Taking a Bite Out of Dental Mercury Pollution

The 2005 Report Card on Dental Mercury Use and Release Reduction

new england

zero

Mercury Campaign

New England Zero Mercury Campaign Partners

Clean Water Action New England
Clean Water Fund New England
Health Care Without Harm
Mercury Policy Project, A Project of the Tides Center
Natural Resources Council of Maine
National Wildlife Federation

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On the Web

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Executive Summary

This first New England Zero Mercury Campaign (NEZMC) Report Card on Dental Mercury Use and Release Reduction finds that while some of the New England states have made progress in developing programs to address dental mercury, other states are failing to adequately address this important issue.

Connecticut, Maine and Massachusetts have taken significant steps toward preventing dental mercury emissions. Rhode Island has an effective program, but it covers less than half of the state's dentists. Unfortunately, New Hampshire and Vermont have yet to develop and implement effective programs to control dental mercury releases.

Background

Most dentists still use "silver" fillings, which are an amalgam of four metals—mercury, silver, copper and tin—with mercury comprising around 50 percent by weight. When fillings are repaired or replaced, mercury is often washed down the drain, thrown in the trash or combined with biomedical waste, which is incinerated.

By far, dental clinics are collectively the single largest wastewater polluters and the third largest users of mercury in the U.S. It is estimated that there are currently over 1,000 tons of mercury in the mouths of U.S. residents—more than half of all the mercury currently in use in all products. Unless proper management systems are put in place and amalgam use reduced, pollution from this source will continue. For dental practices that have not yet adopted better controls and procedures, current disposal methods lead to the eventual release of mercury to the environment. Thus, more stringent controls are necessary to reduce mercury pollution from dental offices.

This report finds that while amalgam use and release by dentists currently results in a significant regional source of mercury pollution, there are affordable solutions available to prevent release. Some of the solutions used by environmentally responsible dental clinics include: using non-mercury fillings, notifying patients about alternatives to mercury fillings, adhering to state best management practices in their offices, and installing and properly operating amalgam separators to capture dental mercury before it is released down the drain. Unfortunately, no New England state has yet mandated the full range of solutions that would prevent mercury releases from this source altogether.

The technological changes required in dental offices to significantly reduce mercury emissions are straightforward to install and operate, and relatively inexpensive. For example, according to industry sources, it costs dentists around $37.00-$75.00 per month to prevent close to 99% of mercury releases down the drain.

In 1998, the Conference of New England Governors and Eastern Canadian Premiers (NEG/ECP) established a landmark goal to "virtually eliminate" mercury emissions in the region. In 2003, the governors' Mercury Task Force reported that, "**As part of the continuing efforts to reduce mercury discharges from the dental sector, the Mercury Task Force will pursue a goal of having 50% of dentists in the region install dental amalgam separators by the end of 2005.** Each jurisdiction will develop an aggressive strategy to ensure that this goal is aggressively pursued."

Voluntary and Mandatory Solutions

Now decision makers across the region must provide the leadership necessary to accomplish that interim goal, and to move beyond it to fully eliminate dental mercury releases. In addition to a plan for 100% participation in the program, necessary steps include initiatives to promote source reduction of dental mercury, collection and proper management of mercury stocks, and control of mercury emissions from crematoria, sludge incinerators and other sources.

In this report, the NEZMC measures states' progress towards achieving these goals in New England, and makes recommendations for further reductions in mercury use and release from dental offices. **This report finds that a combination of voluntary incentives, technical assistance, and mandatory initiatives have been most successful**

in convincing dentists to take the necessary steps to reduce their mercury pollution.

The Past President of the Vermont Dental Society, Daniel Ferraris, DMS, recently provided the following written testimony to a Vermont legislative committee. "It seems clear from the science that amalgam separators do an excellent job at reducing amalgam in wastewater significantly. While no one likes to have mandates put on them, it seems clear to us that we will achieve a much higher level of compliance with mandated separators than a voluntary approach."

Governors and legislatures must now generate the political will to follow through on their commitment and protect our children's health, future generations, and the environment from the preventable use and release of dental mercury.

"While no one likes to have mandates put on them, it seems clear to us that we will achieve a much higher level of compliance with mandated separators than a voluntary approach."

—Daniel Ferraris, DMS
Vermont Dental Society

Recommendations

Based on its review of current state practices, the New England Zero Mercury Campaign presents the following recommendations:

1. Dentists should limit their use of amalgam as much as possible in consideration of the environmental impacts from mercury.

2. In order to encourage use of safer alternatives to mercury fillings, states should require that all state health insurance contracts award coverage for non-mercury fillings that is equal to or greater than that awarded for mercury fillings.

3. States should ban the disposal of dental amalgam into all waste streams and all dental mercury should be trapped, collected and recycled to minimize future impacts.

4. States should require all dentists to reduce their release of dental mercury, through mandates to:
   - Adhere to stringent best management practices,
   - Install and properly maintain amalgam separators to reduce mercury discharge by 98% or greater,
   - Clean and replace mercury-laden pipes and plumbing fixtures,
   - Manage quantities of excess elemental mercury properly, and
   - Submit annual reports on dental mercury use and reduction initiatives.

5. States and/or local governments should provide ongoing opportunities for dental offices to dispose of bulk elemental mercury, in order to prevent accidental spills or improper disposal.

6. The American Dental Association and state dental associations should work cooperatively with state agencies to implement these recommendations to prevent the environmental release of dental mercury. State dental associations should also be more forthcoming with their views on reducing dental mercury use and release.

7. Since dental mercury emissions are projected to dramatically increase over the next few decades, states should develop an emissions reductions program and regulate mercury emissions from crematoria.

8. State environmental and health agencies should endeavor to maintain open and transparent processes that promote public involvement to develop and promote policies to reduce dental mercury use and release.

9. States should implement a thorough and well thought out public education effort to encourage dental associations, dentists and patients to consider the environmental implications of the choice of mercury versus non-mercury dental amalgams.

Introduction

For over 150 years, dental mercury fillings (called "amalgam") have been used extensively to fill cavities in teeth. Amalgam is a metallic alloy consisting primarily of four metals—mercury, silver, copper and tin—with mercury comprising around 50 percent of the amalgam materials by weight.[1]

Unfortunately, current dental practices result in significant quantities of mercury being released from dental clinics, contributing to the build up of this toxic heavy metal in the environment.

Mercury is a persistent, bioaccumulative toxin (PBT) that is converted by bacteria in waterways into its most toxic form, methylmercury. It accumulates in the environment, builds up in the bodies of fish and other wildlife, and moves up the food chain.

When wildlife and humans eat mercury-contaminated fish, the exposure to methylmercury can cause damage to the functioning and development of the central nervous system. Such exposure is particularly harmful for fetuses and young children. Environmental Protection Agency scientists now estimate that one in six women of childbearing age have unsafe mercury levels, translating to 630,000 children born at risk each year in the United States. Adults are also at increased risks of heart problems through consumption of fish.[2]

The New England Governors and Eastern Canadian Premiers have recognized widespread mercury contamination as a threat to public health, the environment and the economy in the region and have developed plans to prevent dental mercury releases to the environment.

In 2003, the Governors' Mercury Task Force reported that, "As part of the continuing efforts to reduce mercury discharges from the dental sector, the Mercury Task Force will pursue a goal of having 50% of dentists in the region install dental amalgam separators by the end of 2005. Each jurisdiction will develop an aggressive strategy to ensure that this goal is aggressively pursued."

The New England Zero Mercury Campaign's *Report Card On Dental Mercury Use and Release Reduction* compares all six New England states on their efforts toward this goal and the other steps necessary to eliminate dental mercury use and release into the environment. On the following pages, dental mercury releases are further explained, the steps necessary to reduce dental mercury use and release are outlined, and each state has been graded on their efforts to date.

State and Local Actions

While some of the New England states have made significant progress in developing programs to address problems caused by dental mercury, other states are failing to adequately address this important source of mercury pollution.

Maine, New Hampshire, Connecticut, and the largest sewage treatment facility in Rhode Island have adopted policies requiring dentists to use amalgam separators to remove mercury waste from their discharge to the wastewater stream. Massachusetts has adopted a voluntary initiative backed up by the threat of regulation. Also, Maine promotes consumer awareness of alternatives to mercury fillings. Rhode Island has adopted a first-in-the-nation provision requiring that insurance companies provide equal coverage for placement of non-mercury fillings.

In Rhode Island, the Narragansett Bay Commission has begun implementing Best Management Practices, requiring dentists in their service area to monitor wastewater for mercury or to install amalgam separators capable of removing 99% of amalgam. Rhode Island's Department of Environmental Management has not yet required other sewage treatment facilities across the state to adopt similar practices.

The Massachusetts Department of Environmental Protection has established a voluntary program for dentists to install amalgam separators. The plan calls for 50% of Massachusetts Dental Society member dentists to participate by January 2005, 90% by January 2006, and 100% by January 2007, with regulations to follow if these goals are not met. While the end result of this process has been positive, the lack of meaningful public involvement by environmental advocates at the outset was, at best, troubling.

The Vermont Department of Environmental Conservation has completed a 3-year pilot project with Vermont dentists demonstrating the viability, ease of operation, and cost effectiveness of amalgam separators.[3] However, Vermont is lagging behind the other states, as it has no requirements to prevent dental mercury releases. Compliance with the state's best management practice procedures remains voluntary, and its effectiveness is unknown.

In Maine, the Department of Health has developed a brochure for distribution by dentists to their patients, outlining the risks of mercury and the availability of non-mercury filling alternatives.[4] In New Hampshire, similar information distribution is required by statute, but has never been fully implemented.

In 2003, the Connecticut Commissioner of the Department of Environmental Protection (CT DEP) apparently allowed the state dental association to block a state policy calling for the reduced use of mercury amalgam. Initially, the Connecticut DEP had proposed a policy that dentists were to use substitutes for mercury amalgam wherever possible in order to reduce the amount of mercury going into the environment, through the following language: "Amalgam substitutes should be used in cases where they are appropriate as determined by dental practices *in order to minimize mercury and silver usage in dental offices*." [5] (Emphasis added.)

However, at the request of the Connecticut State Dental Association, the CT DEP deleted the latter half of the sentence and in its place substituted the term: "…*when determining the best treatment option for the patient*."[6] This concession by the CT DEP effectively resulted in dentists being relieved of an obligation to switch to non-mercury fillings under the State's Best Management Practices. While a NEZMC campaign partner and others specifically requested to participate in the CT DEP dental mercury policy deliberations in December 2002, they were not invited into the "partnership" discussion between the CT DEP and the Connecticut State Dental Association.[7]

The grades for each of the states for their efforts to reduce mercury use and emissions follow.

Grading Criteria for State Efforts to Prevent Dental Mercury Use and Emissions

- **Required Amalgam Separators:** Does the state require dentists, or provide significant incentives for dentists, to install amalgam separators that prevent at least 98% of amalgam waste from going down the drain?

- **Successful Amalgam Separator Installation:** Do a significant percentage of the state's practicing dentists have amalgam separators installed?

- **Best Management Practices:** Does the state mandate that dentists follow Best Management Practices for handling waste dental amalgam?

- **Enforcement:** Does the state have a program to verify compliance with Best Management Practice requirements and Amalgam Separator requirements?

- **Initial Collection Program:** Has the state conducted at least one clean out program to collect excess elemental mercury from dental offices?

- **Ongoing Collection Program:** Does the state have an ongoing program for collecting elemental mercury from dental offices?

- **Crematory Emissions:** Does the state have a mercury emissions reduction program for crematoria?

- **Patient Notification:** Does the state require dentists to notify patients of mercury risks and alternative non-mercury fillings?

- **Health Insurance:** Does the state require that all state health insurance contracts award coverage for non-mercury fillings that is equal to or greater than that awarded for mercury fillings?

Overall State Grades on Mercury Elimination

STATE	GRADE
Connecticut	B
Maine	B
Massachusetts	B-
New Hampshire	D+
Rhode Island	C-
Vermont	D
NEW ENGLAND	C

Graders: The New England Zero Mercury Campaign Partners

Report Card on Dental Mercury Use and Release Reduction

Connecticut

ACTION STEP	GRADE
▪ Required Amalgam Separators	A-
▪ Successful Separator Installation	B+
▪ Best Management Practices (BMPs)	A
▪ Enforcement of BMPs and Separator Use	A
▪ Initial Mercury Collection Program	A
▪ Ongoing Collection Program	B
▪ Crematoria Emissions Reduction	D
▪ Patient Notification	D
▪ Health Insurance	F
OVERALL GRADE	**B**

Progress Made

The CT DEP and the CT Dental Association have cooperated since the late 1990s to minimize the release of dental mercury to the environment. In 2001, a joint effort removed 412 pounds of bulk mercury from Connecticut's dental offices. Ongoing collection opportunities exist through regional household hazardous waste collections. In 2002, the Connecticut General Assembly adopted laws requiring dental schools and practitioners to conform to BMPs for dental offices and mercury amalgam management. The BMPs adopted in 2003 require the use of amalgam substitutes when the dentist deems them to be the best treatment option for the patient, regulate the storage of amalgam waste, require that amalgam wastes be collected for recycling or disposed as hazardous waste, regulate the management of amalgam spills, require inspections of pipes for mercury amalgam when pipes are changed or cleaned, and require the use and regular maintenance of centrally installed amalgam separation units with a minimum of 95% mercury removal. Over 70% of CT's dentists are in compliance with the BMPs and have provided details about their amalgam separation unit.

Improvement Needed

The regulatory structure for minimizing mercury emissions from dental activities is largely in place. What is now needed is the commitment of resources to fully implement that regulatory structure through inspections of dental offices and stack testing of crematoria. The state should also require its health insurers to provide equal coverage for mercury and non-mercury fillings. The BMPs should be amended to require patient notification about the environmental and health effects of mercury and to limit the use of mercury fillings. The state should evaluate and address as appropriate the historical deposition of mercury in waste water pipes and sewers.

Graders: Clean Water Action

Report Card on Dental Mercury Use and Release Reduction

Maine

ACTION STEP	GRADE
▪ Separator Requirement/Incentive	A
▪ % Dentists with Separators	A
▪ BMPs	C
▪ BMP and Separator Compliance	C
▪ Clean Out Program	A
▪ Ongoing Clean Out	D
▪ Crematoria	D
▪ Patient Notification	A
▪ Health Insurance	F
OVERALL GRADE	**B**

Progress Made

In 2001, the Maine Legislature adopted a law requiring patient notification, which is administered by the Maine Bureau of Health. In 2002 DEP developed two publications on best management practices for dental offices covering mercury amalgam management: 1) Environmental Guide to Dentistry; and 2) Maine Dental Practice Pollution Prevention Plan. In 2003, with the cooperation of the Maine Dental Association, the Maine Department of Environmental Protection (MEDEP) conducted a sweep for elemental mercury and collected approximately 125 pounds. In 2003, the legislature passed a law requiring the use and regular maintenance of amalgam separation units that meet the ISO 11143 standard of a minimum of 98% mercury removal. Under the law, dentists are required to keep records of certification, maintenance and shipments to certified recyclers of mercury collected.

Improvement Needed

The regulatory structure for minimizing mercury emissions from dental activities is in place. What is now needed is a system for inspection and enforcement. In addition, the State should adopt standards to reduce or eliminate emissions of Hg from crematoria. The state should also require its health insurers to provide the same coverage for composite fillings as it does for amalgam fillings.

Graders: Natural Resources Council of Maine

Report Card on Dental Mercury Use and Release Reduction

Massachusetts

ACTION STEP	GRADE
▪ Required Amalgam Separators	B+
▪ Successful Separator Installation	B
▪ Best Management Practices (BMPs)	B+
▪ Enforcement of BMPs and Separator Use	A
▪ Initial Mercury Collection Program	A
▪ Ongoing Collection Program	D
▪ Crematoria Emissions Reduction	F
▪ Patient Notification	F
▪ Health Insurance	F
OVERALL GRADE	**B-**

Progress Made

At the start of 2004, the Massachusetts Department of Environmental Protection (MA DEP) launched a voluntary program to encourage dentists to install amalgam separators and use Best Management Practices in their offices. The goals of this program are to have 50% of practicing dentists certified as having separators and following BMPs by January 31, 2005, 90% by January 31, 2006, and 100% by January 31, 2007. If the stated goals are not reached, regulations must be crafted that would require separators and BMPs for all dentists. Thanks largely to the cooperation of the Massachusetts Dental Society (MDS), the program has been extremely successful and at the time of this writing the MA DEP reports that 75% of dentists have installed separators and been certified, vastly exceeding the goals of the first year.

Improvement Needed

Now that the problem of mercury emissions from dental offices is on the way to being addressed, the Massachusetts legislature and agencies should turn their attention to reducing dental mercury from the source. Massachusetts should require dentists to notify their patients about the risks of mercury and the available alternatives. In addition, it should be mandated that all state health insurance contracts give equal coverage for non-mercury and mercury fillings. MDS needs to lend the same support to these important mercury-reductions steps that it has to the separator program. A program to reduce mercury emissions from crematoria is another important next step that is needed.

Graders: Clean Water Action

Report Card on Dental Mercury Use and Release Reduction

New Hampshire

ACTION STEP	GRADE
▪ Required Amalgam Separators	A-
▪ Successful Separator Installation	D-
▪ Best Management Practices (BMPs)	A-
▪ Enforcement of BMPs and Separator Use	C
▪ Initial Mercury Collection Program	F
▪ Ongoing Collection Program	F
▪ Crematoria Emissions Reduction	F
▪ Patient Notification	D
▪ Health Insurance	F
OVERALL GRADE	**D+**

Progress Made

In May 2002, the NH legislature passed first-in-the-nation legislation requiring state rules "for dental offices relative to the use of environmentally appropriate disposal equipment" to trap dental mercury—despite opposition from the ADA.[8] The NH Department of Environmental Services (NH DES) supported the legislation, calling for "better management of mercury amalgam waste, promoting the increased use of alternative fillings and phasing out the use of amalgam over time."[9] Unfortunately, the NH Dental Society succeeded at the very last minute of the rulemaking process in getting the separator technology requirement reduced from 99% capture capability to 95%. The law also requires dental offices to provide information "regarding the risks and benefits of dental mercury, including mercury amalgams." Furthermore, it requires the health department to provide information about the risks and benefits of dental restorative materials including the use of amalgam in children under the age of 6,[10] though materials produced as a result do not achieve this requirement. The state and the Dental Society have collaborated well on development of good Best Management Practices for mercury use and disposal.

Improvement Needed

While a good law is in place for patient notification on mercury amalgam, implementation of the requirement has been weak and materials are needed to fulfill the intent of the legislation. In general, NH DES needs to have the resources to enforce or otherwise follow up on recently passed dental mercury laws, including better tracking of BMP adherence, office clean outs and separator installations. Reduction of mercury emissions from crematoria needs to be included as a key part of the mission of the recently established Governor's task force on crematoria regulation. The legislature also needs to revisit the health insurance coverage issue, having dropped it from a previous mercury bill.

Graders: Clean Water Action

Report Card on Dental Mercury Use and Release Reduction

Rhode Island

ACTION STEP	GRADE
▪ **Required Amalgam Separators**	**C-**
▪ **Successful Separator Installation**	**C-**
▪ **Best Management Practices (BMPs**	**C-**
▪ **Enforcement of BMPs and Separator Use**	**C-**
▪ **Initial Mercury Collection Program**	**A**
▪ **Ongoing Collection Program**	**C**
▪ **Crematoria Emissions Reduction**	**F**
▪ **Patient Notification**	**F**
▪ **Health Insurance**	**B**
OVERALL GRADE	**C-**

Progress Made

The Narragansett Bay Commission (NBC) has begun implementing their best management practices requiring dentists in their service area to monitor wastewater for mercury or to install amalgam separators capable of removing 99% of amalgam waste in addition to other management practices. Already, 120 dentists in their service area have been permitted under the program. Rhode Island has also shown leadership as the only New England state to require equal coverage for non-mercury fillings in state employee health insurance contracts, however, the state has not yet enacted this provision of the law.

Improvement Needed

While the dentists served by NBC are required to participate in an effective program to prevent dental mercury emissions, the other sewage treatment agencies in the state have not yet followed NBC's lead. The Department of Environmental Management (DEM) should require all dentists across the state to adopt similar best management practices to reduce dental mercury emissions regardless of whether they discharge to another sewage treatment facility or to a septic system.

The Rhode Island General Assembly should take steps to inform consumers and reduce the source of dental mercury pollution by requiring dentists to notify their patients about the risks of mercury and the available alternatives. DEM should develop and implement regulations to reduce mercury emissions from crematoria. Additionally, Rhode Island dentists should take steps to limit their use of amalgam as much as possible in consideration of the environmental impacts of mercury.

Graders: Clean Water Action

Report Card on Dental Mercury Use and Release Reduction

Vermont

ACTION STEP	GRADE
▪ **Required Amalgam Separators**	**D**
▪ **Successful Separator Installation**	**D-**
▪ **Best Management Practices (BMPs)**	**C**
▪ **Enforcement of BMPs and Separator Use**	**C**
▪ **Initial Mercury Collection Program**	**A**
▪ **Ongoing Collection Program**	**A**
▪ **Crematoria Emissions Reduction**	**F**
▪ **Patient Notification**	**F**
▪ **Health Insurance**	**F**
OVERALL GRADE	**D**

Progress Made

The Department of Environmental Conservation's (DEC's) three-year pilot project of amalgam separators has been successfully completed. Also, the dental mercury clean out program, sponsored by the Chittenden Solid Waste District, continues to receive excess supplies of mercury from dental offices at no charge. In addition, the Advisory Committee on Mercury Pollution (ACMP) has recommended to the Governor and the Legislature that all dental clinics handling amalgam waste be required to follow best management practices and install amalgam separators. The ACMP has also recommended that the state dental society conduct a survey to ascertain mercury use in the dental sector.

Improvement Needed

The Legislature should pass, and the Governor should sign into law, pending comprehensive mercury legislation requiring dental clinics in Vermont to install amalgam separators as quickly as possible, mandate reporting requirements to ensure that separators are maintained properly, and require DEC to conduct a study with the assistance of the dental society to ascertain the use of mercury in the dental sector. In addition, the state should require insurance companies to provide equal coverage for placement of non-mercury fillings in all state health contracts. Furthermore, dental clinics should also be required to provide patients with written notification regarding the risks from mercury and alternative filling materials that are available. A program to reduce mercury emissions from crematoria is also needed to reduce pollution, given that emissions from this source are projected to double in the next 20 years.

Graders: Mercury Policy Project, National Wildlife Federation

Mercury Use by Dentists

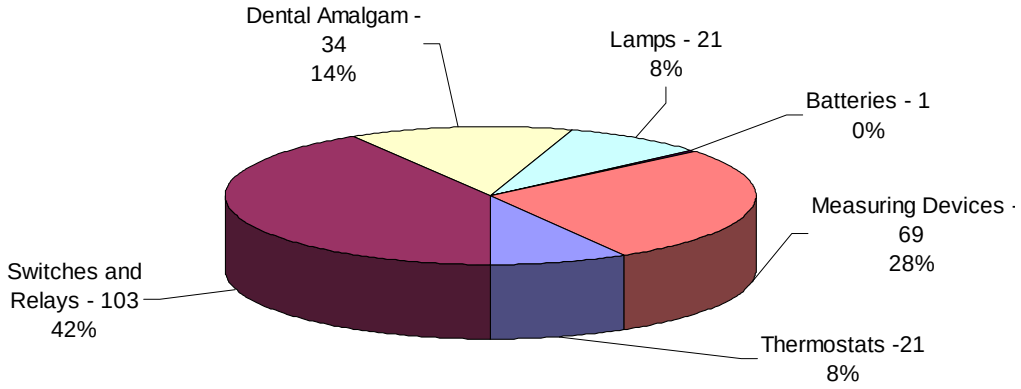
The dental sector is the third largest user of mercury in the United States. In 2004, the U.S. Environmental Protection Agency (EPA) estimated that dental clinics use 34 tons of mercury annually, 14% of the total annual mercury consumption in the U.S. (See Figure 1.)

Approximately 100 million amalgams are placed in patients' teeth each year by 175,000 U.S. dentists.[11] Approximately 70% of these are replacements for old fillings according to the American Dental Association. The amount of amalgam discharged to wastewater is likely to be more than the amount used each year because many dentists remove amalgam fillings and replace them with non-amalgam material. Thus, the dentists discharge even more amalgam than they purchase.

This annual mercury input has added up over time. **It is estimated that there are currently over 1,000 tons of mercury in the mouths of U.S. residents–more than half of all mercury currently in use in all products.** (See Figure 2.) Any part of this giant reservoir that is not captured and properly managed will eventually wind up in the environment.

Figure 1: U.S. Dentists Use 34 Tons of Mercury Each Year

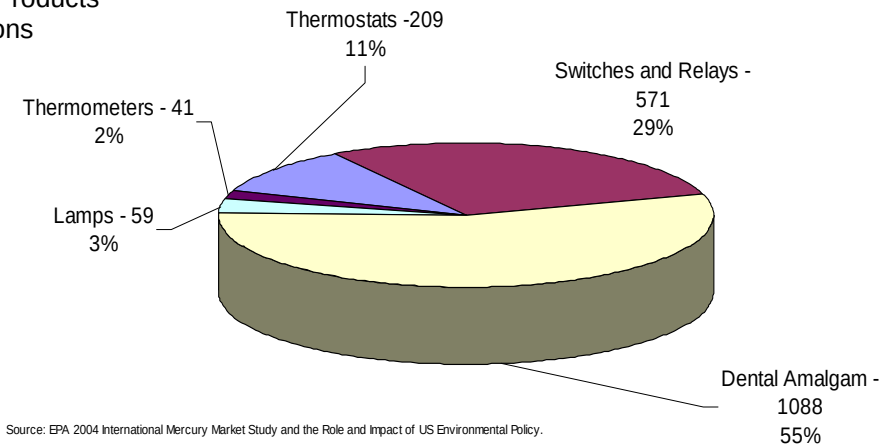
Estimated Annual Consumption of Mercury in Products [12]
Total Annual Consumption = 276 tons



Source: EPA 2004 International Mercury Market Study and the Role and Impact of US Environmental Policy.

Figure 2: Over 1,000 Tons of Mercury in the Fillings of U.S. Residents

Estimated Mercury Reservoirs in Products [13]
Total Mercury Reservoir = 1968 tons



Source: EPA 2004 International Mercury Market Study and the Role and Impact of US Environmental Policy.

Dental Mercury Waste Disposal

Inevitably, any scrap amalgam from dental procedures or amalgam placed in teeth that is not carefully collected and properly managed ends up being released into the environment.

Significant amounts of dental mercury are deposited into the trash, biomedical waste containers or into wastewater sewage sludge, with the finer particles often released into lakes, rivers, or oceans, often after passing through sewage treatment plants. Dental mercury may also be released into groundwater from septic tanks or landfills, or emitted to the air.

Disposal into Wastewater: The wastewater leaving dental offices can contain large amounts of mercury when excess amalgam or old fillings are washed down the drain.

The United States Geological Survey estimates that, in 1996, the dental sector discharged a total of 51 tons of mercury.[14] Studies by the EPA and numerous municipalities document that most municipal wastewater treatment plants have high levels of mercury with significant contributions from dental clinics. [15] [16]

In 2001, the Association of Metropolitan Sewerage Agencies (AMSA) evaluated seven major municipal wastewater treatment plants (WWTPs) to determine and quantify sources of mercury coming into these facilities. At all plants, dental uses were identified as "by far" the greatest contributors to the mercury-load, accounting on average for 40% of the load. Dental mercury was more than three times greater than the next largest source of mercury in wastewater.[17]

Most municipal wastewater treatment systems are not designed to treat hazardous waste or reduce mercury releases to the environment. Consequently, mercury that enters most sewage systems will be discharged to the environment either through the sludge or wastewater.

Sludge is the solid material remaining after wastewater treatment. Mercury can be released to the environment when sludge is incinerated, landfilled, spread on agricultural fields as a fertilizer, or pellitized and sold as lawn fertilizers.

Conditions at certain points within the wastewater treatment process may promote the conversion of elemental mercury into the more toxic methylmercury. Methylmercury is highly soluble and more able to pass through the facility to the receiving lake, river, or salt-water body.

Mercury in Traps, Drains, and Sewer Pipes: Following years of use, the plumbing in dental offices and associated sewer pipes can acquire a significant buildup of dental mercury. This mercury often slowly dissolves and continues to be released into the wastewater stream for years – even after amalgam separators are installed – unless pipes are replaced or cleaned out.[18,19]

Mercury in Septic Systems: Many dental offices that are not in an area serviced by municipal sewage lines have septic systems for wastewater treatment. Similar to municipal treatment plants, the potential for methylation exists in the anoxic environment of a septic tank, which can result in methylmercury entering groundwater through the system's leaching fields.[20] Additionally, mercury can be released to the environment when waste is pumped out from septic systems and treated at wastewater treatment facilities.

Solid Waste: Scrap amalgam is often discarded into the trash and either is dumped in landfills or is incinerated. Mercury sent to an incinerator vaporizes when heated and is emitted to the air through the smokestack, or captured in fly ash and deposited in a landfill.

Mercury that is sent to a landfill may enter groundwater, contaminate underlying soils, vaporize and dissipate to the atmosphere, or be

sent to a wastewater treatment plant with the landfill leachate. Also, mercury may be emitted from the landfill with methane gas.[21]

Biomedical waste/Incineration: Waste dental mercury is often disposed of into the biomedical waste container. A survey found that 25 to 30 percent of dentists place their contact amalgam wastes into biomedical "red bags" that are often incinerated.[22] "Red-bag" waste is usually sent to a medical waste incinerator, or sterilized at high temperatures with pressurized steam (autoclaved) and then sent to a landfill. In either process, the mercury vaporizes when heated and can be released into the atmosphere.

Storage: Before pre-encapsulated amalgams became the norm, dentists used to make their own mercury fillings and some still have large stocks of mercury stored in their offices. Few, if any, dentists today make their own fillings. While some states and locales have hosted "clean sweeps" to collect excess elemental mercury from dentists, based on the quantities collected thus far, it is likely that large amounts of elemental dental mercury remain uncollected and represent a significant risk of being mismanaged or improperly disposed.

Human Wastes: Amalgam has been determined to be the primary source of mercury in human waste.[23] Mercury fillings continually volatize, releasing small amounts of mercury into the body. Some of this mercury is passed through the digestive system. After releases from dental offices, human wastes are the second greatest contributor of dental mercury to waste waster treatment plants (WWTPs).[24]

Cremation: Crematoria emit significant quantities of mercury into the air. This is expected to more than double over the next 20 years, due to decreases in the number of older people cremated with no teeth, greater amounts of mercury in teeth, and the significant increase in cremations in United States and within the region.

In Connecticut, for example, cremations rose from 25.7% of people who died in 1998 to 32% in 2003. By 2010, it is expected to rise to more than 42%. Nationally, one in four Americans is cremated. Approximately 700,000 cremations were performed in 2003 and this figure is expected to rise to 1.4 million by 2025.[25]

In 2003, an estimated 2.5 tons of mercury was emitted from crematoria nationwide. Of this total, the New England portion of mercury releases is estimated at 90 pounds per year.[26] The 1998 Northeastern States Mercury Study estimated that each person cremated had an average of 2.9 grams of mercury.

Mercury Pollution from Dental Offices Can Be Prevented

Systems, products, and guidelines already exist that, when used properly, allow dentists to collect virtually all of the mercury leaving their offices and ensure that it is properly managed instead of entering the waste stream through any of the avenues discussed. The solutions summarized below could prevent significant amounts of dental mercury releases.

Reduced Use of Mercury Amalgam

There are now a variety of non-amalgam materials available for dental fillings that are being used with growing frequency. Switching to other types of fillings will significantly reduce mercury releases to the environment over time. In some European Union countries, less than 10% of dental fillings are made from mercury amalgam, yet U.S. dentists continue to use higher percentages of mercury fillings.[27] Dentists should be encouraged to use safe alternatives to mercury fillings.

Amalgam Separators

Amalgam separator units that capture mercury from wastewater leaving the dental office are currently on the market. The units are installed in the plumbing system of the office and can collect 98% or more of mercury in wastewater.

Amalgam separators are cost effective, require only a modest shift in practices, and only add a very minor increase in operating expense. According to recent estimates, an amalgam separator unit capable of removing both particulates and dissolved mercury can be operated for between $47.95-$100 per month. Yet dentists in only half the states in New England have surpassed the 50% compliance goal established in the region and the other three states are lagging behind.

Best Management Practices

"Best Management Practices" (BMPs) is a general term referring to a set of economically achievable measures and/or actions designed to control, reduce or eliminate the discharge of pollutants to the environment. BMPs have been developed by individual state waste management and pollution prevention authorities, or nongovernmental organizations, and vary from organization to organization. At this point, BMPs are usually voluntary, rather than mandatory.[28]

The New England Zero Mercury Campaign recommends that the following should be included in any fully effective BMPs:

- Installation and proper management of amalgam separators
- Recycling of scrap amalgam and empty amalgam capsules
- Cleaning and replacing all screens, traps and filters on a regular basis
- Use of only non-chlorine/non-oxidizing cleaners on lines to reduce dissolution of mercury in pipes
- Regular clean out of sink traps and pipes in and outside dental offices to remove mercury buildup
- Availability of mercury spill kits in all offices

Crematoria

Currently, no mercury emissions controls are required in New England for crematoria. Yet standards for requiring mercury emission reductions at new or large crematoria are in place in Austria, Belgium, Germany, the Netherlands, Norway, Sweden, Switzerland and the United Kingdom,[29] and should be put in place in New England states. Gas cleaning by a dry sorbent and filter system or equivalent is recommended as the best available technique for the removal of mercury from crematoria in Europe. Up to 98% reduction in mercury emissions is expected from using this technology, according to government authorities. Reducing mercury emissions would also result in reductions in dioxin and furan emissions from crematoria.[30]

Need for More Action to Prevent Dental Mercury Releases

While other sectors of the health community have been highly regulated and made significant progress in reducing mercury emissions, the use and discharge of mercury from dental offices continues in much of the region. Eventually, unless captured, most of this mercury contributes to environmental pollution.

Several factors have contributed to the inaction on dental mercury emissions prevention:

- lack of regulatory control by government agencies,
- lack of support from the American Dental Association and some state dental associations to install amalgam separators, and
- lack of general awareness among many dentists that their waste mercury is a serious pollutant that should be managed properly.

The Role of Dental Societies

Some state agencies have successfully worked with their dental community members and developed model programs to foster effective voluntary and mandatory mercury reduction initiatives. Cooperative approaches by state agencies and dental societies have been effective in increasing compliance in separator installations in Connecticut and other places.

In other areas, the American Dental Association (ADA) or state dental society has refrained from promoting mercury reduction efforts, or even opposed some efforts. These powerful institutions have been able to effectively influence the success or failure of a program for years and continue to do so across the country.

The ADA has not taken a leadership role in preventing mercury pollution and has opposed many initiatives to require dentists to manage their mercury releases safely. The ADA has claimed that their members make only a "small contribution to mercury in dental wastewater."[31] Several claims made by the ADA have undermined the political will necessary to regulate dental mercury emissions. The ADA has claimed that:

- It is a "scientific fact that mercury in dental amalgam chemically combines with other ingredients, including silver, to form a biologically inactive substance,"[32] and
- Mercury in dental amalgam does not leach and it should not be considered a hazardous waste under federal regulations.[33]

The ADA has created its own Best Management Practices (BMPs) for amalgam waste, which it has distributed to most dentists in the country. Unfortunately, these BMPs are very limited in their scope and focus mainly on recycling of amalgam. They do not address many of the topics covered in many states' BMPs and fail to even mention amalgam separators, let alone recommend them.[34]

While some state dental agencies have followed the lead of the ADA and oppose state mercury reduction initiatives, some state associations have begun to recognize the severity of the mercury problem. These state associations are working with state and local governments, as well as non-governmental organizations, to encourage their members to employ best management practices, install and effectively operate amalgam separators and reduce overall mercury emissions.

A case in point is in Vermont, where the state is lagging far behind other states in requiring installation of amalgam separators, but where the state dental association is now expressing support for mandating them. The Past President of the Vermont Dental Society, Daniel Ferraris, DMS, recently provided the following written testimony to a Vermont legislative committee. **"It seems clear from the science that amalgam separators do an excellent job at reducing amalgam in wastewater significantly. While no one likes to have mandates put on them, it seems clear to us that we will achieve a much higher level of compliance with mandated separators than a voluntary approach**."

Conclusion and Recommendations

In 1998, the Conference of New England Governors and Eastern Canadian Premiers (NEG/ECP) set a landmark goal to virtually eliminate mercury emissions in the region. In 2003, the New England Governors set an important goal to have 50% of dental offices in the region install dental amalgam separators by the year 2005.

A growing number of governments now believe that dental mercury is a serious problem that needs to be addressed, and are beginning to act. Voluntary guidelines by themselves are oftentimes not sufficiently effective without the addition of some regulatory "teeth."

Without regulation, sales of separators are less than 1% in all unregulated states with the exception of Minnesota. (Minnesota has a voluntary program where the dental society has put a tremendous amount of energy into making the program work.) Elsewhere, the trend is 80% participation only after a mandate is enforced—meaning a deadline for installation has passed. Seattle tracked the progress with and without regulation and the difference is very clear. Dentists started to install separators only when the enforcement regulation was in place. It took almost 8 years to get less than 10% of the dentists to comply with voluntary requests and less than two years for 80% of the dentists to comply with the regulation.[35]

From a review of the successful efforts, it appears that a combination of voluntary incentives, technical assistance, and mandatory initiatives have been most successful in convincing dentists to take the necessary steps to reduce their mercury pollution.

This classic "carrot and stick" approach has proven successful. State and local governments are now finding that the establishment of enforceable requirements, combined with incentives to encourage voluntary measures, is providing the necessary impetus for dentists to change their practices.

In addition, some states are now promoting phasing out the use of mercury-containing amalgams to the extent compatible with good dental practices, to further limit mercury releases to the environment.[36]

At the same time, other states like Rhode Island are promoting dental mercury source reduction through state contracts that provide equal coverage for non-mercury fillings and consider not covering amalgam fillings.

In the long term, reduced use of mercury amalgams in dentistry will result in reduced emissions from crematoria, and will have the additional benefit of reducing mercury in dental wastewater, sludge and the environment. Alternatives to mercury amalgams are available and are becoming increasingly acceptable to dentists and demanded by patients.[37]

To date, there has been little public attention focused on the environmental impact of dental amalgams. While cremation may be an uncomfortable topic, most people understand that if they have mercury fillings in their teeth, that mercury is eventually going to be released into the environment. In June 2000, the Dental Board of California ruled that dentists there must warn patients that silver (mercury) fillings will expose them to mercury, a metal on the state's list of hazardous substances. A similar type of warning could tell patients that use of mercury amalgams results in long-term emissions of mercury to the environment.[38]

Based on its review of current state practices, the New England Zero Mercury Campaign presents the following recommendations:

1. Dentists should limit their use of amalgam as much as possible in consideration of the environmental impacts from mercury.

2. In order to encourage use of safer alternatives to mercury fillings, states should require that all state health insurance contracts award coverage for non-mercury fillings that is equal to or greater than that awarded for mercury fillings.

3. States should ban the disposal of dental amalgam into all waste streams and all dental mercury should be trapped, collected and recycled to minimize future impacts.

4. States should require all dentists to reduce their release of dental mercury, through mandates to:
   - Adhere to stringent best management practices,
   - Install and properly maintain amalgam separators to reduce mercury discharge by 98% or greater,
   - Clean and replace mercury-laden pipes and plumbing fixtures,
   - Manage quantities of excess elemental mercury properly, and
   - Submit annual reports on dental mercury use and reduction initiatives.

5. States and/or local governments should provide ongoing opportunities for dental offices to dispose of bulk elemental mercury, in order to prevent accidental spills or improper disposal.

6. The American Dental Association and state dental associations should work cooperatively with state agencies to implement these recommendations to prevent the environmental release of dental mercury. State dental associations should also be more forthcoming with their views on reducing dental mercury use and release.

7. Since dental mercury emissions are projected to dramatically increase over the next few decades, states should develop an emissions reductions program and regulate mercury emissions from crematoria.

8. State environmental and health agencies should endeavor to maintain open and transparent processes that promote public involvement to develop and promote policies to reduce dental mercury use and release.

9. States should implement a thorough and well thought out public education effort to encourage dental associations, dentists and patients to consider the environmental implications of the choice of mercury versus non-mercury dental amalgams.

Methodology

The New England Zero Mercury Campaign (NEZMC) graded each New England state on its progress taken to reduce dental mercury use and emissions. Coalition partners in each state gathered relevant information from state agencies and sewage treatment plants to assess the states progress toward reducing mercury use and release.

The individual state grades represent progress on specific aspects of a state's plan to reduce dental mercury use and emissions. The overall grade is weighted heavily first on the state's progress in implementing requirements for separators because the New England Governors have established that step as a priority.

Partners in each state also contacted state dental associations in each New England state with the intent to gather further information, however, none of the state associations chose to respond to the survey. See Appendix A for the survey.

Appendix A **Survey Questions for State Dental Associations**

Name and Title of Respondent _____

Dental Association _____

Address _____

Phone _____

1. How many dentists does your state association represent as of January 2005? _____

2. What actions has your association undertaken to encourage your members to properly manage dental mercury?

- ❑ Support best management practices
- ❑ Participated in a state elemental mercury cleanout
- ❑ Raised members' awareness of importance of reducing use and preventing environmental release of mercury
- ❑ Taken action to prevent workplace exposure to mercury
- ❑ Endorsed and actively promoted amalgam separators
- ❑ Other _____

3. Which of the following best management practices does your association endorse?

- ❑ Amalgam separator equipment requirement
- ❑ Pipe clean out requirement
- ❑ Recycling empty amalgam capsules and scrap amalgam
- ❑ Cleaning or replacing screens, traps, or filters on a regular basis
- ❑ Cleaning screens, traps, and filters before cleaning vacuum lines
- ❑ Use of non-bleach/non-chlorine line cleaners
- ❑ Keeping mercury spill kits in office and training staff in safe clean-up procedures
- ❑ Other _____

4. What incentives, if any, does your association provide for voluntary participation in these best management practices?

- ❑ Group pricing reduction
- ❑ Information sharing
- ❑ Other _____

5. In what ways have you provided your member dentists with information comparing the benefits and risks of the various dental filling materials including mercury amalgam?

- ❑ Website
- ❑ In-person meeting/workshop
- ❑ Newsletter
- ❑ Other membership mailing
- ❑ None
- ❑ Other _____

6. Would your association support requiring that there be equal dental insurance coverage for non-mercury fillings for state employees and Medicaid recipients?

- ❑ Yes
- ❑ No

7. Would your association be willing to survey your member dentists about the quantities of mercury used and recycled each year from dental offices and submit the aggregate amounts to your state's environmental agency?

- ❑ Yes
- ❑ No

8. Does your association allow your member dentists to advertise or promote mercury-free dentistry?

- ❑ Support
- ❑ Don't support

9. Assuming that there are equally effective alternatives readily available would your association support a phase-out in the use of dental amalgam for environmental reasons?

- ❑ Yes
- ❑ No If not, what are the barriers?

_____

Other comments:

Zero Mercury Campaign Partners

New England Clean Water Fund
New England Clean Water Action
36 Bromfield Street #204
Boston, MA 02108
(617) 338-8131

Connecticut Clean Water Fund
Connecticut Clean Water Action
645 Farmington Avenue, Third floor
Hartford, CT 06105-2907
(860) 232-6232

Health Care Without Harm
52 Washington Park
Newton, MA 02460
(617) 244-2891

Mercury Policy Project
1420 North Street
Montpelier, VT 05602
(802) 223-9000

Natural Resources Council of Maine
3 Wade Street
Augusta, ME 04330
(207) 622-3101

New Hampshire Clean Water Fund
New Hampshire Clean Water Action
163 Court Street
Portsmouth, NH 03801
(603) 430-9565

Rhode Island Clean Water Fund
Rhode Island Clean Water Action
741 Westminster Street
Providence, RI 02903
(401) 331-6972

National Wildlife Federation
58 State Street
Montpelier, VT 05602
(802) 229-0650

Key

NEG/ECP: Conference of New England Governors and Eastern Canadian Premiers

The Conference of New England Governors and Eastern Canadian Premiers (NEG/ECP) is composed of the governors of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont, and the premiers of New Brunswick, Newfoundland and Labrador, Nova Scotia, Prince Edward Island and Quebec. It was established in 1973 as a tool for sharing ideas and advancing mutual interests of the states and provinces and encouraging cooperation with the private sector. For more information on resolutions passed by the NEG/ECP or the Mercury Action Plan Regional Progress Report, see www.cap-cpma.ca.

NEZMC: New England Zero Mercury Campaign

The New England Zero Mercury Campaign includes public interest organizations in all six states working to eliminate mercury emissions in the region by 2010 and to promote protective and effective health warnings to prevent mercury exposure. Partners and the states they are active in include Clean Water Fund of New England (CT, MA, NH, RI), Environmental Health Strategy Center (ME, nationwide), Health Care Without Harm (MA, region wide), Mercury Policy Project (VT, nationwide, internationally), National Wildlife Federation (VT, nationwide), Natural Resources Council of Maine (ME), and the Sierra Club (RI).

Previous reports from the New England Zero Mercury Campaign are available at www.cleanwateraction.org/mercury and www.mercurypolicy.org:

- Turning Up the Heat: Eliminating Mercury Thermostats from the Marketplace
- The Costs of Inaction: Shortchanging the Children
  The 2004 Report Card On Mercury Elimination In New England
- Caught in the Middle: The 2003 Report Card On Mercury Elimination In New England
- Can the Tuna: FDA's Failure to Protect Children from exposure to Mercury in Albacore “White” Canned Tuna
- Leaders and Laggards: The 2002 Report Card on Mercury Elimination in New England
- Dentist the Menace? The Uncontrolled Release of Dental Mercury
- Menacing Mercury Product Pushers
- Health Warning: Mercury Product Lobbyists Endanger Children’s Health
- A Failure to Eliminate: A Report Card on Mercury Elimination in New England

End Notes

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