



2017 Minnesota mercury (Hg) methodology

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Agenda

Overview of the emissions inventory

- Landfills
- Open burning
- Composting
- Other
- Cremation
- General laboratories
- Dental services
- Industrial/commercial stationary fuel combustion
- Residential Heating
- Railroad equipment

Emission Inventory overview

- Compiled every 3 years
- Collaborative effort between EPA and MPCA
- Includes criteria air pollutants (CAPs) and air toxics (ATs)
- Includes
 - **Point:** Typically large, stationary sources with relatively high emissions
 - **Mobile:** Broken up into two categories: on-road vehicles and off-road sources.
 - On-road vehicles include vehicles operated on highways, streets and roads.
 - Off-road sources include off-road vehicles and portable equipment powered by internal combustion engines. Lawn and garden equipment, construction equipment, aircraft and locomotives are examples of offroad sources.
 - **Fire:** Emissions are produced by inadvertent or intentional agricultural burning, prescribed burning or forest wild fires
 - **Biogenic:** Emissions from natural sources such as soils and vegetation
 - **Nonpoint:** Typically stationary sources, but generally smaller sources of emissions than point sources. Examples include dry cleaners, gasoline service stations and residential wood combustion.

- 2620030000 - Volatilization from MSW landfills
- MPCA keeps track of household waste generated in the state
- **MPCA estimate average Hg content of MSW to be 0.56 ppm**
 - **analysis based on Hennepin Energy Recovery Center Ash analysis 2014 to 2018**
- MPCA assumed 0.1% of mercury in landfilled MSW was volatilized
- 2525000000 - Emissions from MSW collection & handling process
- MPCA keeps track of household waste generated in the state
- MPCA assumes 5% of mercury in the MSW was evaporated during waste collection & handling process

Open burning

- **2610030000 – Open burning - household waste**
- MPCA keeps track of household waste generated in the state
- Each county estimates how many residents utilize onsite disposal (2.3 lbs/day/person)
- MPCA estimates burnable materials account for 65% of onsite disposal
- MPCA estimate average Hg content of MSW to be 0.56 ppm
- Hg emissions from open burning of residential household waste were estimated with an assumption of 50% average mercury contents in MSW 0.28 ppm (0.00056 Lb/Ton)

Composting

- **2680001000 - Volatilization from land application of sludge**
- MPCA keeps track of total land applied sewage sludge (specific for each POTW facility)
- Hg concentration specific for each POTW
- The place for land application of sludge from one POTW could be anywhere not necessary in the same county as the POTW. Therefore, the state total mercury content was obtained from the data for 121 POTWs, then, allocated to counties by population. Mercury emissions were calculated with an assumption that 1% of the mercury applied to the surface of the land volatilizes within a year, without attempt to calculate any carryover from previous years.
- **2680003000 - Volatilization from land application of compost**
- MPCA estimate average Hg content of MSW to be 0.56 ppm
- MPCA keeps track of household waste generated in the state
- MPCA assumed 1% of mercury in the composted MSW was emitted during the land application

- **2460100000** –Volatilization from dissipative use
 - The state total mercury emissions were projected for 2010 and 2018 in 2008, no new information is provided, we assume a linear reduction from 2010 to 2018
 - Statewide emissions were allocated to counties by population
- **2461900000** - Volatilization from spills and land dumping
 - Hg from Thermostats
 - National-level mercury emissions are apportioned to each county based on population
 - Hg from Thermometers
 - National-level mercury emissions from thermometers are allocated to the county level based on population

- 31502103 – Various healthcare crematorium - Human cremation
- MN DOH keeps track of total human cremations in the state of MN
- To estimate mercury emissions per cremated body, we looked at age distribution of those cremated in the state and assumed an amount of Mercury Amalgam (g) per age group.

Dental Services

- **2850001000 – Dental preparations and use**
- Hg in amalgam has a variety of pathways to the atmosphere
- The amount of mercury emissions from restored teeth was estimated using the average number of filled teeth per person in different age brackets:
- The census data for population by age are were used to estimate county emissions

Age Group	Average Number of Filled Teeth per Person	Percentage of Fillings Containing Mercury	Average Number of Filled Teeth Containing Mercury per Person
0-4	0.44	31.6%	0.14
5-19	1.23	31.6%	0.39
20-34	4.61	50.0%	2.31
35-49	7.78	62.5%	4.86
50-62	9.20	75.0%	6.90
63-79	15.59	100.0%	15.59
80+	6.44	75.0%	4.83

General Laboratories

- **2851001000 - General Laboratory Activities, Miscellaneous Non-Industrial NEC**
- Chemical laboratories use mercury to perform physical measurements and chemical analyses.
- The amount of amalgam prepared in dental offices nationally was estimate to be 13.5 tons (27,000 lbs) in 2017. US EPA estimates that 2% of mercury used in dental offices is emitted to air or 540 lbs (nationally).
 - Using population proportion about 9.26 lbs of Hg was volatized as a results of general laboratory activities in Minnesota

Industrial/commercial stationary fuel combustion

SCC	Description	SCC	Description
2102001000	Fuel Combustion; Industrial; Anthr Coal	2103001000	Fuel Combustion; Comm/Inst; Anthra Coal
2102002000	Fuel Combustion; Industrial; Bit Coal	2103002000	Fuel Combustion; Comm/Inst; Bit Coal
2102004001	Fuel Combustion; Industrial; Distillate Oil Boiler	2103004001	Fuel Combustion; Comm/Inst; Distillate Oil Boiler
2102005000	Fuel Combustion; Industrial; Residual Oil	2103005000	Fuel Combustion; Comm/Inst; Residual Oil
2102006000	Fuel Combustion; Industrial; Natural Gas	2103006000	Fuel Combustion; Comm/Inst; Natural Gas
2102007000	Fuel Combustion; Industrial; LPG	2103007000	Fuel Combustion; Comm/Inst; LPG
2102011000	Fuel Combustion; Industrial; Kerosene	2103011000	Fuel Combustion; Comm/Inst; Kerosene

- Category estimated by EPA
- MPCA submits activity data from point sources – (fuel use from permitted facilities. Fuel is subtracted from statewide total, rest allocated to counties)
- Emissions in each ICI sector are estimated by multiplying the county-level nonpoint source fuel consumption by the emission factors

Residential heating

SCC	Description	SCC	Description
2104001000	Residential Heating: Anthracite Coal	2104008310	Res. Heating: freestanding WS non certified
2104002000	Residential Heating: Bituminous Coal	2104008320	Res. Heating: freestanding WS EPA cert. non-cat
2104004000	Residential Heating: Distillate Oil	2104008330	Res. Heating: freestanding WS EPA certified cat
2104008100	Residential Heating: Fireplaces (cordwood)	2104008400	Residential Heating: Wood pellet stoves
2104008210	Residential Heating: Inserts non-EPA certified	2104008510	Residential Heating: Wood furnace indoor
2104008220	Residential Heating: Inserts EPA certified non-cat	2104008610	Residential Heating: Wood Hydronic heater: outdoor
2104008230	Residential Heating: Inserts EPA certified cat	2104008700	Res. Heating: Outdoor woodburning device, NEC
		2104011000	Residential Heating: Kerosene

- MPCA estimates emissions for wood burning categories
 - MPCA/DNR/US FS administer a survey in the state (every 3 years) to determine how much wood is burned in the state
- EPA completes emissions for other fuels
- Emissions are estimated by multiplying the county-level nonpoint source fuel consumption by the emission factors

Railroad

- 2285002008 - Mobile Sources/Railroad Equipment/Diesel/Line Haul Locomotives: Passenger Trains and (Amtrak) and 2285002009 - Mobile Sources/Railroad Equipment/Diesel/Line Haul Locomotives: Commuter Lines
- Category completed by EPA/ERTAC (Easter Regional Technical Advisory Committee)
- ERTAC used confidential line-haul activity data from the Federal Railroad Administration (FRA) for 2016.
- ERTAC provided county-level emissions summaries to EPA.
- Rail yard emissions were calculated based on supply fuel use and/or yard switcher counts provided by rail companies.

Thank you!

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