



Dental Mercury Initiatives in the United States

Great Lakes Regional Pollution Prevention Roundtable
Summer 2002 Meeting
Toronto Canada



Dental Amalgam – Why is it still being used?

- Currently there is no adequate substitute
 - ▶ Especially in public health settings
- Relatively easy to place
- Low cost
- Resistance to compressive forces
 - ▶ Especially important in posterior teeth
- Still widely used: 200 million amalgam fillings placed in US and Europe



Safety of Dental Amalgam

- No well-controlled studies showing human health effects from amalgam
- No association found between human serum Hg levels and disease – *Ahlqwist et. al., 1999*
- Many ongoing studies currently looking into health effects of mercury (approximately 58 studies)

▶ NIEHS ▶ NIND ▶ NIGMS ▶ NIAID
▶ NIDCR ▶ NCRR ▶ NIAMS ▶ NIA



Proposed Bill to Regulate Dental Amalgam Fillings

- H.R. 4163 sponsored by **Diane Watson (D-Ca)** and **Dan Burton (R-In)**
- Ban mercury containing amalgam fillings in children (<18 yrs), pregnant women and nursing mothers
- Require health warnings to all patients receiving mercury containing fillings
- Total ban on mercury fillings by 2007



Alternative Restorative Materials

- Gallium alloys
 - ▶ 2 products: *Gallium Alloy GF™* and *Galloy™*
 - ▶ Gallium forms a liquid at room temperature when alloyed with Sn
 - ▶ Mixed with Ag, Sn, Cu powder
 - ▶ Gallium alloys exceed ISO setting expansion criteria when contaminated with moisture
- Composites
 - ▶ Polymer matrix (Bis-GMA and UDMA), inorganic fillers, coupling agent, and initiator-activator system
- Cast Restorations
- Porcelains



Regulation:

“What’s taking so long?”

- Pressure from lobbyists
- US regulates at local level
- POTWs have become *de facto* regulatory agencies
 - ▶ *NDC Norfolk*
 - ▶ *NDC Great Lakes*
- Attainability issues



King County Washington State

- Working on dental mercury release since 1990
(Gail Savina)
- Planned mandatory program changed to voluntary program *(dental society pressure)* and back to mandatory
- Voluntary program not successful – only 25 clinics installed separators, 2.8%
- Required to meet local discharge limit of 200 µg/liter (5 year permit just renewed)
- Follow Best Management Practices for amalgam waste



King County Washington State

- Install approved separator *or* apply for permit and demonstrate *not* to be in violation of discharge limit
- Permit fees range from no cost to \$1200 for 5-year period
- King County separator approval process being phased out in favor of the ISO standard (ISO 11143)
- Some specialists are exempt: *OS, OM, OR, OP, Ortho, Perio, and other specialists that don't place or remove amalgam fillings*



King County Washington State

- 800 to 900 general dental clinics in King County
- July 1st 2002 – New office construction must have approved separator
- July 1st 2003 – All dental clinics must have installed separator or permit



King County Point of Contact

Patricia Magnuson

Investigator, King County Industrial
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Duluth Minnesota

Western Lake Superior Sanitary District

- Active in dental Hg issues for over *10 years*
- Work in partnership with the local dental society
 - ▶ 50 general practices with 100 dentists in service area
 - ▶ Educational training (BMPs)
 - ▶ State and local levels
 - ▶ On-site training
 - ▶ Small business waste collection program
 - ▶ Program is 100% voluntary



Duluth Minnesota

Western Lake Superior Sanitary District

- Investigating the effect of separators on Hg influent to their WWTP
- Effluent levels from WWTP now running between 1.2 to 2.7 ppt
- Sludge levels are between 0.19 and 0.68 ppm (dry)
- Trend is continuing downward



Duluth Minnesota

Western Lake Superior Sanitary District

Point of Contact

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Wichita Kansas

- Metropolitan area of 500,000 in SE Kansas
- 200 dental clinics in metro area, 150 of which are general practice
- **Phase 1** -- installation of technology greater than already in office is mandated by October 2001
- If a 50% reduction to WWTP is not obtained by June 2003 then Phase 2 will be implemented
- **Phase 2** -- installation of ISO 11143 certified separators mandated



Wichita Kansas

- City maintains a list of approved separators
- Each clinic samples wastewater annually
- City inspects and samples clinics on an annual basis
- Each clinic submits annual self monitoring report
- WWTP sludge is land applied



Wichita Points of Contact

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Cleveland Ohio

(NEORSD)

- NEORSD will be held to discharge limit of 1 ppt (ng/liter) within a year
- New discharge limit driven by GLWQI (*1.3 ppt ambient Hg levels*)
- 300 MG/D discharged into Lake Erie and Cuyahoga River
- Implementing narrative limit for Hg including BMPs



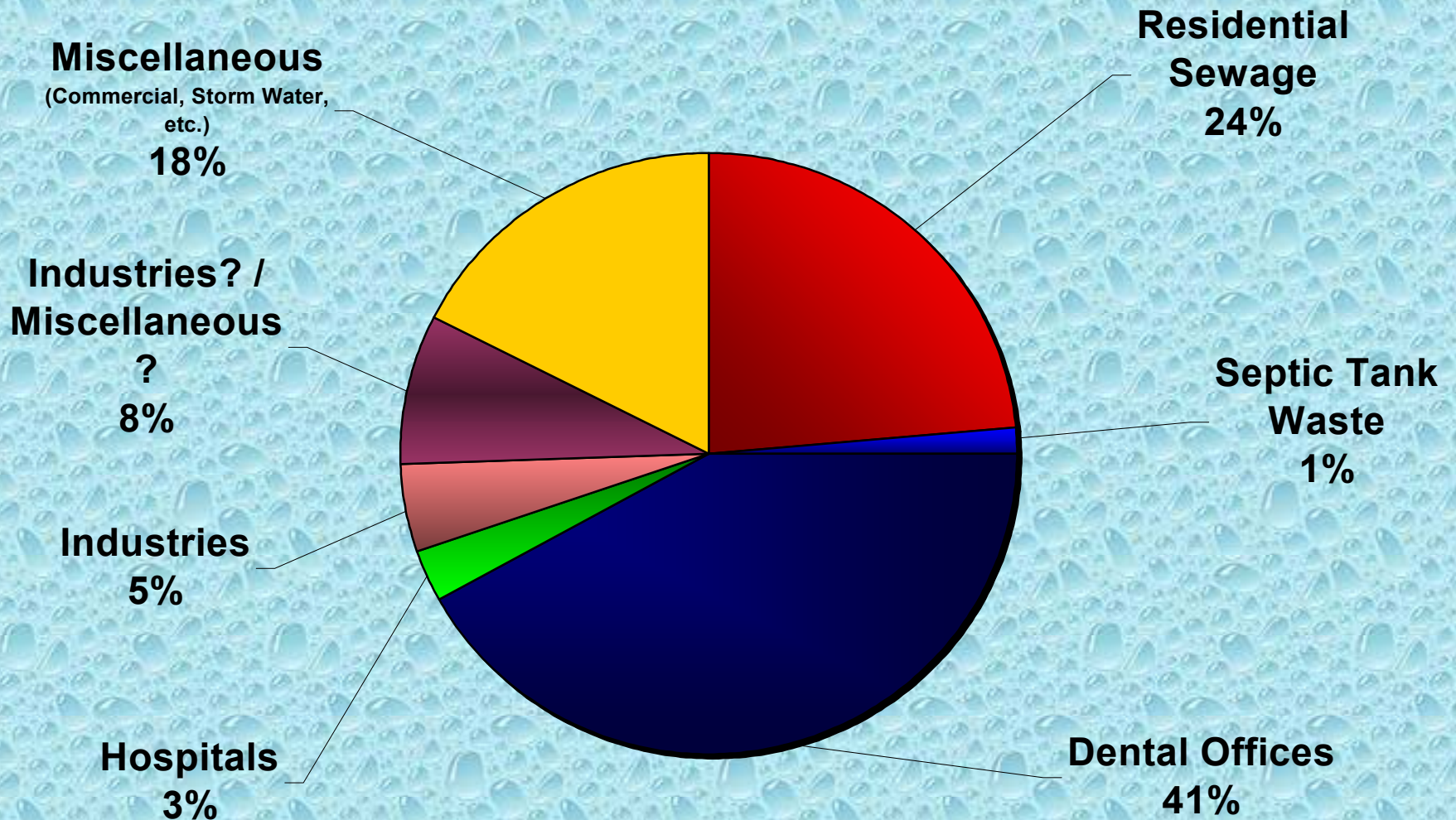
Cleveland Ohio

(NEORSD)

- NEORSD estimates 2/3 of its volume is from residential sources with Hg levels ranging from 50-100 ppt
- May require separators for dental clinics
- Attainability issues: *may not be able to achieve discharge limit even by disconnecting all dental clinics*

NEORSD Mercury Source Estimates August 2002

Data courtesy of Keith Linn, NEORSD





Los Angeles, California

- City of Los Angeles (*and six other cities who contract with LA for sewer discharges*) has formal regulatory program for dental offices that will go into effect late this year
- Will require dental offices to comply with specific BMPs but it does ***not*** require amalgam separators



Richmond, California

San Francisco Bay Area

- 9 dentists in its service area
- 5 ppb discharge limit
- Dentists have worked cooperatively with the city for the past 2-3 years. All the dentists have been cited at least once (fines were waived)
- City has tried numerous methods to reduce Hg discharge -- best results seen where dentist implemented BMPs and installed separator (*However, local discharge limit still exceeded*)



California Point of Contact

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New Hampshire

- Passed legislation requiring its environmental agency to come up with regulations for all dental offices
- Expect to be done in the coming year



Massachusetts

- Massachusetts Executive Office of Environmental Affairs is doing a study of ISO test and available separators
- Currently no regulatory plan in effect
- Point of Contact:

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U.S. Navy Initiatives

- US Navy is in process of installing separators in all dental facilities
- Program Managed by **NDRI**
- Installed systems remove **particulate** and **“dissolved Hg”**
- Install in all **US** and **overseas** dental treatment facilities
- Funding comes from DoD Health Affairs



Bioavailability of Hg in Dental-Unit Wastewater

- A percentage of the Hg in dental wastewater is in a form that can be incorporated into aquatic organisms
- MMHg and ionic Hg have been measured in environmentally significant concentrations
- Aquarium experiments



Systems to Remove Mercury in Dental-Unit Wastewater

- Hg removal equipment for dental offices are widely available on the market
- Range from particulate removal systems to systems with *affinity resins* (sorbents) that remove ionic Hg
- Removal of Hg from this waste stream is good idea



NDRI Study on Separators

- Evaluation of commercially available amalgam separators
- Utilizing *EPA/NSF protocol* which utilizes dental wastewater from dental clinics
- Identified “dissolved” Hg fraction as a significant component



ADA Study on Separators

- Recently published report in *JADA Volume 133, May 2002*
- Evaluated 12 amalgam separators
- Utilized the ISO 11143 standard
- All the units passed and removed at least 96.03% of amalgam sample
- Hg levels in effluent varied widely



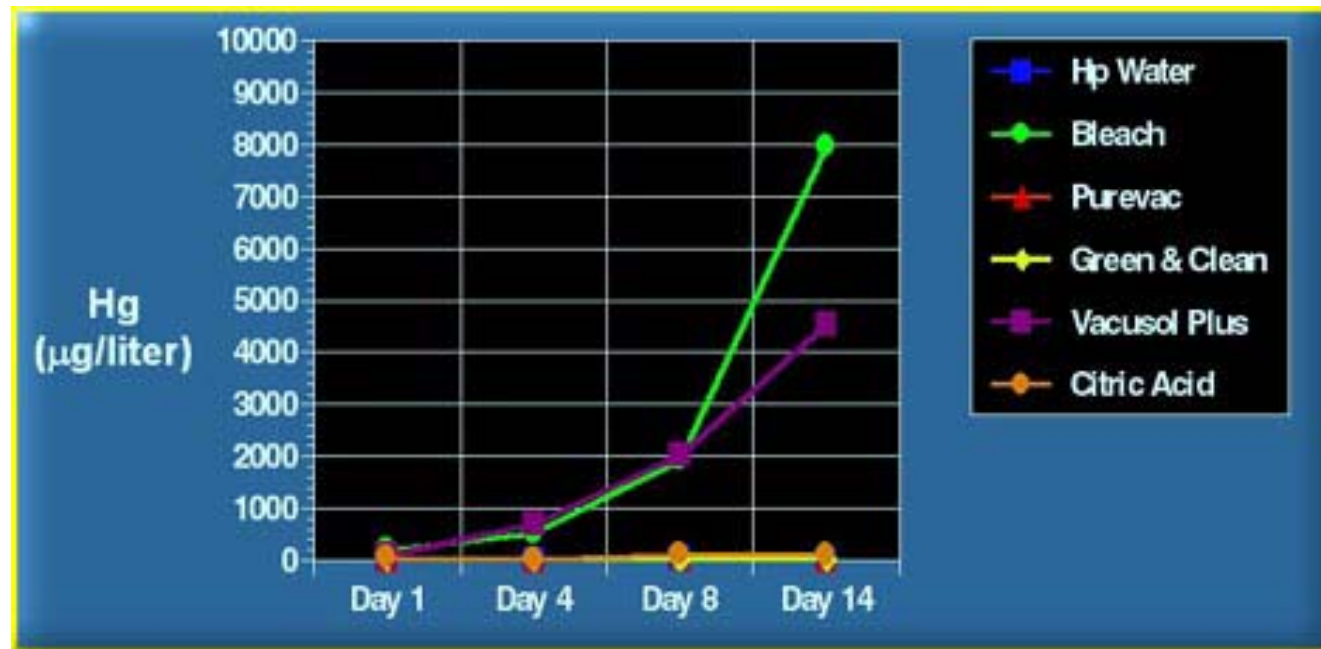
Residual Hg in Sewer Lines

- Residual Hg in wastewater lines can be substantial
- Building plumbing acts as a separator
- TCLP studies on wastewater lines show pipes can exceed RCRA limits for Hg
- Residual Hg can be mobilized



Action of Line Cleaners

- Some oxidizing line cleaners used to clean suction lines can mobilize Hg from amalgam
- Bleach (**Sodium Hypochlorite**) is one of the worst offenders





Summary

- Regulatory efforts in the U.S lag behind Canada
- Political pressure from professional associations may be a contributing factor
- Any reduction of Hg influent to WWTP is a positive outcome
- Local regulators are at forefront of efforts to control Hg release in U.S.