GREAT LAKES REGIONAL POLLUTION PREVENTION ROUNDTABLE

GLRPPR

Spotlight on Minnesota's Manufacturing Sector

By Phyllis Bannon-Nilles and Laura L. Barnes

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 fact sheet summarizes findings for Minnesota's manufacturing sector (NAICS 311-337).

Economy and TRI Emissions

According to TRI data (2015), the food processing sector was the highest emitter, followed by the primary metals industry. The food processing industry had the fourth highest payroll, the fourth highest number of establishments, and the most employees among manufacturing sectors. The primary metals sector ranked thirteenth in payroll size, fourteenth in number of employees, and sixteenth in number of establishments (U.S. Bureau of the Census, 2015). From these data, it is clear the food manufacturing industry is an important cornerstone of Minnesota's economy, consisting of numerous establishments and employing large numbers of people. Chemical releases are a significant issue for this sector. The primary metals sector has a fewer number of larger facilities, with a greater impact on emissions than other sectors. **Figure 1** compares the economic and environmental impact of specific industry sectors.

2015 Data Summary

Number of TRI Entries: 1,367
Number of TRI Facilities: 458 (based on TRI ID)
Number of GHG Facilities: 55
Number of P2 Entries (TRI): 384
Number of P2 Entries Reporting Reductions: 177
Total CO_{2e} Releases: 11,478,198 metric tons
Total On and Off-Site Releases: 14,499,975 lbs.
Chemical Emissions Rank: 6th of 6 Great Lakes states

Releases

	Total	Highest Emitter
Air	8,410,659 lbs.	Food
Land	519,271 lbs.	Food
Water	1,677,968 lbs.	Chemicals
Off-site	3,892,077 lbs.	Primary metals
CO_{2e}	11,478,198 metric tons	Petroleum

Top Five Industry Sector Emitters

TRI	GHG
1. Food	1. Petroleum
2. Primary metals	2. Paper
3. Chemicals	3. Food
4. Fabricated metals	4. Chemicals
5. Petroleum	5. Primary metals

Top Five Chemical Releases

1. N-hexane
2. Ammonia
3. Nitrate compounds
4. Zinc compounds
5. Lead compounds

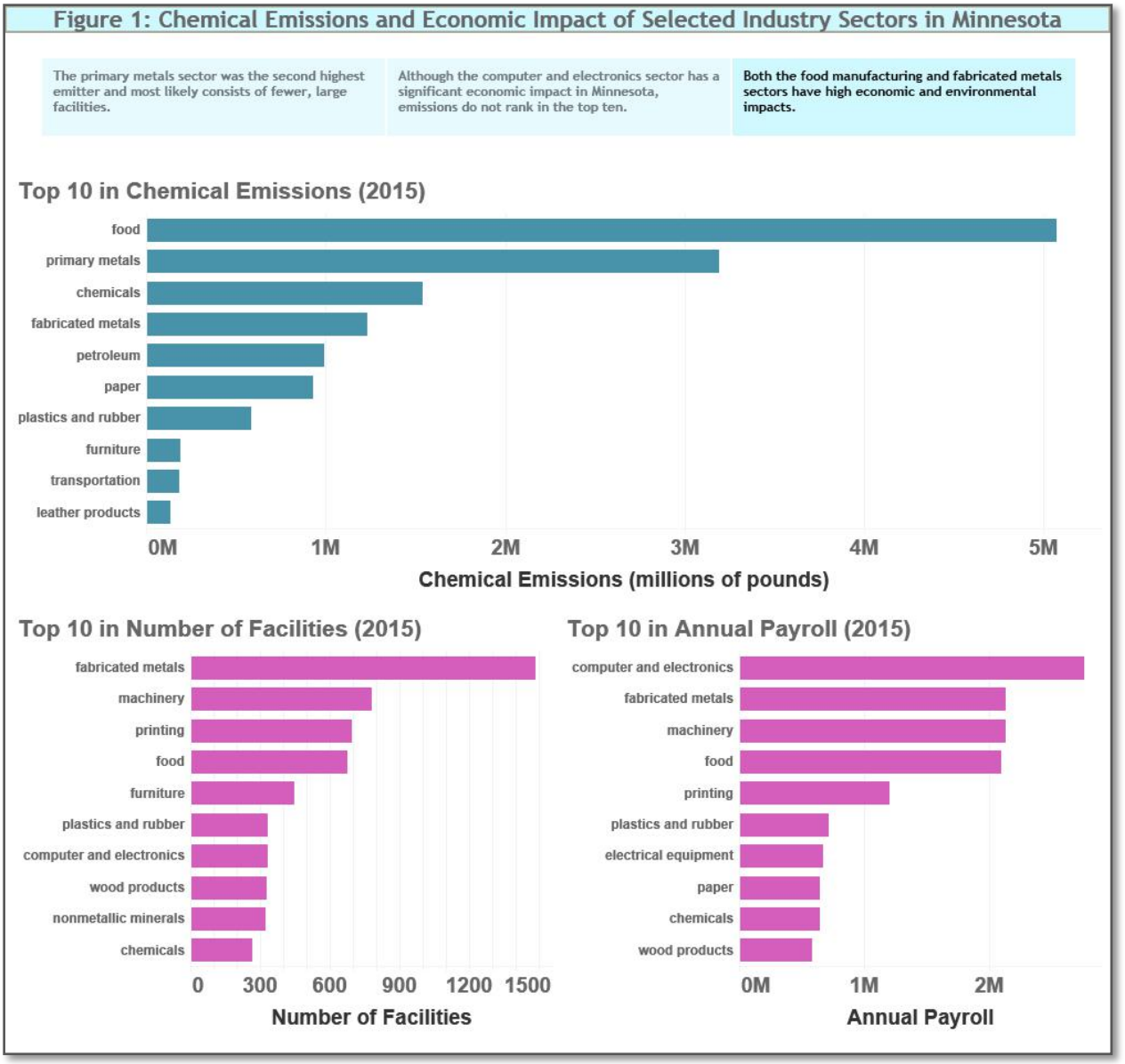
Minnesota is the Top Emitter in:

TRI	GHG
• Leather products	• Computer & electronics

Sectors with the Greatest Emissions Reductions (in pounds)

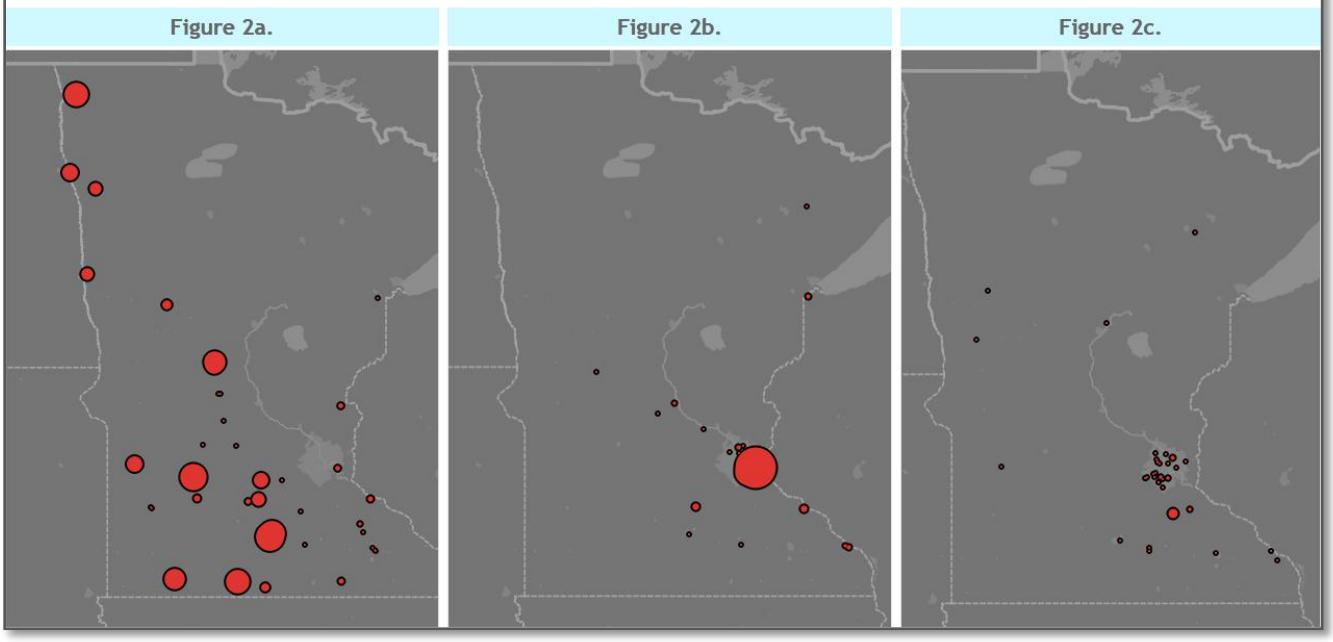
1. Food
2. Chemicals
3. Paper
4. Petroleum
5. Primary metals

This project was funded under U.S. EPA's Pollution Prevention Information Network grant program (agreement number NP- 00E02048).
Originally Published: December 2017



Figures 2a, 2b, and 2c show the distribution of communities containing food manufacturing facilities (a), primary metal facilities (b), and computer and electronics manufacturing facilities (c) with TRI chemical releases of greater than 0 pounds. Circle sizes 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 it easy to discern patterns. For example, food manufacturing facilities are numerous and scattered throughout the western half of the state, and primary metal facilities are fewer in number and concentrated primarily in the southeastern portion of the state in the Minneapolis-St. Paul metropolitan area. Finally, computer and electronics manufacturing facilities are also located primarily in southeast Minnesota. They also have lower emission levels.

Figure 2: Distribution of Minnesota Facilities in the Food Manufacturing sector (2a), the Primary Metals sector (2b), and the Computer and Electronics sector (2c) (TRI, 2015).



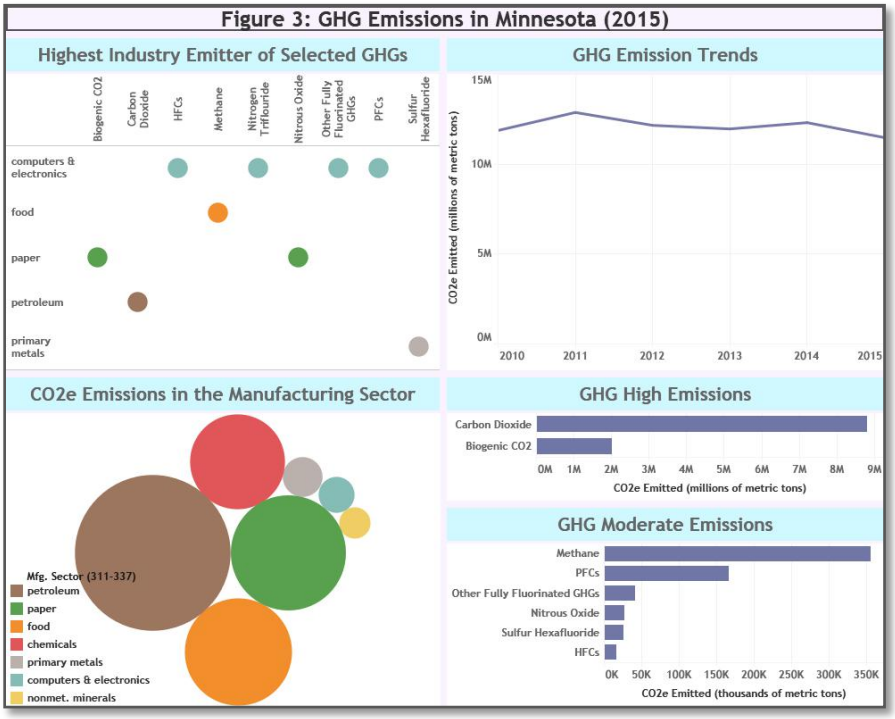
Greenhouse Gas (GHG) Emissions

Minnesota's manufacturing sector ranked fifth of the region's six states in overall GHG emissions in 2015. Every Region 5 state reported a decrease in GHG emissions from 2014 to 2015. Minnesota reported a decrease of approximately 831,593 metric tons of CO_2e.

The top five GHG emitters were the petroleum, paper, food, chemicals, and primary metal manufacturing sectors. The computer and electronics manufacturing sector reported the highest GHG emissions in the region.

The petroleum industry (NAICS 324) was the highest emitter of carbon dioxide (carbon dioxide accounts for nearly all GHG emissions in the state). The paper industry (NAICS 322) was the highest emitter of biogenic CO_2 and nitrous oxide. The food manufacturing industry (NAICS

Figure 3: GHG Emissions in Minnesota (2015)



311) had the highest methane emissions.

The computer and electronics industry (NAICS 334) emitted the most hydrofluorocarbons (HFCs), perflurocarbons (PFCs), nitrogen trifluoride, and other fully fluorinated GHGs. The primary metal industry (NAICS 331) had the highest sulfur hexafluoride emissions. **Figure 3** shows several different visualizations of Minnesota's greenhouse gas emissions data.

Pollution Prevention (P2) Practices

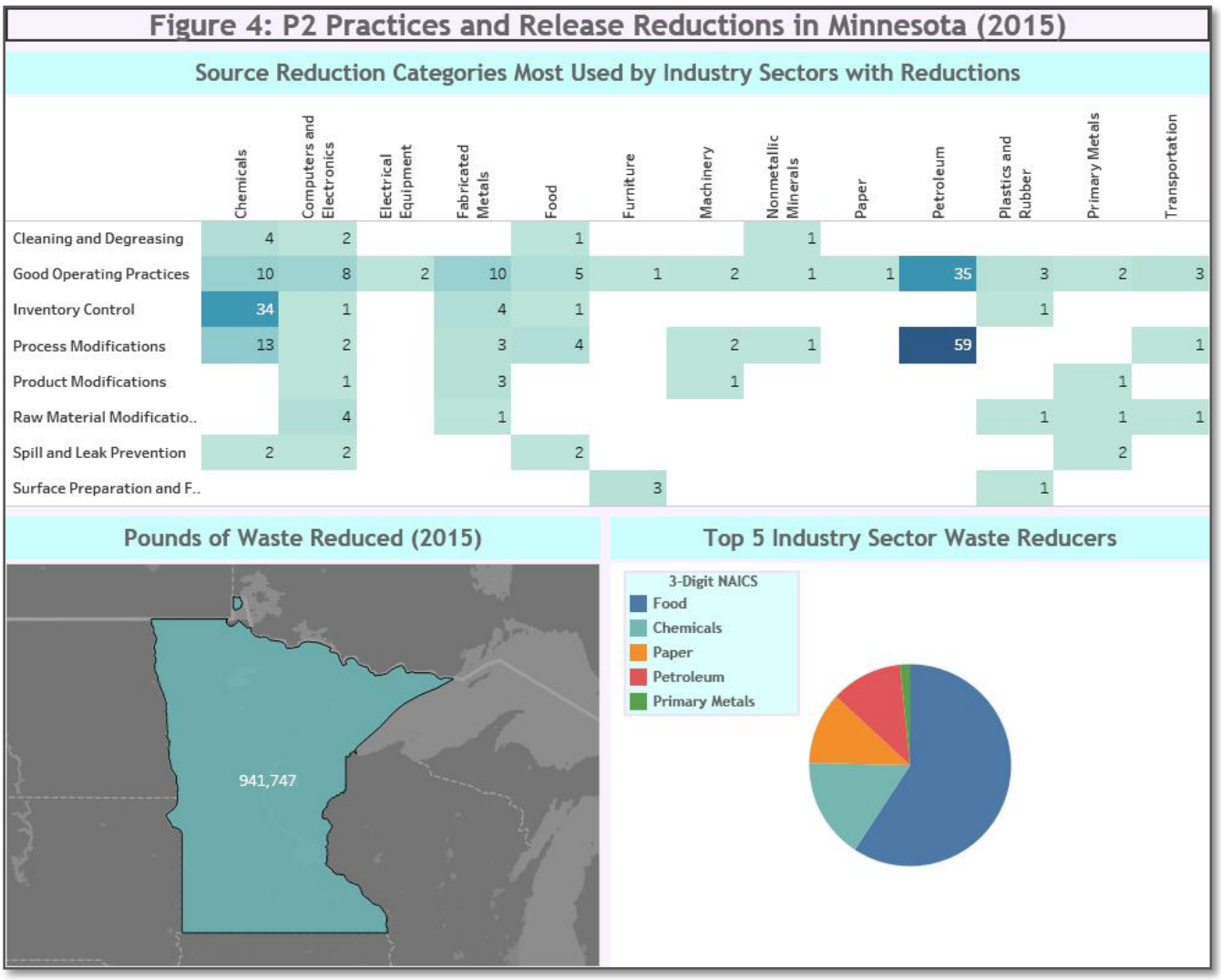
The TRI reporting program includes an optional reporting section where companies can report which pollution prevention practices they used to reduce specific chemicals. Facilities report the activity implemented and the method by which this P2 opportunity was identified using designated codes (W and 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 with that of the prior year. For a chemical used in the generation of electricity, for example, the production ratio for that chemical reflects the annual change in number 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, the 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 with reported reductions, process modifications (W50 through W58) and good operating practices (W13 through W19) were the most effective P2 practices or practice combinations for Minnesota companies reporting in 2015. Inventory control (W21 through W29) was the third most commonly reported practice by facilities with reductions. According to Ranson et al. (2015), the pollution prevention technique that most effectively reduces emissions is raw material modifications (W41 through W49). However, companies in Minnesota did not widely report using this practice.

The most common process modification reported was "other process modifications" (W58), followed by "modified equipment layout or piping" (W52). Facilities also reported good operating practices, such as "improved maintenance scheduling, recordkeeping, or procedures" (W13), along with "other changes in operating practices" (W19). Several companies also reported using "other changes in inventory control" (W29).

Of the six states in the region, Minnesota was third in the number of pounds of toxic emissions reduced (slightly less than 942,000 pounds). As illustrated in **Figure 4**, the top five Minnesota manufacturing industry sectors in reductions of toxic emissions (in order) were food, chemicals, paper, petroleum, and primary metals. These industry sectors all ranked in the top six waste emitters. The fourth highest emitter (fabricated metals) ranked tenth in the number of pounds reduced by an industry sector. The top five chemicals reduced (highest numbers of pounds) were ammonia, zinc

compounds, aluminum (fume or dust), hydrogen sulfide, and cobalt compounds. Ammonia reductions topped 500,000 pounds compared with the next highest reduction (zinc compounds) at close to 71,000 pounds. Ammonia and hydrogen sulfide were most commonly associated with the food industry. The aluminum reduction was reported by a single chemical company, and cobalt compounds were reported by the petroleum industry.



The most notable trend in Minnesota's P2 data is the difference in the amount of waste reduced by food manufacturing facilities compared with all other industry sectors (see pie chart in Figure 4). Food manufacturing facilities reduced 542,035 pounds of emissions, which is over 50% of the total reductions reported statewide. In 2014, the sector reduced emissions by 243,821 pounds, second to the petroleum industry. The next largest reduction in 2015 was 147,754 pounds in the chemical industry, which accounted for about 16% of total reductions.

The food manufacturing industry subsector with the most pounds reduced in 2015 (over 500,000 pounds) was Rendering and Meat Byproduct Processing (NAICS 311613).

Two rendering and meat byproduct processing facilities, part of the same parent company, accounted for close to 93% of the food manufacturing sector's total reductions. They achieved this primarily by decreasing their ammonia emissions at both facilities. They both reported using a variety of P2 practices to achieve their reductions, including improving maintenance scheduling, recordkeeping, or procedures (W13); improving procedures for loading, unloading, and transfer operations (W32); modifying equipment, layout, or piping (W52); and modifying containment procedures for cleaning units (W63). When waste quantities were normalized relative to production for ammonia at these facilities, the number of pounds reduced was lower but still significant.

One beet sugar manufacturing facility reported reducing total emissions by 38,881 pounds, which accounted for 7% of all food sector reductions. Most of these reductions were in hydrogen sulfide emissions. The facility reported using "other changes in operating practices" (W19) as a P2 practice. They stated that changes in beet storage and processing procedures can lead to less sugar loss to wash water and less potential for generating hydrogen sulfide in ponds. Specific changes discussed in the P2 information were increased refrigeration and softening of the beets. Although the company released less hydrogen sulfide, emissions of nitrate compounds and ammonia increased significantly. When the waste quantities were normalized relative to production for hydrogen sulfide, they no longer showed emission reductions.

The chemical manufacturing industry reduced overall emissions by 147,754 pounds in 2015. A chemical product and preparation manufacturer accounted for about 84% of the sector's total emissions by decreasing emissions of 34 different chemicals. The highest reduction was of aluminum (fume or dust) at 57,991 pounds. The facility reported using "other changes in inventory control" (W29) as a P2 practice. They provided no additional details about what those changes were. When waste quantities were normalized relative to production for aluminum, the number of pounds reduced was roughly half as much, indicating that a portion of reduced emissions was due to production-related events. In 2015, the company reported for the first time that it was treating a significant amount of aluminum emissions onsite, rather than releasing them.

One agricultural chemical manufacturer reduced emissions of dichloromethane by about 28% in 2015. They reported using "improved maintenance scheduling, recordkeeping, or procedures" (W13). They stated that they made an effort to minimize the number of rinse cycles implemented in their process and/or to complete initial rinses with water for some formulations before following up with dichloromethane rinses. When waste quantities were normalized relative to production for dichloromethane at this facility, a considerably smaller reduction was seen.

One paint and coating manufacturer reduced emissions of toluene by about 24%. They reported "changing the production schedule to minimize equipment and feedstock changeovers" (W14). They commented that they scheduled light to dark order runs to reduce equipment and change-over solvent flush. They also reported "instituting recirculation within a process" (W51) and "modifying equipment, layout, or piping" (W52) by adding more product transfer pump setups to reduce change-over cleanup

and waste. When waste quantities were normalized relative to production, the number of pounds of toluene reduced was lower but still significant.

In 2015, the petroleum industry reported overall reductions of emissions of 105,224 pounds. One facility contributed to about 72% of the total by reducing emissions of 27 chemicals. The highest reduction was of cobalt compounds at 35,416 pounds. They reported only “other process modifications” (W58) as a P2 practice, with no additional details. When cobalt waste quantities were normalized relative to production, the number of pounds reduced was lower but still significant. However, the company also reported in 2015 that they recycled almost all of the cobalt waste that they generated. In 2014, most of this waste was released. Thus, reported emission reductions may be a result of a change in waste management practices rather than the use of P2 techniques.

Bibliography

Ranson, Matthew, Brendan Cox, Cheryl Keenan, and Daniel Teitelbaum. (2015). "The Impact of Pollution Prevention on Toxic Environmental Releases from U.S. Manufacturing Facilities." *Environmental Science & Technology* 49 (21), pp. 12951-12957. Online at http://pubs.acs.org/doi/full/10.1021/acs.est.5b02367.

U.S. Census Bureau. (2015). NAICS Code 311 through 337 in Minnesota by Establishment. County Business Patterns (NAICS). [Table]. Retrieved from http://factfinder2.census.gov/bkmk/navigation/1.0/en/d_program:BP.

U.S. Environmental Protection Agency. (2010-2015). Greenhouse Gas Data for NAICS 311 through 337 in Minnesota. Greenhouse Gas Reporting Program data via Envirofacts. [Table]. Retrieved from http://www.epa.gov/enviro/facts/ghg/search.html.

U.S. Environmental Protection Agency. (2015). Toxics Release Inventory Data for NAICS 311 through 337 in Minnesota. [Table] Retrieved from data tables available at http://www2.epa.gov/toxics-release-inventory-tri-program/tri-data-and-tools.

U.S. Environmental Protection Agency. (2015). Toxics Release Inventory Data Pollution Prevention Data for NAICS 311 through 337 in Minnesota. [Table] Retrieved from http://www.epa.gov/enviro/facts/tri/p2.html.

U.S. Environmental Protection Agency. (2016). *TRI Pollution Prevention Factsheet*. Washington, DC: U.S. EPA. Online at https://www.epa.gov/sites/production/files/2016-05/documents/p2_factsheet_may_2016_final.pdf.

For More Information

Laura L. Barnes, Executive Director
Great Lakes Regional Pollution Prevention Roundtable
One Hazelwood Drive Champaign, IL 61820
(217) 333-8957 or l-barnes@illinois.edu