Controlling Dental Mercury Waste at the Source

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2014 National Pretreatment and Pollution Prevention Workshop
Minneapolis, MN
May 14, 2014
Dental Amalgam Releases to the Local & Global Mercury Environment

Slide Courtesy of Swedish Chemical Agency
## Major Annual Release Pathways of Dental Amalgam Globally

<table>
<thead>
<tr>
<th>Major release/pathways</th>
<th>Mercury (metric tonnes/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmosphere</td>
<td>50-70</td>
</tr>
<tr>
<td>Surface water</td>
<td>35-45</td>
</tr>
<tr>
<td>Groundwater</td>
<td>20-25</td>
</tr>
<tr>
<td>Soil</td>
<td>75-100</td>
</tr>
<tr>
<td>Recycling of dental amalgam</td>
<td>40-50</td>
</tr>
<tr>
<td>Sequestered, secure disposal</td>
<td>40-50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>260-340</strong></td>
</tr>
</tbody>
</table>

Source: UNEP 2010

[Mercury Policy Project](https://www.mercury-policy-project.org)
US Mercury Use In 2010

- **Switches & Relays**: 38,869
- **Dental Amalgam**: 34,163
- **Lamps**: 16,793
- **Thermostats**: 330
- **Measuring Devices**: 1,530
- **Batteries**: 14,244
- **Formulated Products**: 2,737
- **Other**: 4,759

**Dental Mercury Use:**
Over 34,000 pounds

IMERC Mercury Use in Products
2001 – 2010 Data Analysis
www.newmoa.org/prevention/mercury/imerc/Notification
Dental Sector Largest Mercury Product Use* and Polluter to Nation’s Wastewater

*Source: USGS 2013, IMERC 2013
Consumption of Dental Mercury is Decreasing, But Still Significant

IMERC Mercury Use in Products
2001 – 2010 Data Analysis
www.newmoa.org/prevention/mercury/imerc/Notification
Dental Mercury in Wastewater

- Dental identified as "by far" the greatest mercury contributors to wastewater: over 3 times next source
- AMSA – In all seven POTW’s tested, the largest contributor of mercury were dental clinics
- US EPA estimates 50% of mercury entering POTWs from dental clinics

<table>
<thead>
<tr>
<th>City</th>
<th>Mercury load from dental offices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duluth, Minnesota</td>
<td>36%</td>
</tr>
<tr>
<td>Seattle, Washington</td>
<td>40-60%</td>
</tr>
<tr>
<td>Palo Alto, California</td>
<td>83%</td>
</tr>
</tbody>
</table>
Dental Mercury Uptake in Air, Water, Fish & People

• 2007 US EPA Report to Congress made the link between waste disposal and mercury in fish
• US EPA website states that dental mercury can methylate in wastewater and contaminate fish
• Dental Hg releases from sewage sludge now resulting in significant costs to local communities (more on that later…)...
Human Health Effects of MeHg

- Human Health concerns are the primary driver for low level mercury discharge limits
- Human exposure to mercury in the USA primarily through fish consumption
- Even chronic low dose exposure is thought to be harmful, especially to the fetus and the developing infant
- Nearly all states and EPA/FDA have issued fish consumption advisories due to MeHg
- Global treaty adopted in 2013 by 94 countries to reduce human exposure to mercury, with the USA becoming the first country to ratify it
# MPP’s 2007 Testimony to Congress

## Atmospheric emissions of dental mercury (tons)

<table>
<thead>
<tr>
<th>Pathway</th>
<th>EPA National Emissions Inventory 2002</th>
<th>This report 2005 (low estimate)</th>
<th>This report 2005 (high estimate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human cremation</td>
<td>0.3</td>
<td>3.0</td>
<td>3.5</td>
</tr>
<tr>
<td>Dental clinics</td>
<td>0.6</td>
<td>0.9</td>
<td>1.3</td>
</tr>
<tr>
<td>Dental mercury sewage sludge incineration</td>
<td>0.6</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Dental mercury sludge spread on land and landfill</td>
<td>n.a.</td>
<td>0.8</td>
<td>1.2</td>
</tr>
<tr>
<td>Dental mercury MSW incineration and landfill</td>
<td>n.a.</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Dental mercury infectious and hazardous waste</td>
<td>n.a.</td>
<td>0.5</td>
<td>0.7</td>
</tr>
<tr>
<td>Human respiration</td>
<td>n.a.</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Total</td>
<td>1.5</td>
<td>7.1</td>
<td>9.4</td>
</tr>
</tbody>
</table>
Hg Emissions from Sludge Incineration

• Most POTWs (without separator mandates) transferring dental Hg to sludge incinerators

• Nationwide about 20% of sewage sludge is incinerated on average

• 184 sewage sludge incinerators across the USA

• Dental mercury content estimated on the order of 8.5 tons

• 60% or more of the mercury content is typically emitted to the atmosphere
Sewage Sludge Incinerator (SSI) “MACT” Compliance Costs

- US EPA estimated nationwide Maximum Achievable Control Technology (MACT) costs for 184 existing SSI estimated at approximately $218 million
- Problem primarily from dental mercury pollution
- Much of this cost is borne by local communities
- For more information, see: http://www.epa.gov/ttn/atw/129/ssi/ssipg.html
Do Amalgam Separators Work?

- Toronto, ON 58% Reduction (Source: Toronto Sewer Authority)
- Seattle King County, WA 50% Reduction (Source: Seattle King County Sewer Authority 2005)
- Victoria, BC 70% Reduction (Source: The Victoria Times Colonist, May 5, 2005 Victoria BC)
- Wichita, KS 50% Reduction (Source: Jamie Beldon, Wichita Sewer District)
- MCES, Minneapolis, St. Paul, MN 29% - 44% (Source: Peter Berglund, MCES, 2005)
Requirements for BMPs, Amalgam Separators

- New Hampshire (2005)
- Massachusetts (2006)
- Vermont (2007)
- Rhode Island (2007)
- New Jersey (2009)
- Oregon (2010)
- Michigan (2013)
- New Mexico (2014)
- (Many cities, counties also)
State/Local Government Requirements

• Require adherence to best management practices (BMPs); including installing, properly operating and maintaining amalgam separators
• Require dentists to provide certification that mercury was recycled
• Require dentists to verify compliance w/BMPs, separator requirements through self reporting
• Where self-reporting required and a fine is looming, compliance is high
• (Since 2007, the American Dental Association has recommended separators as part of its BMPs)
Amalgam Separator Costs & Compliance

- San Francisco estimates cost to install separator $883, plus $250/year for recycling, etc.
- NJ DEP estimates that:
  --costs of separator at between $700-$1,000
  --cost per dental facility to be 54 to 81 cents per patient per year
- About 2/3’s of US dentists don’t use amalgam separators
- Whether dentist has 6 months or 4 years to comply, most do so in last 2 months before deadline
Requirements = Compliance*

Amalgam Separators Installed

*Data from Gail Savina and Olivia Chamberlain; KCLHWMP
Summary

• Most cost effective P2 strategy is preventing mercury releases at the source: **the dental clinic!**
• Amalgam separator cost equates to $1.95 per average mercury filling removal or 50 cents per patient per year
• Voluntary efforts have proven largely unsuccessful compared to mandates
• Controlling dental Hg requires mandates
• But burden on state, local government should be minimized!

2013 UNEP Report
Promoting Mercury Treaty
Thank you!

With all the mercury in my mouth I must be an environmental hazard!

Figure 10

Mercury Policy Project