



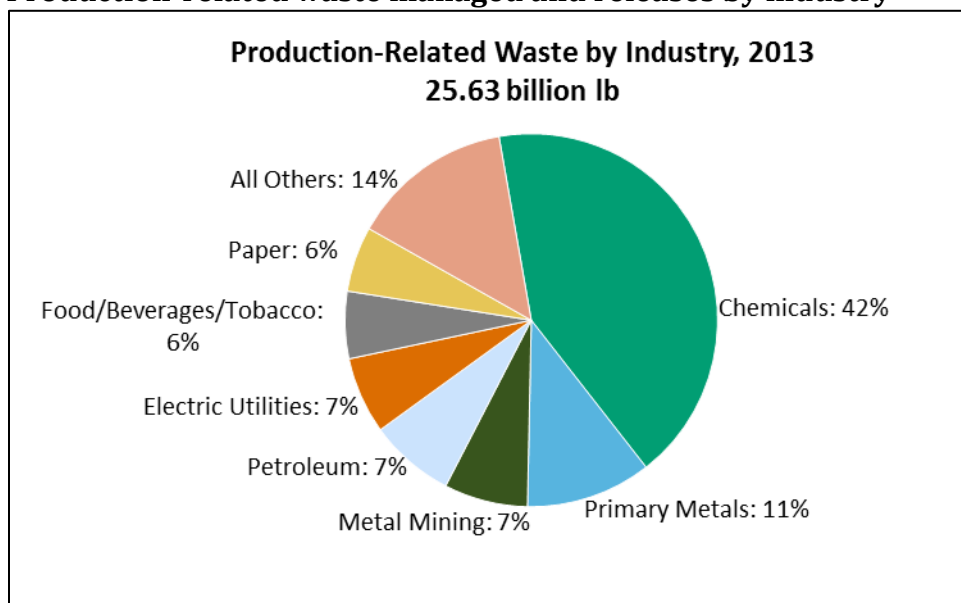
Industry Sectors

Comparing Industry Sectors

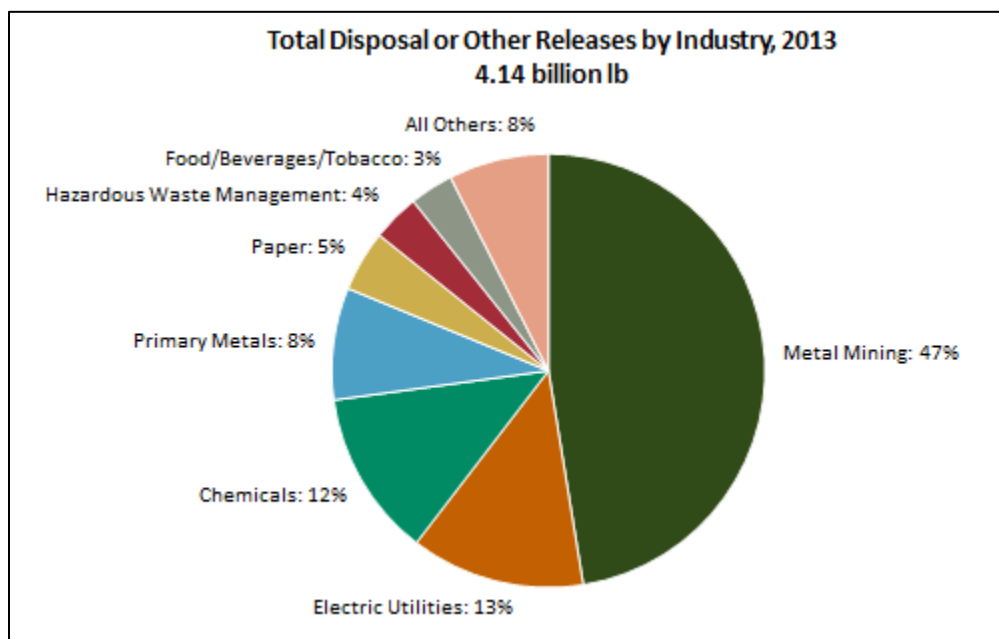
Individual industry sectors reporting to TRI can vary substantially in size, scope, and makeup, therefore, the amounts and types of toxic chemicals generated and managed by each differ greatly. Within a sector, however, the industrial processes, products, and regulatory requirements are often similar, resulting in similar toxic chemical use and waste generation. Therefore, it is useful to look at waste management trends within a sector to identify potential emerging issues and opportunities for better waste management practices.

This chapter examines which sectors contribute the most to production-related waste managed and total disposal or other releases in 2013, and highlights several industry sectors to show trends occurring over time within each. For analysis purposes, the TRI program has combined 3- and 4-digit North American Industry Classification System (NAICS) codes to create 26 distinct industry sector categories.

Production-related waste managed and releases by industry



This pie chart shows that 86% of production-related waste managed was reported from seven industry sectors. More than 60% originated from three sectors: chemicals (42%), primary metals (11%), and metal mining (7%).



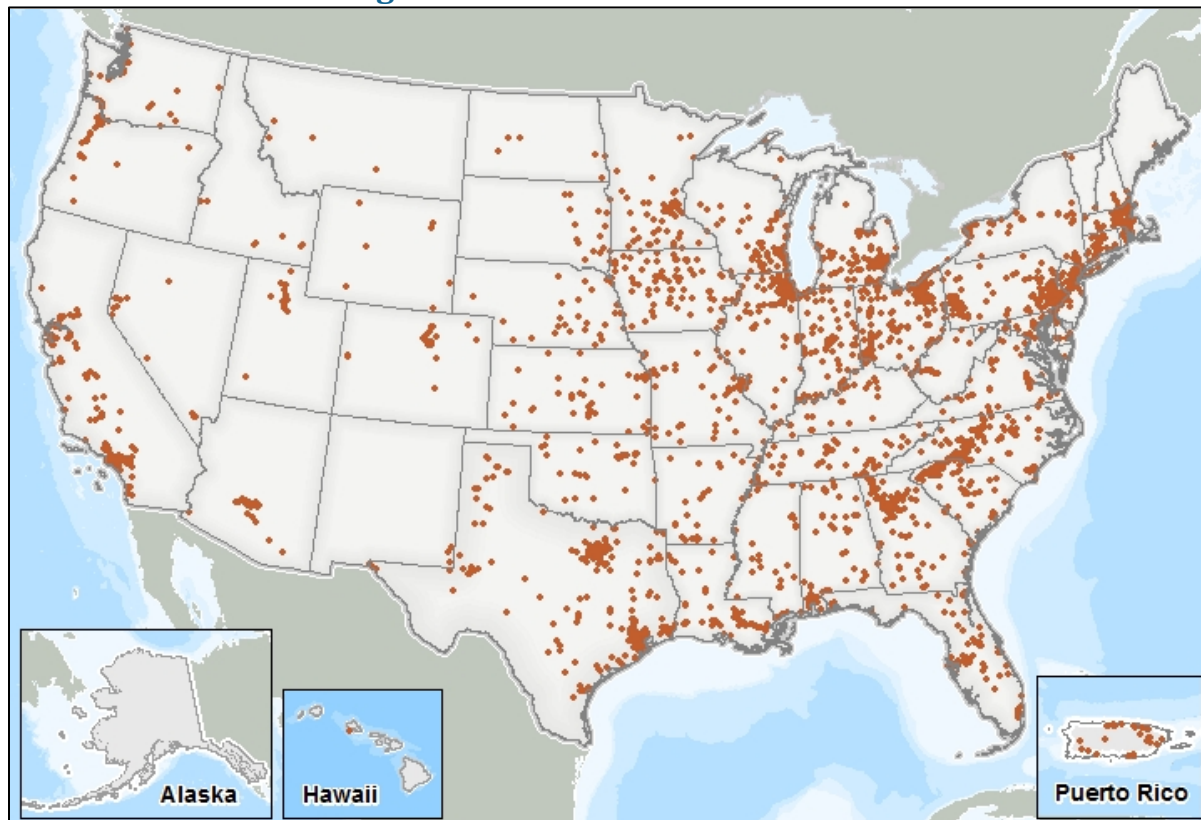
This pie chart shows that 92% of total disposal or other releases of TRI chemicals originated from seven of the 26 TRI industry sectors. Recall that disposal or other releases make up a portion of production-related waste managed, so this chart shows a more in-depth look at the 4.14 billion pounds of releases that are also one part of the 25.63 billion pounds of production-related waste managed. More than two-thirds originated from just three industry sectors: metal mining (47%), electric utilities (13%), and chemicals (12%). Both metal mining and chemical sectors are in the top three for waste management and total releases.

Over time, the amounts and proportions of TRI chemicals managed including how released have varied. For more details, see the production-related waste managed by industry trend graph and the releases by industry trend graph.

Some sectors have reported a significant percentage decrease in production-related waste managed and releases in recent years. For more information on these sectors and their reported source reduction activities, see the industry sectors with largest percentage decrease in releases graph and the types of source reduction activities graph.

It is also important to consider the influence that production and the economy have on waste managed and releases. For more information, see the production-related waste managed and value added by the manufacturing sector graph and the total releases and value added by the manufacturing sector graph.

Chemical Manufacturing



Chemical Manufacturing Facilities Reporting to TRI, 2013

Chemical manufacturers produce a variety of products, including basic chemicals, products used by other manufacturers (such as synthetic fibers, plastics, and pigments), and consumer products (such as paints, fertilizers, drugs, and cosmetics). In 2013, 3,454 chemical manufacturing facilities reported to TRI; more than any other sector. This sector reported 42% of the TRI production-related waste managed; also more than any other sector.



Quick Facts for 2013 Chemical Manufacturing

Number of TRI Facilities: 3,454

Facilities Reporting Newly Implemented Source
Reduction Activities: 737

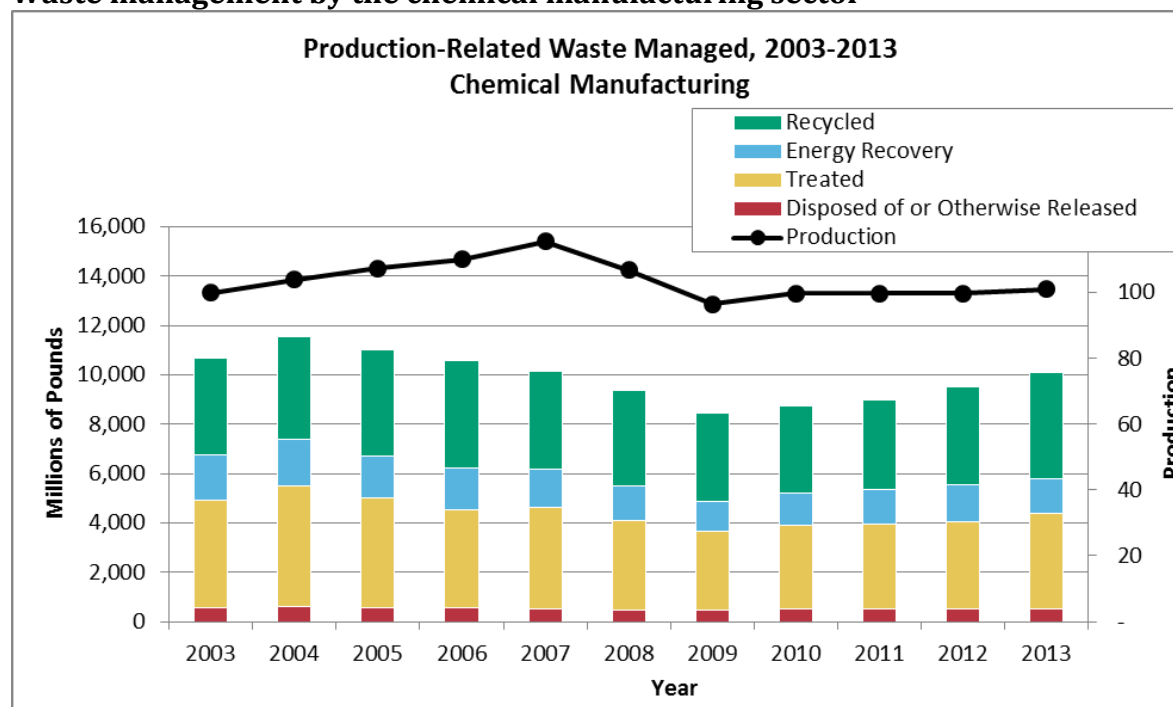
Production-Related Waste Managed: 10,819.1 million lb

- Recycled: 4,375.0 million lb
- Energy Recovery: 1,557.4 million lb
- Treated: 4,364.6 million lb
- Disposed of or Otherwise Released:
522.2 million lb

Total Disposal or Other Releases: 523.3 million lb

- **On-site: 453.8 million lb**
 - Air: 177.9 million lb
 - Water: 34.0 million lb
 - Land: 241.9 million lb
- **Off-site: 69.5 million lb**

Waste management by the chemical manufacturing sector

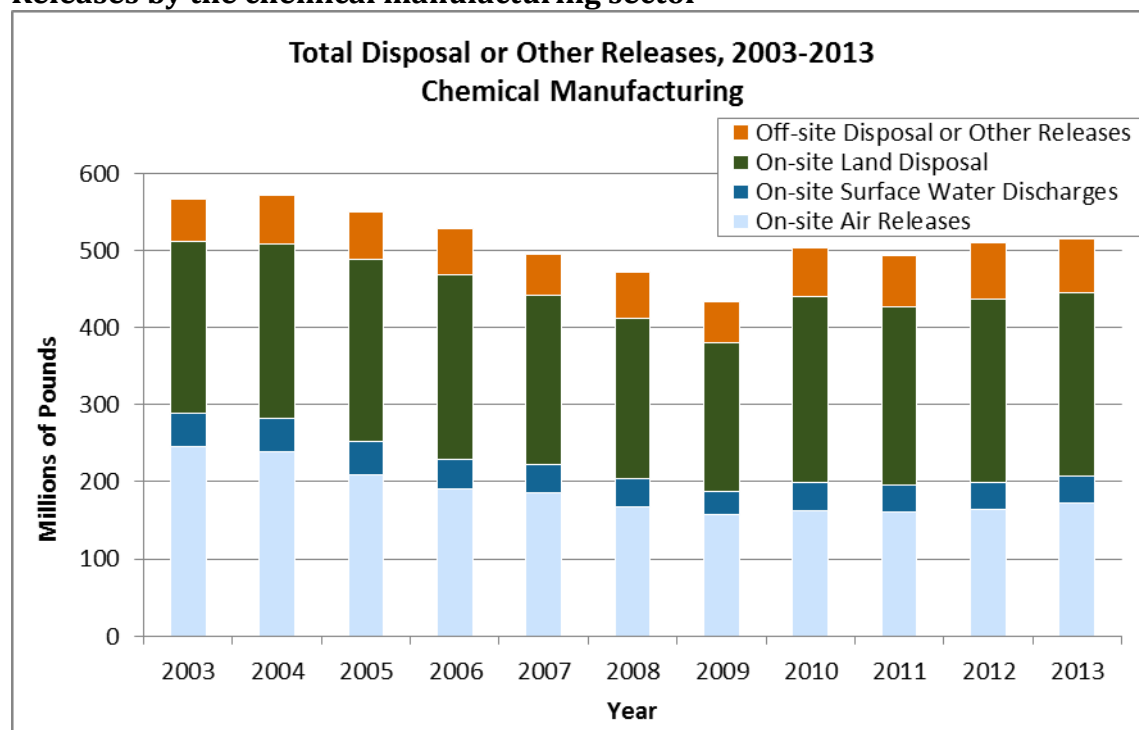


This figure shows that production-related waste managed by the chemical manufacturing sector decreased by 5% from 2003 to 2013, while production (represented by the black line as reported by the [Federal Reserve Board Industrial Production Index](http://www.federalreserve.gov/releases/z1/)) fluctuated but changed little overall. In 2013, 5% of the sector's waste was released, while the rest was managed through treatment, energy recovery, and recycling. Quantities of waste released, treated, or used in energy recovery have decreased since 2003, while the quantity of waste recycled has increased. From 2012 to 2013, production-related waste managed increased by 9%, primarily due to an increase in treatment and recycling.

Although the chemical manufacturing sector has consistently been the sector with the most production-related waste managed, 21% of facilities in the sector initiated source reduction activities in 2013 to reduce their toxic chemical use and waste generation. The most commonly reported category of source reduction activities for the sector was good operating practices, which includes improving maintenance scheduling, record keeping, and procedures and changing production schedules to minimize equipment and feedstock changes. For example, [one facility](#) reported adjusting its production schedule to increase the batch size of [zinc](#) products, which reduced the frequency of vessel cleanouts. Other common source reduction activities in the chemical manufacturing sector include process modifications and spill and leak prevention. TRI's [Pollution Prevention Search Tool](#) can help you learn more about pollution prevention opportunities in this sector.



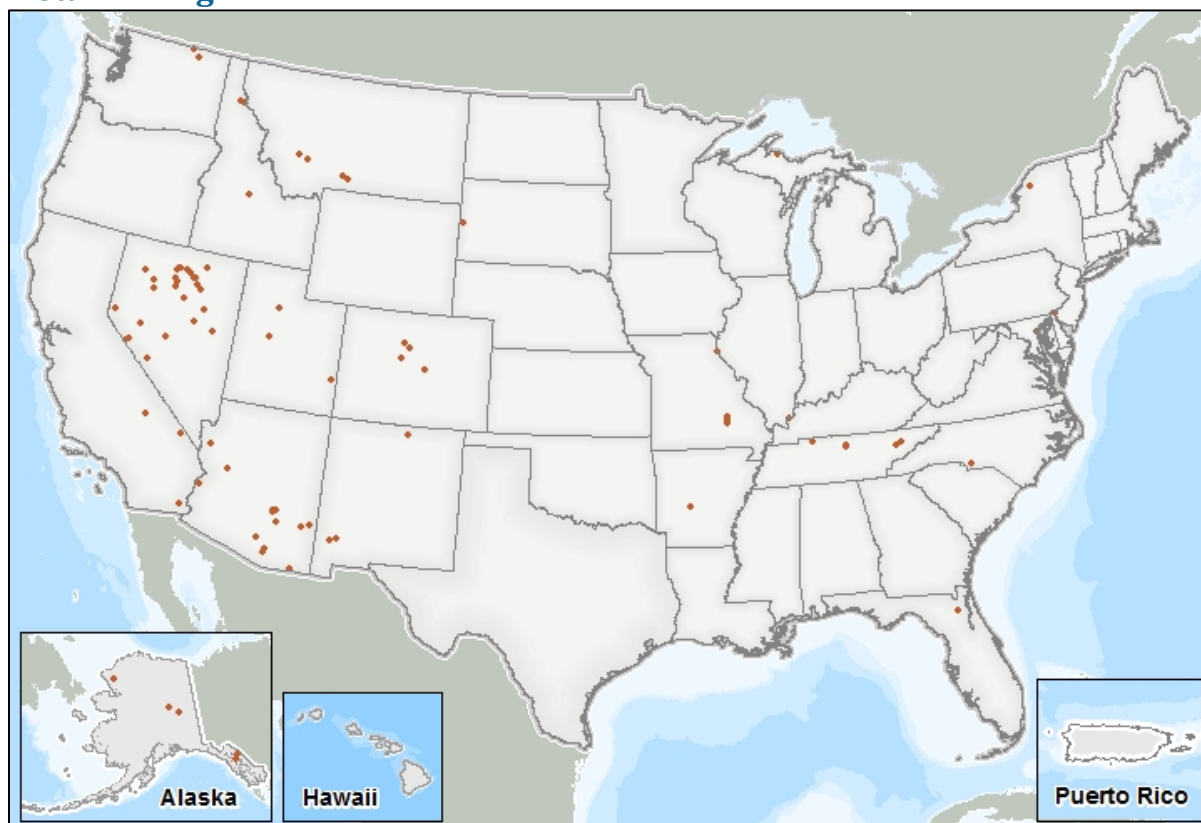
Releases by the chemical manufacturing sector



As shown in this figure, total releases by the chemical manufacturing sector decreased by 9% from 2003 to 2013. This is primarily due to a reduction in air emissions. Water releases have also declined since 2003, while on-site releases to land and off-site disposal have increased slightly. Over the past four years, total releases remained fairly constant with only an increase of 5 million pounds (+1%) from 2012 to 2013. The chemical manufacturing sector had the third-largest quantity of total disposal or other releases in 2013.

For more information on how this sector and others can choose safer chemicals, visit EPA's [Design for the Environment Program](#) pages for [Alternatives Assessments](#) and the [Safer Chemical Ingredients List](#).

Metal Mining



Metal Mines Reporting to TRI, 2013

The portion of the metal mining sector covered by TRI includes facilities mining for copper, lead, zinc, silver, gold, and several other metals. In 2013, 88 metal mining facilities reported to TRI and 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, Tennessee, and Alaska. Metals generated from U.S. mining operations are used in a wide range of products, including automobiles and electrical and industrial equipment. The extraction and beneficiation of these minerals generate large amounts of waste.



Quick Facts for 2013 Metal Mining

Number of TRI Facilities: 88

Facilities Reporting Newly Implemented Source

Reduction Activities: 9

Production-Related Waste Managed: 1,863.4 million lb

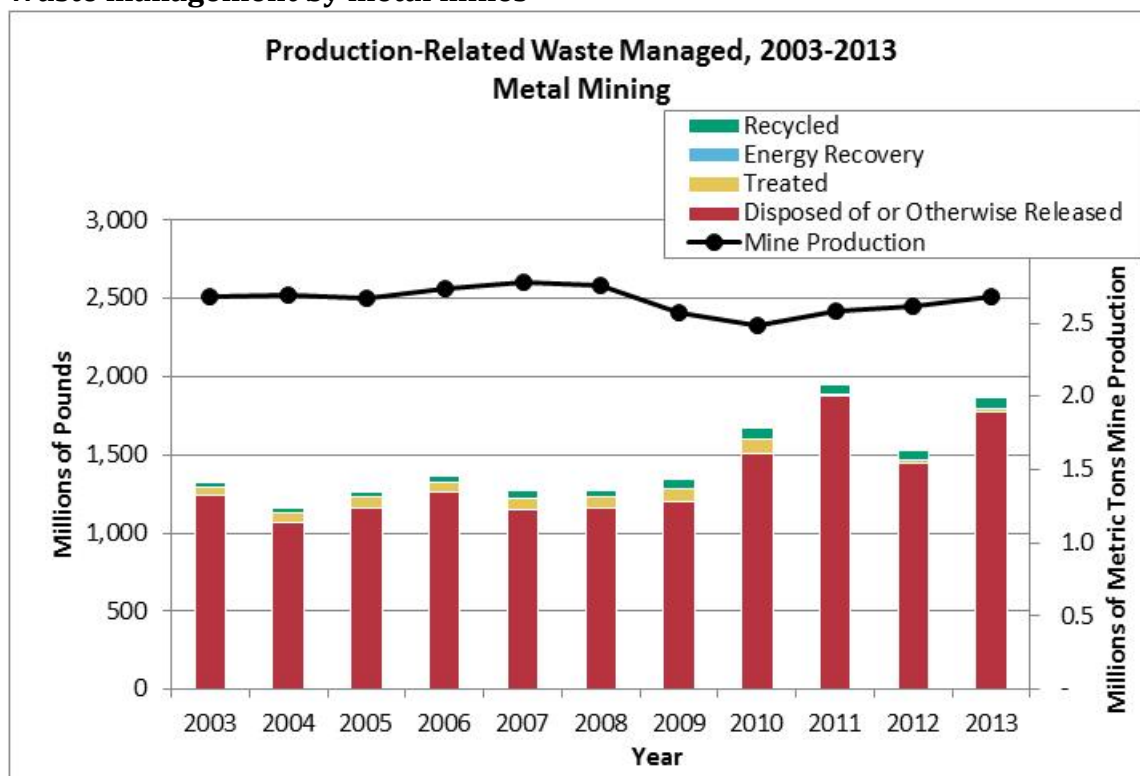
- Recycled: 66.1 million lb
- Energy Recovery: 5 lb
- Treated: 25.2 million lb
- Disposed of or Otherwise Released:
1,772.1 million lb

Total Disposal or Other Releases: 1,966.0 million lb

- **On-site: 1,962.9 million lb**
 - Air: 2.9 million lb
 - Water: 1.3 million lb
 - Land: 1,958.7 million lb
- **Off-site: 3.1 million lb**

Note: The amounts disposed of or otherwise released under Production-Related Waste Managed exclude releases due to catastrophic or other one-time events not related to normal production processes.

Waste management by metal mines

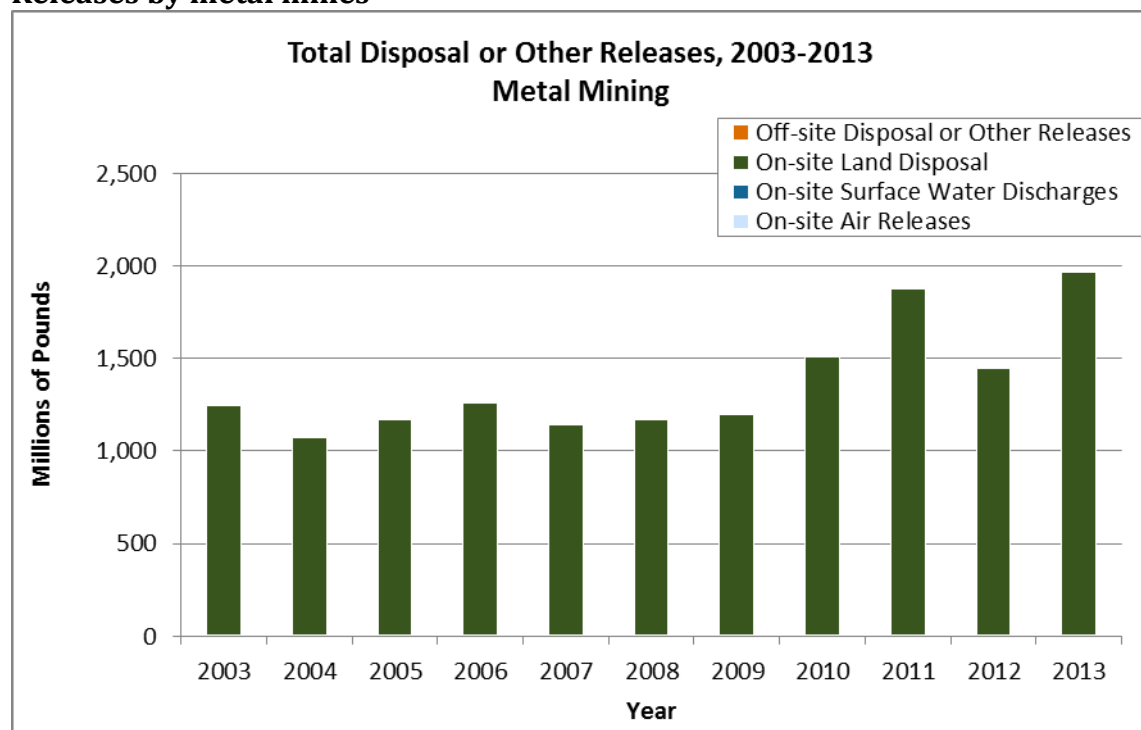


As shown in this figure, 95% of the metal mining sector's production-related waste managed is disposed of or otherwise released. While metal mining production (as reported in the [U.S. Geological Survey Mineral Commodities Surveys](http://www.mrds.gov/)) has remained relatively steady from 2003 to 2013, as shown by the black line in the graph, the quantity of waste managed has fluctuated. This indicates that factors other than production have contributed to the recent changes in quantities of waste managed. One factor frequently cited by facilities is the composition of the extracted ore and waste rock, which can vary substantially from year to year. In some cases, small changes in the waste's composition can impact whether chemicals in waste rock qualify for a concentration-based exemption. Large quantities of toxic chemicals in waste rock may qualify for the exemption and not need to be reported in one year, but not qualify for the exemption the next year or vice versa.

In the metal mining sector, 9 of the 88 facilities initiated source reduction activities in 2013 to reduce their toxic chemical use and waste generation. Toxic chemical quantities reported by this sector are not especially amenable to source reduction, because they primarily reflect the natural composition of the ore and waste rock. The most commonly reported source reduction activity was improving maintenance scheduling, record keeping, or procedures.

To learn more about this sector, visit EPA's website on [reducing pollution from mineral processing operations](http://www.epa.gov/minerals/industry/sectors/metal-mining/).

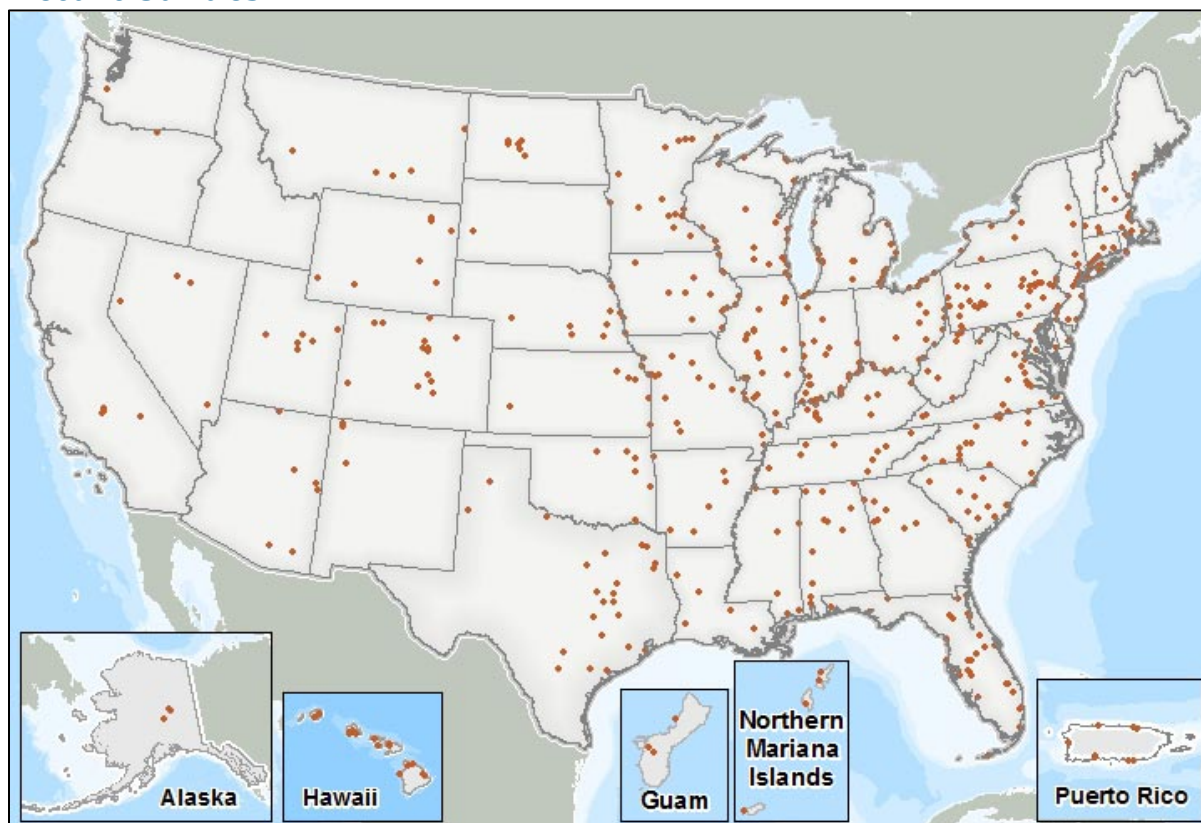
Releases by metal mines



The metal mining sector's total disposal or other releases reflect the high volume of materials managed on-site at metal mines. As shown in this figure, more than 99% of the sector's releases are on-site land disposal. On-site land disposal by metal mines has fluctuated in recent years, decreasing significantly in 2012 and then increasing again in 2013. Several mines have reported that changes in production and changes in the chemical composition of the deposit being mined are the primary cause of these fluctuations in the amount of chemicals reported. 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 toxic chemicals reported nationally.

In 2013, the metal mining sector reported the largest quantity of total disposal or other releases, accounting for 47% of the releases for all industries. It also represents almost three quarters (71%) of the on-site land disposal for all sectors in 2013.

Electric Utilities



Electric Utilities Reporting to TRI, 2013

The electric utilities sector consists of establishments primarily engaged in generating, transmitting, and distributing electric power. Electric-generating facilities use a variety of fuels to generate electricity; however, only those that combust coal or oil to generate power for distribution in commerce must report to TRI. There are 567 electric generating facilities.



Quick Facts for 2013

Electric Utilities

Number of TRI Facilities: 567

Facilities Reporting Newly Implemented Source
Reduction Activities: 17

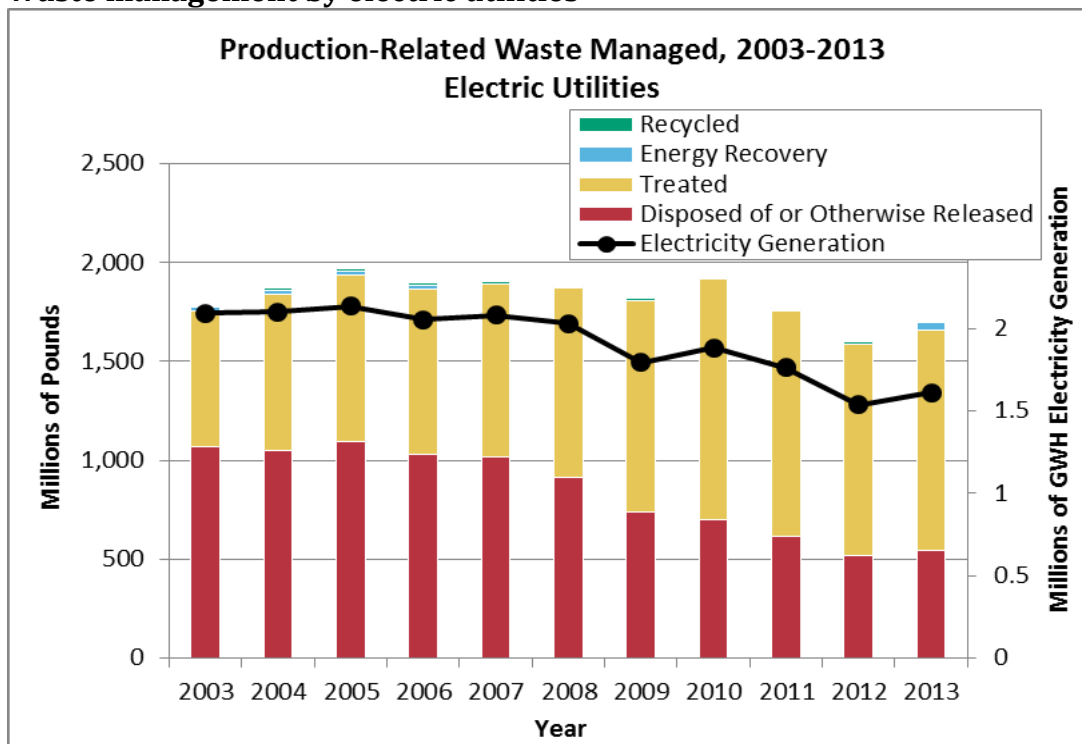
Production-Related Waste Managed: 1,705.6 million lb

- Recycled: 7.3 million lb
- Energy Recovery: 38.9 million lb
- Treated: 1,112.4 million lb
- Disposed of or Otherwise Released:
547.0 million lb

Total Disposal or Other Releases: 547.9 million lb

- On-site: **479.1 million lb**
 - Air: 197.9 million lb
 - Water: 3.3 million lb
 - Land: 277.8 million lb
- Off-site: **68.8 million lb**

Waste management by electric utilities





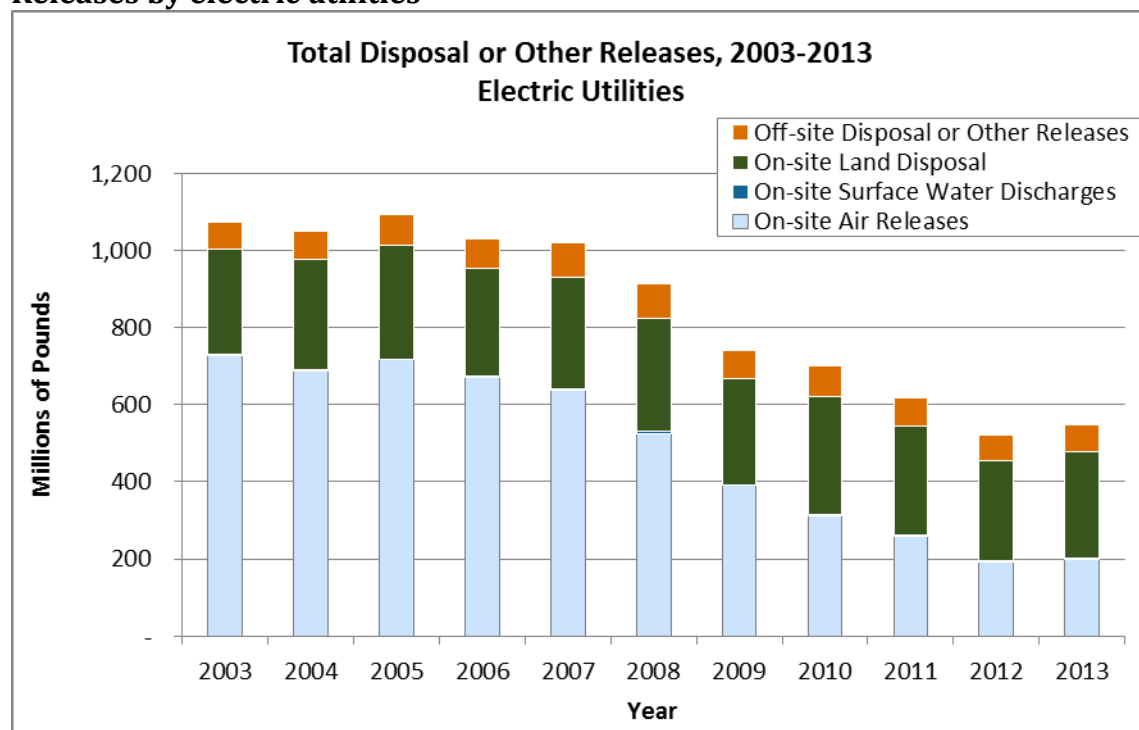
Production-related waste managed has decreased by 4% since 2003, while net electricity generation (in terms of electricity generated using coal and oil fuels as reported by the [U.S. Department of Energy's Energy Information Administration](http://www2.epa.gov/toxics-release-inventory-tri-program/2013-tri-national-analysis)), has decreased by 23%. The recent production decrease is driven by the industry's transition to natural gas, which exempts many electric utilities from TRI reporting. While the overall quantity of production-related waste managed has not significantly changed, the ways in which the sector manages this waste have changed considerably.

In 2013, approximately two-thirds of production-related waste managed was treated, while approximately one-third was released. This is in contrast to 2003, when the opposite was the case – almost two-thirds of the waste was released, and over one-third was treated. This trend is in large part due to an increase in the number of scrubbers at electric utilities that treat (or destroy) acid gases that would otherwise be on-site air releases. The releases per gigawatt-hour (GWH) produced have dramatically decreased, offset by an increase in quantities treated per gigawatt-hour produced.

In the electric utilities sector, only 3% of facilities initiated source reduction activities in 2013 to reduce their toxic chemical use and waste generation. (Note: Adding a scrubber would not be considered a source reduction activity because it controls waste rather than preventing waste generation.) The most commonly reported type of source reduction activities for this sector was process modifications, which include activities such as modifying equipment, layout, or piping. TRI's [Pollution Prevention Search Tool](#) can help you learn more about pollution prevention opportunities in this sector.



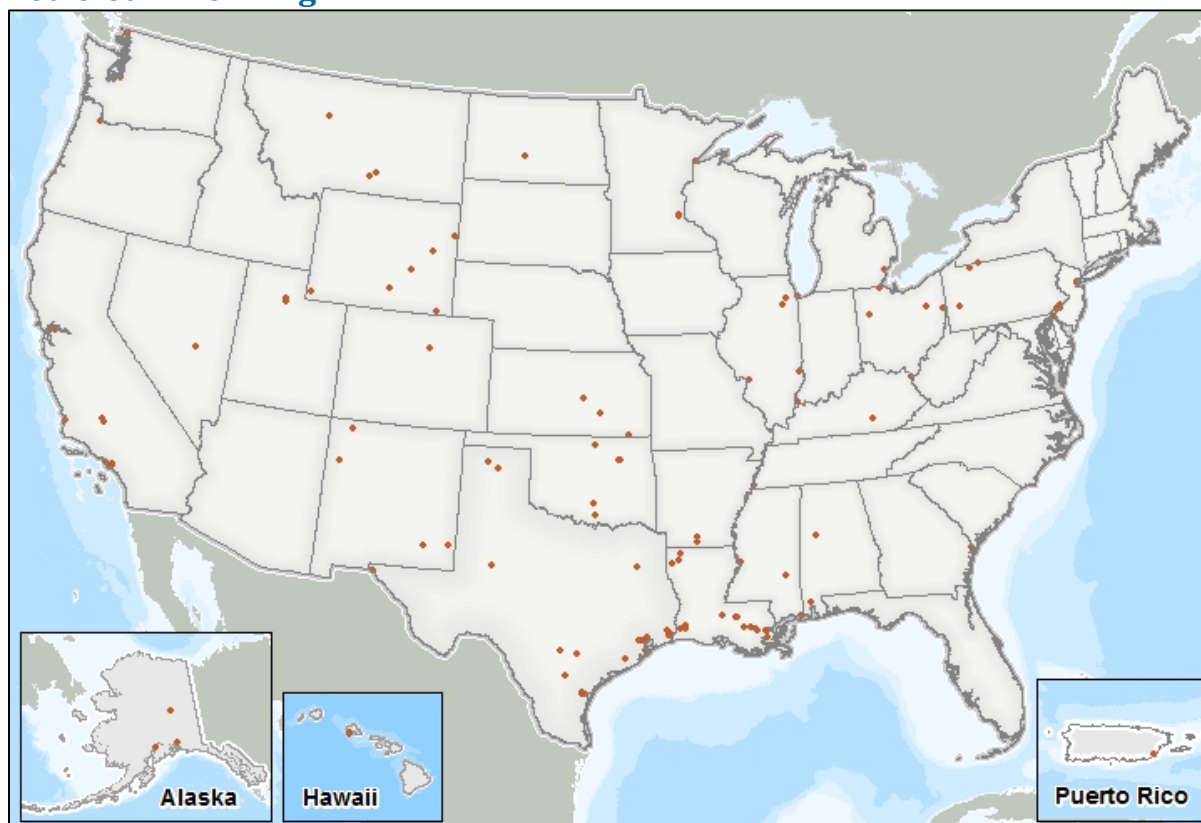
Releases by electric utilities



The electric utilities sector's releases decreased by 49% from 2003 to 2013. This decrease is driven by a 73% decrease in on-site air releases from 2003 to 2013. Over this time period, on-site land disposal and off-site disposal or other releases remained relatively constant, while on-site surface water discharges increased by 13%. From 2012 to 2013, releases by electric utilities increased by 5% (28 million pounds). This increase was primarily driven by an increase in on-site land disposal.

This sector reported the second-largest total disposal or other releases of any industry sector in TRI for 2013, including the largest on-site air emissions, which represented over 25% of air emissions from all industries.

Petroleum Refining



Petroleum Refineries Reporting to TRI, 2013

Petroleum refineries process crude oil and natural gas liquids to produce finished petroleum products. The primary products of the industry fall into three major categories: fuels (e.g., gasoline, kerosene); finished non-fuel products (e.g., solvents, asphalt); and petrochemical feedstocks (e.g., benzene, xylene). While there are only 151 facilities in this sector (0.7% of all facilities), they report almost 7% of production-related waste managed. Refineries are primarily concentrated near oil fields and ports, with the majority being along the Gulf Coast and in the Midwestern states.



Quick Facts for 2013 Petroleum Refining

Number of TRI Facilities: 151

Facilities Reporting Newly Implemented Source

Reduction Activities: 17

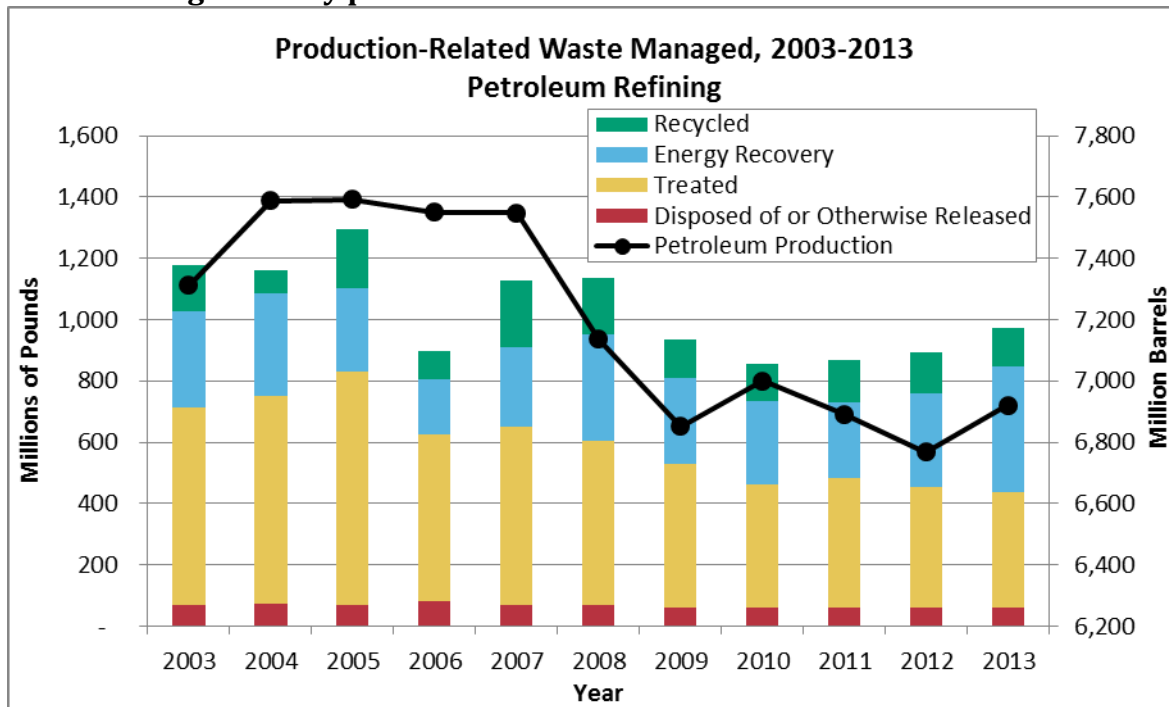
Production-Related Waste Managed: 1,661.3 million lb

- Recycled: 147.8 million lb
- Energy Recovery: 411.4 million lb
- Treated: 1,038.7 million lb
- Disposed of or Otherwise Released:
63.4 million lb

Total Disposal or Other Releases: 63.6 million lb

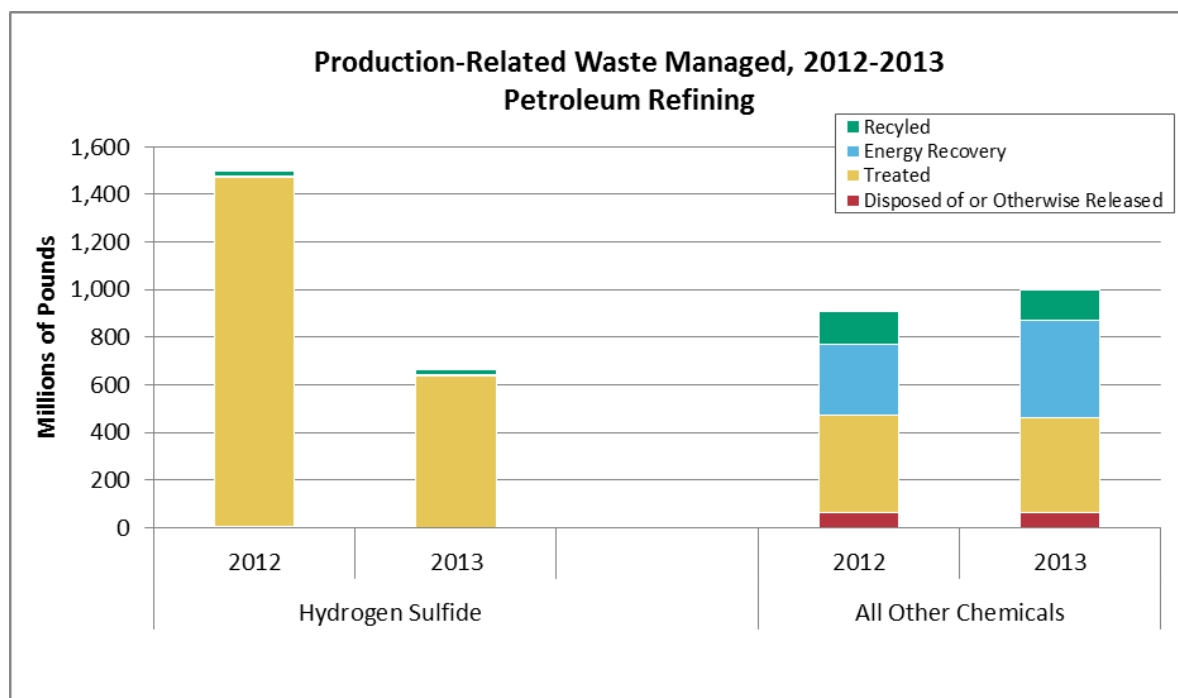
- **On-site: 60.3 million lb**
 - Air: 35.5 million lb
 - Water: 22.3 million lb
 - Land: 2.4 million lb
- **Off-site: 3.3 million lb**

Waste management by petroleum refineries



Note: Hydrogen sulfide is excluded from the production-related waste trend figure because it was not a TRI-reportable chemical until 2012.

This figure shows that production-related waste managed by the petroleum refining sector has decreased by 17% from 2003 to 2012, while production (represented by the black line as reported by the [Federal Reserve Board Industrial Production Index](http://www.federalreserve.gov/releases/z1)) has also decreased, but only by 5%. In 2013, 4% of the sector's waste was released, while the rest was managed through treatment, energy recovery, and recycling. The quantity treated decreased by 45% from 2003 to 2013 while the quantity used for energy recovery increased by 34%. In 2013, three chemicals accounted for two-thirds of the sector's waste — [hydrogen sulfide](#) (40%), [ammonia](#) (18%), and [ethylene](#) (9%). Hydrogen sulfide is excluded from the production-related waste trend figure because it was not a TRI-reportable chemical until 2012. The following figure shows quantities of hydrogen sulfide managed by the petroleum refining sector in 2012 and 2013.



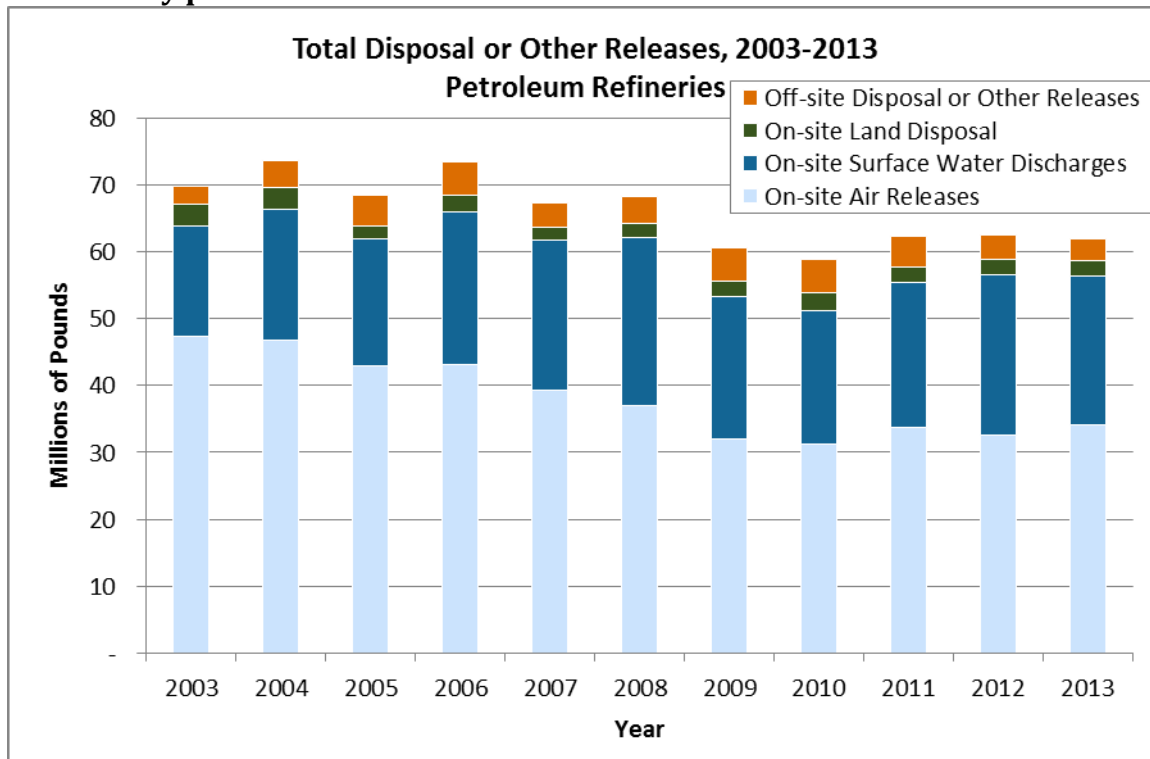
This figure shows the quantity of [hydrogen sulfide](#) that the petroleum refining industry reported to TRI in 2012 and 2013 compared to all other TRI chemicals reported by refineries. Hydrogen sulfide is generated from the hydrotreating process that reacts the sulfur compounds found in crude oil with hydrogen gas. The resulting hydrogen sulfide is then typically converted into elemental sulfur using the Claus process. Thus, almost all hydrogen sulfide is reported as treated.

From 2012 to 2013, when hydrogen sulfide is included, the industry's production-related waste decreased by 31%, driven by a reduction in hydrogen sulfide waste reported, which dropped from 1,483 million lb to 665 million lb. This reduction was primarily due to decreased hydrogen sulfide reporting by a few facilities, although most facilities in the sector reported much less hydrogen sulfide waste in 2013 than they did in 2012.

In 2013, 11% of petroleum refineries initiated source reduction activities in 2013 to reduce their toxic chemical use and waste generation. The most commonly reported source reduction activities were good operating practices, process modifications, and spill and leak prevention. For example, a [petroleum refinery](#) reported that it replaced two charge heaters with one charge heater that uses an ultra-low nitrogen oxides burner and reduced the [benzene](#) waste generated while increasing production. TRI's [Pollution Prevention Search Tool](#) can help you learn more about pollution prevention opportunities in this sector.



Releases by petroleum refineries



The petroleum refining sector's releases decreased by 11% from 2003 to 2013. This decrease was driven by a decrease in on-site air releases from 2003 to 2013, although the reduction is offset in part by increased water releases. From 2012 to 2013, both releases by petroleum refineries and production levels remained relatively steady. The top chemicals released were [nitrate compounds](#) (to water), and [ammonia](#) and [sulfuric acid aerosols](#) (to air). Ammonia is generated from nitrogen compounds in crude oil from hydrotreatment or catalytic cracking. Ammonia is destroyed in wastewater treatment operations, generating nitrate compounds that are subsequently released in wastewater streams. Sulfuric acid is generated by the reaction of water with sulfur compounds present in processed crude oil or from fuel combustion.