

# Dental Mercury Use and Release Reduction

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Medicine & Toxicology in Nashville, Tennessee

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by

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[www.mercurypolicy.org](http://www.mercurypolicy.org)

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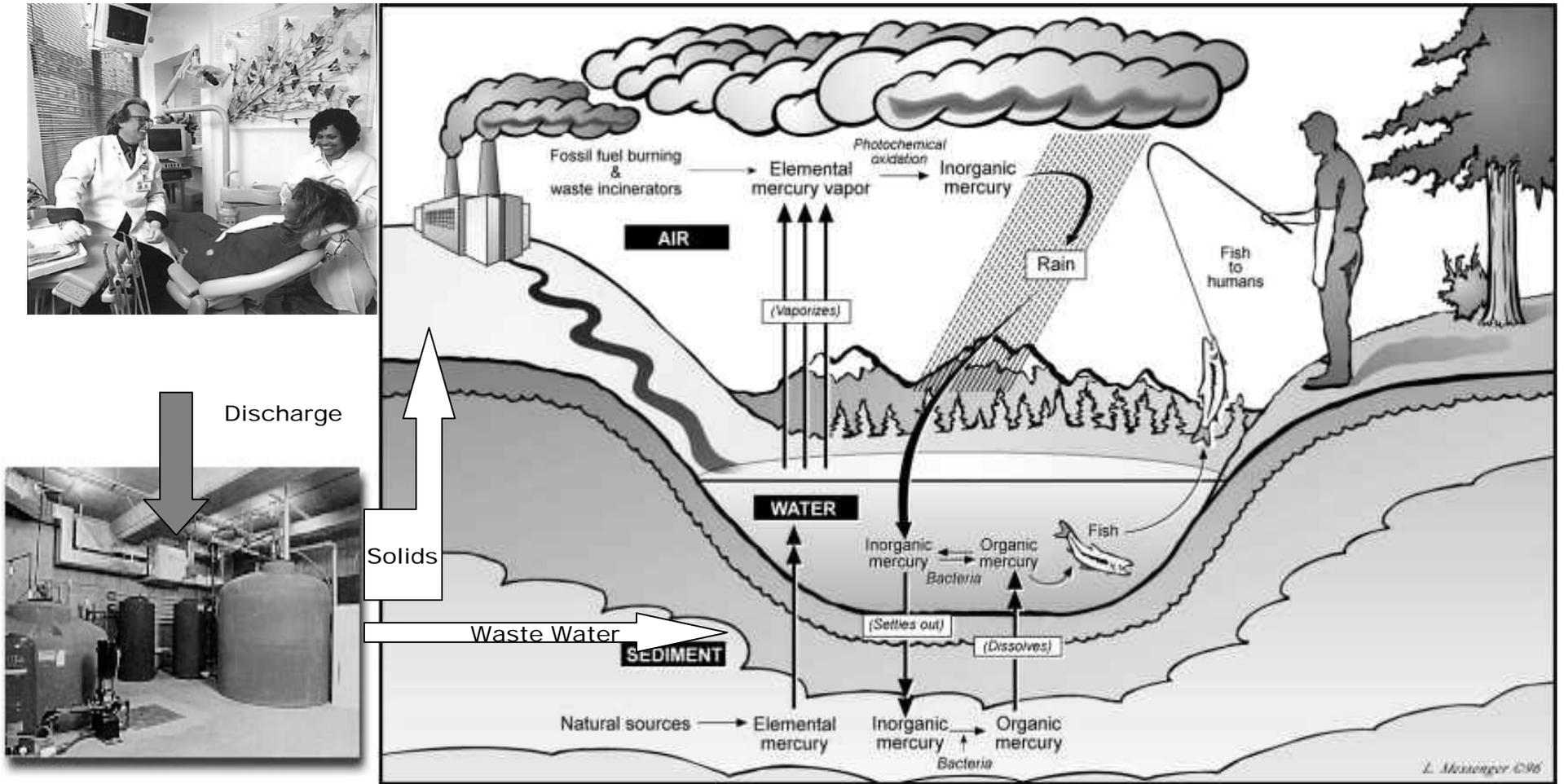
# Mercury: An Invisible Poison



Photo credit: Don Breneman/USEPA GLNPO

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# Mercury in the Biosphere



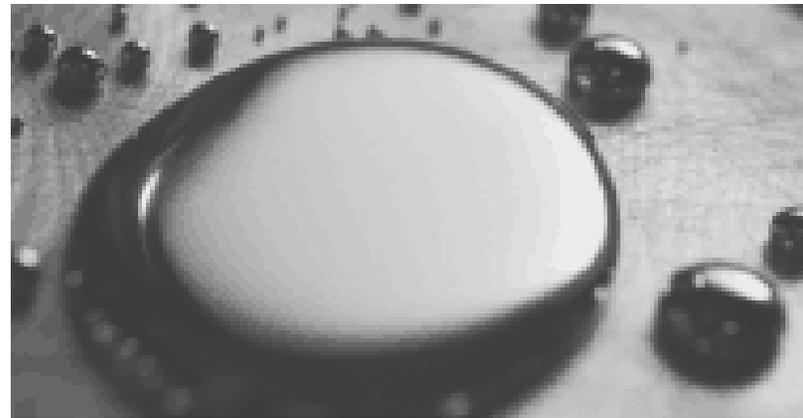
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# Categories of Mercury Release

- Natural
- Anthropogenic
  - Related to mercury use
  - Related to processing of materials with natural trace mercury
- Re-emissions of mercury already in environment
- Releases to land, water, air

# Four Unfortunate Properties of Mercury

- Biomethylation
- Bioaccumulation
- Global Transport
- High Toxicity



# **Adverse Health Effects of Methylmercury (MeHg)**

- Impairment of peripheral vision
- Impairment of speech, hearing and walking
- Uncoordinated movements
- Mental disturbances
- “Pins and needles” sensation in hands and feet

# Sensitive Populations at Higher Exposure Risks From Mercury

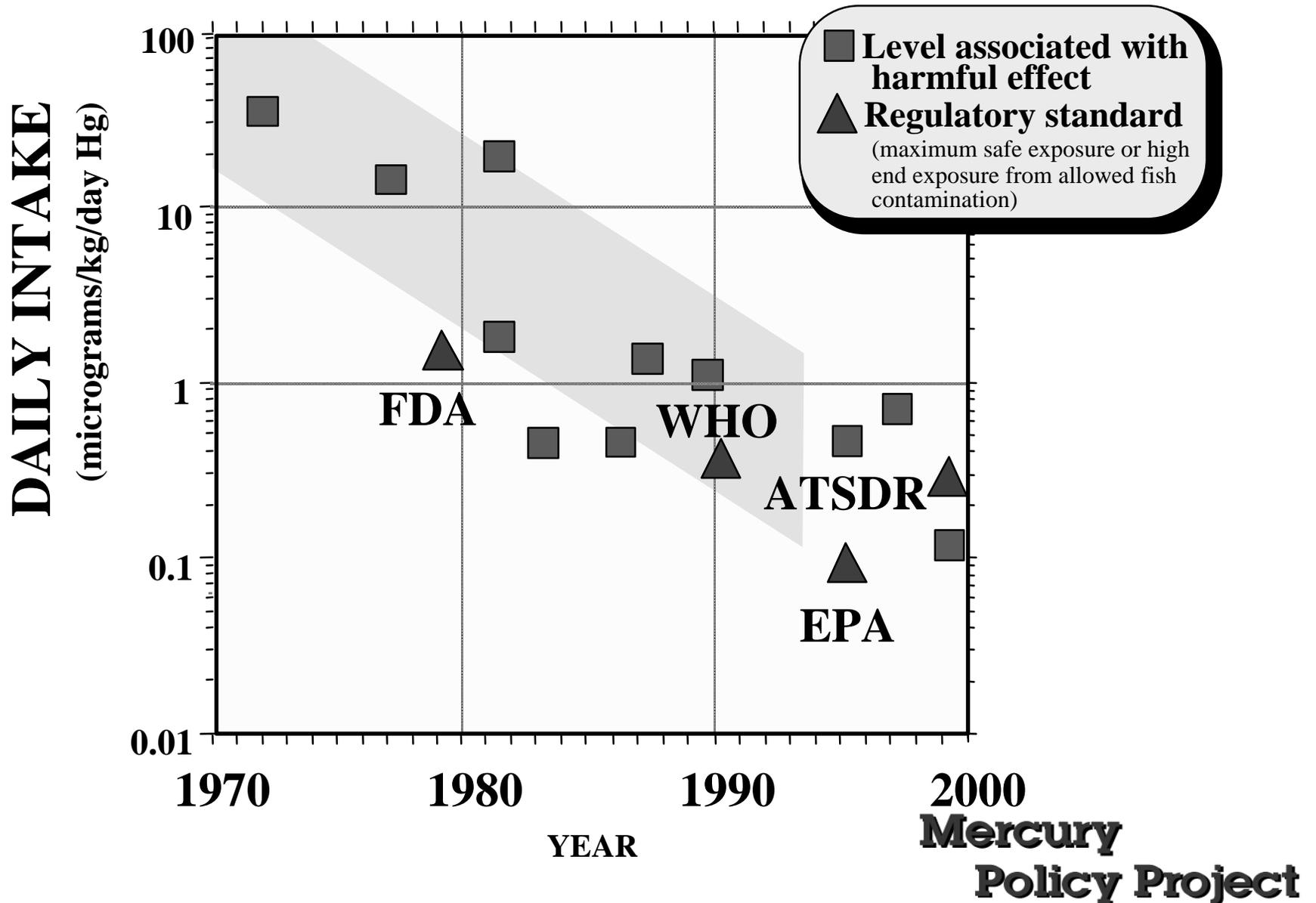
- Pregnant women
- Women of child-bearing age
- Nursing infants
- Babies & children under age 6



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# Mercury's Declining Margins of Safety



# World Health Organization Reviewing Human MeHg Exposure Standard in 2005

- Faroes and Seychelles Island studies reviewed by Joint FAO/WHO Committee (JECFA)
- JECFA recommended that the WHO MeHg human exposure standard be cut in half
- WHO expected to review and act on JECFA recommendation in 2005



# Governments Issue Mercury Fish Consumption Advisories

EPA finds 1 in 6 women has unsafe Hg levels;  
630,000 babies born at risk each year in U.S.

FDA warns pregnant women and children to  
limit canned white “albacore” tuna  
consumption to 6 ounces/week

EU Food Standards Authority (EFSA) warns  
women and children to limit eating tuna and  
swordfish

EFSA estimates 44% French children (ages  
3-6) have Hg levels that exceed U.S. health  
standard; 10% exceed new JECFA standard



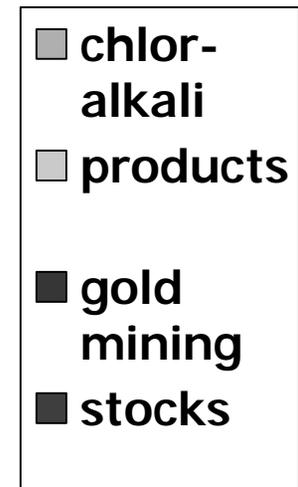
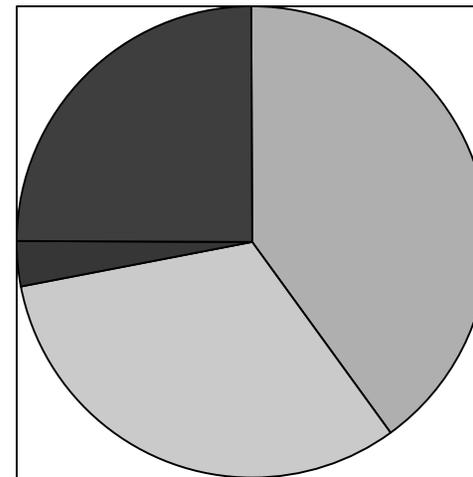
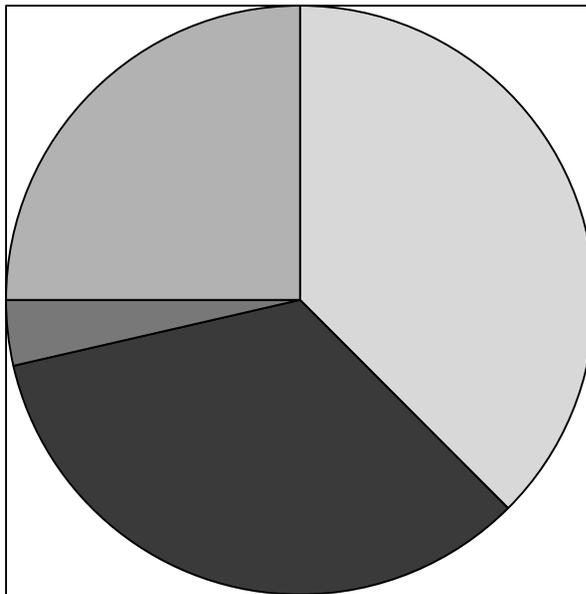
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# Global Mercury Production/Use

(U.S. Geological Survey)

1990-- 5,356 metric tons

1996--3,337 metric tons



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## Consumption of refined mercury between 1985 and 2001 (metal values are in metric tons)<sup>a</sup>

	1985	1990	1992	1993	1994	1995	1996	2001 <sup>b</sup>
Chloralkali	235	247	209	180	135	154	136	46
Paint	169	22	0					
Laboratory	14	32	18	26	24			
Other Chemical/ Allied Products			18	18	25			
Electric Lighting	40	33	55	38	27	30	29	28
Wiring devices and switches	95	70	69	83	79	84	49	60
Batteries	952	106	16	10	6	<0.5		
Measuring Instruments	79	108	52	65	53	43	41	22
<b>Dental</b>	<b>50</b>	<b>44</b>	<b>37</b>	<b>35</b>	<b>24</b>	<b>32</b>	<b>31</b>	<b>44</b>
Other Uses	84	58	148	103	110	93	86	
<b>TOTAL</b>	<b>1718</b>	<b>720</b>	<b>622</b>	<b>558</b>	<b>483</b>	<b>436</b>	<b>372</b>	<b>200</b>

a - Source: US Bureau of Mines, USGS, except b

b - Bethlehem Apparatus Co., Chemical and Engineering News, 2/5//01

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# **Dental Clinics Largely Unregulated for Mercury Use and Disposal**

Mercury fillings and extracted amalgam materials are often:

- rinsed down the drain, usually to a municipal wastewater system or septic system,
- deposited in biomedical waste containers destined for waste incineration,
- or placed in trash disposed in a municipal waste landfill or incinerator.

# Quantities of Dental Mercury Annually Released into Sewers

(assuming 175,000 dentists in the U.S. and 250 workdays per year)

<b>Study</b>	<b>Date</b>	<b>Tons Per Year</b>
Calais	1994	23.5
Drummond	1995	24.6
Arenholt-Bindslev and Larsen	1996	12.0
Water Environment Federation	1999	12.0
Canadian	2001	24.7
AMSA	2002	2.6

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# Studies Confirm Dentists Largest Mercury Polluters to Wastewater

- EPA and municipalities studies document significant contributions from dental clinics.
- Association of Metropolitan Sewerage Agencies evaluated seven major wastewater treatment plants. At each, dental uses were identified as "by far" the greatest contributors to the mercury-load, accounting on average for 40% of the load.
- Dental sector contributes more than three times more mercury than the next largest source.

# Mercury Discharge Studies

<b>City</b>	<b>Mercury load from dental offices</b>
Duluth, Minnesota	36%
Seattle, Washington	40-60%
Palo Alto, California	83%
Greater Boston Area, Massachusetts	13-76%

# Methylation Conditions in Dental Mercury Wastewater & Combustion

- Wastewater treatment systems are not designed to reduce mercury output to the environment.
- Mercury in wastewater settles out in the grit or in the sludge, or is discharged into bodies of water.
- Conditions within treatment process are perhaps favorable for converting some influent mercury into more toxic, organic form (methylmercury).
- About 50% of the sewage sludge in the US is incinerated making the amalgamated mercury “bio-available”.

# Mercury in Traps, Drains, and Sewer Pipes

- Dental offices plumbing significantly laden with amalgam, presenting potential liability concerns
- Amalgam particles trapped in dental plumbing and drainage pipes provide a continuing source of dissolved mercury to wastewater over time.
- Naval Institute has identified several enzyme-based products that clean suction lines while releasing little mercury from trapped amalgam

# Dental Mercury In Septic Systems

- Dentists rely on septic systems for disposal where treatment plants are unavailable.
- Soils and groundwater surrounding the drain fields can become contaminated with mercury and also lead to discharge of methylmercury.
- Significant levels of mercury contamination have been detected within & near dental septic tanks, presenting liability and clean up concerns.

# Biomedical Waste Incineration

- Recent survey indicates that 25%-30% of dentists place contact amalgam wastes into biomedical "red bags."
- Medical waste is a special type of regulated waste due to the potential presence of bacteria and pathogens, which is separated and handled differently from solid wastes.
- "Red-bag" waste often sent to a medical waste incinerator or sterilization, where the mercury is released into the air.

# Best Management Practices (BMPs)

## A. Chair-side (Primary) Traps:

- Disposable traps are preferable
- Inspect chair-side traps daily, replace or clean weekly
- Place disposable trap directly into the contact container
- Reusable amalgam traps: Remove all visible amalgam by tapping the contents into the labeled contact amalgam recycling container.

## B. Vacuum Pump Filters (Secondary Traps)

- Vacuum pump filters should be cleaned or changed regularly, at a minimum of once per month
- Sludge from traps or other plumbing should be poured or brushed, collected and handled as contact amalgam for recycling

# Dental BMPs, Amalgam Separator Installation and Maintenance

- Where best management practices are utilized, about 60% of amalgam waste can be captured.
- An additional 35%—or more—of the mercury can be cost-effectively captured when an amalgam separator is added to the system.
- Amalgam separators must be routinely maintained, or will not perform properly.

# Regulations for Dentistry Requiring BMPs and/or Separators

- Wichita, KS July 2001
- Seattle, King County, WA July 2003
- State of CT, July 2003
- State of ME, December 2004
- San Francisco, CA June 2004
- State of MA 50% 2004, 90% 2005
- Milwaukee, WI July 2008

## Canada:

- Toronto, Montreal, Victoria
- Nationwide by the beginning of 2005

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# Amalgam Separator Installations (based on incomplete estimates)

- Canada, over 27%
- U.S. over 3%, with:
- Over 56%: CT, Over 24%: ME & RI
- Over 18%: MA ,15%: WA, 12%: MN
- Over 4%: CA,KS,NH,VT
- Over 1%: AK,HI,IN,ND,OK,OR,UT,WI,WY
- All Other States: 0-3%

# ADA Working to Undermine Environmental Protection

- ADA recommends "Only voluntary BMP's unless environmental conditions or state law require mercury reductions."
- ADA lobbying EPA, state authorities to rely on voluntary measures that don't include amalgam separators.
- ADA instructs state dental societies to enter into voluntary agreements to avoid amalgam installations.
- ADA has actively opposed state legislation and regulations, and even second guessed state ADAs.

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# Mercury Use Reduction Strategies

- CA dentists must give patients brochure before filling are placed
- RI law will require state health insurance to equally cover non-amalgam placements
- ME and NH adopted laws mandating consumer notification at dental offices
  - ME has completed task, NH has not

## Fillings: The Choices You Have



## Mercury Amalgam and Other Filling Materials

A Patient Education/Information Brochure Prepared by the  
Maine Department of Human Services, Bureau of Health, 2002

### Amalgam Fillings and Mercury

Amalgam fillings are also called dental amalgams or mercury amalgams. They are 40 to 50 percent mercury. These fillings give off mercury vapor. How much vapor is given off depends on how many fillings you have. It also depends on how much time you spend chewing, grinding your teeth, and drinking hot liquids. Mercury vapor can be inhaled and enter the bloodstream. It can then be carried throughout the body. For people with a number of fillings, this can be the major way mercury gets into their body. Any mercury from amalgam fillings we swallow is very poorly absorbed and mostly does not enter our bloodstream.

### Health Concerns

There is a lot of debate about health effects from the mercury in amalgam fillings. Current studies cannot confirm if amalgam fillings cause health problems. Some people have allergic reactions to mercury. Too much mercury can damage the kidneys, nerves, and the brain. The brains of babies and infants that are starting to form and grow are most at risk.

To be careful, Canada and several countries in Europe recommend limits on the use of mercury amalgam. They advise that pregnant women should not have amalgam fillings placed in or removed from their teeth. Some of these countries issue the same warning for nursing women and people with kidney problems. Some countries advise limits on using amalgam fillings with young children and people with braces. The US Public Health Service thinks such advice is not needed. They say amalgam fillings are safe for most people. No country says people who do not have signs of mercury effects should have their fillings removed.

### Environmental Concerns

Some countries limit the use of amalgam fillings to help reduce mercury pollution. Waste is made when new fillings are put in teeth or when fillings are removed. This waste contains mercury. It can pollute the environment. Your dentist can reduce this pollution by using traps and filters to collect the mercury for recycling. Amalgam fillings cause our body's waste (urine and feces) to have mercury. When these mercury-containing wastes enter sewers, they can add to the pollution of our waters.

Once mercury enters our waters, it can change to methylmercury. This builds up in fish. Many states, including Maine, have issued Safe Eating Guidelines on eating fish due to mercury pollution. Mercury used in dentistry is not the major cause of our mercury pollution and resulting fish warnings. It does add to the problem. Wildlife that eat fish, such as eagles, loons and otters, are also at risk of harm from mercury pollution.

# Reduction Strategies in Other Nations

- Health Canada and many EU countries discourage amalgams placed in pregnant women and young children
- Sweden does not provide insurance coverage for mercury fillings, reducing use
- Norway now actively discourages dentists from using mercury, based on principle of substitution and precautionary principle

# Future NGO Support for Promoting Mercury-Free Fillings Depends on:

- Peer reviewed literature study:
  - a.) alternatives (composite materials, e.g. adhesives, plastics) and
  - b.) health concerns (e.g. Bisphenol A)
- Impact study of the mercury alternatives on the waste stream and environment
- Funding to conduct such studies
- MPP in process of raising funds, building collaborative partnership effort
- IAOMT financial, in-kind support (?)

# Mercury is a Global Problem...



...*Requiring  
a Global  
Solution*

*(But we must begin with real action at home!)*

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# **For More Information: [www.mercurypolicy.org](http://www.mercurypolicy.org)**

## **Materials on Amalgam Separators is available:**

ADA Journal Article May 2002; August 2003

- US Navy website: <http://www.nmrc.navy.mil/ndri.htm>
  - MN Dental Association
  - Seattle King County web site
  - San Francisco Public Works

## **Maine, California Consumer Information Brochures:**

[www.state.me.us/dhs/boh/files/odh/AmalBrochFinal2.doc](http://www.state.me.us/dhs/boh/files/odh/AmalBrochFinal2.doc)

[www.dbc.ca.gov](http://www.dbc.ca.gov)

[www.dbc.ca.gov/pdf/dmfs2004.pdf](http://www.dbc.ca.gov/pdf/dmfs2004.pdf)

## **Coming soon: Vermont operational pilot project study of amalgam separators:**

[www.mercvt.org](http://www.mercvt.org)

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