deposited mercury is stored in soils, what is the role of soil erosion and leaching of this mercury from soils?

    - Re-emission: how does re-emission of mercury from soil to the atmosphere obscure reductions in anthropogenic emissions?
- Evaluate importance of international sources, such as:
    - coal combustion in China.
    - gold mining in Brazil.
    - mercury emissions from 340 world-wide chlor-alkali plants.
- Identify the source(s) of methylmercury in rainfall, and any reduction options.
- Enhance the mercury inventory by improving emission estimates for steel recyclers, chlor-alkali plants, soil roasters, and oil refineries, and answering the questions:
    - How fast does land-applied mercury (in sludge, fly ash, MSW compost, and landfill leachate) volatilize? How much methylmercury is produced and volatilizes?
    - How much mercury in solid waste landfills escapes through volatilization and leachate? How much methylmercury is produced and released in leachate and volatilization?
    - How much mercury in ash landfills escapes through volatilization and leachate? How much as methylmercury?
    - Where ash is used in construction (cement, soil stabilization, etc.), what is the rate of mercury volatilization? How much methylmercury is produced?
    - How much mercury in the solid waste stream is lost to the air prior to incineration or landfilling (in dumpsters and during transport)?

Associated options: none.

Cost-effectiveness: The near-term cost-effectiveness cannot be calculated because the strategy's direct reduction potential is zero. The long-term cost-effectiveness cannot be determined. Given that the strategy has the potential to identify, through the proposed research, opportunities to achieve large mercury emission reductions at very low cost, the long-term cost per pound could be relatively low, although total cost would include the reduction option cost plus research costs.

Cost: Not determined. Cost would depend on such factors as the research selected and timelines.

Financing: Financing for research has historically been provided by a variety of sources, including EPA grants, industrial research groups, universities, etc. Financing provided by a dedicated source, such as fees on mercury emission sources, would provide a steadier source of funding.

Reduction Potential: Direct reduction potential is zero. Indirect reduction potential may be positive because research may lead to development of mercury reduction techniques. Also, additional information on sources may help identify cost-effective reduction opportunities that are currently unknown.

Implementation issues:

- Limited financial resources
- Sharing resources/information and coordination at the state, federal, and international level among researchers to optimize use of funds and usefulness of research results
- The zero near-term reduction potential may lead to low acceptance among persons who believe that mercury contamination is a problem that warrants action now.
- Combining research strategies with others that would achieve reductions earlier may be seen as an acceptable "package" of strategies.

Synergistic Strategies: "Minnesota Mercury Research Recommendations, - Develop Comprehensive Minnesota Mercury Inventory." This strategy can be linked to other strategies for which options' research needs have been identified.

Change Reporting Protocols for the US Toxics Release Inventory (TRI) for Mercury
Main Authors: MPCA staff

Background: Mercury is on the list of chemicals on the Toxic Release Inventory (TRI). In order for a facility to report, it must have ten full-time employees, be identified in SIC Codes 20-39, and meet annual usage thresholds (either 25,000 pounds or 10,000 pounds depending on how the chemical is used). Minnesota requires reports from firms classified under other SIC codes and EPA has added seven sectors that will be reporting by July 1999. The public availability of data, under both the TRI and Minnesota Pollution Prevention Act, encourages industry to find ways to reduce pollution. A recent press release from EPA regarding the national TRI report indicates a 71 per cent reduction in releases in Minnesota since 1988.

It is unlikely that an individual facility will meet the 25,000-pound annual usage threshold for mercury. As a result, mercury data typically are not submitted. Currently, electric utilities are required to report mercury emissions on an annual basis under a separate Minnesota law.

This strategy is contained in the Northeast States Governors' Mercury Action Plan, released on June 8, 1998, which makes recommendations for actions in that region and nationally. This approach has also been considered in the past by MPCA staff and staff of the Minnesota Department of Public Safety who oversee the current TRI system.

Affected sources: The number and type of affected sources would depend on what level the reporting limit was lowered to and whether any new industry types were added to the types of sources (determined by SIC code) covered by the law.

Geographic scope: TRI is a national program, so a national level is proposed, although a state level approach could also be taken.

Strategy: Lower the usage threshold for mercury so that the law requires reporting mercury releases. The public availability of data encourages industry to reduce pollution.

In addition, the TRI laws require preparation of pollution prevention plans in certain cases.

A three-pound per facility threshold would match the threshold in the state utility reporting law. However, the appropriateness of a three-pound threshold for TRI should be further evaluated.

Associated options: None.

Cost-Effectiveness: The near-term cost-effectiveness cannot be calculated because the strategy's direct reduction potential is zero. The long-term cost-effectiveness is dependent on whether and to what degree TRI reporting leads to reductions of mercury use and emissions.

Cost: $325,000/yr. statewide.

Basis: Costs would depend on how many new facilities would be required to report mercury emissions under a lowered TRI threshold. Assume that 12 waste combustors, 20 coal boilers, and 100 other facilities would be required to report mercury emissions. Costs consist of time spent to collect and process the data at both company and state levels. One additional state staff person is required at $60,000/yr. Costs incurred by private firms would be two weeks of staff time required to complete and submit forms, at an estimated cost of $2,000/yr. Note that the number of facilities that would need to track releases is likely higher- even if they don't meet the actual threshold, they will need to track to determine if they do or not.

Financing: General fund to cover state staff costs. Other costs would be borne by affected industries.

Reduction Potential: Direct reduction potential is zero. This strategy relates to data collection, which may lead some companies to avoid reporting or negative publicity by reducing mercury releases.

Implementation Issues:

- The purpose of this strategy is twofold: to provide the MPCA with data regarding mercury use and releases, and to make such data publicly available. Regarding fulfilling the first purpose, it should be evaluated whether or not collection of data through the TRI process would provide the most accurate data or if a separate state effort (see Strategy I-1) or other national approach (i.e., EPA's proposed information collection request) would result in better data. The TRI process does not guarantee very accurate data because there are no monitoring requirements. Only submittal of the best available data is required.
- As noted, the appropriate threshold level needs to be evaluated.

- Minnesota law currently requires facilities that report under TRI to submit pollution prevention (P2) plans, which would add to the cost estimates. P2 plans may not be relevant to some sources on the list, because no alternatives exist.

Synergistic Strategies: This strategy would be complementary to those that require collection of data on mercury use or release, although the accuracy of the data collected under TRI reporting may or may not meet the accuracy needs of other strategies.

Information Sources: Steve Tomlyonovich of Minnesota Department of Public Services

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Tax Electricity to Reduce Mercury Emissions Along With Other Pollutants
Main Author: MPCA staff

Background: The intent of this strategy would be to create an incentive for energy conservation and to tie in with actions needed to reduce emissions of other pollutants.

Affected sources: All electric utilities and other electricity generators.

Geographic scope: National

Strategy: Impose a revenue-neutral tax on electricity that would be paid for by electricity consumers nationwide. Set the tax high enough to result in at least a specified percentage decrease in per capita electricity consumption by a target date. Use tax proceeds to reduce other tax rates.

Associated options: Energy efficiency improvements ("demand side management"), that could reduce the amount of coal burned.

Cost-Effectiveness: Not estimated.

Cost: A revenue neutral system should have net costs close to zero, with the exception of program administration costs.

Financing: Taxes would be used to finance administrative costs.

Reduction Potential: Direct reduction potential = 0. Indirect reduction potential ranges from 0 to 6,000 lb./year nationally.

Basis: the national emission estimate for utility boilers = 50 tons/year = 100,000 lb./year
Assume:

- 60 per cent of electricity comes from coal-fired boilers
- Non-coal utilities emit little or no mercury
- The tax results in a 10 per cent decrease in electricity use

(100,000 lb. mercury/year)(0.10)(0.6) = 6,000 lb./year maximum reduction potential

A decrease in electrical consumption may not lead to any decrease in operation of coal-fired utilities, given that coal is one of the lower-cost, typically base load, sources of electricity. If base load facilities do not lower their output, there would be no decrease in mercury release.

Implementation issues:

- The T-word (taxes) has low public acceptance, although a revenue-neutral system would be more acceptable than a new, additional tax. Economic impacts may be significant for some industrial sectors, but the revenue-neutral approach should aim to minimize impacts.
- It is difficult to determine the correct tax to have the desired effect. Even though this is a mandatory strategy, the reduction potential is not easy to determine because reductions are a matter of choice.
- Mercury (and most other pollutants) could be more effectively reduced through a "carbon emissions tax," which would result in coal-fired power plants incurring higher costs. However, an electricity tax could be more easily and cheaply implemented using existing systems for billing and tracking electrical consumption. (Further debate on this issue is important but beyond the scope of this initiative).
- Likely to have significant adverse impacts to those businesses that use a lot of electricity, and which must compete in a global market. This issue could be addressed by limiting taxes to household consumers, although that would also reduce the strategy's reduction potential.
- Other environmental benefits are likely to occur
- Taxing electricity creates a very broad-based tax, which is more equitable.

Information Sources: EPA Mercury Report to Congress

International Mercury Management Plan
Main Author: MPCA staff

Background: Mercury continues to be used in many products manufactured throughout the world. It is also part of some industrial processes. This strategy addresses both the supply side and the demand side of the market equation that affects the amount of mercury used. Mining of new mercury, recycling and sales of mercury from stockpiles affect supply. Demand is determined by a very wide array of users.

US Mercury Stockpile: The US Department of Defense (DoD) and the US Department of Energy (DoE) maintain stockpiles of surplus mercury; approximately 11,000,000 pounds in total. Until 1994, the Defense Logistics Agency had made it a practice to reduce the stockpile by selling mercury. A moratorium on mercury sales was imposed in 1994. The matter has been under study since then, with no resolution yet reached. Selling mercury from the stockpile becomes an issue because different federal agencies view the stockpile differently. To the Defense and Energy agencies, the stockpile is a commodity reserve

that they no longer need and that has a positive value in world markets. To the EPA, the stockpile is a mercury source that could cause contamination if it is sold to industrial users.

Mining: Mercury mines currently operate in Spain and in Khazhakstan. Output from these mines varies somewhat, as world prices change and other factors influence decision-makers. It is reported that the governments keep the mines in production primarily to provide employment.

Affected sources: Industrial sectors worldwide that use mercury in manufacturing or industrial processes.

Geographic scope: National and international

Strategy: Reduce the international supply of mercury so that mercury release reductions would be encouraged, given that reduced mercury supply in world markets should cause prices to increase and demand to fall. Reduce the demand for mercury through education and international agreements that discourage unnecessary use of mercury. Specific suggestions:

1. Recommend to appropriate federal decision-makers that the US stockpile be transferred from its current owners (DoE and DoD) to EPA, along with related authorities and financial resources. Require or recommend that EPA not sell the mercury, except under limited circumstances. Consider also recommending that EPA study the possibilities of using the stockpile for strategic purposes to influence world prices and trade.

2. Purchase or otherwise procure other available reserves of mercury. By limiting the available reserves of mercury (i.e., limiting supply), the U.S. could reduce the relative cost of alternate products.

3. Request that the federal government (State Department) look into potential ways in which the US could request or create incentive to reduce mercury mining in other countries.

4. Work through new or existing international organizations to use education and treaties to voluntarily reduce mercury use.

Associated options: Source reduction for municipal solid waste and wastewater and other options related to intentional use of mercury.

Cost-effectiveness: $0.20 per pound to infinitely expensive
Lower bound: $640,000 / 0 lb. = infinitely expensive
Upper bound: Air: $640,000 / 360,000 lb. = $2/lb.
Total: $640,000 / 3,600,000 lb. = $0.20/lb.

Cost: Costs for the proposed program are largely administrative. The strategy in general may result in some increased cost to consumers from increased price of mercury, although low-cost or no-cost alternatives available for many mercury applications would likely be phased in over time. In 1995, mercury sold for an average price of $250 per 76-pound flask; $3.29 per pound*. Most mercury-containing products contain much less than one pound. There should be no change in the stockpile maintenance costs already incurred by the federal government. Foregone future mercury sales would increase total costs over time. Rough estimate: assuming that eight full-time staff at EPA or other federal government offices are required to implement the strategy, cost = 8 x $80,000/yr. = $640,000. (Note that the loss of potential sales has not been included, ~$ 3.29 per pound, 3.6M pounds per year for 3 years = $35.53M.)

Financing: The financing for the proposed transfer of the stockpile oversight could be covered by transferring appropriate budgets from Department of Defense and Department of Energy to EPA. EPA grants or the general budget could finance Work on international treaties and education.

Reduction Potential: Direct reduction potential is zero. Indirect reduction potential could be up to 3,600,000 lb./year total for all environmental media. Air emission reduction potential, worldwide, is zero to 360,000 lb./year for three years.

The reduction potential of this strategy covers a wide range. The primary near-term reduction would be achieved through permanently retiring the US stockpile rather than selling it. If the reduction in US mercury sales is offset by increased mining, the net impact on emissions reductions could be zero. Conversely, if mining does not increase and use declines as a result, then the reduction potential upper bound is roughly equal to the quantity of mercury in the stockpile divided by the number of years it would take to sell it. If DoD and DoE were to take three years to sell all the mercury, the maximum rate of release would be 11,000,000 lb./3 years = 3,600,000 lb./year. The rate of release would also be influenced by the use of the purchased mercury. Some uses, such as gold mining, would result in nearly 100 per cent release, while others, such as incorporation into fluorescent light bulbs, thermostats, or other products, would result in a lower release rate. Based on the fate of mercury used in products (see Part 6.1), it is estimated that the air emission reduction potential is ten per cent of the total.

Implementation issues:

- The impact of limiting sales from the stockpile should be evaluated to determine the connection between stockpile sales, mining rates, and use rates. Because sales have been suspended for a few years, it should be relatively easy to review the impacts it has had on mining operations. This would help refine the estimated reduction potential and cost-effectiveness.

* Cost estimates from Rob Dunnette, Olmstead County Public Works

- Coordination between government agencies, particularly large federal agencies, which is sometimes difficult, would be needed.
- The EPA does not have storage sites like DoD does, so the potential for EPA to physically taking control of the stockpile is limited.
- A number of international organizations are already addressing mercury issues. However, they could more aggressively pursue international reduction in mining and use. Two such organizations are the Binational Strategy mercury workgroup and the Long Range Transport of Air Pollutants (LRTAP) program. The US EPA, State Department and any other involved federal agencies would be more effective if they were able to put forth a coordinated mercury reduction agenda that recognizes the global nature of mercury as a pollutant.
- Deferred mercury sales mean lost government revenue.

Create a Mercury-Related Outreach Position for Minnesota
Main Author: MPCA

Affected sources: Those located outside of Minnesota.

Geographic scope: Global

Strategy: Create a two-year duration, full-time position at MPCA or OEA, with the assignment to:

a) lobby at the national and international level for mercury reduction,
b) encourage others to implement existing MPCA/OEA programs (e.g., Healthcare outreach), and
c) learn about, and bring back to Minnesota, information on other states' mercury reduction programs.

Associated options: The most cost-effective options, largely related to source reduction

Cost-Effectiveness: The near-term cost-effectiveness cannot be calculated because the strategy's direct reduction potential is zero. The long-term cost-effectiveness cannot be determined, as it is dependent on the success of the outreach effort.

Cost: One full-time Equivalent (1 FTE) = $80,000/yr.

Financing: Grant or general fund money. If this strategy was coupled with VR-6 "Promote MN-Products that Reduce Mercury Release," funding from the Minnesota Department of Trade and Economic Development or related industry sources may be possible.

Reduction Potential: Direct reduction potential is zero. Indirect reduction potential depends on the success of the outreach effort.

Implementation Issues: Others (e.g., EPA and some non-governmental organizations) are already doing this to some extent.

Synergistic Strategies: This would be compatible with promoting an International Mercury Management Plan (O1 and O2), Voluntary Mercury Use Reduction and Proper Mercury Waste Management (VR-1), Promote MN-Products that Reduce Mercury Release (VR-5), and Promote Labeling of "Installed" Mercury Containing Products (VR-6)

Lower Emission Limits for Medical Waste Combustors

Strategy: Establish mercury-emission limits for medical waste combustors at 55 µg/dscm. This is 90 per cent lower than the 550 µg/dscm mercury-emission limit that EPA adopted in September 1997 for new and existing medical waste combustors.

Meeting the lower emission limit will likely require a) source reduction of materials that contain mercury, b) mercury waste segregation, and c) high-efficiency air pollution control equipment. The object of the strategy is to reduce the amount of mercury emitted from medical waste combustion sources.

Background: This strategy is contained in the Northeast States Governors' Mercury Action Plan released June 8, 1998, which make recommendations for actions in that region and nationally.

The EPA established mercury-emission limits as part of the standards for new and existing medical waste combustors. The federal standards regulate more than just mercury emissions. EPA has predicted that, rather than comply with the new standards, most medical waste combustors will cease operating, leaving the large and very remote waste combustors subject to the standard. States must adopt standards for existing facilities that are at least as restrictive as the federal emission limits. That is, states must have a mercury limit in place that allows mercury emissions no greater than 550 µg/dscm. MPCA already has mercury-emission limits that are more stringent than the federal limit. The Mayo Clinic incinerator operates well below its limit, with mercury emissions routinely below 12 µg/dscm.

Current mercury limits for medical waste incinerator facilities in Minnesota (7 per cent oxygen)

Medical Waste Combustor	Minnesota Current Emission Limit	EPA Emission Limit
Mayo Clinic	Permit limit set at 150 µg/dscm	550 µg/dscm
Medical Safety System	300 µg/dscm (long term)	550 µg/dscm
18 other hospital incinerators	None	7,500 µg/dscm

Affected sources: Medical Waste Combustors.

Geographic scope: National.

Associated options: Replace mercury-containing items, laboratory pollution prevention, enhanced air pollution control, waste material separation and proper management, reduce mercury use in medical products, and purchase and use fewer mercury-containing products.

Cost-effectiveness: $1,200/lb. for reducing air emissions. Cost: $18,000/year per incinerator.
Assumptions:

- Capital recovery factor = 0.087 (six per cent for 20 years);
- equipment setup based on system currently in use at Mayo Foundation medical waste incinerator;
- purchase and installation of activated carbon storage and feed system at $45,000 per combustor unit;
- operating cost based on powdered activated carbon at $0.65/lb.; and
- injection rate at 2.5 lb. of carbon per ton of waste burned.

These assumptions yield an annual operating cost of $18,000/yr., for a 1,000-lb./day medical waste combustor unit. Annual mercury emissions are reduced by 16 pounds.

Medical waste combustors are operated as private facilities or as commercial disposal facilities. In either case, expenditures needed to comply with this emission limit would likely be borne by the waste generators using the waste combustor.

Reduction Potential: Direct reduction potential is roughly 800 lb./yr., on a national scale. Direct reduction potential in Minnesota is 16 lb./yr. to air (national scale roughly = 50 times Minnesota's).

Reduction potential depends on the difference between existing emission rates and the proposed emission limits, which would dictate to what degree, if any, a given facility has to reduce emissions to meet the standards. In Minnesota, the reduction potential represented by the 55 µg/dscm standard would occur through air pollution control changes at the commercial incinerator Medical Safety Systems (MSS). MSS currently uses a dry sorbent injection/baghouse system for controls. Emissions testing at the facility shows mercury emissions to be 183 µg/dscm (25 lb./yr.), which currently meets the EPA standard. Adding activated carbon injection to achieve a 55 µg/dscm limit (estimated injection rate: 2.5 lb. carbon per ton medical waste, per Mayo) would result in reducing mercury releases by about two-thirds from this facility, or about 16 lb.

Remaining medical waste combustors in Minnesota either already meet the limit or will cease operating due to other factors involved in complying with federal emission limits. Mayo Foundation facility is currently using dry sorbent injection, powdered activated carbon and a baghouse. Ongoing emissions testing shows mercury emissions to be

routinely below 12 ug/dscm, well below the proposed standard. Because of the costs of adopting the federal standards, nearly all hospital incinerators in Minnesota are expected to cease operating by March 2000.

Implementation Issues:

- Medical waste combustor operators are waiting for states to complete the process of establishing programs to implement the recent federal standards, which are to be submitted for EPA approval by September 1998. The window of opportunity is closing quickly where states can examine further alternative mercury emission limits without backing up and undoing existing decisions, and then directing affected facilities appropriately.
- Standards are typically technology-based, not risk-based. The standard reflects the capabilities of control equipment, and is chosen so that well-operated equipment will meet the limit under nearly all operating conditions.
- The standard needs to be evaluated for long-term compliance. Mercury emissions from waste combustors are highly variable. Even if activated carbon is used, a facility could have a violation if a high-mercury-content item were incinerated. The 55 µg/dscm limit should also be accompanied by a removal efficiency standard that ensures well-operated facilities are not unduly charged with violating an emissions limit.
- The regulation could result in facility shutdowns, because Minnesota law currently requires shutdown of waste combustors that fail stack tests.
- EPA has negotiated an agreement with the American Hospital Association to reduce mercury use. The agreement calls for hospitals to virtually eliminate mercury from the waste stream by 2005 by replacing equipment, such as blood pressure cuffs and thermometers, with mercury-free alternatives.

Lower Emission Limits to 28 ug/dscm for Municipal Waste Combustors
Main Author: MPCA staff

Background: This strategy is contained in the New England Governors' Conference Mercury Action Plan released June 8, 1998, which makes recommendations for actions in that region and nationwide. This recommendation fits in with the Conference's goal to achieve a reduction of at least 50 per cent, through emissions reductions as well as source reductions and safe waste management.

Affected sources: Municipal solid waste (MSW)

Geographic scope: recommended = regional or national, although it could be adopted at a state level.

Strategy: The objective of the strategy is to reduce the amount of mercury emitted from MSW and combustion sources through a combination of source reduction, waste segregation and emission controls. The strategy calls for the region to adopt an emission

limit of 28-ug/dscm for MSW facilities that have capacities of 250 tons/day or more. The strategy also calls for evaluation, on a case-by-case basis, of adopting the 28-ug/dscm standard for existing and new facilities with capacities under 250 tons/day. Finally, facility operators are to do mercury emissions tests on, at least, an annual basis.

The USEPA adopted mercury emission limits for municipal waste combustor (MWC) facilities on December 19, 1995. The State of Minnesota established mercury emission limits as part of new waste combustor rules that were adopted on May 18, 1998. The emission limits are as follows:

Hg LIMITS FOR MUNICIPAL WASTE COMBUSTOR FACILITIES (@ 7% O_2)

MWC Facility	MPCA Class	Minnesota Emission Limit *	USEPA Emission Limit **	1995 Emissions, ug/dscm @ 7%O2
UPA NSP Wilmarth NSP Red Wing	Class A, RDF >250 tpd	50 µg/dscm (short-term) † 30 µg/dscm (long-term) †	80 µg/dscm †	
HERC	Class A, mass-burn >250 tpd	80 µg/dscm (short-term) † 60 µg/dscm (long-term) †	80 µg/dscm †	9 ug/dscm
Fergus Falls WLSSD	Class C, with scrubber	100 µg/dscm (short-term) † 60 µg/dscm (long-term) †	None (standards for facilities under 250 tons per day vacated by US Appeals Court on 4/8/97)	31 ug/dscm 91 ug/dscm
Olmsted County Polk County Quadrant Pope/Douglas City of Red Wing	Class C, without scrubber	1000 µg/dscm (short-term) 600 µg/dscm (long-term)	None (see above note)	119 ug/dscm 91 ug/dscm 184 ug/dscm 158 ug/dscm 166 ug/dscm

* Minnesota Rules 7011.1227, Table 1 ** 40CFR62.14103(a)(3) † or 85 per cent removal

Associated options: installation of control technology

Cost and cost-effectiveness: $3,400 per pound to $7,400 per pound
If this strategy leads to implementation of the "Enhanced Air Pollution Control" at a waste combustor's option, which has a maximum reduction potential of 200 lb./yr., the cost effectiveness would be approximately:

- Low end: $3,400/lb. + [($80,000/combustor/yr.) (10 combustors)]/200 lb. = $7,400/lb.
- Medium: $7,600/lb. + [($100,000/combustor/yr.) (10 combustors)]/200 lb. = $12,600/lb.
- High end: As noted below, the strategy's reduction potential could be zero, in which case the cost-effectiveness ratio cannot be calculated.

Financing: Costs would be borne by waste combustors, except for administrative costs. OEA grant money may be available to county-owned MWC facilities (currently, those that are <250 ton per day plants) to cover capital costs of installing new pollution control equipment.

Reduction Potential: 0 – 200 pounds per year.
Reduction potential depends on the difference between existing emission rates and the proposed emission limits, which would dictate to what degree, if any, a given facility has to reduce emissions to meet the standard. If the 28 ug/dscm limit only was applied to large (>250 tpd) combustors, then the reduction potential is virtually zero, since large combustors in Minnesota either already meet such a limit (as with HERC) or will be required to meet the new limit of 30 ug/dscm soon. If the limit was applied to small combustors, the maximum reduction potential is approximately 200 pounds per year.

Implementation Issues:
- MWC standards for mercury and other pollutants have undergone a very long rulemaking process that has set new standards for MWC combustors. Facilities are in the process of meeting these recent standards. It seems unfair to make another change at this time and disregard the process used to establish the recently promulgated standards. Perhaps a lower standard to be met by a reasonable future date (2005?) could be set to encourage continued improvement.
- The standard is so low that a facility may be faced with violation of the standard but have no known method to achieve compliance. There is significant variability in testing for low concentrations of mercury in air emissions. Even though current mercury emissions from large MWCs in Minnesota are routinely less than the standard, given the variability of mercury emissions, well-run MWC could exceed the standard.
- The regulation could result in facility shut downs, because Minnesota law currently requires shut down of waste combustors following failed stack tests. (The MPCA usually has discretion to determine when failed stack tests warrant facility shut down.) Extending the law to allow 60 days to demonstrate compliance with the standard, rather than the current statutory 30 days would provide some relief.

Lower Emission Limits for Sewage Sludge Incinerators
Main Author: Andrews, MPCA staff

Background: This strategy is contained in the Northeast States Governors' Mercury Action Plan released June 8, 1998, which makes recommendations for actions in that region and nationally.

Affected sources: Municipal sewage sludge incinerators

Geographic scope: Regional or national, although it could be adopted at a state level.

Strategy: The objective is to reduce the overall amount of mercury emitted from municipal sludge incinerators in the region through a combination of source reduction, waste segregation, and emission controls. The strategy calls for: a) evaluation of the feasibility of adopting an emission limit of 100 ug/dscm or lower, b) adoption of source reduction and recycling measures c) pretreatment measures that reduce mercury loading to wastewater, and d) annual emissions monitoring.

Associated options: treatment of scrubber water or, more cost-effectively, the source reduction options

Cost-Effectiveness: Not estimated.

Costs: Cost would depend largely on whether the limit could be met through pollution prevention measures only or if installation or alteration of exhaust stack control equipment would be required.

Financing: Costs for compliance would be borne by the WWTP.

Reduction Potential: 100 pounds per year.
As of 2000, there are expected to be two sludge incinerators operating in the state: Seneca and Metro (both are operated by the Metropolitan Council). Test results for the Metro plant for August 15, 1995 and September 15, 1996 showed emissions of 186 and 155 ug/dscm at seven per cent O2, respectively. Compliance with a 100-ug/dscm emission limit would require a reduction of approximately 50 per cent in emissions. Assuming current emissions from the Metro plant are roughly 200 pounds per year, the reduction potential would be roughly 100 pounds per year.

Implementation Issues:
The Metro facility is in the planning stages of replacing its sludge incinerators with a new processing system for solids. If the new system uses sludge combustion, preliminary plans call for including mercury control technology. The timing of a requirement which calls for use of stack control equipment would greatly affect costs for Metro, given that retrofitting the existing plant is expected to be much more costly than including equipment on a new processing facility.

National Mercury Product Labeling
Main Author: Ned Brooks, MPCA staff

Strategy: Create and require compliance with a comprehensive, national, mercury-product-labeling law or program. The law or program would establish product-specific labeling approaches designed to provide consumers with necessary information regarding product content, characteristics and performance. The information would assist consumers in choosing products that provide the most environmental benefits and in properly disposing of mercury-containing products. Labeling may include information on the availability of end-of-life management programs, options or requirements for the product.

Background: In 1992, the Minnesota Legislature passed laws governing the sale, use, labeling and disposal of mercury and mercury-containing products. The major purposes of the labeling requirement are:

- to provide disclosure of hazardous contents to sellers and purchasers;
- to encourage the sale, purchase and use of non-mercury products (where appropriate alternatives exist); and
- to provide information about content and disposal prohibitions to the consumer at the time of disposal, to help ensure management in accordance with the state's disposal ban.

With the widespread acceptance of Toxic Release Inventory (TRI) reporting and other right-to-know measures, product labeling for hazardous components is becoming more acceptable and expected, and is seen by some as a corporate responsibility to society.

In Minnesota, labeling requirements do not stand alone. They are part of a larger package of mercury-reduction/management measures, including the disposal ban, producer and retailer responsibility requirements, and the Special Waste Pilot Project/Universal Waste Rule to facilitate end-of-life management for all mercury-containing products.

On a national level, the primary purposes of mercury product labeling are for expanding "right-to-know" to consumer products, and for informing them about purchase and disposal decisions. In other words, its purpose is primarily educational and informational. Ideally, a labeling requirement should be accompanied by the other program components used in Minnesota.

Vermont has passed a product-labeling law that is currently being implemented by rule. Maine and Connecticut are also considering a labeling requirement, and the Northeast States Governors' Mercury Action Plan (June 8, 1998) contains general recommendations for a product-labeling requirement for regional/national implementation. As individual states set their own labeling laws, the danger of conflicts between laws increases, and this decreases the potential for achieving a high compliance rate.

Affected Sources: Product manufacturers.

Geographic Scope: National.

Associated Options: Source reduction in municipal solid waste and wastewater.

Cost-effectiveness: Not determined. Product-labeling costs vary depending on the product, but generally represent a very small portion of the product-manufacturing cost, typically a few cents per label. The effect on pollution prevention and proper management is difficult to quantify.

Cost: Not determined. Product-labeling costs vary depending on the product, but generally represent a very small portion of the product-manufacturing cost, typically a few cents per label.

Financing: Cost to be borne by product manufacturer.

Reduction Potential: Unknown.

Implementation Issues:

- The strategy needs to avoid discouraging purchase of mercury-containing products when the alternative may be worse for the environment. For example, use of fluorescent lamps, which contain small amounts of mercury, is recommended as part of energy-conservation measures.
- Disposal information needs to be available to the consumer at the time of disposal. However, in some cases (*e.g.*, thermometers or button batteries), the item is too small to put a label directly on the product.
- The strategy should be consistent with other state and federal laws, such as Federal Trade Commission rules.
- Creation of a consistent, uniform labeling law could be complicated by inconsistencies between states in waste-management/recycling laws. Some state-specific disposal instructions may still be necessary. For example, in states that have not adopted a "universal waste rule," providing for proper mercury disposal would be more difficult and instructions to consumers may vary.

9.2.2 State Strategies

9.2.2.1 Voluntary Strategies

Note that the low-end estimate for the reduction potential for all voluntary strategies is set at zero to account for the chance that no one participates in a voluntary program.

9.2.2.1.1 Strategies Applicable to Many Source Types

Early Reduction Credits (ERC)
Main Author: Center for Clean Air Policy

Affected sources: Any and all sources that have estimates for an emissions baseline and quantified mercury reductions. From a cost-effectiveness standpoint, the greater the number of participants the greater the number of lower-cost reduction opportunities. On the other hand, allowing a large number of participants from a variety of sectors creates an added monitoring and verification burden. The Advisory Council will need to reconcile these issues.

Geographic scope: Because Minnesota's legal jurisdiction extends only to sources within the state, Minnesota could guarantee the validity of earned credits only to entities in Minnesota. Individual sources from other states could participate in the program by earning reductions in accordance with the program rules and exchanging these reductions with Minnesota sources. Alternatively, Minnesota could enter into a memorandum of understanding with other states to set up a more formal multilateral program. In defining the allowable geographic scope the group should consider emissions transport data and the extent to which mercury reductions from other states are likely to affect contamination in Minnesota.

Strategy: The ERC program described here is loosely modeled after and builds upon the Department of Energy's 1605(b) greenhouse gas emissions reporting program. This program is considered a success and is currently being used by all of Minnesota's power companies and several of its major industries to make voluntary reductions in greenhouse gases.

The purpose of an ERC program is to enable sources that use or release mercury to get "credit" for early actions--reductions in mercury use or release that are achieved in advance of mandatory reductions. Credits earned today could be redeemed under any future regulatory regimes or "retired" at any time. Whether they are used or retired, the end result is the same. An equal or greater amount of mercury reductions occur than would have been the case without ERCs. However, the reductions are more likely to occur sooner with an ERC program.

By providing incentives for early action, an ERC program encourages consideration of mercury in decision-making, fosters creative solutions to the mercury issue, and improves the monitoring and measurement infrastructure. More importantly, there is the potential to achieve reductions in mercury use and release that would not otherwise have been made. Moreover, by establishing an early reduction credits program in advance of national action, Minnesota has an opportunity to influence national policy. This is especially true given EPA's support for the Mercury Contamination Reduction Initiative.

One important aspect of an ERC program is that it provides a high degree of flexibility. Source operators participating in the early action program are free to choose any verifiable method of reducing releases at their own facilities or at other facilities in Minnesota or possibly in a larger region (the extent of the region would need to be defined by the group). In this way, source operators who participate will have access to the most cost-effective reduction opportunities. A source operator with credits is free to decide how they should be used. The primary prerequisite to participating in the early reductions credit program is a good emissions baseline.

An ERC program is consistent with many of the other strategies under consideration. In particular, ERCs would provide an incentive to undertake reduction strategies that are voluntary, such as the proposed voluntary reduction of mercury releases from energy sectors. ERCs are also consistent with efforts to enhance the existing mercury inventory and continuing research and development programs.

When developing an ERC program, the Agency and stakeholders will need to consider a number of program design issues. Many of these are discussed under the heading, "implementation issues." It is estimated that a system that meets the needs of the major stakeholder groups can be achieved within a time frame that would enable an ERC program to be in place by January 1, 2000. Timing is especially important for an ERC program. The sooner an ERC program can be implemented, the sooner its benefits can be realized.

Associated options: In general, ERCs for mercury provide an incentive for lower-cost, no-regrets options. ERCs also provide an incentive, in conjunction with other pollutant benefits, for some higher-cost reduction options such as switching to natural gas. The level of the incentive may or may not be strong enough to result in a decision to implement the various options. The strength of the incentive depends on the likelihood of a mandatory requirement in the future as well as other factors such as those noted below under "implementation issues."

Cost-Effectiveness: Sources participating in a voluntary ERC program would be expected to take advantage of only their cost-effective reduction opportunities. Sources will be willing to make reductions to the point at which the marginal cost of reductions equals the expected value of the credits (including sales, public relations benefits, etc.).

Financing: Source operators who participate in the ERC program would finance reductions. However, the term "financing" for this strategy is somewhat of a misnomer. A decision to participate in the ERC program would ordinarily result from a company having determined through a broader evaluation that participation would be beneficial to its bottom line. Furthermore, as mentioned earlier, it can be expected that emission reductions would be achieved using the most cost-effective opportunities available.

It is expected that there will be some government administrative costs associated with program design and implementation. Government administrative costs could be financed by MPCA's operating budget or by other sources of revenue. For example, it may be possible to get some grant funding to demonstrate the bank concept. It may require up to two staff members to design the program with input from potential participants and stakeholders and one staff person to operate the program.

Reduction Potential: The reduction potential of an ERC program depends on several factors, including: 1) the likelihood that a mandatory program will be put in place and the specifications of that program; 2) the amount of time an ERC program is in place prior to the onset of a mandatory program; 3) the availability of low cost reduction opportunities; and 4) the level of certainty on the part of the regulated community that credits earned can later be applied to mandatory control requirements. Depending on these factors, based on cost curves and the results of similar programs, an ERC program is expected to achieve a level of reductions on the order of 0-20 per cent.

Implementation Issues: There are clearly a number of issues that need to be worked out. Program managers will need to:

- Develop a consistent and verifiable baseline. This involves establishing a base year or methodology for establishing a baseline and reaching agreement on acceptable measurement or monitoring techniques.
- Develop procedures to ensure that reductions achieved are credible.
- Develop assurances that 1) credits earned may be applied; 2) credits represent real reductions; 3) the Agency will treat early actors equitably.
- Determine whether the early reductions credit concept can be made consistent with federal requirements.
- Determine whether some form of recognition should be provided for reductions that cannot be reliably measured according to agreed upon procedures.

Timeline: The ERC program should begin as soon as possible in order to take advantage of near-term mercury reduction opportunities in association with other pollutants. It would last indefinitely or until a mandatory program is put in place. A decision would need to be made on how to treat voluntary reductions that were achieved prior to the establishment of the ERC program.

ISO 14000 or Equivalent Environmental Management Systems
Main Author: Carol Andrews, MPCA

Background: ISO 14000 is an internationally accepted Environmental Management System (EMS) developed to guide organizations to improved environmental performance. ISO 14000 was designed to be voluntary. Minnesota, through the MPCA, is one of ten states working with EPA as part of a nationwide Multi-State Working Group on Environmental Management Systems.

Affected sources: The program is voluntary and open to any organization.

Geographic scope: Minnesota. Participation with EPA and the other states in the national working group provides a good avenue for broadening the scope of this strategy.

Strategy: Incorporate standards of performance into an EMS related to proper management of mercury-containing products and pursuit of reductions in mercury releases to air, land or water. Look into the possibility of including such goals in ISO 14000 certification requirements .

Associated options: All of them.

Costs, Reduction Potential, and other details: These are unpredictable. The administrative costs to the state would be relatively low. Costs to companies would vary, depending on the industry and how aggressively they pursue reducing mercury use and release.

Subsidies
Main Author: McCarron, MPCA

Background: A strategy that has a long history in environmental policy is the use of subsidies to reach environmental goals. Subsidies have been described as the mirror image of environmental taxes. Instead of increasing the costs of polluting activities (through taxes), subsidies lower costs by shifting pollution reduction costs from pollution sources to government. Reducing pollution control costs is expected to encourage pollution source operators to take the steps needed to reduce pollution.

Affected sources: Subsidy programs can be configured for any industrial sector. Household and public sector subsidies are also possible. Different sectors will likely require somewhat different subsidy programs.

Geographic scope: Limited to Minnesota. No Minnesota-financed subsidies are likely to be granted outside Minnesota.

Strategy: Reductions in mercury release will be encouraged by subsidies that give pollution source operators a positive incentive to reduce pollution. Pollution reduction activities that otherwise would be very costly for individuals become more affordable if a

government covers some or all of the cost. For example, if a state program offers to pay all or a portion of cleanup costs for mercury collection from the wastewater lines in school laboratories, more school administrators will be likely to order the work done.

Mandates sometimes accompany subsidies, but not always. A subsidy program can be configured either way. Later analysis should perhaps address the question of which basis - voluntary or mandatory - is the more cost-effective way to set up a subsidy program.

Associated options: For strategies which would leave the decision on how to achieve mercury reductions up to each facility, the summary tables and matrix prepared by the SRFRS Committee may be used to estimate which options are most likely.

Pollution Prevention measures, such as product or equipment substitution, seem likely targets for a subsidy program. Other general methods to be encouraged are industrial process changes (e.g., coal cleaning) and the installation and operation of pollution control equipment. The likelihood that a method will be chosen depends on the level of subsidy offered. If the subsidy program covers all costs, then it seems likely that all targeted activities will be adopted. If the subsidy covers only a portion of costs, then relative differences in marginal costs will influence choices.

Cost-Effectiveness: Not estimated. Subsidies are generally not found to be a very cost-effective way to reach environmental goals. The SRFRS' full range of options should be considered, along with their associated costs. However, it seems unlikely that the Advisory Council would want to consider in detail the most costly options. A more likely course would involve subsidies for the cheapest options first, with increasing subsidies for higher cost options becoming available as needed to meet mercury reduction goals.

Cost: Assume, for discussion, that the program goal is a 50 per cent reduction of mercury releases estimated at 5,000 pounds per year. Assume also that the program successfully identifies the cheapest reduction methods available and avoids the most expensive alternatives. SRFRS' unit cost estimates range from $10 per pound to $5.5 million per pound. Midlevel unit cost estimates cluster between $1,000 per pound and $10,000 per pound. Assuming this range represents average costs, a 2,500-pound reduction would cost between $2.5 million to $25 million.[*]

A subsidy program could be established to cover all or part of the estimated cost. It seems likely that a subsidy program would incur relatively high administrative cost, which should be taken into account along with other costs.

Financing: Conventional methods to pay for subsidy programs are: a) fees or excise taxes paid by those whose actions cause the need for subsidies or b) general taxes for subsidies that are distributed very broadly.

[*] The cost estimate is a rough guess. Detailed study is needed to develop estimates with reasonable confidence intervals.

Reduction Potential: The example chosen for the cost estimate assumed a 2,500-pound reduction. In practice, the amount of money available for subsidies will determine how much reduction actually will occur. Small subsidies will likely yield small reductions. Generous subsidies should yield significantly larger reductions.

Implementation Issues:

- Implementation requires: a) an increase in fees or taxes, b) government program reductions large enough to offset the costs of the subsidy program or c) a combination of the first two alternatives. New administrative costs would be incurred as state government sets up and runs the apparatus needed to distribute subsidies fairly and efficiently.
- Various interests can be expected to object to subsidies. Some will oppose any fee or tax increases because they object to the current size and cost of state government and they do not approve of any new programs. Some will oppose cutting other programs from which they receive benefits. Other opposing arguments will maintain that subsidy programs are inefficient, causing over-investment in pollution control equipment and activities. (A subsidy's change of relative prices alters market signals. Long-term impacts require constant government attention and resources.) Finally, some object to subsidies as rewards for pollution; saying that punishment, fines and prohibitions are the appropriate actions to take instead of rewards.

Timeline for Implementation: Given enough money, subsidies can probably be developed rather quickly. One way to reduce the present value of program costs would be to schedule first subsidies targeted for the cheapest pollution reduction activities. More expensive activities could be scheduled to receive subsidies later on.

9.2.2.1.2 Strategies Related to Products

Voluntary Mercury Use Reduction and Proper Mercury Waste Management. Main Author: MN Chamber of Commerce

Affected sources: All sources (homes, government, schools, and businesses). Prioritize efforts to try to maximize reduction (e.g., dental and laboratories).

Geographic scope: Products that are manufactured, used or disposed of in Minnesota.

Strategy: Voluntary reduction and proper management of mercury-containing products. Strategy would encourage reduction of mercury use in products where cost effective alternatives exist, as determined by the manufacturer or user. Establish a statewide advisory group to work with OEA/MNTAP to:

- develop a list of products containing mercury and mercury-free alternatives of comparable cost
- develop and oversee a technical assistance program

- look at what other states are doing and learn from their experiences
- look at ways to encourage development (through positive incentives) of new mercury-free alternatives for products
- encourage establishment of purchasing policies, education programs, and inventory development and tracking for all sources
- implement comprehensive education programs which promote proper disposal of products at the end of product life
- explore innovative ways to improve on proper product management for all sources
- develop a better understanding of activities which may result in improper disposal of mercury-containing products (e.g., building demolition and auto salvaging)
- promote Minnesota made products that reduce mercury releases

Mercury reductions would be encouraged through promotion programs for participants who would give public recognition for reductions (e.g., the Green Star program), tax and other financial incentives, education, technical assistance, tracking, and knowledge of where mercury is. Strategy would be implemented over a two to five year period.

Associated options: Sources would reduce mercury through process changes, product substitution and proper management/recycling/disposal.

Cost-Effectiveness: Not estimated at this time. (The cost and cost-effectiveness can be estimated once the associated options are agreed upon, and product information is better defined.) However, the strategy is designed to promote implementation of the options considered to be the most cost-effective. Administrative costs for this program may impact cost-effectiveness.

Cost: Not estimated at this time. Costs would include program startup, technical assistance, incremental costs of alternative products, education programs, recycling programs, costs of manufacturing changes. There may also be some savings of reduced waste management and product costs in the future. Costs would be somewhat industry/source specific. Funding for state staff time should cover at least three full time equivalents (FTEs).

Financing: Program set-up and implementation costs to come from EPA Grant, General Fund appropriation or LCMR grant, environmental trust fund.

Reduction Potential: Direct reduction potential is unknown because the reductions would be voluntary (the reduction potential can be better defined once the associated options are agreed upon, and product information is better defined). The MPCA and OEA have estimated the quantity of mercury in use in products to be approximately 50-100 metric tons. Reductions would be:

- ongoing
- greater early on
- permanent
- related to all media, air, land and water

Implementation Issues:

- Further refinement is necessary in the mercury emission inventory.
- Prioritizing technical, financial support, and effective program management is essential to encourage participation by all affected stakeholders.
- This is a comprehensive strategy, it will take time to develop and flesh out details.
- Should encourage flexibility/innovation

Reduce Mercury Products in Buildings Using a Strategy Mix
Main Author: MPCA staff

Affected sources: Heating, ventilating, and air conditioning (HVAC) contractors; thermostat and electric switch manufacturers and suppliers; building demolition contractors; State of Minnesota (government)

Geographic scope: Minnesota

Strategy: Use a combination of education, recognition, and laws to reduce the number of mercury-containing products used in buildings and ensure mercury-containing products are managed to prevent mercury release. Implementation methods include:

a) policy statements from MPCA and/or Office of Environmental Assistance stating that use of mercury products should be minimized, and such products may not be disposed of as solid waste
b) education for HVAC and demolition contractors and others
c) public recognition for HVAC and demolition contractors that "do the right thing"
d) requirements that buildings constructed by the state or primarily for use by state agencies avoid using mercury-containing products whenever possible.

Associated options: Reduce mercury discards to MSW

Cost-Effectiveness: $4,600/lb. to $6,400/lb. for reductions to air;
$350/lb. to $475/lb. for reductions to all media

Costs: $140,000 to $190,000.

- One state FTE position to set-up the program ($70,000)
- $50,000 - $100,000 in outreach, education and recognition materials.
- $20,000: removal and handling wastes @ $50/lb. x 400 lb./year

Financing: LCMR, EPA or other grants, general fund

Reduction Potential: 0 to 30 lb./yr. to air; total of 0 to 400 lb./yr. to all media
There are 1.7 million tons of demolition debris disposed in Minnesota each year. The mercury contained in this debris is estimated at 490 lb. Assuming 80 per cent of the

mercury could be diverted, this would give a total reduction of approximately 400 pounds. The mercury-in-products fate tree (reference Part 6.1) predicts that 15 per cent of mercury contained in improperly disposed products is released by air emissions, mainly from waste combustors. However, given that most demolition debris is landfilled, not combusted, the air emissions factor (15 per cent) was decreased to 7.5 per cent:

400 lb./yr. x .15 / 2 = 30 lb./yr. to air.

Related notes: The annual reduction resulting from such a program would decrease as more and more non-mercury products are installed and mercury-containing products are removed. An Indiana program aimed at HVAC contractors reports that they divert 5,000 to 10,000 thermostats from the waste stream for a total reduction of 55 to 110 lbs.

Implementation Issues:

This strategy could be patterned after the program administered by the State of Indiana's Department of Environmental Management.

Promote Labeling of "Installed" Mercury-Containing Products
Main Author: MPCA and OEA staff

Affected sources: All users of mercury-containing products except households, or a few industries in which mercury-containing products are most commonly used.

Geographic scope: Minnesota

Strategy: This strategy is proposed as a voluntary program. MPCA/OEA and others could promote labeling by designing and providing labels. Lists could be provided to describe the most common mercury-containing products.

Associated options: Source separation of mercury-bearing discards and replacement of mercury-bearing products.

Cost Effectiveness: $ 3,300/lb. to $6,400/lb. to air; $500/lb. to $1,000/lb. total to all media

best case: $434,000 + (975 lb. x $50/lb.)/ 975 lb. = $500/lb. total, same / 145 lb. = $3,300/lb. to air

mid-range: $434,000 + (480 lb. x $50/lb.)/480 lb. = $1000/lb. total, same / 72 lb. = $6,400/lb. to air

Cost:[*] $434,000/yr. + $50/lb. x reduction potential to all media

[*] Cost estimates based on information in Section 8.2.1. "Options Applicable to Multiple Industries."

- Assume that the program covers five years and 2,000 facilities per year label their mercury-containing equipment
- $400,000/yr. = $200/affected facility x 2,000 affected facilities/year
- $24,000 for state staff:
  - 1 FTE for one year to develop the program,
  - 1/4 FTE for next four years to promote = 2/5 FTE on average per year = $60,000 x (2/5) = $24,000
- $10,000/yr. for promotional materials, including free labels
- handling and disposal = $50/lb. x (0 to 975 lb./yr.)

Financing:
Facilities would be expected to cover costs of staff training, product labeling and proper disposal of discards. State staff could be funded through a state or federal grant or general funds, or through a fee on mercury-containing products.

Reduction Potential: 0 to 145 lb./yr. to air; 0 to 975 lb./yr. total to all media.
It is estimated that tons of mercury are contained in installed products. Most reductions would occur at WWTPs, waste combustors, and landfills. Releases from spills would also be reduced, along with the potential for direct human health impact and clean up costs associated with spills.

If labeling led to a 25 per cent reduction in improper disposal of mercury-containing products, then maximum reduction potential would be .25 (0 to 580 lb./yr. to air; 3,900 lb./yr. total to all media) = 145 lb./yr. to air, 975 lb./yr. to all media.

Permanent: Yes

Reduce "Installed" Inventory of Mercury through Education and "Clean Sweeps"
Main author: MPCA staff

Affected sources: Many sources, such as households, schools, universities, and dentists. Expand to other targeted audiences later.

Geographic scope: Minnesota, coordinated with other states as appropriate

Strategy: Collect unneeded mercury containing products and bulk mercury to prevent release through spills or improper disposal in the future. Use all available low-cost public announcement options, including press releases, outreach through industry associations, and notices in local newspapers to implore people to look for mercury-containing products and turn them in to county household hazardous waste (HHW) centers. The state could provide financial assistance to counties to cover costs of implementation. Press releases could coincide with the fishing opener or some other appropriate event. Schools could be asked to pledge to be "Mercury-Free" after the clean sweep.

Mercury "round ups" or "clean sweeps" have been conducted by WLSSD, in some Minnesota counties and in other states. WLSSD suggests offering non-mercury thermometers in exchange for mercury-containing products.

Associated options: Clean sweeps

Cost-Effectiveness: $168,000/120 lb. = $1,400/lb. to air

Costs: Total Cost: $168,000/year

There are three main types of costs associated with this proposal. The costs are 1) disposal for the collected mercury, 2) advertising and public information for the collection programs and 3) associated staff costs.

Disposal Costs:
The price for mercury disposal ranges from $0.95/lb. to $5/lb. These prices do not include pick-up, storage or transportation. Hennepin County estimated the total cost for disposing mercury collected through their HHW system, including transportation, labor, storage drums and disposal, to be $50/lb.
Assuming 800 lb./year is collected and disposed at a total cost of $50/lb., cost = $40,000/year.

Advertising Costs: $40,000/yr.
MPCA staff received a cost report from Winona County on their mercury bulb collection program. Winona County spent $1,800/yr.. on advertisements, which includes ads in local papers and ads on the local radio station. Cost estimates take into account an overlapping of information between counties. Larger media outlets would cost more but would also reach more people.

Personnel Costs: $88,000/year
Assume that it would take one staff person per county one week to set up a local mercury collection program. The cost for this staff person would be about $1,000 per county (1 week of $50,000/yr. salary). Cost = $88,000; (note that this type of activity would fall within existing staff's typical work, so it shouldn't be necessary to hire new staff at either the state or county level)

Financing: County HHW sites are already set up to collect mercury. Costs to the counties would be minimal consisting of disposal costs and costs associated with advertising the mercury collection. Funding for advertising would be higher than cost of disposal. Possible funding could come from LCMR grants or other sources.

Reduction Potential: 120 lb./yr. to air, 800 lb./yr. total.
Assumptions: 800 lb./year would be collected, of which 15 per cent would have been released to air through improper disposal or spills.

Implementation Issues:

- The appropriate disposition of collected mercury, i.e., sent to a mercury recycler or to a more permanent mercury retirement system, should be considered.

Collect mercury from Businesses through HHW Collection Programs
Main Author: MPCA Staff

Background: Nearly every county in the state is served by some type of household hazardous waste (HHW) collection program, including over 40 permanent programs. These programs will accept mercury waste from homeowners free of charge. Only a few of these programs accept mercury wastes from businesses. About ten private companies located in the state offer specialized mercury collection and recycling services to businesses. These companies can receive mercury wastes at their facilities, usually through common parcel delivery. This system is not fully developed because the business community is not aware of the services that are available and not all the waste management companies have offered their services to all possible customers.

Affected sources: all users of mercury-containing products

Geographic scope: Minnesota

Strategy: Encourage HHW programs to accept mercury wastes, especially out of service products and bulk mercury from one-time, non-household generators. Assist programs in obtaining a special waste collection license from the MPCA. Work with generator groups and commercial recyclers/consolidators to develop collection programs and increase demand for recycling and consolidation services. For example, work with mercury recyclers, scrap yards and appliance processors who remove mercury switches to develop a collection and recycling system. Help organize a comprehensive system for amalgam recycling. Advertise the availability of this mercury product management option in conjunction with other education strategies.

Cost Effectiveness: $1,300/lb. to air, $200/lb. to all media

Costs: $200,000/yr.
Costs include increased administration and waste management costs for HHW programs, which are generally operated by county governments. Cost estimates assume 50 programs will be active:

- administration: .05FTE @ $2500 X 50 = $125,000
- MPCA staff to help develop the network: .5 FTE, $25,000.
- seed money or subsidy for disposal system $25,000.
- additional waste management costs to businesses: 1000 lb. at $50/lb. = $25,000

Financing: Counties now receive partial funding from the state to operate problem materials collection programs. The additional expense of this program could be at least

partially user paid (disposal) along with state, local or other subsidy. Another possibility would be to receive reimbursement from product manufacturers or sales fees.

Reduction potential: 150 lb./yr. to air
Collect an additional 1,000 pounds. 15 per cent avoided release to air = 150 lbs.

Implementation Issues:
This is an extension of the service provided by many HHW programs that are designed to keep problem materials out of solid waste and wastewater. Some managers would willingly expand while others would be reluctant to add this increased responsibility and expense on their often over-burdened programs.

HHW programs that have expanded into the collection of waste from small businesses usually charge a fee for this service. The fee to businesses would be approximately $5-10 per pound for waste handling and recycling/disposal of the elemental mercury and associated apparatus.

Educate Users of Mercury Containing Products

Affected sources: All users of mercury-containing products.

Geographic scope: Minnesota

Proposed: An educational program that will lead to voluntary reductions in the use and release of mercury. The following are potential audiences for such a program. Audience priorities should be established based on reduction potential.

Heating, ventilating and air-conditioning industry (for thermostats)
Dentists
Homeowners
Demolition industry (for thermostats and mercury switches)
Students
Educational institutions (for laboratory equipment, chemicals, etc.)
Industries, especially those operating boilers
Electricians (mercury switches)
Laboratories

Geographic Scope, Strategy, Associated Options
While the main thrust of the program would be to reduce mercury releases in Minnesota, materials developed can be made available to organizations in other states and Canadian provinces. Compliance would be voluntary, however options exist for subsidizing disposal of mercury-containing products and even replacement of some mercury-containing products.

The intent would be to encourage particular business sectors, through trade associations, etc., and the general public to eliminate the use of mercury-containing products and to ensure that the mercury from such products is recovered when the products are discarded. This would be accomplished by means of a campaign to raise awareness of: a) the problems of mercury contamination, b) laws regarding disposal of mercury-containing items and c) proper disposal methods. Such campaigns have already been undertaken for some sectors. The scope of such existing campaigns could be expanded to statewide in some cases.

To be effective, education campaigns should be designed sector-by-sector. Materials for such campaigns may include written information, posters, information booths at strategic conferences, presentations, videos, public service messages, and much more. Public recognition programs can be used to create incentive to participate. A five-year program should allow time for preparation, several years of concerted effort, time to assess the program's effectiveness, and estimation of the need for additional work.

Cost-effectiveness: $200/lb.

Cost: $90,000/year on average.

Financing: Funding could be entirely public, or a combination of public/private, either through a voluntary partnership with industry or industrial sectors or by assessing fees for mercury releases.

Reduction Potential: 500 lb./year

Basis for costs and reduction potential: The MPCA estimates that purposeful uses, including solid and medical waste combustion, sewage sludge combustion, product disposal, and dental and laboratory discharges will cause about 2,000 pounds of air emissions in 1995. While 100 per cent reduction may not occur, without an educational program some of these releases would increase, due to population and industrial growth.

The effectiveness of education campaigns depends, among other things, the extent of their funding. A very minimal program might consist of one full-time professional staff member and the costs of producing and distributing information. It is doubtful that one person could carry out a campaign for all sectors at once, hence the need to determine priority sectors.

An education campaign would cost roughly $75,000 for the first year; $100,000 for the second, third and fourth years; and $75,000 for the fifth year. During that time the MPCA estimates releases from these sources will be reduced by:

Year one	0 %	0	lb.
Year two	20	400	
Year three	50	1,000	

Year four	65	1,300	
Year five.....	75 %	1,500 lb.	Five-year total 4,200 lb.

Assuming that 50 per cent of the reduction comes from people using fewer mercury-containing products, and 50 per cent results from reductions in improper disposal, the cost for proper handling and disposal of collected mercury would be $50/lb. x 210 lb./yr. = $10,500 per year, on average.

After five years, costs would be limited to maintenance and, presumably, it would be possible to maintain at least 75 per cent compliance, so the cost per pound would drop considerably.

Implementation Issues:

- The above figures assume a strong program. With a minimal program it may not be possible to reach the assumed reduction goals.
- It may be important to subsidize convenient disposal options for sectors such as demolition contractors, salvage yards and electricians.
- Alternatives exist for nearly all products. The likelihood that product manufacturers would oppose or embrace the project education programs would depend on the cost of the alternatives.
- The strategy could be implemented without any change in regulations, provided funds became available, and it would be compatible with other strategies such as product bans.
- Committee members also suggested looking to entities outside of government to do the educating.

Synergistic Strategies: To provide more credits or incentives beyond "it's a good thing to do," this strategy could be combined with other strategies to increase incentives.

Reduce Dental Amalgam Use through Research and Changes in Dental Insurance
Main Author: MPCA Staff

Affected sources: All dentists

Geographic scope: Minnesota

Strategy Description:

1) Research into alternative materials has reduced the amount of mercury used in dental offices to 25 per cent of what was used 25 years ago. Continue research into alternative materials promises further reductions.

2) Dental insurance programs sometimes will only reimburse an amount that is equal to the least cost alternative, which typically is an amalgam. In order to test the feasibility of reimbursement for other materials, the state employee dental program could change coverage in order to see whether amalgam usage drops and whether there is a related effect on dental care.

Associated options: Use less mercury in products

Cost-Effectiveness: $20, 000 - $40,000 / lb. total to all media ($500,000 to $1,000,000 / 25lbs. of reduction)

Costs:

1) A minimum additional investment in restorative material research would be $500,000. $1 million is more likely to make a difference.

2) The cost of dental insurance for the state and its employees is likely to increase if coverage is changed. It is difficult to estimate what the additional cost would be.

Reduction Potential:

1) If amalgam usage is expected to be reduced by 50 per cent over the next ten years, additional research and technology transfer efforts could accomplish that reduction in much less time. In Minnesota this might mean a reduction of about 250 pounds of mercury in all waste streams (25 pounds per year entering the wastewater stream) beginning perhaps in ten years.

2) In a test population of state employees, the amount of reduction in use of amalgam would be hard to measure and would likely be quite small.

Implementation Issues:

1) Research does not lead to change overnight. New materials must be tested over time. Dentists must then be educated and trained in the use of the new technology.

2) Dental benefits for state employees are collectively bargained, so the state cannot easily determine to make a change in coverage.

Training Video and Waste Management Program for Dental Offices. Main Author: Dick Dierks, MDA

Affected sources: All dentists in Minnesota.

Geographic scope: Minnesota

Strategy Description: The Minnesota Dental Association would produce a video that would instruct dentists about appropriate amalgam disposal practices. This tape would include the "Do's and Don'ts" of amalgam management and would be accompanied by a manual, a best practices checklist, a poster, and a test on procedures. The test would be designed in consultation with the MDA's Northeastern District Dental Society instructors and regulators. Completed tests would be returned to the MDA for grading. Acceptance of test results for continuing education credit would be sought from the Minnesota Board of Dentistry. This program would be followed up with a program to recognize environmentally responsible dental offices.

Associated options: a) raw mercury collection, b) replacement of mercury-containing items, c) increased recycling of chairside traps, d) increased recycling of vacuum system filters, and e) additional amalgam capture equipment.

Cost-Effectiveness: $1,600 to $60,000 to air;
$540/lb. to $20,200/lb. for total reductions to all media

Estimated total costs =$282,400 to $10,561,400
Estimated reduction potential = 525 pounds of total releases,
= 175 pounds of air emissions

Costs: The cost to dental offices of the increased recycling from the three dental options ranges from $282,400 to $10,461,400. The cost of developing and distributing a video and the other related materials and establishing a recognition program is estimated to be about $100,000.

Reduction Potential: 175 lb./yr. to air, 525 lb./yr. to all media
The reduction potential of this strategy is the reduction potential shown in the three dental options that relate to capturing and recycling dental office amalgam waste (see Section 8.2.3.). The reduction potential from those three dental options is estimated to be 525 pounds per year to all media, 175 lb./yr. to air.

Implementation Issues:

- Recycling opportunities vary around the state.
- New technologies will be accepted in the marketplace only when adequate testing and information is available to dentists.

References: Minnesota Dental Association (summary table of cost and reduction potential break downs available).

Use Mercury Sludge Concentrations to Target Source Identification Programs.
Main Author: Tim Tuominen

Affected sources: Any discharger to the sewers could be identified as a source of mercury releases. New sources will be discovered.

Geographic scope: Minnesota

Strategy: Wastewater treatment plants must test their sludge for mercury on a regular basis if they land apply it. Mercury concentration information is reported to the MPCA. Since mercury is concentrated in the sludge at a treatment plant, it is a good indication of the amount of mercury that is discharged. Although sludges from treatment plants vary by more than an order of magnitude, most sludges meet the regulatory limits for land application. Some of the plants with high mercury in their sludge need assistance and motivation to identify and reduce the source of the mercury in their sludge. Analysis of the mercury concentration in sludge will be used to show the MPCA which treatment plants require attention.

Cost-Effectiveness:

Year	Cost effectiveness
1	$800/lb.
2	$400 /lb.
3	$275 /lb.
4	$240 /lb.
5+	$200 /lb.

Cost: $10,000 per community.
WLSSD has found that source reduction is the most practical way to reduce mercury in its discharge. If a number of communities can identify common sources, analytical and technical assistance costs can be kept low.

MPCA amendment: assume that the MPCA allocates one-half of a position ($30,000/year) for five years to review sludge mercury concentrations and provide technical assistance, etc. to the ten cities that have the highest mercury sludge concentrations.

Annual cost = $130,000

- $30,000/yr. for MPCA +
- $100,000/yr for community staffing and costs for implementing reduction options in 10 communities @ $10,000/community

Financing: WWTP fees charged to system users.

Reduction Potential:

Mankato's WWTP receives about 60 grams of mercury per day. The input should not be over 10 grams of mercury per day. This adds up to 40 pounds per year. If Mankato's

WWTP reduced its sludge input to 10 grams per day, most of the reduction should be attributed to land or air, less to water.

Reduction potential estimate:

Years 1-3: ten medium sized communities x 30 lb./yr. (assumed average annual mercury release by WWTP) x 0.5 (assuming a successful program achieves 50 per cent reduction) = 150 pounds in Year #1; 300 pounds in Year 2 (first ten communities plus the next ten); and 450 pounds in Year 3.

Years 4+: ten smaller communities x 15 lb./yr. x 0.50 = 75 lb./year = 525 pounds in Year 4; 600 pounds in Year 5, and so on.

Year	Reduction potential
1	150 pounds
2	300 pounds
3	450 pounds
4	525 pounds
5+	600 pounds

Use a Mercury-Detecting Dog to Find Mercury in Likely Locations
Main Author: MPCA staff

Affected sources: Laboratories, especially at schools and universities, and other common users of bulk mercury, mercury-containing chemicals, or mercury-containing products most likely to break (e.g., thermometers).

Geographic scope: Minnesota

Strategy: Trained dogs are used to detect small quantities of illegal drugs. Sweden has used the same approach to detect very low levels of mercury. This strategy recommends that the state buy and train a dog to detect mercury. The dog would first tour schools for the dual purposes of sniffing out mercury in school laboratories, e.g., in sink traps, and as part of an educational program (education to be provided by an accompanying human). Use of the dog could also be requested by county or city personnel as part of their mercury reduction programs in wastewater and in solid waste.

Associated options: Eliminate Use of Mercury Chemicals and Compounds in College and High School Laboratories

Cost-Effectiveness: $400/lb.

Cost: $82,000/yr.

- Trained dog: assume $10,000 for purchase and training.
- 1 FTE = $60,000/yr.
- Educational and promotional materials $5,000/yr.
- Dog food and Travel: $7,000/yr.

Financing: Potential funding includes charging a modest fee for use of the dog, EPA and state grants.

Reduction Potential: 250 lb./year to air

Up to 600 pounds of bulk mercury could be collected from laboratories, which roughly equates to 70 pounds per year of reduced air emissions.

The educational influence on school children and from publicity would also lead to reduced use of mercury-containing products in homes. Assuming this would result in a 10 per cent decrease in annual purchase of mercury-containing products, using the mercury in products fate model, the estimated air emission reductions would be (12,000 lb./yr.) (.10) (.15) = 180 lb./year.

Releases to land and water would also be reduced.

Total = 180 + 70 = 250 lb./year.

Implementation Issues:
- It would take a few years to visit most schools and universities.
- Schools and other facilities may not be interested in such a program. They may find it intrusive; more like an unwanted inspection. Program development should work with potential dog-users and schools to promote the program as assistance/outreach.

State Avoids Buying Mercury-Containing Products
Main Author: MPCA staff

Affected sources: State of Minnesota (government), manufactures and sellers of mercury-containing products

Geographic scope: Minnesota

Strategy: Convince Department of Administration to adopt purchasing rules that establish a preference for products that do not contain mercury.

Associated options: Change to non-mercury alternatives for products, including thermostats, electric switches, pressure gauges, and many more used throughout the state, including at state healthcare and lab facilities and motor vehicles.

Cost-Effectiveness: $10,000/lb. for reductions to air, $1,400/lb. total

Cost: $170,000/yr.

- Two FTEs total = $120,000 (assumed 1/2 FTE at MPCA/OEA and 1.5 equivalent in time required from various Dept of Admin staff to implement the program)
- Increased product costs: $50,000/yr.

Reduction Potential: 17 lbs./yr. to air, 120 lbs./yr. to all media
State government employees comprise approximately three per cent of the state's work force. Assume that the reduction potential from this strategy is three per cent of total emissions associated with products used in the workplace, the estimated reduction potential range is: (0.03)(580 lbs./yr. to air) = 17 lbs./yr. to air,
(0.03)(3,900 lbs./yr. total to all media) = 120 lbs./yr. to all media.
(See Section 8.2.1. "Replace Mercury-Containing Items" for details.)

Implementation issues:

- Exceptions would have to be made for products for which a) non-mercury alternatives don't exist, b) the alternatives have other environmental implications or c) the alternatives are not cost-effective.
- Review would be required to verify which products lack acceptable alternatives.
- The term "no mercury" should be defined as "no intentionally-added mercury."
- The state program of buying environmentally preferable cleaning products, which is currently being implemented, should be considered as a model.

9.2.2.1.3 Strategies Related Mainly to Utilities

Voluntary Reduction of Mercury Releases from Energy Sectors
Main Author: MN Chamber of Commerce

Affected sources: Energy producers in Minnesota.

Geographic scope: Minnesota

Strategy: Encourage and promote development and/or use of lower mercury emissions from energy sources**.** Mercury reductions would be encouraged through tax incentives, technical assistance, education, research grants and other funding sources. The timeline for implementation would be two to five years.

Associated options: All options which are associated with the energy sectors and which deal with reducing emissions due to energy production and use. It would also include options for new generation.

Cost-effectiveness: Currently, cost-effectiveness associated with most sources within the energy-related sectors is estimated to be relatively low (cost estimates are relatively high). However, the strategy encourages implementation of cost-effective options for energy sources through positive incentives and knowledge, and development of cost-effective alternatives.

Cost: not estimated

Financing: EPA grants, private funding, foundations, tax incentives, LCMR and environmental trust fund, DOE, Industry research groups, university grants, general fund.

Reduction potential: The amount of mercury reduced depends on the potential for reductions through voluntary measures. The reductions would be:

- ongoing
- likely to fluctuate over time
- potentially permanent, depending on the options implemented
- associated with releases to land, water or air

Implementation issues:

- Scarcity of financial resources,
- need to develop positive incentives, and
- lack of cost-effective options.

Greening the Generation of Electricity through Customer Choice, Supplier Competition, and Technological Innovation. Main author: Frank Anscombe, EPA

Affected sources: Coal-burning electrical generators

Geographic scope: While this strategy pertains to Minnesota, other States are de-regulating electricity generation.

Strategy: MPCA would endorse competition in provision of electricity as a means to spur technological innovation, including greener energy with lower mercury emissions. The MPCA would endorse the environmental benefits of electricity competition to the State Task Force on Electricity Restructuring. The Task Force would then factor these benefits into its decision-making. (Note: Deregulation of the utility marketplace does not mean environmental deregulation; utilities would still be subject to environmental performance standards and green energy mandates).

Background:
(References refer to citations found at the end of this section.)

For much of the 20th century, it has been national policy to forestall competition in the generation of electricity, based on the thinking that energy provision was a natural monopoly. An exclusive local electricity provider has been the traditional source of electricity to homes and businesses, subject to economic regulation by a State utility commission. Commissions have tended to allow companies to charge customers to recover production costs and also to charge a surplus (i.e., profit). Consumers had little option but to pay such charges. Utilities have generally not had a monetary incentive to encourage energy efficiency by consumers, nor to seek low cost ways of generating electricity. The needs of customers, available technologies, and this billing scheme tended to result in large-scale, centralized generation of electricity from nuclear or coal-fired power plants.

During the early 1990s, the Federal government gave States leeway to introduce competition into the generation of electricity. The response thus far has varied among States. California, Rhode Island, and Massachusetts have recently and substantially liberated their electricity markets. Minnesota's legislature has created a Task Force on Electricity Restructuring that is expected to report in January 1999 (Reference 8).

In any competitive market, suppliers compete on price and product quality. New investments in electricity generation by competitive firms favor the least costly methods of generation. Since 1984, most new generating capacity in the U.S. has been gas-powered (Reference 1), an environmentally cleaner method than coal. Gas-fired turbines are becoming smaller, allowing future decentralization of energy from large plants to generation serving one or a few buildings (References 1 and 2). (This decentralizing tendency is akin to that from mainframes to personal computers and the Internet.) The existing infrastructure of coal-fired plants will remain important for many years, yet the trend is toward cheaper, cleaner, smaller ways of generating energy.

A competitive market will accelerate this trend. Batteries and fuel cells have become far more efficient during the past decade. The dawn of the hydrogen fuel cell as a means of powering cars is nearing, offering promise of emissions-free combustion, with the byproduct being water (References 1, 3, 11, 12). Large-scale investments in solar power are underway by such companies as BP Solar, Enron, Amoco, and Siemens-Solar (Reference 3).

Given choices offered by competing suppliers, many Americans already demonstrate a willingness to pay a premium for renewable forms of energy, such as solar and wind. In Colorado, the Denver utility offers wind-power at $12.50 more per month per house. "Deliberative polls" reveal a willingness among most Texans, briefed on energy issues, to pay a premium for renewable energy; many windmills have been constructed in west Texas, paid for by supplementary green charges (Reference 6). As more people develop cleaner technologies, the cost of renewables will fall, encouraging more participation.

Emissions from coal-fired power plants are a major anthropogenic source of mercury. A competitive energy market in Minnesota would encourage energy providers to offer

energy from renewable sources and cleaner fuel cell, batteries, and gas technologies. In addition, in the long-term, a competitive market will lower fuel bills, which will make industry stronger and provide consumers with savings that they can allocate to other needs.

Some environmentalists reasonably fear that a competitive energy market will result in closure of nuclear plants, increased reliance on coal, and because of lower prices, increased demand for energy. Yet, during the past decade, new investments have been in gas-fired generation. Also, a competitive market will spur technological innovation and greener forms of energy. Cheaper energy will indeed invite increased use, but it is also true that energy demand is relatively "inelastic" (or non-discretionary). Consumers may well prefer to invest their energy cost savings in other needs (e.g., computers, education, food, savings, clothes, etc.).

This proposed Strategy is fundamentally predicated on the view that competition accelerates the commercialization of new technologies.

Many technological advances have resulted from the inspiration of clever individual inventors, who may have little profited from their inventions. For instance, Xerox employees conceived of the personal computer and the mouse, yet their ideas were not commercialized by Xerox, but by Steven Jobs and Apple. 3M took years to see the potential of Post-Its. The Internet was developed under government grants, rather than by competitive firms like IBM or Microsoft. Scientists at a monopoly, AT&T, during its dominance of long-distance telephone communication, developed many important technological advances, such as transistors. Invention is not utterly reliant on competition.

Yet, it does seem to be generally true that competition accelerates the spread of useful innovations. For instance, competitive drug companies have conceived of thousands of new medicines. When competition was introduced into airlines, a new entrant, Southwest, pioneered ticketless travel and sustained low prices. The breakup of AT&T's monopoly and the erosion of IBM's dominance by personal computers has spurred a telecommunications revolution, including the Internet, fax machines, and cheaper telecommunications. By 1915, Henry Ford had invented mass production of autos and had an effective monopoly, yet he lost this dominance by refusing to change the black Model T; a competitive market allowed GM to offer customers cars in different colors and styles.

By such examples, we see that competition is likely to spur innovation. Thus, energy competition will inspire the commercialization of greener technologies. To defer energy competition is to hinder the spread of greener technologies.

Reduction Potential: High, over the long-term.

Cost Effectiveness: High, because this change will be economically sustaining.

Financing: Self-sustaining in a competitive electricity industry. No government funding or taxes will be necessary, though governments will likely wish to invest in research on green technologies in order to promote more rapid innovation.

Implementation Issues:

- Many Minnesotans place a high emphasis on environmental quality. A competitive market will strive to serve their values.
- This proposed strategy complements the strategy that requires electric companies to disclose mercury emissions. Such knowledge would empower consumers to make an informed choice about their energy supplier.
- This proposed strategy complements strategies that mandate emission reductions by utilities.
- This proposal will hold most attraction to business and household consumers of energy, and environmentalists interested in least-cost environmental outcomes that are little contingent on governmental actions.

SRFRS Committee Points of Discussion and Response Comments from the Strategy Proposer:

- Discussion of this strategy was most attended by representatives of utilities, who did not speak out in favor of it.

  Comment: Such persons may have a fiduciary responsibility to their stockholders to defer competition, so as to prolong the advantages of a monopoly economic position.

- A utility representative noted that a utility already offers green energy options and asked if that was sufficient.

  Comment: Competition will, in the long run, greatly expand the variety of green energy options and reduce their price, speeding their adoption through society.

- An environmentalist remarked that energy prices in Minnesota are currently modest, diminishing the need for utility competition.

  Comment: The strategy is relevant to the MPCA based on its promise to speed introduction of cleaner technologies. Whether energy prices are relatively high or low is not the purview of the MPCA. (Yet, competition offers the long-term promise of lowering present energy costs.)

- An environmentalist indicated that there are concerns that utility deregulation could raise prices for Minnesota consumers, with price decreases happening in high-priced areas like California and New England, citing a DOE study on Electricity Prices in a Competitive Market (DOE/EIA-0614).

Comment: Again, the merits of this Strategy are its long-term acceleration of green energy, without regard to whether prices rise or fall. Yet it is safe to predict that in the long term, a competitive electricity market will minimize prices (e.g., the extraordinary price decrease in computing power during the last decade).

- An environmentalist suggested that this strategy include three major environmental protections: a Renewable Portfolio Standard, a public benefits fund, and disclosure.

  Comment: These three provisions are part of the Administration's Strategy for Global Warming. The MPCA may very reasonably decide to include them into this Strategy as well.

- An environmentalist expressed the concern that only one per cent of consumers are likely to elect green power options in the short run, owing to their cost.

  Comment: While some polls have suggested that green power acceptance would be higher than one per cent, it is still realistic to think that a majority of householders will not select green power options owing to their current price premium. Also, businesses, who consume perhaps two-thirds of power, have a fiduciary responsibility to choose the least cost power under a competitive market. Yet, these are not reasons to prevent introduction of competition into the electricity market. Competition will accelerate green energy options for householders and lower costs in the long term, leading to adoption by businesses. Also, inclusion of the three provisions mentioned above will provide a basis for nurturing green power options until they become the low cost alternative.

- Some SRFRS expressed a concern that competition could increase mercury emissions if use of low-cost, coal-fired power plants increased due to the potential to sell electricity in a wider area.

  Comment: Presumably incorporation of the three provisions mentioned above would preclude this unlikely possibility.

- An MPCA staff person expressed concern that utility deregulation is a complicated topic and that SRFRS and the Advisory Council do not have time to study it in depth.

  Comment: This is indeed a complex public policy issue, with many difficult aspects, including recovering past utility investments. It is unlikely that mercury emissions will be a major factor in the Minnesota legislative deliberations on this topic. Yet, the environmental case for utility competition is actually pretty simple: in the long-term, introduction of competition will spur cleaner energy for Minnesota. This insight has been recognized by the Administration in its Global Warming Strategy, with provisions to nurture green energy. It is therefore reasonable for the MPCA to lend its support to energy competition, on environmental grounds, since the MPCA regards

utilities as a major source of mercury to the environment. Many thoughtful observers (some cited in references for further reading) increasingly recognize the convergence of environmental and economic benefits from energy competition.

- Deregulation should only be discussed by the legislative task force.

  Comment: If competition, with suitable environmental provisions, is an engine for reducing emissions from utilities, it would be responsible to recommend this strategy to the legislative task force. The Task Force should reasonably listen to the views of the MPCA on environmental aspects of the competition issue. The MPCA can constructively support the Task Force's deliberations by analyzing the environmental outcomes of alternative policies.

- Reduction potential and cost-effectiveness are evaluated as high, in the long-term.

  Comment: A utility firm representative objected to the evaluations because they are not based on quantitative estimates.

Additional Readings:

1. "Power to the People," *The Economist*, March 28, 1998, pp. 61-63. A great overview.
2. "Smaller Scale and Distributive Generation: the Wave of the Future." *Electric Power Analyst*, February 1998.
3. Robert U. Ayres and Paolo Frankl. "Toward a Nonpolluting Energy System." *Environmental Science and Technology*, Sept. 1 1998, p. 408A-410A
4. Peter Asmus. 1997. *Reinventing Electric Utilities: Competition, Citizen Action, and Clean Power*. Island Press.
5. Peter Asmus. "Power to the People." *The Electricity Journal*, November 1997
6. "Democracy in Texas." *The Economist*, p. 31, May 16, 1998. On the public's appetite for clean energy.
7. "Survey Results Continue to Show Strong Customer Interest in Cleaner Electricity Choices." *The PMA Daily Power Report On-Line*, March 6, 1998.
8. *The Wall Street Journal*, September 14, 1998 has an entire section on deregulation, Energy: Shock Therapy. It can be viewed at http://wsj.com
9. Robert Crandall and Jerry Ellig. "*Economic Deregulation and Customer Choice: Lessons for the Electric Industry*." 1997. Lessons from the introduction of competition into other sectors like telecoms, trucking, and airlines.
10. "Renewable Energy and Restructuring." *The Electricity Journal*, December 1997.
11. "At last: the Fuel Cell." *The Economist*, October 25, 1997, p. 89-92. On the potential for emission free power from hydrogen fuel cells to drive automobiles.
12. "The automakers big time bet on fuel cells." *Fortune*, March 30, 1998.
13. Howard Learner. "Dirty or Clean Replacement Power." *Clean Power Journal*, Summer 1997.
14. "Competition and Clean Air." *The Electricity Journal*, February 1997

15. *The Electricity Journal*, March 1997, largely devoted to Green Power issues. The March 1998 issue has "IOUs and Green Markets." The February 1998 issue has two articles: "The Green-e Program" and "Green Power in Perspective."
16. Robert Ayres. "Toward a Zero-Emissions Economy." *Environmental Science and Technology.* August 1, 1998. 366-367A.

9.2.2.2 Mandatory Strategies

9.2.2.2.1 Strategies Applicable to Many Source Types

Cap Mercury Air Emissions from Most Existing Sources
Main Author: MPCA staff

Background:

The intent of the proposed cap is to ensure that mercury emissions don't increase as population growth and consumer demand increase. Meanwhile, further research, proposed as a separate strategy, would collect data on which to base a decision regarding the need to increase, decrease, or eliminate the cap at a future date.

The cap would help MPCA overcome one of the biggest hurdles related to reducing mercury contamination: the lack of legal authority to limit mercury emissions from new and modified sources during the air permitting process. Facility-specific mercury emissions seldom relate directly to local environmental impacts. This makes it hard to use the MPCA's general authority to set permit limits. In addition, setting permit limits on a case-by-case basis may be considered inconsistent.

A cap on air emissions resembles "New Source Review" regulations for areas where ambient air quality does not meet standards ("non-attainment areas"). When New Source Review applies, existing sources have permit emission limits and new sources must not cause an increase in aggregate emissions. Instead, new sources must get existing sources to make reductions equal to or greater than the potential emission increase caused by new source operations.

Affected sources: all sources of mercury air emissions that have the potential to release ten or more pounds of mercury per year.

Geographic scope: Minnesota

Strategy: Pass legislation and rules which assign to existing sources a cap on emissions at levels based on a baseline year (year to be selected - see implementation issues). Annual testing or other accepted method for estimating annual actual emissions would be required to demonstrate compliance.

Associated options: Source operators who wish to increase production would have to use a mercury reduction option to reduce emissions. The option selected would depend on cost-effectiveness. The proposed strategy would create incentives for sectors which are currently unregulated to develop mercury control systems or to reduce mercury emissions per unit of material burned or processed through process efficiency improvements (e.g., energy efficiency)

Cost-Effectiveness: $62,000/lb. (not including "inconvenience" costs: $45,000/lb., see Distillate Fuel, below).

Cost: estimate: $17,150,000/year

Coal combustion costs: $15,000,000/yr.; assumptions:

- options @ $40,000/lb. of reduction are used to comply; 242 lb. x $40,000/lb. = $9,680,000/yr.
- the cost to utilities of lack of flexibility regarding where reductions are achieve is $5,000,000/yr.

Distillate Fuel Oil: $1,200,000/yr.; assumptions:

- Alternative fuel sources would be used, at a cost of $10,000/lb.; 20 lb. x 10,000 = $200,000/yr.
- Inconvenience cost to distillate oil fuel users = $1,000,000/yr.

Mercury Recyclers: $600,000/yr.; assumptions

- Additional stack controls would be installed @$40,000/lb. = 15 lb. x 40,000 = $600,000/yr.

MPCA staff program administration: 5 FTE @ 70,000/yr. = $350,000/yr.

It is likely that some taconite plants would incur costs as well due to variations in ore mercury concentrations, at a per pound rate equal to or greater than that for coal-fired boilers, even if production rates don't increase. However, cost estimates are not available for taconite plants or other potentially affected sources like oil refineries.

Financing: Funding to cover state staff time could be requested from the legislature.

Reduction Potential: 275 lb./year
Basis: The inventory projections for 2000 and 2005 predict increases in emissions for three sectors: coal combustion, distillate fuel oil combustion, and recycling of mercury products. The total increase is 277 pounds.

Implementation Issues:

- Costs to some facilities could result in unacceptable economic impacts. Or they might prove acceptable. Further information is required to assess this.
- More accurate emissions data than is currently available would be needed to determine compliance.

- The wide range of facilities to which the strategy applies could make administration of the program cumbersome. Careful program design is needed to control administrative cost.
- Selecting the baseline year would be a tricky and contentious issue. Use of a future baseline date, rather than a past date such as 1995, was recommended by the committee so that the year is one for which better emissions data is available. The data quality for most sources in 1995 is considered "low."
- An evaluation is needed to estimate whether the cap is achievable with current technology.
- Consider the implications of not meeting the cap level.
- Availability of control technologies for some sectors may become an issue.
- Some source operators would prefer to have a fixed cap and reduction schedule, rather than have the possibility of a reduction requirement looming in the future.

Cap Mercury Air Emissions from the Largest Four Source Sectors
Main Author: MPCA staff

Affected sources: Coal-fired power plants, taconite, municipal waste combustors, sewage sludge incinerators

Geographic scope: Minnesota

Strategy: Same as the previous strategy, except that the types of affected sources are limited.

Associated options: Source operators who wish to increase production would have to use a mercury reduction option to reduce emissions so that their total stays below the cap. The option selected would depend on what is most cost-effective for the facility. The strategy would create incentives for sectors which are currently unregulated to develop mercury control systems or to reduce mercury emissions per unit of material burned or processed through process efficiency improvements (e.g., energy efficiency).

Cost-Effectiveness: $60,000/lb. (not including "inconvenience" costs: ~$40,000/lb.)

Cost: ROUGH estimate: $15,140,000/year

Coal combustion costs: $15,000,000/yr.; assumptions:
- options @ $40,000/lb. of reduction are used to comply; 242 lb. x $40,000/lb. = $9,680,000/yr.
- the cost to utilities of lack of flexibility regarding where reductions are achieve is $5,000,000/year

MPCA staff program administration: 2 FTE @ 70,000/yr. = $140,000/yr.

It is likely that some taconite plants would incur costs as well due to variations in ore mercury concentrations, at a per pound rate equal to or greater than that for coal-fired boilers, even if production rates don't increase. However, cost estimates are not available for taconite plants or other potentially affected source operators like oil refineries.

Financing: Funding to cover state staff time could be requested from the legislature.

Reduction Potential: 240 lb./year
Basis: The inventory projections for 2000 and 2005 predict increases in emissions for coal-fired boilers of 242 lb./yr. The accuracy of the forecast has been questioned.

Implementation issues:

- Same as for the previous strategy, except that administration would be simplified while keeping the benefit of providing authority to limit mercury emissions from sources other than coal, taconite, MSW combustion and sewage sludge incineration would no longer exist.
- Limiting the cap to fewer facilities makes the strategy less comprehensive.
- The available pool of mercury emissions offsets to a new or expanding company could be small, due to limited feasibility of reduction options, making compliance difficult and/or possibly causing significant economic impacts.

Multiple Source Cap and Trade
Main Author: Center for Clean Air Policy (CCAP)

Affected sources: A cap-and-trade program can be designed to apply to a variety of sources, even those that use mercury in products or processes. However, SRFRS' focus was on applying a cap-and-trade framework to sources of mercury releases to air. Minnesota sources were grouped into several "tiers" based on the ease with which a cap-and-trade program might be applied.

Tier 1	Tier 2	Tier 3
Coal-fired power plants	Taconite industry	Sewage sludge incinerators
Petroleum refiners	Industrial coal-burning sources	Municipal waste combustors
		Medical waste incinerators

Tier 1 sources could be covered by a cap-and-trade system in a relatively straightforward fashion given their experience with cap-and-trade for other pollutants. These source operators may also have some of the administrative and, eventually, the monitoring infrastructure needed for establishing a cap-and-trade system for mercury. **Tier 2** source operators do not have the same experience with cap-and-trade nor the infrastructure but these factors do not pose any special barriers. While some of the **Tier 3** source operators have much of the monitoring infrastructure needed for a cap-and-trade program for mercury, they generally do not have experience with cap-and-trade and face a special

implementation issue: that of double-counting. To include Tier 3 sources in a cap-and-trade program, a method would need to be identified to avoid giving credit twice for reductions made by purposeful users of mercury. Although this problem is difficult to resolve, it may still be desirable to include these sources and their relatively cost-effective reduction opportunities in the cap-and-trade strategy.

Sources that end up not being included in the cap-and-trade strategy could participate on a voluntary basis through an opt-in program. The details of an opt-in program should be worked out in discussion with the group.

Geographic scope: Because Minnesota's legal jurisdiction extends only to sources within the state, the cap-and-trade program could apply only in Minnesota. However, there could be ways to provide incentives for source operators in other states to join. For example, the caps applicable to Minnesota sources could be increased (made easier to comply with) if other states establish cap-and-trade or other mercury reduction programs that would achieve comparable levels of reductions. In addition, individual sources from other states could be allowed to join Minnesota's cap-and-trade strategy through an opt-in program.

Strategy: This strategy would entail the Minnesota Pollution Control Agency setting a mandatory cap on total emissions from a specific group of sources. Source operators are free to choose any verifiable method of meeting the cap, including emissions trading. Emission trading allows a source operator with lower cost reduction opportunities to "over-control" and sell the excess reductions to other source operators who would otherwise face higher cost actions. Early action (reductions that are achieved before the cap is in place) could be accommodated with a banking program.

A number of program design issues need to be considered in developing a successful cap-and-trade program. These include the following:

1. **The level of the cap**. The level of the cap is the primary determinant of both cost and reduction potential.
2. **The timing of the cap**. The amount of time a particular source operator has to comply with a cap can influence the cost of compliance. There should be a phase-in period to facilitate planning of reductions in association with other pollution control requirements and facility operations. In some cases, adequate lead time may allow a facility to try implementing pollution prevention options to try to meet a cap without using control technology.
3. **Affected sources**. While a cap-and-trade program can be designed to be inclusive, some sources fit more readily into a cap-and-trade system than others. It would need to be decided which sources make sense to include under a mandatory cap-and-trade program and which should be allowed to opt in on a voluntary basis.
4. **Allocation of credits to sources**. Credits can be allocated among sources in several ways. For example, MPCA could allocate credits based on historical emissions. Alternatively, credits could be divided evenly among all participating sources. Other

ways of allocating credits are also possible. While the initial allocation doesn't affect the overall cost of reaching the cap, it does influence the cost of compliance for individual sources.

5. **Monitoring requirements**. A good monitoring regimen is an essential element of a cap-and-trade program. Monitoring in some form--either continuous emission monitoring or periodic measurements--is needed to establish baselines and value mercury reductions.
6. **Rules for earning, tracking and trading credits**. Rules would need to be established for earning and trading credits. For example, program designers need to clarify when credits can be earned, what reduction activities count, when credits can be used, and how credits can be traded.
7. **Managing changes**. The affected source operators need to have certainty that the cap will not be changed arbitrarily. At the same time, there needs to be some regulatory review in the face of changes in scientific findings.

Several of these elements are discussed in greater detail below in accordance with the format provided by the MPCA. Should the Advisory Council decide to move forward with a cap-and-trade program, these issues might be better addressed in a different order. In particular, because the level of the cap (which impacts cost and reduction potential) is likely to evoke the most discussion, consensus may be easier to reach on the less contentious program design elements first.

Associated options: Depending on the level at which a cap is set, a cap and trade program provides an incentive for virtually all of the reduction options listed, in order of cost-effectiveness.

Cost-Effectiveness:
A cap-and-trade program would be expected to be more cost-effective for the same level of reductions than technology mandates or other command and control measures. The exact cost-effectiveness will be determined by the level of the cap, administrative costs to establish a trading program, and the amount of trading which occurs.

Cost: Not estimated.

Financing: Reductions would be financed by regulated industries. Government administrative costs could be financed by MPCA's operating budget or by fees (see discussion regarding setting fee rates).

Reduction Potential: The reduction potential of a cap-and-trade program is determined by the level of the cap. The assessment should be conducted not at just one level but at a range of possible levels. Several possible alternatives are described below for discussion purposes:

Variation 1: Set a cap in year 2003 at 1990 levels.
Variation 2: Set a cap in year 2003 at 1990 levels;

Set a cap in year 2012 at 20 per cent below 1995 levels.
Variation 3: Set a cap in year 2003 at 10 per cent below 1990 levels;
Set a cap in year 2012 at 50 per cent below 1995 levels.

Implementation Issues: There are clearly a number of issues that need to be worked out. Key issues include:

- establishing a reliable mercury release monitoring program
- developing procedures to ensure that reductions achieved from opt-in sources are credible
- figuring out the details of an early action program
- ensuring the cap-and-trade program will safeguard local health and environmental quality in addition to providing statewide benefits
- selection of an appropriate baseline year ("fairness" to waste combustors if 1995 is the baseline is an issue because waste combustors did a lot of work between 1990 and 1995 resulting in an 80 per cent reduction in mercury emissions)
- quality of data available in baseline year, especially prior to 1998
- Evaluating if the cap is achievable with current technology
- Implications of not meeting the cap level
- Lack of control technologies for some sectors in the Tier 1 and Tier 2 categories.

Timeline: It is important that the cap-and-trade program be phased in over time. A longer time horizon will enable source operators to plan their reductions to coincide with other requirements and facility operations. At the same time, the strategy should enable source operators to be able to take advantage of near-term reduction opportunities. This can be achieved through an early action program. The details of an early action program would need to be worked out. Prior experience with early action suggests that due to the complexities involved, it may prove useful to consider treating early action as a separate strategy.

Fee on Emissions from Multiple Industries; Proceeds distributed to the First to Install Control Technology

Affected sources: utilities, taconite, and any other as-yet-to-be identified large source sector for which reduction options are unknown or unproven

Geographic scope: Minnesota

Strategy: Add a fee to the state emission inventory and fee system for mercury emissions from selected industries. The fee should be set to generate enough revenue to create a "jackpot" (how much would be necessary remains to be determined). The jackpot would be awarded to the person(s) who first installs a method for controlling mercury emissions that would achieve at least 50 per cent control beyond the control rate achieved by existing equipment. Each affected industrial sector would have a separate competition.

Associated options: all new, technology-based options.

Cost-Effectiveness: not estimated

Costs: not estimated

Financing: not determined

Reduction Potential: not estimated

Implementation Issues: not determined

Performance-Based Emission Limits for Mercury Emissions to Air
Main Authors: MPCA staff and Izaak Walton League

Affected sources: The strategy would affect all point sources of mercury emissions. Specific source types to be regulated would likely include coal-fired power plants, taconite plants, municipal waste combustors and medical waste incinerators.

Geographic scope: Minnesota

Strategy Description: This strategy would set mercury emission standards to require point sources of mercury emissions to reduce mercury emissions by at least 85 per cent, using uncontrolled emission levels as a benchmark. SRFRS committee members have explored many different emission control technologies. Information developed so far by the committee has provided an idea of what technologies are feasible or could be developed for different sectors and sources.

Municipal waste combustors and medical waste incinerators currently are subject to mercury emission standards. These standards, however, are not as strict as they could be; other states are considering making their standards stricter.[*] New standards for reducing mercury in Minnesota would be developed to be consistent with these programs. Coal-fired boilers and taconite plants currently are not subject to mercury emission limits. Mercury control equipment for coal-fired boilers is currently in the pilot project stage for some designs, and in the research and development stage for others. Controls for taconite plants are in the early stages of research.

Cost-Effectiveness: $169,500/lb. for reductions to air
Control technologies are generally more expensive, in the medium-high cost range when all mercury reduction options are considered, due to the fact that they are the most stringent achievable controls and may not have been widely implemented yet. However, a comparison of the cost-effectiveness of this and other strategies must be made in order to make the analysis comprehensive.

[*] "Mercury Action Plan 1998" by the New England Governors/Eastern Canadian Premiers.

Costs: $88,000,000 for utilities and waste combustors
Coal-fired power plants, taconite plants, municipal waste burners, and medical waste burners are the significant sources to be regulated under this strategy. However, SRFRS' studies only cover cost estimates for the electrical utilities and waste combustion sectors. No cost estimates for reduction options are currently available for the taconite plants.

The recommended strategy calls for an 85 per cent emission reduction. SRFRS estimated that installation and operation of a powdered activated carbon system (at 90 per cent control efficiency) would cost between $9,000 and $330,000 per pound, with a $169,500 per pound midpoint. SRFRS estimated the reduction potential for this option at 520 pounds per year. Assuming that the midpoint value is good enough for a first estimate, total costs would be around $88,000,000 per year.

MPCA Administration: three FTE for three years for program development, 2 FTE ongoing for enforcement @ $60,000/FTE per year.

Financing: Reductions would be financed by regulated industries. Administrative costs could be financed by MPCA's operating budget or by fees.

Reduction Potential: 3,700 lb., mainly to air;
The reduction potential for this strategy would depend on the level of the threshold and the difference between the threshold and the level at which sources currently emit. Also, the date set for the starting point of the standards would affect reduction potential. If a very near date was set, emissions would be controlled sooner; however, better technology may be found if a date was set for the long-term.

Traditional emission limits such as this could assure a definite and measurable decrease in emissions. In this regard, the strategy could result in greater reduction potential than a strategy such as cap and trade if aggressive reductions are required of all sources, across the board.

Implementation Issues

- Determining what constitutes typical "uncontrolled" emissions for each sector and source type within sectors would be data-intensive and time consuming.
- Identifying the appropriate groupings of regulated sources (i.e., would standards vary depending on boiler type, coal type, etc.) could be contentious.
- Improved data collection would be required to determine compliance.
- Economic impacts could potentially be significant, including plant shut downs
- The consequences of non-compliance resulting from control technology being unavailable to certain sectors in time to meet the compliance deadline would need to be established.

Timeline: The emission limits should be phased in over time. Timelines for compliance with emission standards would be set at future dates to allow for development of control

options. A longer time horizon will enable source operators to plan their reductions to coincide with other requirements and facility operations. Possible compliance deadlines are: 2001 for waste combustors, 2003 for utilities, and 2006 for taconite plants. If technology to achieve 85 per cent is not available at that time, the rules would need to be re-opened and adjusted.

Require Use of BACT on All Significant Sources of Mercury Emissions to Air. Main Author: MPCA Staff and Izaak Walton League

Affected sources: Same as the previous strategy. This strategy would affect all point sources of mercury. Specific source types to be regulated would likely include coal-fired power plants, taconite plants, municipal waste combustors and medical waste incinerators.

Geographic scope: Minnesota

Strategy: Modify state rules to require that mercury emission source operators install best available control technology (BACT) and/or follow best management practices (BMP) to reduce air emissions.

Associated options: Implementation of the most effective options for each significant emission source would be required by law. It was assumed that fuel switching for utilities would not be considered BACT or BMP. The specific option called for would depend on the source type.

Cost-Effectiveness: Cannot be determined due to inability to quantify reduction potential.

Cost: MPCA Administration: three staff members for three years for program development, four staff members required for case-by-case evaluation of BACT and enforcement. Total costs = $300,000/year.

Costs to each facility: too difficult to approximate.

Reduction Potential: Because BACT and BMP require case-by-case determinations, it is not possible to determine the reduction potential. An estimate would require analysis of each significant source in Minnesota, which is beyond the scope of this report.

Implementation Issues:

- This strategy addresses the technology-related implementation issues discussed under the previous strategy. The definition of BACT means required controls are available.
- Negotiations on a case-by-case basis of what constitutes BACT and BMP would be not only time-consuming but also increase the chances that fairness issues will arise.

Clean Air Investment Fund
Main Author: MPCA staff

Affected sources: A Clean Air Investment Fund could be set up to cover all significant emission sources, either as fund contributors or as fund beneficiaries.

Geographic scope: A state level strategy is proposed, although a Clean Air Investment Fund could be configured for use with complementary strategies at a state, regional or national level.

Strategy Description: Proposals made in other cases (criteria pollutants, CO_2) have called for the use of dedicated funds to limit pollution control costs. An advisory committee to EPA calls these funds Clean Air Investment Funds. Their proposal would establish a ceiling on the average costs of pollution control ($X/ton). If a regulated emission source confronts costs greater than the ceiling value, the source can get an emission "credit" by paying the ceiling amount into the Clean Air Investment Fund. A credit allows the source to emit a given amount (typically one ton) of the regulated pollutant. Total fund proceeds depend on: a) the ceiling value of a credit, b) estimated control costs for different sources and c) the amount of credits that sources need to buy. The Clean Air Investment Fund should be used to pay for other sources' (presumably more cost-effective) pollution reduction actions. Another potential use of a Clean Air Investment Fund would be to limit control costs incurred under a cap-and-trade program.

Applying this sort of program to mercury releases would require implementation of one or more of the strategies that set regulatory limits on mercury releases. These could be either conventional limits on release rates or limits on total annual releases.

Timeline: It would likely take years to implement a Clean Air Investment Fund. Time would be required to: a) establish regulatory limits, b) refine emission inventories, c) negotiate fee rates, d) set up investment criteria, and e) define investment procedures.

Associated options:
Source operators would have available to them the full menu of mercury reduction options listed in Section 8.

Costs and cost-effectiveness: $500/pound to $7,500/pound.
Basis: Costs can be expected to be *roughly* equivalent to costs incurred under a cap-and-trade program, a subsidy program or an emission fee of comparable scope. For discussion purposes, consider the cost estimate made for the subsidy strategy, which was between $2.5 million to $25 million. A Clean Air Investment Fund c*ould* fall into the lower end of the range, if the investing authority successfully identifies the most cost-effective options available. Average unit costs would also depend on the ceiling value that is chosen. They would probably not be lower than the average costs of a comparable cap-and-trade program. Whether the average costs of a subsidy program exceed the average costs of an incentive-based program depends on whether the subsidizing

authority can make consistently efficient investment decisions. *If* the subsidizing authority is successful in identifying low-cost options, then its choices can be expected to yield cost-effectiveness ratios in the lower end of the range in the Options report, roughly between $500/pound to $7,500/pound.

Financing:
Program administration should be covered by Clean Air Investment Fund proceeds.

Reduction Potential: 500 lb./yr.
Reduction potential would depend on the regulatory limits and the ceiling value chosen. They could be set to maintain mercury releases at current levels (see the example that follows this section) or they could be set to a reduction schedule such as the one described under the cap-and-trade strategy. If the subsidizing authority pays for lower-cost options first, reduction potential will be in the neighborhood of 500 to 600 pounds, according to the information in the Options report.

Implementation issues:

- Legislative approval would be needed to make this strategy implementable. Negotiations and regulatory development for the unit cost ceiling and Clean Air Investment Fund administration would also be needed.

- Various interests can be expected to object to the Clean Air Investment Fund. Some will oppose any a fund of this sort because they object to the current size and cost of state government and they do not approve of any new programs. Other opposing arguments will maintain that the subsidies implicit in Clean Air Investment Fund expenditures are inefficient, causing over-investment in pollution control equipment and activities.

Synergistic Strategies: Given the wide range of administrative flexibility, the Clean Air Investment Fund strategy is compatible with most other strategies being considered. In particular, it could be developed to complement the various types of trading strategies under consideration.

Revenue-Neutral Fees - A Clean Air Investment Fund Example
Main Author: MPCA staff

Affected sources: All significant emission sources, either as contributors or as beneficiaries.

Geographic scope: A state level strategy is proposed, although it could be configured for use with complementary strategies at a state, regional or national level.

Strategy Description: This strategy is an application of the Clean Air Investment Fund concept. It would limit "free" emissions, charge a price on emissions in excess of a

defined baseline, and award refunds for decreased emissions. It eliminates the need for state government intervention under the basic Clean Air Investment Fund proposal. Redistributions are based on changes in emissions, not on evaluations of program merit. It establishes a revenue-neutral fee system. A unit-based fee (a charge per pound of mercury emitted) is collected and used to provide refunds at a rate equal to a specified baseline amount, regardless of whether emissions increase or decrease. Sources that emit less than their baseline amount of mercury save money, while sources that increase emissions pay more fees than they receive back in refunds.

Economic impact issues encourage revenue neutrality (defined as a policy change that has no *net* impact on government revenue collections) when fee programs are discussed. The form of tax relief determines the extent to which a fee encourages emission reductions. For example:

- A "feebate" system would return, as a tax rebate payment, some or all of the fees an emission source pays. Timing of payments will matter. If fees are paid before taxes and feebates are distributed, fee/tax payers will incur some opportunity costs; which will decrease emission reduction incentives.
- Tax rate reductions could be used to make fees revenue neutral. This approach would tend to lower private opportunity costs because fee and tax collectors would not hold onto private payments while they figure out how and where to send feebates. However, reducing tax rates would impose added administrative costs because regulators and tax collectors would have to estimate fee and tax proceeds. Early estimates would probably be very rough. Estimators should get better with practice, but they would not be able to avoid completely the need for continual adjustment and re-evaluation of all relevant variables.
- A system of direct tax deductions for fee proceeds would perhaps minimize the transaction costs of the other two systems. Tax planners would still regularly have to refine net tax collection estimates. Questions would likely arise with respect to emission reduction incentives. If producers incur no net change in their combined tax-fee bill, they may see no value in reducing emissions. In fact, if fees offset taxes on a one-for-one basis, emission reductions won't even yield the cost savings that are generally assumed to make them (emission reductions) attractive, and emission increases would not cause net cost increases.
- Tax interaction effects are likely, but indeterminate until very specific program details are defined.

Considering the briefly described options, it seems at least possible that a revenue neutral fee system could yield only slight or meaningless emission reduction incentives. In such a case, the reduction potential and economic impact criteria would seem to be in direct conflict. Improved standing under one criterion would necessarily mean lower standing under another. That is, a fee system with relatively high reduction potential is likely to score low on the economic impact scale, and vice versa.

Using a baseline emission amount resolves the dilemma.

Consider an assumed case in which a source emits 100 pounds of mercury in a year. Assume a $1,000 per pound emission fee is imposed. Total fee payments would be $100,000. If strict revenue neutrality is maintained, the source gets a $100,000 tax refund. If the source reduces its emissions to 90 pounds and strict revenue neutrality still holds, the source's fee payments also drop to $90,000. The source's *net* costs remain the same. Likewise, if emissions increase to 110 pounds, the tax offset increases and net costs again remain the same. In this case, with no defined emission fee baseline, the fee provides no reduction incentive.

However, if tax reductions are pegged to an emission baseline, reduction incentives could take on some meaning. The following modifications to the strict revenue neutrality principle would create reduction incentives:

- First, maintain revenue neutrality as long as emissions remain unchanged. For the example case, a source with baseline emissions of 100 pounds will pay its $100,000 in fees and receive its $100,000 tax refund as long as emissions do not change.
- Second, allow no tax refunds for emissions that exceed the baseline amount. If the source emits 110 pounds, it pays $110,000 in fees and gets a $100,000 tax refund. Net costs for the emission source operator increase by $10,000.
- Third, impose no tax refund penalty for emission reductions. If the source emits 90 pounds, it pays $90,000 in fees and still gets its $100,000 tax refund. Net costs for the emission source operator drop by $10,000. {comment: This would drop government revenue by $10,000 overall which would need to be made up if there is no increase in fees paid by other emission source operators.}
- Fourth, baselines would have to be set for new sources as they begin operations. A few years of operating experience would be needed to set baselines. Consider maintaining strict revenue neutrality for the first three years of operations. Then, use either a three-year emission average or let new source operators choose a single base year from their first three years of operating experience.

A baseline-oriented fee system offers two advantages:

a) It would likely have no adverse economic impacts. Sources that see economic advantages in emission reductions (i.e. some cost savings), should also gain some competitive advantage from the savings. Sources that do not expect cost savings from emission reductions can maintain emissions at baseline levels and incur neither added cost nor competitive disadvantage as long as all other factors (such as technical production changes and market variables) stay the same.
b) Reduction incentives are maintained. There are financial penalties for emission increases and financial rewards for emission reductions. If the accounting is not too hard, penalty amounts can be used to cover the costs of financial rewards.

Financial accounting and economic forecasting requirements could prove to be a disadvantage, if they become too complex. However, complexity is not the same as accuracy. A feebate system, reasonably administered, should not impose transaction

costs greater than the costs of any of the alternative strategies that the Advisory Council has considered. In fact, the transaction costs of a feebate system should prove lower than comparable costs of other strategies (i.e., cap-and-trade, or performance-based standards) because a feebate system would require less reporting of technical detail and less intermediate record-keeping.

Evaluation of baseline-oriented fees with respect to the Advisory Council's criteria:

Feasibility

SRFRS' studies report quite a few ways to reduce mercury releases, ranging from source reduction programs to the installation and operation of emission control equipment. Cost estimates vary from pretty low to quite expensive.

Source operators who confront only expensive choices are unlikely to make any changes, so their fee/tax bills will not change. However, source operators who find low cost reduction options can, and are expected to, reduce mercury releases and receive feebates that lower their total fee/tax bills. These source operators are expected to enjoy a competitive advantage in regional or national markets. Reduction potential depends on the availability of low cost reduction methods. If there are few low cost options available, then reduction potential will be relatively small.

Political acceptability should be high for a program that: a) offers tax relief to any enterprising local firms that lower mercury releases, b) leaves fees and taxes unchanged for firms that do not change their output and c) charges output-increasing firms only for the extra amount of mercury that they release.

However, tax debates can take unexpected turns.

Cost-Effectiveness

Costly elements of a revenue-neutral fee system will include:

- administrative activities such as rule-making and program operations, both of which seem likely to involve costs comparable to those incurred under the Title 5 fee program
- fee/tax costs incurred by private firms, which will depend on the relationship of the fee rate to the cost distribution, among firms, of mercury reduction options; assume for estimating purposes that this element is neutral, since incentives will favor early adoption of low-cost options; if, on the other hand, source operators adopt low-cost reduction strategies faster than they expand output, a net cost increase may occur which will require fiscal coverage from some source, perhaps the whole community of fee payers
- economic costs, which should turn in the state's favor as the adopters of low-cost options exploit market advantages they gain over competitors in other states

Overall, economic gains are expected to at least offset, if not exceed, program development and administration costs. Other strategies are expected to impose higher administrative costs and higher compliance costs, which will make them less cost-effective unless they prove to be much more productive than a baseline-oriented fee system. Moreover, long-term costs are expected to decrease as source operators respond to the continuing incentive that emission fees provide. Development and adoption of mercury reduction innovations will represent an economic opportunity as long as the fee system remains clear and predictable. For discussion purposes, expect total costs to be near the lower end of the estimated range for a subsidy program (net costs in the neighborhood of $2.5 million per year); with cost-effectiveness ranked relatively high.

Reduction Potential

Reduction potential is indeterminate without an assumed fee rate, a defined baseline and better knowledge of the ways costs are distributed within and among affected industrial sectors. In general, SRFRS' studies show that marginal costs increase as mercury reduction methods increase in scale and scope. SRFRS' studies also show that cost schedules vary among sectors, which means that reduction potential is higher in those sectors that incur lower cost.

Permanence

As long as a baseline-oriented fee system stays in effect, mercury reductions induced by the fee can be expected to continue. The incentive lasts as long as the fee structure lasts. Changes in fee rates or baselines are likely to cause changes in mercury reduction efforts.

Compatibility

There should be no conflict between a baseline-oriented fee system, as described, and other state or federal programs.

Flexibility

Regulators will find this alternative somewhat inflexible. If it turns out that changes are needed for fee rates or baselines, adjustments to rules or laws will require time and resources. Source operators appear to have more flexibility. The can choose, in the first instance, whether to take any action or simply to carry on as usual and incur no additional cost. If operators want to adopt mercury reduction methods, changes may prove difficult if they involve permit modifications.

Comprehensives

Experience has shown that all permitted sources can be covered by a baseline-oriented fee system. Experience has also shown that fees for smaller, unpermitted sources may prove

costly to administer. On the other hand, baseline-oriented fee system can be applied on a sector-by-sector basis with relatively little negative overall effect.

Economic Impact

Net economic impacts are expected to be positive, or at worst neutral. Source operators are expected to take economic effects into account when choosing whether to adopt mercury reduction measures. They are not expected to choose options that cause them, or the region as a whole, competitive disadvantage(s). Moreover, as long as local firms avoid negative economic choices, the state's general economy will not incur losses because of the fee.

Benefit/Cost Analysis

This ratio is expected to be positive. Economic costs are expected to be neutral to negative. That is, gains made by firms adopting low-cost mercury reduction methods are expected to outweigh the program's economic costs. This should yield a relatively high Benefit/Cost ratio.

Fairness

Source operators who maintain emissions at baseline amounts will incur no new charges. Operators who reduce emissions will receive financial rewards. Operators who increase emissions will incur costs. This balanced distribution of costs and rewards fits well with the Advisory Council's fairness criterion.

Political and Social Concerns

Impacts on sensitive populations will be positive to the extent that fees encourage mercury reductions. At worst, social impacts will be neutral if no source operators take advantage of the economic incentive that a baseline-oriented fee system presents.

Political concerns are not expected to be quite so easily sorted out. Tax and fee issues are always controversial. They involve more than just consideration of specific government programs. Interested groups present arguments for and against varied measures based on: a) issues related to the specific program under consideration; b) income distribution concerns; c) economic development plans; d) partisan political interests; e) government spending principles; and f) strategic plans for other, perhaps related, programs. Since a baseline-oriented fee system imposes no net fiscal or economic change, debate over the fee's merits may be a bit less controversial than other state revenue debates. However, it seems unlikely that any proposed change in state revenue policy will be uncontroversial.

Establish a Hazardous Waste Standard Related to Total Mercury Content
Main Authors: Western Lake Superior Sanitary District and MPCA Staff

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Affected sources: All waste generators currently subject to hazardous waste regulations (households are exempt)

Geographic scope: National.

Strategy: Promulgate a rule that classifies as hazardous mercury-containing waste that exceeds a set limit, e.g., 0.1 ppm. Base the limit on measurement of total composition or other measures that more comprehensively test the potential environmental impacts of a waste. The current waste classification system uses only the toxicity characteristic leach procedure (TCLP) test to determine whether waste should be managed with extra care under the hazardous waste rules. Given that the primary concern with mercury is volatilization, not leaching, the current system is inadequate. Many wastes that contain significant quantities of mercury can be legally disposed of as solid waste, much of which is combusted. It would be preferable to capture the mercury for retirement, recycling or land disposal.

Associated options: This strategy would encourage use of the source reduction options. This would occur both directly, as less mercury-containing waste would be placed in MSW, and indirectly, as the increased cost of disposing of mercury-containing waste would also lead to reduced use of mercury in products.

Cost-Effectiveness: remains to be determined

Cost: Remains to be determined but will need to include:

- Total composition test: $20-50 /test
- Number of tests conducted per year = # of affected waste streams, assuming < = 1 test/yr. for wastes which don't change in composition
- Time for affected industries to learn about rule and come into compliance x # of affected companies ...
- Time for state and county staff to enforce the rule ~ 0.5 FTE at state level

Financing: Compliance costs would be borne by industries that dispose of wastes that could contain significant levels of mercury. Funding for program (rule) development, education and enforcement would come from federal and state general budgets.

Reduction Potential:

<u>Air emissions</u>

Assume, as a rough guess, that five per cent of the mercury in MSW is contributed by industries that would be affected by the proposed strategy. Reduced air emissions from waste combustors = 3 tons/year x 0.05 = 300 lb./yr.

<u>Total releases</u>

Calculate as range where the high end equals 90 per cent of 29.6 tons/year for 1994-1995; 0.10 x 29.6 = 2.96 ~ 3 tons/year = 6,000 pounds nationally from MWC after existing regulations take effect.*

Implementation Issues:

- This idea/issue may have been discussed in the context of the Hazardous Waste Identification Rule.

References:

"The Effectiveness of the Toxic Characteristic Leaching Procedure to Characterize the Toxic Nature of Mercury-Containing Wastes," a Plan B Paper submitted to the faculty of the graduate school of the University of Minnesota by Thomas L. Holstrom, P.E., November, 19997

Apply the "Outstanding Water Resources" Laws on a Wider Scale
Main Author: MPCA Staff

Affected sources: Any significant source of mercury releases to water

Geographic scope: Minnesota

Strategy: The Outstanding Water Resources laws can lead to establishment of "total maximum daily load" (TMDL) standards for water discharges. This has occurred in some locations in Minnesota already. The same concept/program could be expanded to a wider scale, perhaps on a regional basis (e.g., the metro area would be one regulated region, Northern Minnesota might be another). This would give the MPCA more authority to regulate mercury releases.

Cost and reduction potential: not yet determined

Implementation issues:

- a TMDL program requires testing of all lakes in the affected region; that could be a problem, given the number of lakes (i.e., Minnesota has over 12,000 lakes 10-acres or larger; that's a lot to test).
- TMDLs for mercury are to be established later on in the current 13-year process

Apply the "Outstanding Water Resources" Laws on a Wider Scale
Main Author: National Wildlife Federation

* USEPA Mercury Report to Congress, new emission guidelines are expected to reduce emissions by 90 per cent from 1994-1995 levels.

Affected sources: All sources releasing appreciable amounts of mercury in a watershed would be included in the assessment. Likely sources are: utility, industrial, commercial, and residential boilers; incinerators; industrial and wastewater treatment plant dischargers; industrial mercury users; and other mercury-releasing industries and processes.

Geographic scope: The scope of the project would formally include the St. Louis River watershed, and regions containing sources (such as power plants or incinerators) emitting mercury which may be transported to and deposited within the watershed. The full geographic scope would not be known until all relevant monitoring data are collected from available sources, and modeling is done to estimate likely regional contributors to the watershed.

Strategy Description: Lake Superior's recreational, ecological, and cultural significance makes it an Outstanding National Resource Water under the Clean Water Act. The Minnesota Pollution Control Agency (MPCA) should address the lake's mercury impairment by developing and implementing a watershed clean-up plan that addresses point and non-point mercury sources. In particular, with the assistance of the U.S. EPA, the MPCA should develop a total maximum daily load ('TMDL') for mercury in the Lake Superior basin, under the authority of the Clean Water Act's TMDL provision. The MPCA should also review mercury air and water discharge permits, under the state's recently passed special designation program, to determine their efficacy in reducing mercury pollution.

National Wildlife Federation (NWF) proposes to work with the MPCA and other stakeholders to develop a pilot TMDL approach for the St. Louis River watershed. This would complement NWF's existing project work on TMDLs in the Great Lakes region including pilot TMDL development and the development of a citizen's TMDL handbook.

A multi-stakeholder group should be organized to develop a TMDL schedule for the St. Louis River. The group would include organizations such as the National Wildlife Federation, MPCA, EPA, local municipalities and industries such as the Western Lake Superior Sanitary District and Minnesota Power, Fond du Lac tribe, and other conservation and watershed groups. The TMDL development would involve some air modeling work, as well as data collection from all possible sources to accurately assess current loadings.

Associated options: This strategy calls on MPCA to:
1. Review its existing special designation for Lake Superior to assess its effectiveness in controlling air and water sources of mercury.
2. Target its review and enforcement of NPDES and air permits for mercury discharges.
3. Improve the use of Clean Air Act and state air controls to address atmospheric sources of mercury in collaboration with the U.S. EPA.

4. Develop watershed cleanup plans for all of Minnesota's mercury impaired waters on the 1998 Impaired Waters List with assistance from the U.S. EPA (this list should include all waters for which mercury-related fish consumption advisories exist).
5. Develop and implement a plan for controlling air sources of mercury.
6. Invest in more intensive mentoring of POTWs to control mercury discharges. WLSSD in Duluth, MN, is an example of a successful mentoring between MPCA and a POTW to reduce mercury.

Timeline: Although there are statutory limits on how long states have to initiate TMDL development and implementation, states and supporting organizations can move more quickly if desired. A pilot type project could be developed quickly, within 6-9 months, and implementation should begin shortly thereafter. MPCA's review of permits should be implemented immediately, with a one-year completion date.

Reduction Potential
This strategy has the potential to make significant progress in eliminating water quality impairments to Minnesota's waters, including those from mercury pollution. The actual development of TMDLs will then determine the reductions that are required of all sectors. If it is determined that most mercury loadings to the water body are from air deposition, then more stringent controls will be required on the air sources. Potentially, an incinerator or power plant may need to show 50 per cent, or greater, reductions in mercury releases in order to reduce water concentrations to the desired levels. Additionally, the pilot St. Louis River TMDL could be used to develop other watershed cleanup plans under the TMDL program. This would increase mercury reduction potential.

Cost-Effectiveness
Costs for the reduction schedules will depend on the results of the TMDL development. If it turns out that several incinerators and/or power plants are major sources of mercury to the watershed, then costs range from the 'medium' to 'high' end (e.g. $2,500 - $30,000/lb. and > $30,000, respectively) in the MPCA scheme. However, it is important to obtain accurate assessments of these costs, by looking at all possible control options. . Analysis should include the economic and cultural costs of failing to implement mercury reductions, including: a) health care costs, b) economic loss incurred by recreational and commercial fishing firms, c) loss experienced by people who depend on catching fish for food, d) clean-up costs, and e) other related factors.

Financing: Reductions would be financed largely by affected industries. Some subsidies could possibly be provided, especially if industries adopt either innovative control procedures, or proven options that are at the high-end of cost estimates. Incentives for innovative approaches to achieving reductions (including alternative fuel use or novel control mechanisms) should be provided.

Implementation Issues
Because TMDL implementation is a relatively new arena within the regulatory structure, much of this work will have no precedent. As noted in the strategy on a MACT mandate,

linking MACT controls for air emissions to water quality impacts, will be hard. Given the generally poor control practices for mercury from power plants, MACT standards may be hard to develop. Some voluntary measures may need to be pursued (including coal cleaning, fuel-switching, etc.).

9.2.2.2.2 Strategies Related Mainly to Products

Deposit and Refund Systems
Main Author: MPCA staff

Background: Deposit and refund systems may be used to reduce mercury releases from discards of mercury-bearing goods and equipment. Procedures for deposit and refund systems have become familiar in Minnesota and elsewhere. Customers pay deposits when buying selected goods. Deposits are refunded when customers bring to redemption areas. Deposits could be applied to, say mercury-bearing thermometers, or other mercury-bearing consumer goods or manufacturing equipment.

Affected sources: For the thermometer example described above, households, medical services and, perhaps, veterinary services would be affected.

Geographic scope: A state system is proposed, although regional or national systems are also possible.

Strategy: This strategy reduces mercury releases by creating an incentive to discard properly mercury-containing products. Returned product discards would be recycled, instead of disposed in the solid waste management system. The strategy is mandatory because sellers would be required to charge deposits. Consumers would not be required to return discarded goods, but they would lose their deposits if discards were not returned for refund.

The timeline for implementing the strategy would be years. Development of a deposit and refund system would require time, although perhaps not as much as a conventional regulatory system.

Associated options: Redeeming discards in return for deposits would: a) prevent disposal through general waste management systems and b) move discards into the recycling system.

Cost-Effectiveness: not estimated

Cost: Estimates for administrative costs should be available from existing programs. Analysis would be needed to determine the deposit needed to get consumers to return discarded products.

Financing: Administrative costs could be covered by proceeds from unredeemed deposits.

Reduction Potential: not estimated

Implementation Issues:

- Legislative orders are needed to develop a deposit and refund system for mercury-bearing goods and equipment. Regulators then have to develop systems to collect deposits, distribute refunds and recycle discards.
- Manufacturers and retailers seem likely to object to added cost and trade interference. Administrative costs are likely to be relatively high for a reasonable enforcement effort. Consumers' added costs are seldom taken into account, but they could be high.

Sales Fee on Mercury-Containing Products
Main Author: MPCA staff

Background: An estimated 50 to 100 tons of mercury are found in products in Minnesota. Another six tons of mercury enters the state each year as new products are sold in the state. Assuming a 10- to 40-year life span, the mercury in discarded products adds up to 1.7 to 10 tons per year.[*] The MPCA estimates that the reduction in environmental releases due to decreases in mercury sales or collected mercury products is roughly equal to fifteen per cent of the amount collected or not sold.

Affected sources: Wholesalers and retailers

Geographic scope: Minnesota

Strategy:

Charge a fee or tax on the sale of mercury-containing products (the same products that currently require labeling) in Minnesota. . Use the proceeds to fund: a) outreach to product consumers, b) collection of mercury-containing products, c) product labeling enforcement, and d) product collection and recycling systems. The fee would be set at a level intended to cover needed funding. The law could be added to the existing labeling law. NOTE: because the fee is not proposed to be set explicitly to result in reduced use of mercury in products or decreased purchases, this is not a stand-alone strategy.

Cost-Effectiveness: $400/lb. to $3,300/lb.

Cost: Total annual estimated cost: $149,000 to $1,205,000.

- Program Administration: 0.5 FTE /yr. = $25,000/yr.

[*] See Section 6.1.

- Costs to Sellers: Depend on the method selected to collect the fee. Assume a wholesale fee assessed on 200 wholesalers with additional administrative costs of $500 per wholesaler. Cost = $100,000.
- Costs to Purchasers: $2 to $90 per pound of mercury = $24,000 to $1,080,000/yr.
- Purchasers' costs are based on the assumption that manufacturers pass costs on to consumers. Fee rates depend on what the intended uses for fee proceeds. Based on roughly 12,000 pounds sold per year, the fee rate would vary as follows:
    - Program Administration Only $25,000 = $2/lb.
    - Outreach and Education to product users (plus $25k above) + $50,000 = $6.25/lb.
    - Collection and disposal of the discarded products that offset sales (plus $75k above) + $20,000 to -$60,000 (3.3-10 per cent of 12,000 lb. x $50) = $7.90/lb. to $11.25/lb.
    - Collection and Disposal of all discards (plus $75k admin. and outreach) + $166,650 to 1,000,000 (3.3-10 per cent of 50 tons x $50) = $20 to $90/lb.

For example, with a fee of $20/lb., the increased cost of a thermostat would be $0.20 (1/100 lb.). The increased cost of an electric relay would be $15 (3/4 lb.).

Financing: Funds to cover MPCA staff administrative requirements could be requested from the legislature general funds. Other costs would be borne by product manufacturers, sellers, and consumers.

Reduction Potential: 360 lb./yr. to air

Assuming:
- 12,000 lb. of mercury contained in products is purchased each year
- the fate of mercury in products is as predicted in the Mercury Product Fate Tree shown (see Part 6.1)
- the sales fee results in a 20 per cent reduction in discards due to decreased sales and increased recycling.
- 12,000 lb. x 20 per cent x 15 per cent = 360 lb.

Implementation Issues:
- The best way to collect the fee would need to be determined. Some possibilities include a tax at the point of sale, a tax on the first sale of the product in the state or a registration fee for sellers of products (based on sales volume). This could be modeled after the Petro Fund that levies a tax on the wholesale distribution of fuels (pays for tank clean-up operations). Another possible model is a seller registration fee for pesticides, which is 0.4 per cent of annual sales, with a $250 per year minimum. Total annual fee proceeds are $600,000.
- Other attempts to raise revenue by charging a fee on problem materials and litter have failed in the state.

- One difference between mercury sales and these models is that pesticide sellers and fuel distributors are already registered, so they can relatively easily be contacted and tracked.
- Wholesalers with product stewardship programs in place could be exempt from fees.

Mercury Reduction Plans for All Primary Sources
Main Author: Tim Tuominen, WLSSD

Affected sources:

Persons who cause mercury to end up in the solid waste stream or wastewater, including manufacturers and commercial users of mercury-containing products. This isn't intended to apply to cases in which mercury emissions are incidental, nor to the general public.

Geographic scope: Minnesota

Strategy:

Require a five-year reduction plan and implementation of programs to reduce mercury releases to environment. Source operators, i.e. demolition contractors, hospitals, etc., must show progress to reduce 50 per cent of their mercury releases in five years, 90 per cent in ten years. Spot inspections would determine if reduction goals are being met. If not, regulations and fees would kick in. This type of program would give source operators a chance to show that they can reduce mercury use and releases without regulations. Source operators would need to use proper waste management to avoid regulations that could be more costly. A spot inspection team could be set up using staff from other sources and MPCA, OEA or Minnesota Office of Technical Assistance staff.

Associated options: source reduction for municipal solid waste and wastewater.

Cost-Effectiveness: $6,800/lb. to $18,000/lb. for reductions to air
$500/lb. to $1,500/lb. for reductions to all media

Cost: $6,757,500 to $6,790,000/year
- State staff: 2 FTE = $140,000/year (1 FTE to review plans and provide technical assistance, 1 FTE to track compliance with reduction goals and do spot inspections)
- Costs incurred by source operators:
  - Assume that 3,000 sources make mercury reduction plans (1,200 dental offices, 1,200 hospital and Healthcare facilities, 200 demolition contractors, and 400 other sources)
  - $600,000 per year ($3,000,000/5 years) to prepare reduction plans at $1,000 per source
  - $6,000,000 per year to pay for activities required to implement and demonstrate compliance with the plan, including staff education at $2,000 per source per year

- $17,500 to $50,000 per year for removal and handling of wastes at $50/lb. x 350 to 1,000 lb. per year

Financing: General fund money or grants would be needed to cover costs for state staff time. Counties and primary sources would also need to cover costs. Fee proceeds could appropriately be used to fund this type of strategy.

Reduction Potential: 375 to 1,000 lb./year to air; 4,650 to 13,000 lb./year to all media

- Assume that this strategy would result in a 25 per cent reduction in purchase of mercury-containing products and a 50 per cent reduction in improper disposal,
- based on the mercury in products fate tree, reduction potential = (0.15)[(0.25 x 12,000lb./yr.) + (0.50 x 4,000 to 20,000 lb./yr.)] = 750 lb. to 2,000 lb./year.
- To account for the household exemption, reduction potential estimates have been divided in half.

Implementation Issues:

- Legislation will be required; rule writing by MPCA will also be required.
- Source operators would need to understand the goals and be active in reduction efforts.
- Some sources may be reluctant to participate.
- Good estimations and use of inventories would need to be developed to determine if goals are being met.
- A decision regarding the most appropriate entity to review and approve plans would need to be made.
- It would need to be established more clearly to whom the strategy applies (e.g., "users of more than X units per year of product Y").

Require Use of "Best Management Practices"
Main Author: MPCA staff/SRFRS Committee discussion

Affected sources: The majority of significant mercury sources (i.e., mercury users)

Geographic scope: Minnesota

Strategy:

This strategy is similar to the previous one except that state rules and guidance would be established to describe "best management practices". In addition, the applicability would be limited to a somewhat smaller (2,000 vs. 3,000) number of facilities. Compliance would be determined by testing to determine the average concentration of mercury content of wastewater and municipal solid waste in each country or region of the state. If source operators do not meet regulatory goals (e.g., 50 per cent reduction in five years, 90

per cent reduction in ten years), then source reduction plans as described under the previous strategy would be required.

Associated options: source reduction for municipal solid waste and wastewater.

Cost-Effectiveness: $4,100 to $11,000/lb. for reductions to air.

Cost: $4,117,500 to $ 4,150,000/year

- State staff: 1.5 FTE = $100,000/year (1 FTE to provide technical assistance, 0.5 FTE to track compliance with reduction goals)
- State monitoring costs: $1,000,000: 4 tests of MSW per year in 5 regions (using mass burn waste combustors) @ $50,000/test; assume wastewater testing is covered by WWTP
- Source operators' costs: Assume that 2,000 source operators take action (1000 dental offices, 800 hospital and healthcare facilities, 100 demolition contractors, and 100 other sources).
  - $3,000,000 for activities required to implement a plan, including staff education (2,000 sources at $1,500 per source per year)
  - $17,500 to $50,000 for removal and handling wastes at $50/lb. x 350 to 1,000 lb./year

Financing: General fund money or grants would be needed to cover costs for state staff time. Counties and primary sources would also incur costs. Fee proceeds could also appropriately be used to fund this type of strategy.

Reduction Potential: 375 lb./yr. to 1,000 lb./year to air
- Assume that this strategy would result in a 25 per cent reduction in purchase of mercury-containing products and a 50 per cent reduction in improper disposal.
- Based on the mercury in products fate tree, reduction potential = (0.15)[(0.25 x 12,000lb./yr.) + (0.50 x 4,000 to 20,000 lb./yr.)] = 750 lb. to 2,000 lb./year.
- Estimates are cut in half because the strategy doesn't apply to households.

Implementation Issues: Determining the reduction goal of the program.

Improve Compliance with Mercury Product Labeling Requirements
Main Author: MPCA staff

Background:

Current Minnesota law requires manufacturers of products containing elemental mercury to label the product with content information and disposal advice. The purpose of the label is to inform consumers' purchasing and disposal decisions. Labeling requirements may also affect manufacturers' design and marketing decisions. Some manufacturers have made an effort and incurred expense to comply with this law. Current MPCA

resources do not allow for the widespread enforcement of this law. Some labeling is currently required in other states (e.g., Vermont) and stricter enforcement could lead to nationwide adoption of consistent, across-the-board standards.

Affected sources: Manufacturers of mercury-containing products

Geographic scope: Minnesota.

Strategy: Increase education about and enforcement of the labeling requirement in Minnesota law (Minn. Stat. **§** 116.92). Such an effort would begin by MPCA inspecting products sold at Minnesota stores to determine which products comply with the law and which do not. Institute a system to determine 1) changes in compliance due to enforcement efforts, 2) effects of labels on consumer choices, and 3) how labeling is being used to promote non-mercury products.

Associated options: Source reduction in municipal solid waste and wastewater, specifically options.

Cost Effectiveness: $600/lb. for reductions to air
$90/lb. to all media

Costs: $215,000 per year

- $25,000 for one year to cover 1/2 of an MPCA position, to begin strategy implementation,
- $5,000 for one year for information materials,
- $15,000/year for staff (1/4 position) to cover ongoing enforcement ("maintenance mode").
- Costs to businesses to comply: one-time and ongoing averaged over time = $1,000 x 200 = $200,000/year

Reduction Potential: 360 lb. to air, 2,400 lb./yr. total to all media
Over time this program could lead to a 20 per cent reduction in discarded and purchased products or a 2,400-pound reduction in mercury releases due to increased recycling of products, decreased purchase of products, decreased manufacture of products.

Financing and Synergistic Strategies: This strategy could be combined with another strategy that has a means for providing income, such as a fee on mercury-containing products or emissions. Alternatively, the MPCA could request funding from the legislature.

Label "Installed" Mercury-Containing Products
Main Author: MPCA staff;

Affected sources: All users of mercury-containing products except households, or a few industries in which mercury-containing products are most commonly used.

Geographic scope: Minnesota

Strategy: Require labeling of products which contain mercury to clearly indicate that an item contains mercury, that it should not be disposed of in the trash, and how it should be managed. It may be appropriate to tie this in with an associated existing or new disposal ban.

Associated options: source separation; replacement of mercury-containing products

Cost Effectiveness: $ 3,600/lb. to air; $530/lb. to all media

Cost: $470,000/yr. + $50/lb. x reduction potential to all media

- Assume that the program covers five years and that 2,000 facilities label their mercury-bearing equipment.
- $400,000 per year to put labels on equipment at $200 per affected facility x 2,000 affected facilities per year
- $60,000 for state staff: 1 FTE for one year to develop, 1 FTE for next four years to promote and enforce 1 FTE on average per year = $60,000
- $10,000 per year for promotional materials, including labels
- $0 to $50,000 per year for proper handling and disposal at $50/lb. x (0 to 975 lb./yr.)
- (See part 8.2.1. for the basis of the cost estimate)

Financing:

Source operators would be expected to cover costs of learning about the program, labeling products and disposal for discards. State staff could be funded through a state or federal grant or general funds, or through a fee on mercury-containing products.

Reduction Potential: 145 lb./yr. to air; 975 lb./yr. total to all media

Reduction potential estimates are the same as the ones made for the voluntary labeling strategy, except the lower range is not set at zero because this strategy is mandatory. It is estimated that tons mercury are contained in installed products. Reductions would occur mainly at WWTPs, waste combustors and landfills. Releases from spills (not estimated) would be reduced, which would lower the direct human health impacts and clean up costs imposed by spills.

If labeling reduces improper disposal by 25 per cent, then maximum reduction potential would be .25 (580 lb./yr. to air; 3,900 lb./yr. total to all media) = 145 lb./yr. to air, 975 lb./yr. to all media.

Permanent: Yes and no, depending on how replacements are made.

Implementation Issues:

- Detailed identification of mercury-bearing products that would be found in various applications would be no small task. However, the OEA, the MPCA and others have already done some of this work.

Recordkeeping Requirements for Mercury-Bearing Equipment
Main Author: MPCA staff

Background:

Mercury is found in many types of instruments in manufacturing facilities, utilities, and large buildings. According to comments received during committee discussions, many facility managers have a general idea of the types of equipment that may contain mercury but do not know which specifically items in their facilities actually do contain mercury. Some devices contain mercury, while similar devices do not.

Strategy:

Facility managers would be required to maintain inventories of mercury-bearing equipment items. The strategy could include a requirement to submit the inventory to the MPCA. Facilities likely to be included in such a requirement are:

Manufacturers
Utilities
Governmental Agencies
Property management companies
Educational institutions
Medical facilities

Geographic scope: Minnesota

Associated options: The strategy would have four results:

1) Facility managers would have a comprehensive list of known equipment containing mercury to which they could refer when replacing equipment, thus making it more likely that the used mercury-containing item would be disposed of properly.

2) It would encourage the use of non-mercury containing products to avoid the recordkeeping chores.

3) Enforcing this requirement would raise awareness of the dangers of improper mercury disposal.

4) A further requirement to report the inventory to the MPCA would give the agency valuable information on the amount of mercury in already-installed equipment, which may facilitate programs such as the dairy manometer replacement program.

Cost-effectiveness: $20,750/lb. to air.

Cost: $830,000/yr.

The roughly estimated private cost of recordkeeping requirements ($2,000 per facility) would be proportional to the amount of mercury-bearing devices a facility uses. The strategy would require time to identify likely devices, ascertain whether or not they contain mercury, list them, and maintain the list. The total cost for all facilities, assuming it would require $2,000 per year at 400 affected facilities, would be $800,000 per year.

State staffing needs: Initial discussions with representatives from the major sectors would aid in developing lists of items that may contain mercury. Some outreach would be desirable to inform affected facility managers of the requirement, and presumably some enforcement would be involved to ensure that the requirement is followed. The requirement could be included in MPCA permits issued for a determined period of time. If reporting to the MPCA is required, someone would need to receive and review the reports and record the data. The administrative oversight could be accomplished with about 1/2 FTE at the MPCA, at an annual cost of roughly $30,000.

Reduction Potential: direct = 0, indirect = 40 lb./yr. to air.

Basis: If disposed of improperly, mercury-bearing devices end up in the municipal solid waste stream. They may end up in a waste combustor, or in a landfill. The MPCA estimates that solid and medical waste combustion resulted in the release of 568 pounds of mercury in 1995. While the source of some of the mercury in combustor emissions was household waste, some of it was undoubtedly from large facilities.

Based on a guess that roughly one-fifth of the mercury in incinerator emissions results from improperly discarded equipment, and assuming total projected emissions from waste combustors to be 219 pounds per year in 2000, the potential annual reduction of mercury emissions would be around 40 pounds per year.

Implementation Issues

- Identifying and keeping track of equipment could be very time consuming, dependent upon the size of the facility.

Synergistic Strategies:

This strategy could be implemented along with a "clean sweep" strategy or in advance of a "clean sweep" or similar program. It could include fluorescent lamps, which would provide data useful in assessing the effectiveness of the lamp recycling law, the amount of lamp breakage and more. It would also fit in with plans to improve the mercury emission inventory.

Increase Compliance with Disposal Bans
Main Author: MPCA staff

Background: Existing laws ban disposal of mercury-containing products in the solid waste and wastewater streams. When the legislature passed the bills regarding mercury product disposal, no funding was provided, which has led to a lack of program administration, education, and enforcement.

Affected sources: All users of mercury-containing products (those covered in Minnesota Statutes § 115A.932 and § 116.92, Subdivision 4, **"**Removal from service; products containing mercury").

Geographic scope: Minnesota

Strategy: Following outreach, assistance and education to targeted sectors, MPCA and county solid and hazardous waste personnel could increase investigation and enforcement of the disposal prohibition in key sectors. Enforcement could consist of a notice letter, followed by a fine for continued non-compliance. Information and assistance would be provided at all sites visited.

Associated options: source reduction of municipal solid waste and wastewater.

Cost-Effectiveness: $800/lb. for reductions to air
$120/lb. for reductions to all media

Costs: $120,000 for the first year, and $115,000 for each year thereafter

- $5,000 for information materials for the first year
- $15,000/year for staff (1/4 position) to cover ongoing enforcement
- $50,000/yr. costs for enforcement staff in other agencies.
- $50,000 for increased waste management costs at $50 /lb. X 1,000 lb.

Reduction Potential: 150 lb./yr. to air, 1,000 lb./yr. total.

Financing and Synergistic Strategies:

This strategy could be combined with another strategy that has a means for providing income, such as a fee on mercury-containing products. Alternatively, the MPCA could request funding from the legislature.

Implementation Issues:

For industries that now comply with the disposal ban, this may be welcomed as a change that will level the playing field. The estimated compliance with the disposal ban on fluorescent lamps is 70 per cent, i.e., 70 per cent are recycled. The compliance rate for other mercury-bearing products is thought to be much lower.

Expand Mercury Product Disposal Bans

Affected sources: auto manufacturers and/or automobile scrap yards; households.

Geographic scope: Minnesota

Strategy: Improve the consistency of Minnesota laws that ban MSW disposal of mercury-containing products. Amend the disposal bans so that they apply to households and to all industries.

Associated options: source reduction of municipal solid waste

Cost-Effectiveness: not estimated

Costs: not finalized
- $15,000/year for staff (1/4 position) to work with the legislature and affected sources
- Costs not estimated for affected industries and households, for technical assistance or for enforcement activities.

Reduction Potential: not estimated

Financing: Funding for the 1/4 FTE staff position at MPCA could be covered by existing funding for MPCA staff. Other costs would be borne by industries. A fee on mercury-containing products could be used to cover enforcement costs.

Mandatory Product Stewardship for Products Sold in Minnesota

Main Author: MPCA staff

Background: Minnesota law currently requires manufacturers of mercury displacement relays and mercury-bearing batteries to provide education and incentives for proper management and to cover the costs of proper disposal. The battery law led to the development of a manufacturer-sponsored nationwide program for recycling nickel-cadmium batteries. The relay requirement goes into effect this year. Honeywell

voluntarily established a take-back program for its mercury thermostats that now covers nine states and includes the three major US thermostat manufacturers.

Affected sources: Consumers and product manufacturers. The strategy would apply to the products that are banned from disposal in solid waste/sewer and require labeling.

Geographic scope: Minnesota

Strategy: Expand the relay law to cover more mercury-containing products, including lamps. Require all manufacturers whose products are sold in Minnesota to provide education and incentives and to cover the costs of proper waste management.

Cost-Effectiveness: $ 1,100 - 2,500 per pound for reductions to air.

Costs: $980,000/yr. to $1,130,000/yr.

- MPCA Administration/Enforcement .5 FTE @ 60,000 = $30,000/yr.
- Manufacturer Administration: $300,000 per year for initial set up costs, averaged over 5 years at $15,000/yr. X 100 companies = $1,500,000 / 5
- $500,000/yr. for ongoing program administration at $5,000/yr. X 100 companies
- $150,000/yr. to $300,000/yr. for product Recycling at $50/lb. X 3,000 to 6,000 lbs.

Reduction Potential: 450- 900 lb./yr. to air.

An effective product stewardship program could collect 25-50 per cent (3,000 to 6,000 pounds) of the 12,000 pounds of mercury in products sold in Minnesota every year. The MPCA estimates that roughly 15 per cent, or 450 - 900 pounds, of releases to air per year would be avoided.

Implementation Issues:

- Involving the manufacturer in product collection and recycling has a number of advantages. First it is one of the least expensive methods of collecting of capturing mercury. Honeywell was able to design an accepted, low-cost system for reverse distribution of their thermostats. This system has demonstrated some of the lowest costs per pound for mercury capture and disposal: Each thermostat costs about $0.70 to collect and manage (from the point that they are consolidated by the wholesaler) with about 120 thermostats per pound = less than $100 per pound. The Honeywell model has certainly increased proper management of mercury-containing thermostats.
- Involving the manufacturer may also influence their decisions to produce mercury-containing products or design them for easier removal and management. Manufacturers are also tuned into the users of the products and could be effective at providing outreach to the product users.
- Current law does not require manufacturers to literally take back the items, only to cover costs of proper management. Manufacturers of products could cooperate to

establish a system in Minnesota, contract with existing entities such as household and small business collection programs and mercury recyclers or pay a fee into a state-run collection and disposal system.

- How to deal with products no longer sold is an issue. The law would apply to products being sold at the time the law is passed.
- If Minnesota mandated manufacturers to cover the cost of properly managing lamps and other mercury-containing products, and adjacent states didn't do so as well, such products could be "boot legged" across state lines.

SRFRS Discussion:

This strategy was discussed as a potential NIKE. It was not unanimously identified as a NIKE because it was not entirely clear what the affected businesses would be and the potentially incurred costs.

License Bulk Mercury Sellers and Buyers
Main Author: MPCA Staff

Affected sources: Product manufacturers, neon sign manufacturers, schools and universities, and other bulk elemental mercury users. (Does not apply to waste combustors.)

Geographic scope: Mercury buyers and sellers in Minnesota and mercury importers.

Strategy: Require sellers and buyers of bulk mercury to obtain a license and report the quantities of mercury that they bought, sold, or used each year. The MPCA could then provide them with information on: a) the harmful effects of mercury to humans and in the environment, b) applicable laws, c) non-mercury alternatives, and d) requirements for on-site storage, transport, and proper waste management. The main intent of the strategy is to educate bulk mercury users. The tracking system would not be rigorous enough to provide a "cradle-to-grave" degree of detail.

Bulk mercury sellers must provide a material safety data sheet (MSDS) to buyers[*]. The law also limits the uses for which mercury can be sold. A licensing system for sellers would assist MPCA in knowing who sells and buys mercury. A licensing system would also increase MPCA's ability to enforce the law.

Associated options: Source reduction for municipal solid waste and wastewater

Cost-Effectiveness: $5,100/lb. (based on a five-year average of $255,000)

Cost:

[*] Minnesota Statutes § 116.92 Mercury Emissions Reduction, Subdivision 1.

Administrative costs to the state: $75,000 for five years.

- $25,000 for one year to cover 1/2 of an MPCA position, to begin strategy implementation
- $5,000 for one year for outreach materials
- $15,000/year for staff (1/4 position) to cover ongoing enforcement

Licensed businesses: Total cost for first five years: $1,200,000.

- Source operators would incur costs for the licensing fee, time needed to become familiar with the law, to apply, and time to read and take action based on information received.
    - Year 1: The law would affect 2,000 sellers and buyers (mainly schools)
      Cost to each = $400 to cover staff time and, for those who decide to get licensed, a $100 license fee, which is good for five years
      Total for Year 1 = $800,000

    - Years 2-5: 500 buyers and sellers decide to get licensed while others discontinue using mercury.
      Ongoing costs = $200/year
      Total for Years 2-5 = $100,000/year x 4 years = $400,000

Financing: Licensing fees could be used to cover MPCA administrative costs.

Reduction Potential: 50 lb./yr. to air

Because little is known about use and improper disposal of bulk mercury, reduction potential is difficult to predict. Some reductions in the content of mercury in municipal solid waste and wastewater could be expected. In addition, releases from spills would be expected. Rough guess: reduction potential = 50 pounds per year to air (from MSW and spills) and five pounds per year to water

Implementation Issues: Criteria for determining who needs a license and licensing standards would need to be established.

Synergistic Strategies: inventory improvement, and improvement of the HHHW infrastructure

SRFRS Discussion:

This strategy was discussed as a potential NIKE. It was not unanimously accepted as a NIKE because some committee members found it to be too vague: Who would be licensed? How would the licensing work? What would be the source of funding? What would any licensing fee be based on?

License Sellers and Buyers of Encapsulated Mercury
Main Author: MPCA Staff

Affected sources: Manufacturers, distributors and final goods producers.

Geographic scope: Domestic buyers and sellers in Minnesota, plus importers.

Strategy: Similar to the previous strategy, except that this strategy applies to mercury-containing devices, not bulk mercury. Require affected sources (see above) to obtain a license and report the quantities of mercury that they bought, sold, or used each year. The MPCA could then provide licensees with information on: a) the harmful effects of mercury to humans and in the environment, b) applicable laws, c) non-mercury alternatives, and d) requirements for on-site storage, transport, and proper waste management. This would also provide data that would help the MPCA keep track of who uses mercury.

Cost Effectiveness: $4,000/lb. (based on a five-year average)

Costs:
- $5,000 for one year for outreach materials
- $15,000/yr. for staff (1/4 position) to cover ongoing licensing ("maintenance mode")
- $100,000/yr. costs to businesses using same estimates as were used for the previous strategy
- average cost for five years = $116,000

Reduction Potential: 30 lb. (assumes 1,000 pounds per year sold, 20 per cent reduction and 15 per cent environmental avoidance = 30 lb.)

Financing and Synergistic Strategies: This strategy could be combined with another strategy that has a means for providing income, such as a fee on mercury-containing products. Alternatively, the MPCA could request funding from the legislature.

9.2.2.2.3 Strategies Related Mainly to Utilities

Coal-fired Power Plants Fee, Proceeds to Mercury Control Technology Jackpot
Main Author: MPCA staff

Background: A “jackpot” approach was used to encourage development of an alternative to CFCs for refrigeration.

Affected sources: Public and private coal-fired power plants over 50 MW total capacity.

Geographic scope: Minnesota

Strategy: Add a fee to the state emission inventory and fee system for mercury emissions from coal-fired power plants. The fee should be set to generate enough revenue to create a "jackpot" (how much would be necessary remains to be determined). The jackpot would be awarded to the person(s) who patent and demonstrate full-scale feasibility of a method for controlling mercury emissions from coal-fired power plants. The winning entry should reduce mercury emissions at least 50 per cent more than control equipment does. So, if current control systems reduce mercury emissions by 40 per cent, winning entries should achieve a total control rate of 60 per cent.

Cost-Effectiveness: difficult to determine, because the direct reduction potential is zero, and long-term reduction potential is unknown. A rough estimate, assuming a fee of $400/lb. and a reduction potential of 100 lb. = $16,000/lb.

Cost: Roughly $1,640,000/year

- Cost to utilities would depend on the fee level. A fee of $400/lb. would generate approximately $600,000/year toward the jackpot.
- Assume that costs for research and development are covered by the award.
- $1,000,000/year for continued operation at the demonstration facility (100 lb. @ $10,000/lb.)
- Cost to administer the program: 0.5 FTE at MPCA = $40,000/year

Reduction Potential: direct: 0. Indirect = up to 750 lb./year, although over 100 lb./year appears unlikely.

Basis: coal-fired utility boilers emit approximately 1,500 lb./year. 50 per cent = 750 lb./year. The fee would likely not be set high enough to encourage mercury reductions. Reductions may not occur for a number of years, until the jackpot grows to an enticing size.

Implementation Issues:
- It appears unlikely that a "one size fits all" control technology would be found. The most cost-effective type of control equipment for reducing mercury emissions differs depending on the boiler system design, existing control equipment and other factors.
- Fees are unpopular with the public and regulated industry.
- Use of the funds collected, if the jackpot was awarded by a certain year, should be designated (e.g., apply it toward development of non-mercury emitting energy generation or energy efficiency measures).

Fee on Coal-fired Power Plants, Proceeds to Mercury Control Technology Implementation. Main Author: MPCA staff

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Strategy: Same as the previous strategy, except the jackpot would be awarded to the first facility operator who installs mercury controls.

Cost-Effectiveness: $13,200/lb., assuming a $400/lb. fee and reduction potential of 200 lb.

Cost: Rough estimate: $2,640,000/year

- Cost to utilities would depend on the fee level. A fee of $400/lb. would generate approximately $600,000/year toward the jackpot.
- Assume that costs for research and development are covered by the award.
- $2,000,000/year for continued operation at the demonstration facility (200 lb. @ $10,000/lb.)
- Cost to administer the program: 0.5 FTE at MPCA = $40,000/year
- (This estimate does not consider the cost of installing and operating the equipment to get the jackpot)

Reduction Potential: direct: 0; indirect = up to 750 pounds; assume 200 pounds.

Basis: coal-fired utility boilers emit approximately 1,500 lb./year. 50 per cent = 750 lb./year (although reductions of >50 per cent could occur). If four or five categories of boilers were established, implementation at as many boilers would be encouraged, if the jackpot was large enough. Reductions may not occur for a number of years, until the jackpot grew to an enticing size.

Implementation Issues:

Same as for the previous strategy, "Fee on Coal-fired Power Plants, Proceeds to Mercury Control Technology Jackpot." This strategy addresses the concern that a "one-size-fits-all" technology is not applicable to coal-fired boilers.

Require Electric Companies to Disclose Mercury Emission Rates
Main Authors: MPCA staff and Betty K. Jensen, PSE&G

Affected sources: Sellers of electricity

Scope: Minnesota

Strategy: Encourage emission reductions by requiring public disclosure, e.g., in utility bills, of the mercury emission rate of the electricity generating sources that provide consumer's electricity. For example, Toxic Release Inventory (TRI) reporting has encouraged many companies to reduce toxic chemical use and releases. Illinois requires its power marketers to disclose the environmental profile of the electricity sold, although at the moment mercury emissions are not part of the disclosure label. Including mercury

on a disclosure label would encourage emission reductions, which could start with pilot programs.

Implementation Issues:

- The units in which the emission rate is reported will affect the reader's reaction. It would be helpful to show Minnesota rates relative to a national average. Reporting total annual emissions for each generating source could also be used.
- This strategy relates to the idea of being able to purchase "green power."
- The method to be used to calculate the emission rate would have to be specified to maintain consistency.
- If utilities themselves are the source of the data, then the data may be viewed by some as suspect.
- This concept could be, but does not need to be, tied to utility deregulation.
- How to deal with purchased power would need to be addressed.

Information Sources: Reference documents regarding labeling and disclosure supplied by ME3.

State Buys Environmentally-Preferable Electricity
Main Author: Minnesotans for an Energy Efficient Economy (ME3)

Affected sources: Electricity generation firms.

Geographic scope: Minnesota

Strategy: Adopt and implement purchasing specifications which require that electricity purchased by the state be from generation sources which minimize environmental impacts, including that they are not significant mercury sources.

Associated options: wind and new gas generation

Cost-Effectiveness: not estimated

Reduction Potential: State government makes up approximately three per cent of the state work force. One could infer the reduction potential from this option to be three per cent of total emissions associated with energy production 40 pounds per year.

Implementation Issue: Choice of electricity supplier is not currently available in Minnesota, which makes this strategy infeasible in the short term.

9.2.2.3 State-Level Information/Research Strategies

Minnesota Mercury Research
Main Author: Minnesota Chamber and MPCA Staff

Affected sources: All sources of mercury releases.

Geographic scope: Minnesota

Strategy: Conduct research on topics that are unique or particularly relevant to Minnesota. Continue to evaluate national mercury research studies. Establish an advisory panel to collect and evaluate national and international research findings, identify additional research needs, and guide Minnesota research efforts. Involve research universities and private research entities. Explore the possibility of partnerships with other states. Research should be peer-reviewed and published. Research could include topics such things as:

A) an assessment of state fish consumption advisory levels, comparing Minnesota's system with other state, federal, provincial and tribal advisories and the methodologies used to develop them.. (Results can be used to encourage an appropriate and consistent nationwide advisory that is based on the best available data.)
B) a study to determine the risks state residents experience from mercury, based on actual fish consumption habits and taking into account fish consumption rates and mercury levels from a statistically representative population.
C) an assessment of the impact of fish consumption advisories on tourism .
D) tax incentives for research and demonstration of mercury reduction technologies, focusing on Minnesota industries, such as taconite mining
E) research on the fate of mercury from Minnesota sources , or for which the fate is unique to Minnesota
F) historical and current deposition and accumulation rates.
G) the relationship between mercury emissions, deposition, and fish contamination in Minnesota. (This study should include scientific assessment of what effect recent reductions in mercury deposition have had on fish contamination, and what other factors (sulfate, nutrients, etc.) may influence methylation rates (sediment and fish mercury data, etc.))
H) development of methods to better measure mercury forms from various process streams.
I) national efforts to evaluate mercury transport and fate
J) monitor, track, and participate in national assessments of wildlife impacts, such as effects on walleye, mink, otter, and loon.
K) monitoring programs to detect time trends in atmospheric deposition, fish contamination, lake loading, and other aspects of the mercury cycle, including parameters that may affect bioaccumulation of mercury in Minnesota (e.g., land use, groundwater, and changes in the food chain).
L) impact analysis of urban runoff on receiving waters in Minnesota.

M) impact analysis of climatic seasonal effects on mercury deposition and methylation rates in Minnesota.
N) determination of the appropriate measurement or monitoring techniques (both total mercury and its various forms) for different sources in Minnesota.

Implementation timetable would be two to five years.

Associated options: None

Cost-Effectiveness : Can not be determined because it has no direct reduction potential.

Cost: Will be determined by such factors as the research priorities established by the advisory panel, the availability of research funds, etc.

Financing: EPA grants, private funding, foundations, tax incentives, LCMR and environmental trust fund, DOE, Industry research groups, university grants.

Reduction Potential: Direct = 0. Indirect: some research projects may lead to development of viable mercury reduction techniques. Also, additional information on sources and quantities may lead to further voluntary reductions.

Implementation Issues:

- Financial resources,
- sharing resources and information and
- coordination with other states.

Synergistic Strategies:

"National Mercury Research Recommendations," "Develop Comprehensive Minnesota Mercury Inventory." This strategy also can be linked to the other strategies that relate to options for which research needs have been identified.

SRFRS Discussion:

Research was discussed as a potential NIKE strategy because the committee needs to finalize and review the details of the strategy to be updated by a subcommittee. It was noted that the AC should include research recommendations, both state and federal, but the two should be kept separate.

Minnesota Mercury Research - Fee Funded
Main Author: MPCA Staff

Affected sources: Potentially all sources, depending on research pursued and which sources would be assessed a fee to fund research.

Geographic scope: Minnesota

Strategy: Conduct research on issues that are unique or particularly relevant to Minnesota. Continue to evaluate national mercury research studies. Establish advisory panel to collect and evaluate national and international research efforts, identify additional research needs, and guide Minnesota research efforts. Involve research universities and private research entities and explore the possibility of partnering with other states. Research should be peer-reviewed, published, and could include such things as:

A) An assessment of state fish consumption advisory levels comparing Minnesota with other state, federal, provincial and tribal advisories and methodologies, identifying differences and similarities. Utilize the results of assessment to actively encourage pursuit of the establishment of an appropriate and consistent nationwide advisory based on the best available data.

B) A study to determine the current level of actual risk to state residents from mercury based on actual fish consumption, taking into account fish consumption rates and mercury levels from a statistically representative population and characterizing the most sensitive and exposed portion of the population

C) An assessment of the impact of fish consumption advisories on the tourism industry

D) Research and demonstration of technologies for reducing mercury from various sources through tax incentives or other means, focusing on industries which primarily are Minnesota based, such as taconite mining.

E) Research on the fate of mercury from sources that are primarily Minnesota based, or for which the fate is unique to Minnesota due to climate conditions, etc. An example would be to assess the long-term stability of mercury in taconite tailings.

F) Study on historical and current atmospheric deposition rates of total mercury and methylmercury.

G) Study of the relationship between emissions, deposition, and fish mercury in Minnesota including scientific assessment of what effect recent reductions in mercury deposition have had on fish mercury, and what other factors (sulfate, nutrients, etc.) may influence methylation rates (sediment and fish mercury data, etc.). Define further research needs in this area.

H) Development of methods to better measure/quantify mercury speciation in the various releases to the environment

I) National efforts to evaluate mercury transport and fate.

J) Monitoring of and participation in national research efforts

K) Assessment of wildlife impacts which are particularly relevant to Minnesota, such as effects on walleye, mink, otter, and loon; and to encourage national wildlife studies.

L) New and expanded monitoring programs to detect time trends in atmospheric mercury concentrations, deposition, fish contamination, lake loading, and other aspects of the mercury cycle, including other relevant parameters that may affect bioaccumulation of mercury in Minnesota (e.g., land use, groundwater, and changes in the food chain). Develop a mechanistic understanding of how mercury bioaccumulates in Minnesota waters.

M) Assessment of the impact of urban runoff on receiving waters in Minnesota.

N) Assessment impact of global climate change climatic seasonal effects on mercury deposition and methylation rates in Minnesota.

O) Study of the appropriate measurement or monitoring techniques (both total mercury and its various forms) for different sources in Minnesota to ensure consistency and completeness in the inventory.

Implementation timetable would be two to five years.

Associated options: None

Cost-Effectiveness: Can not be determined due to a direct reduction potential of zero.

Cost: Will be determined by such factors as the research priorities established by the advisory panel, the availability of research funds, etc.

Financing: New fee on mercury emissions to provide a base of funding, to be augmented by EPA grants, private funding, foundations, tax incentives, and funding from LCMR and environmental trust fund, DOE, Industry research groups, and university grants. Prioritize non-general fund funding sources, including: EPA grant, private funding, foundations, tax incentives, LCMR and environmental trust fund, DOE, Industry research groups, university grants.

Reduction Potential: Direct: 0 Indirect: research may lead to development of viable mercury reduction techniques. Also, additional information on sources and quantities may lead to further voluntary reductions.

Implementation Issues: Financial resources, sharing resources/information and coordination with other states.

Synergistic Strategies: "National Mercury Research Recommendations," and "Develop Comprehensive Minnesota Mercury Inventory." This strategy also can be linked to many of the other strategies that incorporate options for which research needs have been identified.

Develop a Comprehensive Minnesota Mercury Inventory

Main Author: Minnesota Chamber of Commerce:

Affected sources: All emitters, all discharges, and all manufacturers, users and disposers of mercury containing products that sell or buy these products in Minnesota.

Geographic scope: Minnesota

Strategy: The goal of this strategy is to fill in data gaps in the Minnesota mercury inventory. The current Minnesota mercury inventory focuses on mercury air emissions only, and includes several source categories which have low confidence data or no data at all. In addition, the current estimate for mercury in products currently in use in Minnesota is significant (50 to 100 metric tons). Low cost, high reduction potential options for addressing mercury are primarily associated with product manufacturing, use and disposal. However, the current inventory estimate is too uncertain to support strategies that address mercury in products. Also, discharges of mercury to water have not been estimated.

Filling these data gaps will improve confidence in cost effectiveness and reduction potential estimates. Data gaps need to be filled in, in order to determine the most cost-effective options with large reduction potential. The timeline for implementation would be 18 months.

This strategy would direct the MPCA to develop, by the end of 1999, a comprehensive mercury inventory. The inventory should estimate mercury releases to air, water and land. It should also estimate mercury releases associated with product manufacturing, use and disposal. Inventory development should be accomplished by involving all sources. If sources do not participate, then the MPCA will estimate releases and uses of mercury for those sources. The MPCA will provide technical assistance, including development and distribution of information on what types of products and processes contain mercury and the estimated amount. An advisory group of stakeholders would be set up to assist in:

- program establishment
- determining positive incentives which would encourage voluntary participation
- defining the data quality elements
- prioritizing information gathering efforts
- reviewing results

The advisory group's goals would be: a) to achieve an inventory of high quality which will be useful for identifying and reprioritizing options and strategies and b) to form the basis for measuring program success.

For some source categories, the approach could be to use funds to conduct independent monitoring in addition to voluntary reporting. Also, there would be a focus on products containing mercury, including manufacturing, use, and disposal. Information would also be gathered to be able to define the media impacted, or potentially impacted (land, water, air).

Associated options: None

Cost-effectiveness: Cannot be estimated because direct reduction potential is zero

Cost: Estimated total cost is $100,000. This would cover administrative costs, technical assistance and some limited monitoring. Research necessary for inventory improvement would be covered in a research strategy.

Financing: MPCA 1999 budget request, EPA grant (demonstration project), LCMR grant, general fund, environmental trust fund

Reduction Potential: Direct: 0 Indirect: Better inventory information will increase potential for significant reductions.

Implementation issues:

- Necessary conditions for funding; a) identify all sources, b) work with all relevant associations and c) adequate participation by all sectors.
- Some funding sources (e.g., LCMR) may not be available during the time frame required for this effort.

Synergistic Strategies: This strategy also can be linked to many of the other strategies that incorporate options for which inventory needs have been identified.