Comparing Industry Sectors

This section examines which sectors contributed the most to production-related waste managed in 2017 and highlights several industry sectors to show trends occurring over time. It also discusses the trends among federal facilities, which report to the Toxics Release Inventory (TRI) regardless of sector. For analysis purposes, the TRI Program has aggregated the North American Industry Classification System (NAICS) codes at the 3- and 4-digit levels, creating 29 industry sector categories. To learn more about which business activities are subject to TRI reporting requirements, see this list of covered NAICS codes.

The industries that are subject to TRI reporting requirements vary substantially in size, scope, and business type. As a result, the amounts and types of chemicals used, generated, and managed by facilities within a given industry sector often differ greatly from those of facilities in other sectors. For facilities in the same sector, however, the processes, products, and regulatory requirements are often similar, resulting in similar manufacture, processing, or other use of chemicals. Looking at chemical waste management trends within a sector can highlight progress made in improving environmental performance, identify emerging issues, and reveal opportunities for better waste management practices.

![Production-Related Waste Managed by Industry, 2017](image)

**Production-Related Waste Managed by Industry, 2017**

- **Chemicals**: 51%
- **Primary Metals**: 8%
- **Petroleum**: 7%
- **Paper**: 7%
- **Food**: 5%
- **Electric Utilities**: 4%
- **Metal Mining**: 7%
- **All others**: 12%

30.57 billion pounds

Note: Percentages may not sum to 100% due to rounding.
Seven industry sectors reported 89% of the quantities of TRI chemicals managed as production-related waste in 2017. A majority of TRI chemical waste managed originated from the chemical manufacturing sector (51%).

This pie chart shows that 80% of the quantities of TRI chemicals disposed of or otherwise released originated from 4 of the 29 industry sectors that are subject to the TRI reporting requirements: metal mining (50%), chemical manufacturing (13%), electric utilities (9%), and primary metals (8%).

For more details on how the amounts and proportions of TRI chemicals managed as waste have changed over time, see the production-related waste managed by industry trend graph.

For more information on the breakdown of these releases by medium, see land disposal by industry, air releases by industry, and water releases by industry.

As with any dataset, there are several factors to consider when using the TRI data. Key factors associated with data presented are summarized in the Introduction. For more information see
Factors to Consider When Using Toxics Release Inventory Data. Also note that the list of TRI chemicals has changed over the years. For comparability, trend graphs include only those chemicals that were reportable for all years presented. Figures that focus only on the year 2017 include all chemicals reportable for 2017, therefore, values for a 2017-only analysis may differ slightly from results for 2017 in a trend analysis.
Manufacturing Sectors

What the Sector Does
The manufacturing sectors are goods-producing industries that transform materials into new products. These sectors include businesses involved in the production of food, textiles, paper, chemicals, plastics, petroleum products, metal products, electronics, furniture, vehicles, equipment, and other products.

This map shows the locations of the manufacturing facilities that reported to TRI for 2017.
For 2017, nearly 90% of the facilities that reported to TRI were in a manufacturing sector. The manufacturing sector accounted for most (86%) of the 30.6 billion pounds of TRI production-related waste reported to TRI for 2017. Two of the manufacturing sectors (paint and coating and chemicals) are highlighted in more detail later in this section.

The TRI-covered industry sectors not categorized under manufacturing include metal mining, coal mining, electric utilities, chemical wholesalers, petroleum terminals, hazardous waste management, and others.
Waste Management Trend

The following graph shows the annual quantities of TRI chemicals managed as waste by the manufacturing sectors.

From 2007 to 2017:

- Production-related waste managed by the manufacturing sectors decreased through 2009, following the trend of reduced production resulting from the economic recession. Since 2009, quantities of waste managed have increased.
  - Quantities of waste released and treated decreased, while the quantity of waste combusted for energy recovery and waste recycled increased.

- It is important to consider the influence the economy has on production and production-related waste generation. This figure also includes the trend in manufacturing sectors’ “value added” (represented by the black line as reported by the Bureau of Economic Analysis, Value Added by Industry). Value added is a measure of production that is defined as the contribution of these manufacturing sectors to the national gross domestic product.
• Production-related waste managed by the manufacturing sectors increased by 26%, while value added by the manufacturing sectors increased by 2%. The large increase in recycled waste starting in 2014 was primarily due to an increase in the quantity of cumene recycled by one facility and dichloromethane recycled by another facility. Excluding these amounts, the total quantities of the manufacturing sectors’ production-related waste decreased by 1% since 2007, even as value added increased.

From 2016 to 2017:

• Production-related waste managed increased by 12% (2.65 billion pounds). This increase is largely due to a single facility that reported recycling 1.5 billion pounds of dichloromethane on site in 2017. This facility did not previously report recycling this chemical on site. Excluding this amount for 2017, the total quantity of the manufacturing sectors’ production-related waste increased by 5%.

• In 2017, only 6% of the manufacturing sectors’ waste was released into the environment, while the rest was managed through treatment, energy recovery, and recycling.
Manufacturing Releases Trend

The following graph shows the annual quantities of TRI chemicals released by the manufacturing sectors.

![Total Disposal or Other Releases: Manufacturing Sectors](image)

From 2007 to 2017:

- Total releases by the manufacturing sectors decreased by 25%. This is primarily due to a reduction in air emissions and off-site disposal or other releases.
- Releases to water also declined, while on-site land disposal increased by 12%.

From 2016 to 2017:

- Total releases decreased by 1% (18 million pounds).
- On-site land disposal, releases to air, and off-site disposal or other releases all decreased.
Source Reduction in the Manufacturing Sectors:

In 2017, 8% of manufacturing facilities initiated more than 3,500 source reduction activities to reduce TRI chemical use and waste generation. The most commonly reported types of source reduction activities were good operating practices and process modifications. For example:

- A writing products manufacturing facility installed a level detection device such that transfer pumps will shut down in case of high levels in the butanol tank, which decreases the chances for spills and overflows. [Click to view facility details in the Pollution Prevention (P2) Tool]

- A plastics and resin manufacturing facility reduced its methanol usage by changing its mold release solvent and cleaning solvent from methanol to isopropyl alcohol. [Click to view facility details in the P2 Tool]

You can learn more about pollution prevention opportunities in this sector by using the TRI Pollution Prevention (P2) Search Tool.
Paint and Coating Manufacturing

What the Sector Does
The paint and coating sector manufactures products that protect and beautify the surfaces to which they are applied – from homes, cars, and manufactured products to bridges and other structures.

This map shows the locations of the paint and coating manufacturing facilities that reported to TRI for 2017.
Paint and Coating Manufacturing Facilities Reporting to TRI, 2017

**Paint and Coating Manufacturing Waste Management Trend**

The following graph shows the annual quantities of TRI chemicals managed as waste by the paint and coating manufacturing industry.
From 2007 to 2017:

- Production-related waste managed by the paint and coating sector decreased from 2007 through 2009, following the trend of reduced production resulting from the economic recession. Since 2009, quantities of waste managed increased through 2014, at which point production-related waste began to decrease. Overall, waste quantities have decreased by 22%.

- Production (represented by the black line as reported by the Federal Reserve Board, Industrial Production Index) increased by 2%.

From 2016 to 2017:

- Production-related waste decreased by 14% (16 million pounds). This is driven by one facility that reported no recycling of methanol for 2017 but had reported over 15 million pounds recycled per year in prior years.

- In 2017, only 4% of the sector’s waste was released into the environment, while the rest was managed through treatment, energy recovery, and recycling.
Paint and Coating Manufacturing Releases Trend

The following graph shows the annual quantities of TRI chemicals released by the paint and coating manufacturing industry.

**Total Disposal or Other Releases: Paint and Coating Manufacturing**

- **From 2007 to 2017:**
  - The sector’s total disposal or other releases decreased by 26% (1.3 million pounds) since 2007. This is primarily due to reductions in releases to air.

- **From 2016 to 2017:**
  - Total releases decreased by 11% (0.5 million pounds), driven by continued reductions in air emissions.
Solvent Use in the Paint and Coating Manufacturing Sector

Certain volatile organic chemicals (VOCs) are used in the paint and coating sector as solvents. Solvents are used to dissolve or suspend other chemicals, such as pigments in paint. Organic solvents are often used because they dry quickly when exposed to air, a property desirable for most paint and coating applications. Many organic solvent chemicals used by the Paint and Coating Manufacturing sector are included on the TRI chemical list. For years, the sector has been implementing efforts to reduce the use and release of solvents. This graph shows the trend in air releases of five solvents that this sector reported releasing in the largest quantities.

- Total releases of these five key solvents from the paint and coating industry have dropped by 842 thousand pounds (37%) since 2007. This is largely due to a reduction in air releases, which decreased 42% since 2007.
- Many facilities in this industry reported changing cleaning solvents or reformulating products to reduce their use of TRI-reportable hazardous solvents. Facilities gave various reasons for these changes, including VOC regulations, industry trends toward lower-VOC products, and a continuing desire to reduce toxics in their products.
Lead in the Paint and Coating Manufacturing Sector

Although lead was banned from consumer paints in the U.S. in 1978, it may still be used in some paints and coatings, such as those for industrial use. Lead use by the paint and coating sector has greatly declined over several decades, with continuing reductions in recent years.

From 2007 to 2017:

- Releases of lead and lead compounds by the paint and coating industry have decreased by 18 thousand pounds (81%).
- The increase in releases in 2010 was due to a large one-time release by one facility and a large transfer to a hazardous waste facility by another facility. The increase from 2016 to 2017 was driven by increased off-site transfers for disposal from one facility which permanently closed in 2017.
- The decline in lead releases by the paint and coating industry reflects efforts by several companies that have voluntarily stopped using lead in their paints and coatings or have begun phasing it out, including AkzoNobel, the world’s largest paint manufacturer, which had completely removed lead pigments and drying agents from its products by 2011.
In 2017:

- 59% of all lead releases in the sector were from facilities owned by PPG. PPG has announced plans to phase out lead from its industrial paints by 2020.

**Source Reduction in the Paint and Coating Sector:**

Eleven percent of paint and coating manufacturing facilities initiated source reduction activities in 2017. The most commonly reported types of source reduction activities were process modifications and good operating practices. For example:

- A paint manufacturing facility reduced the amount of solvent used in its raw materials and replaced it with more environmentally friendly material. [Click to view facility details in the Pollution Prevention (P2) Tool]
- A coating manufacturer has seen decreases in its releases of lead compounds as it has moved customers away from the use of leaded pigments. [Click to view facility details in the P2 Tool]

You can learn more about pollution prevention opportunities in this sector by using the TRI Pollution Prevention (P2) Search Tool.
Chemical Manufacturing

**What the Sector Does**
Chemical manufacturers convert raw materials into thousands of different products, including basic chemicals, products used by other manufacturers (such as synthetic fibers, plastics, and pigments), pesticides, and cosmetics, to name a few.

This map shows the locations of the chemical manufacturing facilities that reported to TRI for 2017.
Chemical Manufacturing Facilities Reporting to TRI, 2017

For 2017, the chemical manufacturing sector had the most facilities (3,449, 16% of facilities that reported for 2017) report to the Toxics Release Inventory (TRI) and reported 51% of all production-related waste managed, more than any other sector.
Chemical Manufacturing Waste Management Trend

The following graph shows the annual quantities of TRI chemicals managed as waste by the chemical manufacturing industry.

![Production-Related Waste Managed: Chemical Manufacturing](image)

From 2007 to 2017:

- Production-related waste managed by the chemical manufacturing sector increased by 51%, while production (represented by the black line as reported by the Federal Reserve Board, Industrial Production Index) decreased by 19%.
  - The large increase in recycled waste starting in 2014 was primarily due to an increase in the quantity of cumene recycled by one facility and dichloromethane recycled by another facility.
  - Excluding those two facilities, total production-related waste managed by the sector decreased by 6%.
- Quantities of TRI chemicals released, treated, or combusted for energy recovery decreased, while the quantities of TRI chemicals recycled increased.
From 2016 to 2017:

- Production-related waste managed at chemical manufacturing facilities increased by 2.5 billion pounds (20%), largely due to a 1.5 billion pound increase in the quantity of dichloromethane recycled by one plastics manufacturing facility.

- In 2017, only 3% of this sector’s waste was released into the environment, while the rest was managed through treatment, energy recovery, and recycling.
Chemical Manufacturing Releases Trend

The following graph shows the annual quantities of TRI chemicals released by the chemical manufacturing industry.

![Graph of Total Disposal or Other Releases: Chemical Manufacturing](image)

**From 2007 to 2017:**

- Total releases by the chemical manufacturing sector decreased by less than 1%.
- The distribution of releases has changed during this time period with reduced releases to air and increased disposal to land. This change has been driven largely by decreased air releases of common chemicals including methanol, carbonyl sulfide, and hydrochloric acid, and increased land disposal of many metal compounds such as barium compounds and zinc compounds.

**From 2016 to 2017:**

- Total releases decreased by 0.5 million pounds (<1%).
- For 2017, the chemical manufacturing sector reported larger air release quantities than any other sector, accounting for 25% of all reported quantities of TRI chemicals emitted to air.
Source Reduction in the Chemical Manufacturing Sector:

Although chemical manufacturing has consistently been the sector with the most production-related waste managed, 10% of facilities (over 300 facilities) in this sector initiated source reduction activities in 2017 to reduce their TRI chemical use and waste generation. The most commonly reported types of source reduction activities were good operating practices and process modifications. For example,

- An artificial and synthetic fibers and filaments manufacturing facility reduced waste by changing from soft water to demineralized water in a process solution bath. The previous water supply was found to be high in sulfates, which interfered with reactivity and catalysis, and the change improved bath solution quality and efficiency. [Click to view facility details in the Pollution Prevention (P2) Tool]

- A synthetic dye and pigment manufacturing facility reduced its nitrate compound use by developing a new dissolution process replacing nitric acid with hydrochloric acid. [Click to view facility details in the P2 Tool]

Resources

EPA's Smart Sectors Program is partnering with chemical manufacturing trade associations to develop sensible approaches that better protect the environment and public health.

TRI’s Pollution Prevention Search Tool can help you learn more about pollution prevention opportunities in this sector.

For more information on how this and other industry sectors can choose safer chemicals, visit EPA’s Safer Choice Program pages for Alternatives Assessments and the Safer Choice Ingredients List.
Metal Mining

What the Sector Does
The metal mining sector extracts and processes ores (metal-bearing rock) to refine the valuable target metals. The portion of the metal mining sector covered by TRI reporting requirements includes facilities mining copper, lead, zinc, silver, gold, and several other metals.

This map shows the locations of the metal mining facilities that reported to TRI for 2017. Mines are shown on this map based on their longitude/latitude which may be miles from the city on the mine’s TRI reporting forms. Mines can qualify their location relative to the city by noting the distance in the street address data field of their TRI reports.
For 2017, 85 metal mining facilities reported to TRI. They tend to be in western states where most of the copper, silver, and gold mining occurs; however, zinc and lead mining tend to occur in Missouri and Tennessee, as well as Alaska. Metals generated from U.S. mining operations are used in a wide range of products, including automobiles and electric and industrial equipment, as well as jewelry and decorative objects. The extraction and beneficiation or other processing of these minerals generate large amounts of on-site land disposals, primarily of metals included on the TRI list of chemicals contained in the ore and waste rock. Metal mining operations are subject to federal and state regulations.
Metal Mining Waste Management Trend

The following graph shows the annual quantities of TRI chemicals managed as waste by the metal mining industry from 2007 to 2017, mainly in the form of on-site land disposal.

From 2007 to 2017:

- While metal mining production (as reported in the United States Geological Survey) remained relatively steady, the quantity of waste managed fluctuated.
- Besides production, one factor commonly cited by facilities as a contributor to the changes in quantities of waste managed is the chemical composition of the extracted ore and waste rock, which can vary substantially from year to year. In some cases, small changes in the waste rock’s composition can impact whether chemicals in waste rock qualify for a concentration-based exemption from TRI reporting in one year but not in the next year or vice versa.
From 2016 to 2017:

- The quantity of TRI chemical waste disposed of or otherwise released by this sector increased by 434 million pounds (29%) between 2016 and 2017, largely driven by a 326 million pound increase reported by one facility.

- During 2017, 97% of the metal mining sector’s production-related waste was disposed of or otherwise released. The majority of this waste consisted of metals, which were primarily disposed of to land on site.
Metal Mining Releases Trend

The following graph shows the annual quantities of TRI chemicals released by the metal mining industry, primarily through on-site land disposal.

From 2007 to 2017:

- More than 99% of the metal mining sector’s releases were in the form of on-site land disposal. The quantity of on-site land disposal by metal mines has fluctuated in recent years.

- Several mines have reported that changes in production and changes in the chemical composition of the deposit being mined are the primary causes of fluctuations in the amount of chemicals reported as disposed of on site.

- Metal mining facilities typically handle large volumes of material, and even a small change in the chemical composition of the deposit being mined can lead to big changes in the amount of TRI chemicals reported.

- The quantity of TRI chemicals released is not an indicator of health risks posed by the chemicals as described in the Introduction. For more information, see the TRI document, Factors to Consider When Using Toxics Release Inventory Data.
In 2017:

- The metal mining sector reported the largest quantity of total disposal or other releases, accounting for 50% of total TRI releases and 72% of on-site land disposal for all industries.

Source Reduction in the Metal Mining Sector:

None of the 85 metal mining facilities reported initiating source reduction activities for TRI chemicals in 2017. Unlike manufacturing, the nature of mining—the necessary movement and disposal of TRI chemicals present in large volumes of earth to access the target ore—does not lend itself to source reduction. TRI’s Pollution Prevention Search Tool can help you learn more about pollution prevention opportunities in this sector.
Electric Utilities

What the Sector Does
Electric utilities generate, transmit, and distribute electric power. Electric-generating facilities use a variety of fuels to generate electricity; however, only those electricity generating facilities that combust coal or oil to generate power for distribution in commerce are subject to TRI reporting requirements.

This map shows the locations of the electric utilities that combust coal or oil to generate power for distribution in commerce and reported to TRI for 2017.
Electric Utilities Reporting to TRI, 2017

For 2017, 474 electricity generating facilities that combust coal or oil reported to TRI.
Electric Utilities Waste Management Trend

The following graph shows the annual quantities of TRI chemicals electric utility facilities manage as waste.

From 2007 to 2017:

- Production-related waste managed decreased by 557 million pounds (29%) since 2007, driven by reduced releases.

- Net electricity generation decreased by 41% (in terms of electricity generated by electric utilities using coal and oil fuels as reported by the U.S. Department of Energy's Energy Information Administration). The recent production decrease (beginning in 2014) was driven by the industry’s transition to natural gas, as only facilities that combust coal or oil to produce power are covered under TRI reporting requirements.

In 2017:

- Approximately three-quarters of the production-related waste was treated, while one-quarter was released to the environment.
This is in contrast to 2007, when over half of the waste was released. This trend is largely due to an increase in scrubbers at electric utilities that treat (or destroy) TRI-reportable acid gases that would otherwise be released on site to the air.
Electric Utilities Releases Trend

The following graph shows the annual quantities of TRI chemicals electric utility facilities released or disposed.

From 2007 to 2017:

- Releases from the electric utilities sector decreased by 66%. This decrease was driven by an 87% decrease in on-site air releases. On-site land disposal, on-site surface water discharges, and off-site disposal also decreased, but to a lesser extent.

From 2016 to 2017:

- Releases by electric utilities decreased by 6% (20 million pounds). This decrease was driven by reductions in on-site land disposal, off-site disposal, and continued reductions in air emissions.
Source Reduction in the Electric Utilities Sector:

In the electric utilities sector, 10 facilities (2% of the electric utility facilities reporting to TRI) initiated source reduction activities in 2017 to reduce their use of TRI chemicals and generation of wastes that contain TRI chemicals. Note that adding treatment equipment is considered a control technology for TRI chemical waste that is generated, and is not a source reduction activity that prevents waste from being generated. The most commonly reported types of source reduction activities for this sector were good operating practices and spill and leak prevention. TRI’s Pollution Prevention Search Tool can help you learn more about pollution prevention opportunities in this sector.
Federal Facilities

This map shows the locations of the federal facilities that reported to Toxics Release Inventory (TRI) in 2017.

Federal Facilities Reporting to TRI, 2017

The 1993 Executive Order 12856, “Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements,” established the requirement that all federal facilities, including facilities operated by the U.S. EPA, are subject to the Toxics Release Inventory (TRI) reporting requirements, regardless of the type of operations at the facility as described by their NAICS code. This executive order has been reaffirmed by subsequent administrations.
Federal Facilities by Industry

The following chart shows the number of federal facilities reporting to TRI by sector for 2017.

Note: Percentages may not sum to 100% due to rounding.

For 2017, 458 federal facilities in 39 different types of operations (based on their 6-digit NAICS codes) reported to TRI. Almost two-thirds of these facilities were in the National Security sector, which includes Department of Defense facilities such as Army and Air Force bases. All federal facilities are subject to TRI reporting requirements regardless of their sector. Therefore, for some industry sectors, the TRI database only includes data from federal facilities. More than three-quarters of federal facilities are in such sectors, including Military Bases (63%); Correctional Institutions (13%); and Police Protection, such as training sites for Border Patrol stations (5%).

As with non-federal facilities, activities at federal facilities drive the types and quantities of waste managed that is reported. Some of the activities at federal facilities that are captured by
TRI reporting are similar to those at non-federal facilities, such as hazardous waste treatment. In other cases, federal facilities may report waste managed from specialized activities that are not usually performed by non-federal facilities. For example, all of the federal facilities included under Police Protection and Correctional Institutions only reported for lead and lead compounds, likely due to the use of lead ammunition on firing ranges at these facilities.
Waste Management by Federal Facilities

The following pie chart shows the percentages of TRI chemicals managed as waste by federal government organizations in 2017.

Production-Related Waste by Government Organization, 2017
146.8 million pounds

- Department of Defense: 47%
- Tennessee Valley Authority: 40%
- Department of the Treasury: 11%
- All Others: 3%

Note: Percentages may not sum to 100% due to rounding.

- The types of waste reported by federal facilities vary by the type of operation.
  - The Tennessee Valley Authority (TVA) is a government-owned electric utility that provides power to southeastern states. Out of the 18 TVA facilities that reported to TRI for 2017, virtually all of the TRI production-related waste comes from the fossil fuel plants that report in the Fossil Fuel Electric Power Generation sector. Nearly 80% of their reported waste was hydrochloric and sulfuric acid aerosols which were mostly treated on site.
  - The Department of the Treasury facilities reporting to TRI are mints for manufacturing currency and, accordingly, they report metals (e.g., copper and nickel) to TRI. All of their metal waste is recycled off site.
Source Reduction at Federal Facilities:

Since federal facilities are subject to TRI reporting regardless of their industry sector classification, their operations are diverse and few focus on manufacturing processes. Due to their unique functions, some federal facilities may face challenges in implementing source reduction strategies to reduce chemical waste. For the 2017 reporting year, 13 federal facilities (3%) reported implementing source reduction activities.

Federal facilities have often indicated barriers in reducing use of lead because it is contained in ammunition used at National Security and Park Service facilities. In 2017, several federal facilities reported using green ammunition in accordance with National Park Service policy to use nonlead ammunition where feasible. To find more examples of federal facilities’ source reduction activities and the barriers they face to implementing source reduction, visit TRI’s Pollution Prevention Search Tool and select industry sectors such as National Security, Correctional Institutions or Police Protection from the dropdown menu under “search criteria.”