

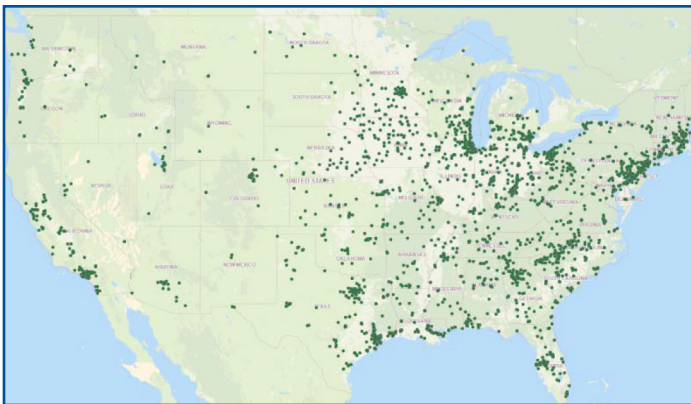
Chemical Manufacturing, Processing and Formulation

P2 National Emphasis Area (FY22-23)
P2-TRI Fact Sheet



EPA adopted six [national emphasis areas](#) (NEAs) for the FY 2022/2023 pollution prevention (P2) grant cycle. This fact sheet summarizes environmental and P2 information for one of the NEAs: **the chemical manufacturing, processing and formulation sector** (NAICS 325). According to the Census Bureau, this sector includes 13,571 establishments.¹ About 25 percent of these establishments (facilities) reported to the [Toxics Release Inventory \(TRI\)](#) for 2020.¹ TRI tracks the management of toxic chemicals as reported by U.S. industrial facilities. Annually, facilities report to TRI how much of each chemical is recycled, combusted for energy recovery, treated, and disposed of or otherwise released to the environment.

Locations of Chemical Manufacturing Facilities Reporting to TRI, 2020



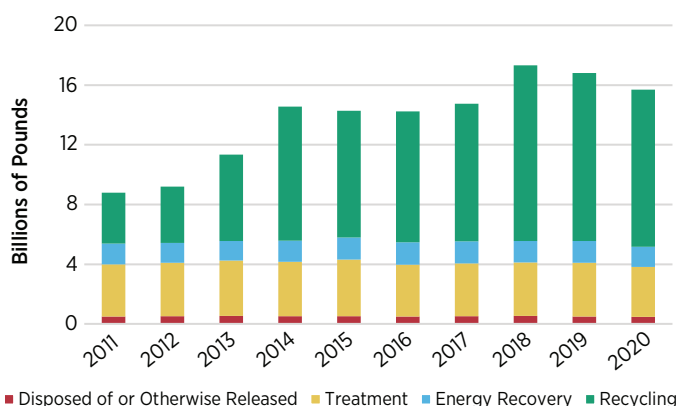
TRI Quick Facts for 2020

	Chemical Manufacturing	All Sectors
Number of TRI Facilities	3,411	21,022
Total Production-Related Waste Managed (lb)	15.9 billion	28.3 billion
Total On-site and Off-site Disposal or Other Releases (lb)	477 million	3.0 billion
Total On-site (lb)	403 million	2.7 billion
• Air (lb)	164 million	550 million
• Water (lb)	24.2 million	194 million
• Land (lb)	216 million	1.95 billion
Total Off-site (lb)	73.6 million	348 million

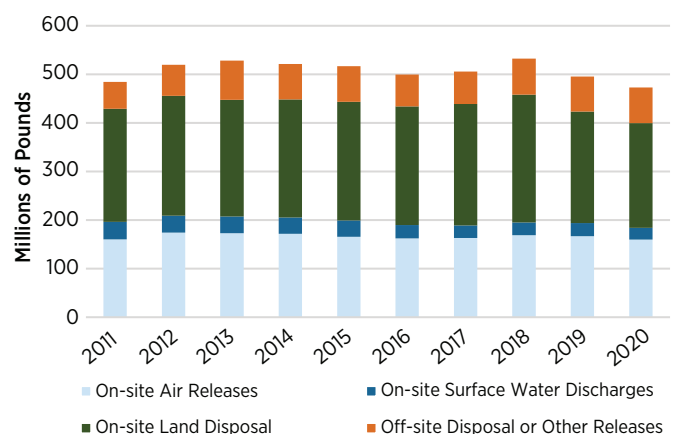
EPA encourages facilities to first eliminate the production of waste at its source (source reduction) prior to recycling, energy recovery, treatment, or disposal. The charts below show quantities of TRI chemicals released or otherwise managed as waste by the sector as reported to TRI. P2 technical assistance providers and others may be able to use the information below to identify opportunities that prevent chemical releases through source reduction activities. Information can be explored in more depth at [EPA's TRI P2 Search Tool](#).

Chemical Manufacturing

Waste Management Approaches



Total Releases by Media



For more information on P2 and the EPA's P2 Program, please contact the P2 Hub at: p2hub@epa.gov or 202-566-0799 or visit www.epa.gov/P2

¹ Data sources: U.S. EPA, 2020 TRI National Analysis data released October 2021; and U.S. Census Bureau, 2017 Economic Census

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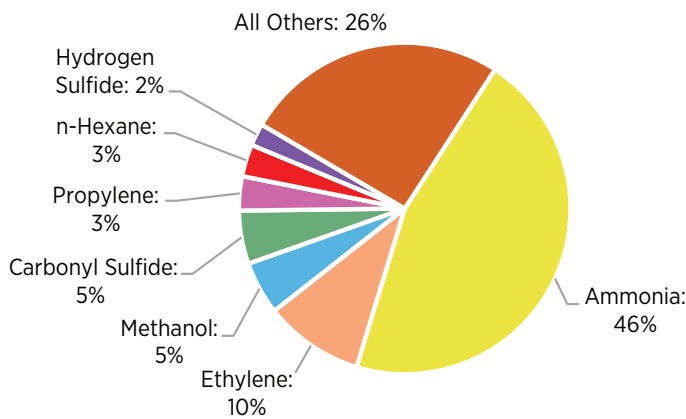
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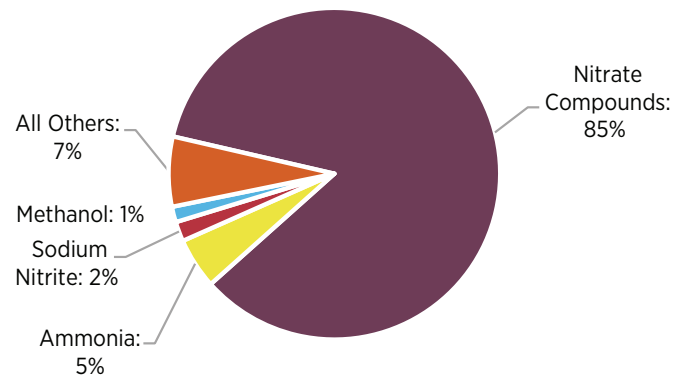
The following charts show the TRI chemicals released on site to air and water by facilities in the chemical manufacturing sector as a whole and for three selected chemical manufacturing subsectors: Pharmaceutical and Medicine Manufacturing (NAICS 3254); Paint, Coating and Adhesive Manufacturing (NAICS 3255); and Soap, Cleaning Compound, and Toilet Preparation Manufacturing (NAICS 3256). In these charts, each metal and its compounds are combined.

Chemical Manufacturing

Releases to Air, 2020
164 million pounds

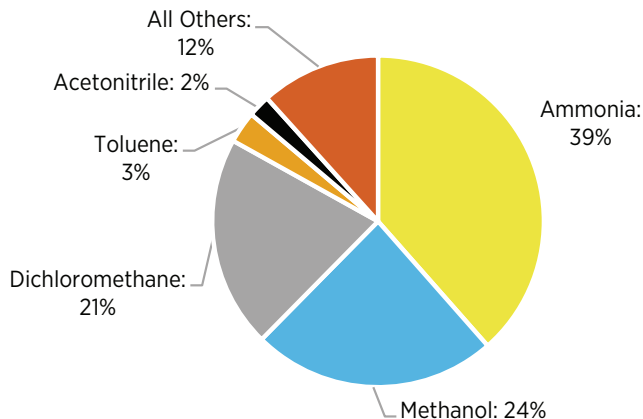


Releases to Water, 2020
24.2 million pounds

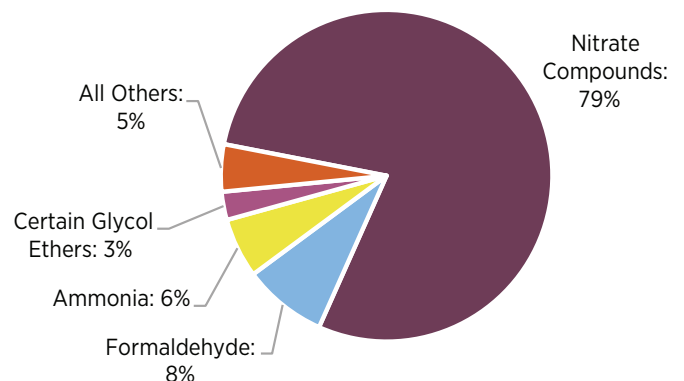


Pharmaceutical and Medicine Manufacturing

Releases to Air, 2020
2.3 million pounds



Releases to Water, 2020
440 thousand pounds



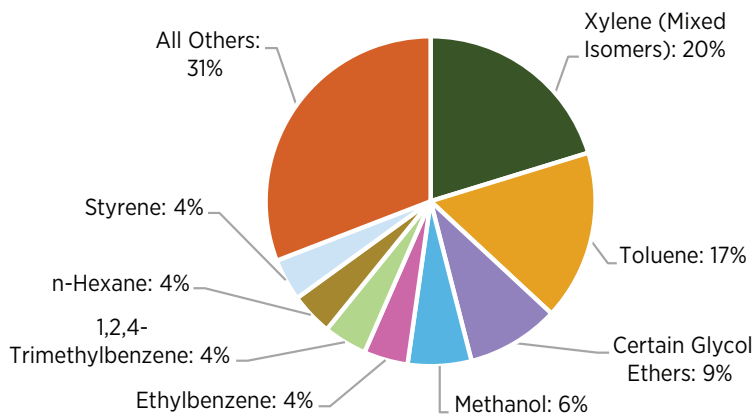
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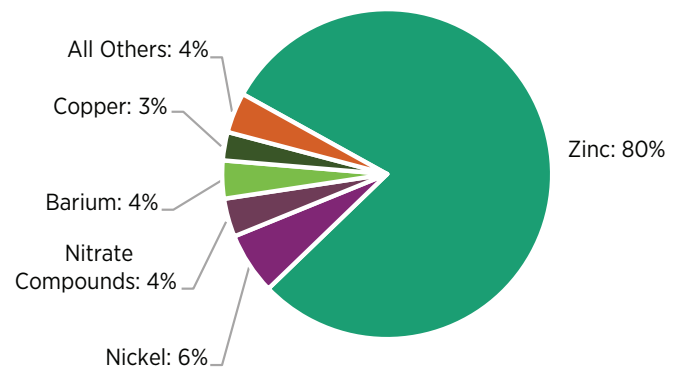


Paint, Coating, and Adhesive Manufacturing

Releases to Air, 2020
2.3 million pounds

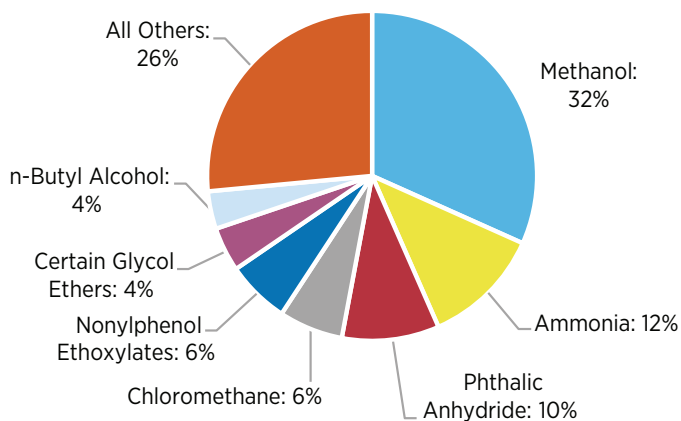


Releases to Water, 2020
3,384 pounds

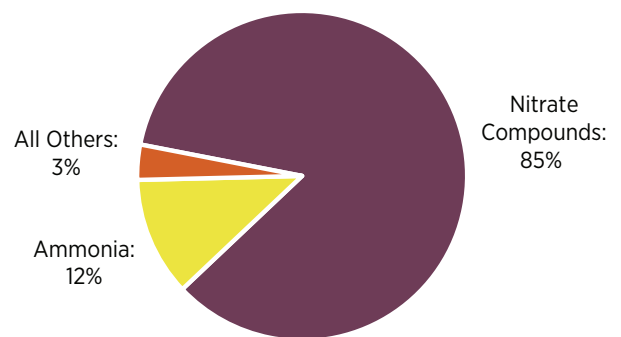


Soap, Cleaning Compound, and Toilet Preparation Manufacturing

Releases to Air, 2020
900 thousand pounds



Releases to Water, 2020
54,320 pounds



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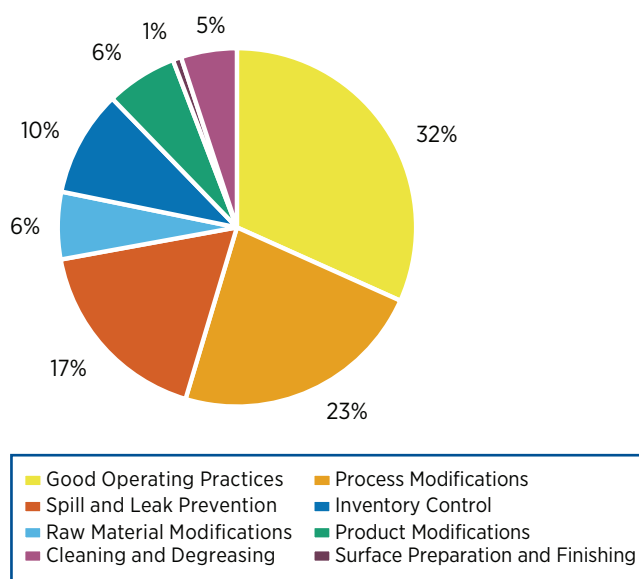


P2 Activities Reported to TRI

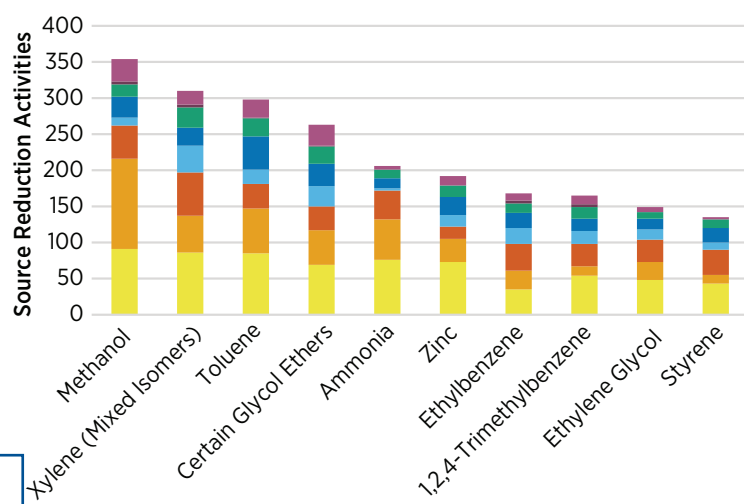
The figures below illustrate the source reduction activities reported to TRI by facilities in the subsectors comprising the chemical manufacturing sector for 2016 - 2020. In the bar chart, each metal and its compounds are combined.

Chemical Manufacturing, 2016-2020

Source Reduction Activities



Source Reduction Activities by Chemical



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P2 Opportunities

Some examples of P2 achievements in the chemical manufacturing sector from published sources are listed below. For information on additional P2 opportunities, go to [EPA's P2 Resources Search tool](#) or the [TRI Pollution Prevention Search tool](#). Some of the sources below link to non-EPA web sites. EPA cannot attest to the accuracy of non-EPA sources and providing links to a non-EPA source is not an endorsement by EPA of the source or the information it contains.

- **Changing from a batch reaction to a continuous process.** Many chemical manufacturing facilities process chemicals through multiple chemical reaction steps, which can be batch reactions or continuous reactions. Often, changing from a batch reaction to a continuous process significantly reduces pollution. Advantages of switching to continuous reactions might include improved product yield and purity; reduced use of inputs, including solvents, catalysts, and energy; reductions in waste generated and an overall increase in manufacturing efficiency.
 - [Continuous process technology: a tool for sustainable production](#) discusses the sustainability aspects of continuous production processes within the chemical manufacturing industry.
 - [Using Continuous Processes to Increase Production](#) provides examples of continuous reactions in the pharmaceutical manufacturing sector.
- **Implementing good manufacturing processes**, such as optimizing reaction sequences to minimize cleaning required.
 - The [TRI Pollution Prevention Search tool](#) includes numerous examples of facilities implementing good operating processes.
- **Improving handling, storage, and spill and leak prevention**, such as using re-usable containers for chemical transport and using containers designed to minimize residues.
 - The European Union's [Best Available Techniques \(BAT\) Reference Document on Emissions from Storage](#) outlines a variety of techniques for preventing spills, leaks, and other emissions during storage and transfer of chemicals.
- **Optimizing reaction conditions** to maximize reaction efficiency and product purity.

Some P2 techniques are specific to certain subsectors, or specific chemical products or processes. For example, P2 opportunities in the pharmaceutical manufacturing subsector include:

- **Choosing solvents for hazardous waste reductions.** Improved solvent use can include reducing quantities of solvents used by increasing processing efficiency; switching to less-hazardous or non-hazardous solvents; considering recovery of catalysts, excess inputs, and products; and considering physical properties such as boiling point that may improve energy efficiency or safety.
 - [Green Techniques for Organic Synthesis and Medicinal Chemistry](#) lists numerous P2 opportunities in the pharmaceutical manufacturing sector, including chapters on solvents and case studies from the pharmaceutical industry.
 - Solvent selection guides, like the [American Chemical Society's Solvent Selection Tool](#) originally developed by AstraZeneca, can help facilities choose appropriate solvents.
- **Substituting Safer Ingredients.** EPA's Safer Choice Program maintains the [Safer Chemical Ingredients List](#), which includes specific chemical ingredients that have been verified as safer choices for use in chemical products. Safer ingredients are listed in many categories, such as colorants, fragrances, and solvents.

For more information on P2 and the EPA's P2 Program, please contact the P2 Hub at:
p2hub@epa.gov or 202-566-0799 or visit www.epa.gov/P2