



SPOTLIGHT ON MICHIGAN'S MANUFACTURING SECTOR

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INTRODUCTION

In 2015, the Great Lakes Regional Pollution Prevention Roundtable (GLRPPR) began a project to analyze data from U.S. EPA's Toxics Release Inventory (TRI) and Greenhouse Gas databases and the Census Bureau's County Business Patterns Database to determine the impact of manufacturing on the economy and environment of the six states in U.S. EPA Region 5. This paper summarizes findings for Michigan's manufacturing sector (NAICS 311-337).

ECONOMY AND TRI EMISSIONS

In 2015, the manufacturing sector in Michigan with the most establishments was the fabricated metal products industry (U.S. Bureau of the Census, 2015). The transportation equipment manufacturing sector had the highest payroll.

According to Toxics Release Inventory data (2015), the primary metals sector was the highest emitter, followed by the chemical manufacturing industry. The primary metals industry had the seventh highest payroll among manufacturing sectors. The chemical manufacturing sector ranked fifth. Primary metals ranked seventh in number of employees, while the chemical sector ranked sixth. Finally, primary metal facilities ranked twelfth in number of establishments while chemicals ranked tenth. From these data, it appears that both the primary metal and chemical sectors may be comprised of larger but fewer facilities that have a greater impact on emissions than sectors with a greater number of relatively smaller facilities.

2015 DATA SUMMARY

Number of TRI Entries: 2,508
Number of TRI Facilities: 711 (based on TRI ID)
Number of GHG Facilities: 84
Number of P2 entries (TRI): 362
Number of P2 entries reporting reductions: 146
Total CO_{2e} Releases: 17,692,486 metric tons
Total On and Off-Site Releases: 33,889,261 lbs.
Chemical emissions rank: 4th of 6 Great Lakes states

RELEASES

	Total	Highest Emitter
Air	9,855,069 lbs.	Transportation equip
Land	736,580 lbs.	Transportation equip
Water	2,658,725 lbs.	Food
Off-site	19,412,857 lbs.	Primary metals
CO _{2e}	17,692,486 metric tons	Primary metals

TOP FIVE INDUSTRY SECTOR EMITTERS

TRI	GHG
1. Primary metals	1. Primary metals
2. Chemicals	2. Nonmetallic minerals
3. Transportation equipment	3. Paper
4. Paper	4. Chemicals
5. Food	5. Petroleum

TOP FIVE CHEMICAL RELEASES

1. Zinc compounds
2. Manganese compounds
3. Nitrate compounds
4. Ammonia
5. Methanol

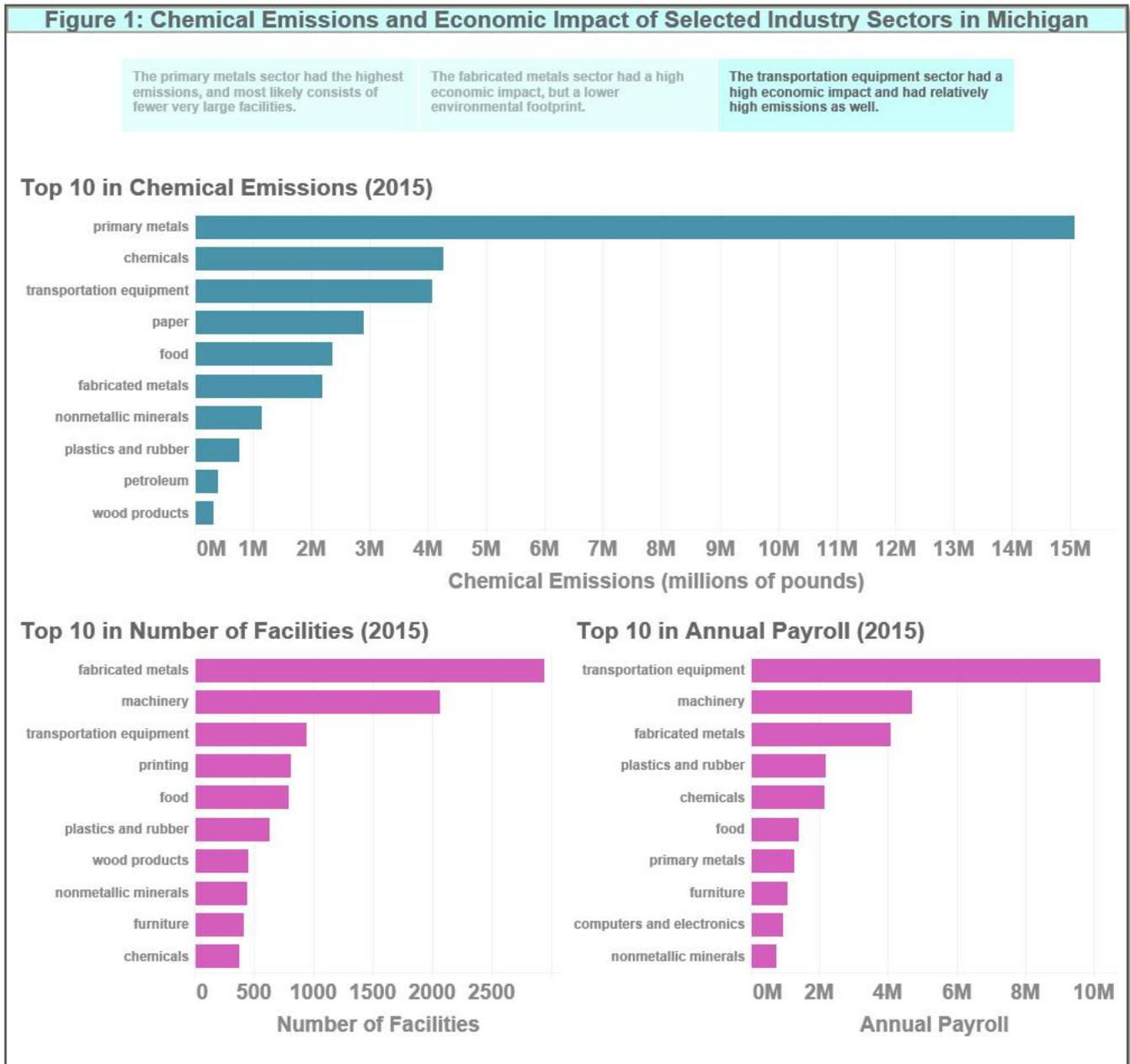
MICHIGAN IS THE TOP EMITTER IN:

TRI	GHG
• Wood products	• Wood products
• Transportation equipment	• Transportation equipment
	• Furniture

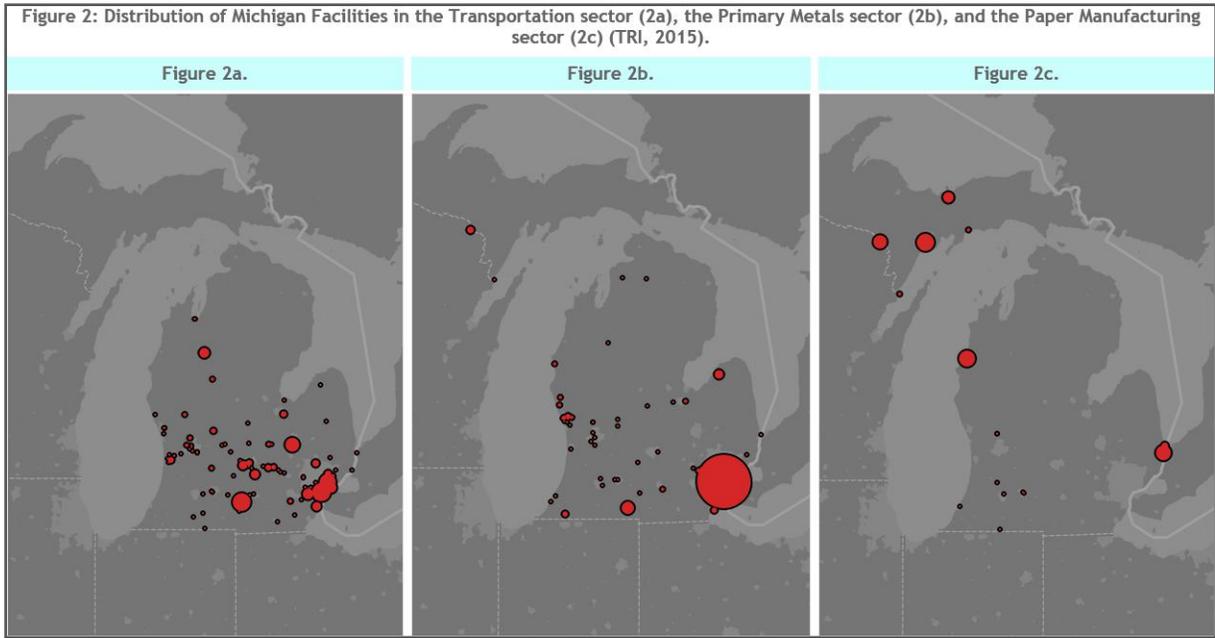
SECTORS WITH THE GREATEST EMISSIONS REDUCTIONS (IN POUNDS)

1. Transportation equipment
2. Paper
3. Fabricated metals
4. Food
5. Nonmetallic mineral products

Figure 1 compares the significance of chemical emissions and economic impact of specific industry sectors.



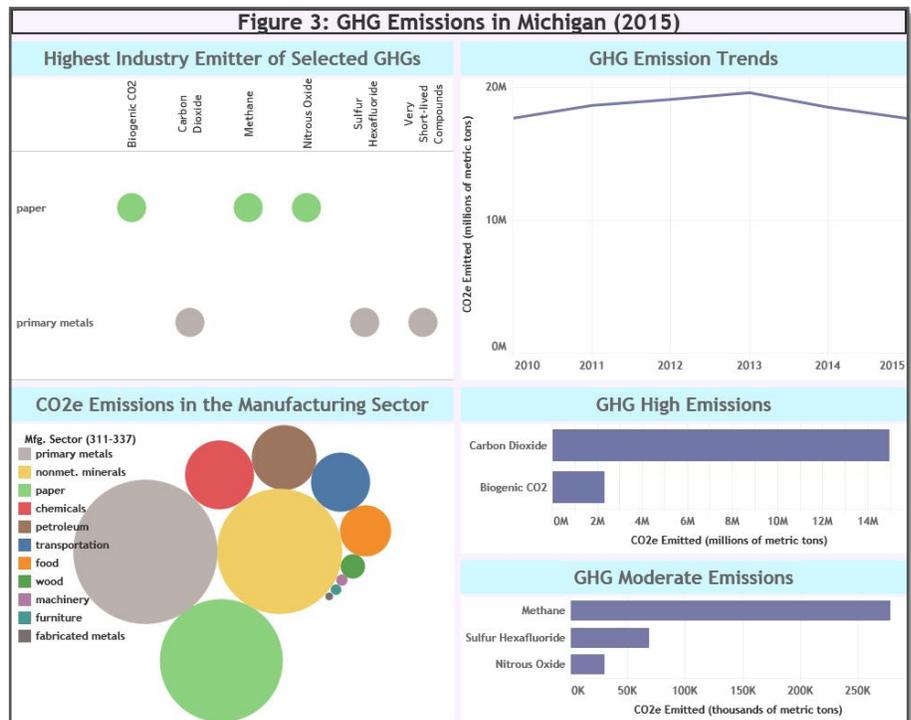
Figures 2a, 2b, and 2c show the distribution of communities that have transportation manufacturing facilities (a), primary metal facilities (b), and paper manufacturing facilities (c) with TRI chemical releases (greater than 0 pounds) in 2015. Sizes of the circles indicate the relative amount of the releases in pounds for the corresponding sector. Circles may represent more than one facility in that geographic location, which makes patterns easier to identify. For example, transportation manufacturing facilities are clustered in the southeast part of Michigan, near the Detroit metropolitan area while primary metal facilities are scattered throughout the state, with some very large emitters in the southeast corner. Finally, the state has fewer paper manufacturing facilities, which are generally located in the northern parts of the state, including several in the Upper Peninsula.



GREENHOUSE GAS (GHG) EMISSIONS

Michigan ranked fourth of the region's six states in overall manufacturing sector GHG emissions in 2015. Every state in the region reported decreased GHG emissions from 2014 to 2015. Michigan's share of that decrease was approximately 837,831 metric tons of CO₂e.

The top five GHG emitters were the primary metals, nonmetallic minerals, paper, chemicals, and petroleum and coal products manufacturing industries. Michigan was the highest GHG emitter of all Region 5 states in the wood products, transportation equipment, and furniture industries.



The primary metals industry was the highest emitter of sulfur hexafluoride, carbon dioxide (carbon dioxide comprises the bulk of all GHG emissions in the state), and other very short-lived compounds. The paper industry was the highest emitter of methane, biogenic CO₂, and nitrous oxide. **Figure 3** shows several different visualizations of Michigan's greenhouse gas emissions data.

POLLUTION PREVENTION (P2) PRACTICES

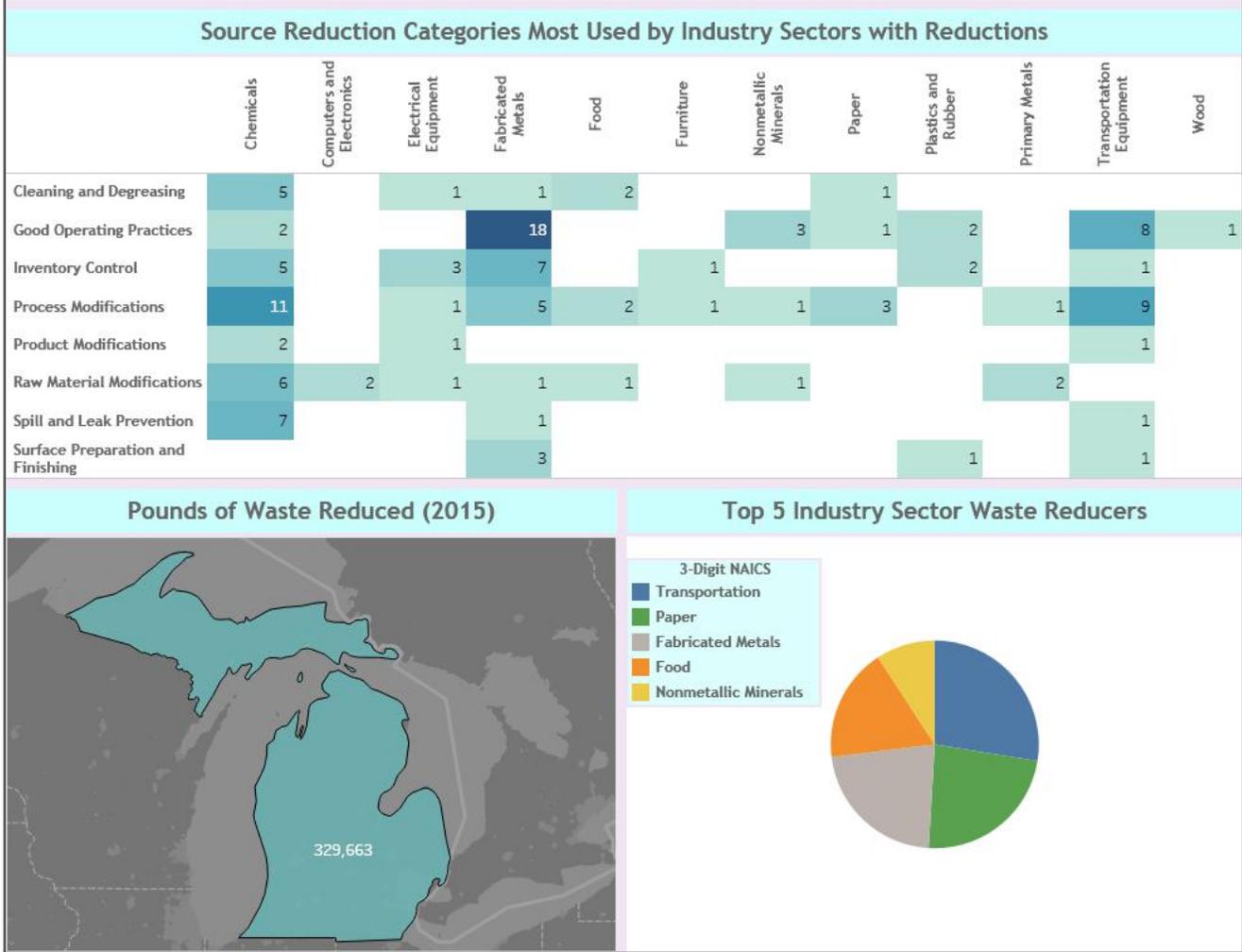
The TRI reporting program includes an optional reporting section where companies can report which pollution prevention practices they used to achieve reductions of specific chemicals. When reporting these activities, facilities report the activity implemented and the method by which this P2 opportunity was identified using designated codes (W and T codes). Facilities can also choose to describe these activities or other measures taken to reduce toxic chemical releases using a free-text data entry field on the TRI reporting form. Under the Pollution Prevention Act, TRI facilities report a production or activity ratio that typically compares production in the current year to the prior year. For a chemical used in the generation of electricity, for example, the production ratio for that chemical reflects annual change of kilowatt hours produced. Using this ratio, year-to-year changes in waste management quantities can be viewed within the context of production, which can help gauge whether reductions were the result of reported source reduction activities (EPA, 2016). Except where noted, discussion of P2 practices in this fact sheet is based on actual reported releases and reductions, rather than the values normalized for production.

Based on the TRI P2 data entries from facilities with reported reductions, process modifications (W50 through W58) and good operating practices (W13 through W19) were the most effective P2 practices or combinations of practices. Inventory control (W21 through W29) and raw material modifications (W41 through W49) were the third and fourth most commonly reported practices. The most common process modification reported by Michigan companies was “modified equipment layout or piping” (W52), followed by “other process modifications” (W58) and “optimized reaction conditions or otherwise increased efficiency of synthesis” (W50). Facilities also reported good operating practices, such as “improved maintenance scheduling, recordkeeping, or procedures” (W13) and “changed production schedule to minimize equipment and feedstock changeovers” (W14). Several companies also reported using inventory control, such as “instituted procedures to ensure that materials do not stay in inventory beyond shelf life” (W21). According to Ranson et al (2015), the pollution prevention technique that most effectively reduces emissions is raw material modifications. Facilities that reported raw material modifications most often used “substitution of raw materials” (W42).

Of the six states in the region, Michigan was last in the number of pounds of toxics emissions reduced (approximately 330,000 pounds). As shown in **Figure 4**, the top five manufacturing industry sectors in reductions of toxic emissions (in order) were: transportation equipment, paper, fabricated metals, food, and nonmetallic mineral products. Three of these sectors (paper, food, and transportation equipment manufacturing) also ranked in the top five waste emitters. However, the two highest emitters of toxic substances (the primary metals and chemicals industries) ranked 10th and 6th respectively in the number of pounds reduced by an industry sector.

The top five chemicals reduced were: hydrochloric acid, N-hexane, zinc compounds, xylene (mixed isomers), and N-methyl-2-pyrrolidone. TRI P2 data from 2015 indicates that hydrochloric acid was commonly associated with the paper industry, N-hexane with the food industry, zinc compounds with the fabricated metal industry, and xylene and N-methyl-2-pyrrolidone with the transportation industry.

Figure 4: P2 Practices and Release Reductions in Michigan (2015)



The four industry sectors with the most reductions differed by less than 30,000 pounds of reductions. Transportation equipment facilities reported 81,243 pounds of reductions in emissions, which is about 25% of the statewide total. In 2014, this sector reduced 365,232 pounds, which made it the highest reducer that year as well. The next highest reported reduction was 68,854 pounds in the paper industry, which accounts for about 21% of the statewide total. Companies in this sector reported zero pounds of reductions in 2014.

One Michigan light truck and utility vehicle manufacturing plant accounted for 47% of the transportation equipment manufacturing sector’s total reductions. The achieved this by decreasing their emissions of a variety of solvents, as well as some heavy metals. This facility did not provide any information regarding P2 practices used to reduce these chemicals, other than a standard statement on environmental policy. When reductions in solvent wastes were normalized relative to production at this facility, the number of pounds reduced was significantly lower, which

The transportation equipment industry subsector with the most pounds reduced in 2015 (over 38,000 pounds) was Light Truck and Utility Vehicle Manufacturing (NAICS 336112).

indicated that the facility's reported emissions reduction was largely due to decreased production rather than the use of pollution prevention techniques.

A motor vehicle seating and interior trim manufacturer decreased their emissions of N-methyl-2-pyrrolidone, which accounted for about 22% of the sector's total reductions. The facility reported using "improved maintenance scheduling, recordkeeping, or procedures" (W13) as a P2 practice. No additional comments were included in the TRI P2 entry. This was the first year they reported a reduction of this chemical. In previous years (2010, 2012, and 2014) they reported reductions of other solvents (such as toluene and xylene) by using a variety of P2 practices, including substituting raw materials in their process (W42). The company stated that better formulations of water-based painting technologies and the use of flame and plasma surface treatments led to these changes. When reductions in N-methyl-2-pyrrolidone emissions were normalized relative to production, the amount of pounds reduced was about half of the actual quantities reported, indicating that a portion of reduced emissions was due to a decrease in production.

A motor vehicle parts manufacturer reported slightly lower solvent and listed "modifying equipment, layout, or piping" (W52) as a P2 practice. They reported that a new mixing area was brought fully online, complete with new process controls for setting schedules and recipes. They also installed piggable pumps in their paint circulation systems. A pig is a bullet-shaped polyurethane foam object that is shot through the paint system at the end of a color run with compressed air and a minimal amount of solvent to force paint out of the lines. ('Piggable' Paint Recirculation, 2009). Again, once release data were normalized for production, the reported solvent reductions were tied to decreased production at the facility rather than P2 practices.

The paper manufacturing industry reduced the second highest amount of emissions in 2015. The sector reduced overall emissions by 68,854 pounds. One paper mill accounted for almost all of the total emission reductions in this sector, primarily through reduced hydrochloric acid emissions. They reported using a different process catalyst (W53) as a P2 practice. Although they reported no further details in the 2015 TRI entry, an entry from 2012 stated that they installed a natural-gas fired boiler to minimize the burning of coal, which produces hydrochloric acid aerosols as a by-product. They also reported that their amount of production-related waste (hydrochloric acid) decreased by almost 68,000 pounds from 2014 to 2015. This company reported using no waste management techniques. All of their waste was released. When hydrochloric acid waste quantities were normalized relative to production, the number of pounds reduced was significantly less. This indicates that the facility's emissions reductions were mostly due to a decrease in production rather than the use of P2 techniques.

One paper bag and coated and treated paper manufacturer reported reducing toluene emissions by using a combination of P2 practices. These included: changing the production schedule to minimize equipment and feedstock changeovers (W14); reducing or eliminating the use of an organic solvent (W56); and other cleaning and degreasing modifications (W71). They also mentioned that they had started to recycle used toluene back into their adhesive blend for use in the next production run.

Again, the P2 search tool indicated that reported toluene reductions were tied to decreased production at the facility rather than implementation of P2 practices.

Three food manufacturing facilities reported release reductions, making this sector the fourth highest reducer of toxic emissions. One spice and extract manufacturer reduced almost 44,000 pounds of emissions of N-hexane by using raw material modifications, specifically by substituting raw materials (W42). Upon using the P2 search tool to look at waste quantities normalized relative to production for N-hexane at this company, the company's reductions decreased but were still significant.

A mineral wool manufacturer reported reducing formaldehyde emissions by about 82%. They listed the substitution of raw materials (W42) as a P2 practice. No details were provided. Upon using the P2 search tool to look at waste quantities normalized relative to production for formaldehyde at this company, the number of pounds reduced was about half as much, indicating that a portion of reduced emissions was due to production-related events.

An electroplating, plating, polishing, anodizing, and coloring facility reported reductions of zinc compounds of about 28% in 2015. They reported "changing the production schedule to minimize equipment and feedstock changeovers" (W14) and "modifying equipment, layout, or piping" (W52) as P2 practices. Upon using the P2 search tool to look at their waste quantities normalized relative to production for zinc compounds, the number of pounds that they reduced was lower but still significant.

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FOR MORE INFORMATION

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