# 2014 ESTIMATES OF ANTHROPOGENIC MERCURY AIR EMISSIONS IN MICHIGAN


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## Executive Summary

This report is a compilation of estimates from the 2014 triennial inventory of anthropogenic mercury emissions prepared by the Michigan Department of Environment, Great Lakes, and Energy (EGLE), formerly the Michigan Department of Environmental Quality (MDEQ), Air Quality Division (AQD).

The estimates for many traditional sources, referred to as point sources, were obtained from the Michigan Air Emissions Reporting System (MAERS). Estimated emissions are reported annually to MAERS by approximately 1,700 facilities and are subject to limited quality assurance efforts by EGLE to identify, verify, and correct outlier data. Values were also obtained from United States Environmental Protection Agency's (USEPA) Toxics Release Inventory (TRI) and the 2014 National Emissions Inventory version 2 (NEI v2). Where facility-reported values were not available, the USEPA created estimates for the purposes of gap-filling for some sectors. In some instances, estimates have also been calculated by the AQD for the mercury inventory, through application of emission factors or stack test emission rates to facility-reported throughput data.

In addition to point source estimates of mercury, values are included for nonpoint sources. The nonpoint category includes small industrial, commercial, and institutional facilities, which are not large enough to trigger air emissions reporting requirements, but may collectively have significant emissions statewide. Mercury calculations were prepared by the AQD for the stationary nonpoint sector based on county employment, population data, and other inputs. Values for some categories and the mobile source sector were obtained from the 2014 NEI v2.

The triennial mercury inventory was prepared using the best available estimates at the time of the inventory's development. Due to the use of stack test-based calculations and emission factors obtained from published reports, the augmented inventory is considered more likely to represent the emissions from individual sources than values based on default emission factors. It should be noted that the enhanced estimates are not quality-assured by the facilities themselves.

There were several changes in calculation methodologies since the development of the 2011 anthropogenic mercury emissions report. This includes revisions to automobile shredding, human cremation, lamp breakage, and thermostats, based on availability of emission factors and methodologies prepared by a USEPA contractor for the nonpoint sector in the 2014 NEI v2.

Additionally, a range of values is presented for the estimated nonpoint mercury emissions from solid waste collection and processing (handling) and from burn barrels (open burning of household waste). Calculations originally developed based on a 2002 study have been used to estimate mercury emissions for these categories in Michigan's previous anthropogenic mercury inventories. However, between 2002 and 2014, there was a substantial decrease in the quantity of mercury within the solid and household waste stream. While the 2014 mercury report includes calculations made with the 2002 factor to present conservative values, the report also includes updated calculations scaled by the decline in mercury content for these sectors. This is to present values which may better reflect the mercury reductions achieved in the solid and household waste stream in Michigan by 2014.

This report, originally posted in July 2021, has been updated. It now adopts the 2014 NEI v2 stationary nonpoint calculations as the final values for those sectors in the mercury inventory. The original report included those estimates but used values from the USEPA Mercury Flow Diagram model as the final nonpoint numbers. While the Mercury Flow Diagram provides estimates of the emissions at different steps in the product recycling and waste streams, the 2014 NEI v2 calculations, which present total emissions, utilize the most current methodologies and emission factors, and are therefore considered the most defensible. Accordingly, the 2014 NEI v2 values have been accepted as the final values for inclusion in the statewide totals and Table 1. The Mercury Flow Diagram estimates are still presented within the report for comparison.

The category of secondary metals production (steel foundries) was revised to include an entry for Barber Steel Foundry Corporation. This facility was bankrupt and closed for several years but resumed operations in 2013. Additionally, a data entry error for nonpoint emissions from human cremation has been corrected.

The revised range of total 2014 anthropogenic mercury emissions for Michigan is 4,289 to 5,585 lbs, compared to 3,995 to 5,439 lbs. The majority of the increase is from the nonpoint categories of nonpoint auto shredding and human cremation.

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## Introduction

Table 1 presents the estimated values of mercury for different sectors and the statewide totals. For some categories more than one estimate was arrived at, based on different methodologies and information sources. In these instances, a range of values is presented.

Speciation profiles were applied to the mercury estimates to quantify different forms of the pollutant for each sector. These forms are particulate mercury or Hg(P), Reactive Gaseous Mercury or RGM, and elemental mercury or Hg(0).

Table 1. 2014 Estimates of Anthropogenic Mercury

| Emission Source | Hg (lbs/yr) in 2014 | 2014, low range | 2014, high range | Hg(p) | RGM | Hg(0) |
|---|---|---|---|---|---|---|
| **FUEL COMBUSTION** | | | | | | |
| COAL COMBUSTION | | | | | | |
| Electric Utilities | 1,832.87 | 1,832.87 | 1,832.87 | 296.70 | 535.92 | 1000.25 |
| Residential | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 |
| Industrial/Commercial | 214.54 | 214.54 | 214.54 | 42.91 | 64.36 | 107.27 |
| Nonpoint Industrial, Institutional/Commercial | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 |
| OIL COMBUSTION | | | | 0.00 | 0.00 | 0.00 |
| Electric Utilities, Boilers | 3.84 | 3.84 | 3.84 | 0.77 | 1.15 | 1.92 |
| Electric Utilities, ICE | 0.16 | 0.16 | 0.16 | 0.03 | 0.05 | 0.08 |
| Residential | 12.13 | 12.13 | 12.13 | 2.43 | 3.64 | 6.07 |
| Industrial/Commercial Boilers | 0.41 | 0.41 | 0.41 | 0.08 | 0.12 | 0.21 |
| Industrial/Commercial, ICE | 0.16 | 0.16 | 0.16 | 0.03 | 0.05 | 0.08 |
| Nonpoint Industrial, Institutional/Commercial | 9.66 | 9.66 | 9.66 | 1.93 | 2.90 | 4.83 |
| NATURAL GAS COMBUSTION | | | | | | |
| Electric Utilities | 7.76E-06 | 7.76E-06 | 7.76E-06 | 0.00 | 0.00 | 0.00 |
| Residential | 2.84E-04 | 2.84E-04 | 2.84E-04 | 0.00 | 0.00 | 0.00 |
| Industrial/Commercial Boilers | 5.52E-05 | 5.52E-05 | 5.52E-05 | 0.00 | 0.00 | 0.00 |
| Stationary Internal Combustion Engines | 9.88E-06 | 9.88E-06 | 9.88E-06 | 0.00 | 0.00 | 0.00 |
| WOOD COMBUSTION | | | | 0.00 | 0.00 | 0.00 |
| Electric Utilities | 38.01 | 38.01 | 38.01 | 7.60 | 11.40 | 19.01 |
| Residential | 7.20 | 7.20 | 7.20 | 1.44 | 2.16 | 3.60 |
| Industrial/Commercial | 37.19 | 37.19 | 37.19 | 7.44 | 11.16 | 18.60 |
| Refuse-derived fuel | 301.37 | 301.37 | 301.37 | 60.27 | 90.41 | 150.69 |
| PETROLEUM REFINING | 34.22 | 34.22 | 34.22 | 6.84 | 10.27 | 17.11 |
| RESIDENTIAL LPG PROPANE COMBUSTION | 5.19 | 5.19 | 5.19 | 1.04 | 1.56 | 2.60 |
| **TOTAL FUEL COMBUSTION** | **2496.95** | **2496.95** | **2496.95** | 429.51 | 735.15 | 1332.29 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **INCINERATION** | | | | | | |
| Sewage Sludge Incineration | 139.55 | 139.55 | 139.55 | 27.91 | 80.94 | 30.70 |
| Municipal Waste | 17.44 | 17.44 | 17.44 | 3.49 | 10.12 | 3.84 |
| Hazardous Waste Incineration | 0.53 - 1.39 | 0.53 | 1.39 | 0.11 - 0.28 | 0.31 - 0.81 | 0.12 - 0.31 |
| Hospital Medical Infectious Waste Incineration | NA | NA | NA | NA | NA | NA |
| Human Cremation (point source) | 0.69 | 0.69 | 0.69 | 0.14 | 0.52 | 0.03 |
| Animal Cremation (point source) | 0.66 | 0.66 | 0.66 | 0.13 | 0.50 | 0.03 |
| Pathological Waste Incineration | 0.09 | 0.09 | 0.09 | 0.02 | 0.07 | 0.00 |
| **INCINERATION TOTALS** | 158.96 - 159.82 | 158.96 | 159.82 | 31.69 - 31.79 | 92.13 - 92.44 | 34.61 - 34.73 |
| | | | | | | |
| **INDUSTRIAL SOURCES** | | | | | | |
| Cement Manufacturing | 118.28 | 118.28 | 118.28 | 1.54 | 99.07 | 17.70 |
| Taconite processing | 37.95 | 37.95 | 37.95 | 3.80 | 3.80 | 30.36 |
| Lime Manufacturing | 23.86 | 23.86 | 23.86 | 2.39 | 2.39 | 19.09 |
| Dental Amalgam Manufacturing | 4 | 4 | 4 | 0.00 | 0.00 | 4.00 |
| Brick Manufacturing | 0.68 | 0.68 | 0.68 | 0.07 | 0.07 | 0.54 |
| Coke Production | 52.56 | 52.56 | 52.56 | 5.26 | 5.26 | 42.05 |
| Thermometer Manufacturing | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 |
| Medical Waste Autoclave | NA | NA | NA | NA | NA | NA |
| Auto Switches-shredding of autos (point source) | 18.61 | 18.61 | 18.61 | 1.86 | 1.86 | 14.89 |
| Relay/Switch Manufacturing | 83.4 | 83.4 | 83.4 | 0.00 | 0.00 | 83.40 |
| PRODUCTION OF METALS | | | | | | |
| Primary metal production (Blast/BOF Steel Manufacturing) | 137.20 | 137.20 | 137.20 | 13.72 | 13.72 | 109.76 |
| EAFs in primary metal production (Steel Manufacturing) | 155.96 | 155.96 | 155.96 | 15.60 | 15.60 | 124.77 |
| EAFs & EIFs in secondary metal production (Steel Foundries) | 16.95 | 16.95 | 16.95 | 1.70 | 1.70 | 13.56 |
| Secondary metal production (Grey Iron), excluding EAFs | 43.58 - 59.86 | 43.58 | 59.86 | 0.36 - 5.99 | 0.36 - 5.99 | 2.86 - 47.89 |
| EAFs & EIFs in Secondary metal production (Grey Iron) | 23.83 - 88.92 | 23.83 | 88.92 | 0.38 - 8.89 | 0.38 - 8.89 | 3.06 - 71.14 |
| **INDUSTRIAL SOURCE TOTALS** | **716.86 - 798.23** | **716.86** | **798.23** | 52.66 - 60.80 | 150.19 - 158.33 | 514.04 - 579.14 |

| **AREA SOURCES** | | | | | | |
|---|---|---|---|---|---|---|
| MERCURY-CONTAINING PRODUCTS | | | | | | |
| Dental Amalgam | 122.72 | 122.72 | 122.72 | 0.00 | 0.00 | 122.72 |
| Auto Switches-shredding of autos (area source) | 161.99 | 161.99 | 161.99 | 16.20 | 16.20 | 129.59 |
| Switches and Relays | 61.53 | 61.53 | 61.53 | 0.00 | 0.00 | 61.53 |
| Measurement and Control Devices | 25.60 | 25.60 | 25.60 | 0.00 | 0.00 | 25.60 |
| Consumer Use of Bulk Mercury | 10.41 | 10.41 | 10.41 | 0.00 | 0.00 | 10.41 |
| Thermostats | 7.42 | 7.42 | 7.42 | 0.00 | 0.00 | 7.42 |
| Fluorescent and Non-Fluorescent Lamp Breakage | 54.65 | 54.65 | 54.65 | 0.00 | 0.00 | 54.65 |
| Drum-top Crushing | 0.12 - 0.24 | 0.12 | 0.24 | 0.00 | 0.00 | 0.12 - 0.14 |
| Thermometers | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 |
| Laboratory Activities | 24.59 | 24.59 | 24.59 | 0.00 | 0.00 | 24.59 |
| WASTE DISPOSAL | | | | | | |
| Volatilization during solid waste collection & processing | 149.56 - 507.27 | 149.56 | 507.27 | 14.96 - 50.73 | 14.96 - 15.73 | 119.65 - 405.82 |
| *Fluorescent and Non-Fluorescent Lamps* | *0.02* | *0.02* | *0.02* | ***0.00*** | ***0.00*** | ***0.02*** |
| *Switches and Relays* | *14.44* | *14.44* | *14.44* | ***0.00*** | ***0.00*** | ***14.44*** |
| *Measurement and Control Devices* | *0.35* | *0.35* | *0.35* | ***0.00*** | ***0.00*** | ***0.35*** |
| *Thermometers* | *0* | *0* | *0* | ***0.00*** | ***0.00*** | ***0.00*** |
| *Bulk Mercury* | *3.90* | *3.90* | *3.90* | ***0.00*** | ***0.00*** | ***3.90*** |
| *Dental Amalgam* | *0.29* | *0.29* | *0.29* | ***0.00*** | ***0.00*** | ***0.29*** |
| Landfill volatilization | 62.66 | 62.66 | 62.66 | 6.27 | 6.27 | 50.13 |
| *Switches and Relays* | *6.68* | *6.68* | *6.68* | *0.00* | *0.00* | *6.68* |
| *Measurement and Control Devices* | *0.18* | *0.18* | *0.18* | *0.00* | *0.00* | *0.18* |
| *Thermostats* | *7.03* | *7.03* | *7.03* | *0.00* | *0.00* | *7.03* |
| *Dental Amalgam* | *1.79* | *1.79* | *1.79* | *0.00* | *0.00* | *1.79* |
| *Thermometers* | *0* | *0* | *0* | *0.00* | *0.00* | *0.00* |
| Disposal of products in burn barrels | 38.27 - 860.13 | 38.27 | 860.13 | 7.65 - 172.03 | 11.48 - 258.04 | 19.14 - 430.05 |
| *Switches and Relays* | *28.70* | *28.70* | *28.70* | *0.00* | *0.00* | *28.70* |
| *Measurement and Control Devices* | *0.71* | *0.71* | *0.71* | *0.00* | *0.00* | *0.71* |
| *Thermometers* | *0* | *0* | *0* | *0.00* | *0.00* | *0.00* |
| RECYCLING | | | | | | |
| Volatilization during collection for recycling | | | | | | |
| *Switches and Relays* | *19.25* | *19.25* | *19.25* | *0.00* | *0.00* | *19.25* |
| *Measurement and Control Devices* | *0.20* | *0.20* | *0.20* | *0.00* | *0.00* | *0.20* |
| Release during recycling | | | | | | |
| *Switches and Relays* | *18.85* | *18.85* | *18.85* | *0.00* | *0.00* | *18.85* |
| *Measurement and Control Devices* | *0.18* | *0.18* | *0.18* | *0.00* | *0.00* | *0.18* |

| | | | | | | |
|---|---|---|---|---|---|---|
| OTHER | | | | | | |
| Cremation | 139.98 | 139.98 | 139.98 | 28.00 | 81.19 | 30.80 |
| Disposal of Bulk Hg to Clean Sweep Sites | 3.90 | 3.90 | 3.90 | 0.00 | 0.00 | 3.90 |
| Volatilization: land application of sludge | 2.5 | 2.5 | 2.5 | 0.25 | 0.25 | 2.00 |
| Contaminated Site Remediation | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 |
| **AREA SOURCE TOTALS** | 904 - 2084 | 904.38 | 2084.07 | 52.32 - 253.46 | 72.34 - 354.67 | 678.72 - 1375.94 |
| | | | | | | |
| **MOBILE SOURCES** | | | | | | |
| On Road | 0.18 - 23.82 | 0.18 | 23.82 | 0.0 - 0.10 | 0.02 - 2.05 | 0.16 - 21.68 |
| Non-Road Rail and Commercial Marine | 9.02 | 9.02 | 9.02 | 1.35 | 2.62 | 5.05 |
| Non-Road Coal-fired Car Ferry | 0.24 - 10.80 | 0.24 | 10.80 | 0.03 - 1.45 | 0.01 - 0.39 | 0.02 - 0.75 |
| Nonroad Equipment and Vehicles - diesel | 0.23 | 0.23 | 0.23 | 0.03 | 0.07 | 0.13 |
| Nonroad Equipment and Vehicles - gasoline | 1.68 | 1.68 | 1.68 | 0.01 | 0.14 | 1.53 |
| Nonroad Equipment and Vehicles - other fuel types | 0.39 | 0.39 | 0.39 | NA | NA | NA |
| **MOBILE SOURCE TOTALS** | 11.42 - 45.33 | 11.74 | 45.94 | 1.43 - 3.11 | 2.91 - 8.01 | 7.01 - 34.43 |
| | | | | | | |
| **TOTAL Hg AIR EMISSIONS** | 4289 - 5585 | 4288.89 | 5585.01 | 589 - 799 | 1111 - 1407 | 2589 - 3379 |

## Fuel Combustion

### *Coal Combustion*

*Electric Utilities*

The estimated mercury released from coal-fired electric utilities was extracted from the USEPA's 2014 NEI v2. The point source mercury estimates from the NEI v2 were predominantly from the Michigan Air Emissions Reporting System (MAERS) 2014 emissions inventory data. Where the electric utilities did not report mercury to MAERS, the NEI v2 was gap filled with a dataset the USEPA created. This dataset, 2014EPA_EGU, utilized unit specific and "bin" average emission factors collected in support of the Mercury and Air Toxics Standards (MATS) rule. The emission factors were applied against 2014 heat input data from USEPA's Clean Air Markets Division Data.

Several of the 2014 NEI v2 values are based on the MAERS default emission estimates for mercury in cases where a facility did not report a mercury value. For the 2014 AQD mercury report, staff of the AQD's Emissions Reporting and Assessment Unit (ERAU) created an alternate estimate by applying appropriate "bin" emission factors from the MATS rule to facility throughput values and heat input data from MAERS. The following table shows where those values were utilized for this report.

Table 2. Electric Utilities, Coal Combustion

| SRN | Facility Name | Emission Unit ID | SCC* | Estimated mercury emissions from 2014 NEI v2 (in lbs) | MATS emission factor-based estimate in place of MAERS default estimate | Final value for 2014 AQD mercury report (in lbs) |
|---|---|---|---|---|---|---|
| B1573 | Escanaba Power Plant | RG0001 | 10100205 | 6.69 | | 6.69 |
| B1833 | Marquette Board of Light & Power | EU0003 | 10100226 | 82.46 | 16.64 | 16.64 |
| B1833 | Marquette Board of Light & Power | EU0012 | 10100204 | 1.67 | 0.00 | 0.00 |
| B1966 | White Pine Electric Power LLC | EU0082 | 10200204 | 0.00 | 0.00 | 0.00 |
| B1966 | White Pine Electric Power LLC | EU0083 | 10200202 | 0.42 | 0.08 | 0.08 |
| B1966 | White Pine Electric Power LLC | EU0084 | 10200202 | 0.00 | 0.00 | 0.00 |
| B1976 | J.B. Sims Generating Station | EU0023 | 10100202 | 47.09 | 3.66 | 3.66 |
| B2132 | Wyandotte Department of Municipal Power Plant | EU0037 | 10100218 | 1.57 | 0.02 | 0.02 |
| B2132 | Wyandotte Department of Municipal Power Plant | EU0037 | 10100238 | 0.00 | 0.00 | 0.00 |
| B2357 | Holland BPW, Generating Station & WWTP | EU0012 | 10100202 | 0.03 | | 0.03 |
| B2357 | Holland BPW, Generating Station & WWTP | EU0013 | 10100202 | 2.63 | 0.74 | 0.74 |
| B2357 | Holland BPW, Generating Station & WWTP | EU0014 | 10100202 | 0.33 | | 0.33 |
| B2647 | LBWL, Eckert, Moores Park & REO Cogeneration | RG0022 | 10100222 | 4.04 | 3.95 | 3.95 |
| B2647 | LBWL, Eckert, Moores Park & REO Cogeneration | RG0023 | 10100222 | 21.66 | 17.83 | 17.83 |
| B2796 | St. Clair / Belle River Power Plant | EU0105 | 10100222 | 26.70 | | 26.70 |
| B2796 | St. Clair / Belle River Power Plant | EU0106 | 10100222 | 22.70 | | 22.70 |
| B2796 | St. Clair / Belle River Power Plant | EU0107 | 10100222 | 18.50 | | 18.50 |
| B2796 | St. Clair / Belle River Power Plant | EU0108 | 10100222 | 23.60 | | 23.60 |
| B2796 | St. Clair / Belle River Power Plant | EU0110 | 10100226 | 111.00 | | 111.00 |
| B2796 | St. Clair / Belle River Power Plant | EU0111 | 10100226 | 132.90 | | 132.90 |
| B2796 | St. Clair / Belle River Power Plant | EU0119 | 10100222 | 148.00 | | 148.00 |
| B2796 | St. Clair / Belle River Power Plant | EU0120 | 10100222 | 155.00 | | 155.00 |
| B2810 | DTE - Electric Company River Rouge | EU0039 | 10100222 | 44.90 | | 44.90 |
| B2810 | DTE - Electric Company River Rouge | EU0040 | 10100226 | 67.80 | | 67.80 |
| B2811 | DTE - Electric Company Trenton Channel | EU0035 | 10100222 | 70.00 | | 70.00 |
| B2811 | DTE - Electric Company Trenton Channel | RG0053 | 10100222 | 32.00 | | 32.00 |
| B2815 | DTE - Electric Company Harbor Beach Power Plant | EU0009 | 10100202 | 0.00 | 0.00 | 0.00 |
| B2816 | DTE Electric Company - Monroe Power Plant | EU0062 | 10100222 | 29.00 | | 29.00 |
| B2816 | DTE Electric Company - Monroe Power Plant | EU0063 | 10100222 | 30.00 | | 30.00 |
| B2816 | DTE Electric Company - Monroe Power Plant | EU0064 | 10100222 | 20.00 | | 20.00 |
| B2816 | DTE Electric Company - Monroe Power Plant | EU0068 | 10100222 | 64.00 | | 64.00 |
| B2835 | J. H. Campbell Plant | EU0059 | 10100222 | 79.00 | | 79.00 |
| B2835 | J. H. Campbell Plant | EU0061 | 10100202 | 119.60 | | 119.60 |
| B2835 | J. H. Campbell Plant | EU0062 | 10100222 | 209.50 | | 209.50 |

| | | | | | | |
|---|---|---|---|---|---|---|
| B2836 | B. C. Cobb Plant | RG0028 | 10100212 | 62.40 | | 62.40 |
| B2840 | Consumers Energy Karn-Weadock Facility | RG0058 | 10100212 | 49.30 | | 49.30 |
| B2840 | Consumers Energy Karn-Weadock Facility | RG0060 | 10100212 | 77.60 | | 77.60 |
| B2846 | J.R. Whiting Co. | EU0019 | 10100202 | 31.30 | | 31.30 |
| B2846 | J.R. Whiting Co. | EU0020 | 10100202 | 34.20 | | 34.20 |
| B2846 | J.R. Whiting Co. | EU0021 | 10100202 | 48.10 | | 48.10 |
| B4001 | LBWL, Erickson Station | EU0007 | 10100222 | 30.44 | 24.24 | 24.24 |
| B4261 | Wisconsin Electric Power Company | EU0032 | 10100202 | 0.16 | 0.17 | 0.17 |
| B4261 | Wisconsin Electric Power Company | EU0033 | 10100202 | 0.16 | 0.15 | 0.15 |
| B4261 | Wisconsin Electric Power Company | EU0034 | 10100222 | 13.72 | 13.68 | 13.68 |
| B4261 | Wisconsin Electric Power Company | EU0035 | 10100222 | 17.42 | 16.49 | 16.49 |
| B4261 | Wisconsin Electric Power Company | EU0036 | 10100222 | 18.23 | 16.59 | 16.59 |
| B6611 | Michigan South Central Power Agency | EU0003 | 10100202 | 54.84 | 3.90 | 3.90 |
| N1685 | TES Filer City Station | RG0017 | 10100204 | 0.78 | 0.56 | 0.56 |
| N7786 | DTE Pontiac North, LLC | EU0011 | 10100204 | 0.00 | 0 | 0.00 |
| TOTALS | | | | 2011.45 | | 1832.87 |

*SCC = Source Classification Codes

*Residential*

Residential fuel combustion estimates were generated as part of EGLE's submittal to the USEPA's 2014 NEI v2. For residential coal combustion, an emission factor of 0.00042 lbs/ton was used, along with 2014 statewide fuel consumption data from the Energy Information Administration (EIA) of the United States Department of Energy (USDoE). As zero tons of residential coal consumption were reported, mercury emissions are assumed to be zero (EGLE, 2020).

Table 3. Residential Coal Combustion

| Category | Throughput tons | Emission Factor | Lbs Emitted |
|---|---|---|---|
| Residential Coal Combustion | 0.00 | 4.20E-04 | 0.00 |

*Industrial/Commercial*

Point source estimates, such as those for industrial and commercial combustion of coal, were collected from MAERS. These point source estimates were generated as part of Michigan's submittal to the USEPA's 2014 NEI v2 (EGLE, 2020).

The following industrial and commercial sources of coal combustion were included in the estimate:

Table 4. Industrial/Commercial Coal Combustion

| SRN | Facility Name | SCC | Coal in Tons | Emission Factor in Lb/Ton | Estimated Emissions in Lbs |
|---|---|---|---|---|---|
| A0884 | Escanaba Paper Company | 10200212 | 108438 | 4.16E-04 | 45.11 |
| A6175 | Nexteer Automotive Corporation | 10200204 | 10500.00 | 4.16E-04 | 4.37 |
| A6240 | Cargill Salt - St. Clair | 10100204 | 23576.10 | 4.16E-04 | 9.81 |
| A6380 | Abbott Nutrition | 10200205 | 0.00 | 4.16E-04 | 0.00 |
| A6475 | MPI Acquisition, LLC | 10200204 | 51038.00 | 4.16E-04 | 21.23 |
| B1470 | Neenah Paper - Michigan Inc | 10200204 | 47866.00 | 4.16E-04 | 19.91 |
| B1563 | Great Lakes Tissue | 10200205 | 0.00 | 4.16E-04 | 0.00 |
| B1824 | Morton Salt, Inc. | 10100205 | 49247.00 | NA | 20.49 |
| B2873 | Michigan Sugar Company - Sebewaing Factory | 10100204 | 25485.00 | 4.16E-04 | 10.60 |
| B2875 | Michigan Sugar Company, Caro Factory | 10100204 | 5977.00 | 4.16E-04 | 2.49 |
| B2876 | Michigan Sugar Company, Croswell Factory | 10100204 | 18155.00 | 4.16E-04 | 7.55 |
| B3610 | Pharmacia & Upjohn Co LLC, a Subsidiary of Pfizer | 10200204 | 38414.01 | 4.16E-04 | 15.98 |
| B3692 | Packaging Corporation of America - Filer City Mill | 10100202 | 517.70 | 4.16E-04 | 0.22 |
| B6420 | E.B. Eddy Paper Inc. | 10200202 | 53338.00 | 4.16E-04 | 22.19 |
| B7192 | Verso Quinnesec, LLC | 10200204 | 808.00 | 4.16E-04 | 0.34 |
| B7227 | General Motors LLC - Orion Assembly | 10200204 | 0.00 | 4.16E-04 | 0.00 |
| K3249 | Michigan State University | 10300206 | 15540.90 | 4.16E-04 | 6.47 |
| K3249 | Michigan State University | 10300218 | 52763.20 | 4.16E-04 | 21.95 |
| N0677 | Steelcase Inc.- Kentwood Complex | 10100204 | 14035.80 | 4.16E-04 | 5.84 |
| TOTAL | | | | | 214.54 |

*Nonpoint Coal Combustion, Industrial and Commercial-Institutional*

Within the 2014 NEI v2, the USEPA estimated zero lbs of mercury emissions from nonpoint industrial and commercial-institutional sources that burned coal.

Table 5. Nonpoint Combustion of Coal from Industrial and Commercial-institutional Sources

| Data Source | Mercury emissions in lbs | Nonpoint Sector |
|---|---|---|
| 2014 NEI v2 | 0.00 | Fuel Comb - Industrial Boilers, ICEs - Coal |
| 2014 NEI v2 | 0.00 | Fuel Comb - Comm/Institutional - Coal |
| Total | 0.00 | |

### *Oil Combustion*

*Electric Utilities, External Combustion Boilers*

Mercury emissions from oil-fired electric utilities were estimated using data from MAERS as part of Michigan's submittal to the USEPA's 2014 NEI v2 (EGLE, 2020). The oil combustion, or throughput, is expressed in thousands of gallons (E3GAL). The following sources were included in the estimate for oil-fired boilers:

Table 6. Electric Utilities, External Combustion Boilers

| SRN | Facility Name | SCC | Factor in LB/E3GAL | Oil in E3GAL | Estimated Emissions in Lbs |
|---|---|---|---|---|---|
| B1833 | Marquette Board Of Light & Power | 10100501 | 4.20E-04 | 11.40 | 0.00 |
| B2647 | LBWL, Eckert, Moores Park & REO Cogeneration | 10100501 | 4.20E-04 | 128.32 | 0.05 |
| B2796 | St. Clair / Belle River Power Plant | 10100401 | 1.13E-04 | 0.00 | 0.00 |
| B2796 | St. Clair / Belle River Power Plant | 10100501 | 4.20E-04 | 2184.89 | 0.92 |
| B2796 | St. Clair / Belle River Power Plant | 10200501 | 4.20E-04 | 7.33 | 0.00 |
| B2811 | DTE - Electric Company Trenton Channel | 10100501 | 4.20E-04 | 1701.03 | 0.71 |
| B2815 | DTE - Electric Company Harbor Beach Power Plant | 10100501 | 4.20E-04 | 0.00 | 0.00 |
| B2815 | DTE - Electric Company Harbor Beach Power Plant | 10200501 | 4.20E-04 | 0.00 | 0.00 |
| B2816 | DTE Electric Company - Monroe Power Plant | 10100501 | 4.20E-04 | 1441.54 | 0.61 |
| B2816 | DTE Electric Company - Monroe Power Plant | 10200501 | 4.20E-04 | 456.33 | 0.19 |
| B2835 | J.H. Campbell Plant | 10100501 | 4.20E-04 | 1214.70 | 0.29 |
| B2840 | Consumers Energy Karn-Weadock Facility | 10100401 | 1.13E-04 | 524.80 | 0.06 |
| B2840 | Consumers Energy Karn-Weadock Facility | 10100501 | 4.20E-04 | 1169.80 | 0.49 |
| B2846 | J.R. Whiting Co. | 10100501 | 4.20E-04 | 439.82 | 0.18 |
| B2846 | J.R. Whiting Co. | 10200501 | 4.20E-04 | 9.66 | 0.00 |
| B2934 | Palisades Nuclear Plant | 10200501 | 4.20E-04 | 86.45 | 0.04 |
| B4001 | LBWL, Erickson Station | 10100501 | 4.20E-04 | 93.31 | 0.04 |
| B4252 | AEP Cook Nuclear Plant | 10100501 | 4.20E-04 | 17.44 | 0.01 |
| B4252 | AEP Cook Nuclear Plant | 10200501 | 4.20E-04 | 0.00 | 0.00 |
| B4261 | Wisconsin Electric Power Company | 10100501 | 4.20E-04 | 500.00 | 0.21 |
| B6145 | DTE - Electric Company Greenwood Energy Center | 10100401 | 1.13E-04 | 7.05 | 0.00 |
| B6145 | DTE - Electric Company Greenwood Energy Center | 10100501 | 4.20E-04 | 60.40 | 0.03 |
| B6145 | DTE - Electric Company Greenwood Energy Center | 10200401 | 1.13E-04 | 0.00 | 0.00 |
| B6145 | DTE - Electric Company Greenwood Energy Center | 10200501 | 4.20E-04 | 0.00 | 0.00 |
| B6611 | Michigan South Central Power Agency | 10100501 | 4.20E-04 | 5.28 | 0.00 |
| TOTAL | | | | | 3.84 |

*Electric Utilities, Stationary Internal Combustion Engines*

Oil-fired, stationary internal combustion engines were separated from oil-fired, external combustion boilers in the report to provide greater clarity. Throughput and emissions from facilities with electric-generating units (EGU) are presented below for 2014, based on data from MAERS and standard USEPA emission factors. Mercury in the amount of 0.16 lbs was estimated for this sector.

Table 7. Electric Utilities, Stationary Internal Combustion Engines

| SRN | Facility Name | SCC | Emission Factor in Lb/E3 GAL | Diesel Fuel in E3 GAL | Estimated Emissions in Lbs |
|---|---|---|---|---|---|
| B1573 | Escanaba Power Plant | 20100101 | 1.644E-04 | 163.81 | 0.03 |
| B2185 | Detroit Public Lighting Department | 20100101 | 1.644E-04 | 0.00 | 0.00 |
| B2806 | DTE - Electric Company Superior | 20100101 | 1.644E-04 | 0.04 | 0.00 |
| B2808 | DTE - Electric Company Northeast Station | 20100101 | 1.644E-04 | 82.18 | 0.01 |
| B2835 | J.H. Campbell Plant | 20100101 | 1.644E-04 | 0.64 | 0.00 |
| B2846 | J.R. Whiting Co. | 20100101 | 1.644E-04 | 0.00 | 0.00 |
| B4321 | The DTE Electric Company - Fermi Energy Center | 20100101 | 1.644E-04 | 613.36 | 0.10 |
| B6553 | UPPCO Portage Station | 20100101 | 1.644E-04 | 54.85 | 0.01 |
| N2586 | Holland BPW, 48Th Street Peaking Station | 20100101 | 1.644E-04 | 16.90 | 0.00 |
| N6000 | Holland Board of Public Works | 20100101 | 1.644E-04 | 10.46 | 0.00 |
| N6171 | Wolverine Power, Tower Power Plant | 20100101 | 1.644E-04 | 54.70 | 0.01 |
| N6249 | Wolverine Power, Vestaburg Power Plant | 20100101 | 1.644E-04 | 0.00 | 0.00 |
| TOTAL | | | | | 0.16 |

*Residential*

For estimating mercury emitted by residential oil combustion, an emission factor of 0.00042 lbs/1,000 gallons was used along with 2014 statewide fuel consumption data from the EIA, USDoE to generate estimated emissions of mercury (EGLE, 2020).

Table 8. Residential Oil Combustion

| Category | Throughput E3GAL | Emission Factor | Lbs Emitted |
|---|---|---|---|
| Residential Oil Combustion | 28,869.00 | 4.200E-04 | 12.13 |

*Industrial/Commercial (External Combustion Boilers)*

Point source estimates such as those for industrial and commercial combustion of oil were collected from MAERS (EGLE, 2020). These point source estimates were generated as part of Michigan's submittal to USEPA's 2014 NEI v2. The following industrial and commercial oil-fired, external combustion boilers were included in the estimate.

Table 9. Industrial/Commercial (External Combustion Boilers)

| SRN | Facility Name | SCC | Oil in E3 GAL | Emission Factor in Lb/E3 GAL | Estimated Emissions in Lbs |
|---|---|---|---|---|---|
| A0023 | Otsego Paper Inc. | 10200501 | 0 | 4.20E-04 | 0.0000 |
| A0884 | Escanaba Paper Company | 10200401 | 496.847 | 1.13E0-04 | 0.0562 |
| A2402 | Access Business Group, LLC | 10100501 | 3.95 | 4.20E-04 | 0.0017 |
| A2402 | Access Business Group, LLC | 10200501 | 0.396 | 4.20E-04 | 0.0002 |
| A2849 | Wacker Chemical Corp | 10200501 | 0 | 4.20E-04 | 0.0000 |
| A5858 | Mead Johnson & Company, LLC | 10200501 | 0 | 4.20E-04 | 0.0000 |
| A6218 | Dunn Paper, Inc. | 10200401 | 0 | 1.13E0-04 | 0.0000 |
| A6218 | Dunn Paper, Inc. | 10200501 | 0 | 4.20E-04 | 0.0000 |
| A6240 | Cargill Salt - St. Clair | 10200501 | 0 | 4.20E-04 | 0.0000 |
| A6475 | MPI Acquisition, LLC | 10200501 | 0 | 4.20E-04 | 0.0000 |
| B1470 | Neenah Paper - Michigan Inc. | 10200501 | 0.087 | 4.20E-04 | 0.0000 |
| B1479 | Certainteed Ceilings Corporation | 10200501 | 0 | 4.20E-04 | 0.0000 |
| B1534 | Graphic Packaging International, Inc. | 10200401 | 0 | 1.13E0-04 | 0.0000 |
| B1606 | General Motors LLC Flint Assembly | 10200501 | 0.059 | 4.20E-04 | 0.0000 |
| B1678 | Graphic Packaging International, Inc. | 10200401 | 0 | 1.13E0-04 | 0.0000 |
| B1678 | Graphic Packaging International, Inc. | 10200501 | 0 | 4.20E-04 | 0.0000 |
| B1798 | General Motors LLC- Warren Transmission Plant | 10200401 | 0 | 1.13E0-04 | 0.0000 |
| B1827 | Empire Iron Mining Partnership | 10200501 | 0 | 4.20E-04 | 0.0000 |
| B2024 | White Pigeon Paper Company | 10200401 | 0 | 1.13E0-04 | 0.0000 |
| B2024 | White Pigeon Paper Company | 10200501 | 0 | 4.20E-04 | 0.0000 |
| B2052 | Racer Trust - Willow Run Plant Industrial Land | 10200501 | 0 | 4.20E-04 | 0.0000 |
| B2064 | Ford Motor Co./Rawsonville Plant | 10200501 | 0 | 4.20E-04 | 0.0000 |
| B2814 | Detroit Thermal Beacon Heating Plant | 10300501 | 0 | 4.20E-04 | 0.0000 |
| B3610 | Pharmacia & Upjohn Co LLC, A Subsidiary of Pfizer | 10200501 | 0 | 4.20E-04 | 0.0000 |
| B4049 | GM Technical Center | 10200401 | 0 | 1.13E0-04 | 0.0000 |
| B4072 | Rock-Tenn Co. | 10200401 | 3.15 | NA | 0.0004 |
| B6420 | E.B. Eddy Paper Inc. | 10200501 | 5.68 | 4.20E-04 | 0.0024 |
| D8065 | Dart Container Corporation of Michigan | 10300501 | 0.336 | 4.20E-04 | 0.0001 |
| E6807 | Spectrum Health Blodgett Campus | 10200503 | 0.019 | NA | 0.0000 |
| G5252 | Oakland Co. Service Center - Central Steam Plant | 10200401 | 10.6 | 1.13E0-04 | 0.0012 |
| H5877 | Eastern MI University | 10300501 | 12.946 | 4.20E-04 | 0.0054 |
| K1271 | Henry Ford Hospital | 10300501 | 0.652 | 4.20E-04 | 0.0003 |
| K1283 | Oakwood Southshore Medical Center | 10300501 | 0.02 | 4.20E-04 | 0.0000 |
| K2460 | Central Michigan University | 10300501 | 0.1 | 4.20E-04 | 0.0000 |
| K2688 | B.O.P. Federal Correctional Institute | 10300501 | 1.6 | 4.20E-04 | 0.0007 |
| M0675 | University of Michigan | 10300501 | 55.024 | 4.20E-04 | 0.0231 |
| M1954 | Covenant Health Care | 10300501 | 300 | 4.20E-04 | 0.1260 |
| M3431 | St Joseph Mercy Hospital | 10300501 | 7.8 | 4.20E-04 | 0.0033 |
| M3641 | University of Michigan Flint | 10200501 | 0 | 4.20E-04 | 0.0000 |
| M3653 | V A Medical Center | 10300501 | 4.5355 | 4.20E-04 | 0.0019 |
| M3792 | Northern Michigan University | 10300501 | 60.719 | 4.20E-04 | 0.0255 |
| M4148 | Detroit Renewable Power, LLC | 10100501 | 389.8 | 4.20E-04 | 0.1637 |
| N0780 | Louisiana-Pacific Corp Newberry Plant | 10200501 | 0.108 | 4.20E-04 | 0.0000 |
| N5930 | Delta College | 10100501 | 0 | 4.20E-04 | 0.0000 |
| N6016 | Genesys Regional Medical Center | 10300501 | 1.1 | 4.20E-04 | 0.0005 |
| TOTAL | | | | | 0.4126 |

*Stationary Internal Combustion Engines (Oil-Fired, Industrial / Commercial)*

Oil-fired, stationary internal combustion engines were separated from oil-fired, external combustion boilers in the report to provide greater clarity. Throughput and emissions from commercial/industrial facilities are presented below for 2014, based on data from MAERS and standard USEPA emission factors. Mercury in the amount of 0.059 lbs was estimated for this sector.

Table 10. Stationary Internal Combustion Engines (Oil-Fired, Industrial / Commercial)

| SRN | Facility Name | SCC | Diesel Fuel in E3 gal. | Emission Factor in Lb/E3 gal. | Est. Emissions (lbs) |
|---|---|---|---|---|---|
| A1641 | General Motors Lansing Grand River Assembly | 20200102 | 1.693 | 4.129E-05 | 0.00007 |
| A3567 | Ford Motor Company - Sterling Plant | 20200102 | 0.727 | 4.129E-05 | 0.00003 |
| A3569 | Axalta Coating Systems, LLC - Mt. Clemens Plant | 20200102 | 1.548 | 4.129E-05 | 0.00006 |
| A4043 | Dow Corning - Midland Plant | 20200102 | 0.982 | 4.129E-05 | 0.00004 |
| A5764 | Ventra Evart, LLC | 20200102 | 0.15 | 4.129E-05 | 0.00001 |
| A5858 | Mead Johnson & Company, LLC | 20200102 | 0.395 | 4.129E-05 | 0.00002 |
| A8638 | Detroit Diesel Corporation | 20200102 | 2.299 | 4.129E-05 | 0.00009 |
| A8640 | Ak Steel - Dearborn Works | 20200102 | 5.985 | 4.129E-05 | 0.00025 |
| A8645 | Ford Motor Co. - Livonia Transmission | 20200102 | 0.647 | 4.129E-05 | 0.00003 |
| A8648 | Ford Motor Co. Rouge Complex | 20200102 | 1.6471 | 4.129E-05 | 0.00007 |
| B1548 | Post Foods | 20200102 | 0.0422 | 4.129E-05 | 0.00000 |
| B1771 | Ford Motor Company - Van Dyke Plant | 20200102 | 1.492 | 4.129E-05 | 0.00006 |
| B1798 | General Motors LLC - Warren Transmission Plant | 20200102 | 0.49 | 4.129E-05 | 0.00002 |
| B1991 | GM LLC Saginaw Metal Casting Operations | 20200102 | 1.31 | 4.129E-05 | 0.00005 |
| B2063 | Faurecia Interior Systems Saline, LLC | 20200102 | 0.93265 | 4.129E-05 | 0.00004 |
| B2064 | Ford Motor Co. - Rawsonville Plant | 20200102 | 0.48 | 4.129E-05 | 0.00002 |
| B2209 | Eaton Corporation - Galesburg Campus | 20200102 | 121.5 | 4.129E-05 | 0.00502 |
| B2869 | Ford Motor Company - Romeo Engine Plant | 20200102 | 0.5231 | 4.129E-05 | 0.00002 |
| B2956 | Ford Motor Co. New Model Program Center | 20200102 | | | 0.00000 |
| B3241 | Ford Motor Co. Brownstown | 20200102 | 0.0791 | 4.129E-05 | 0.00000 |
| B3350 | FCA Us LLC – Trenton Engine Complex | 20200102 | 0.175 | 4.129E-05 | 0.00001 |
| B3534 | Edw. C. Levy Co. Plant 2 Portable Crusher | 20200102 | 10.5 | 4.129E-05 | 0.00043 |
| B3610 | Pharmacia & Upjohn Co LLC, a Subsidiary of Pfizer | 20200102 | 2.67 | 4.129E-05 | 0.00011 |
| B4032 | General Motors LLC - Pontiac North Campus | 20200102 | 3.29 | 4.129E-05 | 0.00014 |
| B4058 | Rieth-Riley Construction Co., Inc. | 20200102 | 11.709 | 4.129E-05 | 0.00048 |
| B4072 | Rock-Tenn Co. | 20200102 | 0.183 | 4.129E-05 | 0.00000 |
| B4102 | U S Gypsum Co. | 20200102 | 12.08 | 4.129E-05 | 0.00050 |
| B4147 | Rieth-Riley Construction Co. Inc. | 20200102 | 7.3 | 4.129E-05 | 0.00030 |
| B4164 | Bolen Asphalt Paving, Inc. | 20200102 | 11.4 | 4.129E-05 | 0.00047 |
| B4288 | Zoetis P&U LLC | 20200102 | 0.20691 | 4.129E-05 | 0.00001 |
| B4383 | Kasson Sand And Gravel | 20200102 | 12.795 | 4.129E-05 | 0.00053 |

| | | | | | |
|---|---|---|---|---|---|
| B6177 | Wiegand's Crushing, Inc. | 20200102 | 23.28328 | 4.129E-05 | 0.00096 |
| B6230 | Ford Motor Co. Research & Dev Center | 20200102 | 2.07 | 4.129E-05 | 0.00009 |
| B6508 | Clinton Village Of | 20200102 | 0.493 | 4.129E-05 | 0.00002 |
| B7013 | Huron Casting Inc. & Blue Diamond Steel Casting | 20300102 | 0 | 1.668E-04 | 0.00000 |
| B7090 | Michigan Milk Producers Association | 20100101 | 3.19 | 1.644E-04 | 0.00052 |
| B7205 | Knauf Insulation, LLC | 20200102 | 4.658 | 4.129E-05 | 0.00019 |
| B7302 | Weyerhaeuser NR Company | 20200102 | 0.714 | 4.129E-05 | 0.00003 |
| D8065 | Dart Container Corporation of Michigan | 20200102 | 10.54 | 4.129E-05 | 0.00044 |
| F3254 | Selfridge Air National Guard Base | 20300102 | 2.48 | 1.644E-04 | 0.00041 |
| G7126 | Grand Valley State University | 20200102 | 0.963 | 4.129E-05 | 0.00004 |
| K2460 | Central Michigan University | 20200102 | 0.5 | 4.129E-05 | 0.00002 |
| M0675 | University of Michigan | 20200102 | 3.88 | 4.129E-05 | 0.00016 |
| M0675 | University of Michigan | 20200103 | 0 | 1.668E-04 | 0.00000 |
| M4174 | Detroit Metropolitan Wayne County Airport | 20100101 | 3.225 | 1.644E-04 | 0.00053 |
| M4175 | Ford Motor Co | 20200102 | 0.734 | 4.129E-05 | 0.00003 |
| M4199 | General Motors Hamtramck | 20200102 | 1.34 | 4.129E-05 | 0.00006 |
| M4731 | Ajax Paving Industries, Inc. | 20200102 | 0 | 4.129E-05 | 0.00000 |
| N0503 | Lyon Sand & Gravel Co - Rap Plant | 20200102 | 27.9 | 4.129E-05 | 0.00115 |
| N0677 | Steelcase Inc.- Kentwood Complex | 20100101 | 0.054 | 1.644E-04 | 0.00001 |
| N0929 | Ford Motor Company - Flat Rock Assembly | 20200102 | 1.3361 | 4.129E-05 | 0.00006 |
| N1192 | Denso Manufacturing Michigan, Inc. | 20200102 | 0.3072 | 4.129E-05 | 0.00001 |
| N1316 | Njt Enterprises, LLC (Formally Mayco Plastics) | 20200102 | 1.19 | 4.129E-05 | 0.00005 |
| N1357 | Rieth-Riley Construction Co Inc. | 20200102 | 0 | 4.129E-05 | 0.00000 |
| N1594 | Rieth-Riley Construction Co, Inc. | 20200102 | 2.368 | 4.129E-05 | 0.00010 |
| N1656 | Albrecht Sand and Gravel | 20200102 | 29.02 | 4.129E-05 | 0.00120 |
| N1905 | Bolen Asphalt Paving, Inc. | 20200102 | 9.52 | 4.129E-05 | 0.00039 |
| N1917 | Ajax Paving Industries, Inc. | 20200102 | 26 | 4.129E-05 | 0.00107 |
| N2155 | FCA US LLC - Jefferson North Assembly Plant | 20200102 | 0.836 | 4.129E-05 | 0.00002 |
| N2184 | Rieth-Riley Construction Co. Inc. | 20200102 | 39.146 | 4.129E-05 | 0.00162 |
| N2627 | Great Lakes Aggregates, Hazmag Plant | 20200102 | 39.624 | 4.129E-05 | 0.00164 |
| N3152 | American Aggregates of Michigan Eljay 54 | 20200102 | 0 | 4.129E-05 | 0.00000 |
| N3177 | Aggregate Industries - AC3 Portable Plant | 20200102 | 4.752 | 4.129E-05 | 0.00020 |
| N3396 | A & E Agg. Inc (Plant 1) - Brown Road, Orion Twp. | 20200102 | 15.33 | 4.129E-05 | 0.00063 |
| N3435 | Balkema Excavating/Aggregate Resources Plant 102 | 20200102 | 11.566 | 4.129E-05 | 0.00048 |
| N3631 | GS Materials, LLC | 20200102 | 20.679 | 4.129E-05 | 0.00085 |
| N5131 | Balkema Excavating/Aggregate Resources Plant 103 | 20200102 | 6.53 | 4.129E-05 | 0.00027 |
| N5241 | Great Lakes Aggregates, LLC - Sylvania Minerals | 20200102 | 0 | 4.129E-05 | 0.00000 |
| N5476 | R E Glancy Inc. | 20200102 | 0 | 4.129E-05 | 0.00000 |
| N5477 | R E Glancy Inc. | 20200102 | 10.34 | 4.129E-05 | 0.00043 |
| N5748 | Elmer’s Crane and Dozer, Inc. | 20200102 | 8.883 | 4.129E-05 | 0.00037 |
| N5816 | Aggregate & Developing LLC | 20200102 | 0 | 4.129E-05 | 0.00000 |

| | | | | | |
|---|---|---|---|---|---|
| N5819 | Elmer’s Crane and Dozer, Inc. | 20200102 | 1.476 | 4.129E-05 | 0.00006 |
| N5841 | Halliday Sand & Gravel Inc - Plant #2 | 20200102 | 19.4 | 4.129E-05 | 0.00080 |
| N5842 | Halliday Sand & Gravel Inc - Plant #3 | 20200102 | 20 | 4.129E-05 | 0.00083 |
| N5963 | R E Glancy Inc. | 20200102 | 11.55 | 4.129E-05 | 0.00048 |
| N5998 | Aggregate Industries - Nb1 Portable Plant | 20200102 | 19.1768 | 4.129E-05 | 0.00079 |
| N6022 | Rieth-Riley Construction Co., Inc. | 20200102 | 3.899 | 4.129E-05 | 0.00016 |
| N6197 | Aggregate Industries - AC2 Portable Plant | 20200102 | 4.8928 | 4.129E-05 | 0.00020 |
| N6283 | Aggregate Industries - Day Road | 20200102 | 32.1344 | 4.129E-05 | 0.00133 |
| N6306 | Hanlee Equipment LLC | 20200102 | 107.182 | 4.129E-05 | 0.00443 |
| N6307 | Halliday Sand & Gravel, Plant #1 225-97A | 20200102 | 0 | 4.129E-05 | 0.00000 |
| N6338 | Tri City Aggregates | 20200102 | 0 | 4.129E-05 | 0.00000 |
| N6355 | R.E. Glancy, Inc. | 20200102 | 6.12 | 4.129E-05 | 0.00025 |
| N6385 | Mid-Michigan Materials Inc. | 20200102 | 2.254 | 4.129E-05 | 0.00009 |
| N6413 | Rieth-Riley Construction Co., Inc. | 20200102 | 32.55 | 4.129E-05 | 0.00134 |
| N6429 | Halliday Sand & Gravel (945 Cone) | 20200102 | 12.2 | 4.129E-05 | 0.00050 |
| N6430 | Halliday Sand and Gravel | 20200102 | 7.6 | 4.129E-05 | 0.00031 |
| N6432 | Tri City Aggregates | 20200102 | 18.311 | 4.129E-05 | 0.00076 |
| N6448 | Manthei Development Corp/ MDC Contracting, LLC | 20200102 | 3.8 | 4.129E-05 | 0.00016 |
| N6453 | Elmer’s Crane and Dozer, Inc. | 20200102 | 7.567 | 4.129E-05 | 0.00031 |
| N6481 | Undine, Inc. | 20200102 | 0.85 | 4.129E-05 | 0.00004 |
| N6488 | Lc Materials | 20200102 | 10.9 | 4.129E-05 | 0.00045 |
| N6548 | Ottawa Aggregates Inc. | 20200102 | 0 | 4.129E-05 | 0.00000 |
| N6589 | Balkema Excavating, Inc. -- Portable Plant 101 | 20200102 | 0 | 4.129E-05 | 0.00000 |
| N6599 | Florence Cement Company, Inc. | 20200102 | 3.056 | 4.129E-05 | 0.00013 |
| N6600 | Florence Cement Co. Inc. | 20200102 | 4.396 | 4.129E-05 | 0.00018 |
| N6608 | Rieth-Riley Construction Co., Inc. | 20200102 | 70.805 | 4.129E-05 | 0.00292 |
| N6626 | Alphagen Power LLC - Jackson Power Facility | 20200102 | 0.2652 | 4.129E-05 | 0.00001 |
| N6631 | Dearborn Industrial Generation | 20200102 | 2.97 | 4.129E-05 | 0.00012 |
| N6664 | Custom Crushing & Recycle, Inc. | 20200102 | 50.8 | 4.129E-05 | 0.00210 |
| N6704 | Hubscher & Son, Inc. - Pioneer 50Ve Portable | 20200102 | 4.573 | 4.129E-05 | 0.00019 |
| N6705 | Hubscher And Son, Inc. - Cedarapids 443 | 20200102 | 4.837 | 4.129E-05 | 0.00020 |
| N6749 | Carrick Gravel And Crushing | 20200102 | 10.761 | 4.129E-05 | 0.00044 |
| N6750 | Elmer’s Crane and Dozer, Inc. | 20200102 | 0 | 4.129E-05 | 0.00000 |
| N6762 | Dykema Excavators Inc. | 20200102 | 4.998 | 4.129E-05 | 0.00021 |
| N6804 | Klett Recycle, Inc. | 20200102 | 8.32 | 4.129E-05 | 0.00034 |
| N6837 | Rock Recyclers | 20200102 | 52.872 | 4.129E-05 | 0.00218 |
| N6848 | Parker Excavating Gravel & Recycling Inc. | 20200102 | 0 | 4.129E-05 | 0.00000 |
| N6849 | Parker Excavating Gravel & Recycle Inc. | 20200102 | 2.058 | 4.129E-05 | 0.00008 |
| N6850 | Parker Excavating Gravel & Recycle Inc. | 20200102 | 3.444 | 4.129E-05 | 0.00014 |
| N6851 | Parker Excavating Gravel & Recycle Inc. | 20200102 | 8.211 | 4.129E-05 | 0.00034 |
| N6861 | Custom Crushing Lakeshore | 20200102 | 43.3 | 4.129E-05 | 0.00179 |
| N6880 | Carr Brothers & Sons Inc. - Plant 2 | 20200102 | 11.796 | 4.129E-05 | 0.00049 |

| | | | | | |
|---|---|---|---|---|---|
| N6883 | Carr Brothers & Sons Inc. - Plant 1 | 20200102 | 6.344 | 4.129E-05 | 0.00026 |
| N6901 | R. Smith & Sons, Inc. - Plant #1 | 20200102 | 19 | 4.129E-05 | 0.00078 |
| N6913 | Searles Construction - 45 Plant | 20200102 | 13.52 | 4.129E-05 | 0.00056 |
| N6914 | Searles Construction - Wash Plant | 20200102 | 5.445 | 4.129E-05 | 0.00022 |
| N6950 | General Motors LLC-Lansing Delta Township | 20200102 | 1.231 | 4.129E-05 | 0.00005 |
| N6957 | Halliday Sand and Gravel Inc. (6000 Cone Plant) | 20200102 | 12.2 | 4.129E-05 | 0.00050 |
| N7011 | Grosso Trucking and Supply Company | 20200102 | 5.7 | 4.129E-05 | 0.00024 |
| N7151 | Paul Bechtel Sand and Gravel LLC | 20200102 | 10.35 | 4.129E-05 | 0.00043 |
| N7168 | American Aggregates-Telsmith 52G Portable Crusher | 20200102 | 11.1 | 4.129E-05 | 0.00046 |
| N7232 | Carl Schlegel, Inc. | 20200102 | 0.256 | 4.129E-05 | 0.00001 |
| N7259 | Alpena Aggregate Inc. | 20200102 | 23.341 | 4.129E-05 | 0.00096 |
| N7288 | Weber Sand and Gravel, Inc. - Cedar Rapids | 20200102 | 13.326 | 4.129E-05 | 0.00055 |
| N7375 | American Aggregates of Michigan, Inc. Sandvik Cone | 20200102 | 8 | 4.129E-05 | 0.00033 |
| N7383 | Green Plains Holdings II LLC | 20200102 | 2.44 | 4.129E-05 | 0.00010 |
| N7385 | K & K Crushing and Leasing | 20200102 | 0.94 | 4.129E-05 | 0.00004 |
| N7390 | Balkema Excavating Inc.-Plant 104 | 20200102 | 0 | 4.129E-05 | 0.00000 |
| N7392 | Mack Truck & Weigand's Crushed Concrete | 20200102 | 22.50249176 | 4.129E-05 | 0.00093 |
| N7407 | Barber Creek Sand and Gravel, Inc. | 20200102 | 11.289 | 4.129E-05 | 0.00047 |
| N7595 | R. Smith and Sons Inc. | 20200102 | 12 | 4.129E-05 | 0.00050 |
| N7618 | Great Lakes Aggregates LLC Terex Facility | 20200102 | 4.428 | 4.129E-05 | 0.00018 |
| N7858 | Tri City Aggregates | 20200102 | 6.518 | 4.129E-05 | 0.00027 |
| N7886 | Hyundai-Kia America Technical Center Inc. (Hatci) | 20200102 | 0.18 | 4.129E-05 | 0.00001 |
| N7981 | Aggregate & Developing LLC - Superior Pit | 20200102 | 15.082 | 4.129E-05 | 0.00062 |
| N7996 | Florence Cement Plant #741 | 20200102 | 3.804 | 4.129E-05 | 0.00016 |
| N8066 | Carl Schlegel Inc. | 20200102 | 0.59 | 4.129E-05 | 0.00002 |
| N8078 | Joy Construction & Leasing Inc. | 20200102 | 0.03 | 4.129E-05 | 0.00000 |
| N8162 | Clayton Unit CPF | 20200102 | 0.6894 | 4.129E-05 | 0.00003 |
| N8252 | Barber Creek Sand and Gravel | 20200102 | 2.9778 | 4.129E-05 | 0.00012 |
| P0197 | Bierlein Companies, Inc. | 20200102 | 0.18 | 4.129E-05 | 0.00001 |
| P0269 | Bierlein Companies, Inc. | 20200102 | 1.35 | 4.129E-05 | 0.00006 |
| P0315 | Jule Swartz & Sons Excavating-Mann Road Concord | 20200101 | 1.2 | 1.680E-04 | 0.00020 |
| P0333 | D & R Demolition LLC | 20200102 | 0 | 4.129E-05 | 0.00000 |
| P0358 | Kraken Crushed Concrete & Recycling - Northville | 20200102 | 6.766 | 4.129E-05 | 0.00028 |
| P0377 | Florence Cement Company | 20200102 | 2.024 | 4.129E-05 | 0.00008 |
| P0411 | Revolution Onsite Crushing | 20200102 | 5.544 | 4.129E-05 | 0.00023 |
| P0456 | Holz Sand & Gravel, LLC | 20200102 | 0.85 | | 0.00004 |
| P0504 | Toebe Construction Rex Plant 2 | 20200102 | 8.176 | 4.129E-05 | 0.00034 |
| P0526 | Heritage Resources, Inc. | 20200102 | 12.29 | 4.129E-05 | 0.00051 |
| P0533 | L & L Construction Co. | 20200102 | 7.2757 | 4.129E-05 | 0.00030 |
| P0539 | Weber Sand & Gravel Inc.-North Branch | 20200102 | 6.488 | 4.129E-05 | 0.00027 |
| TOTAL | | | | | 0.05918 |

*Nonpoint Oil Combustion, Industrial and Commercial-Institutional*

Within the 2014 NEI v2, the USEPA estimated a total of 9.66 lbs of mercury emissions from nonpoint industrial and commercial-institutional sources that burned oil. This includes boilers and internal combustion engines.

Table 11. Nonpoint Combustion of Oil from Industrial and Commercial-institutional Sources

| Data Source | Mercury Emissions (lbs) | Nonpoint Sector |
|---|---|---|
| 2014 NEI v2 | 6.86 | Fuel Comb. - Industrial Boilers, ICEs - Oil |
| 2014 NEI v2 | 2.80 | Fuel Comb. - Comm/Institutional - Oil |
| Total | 9.66 | |

***Natural Gas Combustion***

*Electric Utilities*

Mercury emissions from natural gas-fired electric utilities were estimated using an emission factor published by the Electric Power Research Institute (EPRI 1996 for natural gas combustion. Throughput, or natural gas consumption, is expressed in millions of cubic feet (MMCF). The EPRI factor of 8.00E-10 lb/MMCF is several orders of magnitude lower than the USEPA emission factor used in MAERS, which is 2.6E-04 lb/MMCF. The result is that the estimated mercury emissions for this category drop to 7.76E-06 lbs statewide, compared to the MAERS estimate of 1.95 lbs for 2014 (McGeen, 2020).

The following sources are included in the estimate for emissions from natural gas-fired electric utilities.

Table 12. Electric Utilities, Natural Gas Combustion

| SRN | Facility Name | SCC | Natural Gas in MMCF | MAERS Factor in Lb/MMCF | Estimated Emissions in Lbs from MAERS | EPRI Factor in Lb/MMCF | EPRI-based Emissions Estimates in Lbs |
|---|---|---|---|---|---|---|---|
| B1966 | White Pine Electric Power LLC | 10200602 | 309.00 | 2.60E-04 | 0.08034 | 8.00E-10 | 2.47E-07 |
| B1976 | J.B. Sims Generating Station | 10100601 | 44.00 | 2.60E-04 | 0.01144 | 8.00E-10 | 3.52E-08 |
| B1976 | J.B. Sims Generating Station | 10200602 | 7.23 | 2.60E-04 | 0.00188 | 8.00E-10 | 5.78E-09 |
| B2132 | Wyandotte Dept. of Municipal Power Plant | 10100601 | 1552.63 | 2.60E-04 | 0.16527 | 8.00E-10 | 1.24E-06 |
| B2357 | Holland BPW, Generating Station & WWTP | 10100601 | 29.22 | 2.60E-04 | 0.00760 | 8.00E-10 | 2.34E-08 |
| B2796 | St. Clair / Belle River Power Plant | 10100601 | 222.76 | 2.60E-04 | 0.05792 | 8.00E-10 | 1.78E-07 |
| B2796 | St. Clair / Belle River Power Plant | 10100604 | 305.92 | 2.60E-04 | 0.07954 | 8.00E-10 | 2.45E-07 |
| B2810 | DTE - Electric Company River Rouge | 10100601 | 805.99 | 2.60E-04 | 0.20960 | 8.00E-10 | 6.45E-07 |
| B2810 | DTE - Electric Company River Rouge | 10100604 | 639.09 | 2.60E-04 | 0.16620 | 8.00E-10 | 5.11E-07 |
| B2810 | DTE - Electric Company River Rouge | 10200601 | 71.03 | 2.60E-04 | 0.01847 | 8.00E-10 | 5.68E-08 |
| B2815 | DTE - Electric Company Harbor Beach Power Plant | 10200602 | 0.00 | 2.60E-04 | 0.00000 | 8.00E-10 | 0.00E+00 |
| B2836 | B. C. Cobb Plant | 10100604 | 275.80 | 2.60E-04 | 0.07171 | 8.00E-10 | 2.21E-07 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B2836 | B. C. Cobb Plant | 10200602 | 6.82 | 2.60E-04 | 0.00177 | 8.00E-10 | 5.46E-09 |
| B2840 | Consumers Energy Karn-Weadock Facility | 10100601 | 166.60 | 2.60E-04 | 0.04331 | 8.00E-10 | 1.33E-07 |
| B2840 | Consumers Energy Karn-Weadock Facility | 10100602 | 0.11 | 2.60E-04 | 0.00003 | 8.00E-10 | 8.48E-11 |
| B2840 | Consumers Energy Karn-Weadock Facility | 10100604 | 138.90 | 2.60E-04 | 0.03611 | 8.00E-10 | 1.11E-07 |
| B4260 | L'Anse Warden Electric Company LLC | 10100601 | 29.00 | 2.60E-04 | 0.00302 | 8.00E-10 | 2.32E-08 |
| B6145 | DTE - Electric Company Greenwood Energy Center | 10100601 | 1810.94 | 2.60E-04 | 0.47080 | 8.00E-10 | 1.45E-06 |
| B6145 | DTE - Electric Company Greenwood Energy Center | 10200602 | 22.53 | 2.60E-04 | 0.00586 | 8.00E-10 | 1.80E-08 |
| B6611 | Michigan South Central Power Agency | 10100601 | 7.37 | 2.60E-04 | 0.00192 | 8.00E-10 | 5.90E-09 |
| B6611 | Michigan South Central Power Agency | 10100602 | 4.40 | 2.60E-04 | 0.00114 | 8.00E-10 | 3.52E-09 |
| B6636 | Consumers Energy - Ray Compressor Station | 10200602 | 14.96 | 2.60E-04 | 0.00389 | 8.00E-10 | 1.20E-08 |
| B6636 | Consumers Energy - Ray Compressor Station | 10300602 | 26.37 | 2.60E-04 | 0.00686 | 8.00E-10 | 2.11E-08 |
| B6636 | Consumers Energy - Ray Compressor Station | 10300603 | 4.17 | 2.60E-04 | 0.00109 | 8.00E-10 | 3.34E-09 |
| N0890 | Viking Energy of Lincoln, LLC | 10100601 | 1258.00 | 2.60E-04 | 0.00000 | 8.00E-10 | 1.01E-06 |
| N1099 | Consumers Energy - Northville Compressor Station | 10300603 | 0.97 | 2.60E-04 | 0.00025 | 8.00E-10 | 7.74E-10 |
| N1160 | Viking Energy of McBain | 10100601 | 1876.00 | 2.60E-04 | 0.48780 | 8.00E-10 | 1.50E-06 |
| N1266 | Hillman Power Co. | 10100602 | 0.03 | 2.60E-04 | 0.00001 | 8.00E-10 | 2.00E-11 |
| N2388 | Grayling Generating Station Limited Partnership | 10100601 | 0.38 | 2.60E-04 | 0.00010 | 8.00E-10 | 3.04E-10 |
| N3391 | DTE Gas Company - Washington 10 Compressor Station | 10200602 | 58.47 | 2.60E-04 | 0.01520 | 8.00E-10 | 4.68E-08 |
| N3570 | Genesee Power Station Limited Partnership | 10100601 | 4.20 | 2.60E-04 | 0.00109 | 8.00E-10 | 3.36E-09 |
| N5573 | Consumers Energy - White Pigeon Compressor Station | 10300603 | 6.03 | 2.60E-04 | 0.00157 | 8.00E-10 | 4.82E-09 |
| N7786 | DTE Pontiac North, LLC | 10300601 | 0.00 | 2.60E-04 | 0.00000 | 8.00E-10 | 0.00E+00 |
| TOTAL | | | | | 1.95177 | | 7.76E-06 |

*Residential*

For residential natural gas combustion, the EPRI emission factor of 8.0E-10 lb/MMCF was used along with 2014 statewide fuel consumption data from the EIA, USDoE to generate estimated emissions of mercury (EGLE, 2020). This resulted in statewide total emissions from this category of 2.84E-04 lbs, compared to the estimate of 92.30 lbs, which is based on the WebFIRE natural gas combustion factor of 2.60E-04 lb/MMCF.

Table 13. Residential, Natural Gas Combustion

| Category | Throughput MMCF | Emission Factor | Lbs Emitted |
|---|---|---|---|
| Residential Natural Gas Combustion | 355,000.00 | 8.00E-10 | 0.000284 |

*Industrial/Commercial Boilers*

For natural gas combustion from Industrial and Commercial boilers, the EPRI emission factor of 8.0E-10 lb/MMCF was utilized, along with 2014 activity data from MAERS. The statewide total mercury emissions estimated for this category were 5.52E05 lbs. The MAERS estimate, based on the standard USEPA factor, was 17.77 lbs for this category.

The following industrial and commercial sources of natural gas combustion were included in the estimate:

Table 14. Industrial/Commercial Boilers, Natural Gas Combustion

| SRN | Facility Name | SCC | Natural Gas in MMCF | MAERS Emission Factor in Lb/MMCF | MAERS Emission Estimates in Lbs | EPRI Emission Factor in Lb/MMCF | EPRI-based Emission Estimates in Lbs |
|---|---|---|---|---|---|---|---|
| A0023 | Otsego Paper Inc. | 10200601 | 22.49 | 2.60E-04 | 0.0058 | 8E-10 | 1.799E-08 |
| A0402 | Menasha Packaging Company, LLC - Coloma Plant | 10200602 | 44.74 | 2.60E-04 | 0.0116 | 8E-10 | 3.579E-08 |
| A0563 | Kellogg USA Inc. | 10200602 | 391.94 | 2.60E-04 | 0.1019 | 8E-10 | 3.136E-07 |
| A0884 | Escanaba Paper Company | 10200601 | 1138.57 | 2.60E-04 | 0.2960 | 8E-10 | 9.109E-07 |
| A0884 | Escanaba Paper Company | 10200602 | 315.60 | 2.60E-04 | 0.0821 | 8E-10 | 2.525E-07 |
| A1640 | Demmer Corp. | 10200602 | 12.40 | 2.60E-04 | 0.0032 | 8E-10 | 9.920E-09 |
| A1864 | Industrial Steel Treat Co. | 10300603 | 214.26 | 2.60E-04 | 0.0557 | 8E-10 | 1.714E-07 |
| A1932 | Royal Adhesives & Sealants | 10300603 | 184.40 | 2.60E-04 | 0.0479 | 8E-10 | 1.475E-07 |
| A1991 | Kalsec, Incorporated | 10200602 | 56.84 | 2.60E-04 | 0.0148 | 8E-10 | 4.547E-08 |
| A2396 | Leon Plastics | 10300603 | 0.34 | 2.60E-04 | 0.0001 | 8E-10 | 2.720E-10 |
| A2402 | Access Business Group, LLC | 10100602 | 4.60 | 2.60E-04 | 0.0012 | 8E-10 | 3.680E-09 |
| A2402 | Access Business Group, LLC | 10200602 | 72.67 | 2.60E-04 | 0.0189 | 8E-10 | 5.814E-08 |
| A2620 | Gm Components Holdings, LLC | 10200601 | 0.00 | 2.60E-04 | 0.0000 | 8E-10 | 0.000E+00 |
| A2620 | Gm Components Holdings, LLC | 10200602 | 183.75 | 2.60E-04 | 0.0478 | 8E-10 | 1.470E-07 |
| A2849 | Wacker Chemical Corp. | 10200602 | 43.85 | 2.60E-04 | 0.0114 | 8E-10 | 3.508E-08 |
| A3567 | Ford Motor Company - Sterling Plant | 10200601 | 220.94 | 2.60E-04 | 0.0574 | 8E-10 | 1.767E-07 |
| A3567 | Ford Motor Company - Sterling Plant | 10200602 | 126.89 | 2.60E-04 | 0.0330 | 8E-10 | 1.015E-07 |
| A3569 | Axalta Coating Systems, LLC- Mt Clemens Plant | 10200602 | 25.74 | 2.60E-04 | 0.0067 | 8E-10 | 2.059E-08 |
| A4033 | The Dow Chemical Company U.S.A., Midland | 10200601 | 8.70 | 2.60E-04 | 0.0023 | 8E-10 | 6.960E-09 |
| A4033 | The Dow Chemical Company U.S.A., Midland | 10200602 | 160.00 | 2.60E-04 | 0.0416 | 8E-10 | 1.280E-07 |
| A4043 | Dow Corning - Midland Plant | 10200601 | 1457.59 | 2.60E-04 | 0.3790 | 8E-10 | 1.166E-06 |
| A4043 | Dow Corning - Midland Plant | 10200602 | 160.38 | 2.60E-04 | 0.0417 | 8E-10 | 1.283E-07 |
| A4285 | Lorin Industries | 10200602 | 40.40 | 2.60E-04 | 0.0105 | 8E-10 | 3.232E-08 |
| A4338 | Gerber Products Co. | 10200601 | 45.43 | 2.60E-04 | 0.0118 | 8E-10 | 3.634E-08 |
| A4338 | Gerber Products Co. | 10200602 | 253.36 | 2.60E-04 | 0.0659 | 8E-10 | 2.027E-07 |
| A4741 | Michigan Seamless Tube, LLC | 10200602 | 119.17 | 2.60E-04 | 0.0310 | 8E-10 | 9.534E-08 |
| A5262 | General Motors LLC - Milford Proving Ground | 10300602 | 344.26 | 2.60E-04 | 0.0895 | 8E-10 | 2.754E-07 |
| A5806 | Hillshire Brands Company | 10200602 | 172.23 | 2.60E-04 | 0.0448 | 8E-10 | 1.378E-07 |
| A5858 | Mead Johnson & Company, LLC | 10200602 | 167.89 | 2.60E-04 | 0.0437 | 8E-10 | 1.343E-07 |
| A6175 | Nexteer Automotive Corporation | 10200602 | 521.61 | 2.60E-04 | 0.1356 | 8E-10 | 4.173E-07 |
| A6218 | Dunn Paper, Inc. | 10200602 | 414.61 | 2.60E-04 | 0.1078 | 8E-10 | 3.317E-07 |
| A6220 | Intertape Polymer Group | 10200602 | 99.94 | 2.60E-04 | 0.0260 | 8E-10 | 7.995E-08 |
| A6240 | Cargill Salt - St. Clair | 10200601 | 936.20 | 2.60E-04 | 0.2435 | 8E-10 | 7.490E-07 |
| A6240 | Cargill Salt - St. Clair | 10200602 | 63.50 | 2.60E-04 | 0.0165 | 8E-10 | 5.080E-08 |
| A6380 | Abbott Nutrition | 10200602 | 380.02 | 2.60E-04 | 0.0988 | 8E-10 | 3.040E-07 |
| A6475 | MPI Acquisition, LLC | 10200602 | 0.00 | 2.60E-04 | 0.0000 | 8E-10 | 0.000E+00 |
| A6714 | Georgia-Pacific Corrugated II LLC | 10200602 | 56.13 | 2.60E-04 | 0.0146 | 8E-10 | 4.490E-08 |
| A6902 | Darling Ingredients Inc. | 10200602 | 39.04 | 2.60E-04 | 0.0102 | 8E-10 | 3.123E-08 |
| A7757 | US Silica Co | 10200602 | 93.97 | 2.60E-04 | 0.0244 | 8E-10 | 7.518E-08 |
| A7809 | US Steel Great Lakes Works | 10200602 | 1681.71 | 2.60E-04 | 0.4372 | 8E-10 | 1.345E-06 |
| A8448 | Durr Systems, Inc. | 10100602 | 25.11 | 2.60E-04 | 0.0065 | 8E-10 | 2.009E-08 |
| A8638 | Detroit Diesel Corporation | 10200602 | 252.91 | 2.60E-04 | 0.0658 | 8E-10 | 2.023E-07 |
| A8645 | Ford Motor Co/ Livonia Transmission | 10200601 | 132.02 | 2.60E-04 | 0.0343 | 8E-10 | 1.056E-07 |
| A8645 | Ford Motor Co/ Livonia Transmission | 10200602 | 117.36 | 2.60E-04 | 0.0305 | 8E-10 | 9.389E-08 |
| A8648 | Ford Motor Co Rouge Complex | 10200602 | 51.19 | 2.60E-04 | 0.0133 | 8E-10 | 4.095E-08 |
| A8650 | Ford Motor Co/ Wayne Complex | 10100602 | 144.64 | 2.60E-04 | 0.0376 | 8E-10 | 1.157E-07 |
| A8651 | Ford Motor Company, Woodhaven Stamping Plant | 10200602 | 12.97 | 2.60E-04 | 0.0034 | 8E-10 | 1.037E-08 |
| B0785 | Quaker Chemical Corp. | 10200602 | 50.49 | 2.60E-04 | 0.0131 | 8E-10 | 4.039E-08 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| B1470 | Neenah Paper - Michigan Inc. | 10200601 | 12.03 | 2.60E-04 | 0.0031 | 8E-10 | 9.624E-09 |
| B1476 | Decorative Panels International, Inc. | 10200602 | 661.30 | 2.60E-04 | 0.0688 | 8E-10 | 5.290E-07 |
| B1493 | Michigan Sugar Company - Bay City | 10200601 | 2136.60 | 2.60E-04 | 0.5556 | 8E-10 | 1.709E-06 |
| B1526 | Darling Ingredients Inc. | 10200602 | 354.34 | 2.60E-04 | 0.0921 | 8E-10 | 2.835E-07 |
| B1534 | Graphic Packaging International, Inc. | 10200601 | 1148.00 | 2.60E-04 | 0.2985 | 8E-10 | 9.184E-07 |
| B1537 | RalCorp. Holdings, Inc. | 10200602 | 142.42 | 2.60E-04 | 0.0370 | 8E-10 | 1.139E-07 |
| B1548 | Post Foods | 10200601 | 429.90 | 2.60E-04 | 0.1118 | 8E-10 | 3.439E-07 |
| B1563 | Great Lakes Tissue | 10200602 | 176.30 | 2.60E-04 | 0.0458 | 8E-10 | 1.410E-07 |
| B1598 | Flint Water Pollution Control Facility | 10300602 | 50.27 | 2.60E-04 | 0.0131 | 8E-10 | 4.022E-08 |
| B1604 | Gm Customer Care & Aftersales - Swartz Creek | 10200602 | 169.88 | 2.60E-04 | 0.0442 | 8E-10 | 1.359E-07 |
| B1606 | General Motors LLC Flint Assembly | 10200601 | 250.84 | 2.60E-04 | 0.0652 | 8E-10 | 2.007E-07 |
| B1677 | Allnex USA Inc. | 10100602 | 283.01 | 2.60E-04 | 0.0736 | 8E-10 | 2.264E-07 |
| B1678 | Graphic Packaging International, Inc. | 10200601 | 2281.77 | 2.60E-04 | 0.5933 | 8E-10 | 1.825E-06 |
| B1713 | American Seating Company | 10200602 | 29.11 | 2.60E-04 | 0.0076 | 8E-10 | 2.329E-08 |
| B1771 | Ford Motor Company-Van Dyke Plant | 10200601 | 37.60 | 2.60E-04 | 0.0098 | 8E-10 | 3.008E-08 |
| B1771 | Ford Motor Company-Van Dyke Plant | 10200602 | 64.81 | 2.60E-04 | 0.0169 | 8E-10 | 5.185E-08 |
| B1798 | General Motors LLC- Warren Transmission Plant | 10200602 | 108.53 | 2.60E-04 | 0.0282 | 8E-10 | 8.682E-08 |
| B1801 | FCA US LLC, Sterling Stamping Plant | 10100602 | 212.41 | 2.60E-04 | 0.0552 | 8E-10 | 1.699E-07 |
| B1824 | Morton Salt, Inc. | 10100604 | 0.98 | 2.60E-04 | 0.0003 | 8E-10 | 7.840E-10 |
| B1824 | Morton Salt, Inc. | 10200602 | 0.66 | 2.60E-04 | 0.0002 | 8E-10 | 5.280E-10 |
| B1827 | Empire Iron Mining Partnership | 10200602 | 25.63 | 2.60E-04 | 0.0067 | 8E-10 | 2.050E-08 |
| B1855 | Menominee Acquisition Corporation | 10200602 | 412.43 | 2.60E-04 | 0.1072 | 8E-10 | 3.299E-07 |
| B1912 | L-3 Communications Corp: Combat Propulsion Systems | 10200602 | 7.87 | 2.60E-04 | 0.0020 | 8E-10 | 6.298E-09 |
| B1925 | Diversified Machine Montague, LLC | 10200602 | 24.60 | 2.60E-04 | 0.0064 | 8E-10 | 1.968E-08 |
| B1945 | Quikrete-Flint | 10200602 | 15.57 | 2.60E-04 | 0.0040 | 8E-10 | 1.246E-08 |
| B1961 | Barber Steel Foundry Corporation | 10200602 | 16.27 | 2.60E-04 | 0.0042 | 8E-10 | 1.302E-08 |
| B1991 | Gm LLC Saginaw Metal Casting Operations | 10200602 | 71.24 | 2.60E-04 | 0.0185 | 8E-10 | 5.699E-08 |
| B2013 | Ox Paperboard of Michigan, LLC | 10200602 | 278.78 | 2.60E-04 | 0.0072 | 8E-10 | 2.230E-07 |
| B2014 | Day International, Inc. A Flint Group Company | 10200602 | 73.54 | 2.60E-04 | 0.0191 | 8E-10 | 5.883E-08 |
| B2024 | White Pigeon Paper Company | 10200601 | 28.01 | 2.60E-04 | 0.0073 | 8E-10 | 2.241E-08 |
| B2024 | White Pigeon Paper Company | 10200602 | 359.34 | 2.60E-04 | 0.0934 | 8E-10 | 2.875E-07 |
| B2032 | FCA US LLC | 10200602 | 9.81 | 2.60E-04 | 0.0026 | 8E-10 | 7.846E-09 |
| B2050 | MPI Research | 10300602 | 197.80 | 2.60E-04 | 0.0514 | 8E-10 | 1.582E-07 |
| B2050 | MPI Research | 10300603 | 95.90 | 2.60E-04 | 0.0249 | 8E-10 | 7.672E-08 |
| B2052 | Racer Trust - Willow Run Plant Industrial Land | 10200601 | 0.00 | 2.60E-04 | 0.0000 | 8E-10 | 0.000E+00 |
| B2052 | Racer Trust - Willow Run Plant Industrial Land | 10200602 | 0.00 | 2.60E-04 | 0.0000 | 8E-10 | 0.000E+00 |
| B2063 | Faurecia Interior Systems Saline, LLC | 10200602 | 66.91 | 2.60E-04 | 0.0174 | 8E-10 | 5.353E-08 |
| B2064 | Ford Motor Co/Rawsonville Plant | 10200602 | 158.92 | 2.60E-04 | 0.0413 | 8E-10 | 1.271E-07 |
| B2103 | Detroit Wastewater Treatment Plant | 10300602 | 46.40 | 2.60E-04 | 0.0121 | 8E-10 | 3.712E-08 |
| B2158 | Buckeye Terminals, LLC - Woodhaven Terminal | 10300602 | 0.00 | 2.60E-04 | 0.0000 | 8E-10 | 0.000E+00 |
| B2217 | Eaton Research Center | 10300603 | 16.03 | 2.60E-04 | 0.0042 | 8E-10 | 1.282E-08 |
| B2329 | Par Sterile Products LLC | 10200602 | 58.17 | 2.60E-04 | 0.0151 | 8E-10 | 4.653E-08 |
| B2331 | Michigan State University - Bioeconomy Institute | 10200602 | 27.00 | 2.60E-04 | 0.0070 | 8E-10 | 2.160E-08 |
| B2337 | VCF Films, Inc. | 10200602 | 1.61 | 2.60E-04 | 0.0004 | 8E-10 | 1.287E-09 |
| B2359 | Birds Eye Foods LLC | 10200602 | 65.50 | 2.60E-04 | 0.0170 | 8E-10 | 5.240E-08 |
| B2429 | Faurecia Interior Systems | 10200602 | 29.41 | 2.60E-04 | 0.0076 | 8E-10 | 2.353E-08 |
| B2460 | General Motors LLC - Bay City | 10200602 | 165.06 | 2.60E-04 | 0.0429 | 8E-10 | 1.320E-07 |
| B2561 | Packaging Corporation of America | 10300602 | 71.70 | 2.60E-04 | 0.0186 | 8E-10 | 5.736E-08 |
| B2644 | Hemlock Semiconductor Corporation | 10200602 | 926.15 | 2.60E-04 | 0.2408 | 8E-10 | 7.409E-07 |
| B2751 | Magna Mirrors | 10300603 | 20.05 | 2.60E-04 | 0.0052 | 8E-10 | 1.604E-08 |
| B2763 | U.S. Army Garrison-Detroit Arsenal | 10300603 | 117.10 | 2.60E-04 | 0.0305 | 8E-10 | 9.368E-08 |
| B2767 | FCA US LLC Warren Truck Assembly Plant | 10200601 | 586.29 | 2.60E-04 | 0.1524 | 8E-10 | 4.690E-07 |
| B2767 | FCA US LLC Warren Truck Assembly Plant | 10200602 | 20.95 | 2.60E-04 | 0.0054 | 8E-10 | 1.676E-08 |
| B2814 | Detroit Thermal Beacon Heating Plant | 10300601 | 1170.00 | 2.60E-04 | 0.3042 | 8E-10 | 9.360E-07 |
| B2817 | Vertellus Health & Specialty Products, LLC | 10200602 | 65.84 | 2.60E-04 | 0.0171 | 8E-10 | 5.267E-08 |
| B2838 | Veolia Energy Grand Rapids, LLC | 10300601 | 695.08 | 2.60E-04 | 0.1807 | 8E-10 | 5.561E-07 |
| B2838 | Veolia Energy Grand Rapids, LLC | 10300602 | 260.81 | 2.60E-04 | 0.0678 | 8E-10 | 2.086E-07 |
| B2873 | Michigan Sugar Company - Sebewaing Factory | 10200602 | 356.89 | 2.60E-04 | 0.0928 | 8E-10 | 2.855E-07 |

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| B2875 | Michigan Sugar Company, Caro Factory | 10200601 | 201.00 | 2.60E-04 | 0.0523 | 8E-10 | 1.608E-07 |
| B2875 | Michigan Sugar Company, Caro Factory | 10200602 | 309.00 | 2.60E-04 | 0.0803 | 8E-10 | 2.472E-07 |
| B2876 | Michigan Sugar Company, Croswell Factory | 10200602 | 250.09 | 2.60E-04 | 0.0650 | 8E-10 | 2.001E-07 |
| B2926 | Sunoco Partners M & T, L.P. - River Rouge Terminal | 10300603 | 0.02 | 2.60E-04 | 0.0000 | 8E-10 | 1.600E-11 |
| B2952 | Silbond Corp. | 10200602 | 34.26 | 2.60E-04 | 0.0089 | 8E-10 | 2.741E-08 |
| B3012 | Detroit Thermal Blvd Heating Plant | 10300602 | 6.30 | 2.60E-04 | 0.0016 | 8E-10 | 5.040E-09 |
| B3037 | Fitzgerald Finishing LLC | 10300603 | 134.32 | 2.60E-04 | 0.0349 | 8E-10 | 1.075E-07 |
| B3241 | Ford Motor Co Brownstown | 10200602 | 44.30 | 2.60E-04 | 0.0115 | 8E-10 | 3.544E-08 |
| B3291 | Gibraltar National Corp. / Quikrete Detroit | 10100602 | 17.92 | 2.60E-04 | 0.0047 | 8E-10 | 1.434E-08 |
| B3350 | FCA US LLC – Trenton Engine Complex | 10200601 | 2.98 | 2.60E-04 | 0.0008 | 8E-10 | 2.384E-09 |
| B3350 | FCA US LLC – Trenton Engine Complex | 10200602 | 79.43 | 2.60E-04 | 0.0207 | 8E-10 | 6.354E-08 |
| B3610 | Pharmacia & Upjohn Co LLC, A Subsidiary of Pfizer | 10200601 | 684.66 | 2.60E-04 | 0.1780 | 8E-10 | 5.477E-07 |
| B3692 | Packaging Corporation of America - Filer City Mill | 10200601 | 3643.00 | 2.60E-04 | 0.9471 | 8E-10 | 2.914E-06 |
| B4032 | General Motors, LLC - Pontiac North Campus | 10200602 | 235.05 | 2.60E-04 | 0.0611 | 8E-10 | 1.880E-07 |
| B4045 | H.J. Heinz Company, L.P. | 10300602 | 65.49 | 2.60E-04 | 0.0170 | 8E-10 | 5.239E-08 |
| B4049 | Gm Technical Center | 10200601 | 670.77 | 2.60E-04 | 0.1744 | 8E-10 | 5.366E-07 |
| B4049 | Gm Technical Center | 10200602 | 2.60 | 2.60E-04 | 0.0007 | 8E-10 | 2.080E-09 |
| B4072 | Rock-Tenn Co | 10200601 | 856.22 | 2.60E-04 | 0.2226 | 8E-10 | 6.850E-07 |
| B4131 | MNP Corp. | 10300602 | 207.82 | 2.60E-04 | 0.0540 | 8E-10 | 1.663E-07 |
| B4238 | French Paper Company | 10200602 | 159.00 | 2.60E-04 | 0.0413 | 8E-10 | 1.272E-07 |
| B4288 | Zoetis P&U LLC | 10200601 | 46.09 | 2.60E-04 | 0.0120 | 8E-10 | 3.687E-08 |
| B4288 | Zoetis P&U LLC | 10200602 | 167.37 | 2.60E-04 | 0.0435 | 8E-10 | 1.339E-07 |
| B4302 | Esco Company, LLC | 10200602 | 74.90 | 2.60E-04 | 0.0195 | 8E-10 | 5.992E-08 |
| B4306 | Gerdau Special Steel North America - Jackson Mill | 10200602 | 110.19 | 2.60E-04 | 0.0287 | 8E-10 | 8.815E-08 |
| B4311 | Adm Grain Co | 10200602 | 51.11 | 2.60E-04 | 0.0133 | 8E-10 | 4.089E-08 |
| B4395 | Keebler Co | 10200602 | 56.20 | 2.60E-04 | 0.0146 | 8E-10 | 4.496E-08 |
| B4752 | Great Lakes Petroleum Terminal, LLC | 10200601 | 69.00 | 2.60E-04 | 0.0179 | 8E-10 | 5.520E-08 |
| B4885 | Tilden Mining Company LLC | 10200601 | 1792.00 | 2.60E-04 | 0.4659 | 8E-10 | 1.434E-06 |
| B4925 | O-N Minerals (Michigan) Co. Dba Carmeuse Lime | 10200602 | 57.26 | 2.60E-04 | 0.0149 | 8E-10 | 4.581E-08 |
| B4942 | Dow Agrosciences LLC | 10200602 | 30.00 | 2.60E-04 | 0.0078 | 8E-10 | 2.400E-08 |
| B4977 | Pinnacle Foods Group LLC | 10200602 | 198.40 | 2.60E-04 | 0.0516 | 8E-10 | 1.587E-07 |
| B5162 | Xcel Steel Pickling | 10200602 | 20.30 | 2.60E-04 | 0.0053 | 8E-10 | 1.624E-08 |
| B5417 | DW-National Standard-Niles, LLC | 10200602 | 85.90 | 2.60E-04 | 0.0223 | 8E-10 | 6.872E-08 |
| B5453 | Coastal Container Corp. | 10200602 | 0.00 | 2.60E-04 | 0.0000 | 8E-10 | 0.000E+00 |
| B5830 | Ajax Metal Processing Inc. | 10200602 | 145.40 | 2.60E-04 | 0.0378 | 8E-10 | 1.163E-07 |
| B5853 | Detroit Media Partnership | 10100602 | 68.87 | 2.60E-04 | 0.0179 | 8E-10 | 5.510E-08 |
| B5966 | Sun Chemical Corp. | 10200602 | 78.77 | 2.60E-04 | 0.0205 | 8E-10 | 6.302E-08 |
| B6027 | Inteva Products Adrian Operations | 10200602 | 29.33 | 2.60E-04 | 0.0076 | 8E-10 | 2.346E-08 |
| B6178 | Huron Valley Steel Corp. | 10200602 | 0.00 | 2.60E-04 | 0.0000 | 8E-10 | 0.000E+00 |
| B6230 | Ford Motor Co Research & Dev Center | 10200602 | 68.67 | 2.60E-04 | 0.0179 | 8E-10 | 5.493E-08 |
| B6237 | Ypsilanti Comm. Utilities Authority | 10200602 | 2.31 | 2.60E-04 | 0.0006 | 8E-10 | 1.851E-09 |
| B6420 | E.B. Eddy Paper Inc. | 10200602 | 85.36 | 2.60E-04 | 0.0222 | 8E-10 | 6.829E-08 |
| B6420 | E.B. Eddy Paper Inc. | 10300603 | 4.21 | 2.60E-04 | 0.0011 | 8E-10 | 3.368E-09 |
| B6519 | Albemarle Corporation | 10200602 | 17.82 | 2.60E-04 | 0.0046 | 8E-10 | 1.426E-08 |
| B6569 | Henkel Corporation | 10200602 | 32.02 | 2.60E-04 | 0.0083 | 8E-10 | 2.561E-08 |
| B6619 | Tiara Yachts Division of S2 Yachts | 10300603 | 54.98 | 2.60E-04 | 0.0143 | 8E-10 | 4.398E-08 |
| B6620 | Coldwater Veneer | 10300603 | 0.20 | 2.60E-04 | 0.0001 | 8E-10 | 1.600E-10 |
| B6633 | American Axle & Manufacturing, Inc. | 10200602 | 93.51 | 2.60E-04 | 0.0243 | 8E-10 | 7.481E-08 |
| B7038 | Continental Dairy Facilities, LLC | 10200602 | 300.00 | 2.60E-04 | 0.0780 | 8E-10 | 2.400E-07 |
| B7061 | Gerdau Macsteel Monroe | 10200602 | 383.47 | 2.60E-04 | 0.0997 | 8E-10 | 3.068E-07 |
| B7090 | Michigan Milk Producers Association | 10200602 | 268.53 | 2.60E-04 | 0.0698 | 8E-10 | 2.148E-07 |
| B7192 | Verso Quinnesec, LLC | 10200601 | 306.34 | 2.60E-04 | 0.0797 | 8E-10 | 2.451E-07 |
| B7192 | Verso Quinnesec, LLC | 10200602 | 67.21 | 2.60E-04 | 0.0175 | 8E-10 | 5.377E-08 |
| B7198 | ANR Pipeline-Cold Sprngs12 /Blue Lk/Cold Springs 1 | 10300603 | 36.97 | 2.60E-04 | 0.0096 | 8E-10 | 2.958E-08 |
| B7227 | General Motors LLC - Orion Assembly | 10200601 | 157.13 | 2.60E-04 | 0.0409 | 8E-10 | 1.257E-07 |
| B7227 | General Motors LLC - Orion Assembly | 10200602 | 17.70 | 2.60E-04 | 0.0046 | 8E-10 | 1.416E-08 |
| B7244 | JBS Plainwell, Inc. | 10200602 | 208.20 | 2.60E-04 | 0.0541 | 8E-10 | 1.666E-07 |

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| B7248 | FCA US LLC Sterling Heights Assembly Plant | 10100602 | 772.08 | 2.60E-04 | 0.2007 | 8E-10 | 6.177E-07 |
| B7248 | FCA US LLC Sterling Heights Assembly Plant | 10200602 | 424.48 | 2.60E-04 | 0.1104 | 8E-10 | 3.396E-07 |
| B7248 | FCA US LLC Sterling Heights Assembly Plant | 10300602 | 12.57 | 2.60E-04 | 0.0033 | 8E-10 | 1.006E-08 |
| B7248 | FCA US LLC Sterling Heights Assembly Plant | 10300603 | 39.48 | 2.60E-04 | 0.0103 | 8E-10 | 3.158E-08 |
| B7276 | L Perrigo Co. | 10200602 | 99.85 | 2.60E-04 | 0.0260 | 8E-10 | 7.988E-08 |
| B8573 | Great Lakes Gas Trans Station #11 (TransCanada #11 | 10300603 | 3.01 | 2.60E-04 | 0.0008 | 8E-10 | 2.408E-09 |
| B8704 | Michigan Turkey Producers Co-Op Inc. | 10300603 | 71.97 | 2.60E-04 | 0.0187 | 8E-10 | 5.758E-08 |
| B8707 | Springs Window Fashions, LLC | 10200602 | 0.39 | 2.60E-04 | 0.0001 | 8E-10 | 3.106E-10 |
| B8863 | Adm Grain Company | 10200602 | 11.66 | 2.60E-04 | 0.0030 | 8E-10 | 9.328E-09 |
| B9080 | Envirosolids, LLC | 10300603 | 0.05 | 2.60E-04 | 0.0000 | 8E-10 | 4.184E-11 |
| C5704 | Lakeland Medical Center (Former Memorial Hospital) | 10300602 | 9.59 | 2.60E-04 | 0.0025 | 8E-10 | 7.671E-09 |
| C5728 | Andrews University | 10300602 | 152.10 | 2.60E-04 | 0.0396 | 8E-10 | 1.217E-07 |
| D3598 | Hurley Medical Center | 10300602 | 179.81 | 2.60E-04 | 0.0468 | 8E-10 | 1.438E-07 |
| D6394 | Mid-Michigan Medical Center - Gratiot | 10300603 | 71.90 | 2.60E-04 | 0.0187 | 8E-10 | 5.752E-08 |
| D8065 | Dart Container Corporation of Michigan | 10200602 | 193.91 | 2.60E-04 | 0.0504 | 8E-10 | 1.551E-07 |
| E4437 | Northwest Hardwoods | 10200602 | 22.20 | 2.60E-04 | 0.0058 | 8E-10 | 1.776E-08 |
| E4569 | Arkema, Inc. | 10200602 | 45.16 | 2.60E-04 | 0.0117 | 8E-10 | 3.613E-08 |
| E5094 | Hutchinson Antivibration Systems, Inc. | 10200602 | 39.08 | 2.60E-04 | 0.0102 | 8E-10 | 3.126E-08 |
| F3254 | Selfridge Air National Guard Base | 10300603 | 145.50 | 2.60E-04 | 0.0378 | 8E-10 | 1.164E-07 |
| G5066 | St Joseph Mercy Hospital | 10300602 | 163.87 | 2.60E-04 | 0.0426 | 8E-10 | 1.311E-07 |
| G5067 | William Beaumont Hospital | 10300602 | 513.90 | 2.60E-04 | 0.1336 | 8E-10 | 4.111E-07 |
| G5067 | William Beaumont Hospital | 10300603 | 23.90 | 2.60E-04 | 0.0062 | 8E-10 | 1.912E-08 |
| G5252 | Oakland Co. Service Center - Central Steam Plant | 10300602 | 139.30 | 2.60E-04 | 0.0362 | 8E-10 | 1.114E-07 |
| G7126 | Grand Valley State University | 10300602 | 140.98 | 2.60E-04 | 0.0367 | 8E-10 | 1.128E-07 |
| H5265 | Edwards Brothers, Inc. | 10300603 | 13.18 | 2.60E-04 | 0.0034 | 8E-10 | 1.054E-08 |
| H5877 | Eastern MI University | 10300601 | 233.93 | 2.60E-04 | 0.0608 | 8E-10 | 1.871E-07 |
| H5877 | Eastern MI University | 10300602 | 37.39 | 2.60E-04 | 0.0097 | 8E-10 | 2.991E-08 |
| J4912 | Oakwood Hospital | 10300602 | 189.00 | 2.60E-04 | 0.0491 | 8E-10 | 1.512E-07 |
| K1260 | Oakwood Healthcare Annapolis | 10100602 | 64.00 | 2.60E-04 | 0.0166 | 8E-10 | 5.120E-08 |
| K1271 | Henry Ford Hospital | 10300602 | 431.00 | 2.60E-04 | 0.1121 | 8E-10 | 3.448E-07 |
| K1283 | Oakwood Southshore Medical Center | 10300602 | 52.17 | 2.60E-04 | 0.0136 | 8E-10 | 4.174E-08 |
| K2087 | Lakeland Correctional Facility | 10300602 | 128.93 | 2.60E-04 | 0.0335 | 8E-10 | 1.031E-07 |
| K2131 | Western Michigan University | 10300602 | 299.41 | 2.60E-04 | 0.0779 | 8E-10 | 2.395E-07 |
| K2155 | Ferris State University | 10300602 | 298.83 | 2.60E-04 | 0.0777 | 8E-10 | 2.391E-07 |
| K2460 | Central Michigan University | 10300601 | 307.22 | 2.60E-04 | 0.0799 | 8E-10 | 2.458E-07 |
| K2460 | Central Michigan University | 10300602 | 107.82 | 2.60E-04 | 0.0280 | 8E-10 | 8.626E-08 |
| K2688 | B.O.P. Federal Correctional Institute | 10300602 | 110.90 | 2.60E-04 | 0.0288 | 8E-10 | 8.872E-08 |
| K2729 | Botsford Hospital | 10300602 | 112.77 | 2.60E-04 | 0.0293 | 8E-10 | 9.021E-08 |
| K3249 | Michigan State University | 10200602 | 21.50 | 2.60E-04 | 0.0056 | 8E-10 | 1.720E-08 |
| K3249 | Michigan State University | 10300601 | 4454.36 | 2.60E-04 | 1.1581 | 8E-10 | 3.563E-06 |
| K3249 | Michigan State University | 10300603 | 25.32 | 2.60E-04 | 0.0066 | 8E-10 | 2.026E-08 |
| K5375 | University MI Dearborn | 10300602 | 87.70 | 2.60E-04 | 0.0228 | 8E-10 | 7.016E-08 |
| K5375 | University MI Dearborn | 10300603 | 42.60 | 2.60E-04 | 0.0111 | 8E-10 | 3.408E-08 |
| L0550 | Calvin College | 10300602 | 98.70 | 2.60E-04 | 0.0257 | 8E-10 | 7.896E-08 |
| M0037 | Mercy Health | 10300602 | 66.01 | 2.60E-04 | 0.0172 | 8E-10 | 5.281E-08 |
| M0239 | Wayne State University | 10300602 | 687.61 | 2.60E-04 | 0.1788 | 8E-10 | 5.501E-07 |
| M0239 | Wayne State University | 10300603 | 24.46 | 2.60E-04 | 0.0064 | 8E-10 | 1.957E-08 |
| M0675 | University of Michigan | 10200602 | 206.15 | 2.60E-04 | 0.0536 | 8E-10 | 1.649E-07 |
| M0675 | University of Michigan | 10300601 | 2215.07 | 2.60E-04 | 0.5760 | 8E-10 | 1.772E-06 |
| M0675 | University of Michigan | 10300602 | 130.87 | 2.60E-04 | 0.0340 | 8E-10 | 1.047E-07 |
| M0675 | University of Michigan | 10300603 | 522.69 | 2.60E-04 | 0.1359 | 8E-10 | 4.182E-07 |
| M1812 | St John Hospital & Medical Center | 10300602 | 84.09 | 2.60E-04 | 0.0219 | 8E-10 | 6.727E-08 |
| M1952 | St Mary's Of Michigan | 10300602 | 94.60 | 2.60E-04 | 0.0246 | 8E-10 | 7.568E-08 |
| M1954 | Covenant Health Care | 10300602 | 300.00 | 2.60E-04 | 0.0780 | 8E-10 | 2.400E-07 |
| M1967 | St. John Providence Hospital | 10300602 | 145.51 | 2.60E-04 | 0.0378 | 8E-10 | 1.164E-07 |
| M1968 | Pontiac Osteopathic Hospital | 10300602 | 59.68 | 2.60E-04 | 0.0155 | 8E-10 | 4.774E-08 |
| M2032 | Spectrum Health-Butterworth Campus | 10300602 | 274.13 | 2.60E-04 | 0.0713 | 8E-10 | 2.193E-07 |

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| M3431 | St Joseph Mercy Hospital | 10300602 | 237.90 | 2.60E-04 | 0.0619 | 8E-10 | 1.903E-07 |
| M3641 | University of Michigan Flint | 10300602 | 95.46 | 2.60E-04 | 0.0248 | 8E-10 | 7.637E-08 |
| M3641 | University of Michigan Flint | 10300603 | 14.86 | 2.60E-04 | 0.0039 | 8E-10 | 1.189E-08 |
| M3653 | V A Medical Center | 10300602 | 134.99 | 2.60E-04 | 0.0351 | 8E-10 | 1.080E-07 |
| M3792 | Northern Michigan University | 10300602 | 156.21 | 2.60E-04 | 0.0406 | 8E-10 | 1.250E-07 |
| M3912 | Adm Grain Company | 10200602 | 34.29 | 2.60E-04 | 0.0089 | 8E-10 | 2.743E-08 |
| M4086 | Toyota Technical Center USA | 10300603 | 4.16 | 2.60E-04 | 0.0011 | 8E-10 | 3.328E-09 |
| M4153 | Hope College | 10300602 | 148.71 | 2.60E-04 | 0.0387 | 8E-10 | 1.190E-07 |
| M4174 | Detroit Metropolitan Wayne County Airport | 10300602 | 339.98 | 2.60E-04 | 0.0884 | 8E-10 | 2.720E-07 |
| M4175 | Ford Motor Co | 10300602 | 155.55 | 2.60E-04 | 0.0404 | 8E-10 | 1.244E-07 |
| M4199 | General Motors Hamtramck | 10200602 | 155.73 | 2.60E-04 | 0.0405 | 8E-10 | 1.246E-07 |
| M4204 | Zeeland Farm Services, Inc. | 10300602 | 112.56 | 2.60E-04 | 0.0293 | 8E-10 | 9.004E-08 |
| M4232 | Huron Valley - Sinai Hospital | 10200602 | 58.90 | 2.60E-04 | 0.0153 | 8E-10 | 4.712E-08 |
| M4347 | Praxair, Inc. | 10200602 | 97.26 | 2.60E-04 | 0.0253 | 8E-10 | 7.781E-08 |
| M4547 | Fritz Products | 10200602 | 67.18 | 2.60E-04 | 0.0175 | 8E-10 | 5.374E-08 |
| M4732 | Amcane Sugar LLC | 10200602 | 171.91 | 2.60E-04 | 0.0447 | 8E-10 | 1.375E-07 |
| M4752 | John D Dingell VA Medical Center | 10300602 | 228.63 | 2.60E-04 | 0.0594 | 8E-10 | 1.829E-07 |
| M4764 | Ford Motor Co Elm Street Boiler House | 10200601 | 730.61 | 2.60E-04 | 0.1900 | 8E-10 | 5.845E-07 |
| M4764 | Ford Motor Co Elm Street Boiler House | 10200602 | 618.34 | 2.60E-04 | 0.1608 | 8E-10 | 4.947E-07 |
| M4768 | Flat Rock Metal Inc. | 10200602 | 92.90 | 2.60E-04 | 0.0242 | 8E-10 | 7.432E-08 |
| M4772 | Wayne Co Comm College Western | 10300603 | 6.20 | 2.60E-04 | 0.0016 | 8E-10 | 4.960E-09 |
| M4773 | Wayne Co Comm College Downriver | 10300603 | 14.40 | 2.60E-04 | 0.0037 | 8E-10 | 1.152E-08 |
| M4774 | Wayne Co Comm College Eastern | 10300603 | 14.60 | 2.60E-04 | 0.0038 | 8E-10 | 1.168E-08 |
| M4833 | Wayne Co Comm College Northwest | 10300603 | 0.00 | 2.60E-04 | 0.0000 | 8E-10 | 0.000E+00 |
| N0547 | Kruger Commodities | 10200602 | 272.32 | 2.60E-04 | 0.0708 | 8E-10 | 2.179E-07 |
| N0677 | Steelcase Inc.- Kentwood Complex | 10200602 | 7.71 | 2.60E-04 | 0.0020 | 8E-10 | 6.168E-09 |
| N0677 | Steelcase Inc.- Kentwood Complex | 10300602 | 102.00 | 2.60E-04 | 0.0265 | 8E-10 | 8.160E-08 |
| N0731 | Nortru, LLC | 10300603 | 0.86 | 2.60E-04 | 0.0002 | 8E-10 | 6.873E-10 |
| N0842 | Gage Products Company | 10200602 | 48.00 | 2.60E-04 | 0.0125 | 8E-10 | 3.840E-08 |
| N0923 | Ventra Ionia Main, LLC | 10200602 | 97.82 | 2.60E-04 | 0.0254 | 8E-10 | 7.826E-08 |
| N1192 | Denso Manufacturing Michigan, Inc. | 10200602 | 6.65 | 2.60E-04 | 0.0017 | 8E-10 | 5.322E-09 |
| N1237 | Georgia Pacific Chemicals LLC | 10200602 | 20.70 | 2.60E-04 | 0.0054 | 8E-10 | 1.656E-08 |
| N1280 | Flint Hills Resources Marysville, LLC | 10300602 | 115.97 | 2.60E-04 | 0.0302 | 8E-10 | 9.278E-08 |
| N1336 | BASF Corporation | 10200602 | 39.80 | 2.60E-04 | 0.0104 | 8E-10 | 3.184E-08 |
| N1436 | FCA US Technology Center | 10200602 | 485.10 | 2.60E-04 | 0.1261 | 8E-10 | 3.881E-07 |
| N1461 | Welch Foods Inc. | 10200602 | 165.79 | 2.60E-04 | 0.0431 | 8E-10 | 1.326E-07 |
| N1604 | Kent County Waste to Energy Facility | 10300602 | 18.33 | 2.60E-04 | 0.0048 | 8E-10 | 1.466E-08 |
| N1622 | Pollard (U.S.) Ltd. | 10200602 | 45.30 | 2.60E-04 | 0.0118 | 8E-10 | 3.624E-08 |
| N1701 | Morbark Inc. | 10200602 | 51.80 | 2.60E-04 | 0.0135 | 8E-10 | 4.144E-08 |
| N1781 | Magna Mirrors Corporation | 10300603 | 90.30 | 2.60E-04 | 0.0235 | 8E-10 | 7.224E-08 |
| N1784 | Ada Cogeneration Limited Partnership | 10100602 | 241.21 | 2.60E-04 | 0.0627 | 8E-10 | 1.930E-07 |
| N1794 | Atlas Eps, A Division of Atlas Roofing Corp. | 10200602 | 0.93 | 2.60E-04 | 0.0002 | 8E-10 | 7.440E-10 |
| N1966 | Michigan Automotive Compressor Inc. | 10300603 | 197.13 | 2.60E-04 | 0.0513 | 8E-10 | 1.577E-07 |
| N2155 | FCA US LLC - Jefferson North Assembly Plant | 10200602 | 152.24 | 2.60E-04 | 0.0396 | 8E-10 | 1.218E-07 |
| N2432 | A G Simpson (USA), Inc. | 10100602 | 19.78 | 2.60E-04 | 0.0051 | 8E-10 | 1.582E-08 |
| N2614 | NBHX Trim USA Corporation | 10200602 | 34.45 | 2.60E-04 | 0.0090 | 8E-10 | 2.756E-08 |
| N2915 | Toyota Motor Engineering And Manufacturing | 10300603 | 47.60 | 2.60E-04 | 0.0124 | 8E-10 | 3.808E-08 |
| N2954 | Cargill Salt - Hersey | 10200602 | 148.40 | 2.60E-04 | 0.0386 | 8E-10 | 1.187E-07 |
| N3225 | Kent Career Technical Center | 10300602 | 27.50 | 2.60E-04 | 0.0072 | 8E-10 | 2.200E-08 |
| N3417 | Lymtal International, Inc. | 10200601 | 5.38 | 2.60E-04 | 0.0014 | 8E-10 | 4.304E-09 |
| N3422 | Oakland University | 10300602 | 246.84 | 2.60E-04 | 0.0642 | 8E-10 | 1.975E-07 |
| N3519 | Zoetis P&U LLC | 10200602 | 0.00 | 2.60E-04 | 0.0000 | 8E-10 | 0.000E+00 |
| N3519 | Zoetis P&U LLC | 10300602 | 38.65 | 2.60E-04 | 0.0101 | 8E-10 | 3.092E-08 |
| N3655 | Bronson Battle Creek | 10300602 | 79.58 | 2.60E-04 | 0.0207 | 8E-10 | 6.367E-08 |
| N3929 | Resolute Forest Products - Menominee | 10200601 | 569.57 | 2.60E-04 | 0.1481 | 8E-10 | 4.557E-07 |
| N3987 | William Beaumont Hospital | 10300602 | 110.90 | 2.60E-04 | 0.0288 | 8E-10 | 8.872E-08 |
| N4975 | Michigan Power Limited Partnership | 10200601 | 14.78 | 2.60E-04 | 0.0038 | 8E-10 | 1.182E-08 |
| N5056 | Magna Mirrors Corporation - Newaygo | 10300603 | 19.30 | 2.60E-04 | 0.0050 | 8E-10 | 1.544E-08 |
| N5226 | Quincy Street, Inc. | 10200602 | 31.00 | 2.60E-04 | 0.0081 | 8E-10 | 2.480E-08 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| N5575 | ANR Pipeline Company - Bridgman Compressor Station | 10300603 | 16.67 | 2.60E-04 | 0.0043 | 8E-10 | 1.334E-08 |
| N5688 | Perrigo Holland, Inc. | 10200602 | 93.92 | 2.60E-04 | 0.0244 | 8E-10 | 7.514E-08 |
| N5747 | Pioneer Metal Finishing Industrial Hwy | 10300603 | 94.32 | 2.60E-04 | 0.0245 | 8E-10 | 7.545E-08 |
| N5767 | Tweddle Group | 10300602 | 25.40 | 2.60E-04 | 0.0066 | 8E-10 | 2.032E-08 |
| N5797 | Boar's Head Provisions Co., Inc. | 10300602 | 153.59 | 2.60E-04 | 0.0399 | 8E-10 | 1.229E-07 |
| N5866 | Metal Technologies, Inc., Ravenna Ductile Iron | 10200602 | 80.61 | 2.60E-04 | 0.0210 | 8E-10 | 6.449E-08 |
| N5930 | Delta College | 10300602 | 73.98 | 2.60E-04 | 0.0192 | 8E-10 | 5.918E-08 |
| N5930 | Delta College | 10300603 | 0.00 | 2.60E-04 | 0.0000 | 8E-10 | 0.000E+00 |
| N6013 | Continental Aluminum | 10200602 | 119.80 | 2.60E-04 | 0.0311 | 8E-10 | 9.584E-08 |
| N6016 | Genesys Regional Medical Center | 10300602 | 133.77 | 2.60E-04 | 0.0348 | 8E-10 | 1.070E-07 |
| N6358 | Detroit Thermal Henry Heating Plant | 10300602 | 2.13 | 2.60E-04 | 0.0006 | 8E-10 | 1.704E-09 |
| N6388 | Pioneer Metal Finishing - Stephens Road | 10200602 | 28.06 | 2.60E-04 | 0.0073 | 8E-10 | 2.245E-08 |
| N6577 | ND Industries, Inc. | 10300603 | 7.70 | 2.60E-04 | 0.0020 | 8E-10 | 6.160E-09 |
| N6631 | Dearborn Industrial Generation | 10200601 | 67.06 | 2.60E-04 | 0.0174 | 8E-10 | 5.365E-08 |
| N6726 | Heat Treating Services Corp. - Plant 3 | 10200602 | 207.12 | 2.60E-04 | 0.0538 | 8E-10 | 1.657E-07 |
| N6734 | Heritage-Crystal Clean, LLC | 10200602 | 2.21 | 2.60E-04 | 0.0006 | 8E-10 | 1.766E-09 |
| N6767 | New Covert Generating Company, LLC | 10200602 | 21.14 | 2.60E-04 | 0.0055 | 8E-10 | 1.691E-08 |
| N6866 | Georgia Pacific Corrugated LLC III | 10200602 | 75.97 | 2.60E-04 | 0.0198 | 8E-10 | 6.078E-08 |
| N6950 | General Motors LLC-Lansing Delta Township | 10200602 | 148.01 | 2.60E-04 | 0.0385 | 8E-10 | 1.184E-07 |
| N6976 | Huntington Foam LLC | 10200602 | 56.02 | 2.60E-04 | 0.0146 | 8E-10 | 4.482E-08 |
| N6980 | WMU Energy Resource Center | 10300602 | 52.90 | 2.60E-04 | 0.0138 | 8E-10 | 4.232E-08 |
| N6996 | Michigan Ethanol D/B/A Poet Biorefining - Caro | 10200602 | 1520.10 | 2.60E-04 | 0.3952 | 8E-10 | 1.216E-06 |
| N7096 | Heat Treating Services Corp. Of America - Plant 1 | 10200602 | 171.69 | 2.60E-04 | 0.0446 | 8E-10 | 1.374E-07 |
| N7132 | Sun Gro Horticulture | 10100602 | 63.00 | 2.60E-04 | 0.0164 | 8E-10 | 5.040E-08 |
| N7289 | Sonoco Protective Solutions, Inc. | 10200602 | 243.72 | 2.60E-04 | 0.0634 | 8E-10 | 1.950E-07 |
| N7303 | Bluewater Gas Storage Facility | 10200602 | 0.77 | 2.60E-04 | 0.0002 | 8E-10 | 6.160E-10 |
| N7349 | Metro Health Hospital | 10300602 | 97.94 | 2.60E-04 | 0.0255 | 8E-10 | 7.835E-08 |
| N7383 | Green Plains Holdings II LLC | 10200602 | 1095.10 | 2.60E-04 | 0.2847 | 8E-10 | 8.761E-07 |
| N7411 | SMR Automotive Systems USA, Inc. | 10300603 | 14.49 | 2.60E-04 | 0.0038 | 8E-10 | 1.159E-08 |
| N7493 | Marysville Ethanol, LLC | 10200601 | 1429.00 | 2.60E-04 | 0.3715 | 8E-10 | 1.143E-06 |
| N7809 | Adept Plastic Finishing | 10200602 | 38.45 | 2.60E-04 | 0.0100 | 8E-10 | 3.076E-08 |
| N8192 | Request Foods, Inc. | 10200602 | 121.80 | 2.60E-04 | 0.0317 | 8E-10 | 9.744E-08 |
| N8265 | Hearthside Food Solutions LLC | 10300603 | 20.89 | 2.60E-04 | 0.0054 | 8E-10 | 1.671E-08 |
| N8270 | Hearthside Food Solutions | 10300603 | 21.08 | 2.60E-04 | 0.0055 | 8E-10 | 1.686E-08 |
| N8273 | Providence Park Hospital | 10300602 | 86.13 | 2.60E-04 | 0.0224 | 8E-10 | 6.890E-08 |
| P0024 | A123 Systems | 10200602 | 0.12 | 2.60E-04 | 0.0000 | 8E-10 | 9.680E-11 |
| P0087 | Lg Chem Michigan Inc. | 10200602 | 65.40 | 2.60E-04 | 0.0170 | 8E-10 | 5.232E-08 |
| P0243 | Beaumont Information Technology Center | 10300603 | 1.94 | 2.60E-04 | 0.0005 | 8E-10 | 1.552E-09 |
| P0336 | Henry Ford West Bloomfield Hospital | 10300602 | 185.22 | 2.60E-04 | 0.0482 | 8E-10 | 1.482E-07 |
| P0448 | Postle Aluminum | 10200602 | 76.80 | 2.60E-04 | 0.0200 | 8E-10 | 6.144E-08 |
| P0468 | Newberry Correctional Facility | 10300602 | 605.34 | 2.60E-04 | 0.1574 | 8E-10 | 4.843E-07 |
| P0517 | Mastronardi Produce | 10200602 | 286.65 | 2.60E-04 | 0.0745 | 8E-10 | 2.293E-07 |
| TOTAL | | | | | 17.7718 | | 5.520E-05 |

*Stationary Internal Combustion Engines*

Stationary internal combustion engine emissions were calculated similarly to industrial/commercial boilers that combust natural gas. The EPRI factor produced a statewide estimate of 9.88E-06 lbs, compared to the MAERS estimate, which produced an estimate of 107.08 lbs using the USEPA factor.

The following sources of natural gas combustion were included in the estimate:

Table 15. Stationary Internal Combustion Engines, Natural Gas

| SRN | Facility Name | SCC | Natural gas in MMCF | Emission factor in Lb/MMCF | MAERS Emission Estimates in Lbs | EPRI Emission Factor in Lb/MMCF | EPRI-based Emission Estimates in Lbs |
|---|---|---|---|---|---|---|---|
| A1641 | General Motors Lansing Grand River Assembly | 20200202 | 0.00 | 1.193E-02 | 0.00 | 8.00E-10 | 1.60E-12 |
| A3567 | Ford Motor Company - Sterling Plant | 20200202 | 0.08 | 1.193E-02 | 0.00 | 8.00E-10 | 6.40E-11 |
| A5858 | Mead Johnson & Company, LLC | 20200202 | 0.00 | 1.193E-02 | 0.00 | 8.00E-10 | 7.69E-14 |
| A8638 | Detroit Diesel Corporation | 20200202 | 0.00 | 1.193E-02 | 0.00 | 8.00E-10 | 0.00E+00 |
| A8645 | Ford Motor Co./Livonia Transmission | 20200202 | 0.08 | 1.193E-02 | 0.00 | 8.00E-10 | 6.57E-11 |
| A8648 | Ford Motor Co. Rouge Complex | 20200202 | 0.04 | 1.193E-02 | 0.00 | 8.00E-10 | 3.36E-11 |
| A9831 | Marathon Petroleum Company LP | 20200202 | 0.00 | 1.193E-02 | 0.00 | 8.00E-10 | 0.00E+00 |
| B1771 | Ford Motor Company - Van Dyke Plant | 20200202 | 0.12 | 1.193E-02 | 0.00 | 8.00E-10 | 9.86E-11 |
| B2942 | Consumers Energy Gaylord Combustion Turbine Plant | 20100201 | 201.15 | 6.763E-03 | 1.36 | 8.00E-10 | 1.61E-07 |
| B3350 | FCA Us LLC – Trenton Engine Complex | 20200202 | 0.28 | 1.193E-02 | 0.00 | 8.00E-10 | 2.25E-10 |
| B3721 | ANR Pipeline - Reed City Compressor Station | 20200202 | 92.07 | 1.193E-02 | 1.10 | 8.00E-10 | 7.37E-08 |
| B4032 | General Motors LLC - Pontiac North Campus | 20200202 | 0.01 | 1.193E-02 | 0.00 | 8.00E-10 | 8.00E-12 |
| B4049 | GM Technical Center | 20200202 | 0.00 | 1.193E-02 | 0.00 | 8.00E-10 | 0.00E+00 |
| B4282 | Marysville Hydrocarbons, LLC | 20200201 | 2.63 | 6.763E-03 | 0.02 | 8.00E-10 | 2.10E-09 |
| B4292 | Merit Energy Co. - Kalkaska Gas Plant | 20100201 | 477.85 | 6.763E-03 | 3.23 | 8.00E-10 | 3.82E-07 |
| B4292 | Merit Energy Co. - Kalkaska Gas Plant | 20200201 | 36.85 | 6.763E-03 | 0.25 | 8.00E-10 | 2.95E-08 |
| B4942 | Dow Agrosciences, LLC | 20200201 | 700.00 | 6.763E-03 | 4.73 | 8.00E-10 | 5.60E-07 |
| B5421 | Vandyke Generating Plant | 20200201 | 8.09 | 6.763E-03 | 0.05 | 8.00E-10 | 6.47E-09 |
| B6001 | Herman Miller, Inc. | 20200202 | 0.03 | 1.193E-02 | 0.00 | 8.00E-10 | 2.16E-11 |
| B6230 | Ford Motor Co Research & Dev. Center | 20200202 | 0.27 | 1.193E-02 | 0.00 | 8.00E-10 | 2.19E-10 |
| B6481 | Mid-Michigan Gas Storage Co - Capac | 20200202 | 0.00 | 1.193E-02 | 0.00 | 8.00E-10 | 0.00E+00 |
| B6508 | Village of Clinton | 20200202 | 0.04 | 1.193E-02 | 0.00 | 8.00E-10 | 2.80E-11 |
| B6636 | Consumers Energy - Ray Compressor Station | 20200201 | 76.52 | 6.763E-03 | 0.52 | 8.00E-10 | 6.12E-08 |
| B6637 | Consumers Energy - St. Clair Compressor Station | 20200201 | 87.45 | 6.763E-03 | 0.59 | 8.00E-10 | 7.00E-08 |
| B7196 | ANR Storage Co. - Excelsior Compressor Station | 20200202 | 142.40 | 1.193E-02 | 1.70 | 8.00E-10 | 1.14E-07 |
| B7197 | ANR -- Rapid River Compressor Station | 20200202 | 166.01 | 1.193E-02 | 1.98 | 8.00E-10 | 1.33E-07 |
| B7198 | ANR Pipeline-Cold Sprngs12/Blue Lk/Cold Springs 1 | 20200202 | 706.53 | 1.193E-02 | 8.43 | 8.00E-10 | 5.65E-07 |
| B7219 | ANR Pipeline Co. South Chester Compressor Station | 20200202 | 165.46 | 1.193E-02 | 1.97 | 8.00E-10 | 1.32E-07 |
| B7220 | ANR Pipeline Co - Woolfolk Compressor Station | 20200202 | 641.36 | 1.193E-02 | 7.65 | 8.00E-10 | 5.13E-07 |
| B7390 | ANR Pipeline - Central Charlton Compressor Station | 20200202 | 59.51 | 1.193E-02 | 0.71 | 8.00E-10 | 4.76E-08 |
| B8337 | ANR Pipeline Co.-Muttonville Compressor Station | 20200202 | 53.60 | 1.193E-02 | 0.64 | 8.00E-10 | 4.29E-08 |
| B8573 | Great Lakes Gas Trans Station #11 (TransCanada #11) | 20200201 | 226.60 | 6.763E-03 | 1.53 | 8.00E-10 | 1.81E-07 |
| B8573 | Great Lakes Gas Trans Station #11 (TransCanada #11) | 20200202 | 0.01 | 1.193E-02 | 0.00 | 8.00E-10 | 8.00E-12 |
| M4085 | FCA US LLC - Mack Avenue Engine Plant | 20200202 | 0.00 | 1.193E-02 | 0.00 | 8.00E-10 | 2.40E-12 |
| M4780 | Roush Industries | 20200202 | 3.22 | 1.193E-02 | 0.04 | 8.00E-10 | 2.58E-09 |
| N1652 | West Branch Production Gathering & Compressor Stat | 20200202 | 21.10 | 1.193E-02 | 0.25 | 8.00E-10 | 1.69E-08 |
| N1685 | TES Filer City Station | 20200202 | 0.06 | 1.193E-02 | 0.00 | 8.00E-10 | 4.56E-11 |
| N2168 | Great Lakes Gas Transmission Station #7 | 20200201 | 12.16 | 6.763E-03 | 0.08 | 8.00E-10 | 9.73E-09 |
| N2168 | Great Lakes Gas Transmission Station #7 | 20200202 | 0.01 | 1.193E-02 | 0.00 | 8.00E-10 | 8.00E-12 |
| N2901 | Consumers Energy - Muskegon River Compressor Station | 20200201 | 54.66 | 6.763E-03 | 0.37 | 8.00E-10 | 4.37E-08 |
| N2954 | Cargill Salt - Hersey | 20200201 | 483.40 | 6.763E-03 | 3.27 | 8.00E-10 | 3.87E-07 |
| N3022 | Eaton Rapids Gas Storage System | 20200202 | 130.12 | 1.193E-02 | 1.55 | 8.00E-10 | 1.04E-07 |
| N3391 | DTE Gas Company - Washington 10 Compressor Station | 20200202 | 684.09 | 1.193E-02 | 8.16 | 8.00E-10 | 5.47E-07 |
| N3392 | DTE Gas Company-Taggart Compressor Station | 20200202 | 473.42 | 1.193E-02 | 5.65 | 8.00E-10 | 3.79E-07 |
| N3758 | Great Lakes Gas Transmission Station #10 | 20200201 | 222.24 | 6.763E-03 | 1.50 | 8.00E-10 | 1.78E-07 |
| N3758 | Great Lakes Gas Transmission Station #10 | 20200202 | 0.01 | 1.193E-02 | 0.00 | 8.00E-10 | 8.00E-12 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| N3759 | Great Lakes Gas Transmission Station #9 | 20200201 | 12.88 | 6.763E-03 | 0.09 | 8.00E-10 | 1.03E-08 |
| N3759 | Great Lakes Gas Transmission Station #9 | 20200202 | 0.01 | 1.193E-02 | 0.00 | 8.00E-10 | 8.00E-12 |
| N3760 | Great Lakes Gas Transmission Station #8 | 20200201 | 775.58 | 6.763E-03 | 5.25 | 8.00E-10 | 6.20E-07 |
| N3760 | Great Lakes Gas Transmission Station #8 | 20200202 | 0.03 | 1.193E-02 | 0.00 | 8.00E-10 | 2.40E-11 |
| N3818 | Great Lakes Gas Transmission Station #13 | 20200201 | 120.79 | 6.763E-03 | 0.82 | 8.00E-10 | 9.66E-08 |
| N5574 | ANR Pipeline Company - Hamilton Compressor Station | 20200201 | 844.33 | 6.763E-03 | 5.71 | 8.00E-10 | 6.75E-07 |
| N5574 | ANR Pipeline Company - Hamilton Compressor Station | 20200202 | 6.39 | 1.193E-02 | 0.08 | 8.00E-10 | 5.11E-09 |
| N5575 | ANR Pipeline Company - Bridgman Compressor Station | 20200201 | 119.43 | 6.763E-03 | 0.81 | 8.00E-10 | 9.55E-08 |
| N5575 | ANR Pipeline Company - Bridgman Compressor Station | 20200202 | 473.66 | 1.193E-02 | 5.65 | 8.00E-10 | 3.79E-07 |
| N5576 | ANR Pipeline Co. - Goodwell Compressor Station | 20200201 | 150.50 | 6.763E-03 | 1.02 | 8.00E-10 | 1.20E-07 |
| N5576 | ANR Pipeline Co. - Goodwell Compressor Station | 20200202 | 0.07 | 1.193E-02 | 0.00 | 8.00E-10 | 5.60E-11 |
| N5578 | ANR Pipeline Co. - Winfield Compressor Station | 20200202 | 21.23 | 1.193E-02 | 0.25 | 8.00E-10 | 1.70E-08 |
| N5581 | Great Lakes Gas - Farwell Compressor Station 12 | 20200201 | 51.48 | 6.763E-03 | 0.35 | 8.00E-10 | 4.12E-08 |
| N5581 | Great Lakes Gas - Farwell Compressor Station 12 | 20200202 | 214.55 | 1.193E-02 | 2.56 | 8.00E-10 | 1.72E-07 |
| N5586 | ANR Pipeline Company Lincoln Compressor Station | 20200202 | 147.89 | 1.193E-02 | 1.76 | 8.00E-10 | 1.18E-07 |
| N5798 | Core Energy, LLC., Chester 10 CO2 Recovery | 20200202 | 168.00 | 1.193E-02 | 2.00 | 8.00E-10 | 1.34E-07 |
| N6242 | HRF Exploration & Production - Walking Buck | 20200202 | 73.20 | 1.193E-02 | 0.87 | 8.00E-10 | 5.86E-08 |
| N6266 | Federal Mogul Powertrain Inc. | 20200202 | 0.74 | 1.193E-02 | 0.01 | 8.00E-10 | 5.90E-10 |
| N6512 | Westside Gas Producers, LLC | 20200202 | 103.60 | 1.193E-02 | 1.24 | 8.00E-10 | 8.29E-08 |
| N6833 | Wolverine Power, Gaylord Generating Station | 20100201 | 207.07 | 6.763E-03 | 1.40 | 8.00E-10 | 1.66E-07 |
| N6838 | Vector Pipeline L.P., Highland Compressor Station | 20200201 | 1077.35 | 6.763E-03 | 7.29 | 8.00E-10 | 8.62E-07 |
| N6950 | General Motors, LLC - Lansing Delta Township | 20200202 | 0.08 | 1.193E-02 | 0.00 | 8.00E-10 | 6.72E-11 |
| N7113 | Michigan Public Power Agency | 20100201 | 222.00 | 6.763E-03 | 1.50 | 8.00E-10 | 1.78E-07 |
| N7624 | Vector Pipeline L.P. | 20200201 | 915.29 | 6.763E-03 | 6.19 | 8.00E-10 | 7.32E-07 |
| N8151 | Vector Pipeline L.P., Athens Compressor Station | 20200201 | 696.25 | 6.763E-03 | 4.71 | 8.00E-10 | 5.57E-07 |
| P0271 | South Buckeye 127 CPF Gas Plant | 20200202 | 14.20 | 1.193E-02 | 0.17 | 8.00E-10 | 1.14E-08 |
| TOTAL | | | | | 107.08 | | 9.88E-06 |

### *Wood Combustion*

*Electric Utilities*

Mercury emissions from wood-fired electric utilities were estimated using data from MAERS as part of Michigan's submittal to the USEPA's 2014 NEI v2 (EGLE, 2020). Wood consumption, or throughput, is expressed in tons.

A mercury emission factor was not available for the source classification code (SCC) selected by Genesee Power for reporting of wood and wood waste combusted in their boiler. Accordingly, an emission rate factor obtained from their July 2016 stack testing (Bureau Veritas North America Inc., 2016) was used by the AQD with hourly activity data from MAERS to create an estimate (McGeen, 2020).

Wood-fired electric utilities included in the estimate:

Table 16. Electric Utilities, Wood Combustion

| SRN | Facility Name | SCC | Factor in Lb/Ton | Wood in Tons | Estimated Emissions in Lbs |
|---|---|---|---|---|---|
| B1966 | White Pine Electric Power LLC | 10200905 | 5.15E-06 | 1.00 | 0.00 |
| B4260 | L'Anse Warden Electric Company LLC | 10100903 | 3.64E-05 | 121325.00 | 1.77 |
| N0890 | Viking Energy of Lincoln, LLC | 10100902 | 3.64E-05 | 180356.00 | 0.00 |
| N1160 | Viking Energy of McBain | 10300902 | 5.15E-06 | 161935.00 | 0.83 |
| N1266 | Hillman Power Co. | 10100902 | 3.64E-05 | 284565.00 | 10.36 |
| N1395 | Cadillac Renewable Energy Facility | 10100902 | 3.64E-05 | 317238.81 | 11.55 |
| N2388 | Grayling Generating Station Limited Partnership | 10100902 | 3.64E-05 | 337121.00 | 12.27 |
| N3570 | Genesee Power Station Limited Partnership | 10100911 | 1.50e-04 lb/hour | 8208 hours | 1.23 |
| TOTAL | | | | | 38.01 |

*Industrial/Commercial*

Point source estimates such as those for industrial and commercial combustion of wood were collected from MAERS (EGLE, 2020). These point source estimates were generated as part of Michigan's submittal to USEPA's 2014 NEI v2.

Facilities included in the estimate:

Table 17. Industrial Commercial, Wood Combustion

| SRN | Facility Name | SCC | Wood in Tons | Emission Factor in Lbs | Estimated Emissions in Lbs |
|---|---|---|---|---|---|
| A0749 | Ameriwood Industries | 10300903 | 1638.00 | 3.64E-05 | 0.06 |
| A0884 | Escanaba Paper Company | 10200902 | 532371.00 | 3.395E-05 | 18.07 |
| A0999 | Michigan Maple Block Co. | 10200906 | 2466.00 | 5.15E-06 | 0.01 |
| A5937 | Howard Miller Company | 10200906 | 813.44 | 5.15E-06 | 0.00 |
| B1476 | Decorative Panels International, Inc. | 10200901 | 35669.00 | 3.15E-05 | 0.45 |
| B1476 | Decorative Panels International, Inc. | 10200902 | 18038.00 | 3.395E-05 | 0.24 |
| B6001 | Herman Miller, Inc. | 10200907 | 5474.00 | 5.15E-06 | 0.03 |
| B6620 | Coldwater Veneer | 10300903 | 1300.00 | 3.64E-05 | 0.05 |
| B7099 | Connor Aga Sports Flooring LLC | 10200905 | 4234.80 | 5.15E-06 | 0.02 |
| B7192 | Verso Quinnesec, LLC | 10200902 | 519799.00 | 3.395E-05 | 17.65 |
| B8603 | Jeld-Wen Interior Door - Grand Rapids | 10300903 | 0.00 | 3.64E-05 | 0.00 |
| B8707 | Springs Window Fashions, LLC | 10200905 | 907.13 | 5.15E-06 | 0.00 |
| E4437 | Northwest Hardwoods | 10200906 | 4109.00 | 5.15E-06 | 0.02 |
| K2460 | Central Michigan University | 10300903 | 38.00 | 3.64E-05 | 0.00 |
| N0780 | Louisiana-Pacific Corp. Newberry Plant | 10200905 | 15107.00 | 5.15E-06 | 0.08 |
| N1271 | Fiber Char Corp. | 10200910 | 201.00 | | 0.12 |
| N1315 | Louisiana-Pacific Corp Sagola Plant | 10200904 | 18547.00 | 5.15E-06 | 0.10 |
| N2206 | Banks Hardwoods, Inc. | 10200906 | 8721.00 | 5.15E-06 | 0.04 |
| N2454 | Wolverine Hardwoods Inc. | 10100903 | 950.00 | 3.64E-05 | 0.03 |
| N5940 | Potlatch Land & Lumber LLC | 10200905 | 39565.00 | 5.15E-06 | 0.20 |
| TOTAL | | | | | 37.19 |

*Residential*

For residential wood combustion, the USEPA's estimate of mercury emissions from the 2014 NEI v2 was utilized. The USEPA calculated that 7.20 lbs of mercury was emitted from residential wood burning in Michigan. This estimate is based on inputs and emission factors included in the USEPA's Residential Wood Combustion Tool; an Access database designed for estimating pollutants from the residential wood sector. The sector includes estimates for freestanding woodstoves (USEPA certified catalytic and non-catalytic, and non-certified), inserts (USEPA certified catalytic and non-catalytic, and non-certified), fireplaces burning cordwood, indoors wood furnaces, outdoor hydronic heaters, wood pellet stoves, and miscellaneous woodburning devices not elsewhere classified.

### *Tire-Derived Fuel Combustion*

Several facilities utilized tire-derived fuel (TDF) to fire their boilers. Viking Energy of Lincoln, LLC (N0890) is the only facility to have reported a mercury value to MAERS based on their stack testing in 2010, which did not detect any amount of mercury (EGLE, 2020). The other values are default MAERS estimates based on a USEPA emission factor.

Table 18. TDF Boilers

| SRN | Facility Name | Emission Unit ID | SCC | Emission factor in Lb/Ton | Estimated Emissions in Lbs | Tire-Derived Fuel in Tons |
|---|---|---|---|---|---|---|
| B2132 | Wyandotte Department of Municipal Power Plant | EU0037 | 10101201 | 3.86E-03 | 41.16 | 10651.04 |
| B6611 | Michigan South Central Power Agency | EU0003 | 10101201 | 3.86E-03 | 36.89 | 9548.00 |
| N0890 | Viking Energy of Lincoln, LLC | EU0003 | 10101201 | Non-detect | 0.00 | 11140.00 |
| N1160 | Viking Energy of McBain | EU0003 | 10101201 | 3.86E-03 | 44.29 | 11461.00 |
| N1685 | TES Filer City Station | RG0017 | 10101201 | 3.86E-03 | 102.07 | 26414.50 |
| N2388 | Grayling Generating Station Limited Partnership | EU0008 | 10101201 | 3.86E-03 | 22.45 | 5811.00 |
| N3570 | Genesee Power Station Limited Partnership | EU0009 | 10101201 | 3.86E-03 | 12.55 | 3247.00 |
| B4260 | L'Anse Warden Electric Company LLC | EU0009 | 10201201 | 3.86E-03 | 41.97 | 10861.00 |
| TOTAL | | | | | 301.37 | |

### *Petroleum Refining*

Marathon Ashland Petroleum (A9831), the only petroleum refinery in the state, emitted 34.22 lbs of mercury in 2014 according to data gathered from MAERS as part of Michigan's submittal to the USEPA's 2014 NEI v2 (EGLE, 2020).

Table 19. Petroleum Refining

| SRN | Facility Name | SCC | Process Gas in MMCF | Emission factor in Lb/MMCF | Estimated Emissions in Lbs |
|---|---|---|---|---|---|
| A9831 | Marathon Petroleum Company LP | 30600106 | 12535.390 | 2.73E-03 | 34.22 |

### *Residential LPG (Propane) Combustion*

Residential fuel combustion estimates were generated as part of Michigan's submittal to the USEPA's 2014 NEI v2. For residential Liquefied Petroleum Gas (LPG) or propane combustion, an emission factor of 1.20E-05 lbs/1,000 gallons was selected. This factor was used along with 2014 statewide fuel consumption data from the EIA, USDoE to generate estimated emissions of mercury for 2014 (EGLE, 2020). LPG consumption, or throughput, is expressed in thousands of gallons.

Table 20. Residential Propane Combustion.

| Category | Throughput E3GAL | Emission Factor lb/E3GAL | Lbs Emitted | Year |
|---|---|---|---|---|
| Residential LPG Propane | 432,264.00 | 1.20E-05 | 5.19 | 2014 |

## INCINERATION

### *Sewage Sludge Incineration*

When possible, specific facility information was collected and used to compute emissions. The Battle Creek Wastewater Treatment Plant (WWTP) has two multiple hearth sewage sludge incinerators, which have venturi scrubber, impingement scrubber, quencher, and afterburner controls. Stack testing data from 2014 was referenced in an AQD inspection report of March 5, 2015 (Lane, 2015). A maximum value of 0.086 grams per day was recorded, compared to a permitted emission limit of 10 grams per day. If the facility operated 365 days per year with that emissions rate, the estimated emissions are 0.069 lbs annually (McGeen, 2020).

According to MAERS, 101786.1 tons of biosolids (sewage sludge) were incinerated at the Detroit Wastewater Treatment Plant in 2014. Using an emission factor derived from a 2012 stack test at the facility, 109.93 lbs of mercury were likely released to the air in 2014 (McGeen, 2020).

The Flint Water Pollution Control Plant has an afterburner, venturi and impingement tray scrubber and mist eliminator controls. The 2014 NEI v2 contained the original MAERS default mercury calculation of 12.65 lbs which was based on an uncontrolled emission factor. Subsequently, when a tiered emission estimator was implemented in MAERS that applied controlled HAP emission factors to calculations where there was an appropriate match for SCC, pollutant and reported control technology, a controlled MAERS default mercury estimate of 0.03 lbs was created. Recent stack testing data was not available; therefore, stack tests from 2001 and 2014 MAERS hourly operating data were also used by ERAU staff to prepare an emissions estimate of 5.77 lbs (McGeen, 2020). This results in a range of estimates in which the stack test-based estimate may be the most appropriate for the facility, although the age of the stack test should be considered when evaluating the representativeness of the calculation. The facility ceased operation of the incinerators on March 10, 2016, due to pending compliance requirements of 40 CFR Part 60 Subpart MMMM, Emission Guidelines and Compliance Times for Existing Sewage Sludge Incineration Units, which were due to take effect on March 30, 2016. The permits were subsequently voided and the building, which once housed the incinerators, has been repurposed for sludge dewatering, as verified by AQD field staff in 2017 (EGLE, 2020).

Emissions in 2014 from the Ypsilanti Community Utilities Authority (YCUA) were reported at 0.87 lbs / yr in the annual MAERS reporting (EGLE, 2020). This was based on stack testing conducted at the facility on December 6, 2011. The new incinerator is a fluidized bed incinerator with venturi and impingement scrubbers, wet electrostatic precipitator, and carbon adsorption.

The East Lansing POTW shut down its incinerator in 2002; therefore, it was not included in this inventory. The Trenton WWTP removed its incinerator in 2003 and it was also not included. The Ann Arbor WWTP incinerator ceased operations and the permit was voided in 2006. The Port Huron WWTP removed its incinerator by 2010 as verified during an inspection by AQD district staff (EGLE, 2020).

The following sewage sludge incinerators were included in the calculation:

Table 21. Sewage Sludge Incinerators

| SRN | Facility Name | SCC | Sludge in Tons | MAERS Estimates (2014 NEI v2 estimates) in Lbs | Emission Basis | ERAU calculations based on stack tests | Best Estimate in Lbs |
|---|---|---|---|---|---|---|---|
| B1598 | Flint Water Pollution Control Facility | 50100515 | 2750.00 | 12.65 | MAERS EF | 5.77 | 5.77 |
| B1792 | Warren Wastewater Treatment Plant | 50100515 | 4981.00 | 22.91 | MAERS EF | | 22.91 |
| B1950 | Pontiac Wastewater Treatment Plant | 50100515 | 0.00 | 0.00 | MAERS EF | | 0.00 |
| B6237 | Ypsilanti Community Utilities Authority | 50100516 | 5144.00 | 0.87 | Stack Test | | 0.87 |
| B6307 | City of Battle Creek Wastewater Treatment Plant | 50100515 | 3097.20 | 14.25 | MAERS EF | 0.07 | 0.07 |
| B2103 | Detroit Wastewater Treatment Plant | 50200506 | 101786.10 | NA | NA | 109.93 | 109.93 |
| TOTAL | | | | 50.68 | | | 139.55 |

Trends for Mercury in Michigan Biosolids (EGLE, 2020).

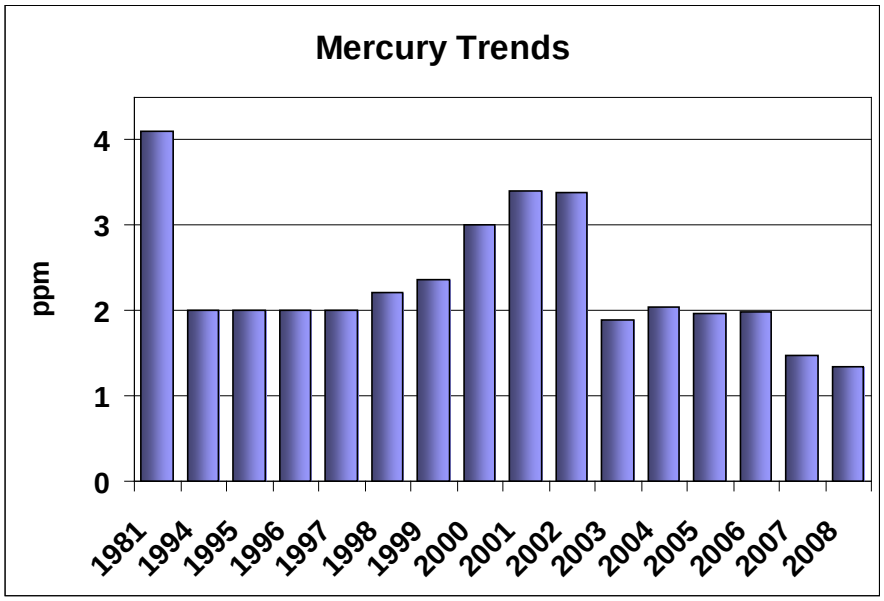
Table 22. Hg Concentrations in Biosolids, 2002-2008

| Year | Hg Concentrations in Biosolids mg/kg |
|---|---|
| 2002 | 3.39 |
| 2003 | 1.9 |
| 2004 | 2.0 |
| 2005 | 1.96 |
| 2006 | 1.99 |
| 2007 | 1.48 |
| 2008 | 1.35 |
| 2009 | 1.63 |
| 2010 | 1.83 |
| 2011 | 2.01 |
| 2012 | 1.61 |
| 2013 | 1.54 |
| 2014 | 1.54 |

In an email on February 19, 2014, Michael Person indicated, "… please note that this is the average concentration in land applied biosolids not sewage sludge that is incinerated. It is probably fairly close, but I do not have the Hg concentration of incineration only facilities."

Pre-2008 trends in biosolids are shown below, as documented by the MDEQ's Water Bureau (MDEQ, 2009).

Table 23. Mercury Concentration Trends in Biosolids, 1981-2008




***Municipal Waste Incineration***

Two municipal waste combustors were operating in Michigan in 2014.

Kent County Waste-to-Energy submitted facility-verified estimates of 2.00 lbs of mercury to MAERS for the 2014 operating year based on stack testing (EGLE, 2020).

The Jackson County Waste-to-Energy facility (N1125) ceased operations in 2013 and the Renewable Operating Permit was voided in 2014 (EGLE, 2020). Accordingly, estimates have not been prepared for this facility.

Detroit Renewable Power, LLC (formerly Greater Detroit Resource Recovery Facility) conducted stack testing in 2014 (EGLE, 2020). Subsequent to the release of the 2014 NEI v2, ERAU staff utilized the 2014 stack testing rate to develop an estimate of 15.44 lbs of mercury emissions for the facility. The facility was shut down on March 26, 2019, and the facility boilers have not operated on refuse-derived fuel since that date (Zynda, 2020).

Table 24. Municipal Waste Incineration

| SRN | Facility Name | Refuse in Tons | Factor Value | Factor Numerator and Denominator | Comments | Estimated Emissions in Lbs |
|---|---|---|---|---|---|---|
| N1604 | Kent County Waste-to-Energy Facility | 180930 | 5.60E-03 | Lb/Ton | Reported by facility based on stack test. | 2.00 |
| M4148 | Detroit Renewable Power, LLC | 805730 | 5.50E-03 | Lb/Hour | Stack-test based ERAU calculation entered into MAERS, subsequent to NEI reporting | 15.44 |
| TOTAL | | | | | | 17.44 |

### *Hazardous Waste Incineration*

One facility operates a hazardous waste incinerator in Michigan: Dow Chemical (A4033). In 2003, Dow began operating a new incinerator, the 32 Incinerator, to replace the existing 830 Building and 703 Building Incinerators. Based on stack testing conducted on the 32 Incinerator in 2009, for Dow's 32 Incinerator HWC MACT Notification of Compliance and Comprehensive Performance Test, less than 1.59E-04 pounds of mercury per hour were emitted from this facility under test conditions designed to simulate extreme operating parameters. Based on the continuous year-round operating schedule reported to MAERS in 2014, this extrapolates to annual emissions of 1.39 lbs of mercury. Actual emissions were likely less as the performance test simulates adverse rather than routine operating conditions. The most recent stack testing for the Incinerator HWC MACT Notification of Compliance and Comprehensive Performance Test was in November 2019. Based on those results, year-round emissions of 0.53 lbs were estimated (McGeen, 2020).

Table 25. Hazardous Waste Incineration

| SRN | Facility Name | Emission Factor in Lb/Hour | Estimate in Lbs | Comments |
|---|---|---|---|---|
| A4033 | Dow Chemical | 1.59E-04 | 1.39 | Based on 2009 stack test |
| A4033 | Dow Chemical | 6.05E-05 | 0.53 | Based on 2019 stack test |

### *Hospital Medical Infectious Waste Incineration*

There is not currently any medical waste incineration facility operating in Michigan. City Medical Waste (M4139) in Hamtramck was a hospital medical infectious waste incinerator, which stopped operating on July 28, 2008. This was per the date of a court order, which required the company to cease operation of the facility (McLemore, 2010). The ROP was voided on December 15, 2008 (Foy, 2010).

### *Human Cremation (Point Source)*

One university reported the combustion of human remains in 2014.

A range of estimates is presented. While the emission factor developed in the Takaoka study is much lower than the other available factors, it is based on a study of crematories in Japan. The emission factors prepared for different age groups by the Bay Area Air Quality Management District (BAAQMD) in California are higher but may reflect differences in dental care in the United States. The emission factors from BAAQMD, which were utilized by the USEPA in development of the 2014 NEI v2 stationary nonpoint emission estimates for cremation, are considered more likely to be representative of cremation in the United States.

Age distribution for human cremations at the universities was not known. The BAAQMD emission factor for the age group with the highest quantity of mercury amalgams, 55-64 years old, was selected to develop the most conservative estimate.

Table 26. Human Cremation, Point Sources

| Facility Name | Emission Unit Name | Description | SCC | MAERS Default Estimates in Lbs | Human Cremation Based on Takaoka Emission Factor[1] | Human Cremation Estimate Based on BAAQMD Emission Factor[2] | Best Estimate in Lbs |
|---|---|---|---|---|---|---|---|
| Wayne State University | EUINCINERATORFG | Emission Unit covers all 3 Incinerators (2 at Scott Hall & 1 at Mott) in FGINCIN of PTI No. 80-06. A combined throughput has been entered for all units. | 50200505 | 0.01387 | 2.61E-07 | 0.69 | 0.69 |

[1] Factor of 1.38E-08 lb/ton obtained from study “Mercury emission from crematories in Japan” (Takaoka, Oshita, Takeda and Morisawa, 2010).
[2] Since age group of human cremations is not known, the factor of 3.65E-02 lb/ton for the age group with the highest number of mercury amalgams, and highest mercury content, is utilized for the most conservative estimate.

### *Animal Cremations*

Two incinerators at Michigan State University, identified in MAERS as EUCREMATORY and EUDCPAHINC01, were used for cremation of small animals, and animals tested for tuberculosis, respectively (McGeen, Daniel, 2020). No human remains are cremated at MSU although it would be permissible at EUDCPAHINC01 under the facility's Renewable Operating Permit. A third incinerator, EUFLRINC01, has been moved to the pathological waste incinerator category as it is not used for cremations. Instead, it incinerates animal waste and bedding, wood infested by emerald ash borers, pharmaceuticals, and low-level radioactive waste.

Three facilities, which cremate animal remains, were removed from the annual MAERS reporting requirement after 2005 but still conduct cremations, therefore estimates were made using 2005 throughout values as surrogates.

For estimation of mercury from animal cremations, a 2012 emission factor prepared by Reindl was used. This emission factor is based on a study of mercury emissions from blood and tissues (but not teeth) from humans. In the absence of cremation emission factors specific to animals this factor is used as a surrogate. It is likely to be more representative of animal cremations than factors based on cremation of humans with mercury dental amalgams, due to the absence of amalgams in animals (McGeen, 2021).

Table 27. Animal Cremation, Point Sources

| SRN | Facility Name | Emission Unit Name | Description | MAERS Default Estimates in Lbs | Animal Cremation Estimate Based on Reindl Emission Factor[3] | Best Estimate in Lbs |
|---|---|---|---|---|---|---|
| K3249 | Michigan State University | EUDCPAHINC01 | ASC design incinerator located at new DCPAH facility on Bennett Rd. Gas fired with 1200 lb/hr capacity at 1800 F and 1 second retention time in secondary chamber. | 0.29830 | 0.61 | 0.61 |
| K3249 | Michigan State University | EUCREMATORY | Small animal crematorium located at DCPAH | 0.00254 | 0.005 | 0.005 |
| N6543 | Monroe County Animal Control | EU00001 | Animal Crematory Incinerator | NA | 0.002 | 0.002 |
| N7158 | Rainbow Bridge | EU002 | Animal Crematory Incinerator | NA | 0.004 | 0.004 |
| N6494 | Union Lake Veterinary Hospital | EU00001 | Animal Crematory Incinerator | NA | 0.041 | 0.041 |
| TOTALS | | | | 3.01E-01 | 0.66 | 0.66 |

### *Pathological Waste Incineration*

Zoetis P&U LLC (N3519), a medical research and development facility, is estimated to have emitted 0.005762 lbs of mercury in 2014 from the disposal of pathological waste in their pathological waste incinerator. This is based on the use of a WebFIRE emission factor by the MAERS emission estimator.

The waste incinerator at Michigan State University, which operates under the emission unit EUFLRINC, was identified as a pathological waste incinerator. Per AQD district staff, this incinerator does not incinerate human or animal remains. It incinerates animal waste and bedding, wood from trees infested with the emerald ash borer, pharmaceuticals, and low-level radioactive waste (McGeen, Daniel, 2020).

Table 28. Pathological Waste Incineration

| SRN | Facility Name | Throughput tons | Emission Factor lb / ton | Source of Factor | Lbs Emitted | EI Year |
|---|---|---|---|---|---|---|
| N3519 | Zoetis P&U LLC | 7.85 | 7.34E-04 | MAERS | 0.00576 | 2014 |
| K3249 | Michigan State University | 113.04 | 7.34E-04 | MAERS | 0.08297 | 2014 |
| TOTAL | | | | | 0.08873 | |

## INDUSTRIAL SOURCES

### *Cement Manufacturing*

There are two cement manufacturing facilities in Michigan: Lafarge, and St. Marys Cement. Throughput values for all of the facilities were obtained from EI Toolkit. Lafarge's own 2014 estimate of mercury from their cement manufacturing facility was 115.16 lbs, as reported to MAERS. Speciation data for kiln emissions, and raw materials grinding and drying was obtained from a 2007 report prepared for the company (Advanced Environmental Management Group, 2007).

Table 29. Lafarge Cement Manufacturing

| B1477 (Lafarge) processes, for 2014 | Hg in lbs | Particulate Divalent Speciation Factor | Gaseous Divalent Speciation Factor | Elemental Gaseous Speciation Factor | Hg(p) in lbs | RGM in lbs | Hg(0) in lbs |
|---|---|---|---|---|---|---|---|
| Kiln 19 | 43.51 | 0.01 | 0.85 | 0.14 | 0.44 | 36.98 | 6.09 |
| EU Clinker 19 | 0.08 | 0.01 | 0.85 | 0.14 | 0.00 | 0.07 | 0.01 |
| Kiln 20 | 22.88 | 0.01 | 0.85 | 0.14 | 0.23 | 19.45 | 3.20 |
| EU Clinker 20 | 0.09 | 0.01 | 0.85 | 0.14 | 0.00 | 0.08 | 0.01 |
| Kiln 21 | 35.02 | 0.01 | 0.85 | 0.14 | 0.35 | 29.77 | 4.90 |
| EU Clinker 21 | 0.08 | 0.01 | 0.85 | 0.14 | 0.00 | 0.07 | 0.01 |
| Kiln 22 | 4.27 | 0.01 | 0.91 | 0.08 | 0.04 | 3.89 | 0.34 |
| EU Clinker 22 | 1.59 | 0.01 | 0.91 | 0.08 | 0.02 | 1.45 | 0.13 |
| Kiln 23 | 4.77 | 0.01 | 0.91 | 0.08 | 0.05 | 4.34 | 0.38 |
| EU Clinker 23 | 2.81 | 0.01 | 0.91 | 0.08 | 0.03 | 2.56 | 0.22 |
| Raw Material Grinding and Drying | 0.06 | 0.17 | 0.38 | 0.45 | 0.01 | 0.02 | 0.03 |
| TOTAL | 115.16 | | | | 1.16 | 98.66 | 15.33 |

A facility-submitted MAERS value was not available for St. Marys Cement. Accordingly, 2010 stack testing data and 2014 hourly operating data was used by the AQD's Emissions Reporting and Assessment Unit (ERAU), to estimate emissions of mercury at 3.15 lbs (McGeen, 2020). For comparison, the 2014 TRI value of 26.76 lbs has also been included in the report. A total of 184.09 lbs of mercury was estimated from cement manufacturing in Michigan in 2014.

The following cement manufacturing facilities were included in the inventory:

Table 30. Cement Manufacturing

| SRN | Facility | Throughput in Tons | TRI Data in Lbs | MAERS Estimate in Lbs | Stack Test-Based Estimate in Lbs | Source for Best Estimate | Lbs Hg Emitted, Best Estimate |
|---|---|---|---|---|---|---|---|
| B1477 | Lafarge | 7,594,409 | 149.00 | 115.13 | | Facility reported value in MAERS, 2014 | 115.13 |
| B1559 | St. Marys Cement | 1,032,745 | 26.76 | 227.20 | 3.15 | 2010 stack test | 3.15 |
| TOTAL | | | | | | | 118.28 |

### *Taconite Processing*

Michigan has two taconite processing plants, Empire and Tilden, located in the Marquette Range of the Upper Peninsula. Cleveland-Cliffs is the owner of both Tilden and Empire.

Tilden processes both hematite and magnetite. A 2002 stack test for Tilden (B4885) found it emitted 71.83 lbs/yr of mercury based on reported continuous operation of 8,760 hours (Tilden, 2002). More recent stack testing is not available for mercury. Based on the 2002 factor and the 2014 operating schedule for coal-fired and gas-fired pellet production from Tilden, an estimate of 37.95 lbs was created for 2014.

Empire (B1827) only produces taconite from magnetite. Based on an emission factor of 3.54E-06 lb of mercury per long ton of coal-fired pellets made (3.161E-06 lb/ton) from Jiang (1999), and a greatly diminished 2014 production value of 726 tons from coal firing, 0.002 lbs of mercury was likely emitted from Empire for 2014. Taconite in the amount of 2.94 million tons was reported for the gas-fired processes at Empire but there is not an emission factor or stack test for these processes at the facility. Therefore, any associated mercury emissions have not been quantified. Total estimated mercury emissions from taconite processing amount to 37.95 lbs.

### *Dental Amalgam Manufacturing*

In 2014 there was one dental amalgam manufacturer in Michigan, Kerr Industries (B2658). Based on the average mercury concentration inside the building and the ventilation rate of the building, one can estimate that less than four pounds of mercury are emitted from this facility every year. Lumex RA915+ monitoring inside the building yielded an estimated average mercury concentration of approximately 500 ng/$m^3$ for the entire building, which has a volume of 44,309 $m^3$ and has nine air exchanges per hour (MDEQ, 2009).

### *Lime Manufacturing*

Throughput values for facilities with lime kilns were obtained using MAERS. These throughputs were multiplied by an emission factor to estimate mercury emissions. The emission factor of $1.2 \times 10^{-4}$ lbs of mercury per ton of lime produced corresponds to facilities that manufacture lime (Pilgrim, 1998). The emission factor from WebFIRE for lime kilns used by the paper manufacturing industry ($2.90 \times 10^{-7}$ lbs of mercury per ton of lime produced) was used to estimate emissions from Escanaba Paper Company and Verso Paper – Quinnesec. Using the WebFIRE and Pilgrim emission factors, and USEPA's augmentation of the 2014 NEI v2, it is estimated that 23.86 lbs of mercury was emitted to the air in 2014 from lime manufacturing kilns (McGeen, 2020).

The following lime kilns were included in the calculation:

Table 31. Lime Manufacturing

| SRN | Facility | Lime or Unbleached Pulp in Tons[1] | WebFIRE and Pilgrim Emission Factors[2] | Mercury Estimates in Lbs | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | MAERS Default | ERAU Calculation | 2014 TRI Data[3] | EPA Augmentation of 2014 NEI v2 | Best Estimate in Lbs |
| A0884 | Escanaba Paper Co. | 104,655.00 | 2.90E-07 | 0.02 | 0.03 | 37.82 | | 0.03 |
| A3900 | Martin Marietta Magnesia Specialties, LLC | 153,333.00 | 1.20E-04 | 0.98 | 18.40 | | | 18.4 |
| B2169 | Carmeuse Lime, Inc., River Rouge | 300,095.00 | | | | 3.46 | 2.06 | 2.06 |
| B7192 | Verso Paper - Quinnesec | 496,606.00 | 2.90E-07 | 0.14 | 0.14 | | | 0.14 |
| N7362 | Graymont Western Lime, Inc. | 213,492.00 | | | | 3.23 | 3.23 | 3.23 |
| | TOTAL | 1,268,181.00 | | | | | | 23.86 |

[1] For Escanaba Paper Co. and Verso Paper - Quinnesec, throughput was reported in tons of unbleached paper.

[2] 1.2E-04 lb/ton of lime from Pilgrim, 1998; 2.9E-07 lb/ton of unbleached pulp from WebFIRE

[3] The majority of the A0884 TRI estimate is likely from their coal-fired boiler rather than lime manufacturing; emissions from boiler are already accounted for under fuel combustion.

### *Phosphate Mills*

Michigan does not have any phosphate mills. Based on a query of the SCCs involving phosphates, superphosphates, and ammonium phosphates, the only facility in MAERS associated with the use of phosphates is B1989, Agrium Advanced Technologies (US), Inc. (EGLE, 2020). This facility's North American Industry Classification System code of 325314 indicates "Fertilizer (Mixing Only) Manufacturing."

### *Brick Manufacturing*

Hanson Brick (A6497) in Corunna, emitted 0.68 lbs from its two gas-fired kilns in 2014, based on the facility reported throughput and the application of a standard USEPA emission factor by the MAERS emission estimator (EGLE, 2020).

Table 32. Brick Manufacturing

| SRN | Facility | Throughput tons | Emission Factor | Lbs Emitted | Year |
|---|---|---|---|---|---|
| A6497 | Hanson Brick | 0 | 7.50E-06 | 0 | 2014 |
| A6497 | Hanson Brick | 90113 | 7.50E-06 | 0.68 | 2014 |
| | TOTAL | | | 0.68 | 2014 |

### *Coke Production*

Michigan has one coke battery, EES Coke Battery, LLC (P0408). This facility was formerly part of US Steel (A7809) on Zug Island, River Rouge, until it was permitted as a separate stationary source (P0408). In a permit application submitted in June 2014, EES Coke estimated a maximum emission rate for mercury of 0.006 lb/hr (Brunner, 2014). Accordingly, a maximum annual estimate of 52.56 lbs has been estimated by the AQD (McGeen, 2014). More recent stack test data is not available.

### *Medical Waste Autoclave*

There were no medical waste autoclaves operating in Michigan in 2014. There were two medical waste autoclaves referenced in the 2005 mercury report. One was Michigan Waste Services (M4139) in Grand Blanc. This facility, which utilized a medical waste incinerator as well as the autoclave, is no longer operating. The source ceased operations on July 28, 2008, per the date of a court order, which required the company to cease operation of the facility (McLemore, 2010). The other medical waste autoclave was Agility (N7568), in Kentwood. This facility was later known as Stericycle, Inc. The source started operation on October 7, 2004, and closed in 2010 (Charley, 2010).

## PRODUCTION OF METALS

Primary Metal production refers to metal created from ore, whereas secondary metal production refers to the production of alloys from ingots and the recovery of metal from scrap and salvage (USEPA, 1986). Metal production that uses scrap is of more concern for mercury emissions, because of the wide application of mercury-containing convenience light switches and antilock brake switches used in vehicles until 2003 (End-of Life Vehicles Solutions Corporation, 2014).

### *BOFs in Primary Metal Production (Steel Manufacturing)*

Basic Oxygen Furnaces (BOFs) are used to make steel from molten metal and scrap. The input material is typically 70 percent molten pig iron and 30 percent scrap (Grinstern, 2010). The input material is refined by injecting high-purity oxygen into the furnace; the oxygen reacts with carbon and other impurities in the metal to remove them from the metal. Basic oxygen process steelmaking is executed in large, refractory-lined, pear-shaped furnaces (USEPA,1986).

There are two facilities in Michigan that make steel using the basic oxygen process: Cleveland-Cliffs Steel Corporation Dearborn Works (formerly AK Steel – Dearborn Works, known in 2014 as Severstal and before that as Rouge Steel) (A8640), and US Steel Great Lakes Works (A7809). For 2014 operations, Severstal reported 51.10 lbs of mercury emissions to the USEPA's TRI. TRI data for 2014 indicates that US Steel emitted 86.1 lbs of mercury. In total, it is estimated that facilities engaged in steelmaking via the Blast/BOF process emitted 137.2 lbs of mercury to the atmosphere in 2014.

Table 33. Steel Manufacturing

| SRN | Facility | Comments | Estimated Emissions in Lbs |
|---|---|---|---|
| A8640 | Severstal (formerly River Rouge) | 2014 TRI | 51.1 |
| A7809 | US Steel Great Lakes Works | 2014 TRI | 86.1 |
| TOTAL | | | 137.2 |

### *Electric Arc Furnaces (EAFs) in Primary Metal Production (Steel Manufacturing)*

Electric arc furnaces are the most common type of furnace used for the electric production of steel. EAFs are capable of melting small amounts of iron scrap, pig iron, and direct reduced iron, but primarily melt scrap (Energy International, 2005). According to the AP-42 Compilation of Emission Factors, about 57% of total steel produced in the United States comes from EAFs in operations called minimills (USEPA, 2010). Minimills use 100% scrap charge (Metals Advisor).

Gerdau MacSteel Jackson (B4306) in Jackson, MI conducted stack testing in May 2014. Based on the stack test emission factor of 4.00-03 lb/hr, and the 2014 operating schedule of 6,000 hours reported to MAERS, 24.00 lbs are estimated for this facility (McGeen, 2020).

Gerdau MacSteel Monroe (B7061) estimated in their 2014 MAERS report that their mercury emissions for the year were 125.8 lbs. This is based on facility stack test data. The ERAU also added a value of 0.03 lbs for emissions of particle bound mercury from the baghouse, based on baghouse dust analysis performed by the facility in 2005. Accordingly, a total estimate of 125.83 lbs of mercury was estimated for Gerdau MacSteel Monroe. These emissions are comprised of elemental and gaseous reactive mercury (McGeen, 2020).

Ervin Amasteel (B1754) conducted stack testing in 2013 on their EAF baghouse exhaust. The emission rate of 3.04E-07 gr/dscf was utilized by the ERAU to estimate annual emissions of 6.16 lbs of mercury from the facility (McGeen, 2020).

Table 34. EAFs

| SRN | Facility Name | SCC | Steel in Tons | Emission Factor | Hrs / yr | Estimated Emissions | Basis |
|---|---|---|---|---|---|---|---|
| B7061 | Gerdau MacSteel Monroe | 30300908 | 592,788.66 | 1.60E-02 lb/hr | 7872 | 125.83 | Facility-reported value |
| B4306 | Gerdau Special Steel North America, Jackson Mill | 30300904 | 287,631.72 | 4.00E-03 lb/hr | 6000 | 24.00 | ERAU estimate based on facility's 2014 stack test |
| B1754 | Ervin Amasteel Division | 30400701 | 91,768.00 | 3.04E-07 gr/dscf | 4112 | 6.16 | ERAU estimate based on facility's 2013 stack test |
| TOTAL | | | | | | 155.96 | |

### *EAFs and Electric Induction Furnaces (EIFs) in Secondary Metal Production (Steel Foundries)*

EAFs and EIFs are used by the steel industry to melt and formulate steel. EAFs are large, welded, cylindrical steel vessels with removable roofs through which three retractable carbon electrodes are lowered; a metal charge is melted by the resistive heating generated from electrical current flowing among the electrodes and through the charge. EAFs are used to produce carbon and alloy steels. The input material to an EAF is typically 100% scrap (USEPA, 1986).

EIFs are cylindrical or cup-shaped vessels that are surrounded by electrical coils. The coils are energized with an alternating current to produce a fluctuating magnetic field that heats the metal charge (USEPA, 1986).

Throughput information for secondary metal production (steel foundries) was obtained from MAERS. An emission factor from *"Toxics in Vehicles: Mercury"* was then applied since WebFIRE was lacking an emission factor for this category (Ecology Center & Great Lakes United, 2001).

Barber Steel Foundry Corporation (B1961) was bankrupt and did not operate for several years, but resumed operations in 2013. Michigan Steel (B1929) and Ancast, Inc. (N7276) closed permanently in 2012 and are therefore not included in the 2014 inventory. Barron Industries, Inc. was removed from the MAERS reporting requirement in 2012. The facility's 2011 reported throughput is used as the basis for an estimate in the absence of more recent information (McGeen, 2021).

Cannon Muskegon Corp. (A4315) was not included for mercury estimates since they do not melt any automotive or common white goods scrap. They only use high quality/purity metals due to the products they produce; therefore, any mercury emitted would have to come from the metal itself as opposed to contamination from mercury switches (Grinstern, 2010).

The following EAFs and EIFs in steel foundries were included in the calculation:

Table 35. EAFs and EIFs

| SRN | Facility Name | Emission Unit Name | Emission Unit Description | SCC | Iron in Tons | Emission factor in lb/ton[1] | Estimated Emissions in Lbs |
|---|---|---|---|---|---|---|---|
| B1961 | Barber Steel Foundry Corp. | EU-MELTING | One 6 ton per hour electric induction furnace. Two permitted 10 ton per hour furnaces not installed during 2014. | 30400705 | 2576.4 | 6.90E-04 | 1.78 |
| B7013 | Huron Casting, Inc. & Blue Diamond Steel Casting | EU-INDUCTION | Induction Furnaces Pourline A. Recirculated | 30400705 | 18286.00 | 6.90E-04 | 12.62 |
| B7357 | Temperform LLC | EUSCRUBBER1 | Melting, pouring and cooling operations equipped with 4 electric induction furnaces, pour station, ladle drying station, heaters and mold spray. This emission unit is controlled by a 40,000 CFM wet scrubber, SV001. | 30400705 | 1212.00 | 6.90E-04 | 0.84 |
| B7870 | Eagle Alloy, Inc. | RG08 | Melting & Pouring Equipment-Eagle Prec. | 30400705 | 1585.87 | 6.90E-04 | 1.09 |
| N2631 | Barron Cast, Inc. | EU-E I Furn | Electric Induction Furnace | 30400705 | 910.00 | 6.90E-04 | 0.63 |
| TOTAL | | | | | | | 16.95 |

[1] Emission factor from "Toxics in Vehicles: Mercury" (Ecology Center & Great Lakes United, 2001).

Table 36. Supporting Data from *Toxics in Vehicles: Mercury*
(Ecology Center & Great Lakes United, 2001)

**Mercury Emission Factors for EAFs (1997-2000 test data)**

| Company | State | Production Capacity Short Tons/year | Estimated Hg Emissions Low Lbs/yr | Estimated Hg Emissions High Lbs/yr | Average Estimated Hg Emissions Lbs/yr | Average Emission Factor | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lbs Hg/ton | Kg Hg/metric ton |
| Marion Steel | OH | 365,000 | 371 | 572 | 514 | 0.0014 | 0.0007 |
| Co-Steel Sayreville | NJ | 750,000 | 24 | 4730 | 597 | 0.00080 | 0.00040 |
| North Star Steel | MN | 465,000[b] | 136 | 136 | 136 | 0.00029 | 0.00011 |
| Co-Steel Raritan | NJ | 800,000 | 129 | 323 | 224 | 0.00028 | 0.00014 |
| Overall average emission factor | | | | | | 0.00069 | 0.00035 |

Note: Except for NSS, estimated mercury emissions are based on actual stack-test data for pounds of mercury emitted per hour times the allowable operating hours per year. NSS mercury emissions are based on actual stack-test data times the annual hours the EAF is under power.

[an] Except for NSS, production capacity data from Iron & Steel Maker, EAF Roundup, May 2000.

[b] Based on estimated 1998 production instead of capacity.

### *Secondary Metal Production (Grey Iron)*

Grey iron is a type of cast iron with 3.5% carbon and is used in industry. Much of the carbon in this type of cast iron separates out as graphite, which gives grey iron its grey appearance (Dictionary.com). This broad grouping includes the following two categories: cupolas in secondary metal production (grey iron), and EAFs and EIFs in secondary metal production (grey iron).

### *Cupolas in Secondary Metal Production (Grey Iron)*

The cupola is a type of furnace used in the iron foundry industry. It uses coke as a fuel and is typically composed of a cylindrical steel shell with a refractory-lined or water-cooled inner wall (USEPA, 1986).

For Grede, LLC. (B1577) and Cadillac Casting, Inc. (B2178), recent stack test data was available and was deemed applicable for use in estimating 2014 emissions based on lack of process equipment changes preceding or following the years in which the testing occurred. A 2010 stack test was used for CWC Textron (B1909) in lieu of a 2017 stack test; due to process modifications that occurred after 2014, the 2010 test results were seen as more likely to be representative of 2014 operating conditions. Accordingly, ERAU staff created mercury estimates for these sources using the emission rates in lbs per ton. Emission rates in lbs per hour were also utilized, where available. The resulting values were several times lower than the MAERS default estimates and the estimates based on the New Jersey or WebFIRE emission factors (McGeen, 2020).

Stack testing data from other cupolas engaged in secondary metal production of grey iron was not available. Where knowledge was available on control information, a controlled factor from WebFIRE was selected. The “New Jersey” emission factor was generated based on stack tests from three facilities between 1993 and 1999 (Ecology Center & Great Lakes United, 2001). Cupolas emitted an estimated 43.58 to 43.76 lbs of mercury in 2014.

The following cupolas engaged in the production of grey iron were included in the inventory:

Table 37. Cupolas - Grey Iron

| SRN | Facility Name | Default Estimates from 2014 NEI v2 in lbs | Iron in Tons | Estimated Emissions from Stack Testing and NEI[1,2,3] | Estimated Emissions from Stack Testing, NJ Emission Factor and Controlled FIRE Factor[4,5] |
|---|---|---|---|---|---|
| A0767 | East Jordan Iron Works, dba EJUSA, Inc. | 61.57 | 176918.00 | 44.23 | 28.13 |
| A3934 | Great Lakes Castings LLC | 17.95 | 54887.81 | 13.72 | 13.72 |
| B1577 | Grede LLC - Iron Mountain | 24.32 | 69877.00 | 1.18 | 1.18 |
| B1909 | CWC Textron | 21.67 | 62281.00 | 9.28E-03 to 2.54E-02 | 9.28E-03 to 2.54E-02 |
| B2178 | Cadillac Casting, Inc. | 51.64 | 148396.00 | 0.54 - 0.70 | 0.54 - 0.70 |
| TOTAL | | 177.15 | | 59.68 - 59.86 | 43.58 - 43.76 |

[1] B1577 stack test on May 8, 2012

[2] B1909 stack test on June 20, 2010

[3] B2178 stack test on October 25, 2016

[4] Emission factor of 2.50E-04 lb/ton from New Jersey study applied to A3934 calculation

[5] Controlled FIRE factor of 1.59E-04 lb/ton applied to A0767 and B1577 calculations

Table 38. Supporting Data from *Toxics in Vehicles: Mercury* (Ecology Center & Great Lakes United, 2001)

**Mercury Emissions from New Jersey Foundries**

| Facility | Permitted Production Capacity (short tons/yr) | Mercury Permit Limit (lbs/yr) | Stack Test Date | Mercury Emissions (lbs/yr) | Average Mercury Emission Factor | |
|---|---|---|---|---|---|---|
| | | | | | (lbs/short ton) | (kg/metric ton) |
| Atlantic States Iron Pipe Co. | 234,000 | 137 | Nov. 1993 | 40 | 0.00032 | 0.000016 |
| | | | Nov. 1999 | 108 | | |
| Griffin Pipe Products | 182,000 | 312 | Sept. 1997 | 10 | 0.000055 | 0.000027 |
| U.S. Pipe and Foundry, Inc. | 262,964 | 80 | Sept. 1997 | 96 | 0.00037 | 0.00018 |
| Average Emission Factor | | | | | 0.00025 | 0.00012 |

Source: Agrawal, Sunila, NJ DEP, October 30, 2000.

### *EAFs and EIFs in Secondary Metal Production (Grey Iron)*

An EAF is a large, welded, cylindrical steel vessel with a removable roof through which three retractable carbon electrodes are lowered and energized, creating arcs that melt metallic charge with their heat. EIFs are cylindrical or cup-shaped vessels that are surrounded by electrical coils, energized to produce an electromagnetic field that heats the metal charge (USEPA, 1986).

Stack testing was not available for EAFs and EIFs involved in the secondary metal production of grey iron. Throughput information was obtained from the EI Toolkit. An emission factor of 2.70E-04 lb/ton was obtained from the Indiana Department of Environmental Management's "Summary of Mercury Emissions from Non-Electric Generating Units" (IDEM, 2004). This emission factor was then compared to the emission factor of 7.20E-05 lb/ton corresponding to grey iron production from WebFIRE to generate a range (McGeen, 2020).

The following EAFs and EIFs engaged in the production of grey iron in 2014 were included in the calculations:

Table 39. EAFs and EIFs - Grey Iron

| SRN | Facility Name | SCC | Iron in Tons | Stack Test Factor in Lb/Hour | Stack Test-Based Estimate in Lbs | Estimate in Lbs per Stack Testing and FIRE Factor | Estimate in Lbs per Stack Testing and IDEM Factor |
|---|---|---|---|---|---|---|---|
| A0171 | Hastings Manufacturing Company | 30400303 | 1370.60 | | | 0.10 | 0.37 |
| B1661 | Pioneer Foundry Co., Inc. | 30400303 | 826.00 | | | 0.06 | 0.22 |
| B1709 | Federal-Mogul Powertrain Systems | 30400303 | 14955.00 | | | 1.08 | 4.04 |
| B1716 | Betz Industries, Inc. | 30400303 | 35786.00 | < 4.969E-05 | 0.11 | 0.11 | 0.11 |
| B1737 | Kent Foundry Co. | 30400303 | 6186.80 | | | 0.45 | 1.67 |
| B2015 | Metal Technologies, Inc. Three Rivers Gray Iron | 30400303 | 175569.00 | | | 12.64 | 47.40 |
| B4538 | Blackmer | 30400303 | 3964.42 | | | 0.29 | 1.07 |
| M4387 | Process Prototype, Inc. | 30400303 | 116.64 | | | 0.01 | 0.03 |
| N5814 | Asama Coldwater Manufacturing, Inc. | 30400303 | 96982.00 | 6.11E-06 | 0.04 | 0.04 | 0.04 |
| N5866 | Metal Technologies, Inc., Ravenna Ductile Iron | 30400303 | 125801.00 | | | 9.06 | 33.97 |
| TOTAL | | | | | | 23.83 | 88.92 |

EAFs and EIFs engaged in the production of grey iron produced between 23.83 and 88.92 lbs of mercury emissions in 2014 (McGeen, 2020).

### *Auto Switches – Shredding of Autos (Point Source)*

Mercury emissions from the shredding of automobiles have a point source component (from permitted facilities) as well as a nonpoint source component from unpermitted facilities.

Table 40. Shredding of Autos

| Category | 2014 Mercury Estimate in Lbs for Michigan | |
|---|---|---|
| | USEPA Mercury Flow Diagram Calculation | 2014 NEI v2 Calculation |
| Point source auto shredding | 18.61 | 18.61 |
| Area source auto shredding | 71.49 | 161.99 |
| Statewide totals: auto shredding | 90.10 | 180.6 |

Using Michigan data about scrapped vehicles, a range of emissions from 32.85 lbs to 180.60 lbs of mercury were emitted statewide to the atmosphere from shredding (McGeen, 2020). It was estimated that a maximum of 18.61 lbs were emitted by point sources per the table below. Estimates were based on the availability of stack test data and permitted hours of operation, or Lumex monitoring.

In the nonpoint source section, the methodology for estimating the nonpoint source component of auto shredding emissions (71.49 lbs to 161.99 lbs) will be presented.

Table 41. Point Source Auto Shredding

| Company | SRN | Emission Control Equipment | Emissions (lbs/yr) | Comments |
|---|---|---|---|---|
| Louis Padnos Iron & Metal Co.<br>2001 Turner Ave NW, Grand Rapids, MI 49504 | A2457 | Shredder has "water only" spray in the hammer mill. | 11.44 | 2008 stack test |
| SLC Recycling, Inc. (Ferrous Processing & Trading) | A4750 | Baghouse | 0.4 | 2001 stack test; EU-SHREDDER currently permitted under 309-00B, which has mercury limit of 0.0012 lbs/hour mercury and restriction for 6240 hours of annual operation |
| Louis Padnos Iron & Metal Co.<br>120 S. River Avenue, Holland, MI 49423 | B1982 | Multicyclone, water injection | NA | 365-98A, active, for AUTOMOBILE SHREDDER-WATER INJECTION SYSTEM/REVISE. |
| Ferro-Met Corp.<br>1011 N. Washington Saginaw, MI 48601 | B1997 | Not currently operating | NA | 201-88, active, for SHREDDING SYSTEM. |

| | | | | |
|---|---|---|---|---|
| Jackson Iron & Metal,<br>810 Lewis Street,<br>Jackson, MI 49201 | B2281 | Shredder has "water only" spray in the hammer mill. | 2.01 | PTI 93-04 voided on 1/06/2005. PTI 93-04A issued on 1/06/2005 and is currently active; FG-SHREDDERAPC has limit of 0.02 lbs Hg/hour. EUSHREDDER has limit of 3120 hours per rolling 12 month time period. Per inspection report of 7/03/2019, 2005 stack test report had results of 0.008 lb/hr Hg from EU-SHREDDER. At 3120 hours per year, this results in a calculation of 24.96 lbs of Hg emissions annually. However, per an 8/04/2015 inspection report, 2500 to 3000 cars are shredded annually at this facility. The total estimated mercury in vehicle switches for those automobiles ranges from 3 to 4 lbs. Utilizing the same emission factors as for the USEPA flow diagram nonpoint source calculations, up to 2.01 lbs of mercury are estimated to have been released from the 2500 to 3000 vehicles processed annually at this facility. |
| Fritz Enterprises,<br>23550 Pennsylvania Rd, Taylor, MI 48180 | B3240 | Water spray and cyclone on shredder. | 1 | 2003 Lumex Monitoring (assuming 8 hour workday/365 days/yr) |
| FPT-Pontiac Division LLC<br>500 Collier Rd.<br>Pontiac, MI 48056 | B4146 | Water spray on hammer mill with a control system of primary cyclone, followed by a quad cyclone, then a fabric filter (cloth filter/roller). Material handling systems down line are controlled by cyclones. | NA | 120-80, active, for HAMMERMILLS CAR SHREDDER AND FABRIC FILTER AND CYCLONIC COLLECTORS. |
| Sturgis Iron & Metal,<br>70675 Centerville,<br>Sturgis, MI 49091 | B4372 | Shredder ducted to a cyclone and cyclones on material handling. | NA | 25-03A for aluminum shredder (particulate limits), active. 355-79A (particulate limits), active. |
| Louis Padnos Iron & Metal Co.<br>1900 W. Willow<br>Lansing, MI 48917 | B4884 | Shredder has "water only" spray in the hammer mill. | NA | 100-18 for new shredder voided on 8/18/2020. 205-75 and 52-75 still active. |
| Huron Valley Steel Corp.<br>41000 Huron River Dr.<br>Belleville, MI 48111 | B6178 | Two cyclones | NA | No stack test, TRI, permit or MAERS data available for mercury emissions |
| West Michigan Iron and Metal<br>1845 Chicago Dr. SW,<br>Wyoming, MI 49509 | B7634 | Shredder enclosed by a metal hood and ducted to a cyclone followed by a wet scrubber. | NA | 1094-80, 15 CAT/HOUR FRAGMENTIZER WITH WET SCRUBBER AND CYCLONE |
| Rifkin Scrap Iron & Metal<br>1445 N. Niagara St.<br>Saginaw, MI 48602 | N0844 | Shredder enclosed by a metal hood and ducted to a cyclone followed by a wet venturi scrubber. | 2.7 | 2004 stack test at baghouse (assuming operating 24 hr/d, 365 d/yr) |
| Portland Iron & Metal,<br>3130 Knoll Rd.<br>Portland, MI 48875 | N1340 | Water spray on shredder. Z-box with cyclone for material separation. | NA | PTI 2-15, PM emission limit only. 381-98, opacity limits. |

| | | | | |
|---|---|---|---|---|
| Kalamazoo Metal Recyclers<br>1525 King Highway<br>Kalamazoo, MI 49001 | N1373 | Shredder enclosed by a metal hood and ducted to a cyclone followed by a wet venturi scrubber. | NA | PTI 364-78 |
| E. Kingsford Iron and Metal<br>100 Superior Avenue,<br>Kingsford, MI 49801 | N3753 | NA | NA | No stack test, TRI, permit or MAERS data available for mercury emissions |
| Strong Steel Products,<br>6464 Strong<br>Detroit, MI 48211 | N6293 | Shredder has water added to control emissions. | 1 | 2005 Lumex Monitoring (5008 max. operating hours) |
| S & S Metal Processing<br>5032 Dort Highway<br>Flint, MI 48505 | N6823 | Shredder (60 ton/hr thruput) enclosed by a metal hood and ducted to a cyclone followed by a wet cyclonic scrubber. | 6.13E-02 | 2011 stack test data associated with PTI 92-00B (currently active) found in 2015 MACES inspection report for Fritz Enterprises of Flint, SRN # N6823. Limit of 0.0022 lb/hour and stack testing results showed emissions of 7.0E-06 lb/hour. Based on that hourly rate, emissions of 6.13E-02 lbs would result from continuous year-round operation. Emissions in 2014 may have been much lower as the facility had only operated 17 days in 2015 at the time of the inspection on 7/16/2015 due to a low price for steel on the commodities market. |
| TOTAL | | | 18.61 | |

### *Relay Manufacturers*

MDI (Mercury Displacement Industry, SRN N5886) operates in Edwardsburg, MI. According to the facility's TRI report, it emitted 83.4 lbs of mercury in 2014. According to the 2005 NATA, the mercury emissions are elemental mercury.

## NONPOINT SOURCES

### *MERCURY IN PRODUCTS*

Incineration of wastes contaminated with mercury-containing products has been known for some time to release mercury to the air, but other pathways for atmospheric mercury emissions from products have received little attention. Emissions from products in this inventory were calculated using the flow model approach. The flow pathway technique was pioneered by the Swedish Nation Chemicals Inspectorate (KEMI), which estimated releases from batteries, fluorescent lamps, and sewage sludge. Barr Engineering Company (Barr) and Minnesota Pollution Control Agency (MPCA) used the KEMI approach to estimate the quantity of mercury releases from products in Minnesota. The Minnesota study expanded the KEMI technique to include additional release pathways and additional products. The Minnesota study looked at releases to air, water, and land. The flow model developed during the Minnesota study has since been used to estimate emissions in studies conducted by the Wisconsin Department of Natural Resources and USEPA Region 5 with assistance from Barr (WDNR, 2006). The estimates for emissions from products in this inventory used the most recent model that was updated by USEPA Region 5. Michigan specific data was incorporated into the model when possible. Since the purpose of this inventory is to quantify air emissions, releases to land and water were not included. The methodology used for each specific product is described below.

### *Dental Amalgam*

Substituting Michigan data for national data in the USEPA Mercury Flow Diagram, emissions from dental amalgam were calculated (McGeen, 2020). Emissions in this category can be further subdivided into four categories: emissions from the dental office, emissions from the consumer "in use," emissions from recycling, and emissions from dental amalgam in the solid waste stream.

Emissions from dental offices are based on the Interstate Mercury Education & Reduction Clearinghouse Fact Sheet: Mercury Use in Dental Amalgam (IMERC, 2018). According to the December 2018 version of the fact sheet, there were 31,940 total lbs of mercury sold nationally in dental amalgam in 2013. The 2014 calculation assumes that 2014 sales were identical to 2013. Michigan's proportion of the national sales was determined by population (3.1% of the national value). Furthermore, it was assumed that all amalgam sold within the year was placed. Accordingly, 996.53 lbs was assumed for placement of dental amalgam in Michigan in 2014.

This corresponds to 68.23 lbs of mercury emissions, assuming that 7% of the mercury in an amalgam volatilizes to the air during placement of the amalgam.

Additionally, it was estimated that 516.74 lbs of mercury returned to the dental office in the form of mercury amalgams, which were replaced with new amalgam. Seven percent of the replaced amalgam or 37.99 lbs of mercury was emitted from the dental office in the form of air emissions. This source of emissions was inadvertently omitted from the AQD's 2002 and 2005 mercury reports.

Consumer "in use" emissions were estimated to be 14.42 lbs. This estimate was based on the assumption that 76 percent of the mercury input to dental offices goes to the consumer. A release factor of 0.02% was used to estimate the amount of mercury that would be exhaled to the air.

Mercury from storage, transit, and transfer en route to MSW landfills was estimated at 0.29 lbs. Mercury from disposal as MSW was estimated at 1.79 lbs.

Mercury in the amount of 6.44 lbs from mass burn and refuse derived fuel (RDF) was estimated by the USEPA model, but since this category is already accounted for in the point source inventory, this estimate was not included in the Michigan 2014 mercury inventory.

Mercury in the amount of 122.72 lbs was estimated in total for the category of dental amalgams in 2014, for the placement of dental amalgams and consumer "in use" emissions. An additional value for mercury in the amount of 2.08 lbs was estimated for the waste steam as noted above. These values do not include the emission estimates from cremation, which is a separate nonpoint source category.

Table 42. Dental Amalgam

| Dental Amalgam | | |
|---|---|---|
| **Year** | **lb** | **Subset** |
| 2014 | 68.23 | Emissions from replacement (removal) of dental amalgam |
| 2014 | 37.99 | Emissions from placement of dental amalgam |
| 2014 | 14.42 | Consumer “in use” emissions |
| 2014 | 0.29 | Storage, transit and transfer (MSW) |
| 2014 | 1.79 | Landfills |
| 2014 | NA | Recycling |
| 2014 | NA | Mass burning and RDF (accounted for under point sources) |
| 2014 | NA | Burn barrels |
| TOTALS | 122.72 | |
| **Assignment in Table 1** | | |
| Table 1 | 122.72 | Mercury-containing Products |
| Table 1 | 2.08 | All other values (storage, transfer and transit) are included under subsets of Waste Disposal category |

### *Fluorescent and Non-fluorescent Lamps*

Substituting Michigan data for national data in the USEPA Mercury Flow Diagram, an emissions estimate for fluorescent lamp breakage was calculated (McGeen, 2020). Mercury in the amount of 5.42 tons was present in lamp sales in 2013, based on data from IMERC‘s Mercury Use in Products fact sheet (IMERC, 2018). This represents a 50% decline since 2001 and a 35% decline since 2010. The IMERC data was presented for lamp manufacturing as a whole and did not apportion the number into values for fluorescent and non-fluorescent lighting. Accordingly, the two categories have been grouped together for the 2014 mercury report.

For the estimation of Michigan’s 2014 emissions, it was assumed that 2014 lamp sales in the United States were the same as in 2013. Using Michigan and national population data for 2014, it was assumed that Michigan received a proportionate percentage of the lamps containing mercury (3.12%, or 19,177,840 lamps). This number was increased to account for an additional 0.5% broken at retail locations (for 19,273,729 lamps), and an additional 5.0% broken prior to delivery to retail locations (production total of 20,237,416 lamps). The quantity of lamps in retail and the quantity of lamps purchased by consumers were then multiplied by release factors to estimate the amount of mercury emitted when a fraction of these lamps was broken. The release factor for breakage during retail was 0.002%, and the release factor for consumer breakage was 0.01%. It was assumed that each lamp manufactured in 2014 contained 0.008 g of mercury (NEMA, 2000). In 2007 participating manufacturers capped the total mercury content in CFLs at less than 25 watts at 5 milligrams (mg) per unit. CFLs that use 25 to 40 watts of electricity were capped at 6 mg per unit (NEKA, 2007). The proportion of CFL to full-size fluorescent bulb sales was not available, therefore the more conservative assumption of 8 mg per unit is still being used for purposes of the 2014 emissions estimation for this nonpoint source category. This method yielded an emissions estimate of 0.68 lbs of mercury emitted from lamp breakage by retailers, and 3.37 lbs emitted from lamp breakage by consumers. An additional 0.18 lbs of mercury from lamps broken at production facilities was estimated, for a total of 4.23 lbs directly from lamp breakage.

The USEPA Flow Diagram was also used to estimate emissions from the disposal of lamps in the MSW stream. Of the total number of disposed fluorescent lamps (537.38 lb/yr in Michigan based on an estimate of lamps being discarded at the end of their life expectancy in 2014), 78% or 419.16 lbs likely ended up in the solid waste stream. Assuming 10% of the mercury in each lamp was released while in transit, 41.91 lbs of mercury emissions would be attributable to the collection and processing of lamp-containing MSW.

Assuming 84% of lamps in MSW end up in landfills, and 1% of the mercury is released, 2.95 lbs of mercury emissions can be attributed to landfill emissions from disposed lamps. Another 6.50 lbs of emissions were likely due to the 2% of lamps in MSW that are burned in burn barrels, assuming a 90% release factor. Emissions in the amount of 24.80 lbs were estimated from lamps incinerated in mass burn/RDF combustion. However, Michigan's 2014 mercury inventory already accounts for solid waste incineration under point sources, so the 24.80 lbs of nonpoint source mercury emissions estimated by the USEPA Mercury Flow Diagram for mass burn/RDF has been omitted from the Michigan 2014 inventory.

Using the USEPA Mercury Flow Diagram and assuming that Michigan recycles fluorescent lamps at the same rate as the national average, 22%, about 8.8 million lamps should have been recycled in Michigan in 2014. Approximately 1.17 lbs of mercury was likely released during the transport of lamps to the recycling facility based on a 1% release factor.

It can be estimated that the five companies in Michigan with fluorescent lamp recyclers emit 3.5 lbs of mercury per year, assuming that they are emitting the maximum amount allowed by their permit conditions. These six facilities are not required to report to the Michigan Air Emissions Reporting System. Therefore, it was not known how many hours they operated or, in the case of the portable sources, where they operated and emitted in 2014.

Table 43. Fluorescent Lamp Recyclers

| SRN | Facility | Portable or Stationary | Permit Limit | Max. Emitted lbs |
|---|---|---|---|---|
| N5941, N5942, N5614 | Valley City | Each facility is portable. | 0.004 g / hr for each portable lamp recycler | 0.23 |
| N5948 | Greenlites (Cleanlites) | Stationary | 0.08 g / hr | 1.50 |
| N6821 | Reliable Relamping | Facility is permitted as both a portable and a stationary source. | 0.01 g / hr | 0.19 |
| N5549 | Greenlite Lamp Recycling | Stationary | 0.08 g / hr | 1.55 |
| P0621 | 3S International, LLC | Stationary | The permittee shall not process more than 9,636 tons of fluorescent light bulbs per year in FGRECYCLERS per 12-month rolling time period. | NA |
| Total | | | | 3.50 |

Hence, fluorescent and non-fluorescent lamp breakage, recycling, and the solid waste stream are estimated to have released 87.45 lbs of mercury to the atmosphere in 2014. Lamp breakage is estimated to have released 4.23 lbs of mercury by itself, and the remaining disposal activities (storage, transfer, transit, and recycling) are estimated to have released 56.03 lbs. Of the disposal activities, the subset of fluorescent lamp recycling and recycling-related activities account for 4.67 lbs.

The USEPA's 2014 NEI v2 contains a relatively close estimate for Michigan of 54.65 lbs from non-recycling breakage and 0.02 lbs from recycling breakage. This is based on methodologies and calculations prepared by the USEPA's contractor, Abt Associates. Ultimately, the 2014 NEI v2 value has been used for the report as the most defensible calculation, though Table 44 shows the values estimated via the USEPA Mercury Flow Diagram for comparison.

Table 44. Fluorescent and Non-fluorescent Lamps

| **Fluorescent Lamps** | | | |
|---|---|---|---|
| **Year** | **Flow Diagram Estimate in Lbs** | **2014 NEI v2 Estimate in Lbs** | **subset** |
| 2014 | 0.18 | 54.65 | Production breakage |
| 2014 | 0.68 | | Retail breakage |
| 2014 | 3.37 | | Consumer breakage |
| 2014 | 41.91 | | Storage, transit and transfer (MSW) |
| 2014 | 1.17 | | Landfills |
| 2014 | 2.95 | 0.02 | Storage, transit and transfer (recycling) |
| 2014 | 3.5 | | Recycling |
| 2014 | NA | NA | Mass burning and RDF |
| 2014 | 6.50 | NA | Burn barrels |
| TOTALS | 60.26 | 54.67 | |
| **Assignment in Table 1** | | | |
| Table 1 | | 54.65 | Mercury-containing Products |
| Table 1 | | 0.02 | All other values (storage, transfer and transit en route to recycling) are included under Waste Disposal category |

### *Drum Top Crushers*

As of 2014, there were ten active permits issued by EGLE for drum-top crushers (DTCs) with an eleventh permit voided but the process rolled into the facility's Renewable Operating Permit. Accordingly, there were 11 permitted DTCs operating in 2014. Of the active DTCs in 2014, the permits for several have since been voided. The information available for these sources is summarized below. Based on the maximum allowed number of lamps to be crushed each year (5,000 per facility with 90% control for carbon filters, per Joy Taylor Morgan, EGLE), the amount emitted from this category in 2014 can be estimated at a minimum of 0.12 lbs and a maximum of 0.24 lbs (McGeen, 2020).

Table 45. DTCs

| Permit No | SRN | Company | Location | Approved | Voided | Comments |
|---|---|---|---|---|---|---|
| 170-13 | B8747 | Johnson Matthey Vehicle Testing & Development | Taylor | 12/11/2013 | 2/10/2020 | |
| 159-14 | B8876 | Flowserve Corporation | Kalamazoo | 10/23/2014 | 2/23/2017 | |
| 23-10 | E8510 | Adrian College | Adrian | 2/3/2010 | 12/20/2016 | |
| 112-10 | N0929 | Auto Alliance International | Flat Rock | 6/9/2010 | 5/19/2011 | Rolled into ROP |
| 59-14 | N3111 | Tenneco, Inc. | Marshall | 5/5/2014 | 5/23/2016 | |
| 117-10 | N5245 | Marquette County Solid Waste Management | Marquette | 7/19/2010 | | |
| 138-06 | N7614 | Shaheen Chevrolet, Inc. | Lansing | 7/13/2006 | | |
| 40-10 | P0063 | McPhee Electric & Telecommunications | Potterville | 3/8/2010 | 10/18/2017 | |
| 49-11 | P0231 | Hybra Recycling, LLC | Traverse City | 5/4/2011 | 5/24/2016 | |
| 16-14 | P0500 | Sebewaing Light & Water Dept | Sebewaing | 2/14/2014 | | |
| 68-14 | P0515 | Tenneco Automotive, Inc. | Litchfield | 5/27/2014 | 3/13/2018 | |

### *Auto Switches – Shredding of Autos (Nonpoint Sources)*

Nonpoint source mercury emissions from the shredding of automobiles were calculated by substituting Michigan data for national data in the USEPA Flow Diagram (McGeen, 2020). Additionally, a value prepared by the USEPA's contractor for the 2014 NEI v2 is included and is accepted as the final value for the report.

Using Michigan data about scrapped vehicles, an estimated 32.85 lbs of mercury was emitted to the atmosphere from shredding, in total. It was estimated that 225.53 lbs of mercury was present in switches in end-of-life vehicles in Michigan in 2014, based on the estimated number of vehicles scrapped in Michigan (5.44% or 457,090 vehicles). Previous mercury inventories assumed an average of 0.54 switches per vehicle with an average of 1 gram of mercury per switch. Ninety-nine percent of these vehicles were assumed to be sent to scrap yards/dismantlers, with the remaining 1% being disposed of in some other manner.

However, the number of vehicles with mercury switches has declined as the vehicle population ages. As documented by End-of-Life-Vehicle Solutions, vehicles manufactured in the 2003 model year and beyond do not contain mercury convenience switches (ELVS, 2007). In addition, the

average age of vehicles in Michigan at present is 10.7 years. The average age of vehicles in the U.S. in 2014 was 11.4 years (Bureau of Transportation Statistics, 2017).

The 2014 mercury report, as originally released in July 2021, contained a back-calculated estimate for mercury remaining in the vehicle pool, which significantly lowered the air emissions calculations. However, after comparison with the 2014 NEI v2 assumptions, that value was later considered to be an underestimate of the quantity of available mercury. Accordingly, the estimate of mercury remaining in the vehicle fleet was recalculated based on the standard USEPA Mercury Flow Diagram assumptions. The resulting emission estimates presented here are significantly closer to the estimates from the 2014 NEI v2.

Based on an End-of-Life-Vehicle Solutions report, 42.31 lbs of mercury was recovered from mercury switches in 2014 (ELVS, 2019). Sixty-six percent of the vehicles sent to scrap yards/dismantlers were assumed to be shredded. Per the USEPA Flow Diagram, it was estimated that 22% or 72.08 lbs of mercury in these vehicles will be released during the shredding process. This release factor was based on the *North Star Steel Mercury Mass Balance Report*, prepared by Barr in 1999. Another 18.02 lbs of mercury should be released from auto fluff, assuming a 25% release factor per the Barr report.

This results in a flow diagram calculation total of 90.10 lbs from the auto shredding sector. Following the deduction of 18.61 lbs of mercury estimated for the point source component of auto shredding, the nonpoint source component is estimated to be 71.49 lbs in 2014.

The USEPA's 2014 NEI v2 contained a nonpoint estimate for Michigan of 180.60 lbs from shredding. This activity, under SCC of 2650000002 is entirely for switches in automobiles per the documentation and calculations prepared by the USEPA's contractor Abt Associates. The USEPA apportioned a national estimate for unrecycled automobile switches (2.1 million) to counties based on the number of car recycling facilities per county.

The following table presents the range of emissions estimated for the nonpoint component of auto switches (automobile shredding).

Table 46. Auto Shredders, Nonpoint

| Auto Switches - Estimated Mercury Emissions in Lbs | | | |
|---|---|---|---|
| **Year** | **USEPA Mercury Flow Diagram** | **2014 NEI v2 Calc.** | **Subset** |
| 2014 | 72.08 | 180.6 | Shredding (NEI value was not apportioned between shredding and auto fluff) |
| 2014 | 18.02 | NA | Auto fluff |
| 2014 | NA | NA | Storage, transit and transfer (MSW) |
| 2014 | NA | NA | Storage, transit and transfer (recycling) |
| 2014 | NA | NA | Landfills |
| 2014 | NA | NA | Recycling |
| 2014 | NA | NA | Mass burning and RDF |
| 2014 | NA | NA | Burn barrels |
| TOTAL | 90.10 | 180.6 | Area source and point source totals |
| | 71.49 | 161.99 | Area source total |
| | 18.61 | 18.61 | Point source total |
| **Assignment in TABLE 1** | | | |
| TABLE 1 | | 161.99 | Mercury-containing Products |
| TABLE 1 | | 18.61 | Point source deduction entry |

### *Switches and Relays*

Using national data in the USEPA Flow Diagram, emissions from switches and relays were estimated as a proportion of national emissions (McGeen, 2020). Michigan accounted for 3.12% of the United States population in 2014 so national values were scaled down to reflect Michigan's proportion of the national population.

Approximately 1.08 lbs of mercury was emitted from the retail of switches and relays, assuming 0.1% of mercury in switches and relays is released during retail in 2014. The quantity of mercury sold annually in switches and relays nationally was based on the 2010 figure from the most recent IMERC Fact Sheet: Mercury Use in Switches & Relays (IMERC, 2014). The 2010 value was adjusted for an annual 4% decline by 2014.

For consumer breakage of switches and relays a 0.05% release factor was used. It is estimated that 60.45 lbs of mercury was emitted from consumer breakage in 2014, for a total of 61.53 lbs from the consumer and retail category.

During the storage, transit, and transfer of MSW, 14.44 lbs of mercury was likely released assuming a 1.5% release factor. Another 19.25 lbs of mercury was released in 2014 during the storage and transfer of switches and relays bound for recycling. Approximately 40% of the mercury in discarded switches and relays is sent on for recycling.

The switches and relays in MSW which reach landfills contributed 6.68 lbs of mercury emissions under the assumption that 1% of the mercury is released. Another 18.85 lbs of mercury was likely released due to recycling switches and relays, assuming a 1% release factor and is reported under recycling. The mercury model projected that 93.56 lbs more would be lost due to mass burning and RDF combustion, but this was not included in the switch and relay nonpoint source estimate as the incineration category has already been accounted for under point sources. Three percent of switches and relays in MSW were likely burned in burn barrels, releasing 90% of the mercury contained in them, or 28.70 lbs.

In total, 149.45 lbs of mercury was likely released from activities associated with mercury-containing switches and relays in 2014. This includes the solid waste stream.

Mercury in the amount of 61.53 lbs is listed in Table 1 for the Switches & Relays component of the mercury-containing products category. This includes only the emissions from retail and consumer breakage. The remaining emissions from activities such as storage, transfer, transit, and recycling are reported in Table 1 under the Waste Disposal category.

Table 47. Switches and Relays

| Switches and Relays | | |
|---|---|---|
| **Year** | **lb** | **Subset** |
| 2014 | 1.08 | Retail breakage |
| 2014 | 60.45 | Consumer breakage |
| 2014 | 14.44 | Storage, transit and transfer (MSW) |
| 2014 | 19.25 | Storage, transit and transfer (recycling) |
| 2014 | 6.68 | Landfills |
| 2014 | NA | Compost |
| 2014 | 18.85 | Recycling |
| 2014 | NA | Mass burning and RDF |
| 2014 | 28.70 | Burn barrels |
| TOTAL | 149.45 | |
| **Assignment in TABLE 1** | | |
| TABLE 1 | 61.53 | Mercury-containing Products |
| TABLE 1 | 87.92 | All other values (storage, transfer, transit and recycling) are included under subsets of Waste Disposal category |

### *Thermostats*

Emissions from thermostats were estimated by substituting Michigan data for national data in the USEPA Flow Diagram (McGeen, 2020). Emissions were estimated from production, retail, and consumers.

The fact sheet Mercury Use in Thermostats provided an estimate of total mercury sold nationally in electro-mechanical thermostats (IMERC, 2018). The fact sheet indicated that 102 lbs of mercury was sold nationally in thermostats in 2013. This represents a decline of almost 99% in mercury use in thermostats since 2001. According to Clean Water Action, this decline was due in large part to state laws which banned the sale of thermostats containing mercury (Clean Water Action, 2010). IMERC states that by 2016, all known manufacturers of thermostats have phased out the use of mercury. As thermostats have a life expectancy of 30 to 50 years, emissions from discarded thermostats will occur for some years into the future.

Assuming that mercury use in 2014 thermostats sold is equal to 2013 levels and using Michigan's 2014 population data to apportion the United States total sales to Michigan, 309 thermostats containing mercury were estimated to be sold in Michigan in 2014. This includes sales for new construction, and sales for the replacement of older units. This estimate assumes that Michigan received an even percentage of the national number of thermostats produced, and that thermostats contain an average of 3.67 g mercury per unit.

It was presumed that 0.2% of the mercury in new electro-mechanical thermostats was emitted during production, resulting in 0.01 lbs of mercury emissions. Another 0.2% of the mercury in thermostats was emitted from breakage during retail. This likely contributed 0.01 lbs of mercury emissions in 2014.

Based on state and national population data, and national estimates for the number of thermostats replaced, an estimated 109,200 mercury-containing thermostats were replaced (discarded by consumers) in Michigan in 2014. This estimate assumes that Michigan accounted for an even

percentage of the national number of thermostats replaced, that thermostats contain an average of 3.67 g mercury per unit, and that 70% of the thermostats removed contained mercury (an increasing share of replaced thermostats is expected to be non-mercury, based on the gradual increase since the 1990s in the sale of non-mercury thermostats). An estimated 8.64 lbs of mercury was emitted from consumer breakage of the replaced thermostats. During consumer use, 1% percent of the mercury in thermostats was expected to have volatilized due to breakage. The total emission estimate from retail and consumer breakage is 8.66 lbs.

Based on the estimated 109,200 mercury-containing thermostats discarded by consumers in 2014, 18.65 lbs was contained in the 2% of thermostats that were recycled.

Per the USEPA Mercury Flow Diagram, 0.37 lbs of mercury was estimated to be emitted during storage, transit, and transfer on the way to recycling. Mercury in the amount of 0.18 lbs was estimated to be emitted during recycling.

Mercury in the amount of 776.53 lbs in thermostats entered the solid waste stream. During the storage, transit, and transfer of MSW, thermostats contributed 11.64 lbs of emissions. Three percent of thermostats in MSW were likely burned in burn barrels emitting 90% or 23.17 lbs of the mercury they contained. Mercury in the amount of 5.38 lbs was likely released due to the 75% of the thermostats in the MSW stream that were landfilled, assuming 1% of the mercury would volatilize.

An additional 88.18 lbs of mercury was present in the 10% of thermostats which ended up under demolition debris disposal. Mercury in the amount of 0.88 lbs was emitted during the storage, transit, and transfer to demolition debris landfills. Additional mercury in the amount of 1.65 lbs was emitted after disposal in the demolition debris landfills.

There are also wastewater treatment and sludge disposal emission components for thermostats which enter the MSW stream. A value of 0.90 lbs of mercury emissions were estimated from wastewater treatment. Another 0.46 lbs was estimated from land application air emissions, but this category has been estimated as a separate nonpoint source. Mercury in the amount of 1.23 lbs, estimated by the USEPA Mercury Flow Diagram for WWTP incineration was not included, since this category is addressed under point sources.

Not including the emissions from wastewater treatment and land application, 51.93 lbs of mercury was likely emitted due to thermostats in 2014. Of this, 8.66 lbs was emitted directly from retail and consumer breakage.

The USEPA's 2014 NEI v2 includes an estimated 7.42 lbs of mercury emissions in Michigan from thermostats and thermometers under SCC 2650000000. The USEPA's methodology from contractor Abt Associates presumed that there are 2.3 million improperly disposed thermostats nationwide, with estimated emissions per device of 1.5% (0.045 grams) of the mercury content of thermostats prior to disposal in a landfill or incinerator. The emissions were apportioned to counties based on population data. This methodology results in 71,760 thermostats discarded in Michigan in 2014, which is a smaller number than Michigan's calculation. The 2014 NEI v2 calculation is considered the most defensible estimate and is used as the final value in the report. However, it does not account for estimated emissions occurring at the numerous steps in the product disposal path, therefore the USEPA Mercury Flow Diagram values are provided here for comparison.

Table 48. Thermostats

| Thermostats | | | |
|---|---|---|---|
| **Year** | **Flow Diagram Estimate in Lbs** | **2014 NEI v2 Estimate in Lbs** | **Subset** |
| 2017 | 0.01 | 0 | Production losses |
| 2017 | 8.64 | 7.42 | Consumer breakage |
| 2017 | 0.01 | 0 | Retail breakage |
| 2017 | 11.64 | NA | Storage, transit and transfer (MSW) |
| 2017 | 0.88 | NA | Storage, transit and transfer (demolition debris landfills) |
| 2017 | 0.37 | NA | Storage, transit and transfer (recycling) |
| 2017 | 5.38 | NA | Landfills |
| 2017 | 1.65 | NA | Landfills (demolition debris) |
| 2017 | 0.18 | NA | Recycling |
| 2017 | NA | NA | Mass burning and RDF |
| 2017 | 23.17 | NA | Burn barrels |
| TOTAL | 51.93 | 7.27 | |
| **Assignment in TABLE 1** | | | |
| TABLE 1 | | 7.42 | Mercury-containing Products |

### *Measurement and Control Devices*

Emissions from measurement and control devices were estimated as a proportion of national emissions using the USEPA Flow Diagram (McGeen, 2020). According to the IMERC fact sheet Mercury Use in Measuring Devices, 0.58 tons of mercury was contained in measuring devices sold nationally in 2013 (IMERC, 2018). This represents an 89% decline since 2001 when measuring devices sold contained 5.12 tons of mercury. Much of the decline comes from the discontinuation of mercury in barometers and dairy manometers, and the reduction of mercury used in thermometers. Based on the USEPA's assessment that mercury thermometers have an average life span of five years, the same assumption will be made for mercury manometers until data can be found indicating otherwise. Michigan accounted for 3.12% of the US population in 2014 so national values were adjusted accordingly to generate Michigan-specific values.

Approximately 0.04 lbs of mercury was emitted from the retail of measurement and control devices assuming 0.1% of mercury in measurement and control devices is released during retail. For consumer breakage of measurement and control devices a 0.2% release factor was used. Mercury in the amount of 25.60 lbs was emitted from consumer breakage in 2014, for a total of 25.60 lbs from retail and consumer breakage.

During the storage, transit, and transfer of measurement and control devices as MSW, 0.35 lbs of mercury was likely released assuming a 1.5% release factor. Approximately 40% of the mercury in discarded measurement and control devices is sent on for recycling. Mercury in the amount of 0.20 lbs was release during storage and transfer of measurement and control devices bound for recycling. Another 0.18 lbs of mercury was likely released due to recycling assuming a 1% release factor and will be grouped with retail and consumer losses.

Three percent of measurement and control devices in MSW were likely burned in a burn barrel releasing 90% of the mercury contained in them. Accordingly, 0.71 lbs of mercury was released due to measurement and control devices being burned in burn barrels. Seventy-five percent of measurement and control devices in MSW are sent to landfills. Measurement and control devices in landfills contribute 0.18 lbs of mercury emissions assuming 1% of the mercury is released.

In total, 27.21 lbs of mercury was likely released from all activities associated with mercury-containing measurement and control devices in 2014.

Table 49. Measurement & Control Devices

| Measurement & Control Devices | | |
|---|---|---|
| **Year** | **lb** | **Subset** |
| 2014 | 0.04 | Retail breakage |
| 2014 | 25.55 | Consumer breakage |
| 2014 | 0.35 | Storage, transit and transfer (MSW) |
| 2014 | 0.20 | Storage, transit and transfer (recycling) |
| 2014 | 0.18 | Landfills |
| 2014 | 0.18 | Recycling |
| 2014 | NA | Mass burning and RDF |
| 2014 | 0.71 | Burn barrels |
| TOTAL | 27.21 | |
| **Assignment in TABLE 1** | | |
| TABLE 1 | 25.60 | Mercury-containing Products |
| TABLE 1 | 1.61 | All other values (storage, transfer, transit and recycling) are included under subsets of Waste Disposal category |

### *Thermometers*

In 2003, Michigan PA 578 banned the sale of mercury thermometers in Michigan, or for use in the state of Michigan. The only exceptions are if a mercury thermometer is sold or offered for one of the following:

a. A use for which a mercury thermometer is required by state or federal statute, regulation, or administrative rule;
b. Pharmaceutical research purposes; or
c. By prescription.

Mercury thermometers in household use are assumed to have a 5-year lifespan prior to breakage and disposal. Therefore, it is assumed that household use and breakage of mercury thermometers in 2014 is negligible, based on the ban on sales since 2003. Mercury thermometers used in hospitals were assumed to have a 1-year life span prior to breakage and disposal; therefore, it was assumed no hospital mercury thermometers were in use in 2014. Accordingly, mercury emissions from breakage and disposal of mercury thermometers are assumed to be minimal in 2014 and zero emissions have been calculated (McGeen, 2020).

### *Bulk Mercury*

Household hazardous waste collection sites operated by county and city health departments collected 390.19 lbs of elemental free-flowing mercury in 2014 (McGeen, 2020). The USEPA Flow Model estimates that 1% or 3.90 lbs of this mercury was released to the air. A total of 390.19 lbs of bulk mercury was also transported as waste in 2014. One percent or 3.90 lbs of this mercury was expected to be released during waste transport. Approximately 5,202.53 lbs of mercury was calculated as the total consumer input by extrapolating from the total waste estimates. It was assumed that bulk mercury disposed of as waste comprised 7.5% of total consumer input. Mercury from consumers had an expected release factor of 0.2%, resulting in emissions of approximately 10.41 lbs of elemental mercury in 2014. Therefore, approximately 18.21 lbs of mercury was likely released from all aspects of the bulk mercury category in 2014 (McGeen, 2020).

Table 50. Consumer Use of Bulk Mercury

| Consumer Use of Bulk Mercury | | |
|---|---|---|
| **Year** | **lb** | **Subset** |
| 2014 | 3.90 | Released from collection of bulk mercury emissions (Clean Sweep sites) |
| 2014 | 10.41 | Consumer and retail |
| 2014 | 3.90 | Storage, transit and transfer (MSW) |
| 2014 | NA | Landfills |
| 2014 | NA | Recycling |
| 2014 | NA | Mass burning and RDF |
| 2014 | NA | Burn barrels |
| TOTAL | 18.21 | |
| **Assignment in TABLE 1** | | |
| TABLE 1 | 10.41 | Mercury-containing Products |
| TABLE 1 | 3.90 | See CLEAN SWEEP SITES entry |
| TABLE 1 | 3.90 | All other values (storage, transfer, transit and recycling) are included under subsets of Waste Disposal category |

### *Volatilization During Solid Waste Collection and Processing*

Although the USEPA Mercury Flow Diagram includes calculations for emissions from solid waste processing (handling) for each product type, the AQD has prepared an in-house calculation for each triennial mercury inventory to represent any emissions that may occur above and beyond the flow diagram calculations.

The estimate for volatilization during solid waste collection and processing was based on the assumption that 1.5% of the mercury in solid waste is volatilized during collection, transportation, and mechanical processing (MPCA, 2001). In prior mercury reports a mercury value was estimated for composted municipal solid waste in Michigan. However, since then it has been clarified that composting in Michigan consists almost entirely of yard waste. Yard waste was once sent to landfills but resulted in numerous odor issues and even fire hazards as it decomposed. Accordingly, it is kept separate from the municipal solid waste stream and it is highly unlikely that batteries or mercury-containing devices would contaminate the yard waste compost (Hiday, 2020). Based on this information, composted yard waste is not included as a source of mercury emissions in the 2014 mercury report.

The quantity of solid waste combusted was calculated using MAERS throughput values (see Municipal Waste Incineration). Landfill data from 2014 was obtained from the Materials Management Division (EGLE, 2020). For this estimate, only Type II in-state waste (municipal solid waste) was considered. The value was 22,425,777 cubic yards and a weight of 0.333 tons per yard was assumed for an estimate of 7,467,783.74 tons. Since out-of-state waste is not likely to be transported to a transfer station in Michigan, it was not included in this estimate. It is assumed that the mercury concentration of MSW is approximately 0.004 lbs of mercury per ton of solid waste (van Veizen, 2002). Mercury in the amount of 507.27 lbs was estimated due to volatilization during the collection and processing of MSW in 2014 based on this methodology (McGeen, 2020).

The van Veizen emission factor from 2002 may not reflect trends by 2014 in the solid waste stream for mercury products and devices. Within the USEPA flow diagram, mercury emissions estimated from solid waste collection and processing declined from 249 lbs to 73.41 lbs, or a decrease of 71%. If this information is used to scale the calculation based on the van Veizen factor, an adjusted estimate of 149.56 lbs of mercury from solid waste collection and processing is calculated for 2014. This AQD estimate may still be partially duplicative of the 73.41 lbs estimated mercury emissions from the flow diagram for solid waste collection and processing.

Table 51. Solid Waste Collection and Processing

| Fate of Municipal Solid Waste (MSW) | Amount | Reference |
|---|---|---|
| Resource Recovery (tons) | 986,660.00 | From 2014 MSW incineration sector |
| Landfill Type II In-State Waste (tons) | 7,467,783.74 | MDEQ, OWMRP, for 2014 |
| Total landfill, combusted | 8,454,443.74 | |
| Calculated Mercury Content (lb/ton) | 0.004 | van Veizen (2002) |
| Mercury content (lb) of SW (excluding recycling) | 33,817.77 | |
| Volatilization during handling and transport, in lbs (equals 1.5% of mercury content from landfill, combustion) | 507.27 | |
| Scaled emission estimate in lbs, based on 71% decline in solid waste inputs from 2002 through 2014 | 149.56 | 2002 through 2014 product use and waste inputs within USEPA Mercury Flow Diagram |

### *Landfill Volatilization*

The estimate for volatilization from solid waste in landfills was based on the assumption that 0.1% of the mercury in landfilled solid waste is volatilized per year based on studies of MSW emissions in Florida (Lindberg and Price, 1999).

To estimate the quantity of MSW landfilled in Michigan in 2014, a Michigan specific figure from the MDEQ's Office of Waste Management & Radiological Protection was utilized (MDEQ, OWMRP, 2014). For this estimate, total landfilled Type II (in-state and out-of-state) waste (47,043,458 cubic yards) was considered and a weight of 0.333 tons per yard was assumed. It is assumed that the mercury concentration of MSW is approximately 0.004 lbs of mercury per ton of solid waste (van Veizen, 2002). Approximately 62.66 lbs of mercury was likely emitted due to volatilization from landfilled MSW in 2014 (EGLE,2020).

The USEPA's 2014 NEI v2 estimated that 30.69 lbs of mercury emissions were emitted from the working face of landfills, based on methodologies and calculations prepared by the USEPA's contractor, Abt Associates. The emissions from the working face of landfills were included in the 1999 study as a subset of the total emissions from volatilization of mercury in landfill waste. Accordingly, the estimate of 62.66 lbs based on the Lindberg and Price methodology already accounts for this pathway.

Table 52. Landfill Volatilization

| Fate of Municipal Solid Waste | Amount | Reference |
|---|---|---|
| Total landfilled in-state and out-state Type II Waste (Municipal & Commercial Waste) in cubic yards, 2014 | 47,043,458 | MDEQ, Office of Waste Management & Radiological Protection |
| Total landfilled Type II Waste in tons (assumes 0.333 tons/yd), 2014 | 15,665,472 | MDEQ, Office of Waste Management & Radiological Protection |
| Calculated mercury content (lb/ton) | 0.0040 | van Veizen (2002) |
| Mercury content in lb of solid waste (excluding recycling) | 62,662 | |
| Volatilization from landfilled municipal solid waste in lb (0.1% of mercury in MSW volatilizes) | 62.66 | Lindberg and Price (1999) |

### *Burn Barrels*

While the USEPA Mercury Flow Diagram includes calculations for emissions from burn barrels (open burning of MSW) for each product type, the AQD has prepared an in-house calculation as well for each triennial mercury inventory to represent emissions which may occur above and beyond the flow diagram calculations.

For the category of burn barrels, the methodology from the 2005 report was utilized to estimate 103.44 lbs of mercury from the open burning of MSW in 2014. The USEPA's methodology was from Appendix A of *Documentation for the Final 2002 Nonpoint Sector (Feb 06 Version) National Emissions Inventory for Criteria and Hazardous Air Pollutants*. The ratio of urban to rural population was obtained from 2010 U.S. Census data, and then multiplied by a 2014 U.S. Census Bureau estimate of the county population in Michigan to obtain an estimate of rural population in 2014. The USEPA's estimate of 3.37 lbs of solid waste per person per day was used to calculate total solid waste generated. It was assumed that MSW has a mercury content of 0.0040 lb/ton (van Veizen, 2002). Per an estimate by Minnesota Pollution Control Agency (MPCA, 20008), 2% of MSW was assumed to be disposed of in burn barrels, resulting in the estimate of 103.44 lbs (McGeen, 2020).

Per the USEPA's open burning estimates in the 2014 NEI v2, an estimated 215,032 tons of MSW were burned. From this source, burn barrel emissions of mercury for 2014 are estimated at 860.13 lbs utilizing the van Veizen emission factor and the throughput from the 2014 NEI (McGeen, 2020). This value is substantially higher due to the assumption of a larger quantity of available waste being burned. The number of mercury-containing devices in use has declined since the 2002 study was conducted by van Veizen, therefore this calculation may overestimate the quantity of mercury emissions from open burning of MSW in 2014.

Additionally, an emissions component from burn barrels of 59.08 lbs has already been estimated for several of the mercury product use categories such as thermostats, switches and relays, and fluorescent and non-fluorescent bulbs based on the USEPA Mercury Flow Diagram. These types of product account for the likeliest source of mercury in MSW in burn barrels, with the exception of mercury-containing batteries for which calculation methodologies are not available. For 2014, there is an estimated 63% less mercury emissions from burn barrels than the 2002 calculation from the USEPA Mercury Flow Diagram. Therefore, the AQD calculations, utilizing the 2002 van Veizen factor, and waste inputs per MPCA's assumptions or the 2014 NEI v2, and the resulting emissions estimates of 103.44 lbs and 860.13 lbs, may be overestimates based on the reduced presence of mercury in the solid waste stream in 2014.

Scaling the AQD calculations based on the 63% decline of mercury from products per the USEPA flow diagram, an adjusted range of 38.27 lbs and 318.25 lbs is derived for 2014. Even these values may pose some overlap with the 59.08 lbs of burn barrel emissions from the flow diagram, but they are more likely to reflect current trends in the waste stream.

Table 53. Open Burning of Solid Waste (burn barrels)

| Methodology | Assumptions | Emission factor | Estimated Emissions from Burn Barrels in Lbs |
|---|---|---|---|
| MPCA waste assumptions | 2% of solid waste is assumed to be burned in burn barrels. | Van Veizen emission factor (2002) | 103.44 |
| 2014 NEI v2 inputs | Quantity of solid waste in burn barrels was estimated by USEPA. | Van Veizen emission factor (2002) | 860.13 |
| Scaled estimate based on MPCA assumptions | 63% estimated decline in open burning of solid waste (burn barrels), based on product and waste inputs in USEPA Mercury Flow Diagram from 2002 through 2014. | Van Veizen emission factor (2002) | 38.27 |
| Scaled estimate based on 2014 NEI v2 inputs | 63% estimated decline in open burning of solid waste (burn barrels), based on product and waste inputs in USEPA Mercury Flow Diagram from 2002 through 2015. | Van Veizen emission factor (2002) | 318.25 |

### *Human Cremation*

From the 2014 NEI v2, based on current methodologies and calculations prepared by the USEPA's contractor, Abt Associates, Michigan's estimated nonpoint emissions of mercury from human cremation are 137.49 lbs with estimated emissions from animal cremation of 2.49 lbs (USEPA, 2016), or 39.98 lbs total. Abt Associates prepared detailed estimates based on deaths by age group by state and county. Different emission factors were developed for each age group based on the average quantity of mercury dental amalgams per person within that age group.

### *Volatilization: Land Application of Sewage Sludge*

Sewage sludge in the amount of 81,156 dry English tons was land applied in Michigan in 2014 according to estimates from the Biosolids Program of EGLE's Water Resources Division (EGLE, 2020). Sewage sludge had an average concentration of 1.54 ppm of mercury in 2014. Assuming 1% of mercury applied to the surface of the land volatilized within one year (MPCA, 2004), but not taking into account any carryover from previous years, 2.50 lbs of mercury was likely emitted via volatilization from surface-applied sewage sludge in 2014 (McGeen, 2020).

### *Contaminated Site Remediation*

The only known source of atmospheric mercury emissions from the clean-up of a contaminated site in Michigan was the dredging of the BASF Riverview site in Detroit. The dredging of this site began in late 2006 and was completed in the second week of 2007 (Sadoff, 2006). Therefore in 2014 there are no known air emissions of mercury from contaminated site remediation.

### *General Laboratory Activities*

The USEPA's 2014 NEI v2 contains an estimate for Michigan of 24.59 lbs of mercury emissions from general laboratory activities. This value was pulled forward from the 2008 NEI. The last survey on mercury use in laboratories was conducted in 2002. Accordingly, there is uncertainty as to whether the underlying assumptions used for the 2008 calculation are still representative of laboratory use of mercury in 2014. While the survey data may not be representative of laboratory activities in 2014, it has been included in this report as the best available estimate.

## Mobile Sources

### *ON-ROAD*

The USEPA and the University of Michigan (U of M) Air Quality Laboratory collaborated on a pilot project in 2002 to investigate motor vehicle mercury emissions (Hoyer et al., 2004). This pilot project produced significantly different emission factors than those previously used to estimate mobile source mercury emissions from on-road vehicles. Michigan's 1999 mercury emissions inventory estimated on-road mobile source emissions using emission factors that were the detection limit cut in half from Coordinating Research Council (CRC) data. The emission factors produced by the USEPA/U of M pilot project were several orders of magnitude lower than the estimate based on the CRC factor.

Table 54. Estimated On-road Emissions, CRC and USEPA/U of M Emission Factors)

| YEAR | Total on-road Hg emissions in lbs (CRC factor) | Total on-road low range Hg emissions in lbs (EPA/U of M factor) | Total on-road high range Hg emissions in lbs (EPA/U of M factor) | EPA NEI Hg estimate for on-road (in lbs) |
|---|---|---|---|---|
| 2014 | 1727.43 | 0.18 | 0.48 | 23.82 |

Table 55. Comparison of 1999 (CRC) and 2002 (USEPA/U of M) Emission Factors

| Vehicle Type | 1999 Emission Factor | 2002 Emission Factor |
|---|---|---|
| Light-duty Diesel | 6,579 ng/mi | 6.4-11.1 ng/mi |
| Heavy-duty Diesel | 86,577 ng/mi | 6.4-11.1 ng/mi |
| Light-duty Gasoline | 875 ng/mi | 0.3-1.4 ng/mi |
| Heavy-duty Gasoline | 839 ng/mi | 0.3-1.4 ng/mi |

Table 56. 2014 Michigan Statewide Vehicle Miles Traveled and Estimated Mercury Emissions from 2014 NEI v2

| On-road Sector | Vehicle Miles Traveled (VMT) in Millions | Hg Emissions in lbs from 2014 NEI v2 |
|---|---|---|
| Light-duty Gasoline | 83,989.84 | 23.48 |
| Heavy-duty Gasoline | 3,287.17 | 0.2 |
| Light-duty Diesel | 325.31 | 0.04 |
| Heavy-duty Diesel | 8,144.88 | 0.1 |
| Total VMT in Michigan | 95,747.21 | 23.82 |

The Light-Duty Gasoline Vehicles emission factor from USEPA/U of M was applied to all gasoline vehicles for 2014, and the Heavy-Duty Diesel Vehicles emission factor from USEPA/U of M was applied to all diesel vehicles. The resulting 2014 estimate suggests that <1 lbs of mercury was emitted from on-road vehicles (0.18 to 0.48 lbs).

It should be noted that the USEPA/U of M pilot project did not measure reactive gaseous mercury and since this was a pilot project, few vehicles were studied. Further research is needed to estimate emissions from mobile sources with the desired degree of certainty. This pilot study tested light-duty gasoline vehicles and heavy-duty diesel vehicles. These estimates only include mercury from tailpipe emissions and do not address other potential mercury sources from on-road vehicles such as mercury in brake pads. Brake wear was identified as a potentially significant source of mercury emissions from mobile sources during the pilot study (Hoyer et al., 2004).

The estimate from the USEPA's 2014 NEI v2 suggests that 23.82 lbs of mercury was emitted from on-road vehicles.

***NON-ROAD***

The 2014 mercury inventory includes several non-road categories. These categories are off-road vehicles and equipment (diesel and gasoline-powered), commercial marine vessels, and railroads.

The estimate from the USEPA's 2014 NEI v2 non-road inventory estimates that 2.30 lbs of mercury was emitted from off-road vehicles and equipment. This includes snowmobiles, ATVs, agricultural, construction, mining, and lawn and garden equipment, and railroad maintenance of way equipment. Mercury in the amount of 0.23 lbs was from diesel equipment and vehicles, and 1.68 lbs of mercury was from gasoline-powered vehicles and equipment, with 0.39 lbs emitted by other fuel types (USEPA, 2014 NEI v2).

The USEPA's 2014 NEI v2 nonpoint inventory estimates that 0.06 lbs of mercury was emitted from commercial marine vessels and 8.96 lbs from came from railroad locomotives. This includes port and underway emissions for the marine vessels. It also includes emissions from line-haul locomotives for Class I, II, and III railroads (large carriers, regional railroads, and shortlines, respectively).

A preliminary estimate of between 0.24 and 10.80 lbs of mercury emitted per year was generated for Michigan's only coal-burning ferry, the *S.S. Badger,* owned by Lake Michigan Carferry Service. The *Badger* burns 12,000 tons of bituminous coal per year on average, according to the USEPA (USEPA, 2013). Using the range of mercury concentration in bituminous coal of 0.01-0.45 ppm (MMEUW, 2005), the preliminary range of emissions was created (McGeen, 2014). Efforts to estimate other emissions from this source sector and other non-road mobile sources have not been conducted to date.

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This inventory represents the best information available at the time of the last update.