



Mercury Product Life-Cycle Model: Uses and Results

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Questions

- Are Products (Still) Important Sources of Mercury to the Environment?
 - Incinerators have been controlled
 - Mercury thermometers have become rare
- Which Products Contribute the Most?
- Which Pathways Contribute the Most?
- Which Interventions Will Reduce Mercury the Most?



Mercury Product Life-Cycle Release Estimation Project

- Minnesota PCA (Ed Swain)/Barr Engineering (Carol Andrews, Bruce Monson)– estimates for MN in 2001– Used to improve MPCA mercury emissions inventories
- Wisconsin DNR/Barr/Dane County– adapted for WI in 2003-2004
- 2004-5; EPA Region 5, WDNR (Randy Case), Dane County (John Reindl), Barr (Cliff Twaroski, Sarah Disch) develop national estimates



Life-Cycle Mercury Flow Approach

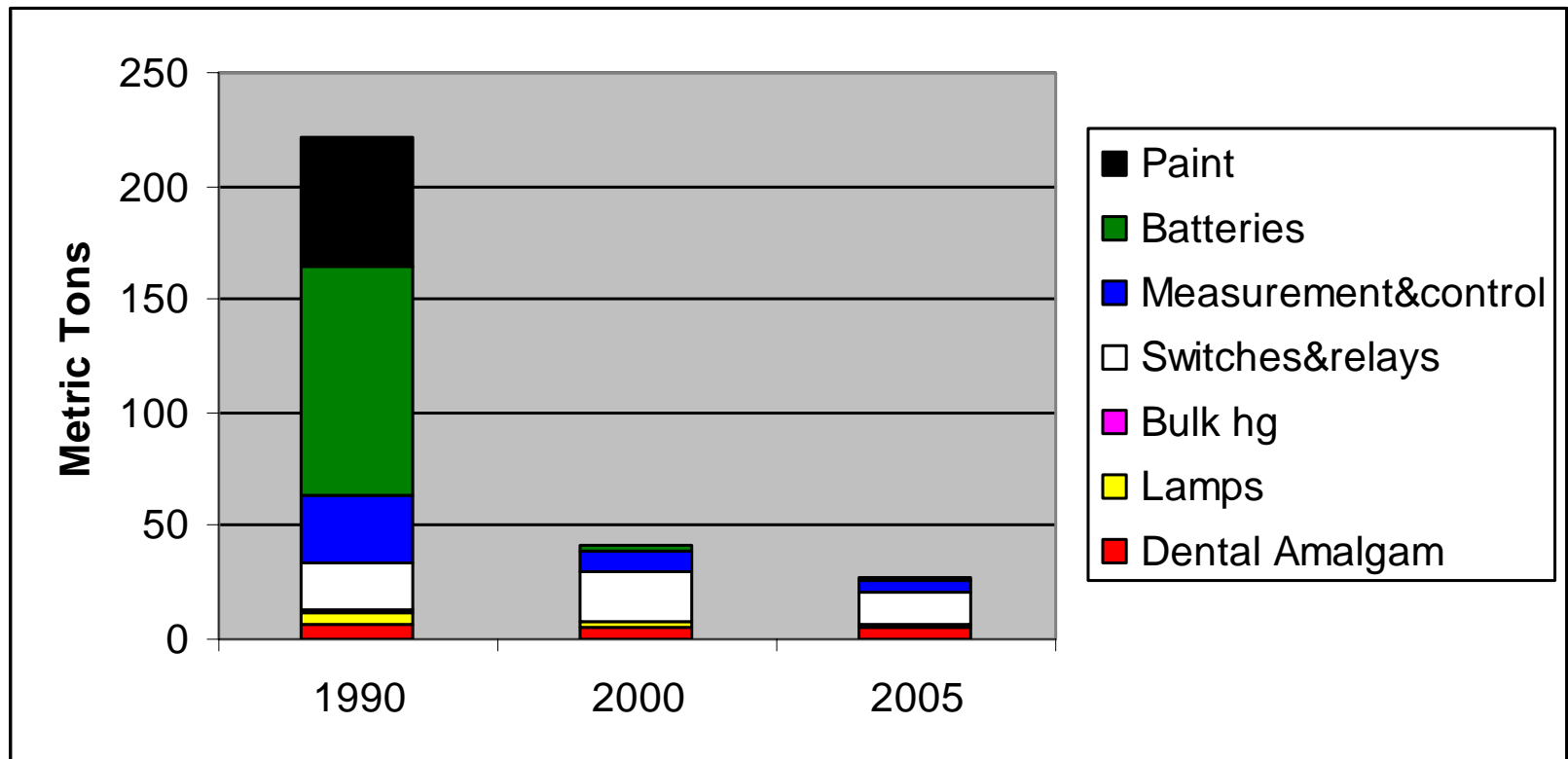
- Mass Balance: mercury used in products is released, recycled, or maintained in inventory
- Linked Spreadsheets
- Inputs
 - Mercury used in products
 - Product disposal (sometimes derived, sometimes an input)
 - Distribution Factors
 - Release Factors
- Outputs: preliminary, rough estimates of releases to air, water, land in 1990, 2000, 2005



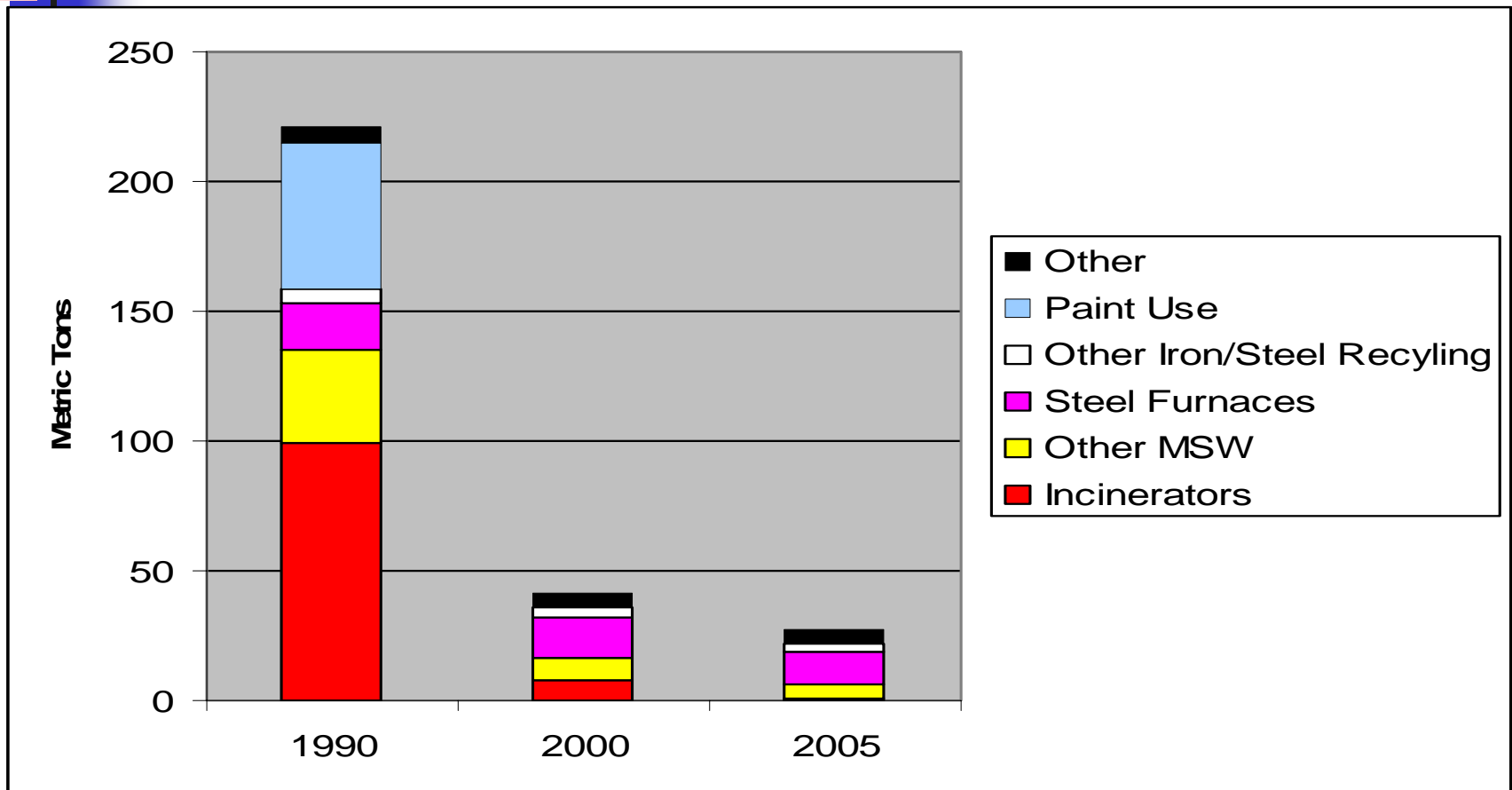
Products Covered

- Dental amalgam
- Fluorescent lamps, other lamps
- Bulk liquid mercury
- Switches and relays
 - Auto switches
 - Thermostats
- Measurement and Control Devices
 - Thermometers
- Batteries and paint– back of the envelope
- Did not evaluate chemicals, medicines, ritual use

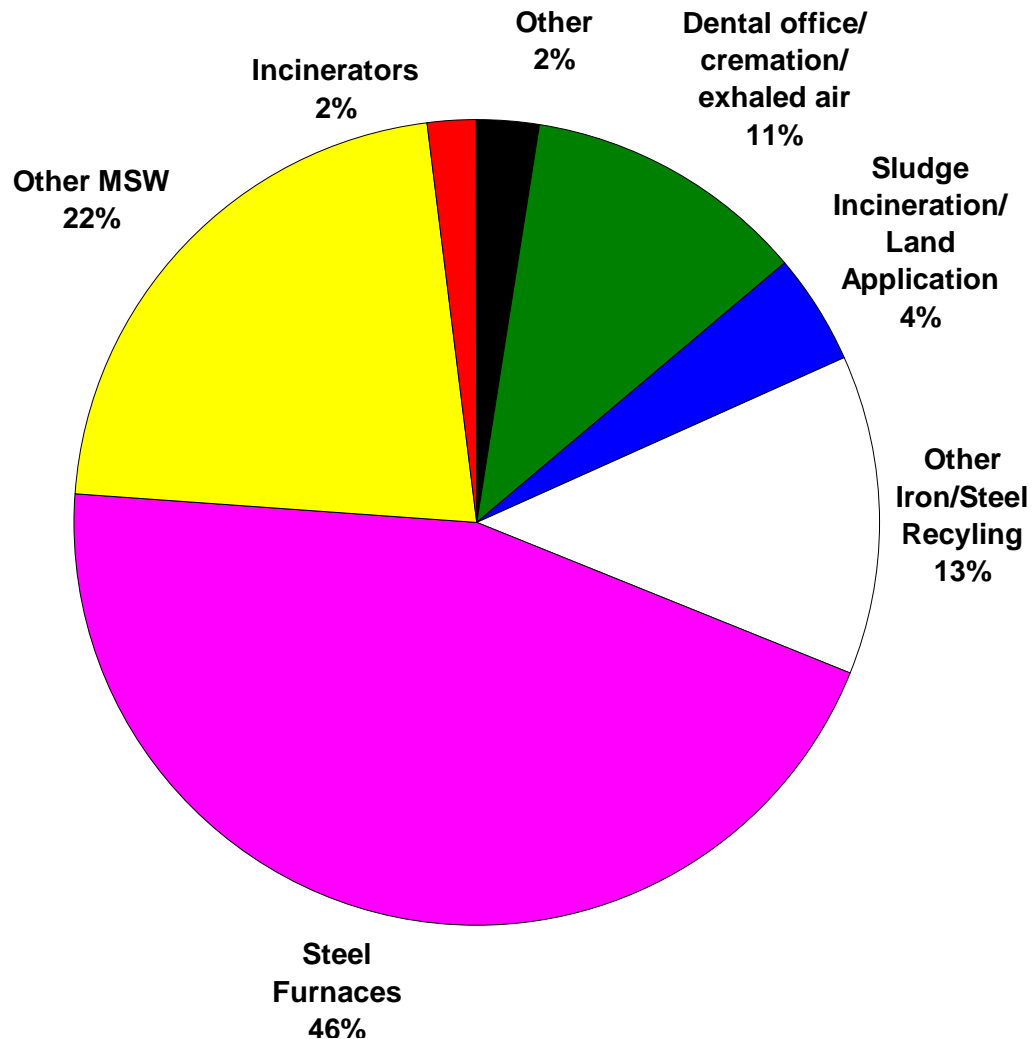
Product-Related Air Emissions, by Product



Product-Related Air Emissions, by Pathway



Product-Related Air Emissions by Pathway: 2005



**Total: 27
metric tons**



Selected 1999 NEI* Emissions Compared with Model (2000)

	NEI	Model
Medical/Municipal Incinerators	5.9	8.2
Mercury Recycling	0.2	0.8
Iron and Steel Furnaces	10.7	15.3
Lamp Breakage	1.4	1.6
All Product Breakage	not estimated	0.6
Zinc Production	not estimated	3.1
Metal Shredders	not estimated	1.2
Burn Barrels	not estimated	2.3

NEI: EPA's National Emissions Inventory.

* Steel furnace estimate from 2002 NEI– Electric Arc Furnaces only.



Iron and Steel Recycling

- Less decrease than in most other categories
- Not just autos– autos account approximately 1/2 of steel furnace emissions (high uncertainty)
- Other switches and relays, measurement devices – commercial appliances? Industrial equipment?
- Not just steel furnaces: shredders, auto fluff and
- Secondary zinc production emissions (TRI, 2003)
 - Inmetco International Metals, Ellwood City, PA: 1900 lbs mercury air emissions
 - Horsehead Resource Development
 - Chicago: 210 lbs mercury air emissions
 - Palmerton, PA: 220 lbs mercury air emissions
 - Rockwood, TN: 99 lbs mercury air emissions



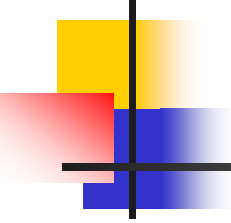
Solid Waste Management System

- Emissions declining rapidly
- Big impacts from battery P2; incinerator regulations
- Emissions could be significant for:
 - Burn barrels (est. more than 2 tons)
 - Product breakage during use, transport to disposal sites
 - High uncertainty



Dental Amalgam

- Significant water releases (381 kg in 2005) >50% of product-related total
- Air releases from sludge incineration and land application, dental office vacuum system, cremation, exhaled air (high uncertainty)
- Potential BMP/Separator impact?



Evaluation of Potential Control Options: Dental Amalgam, 2005

	Land Release	Water Release	Air Release
BMP Status quo, 10% separators	23.4	0.4	5.5
100% BMP adherence, 10% separators	13.5	0.3	4.2
100% adoption of BMPs and 95%-effective separators	11.2	0.1	3.6

In metric tons. Assumes that WWTPs are equally effective at removing dental amalgam and other mercury from sewage.



Evaluation of Potential Control Options—Air Emissions Impact

- Auto switches, 2005
 - 0 switch removal— 8.2 metric tons
 - 20% removal— 6.6 metric tons
 - 80% recycling—1.9 metric tons
- Fluorescent lamps, 2005
 - 25% lamp recycling (status quo)—1.1 metric tons
 - 75% lamp recycling— 0.6 metric tons

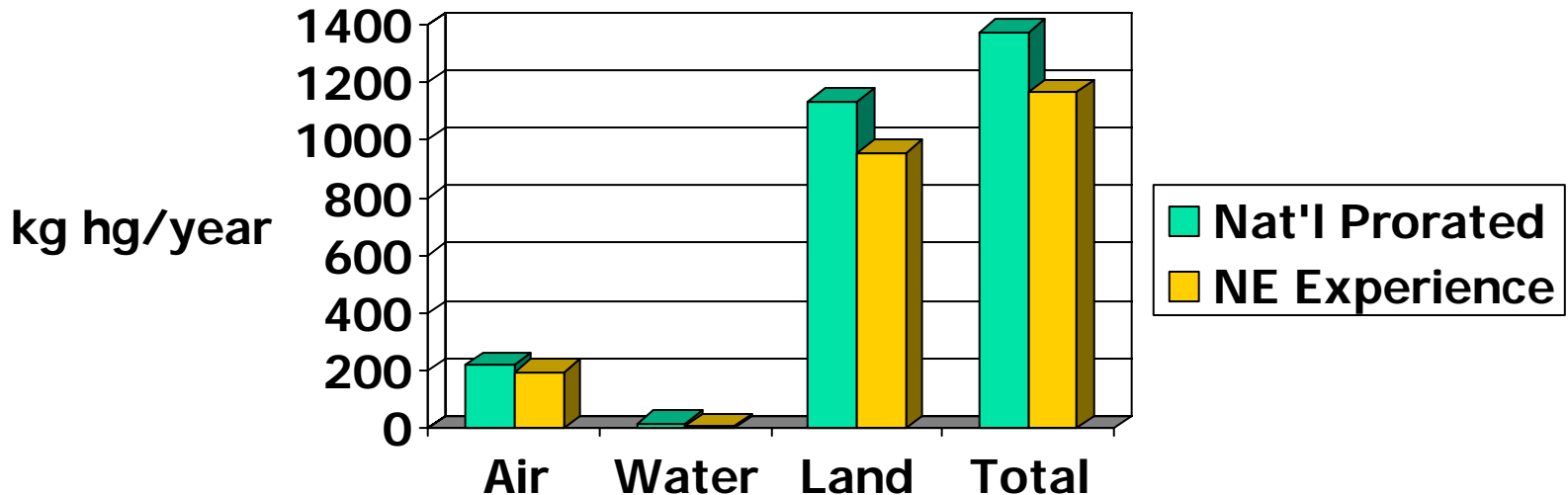


Dental Amalgam: New England Experience

- Pro-rated population represent NE
- Used NE Solid Waste Management
 - 60 % Incineration
 - 40% Landfill
- Used NE Dental Experience
 - 42% Chair-side Traps
 - Assumed 95% Amalgam Separators

Comparison of Nat'l & NE Dental Amalgam 2005-2010

Dental 2005-2010





Conclusions

- Products Are Still Important Sources of Mercury to the Environment
 - Releases reduced significantly
- Important reduction opportunities in iron and steel production/recycling; dental, lamps
- Model provides opportunity to better understand release pathways and to test impact of potential control strategies
- Quantification is rough—many uncertainties
- Model can be adapted for state/local use



Questions?
