

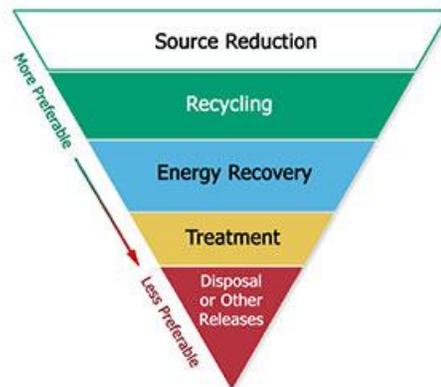
Pollution Prevention and Waste Management in the 2015

TRI National Analysis

The Toxics Release Inventory (TRI) collects information from facilities on the quantities of toxic chemicals they recycle, combust for energy recovery, treat for destruction, and dispose of or otherwise release on- and off-site. These quantities, in aggregate, are collectively referred to as the quantity of production-related waste managed.

Looking at production-related waste managed over time helps track progress in reducing waste generation and moving toward preferred waste management practices. EPA encourages facilities to first eliminate waste at its source. For waste that is generated, the most preferred management method is recycling, followed by burning for energy recovery, treating, and, as a last resort, disposing of or otherwise releasing the waste into the environment. These waste management priorities

are illustrated in the waste management hierarchy established by the Pollution Prevention Act (PPA) of 1990. The goal is that, when possible, facilities will shift over time from disposal or other releases toward the preferred techniques in the waste management hierarchy.



Sections in this chapter

[Source Reduction/Pollution Prevention](#)

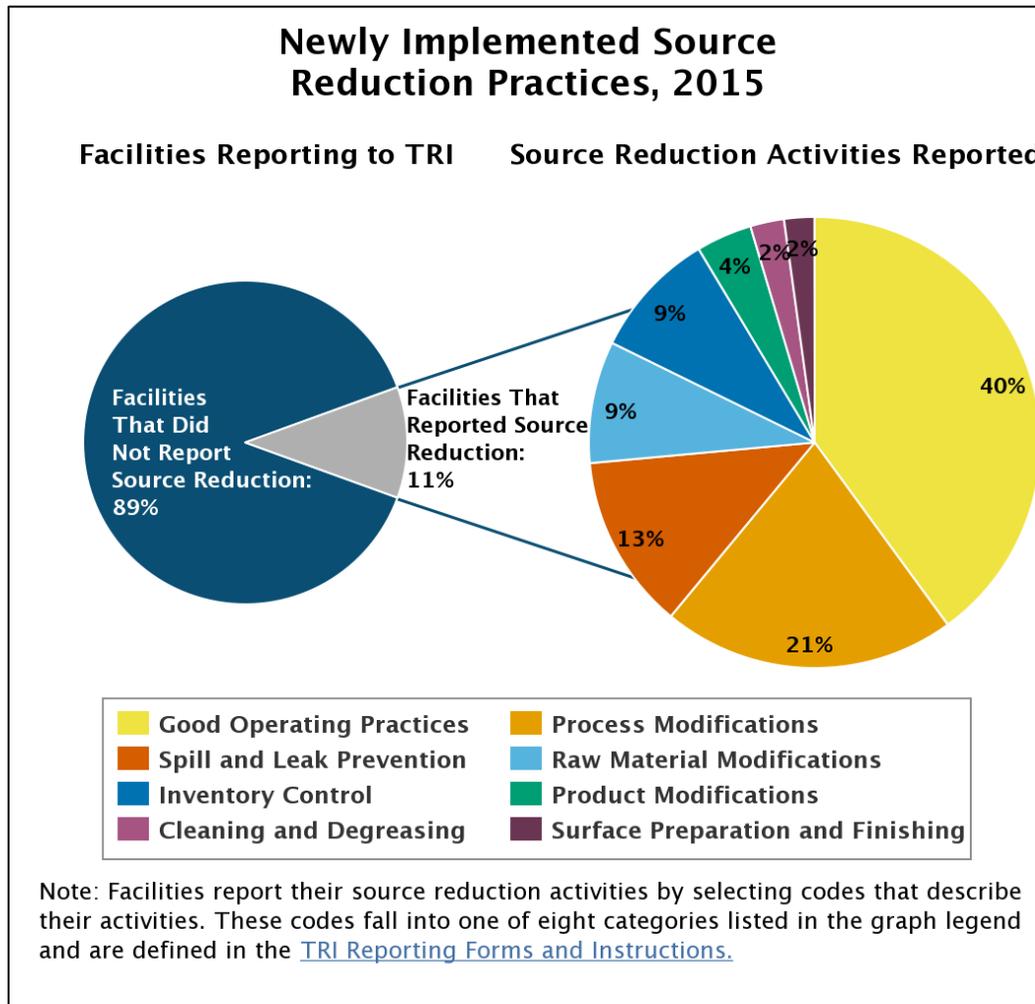
[Waste Management Trends](#)

[Waste Management by Chemical and Industry](#)

[Waste Management by Parent Company](#)

Source Reduction Activities Reported

Facilities report the source reduction activities that they implemented during the year. Source reduction includes activities that eliminate or reduce the generation of chemical waste, whereas other waste management practices (e.g., recycling) refer to how chemical waste is managed after it is generated.

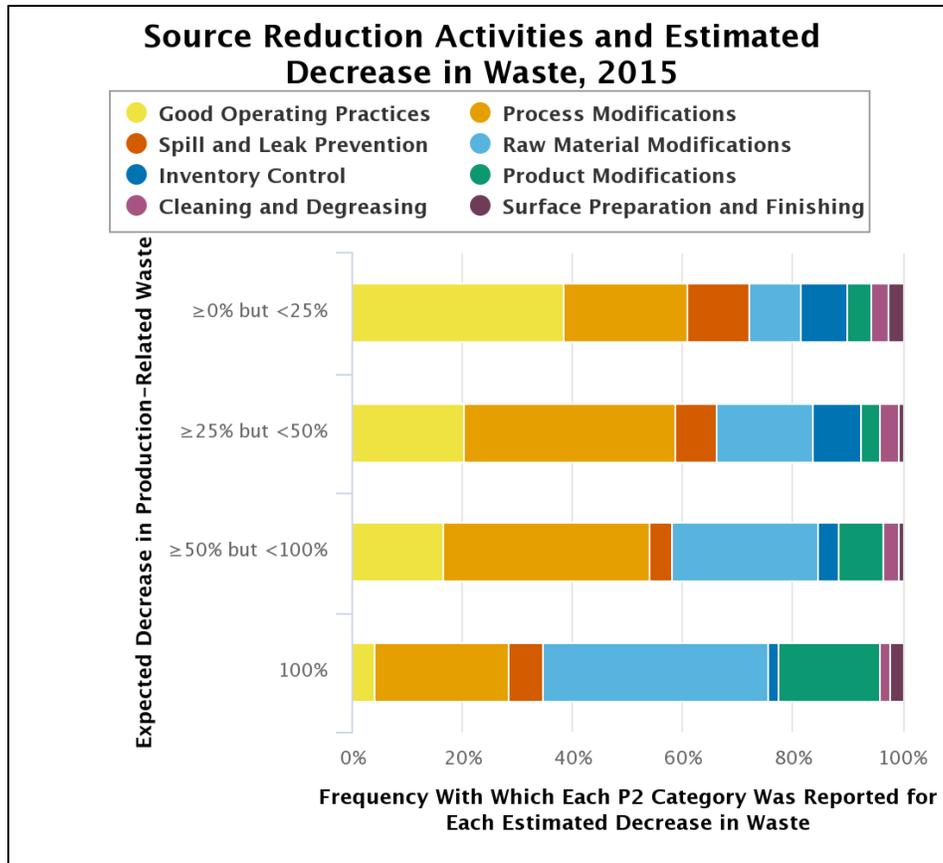


In 2015:

- 2,424 facilities (11% of all facilities that reported to the Toxics Release Inventory (TRI) Program) reported initiating a total of 7,508 source reduction activities.
- Note that facilities may have ongoing source reduction activities initiated in previous years that are not included in the figure. You can [find information on previously implemented source reduction activities by using the TRI Pollution Prevention \(P2\) Search Tool](#).

Estimated Reduction in Production-Related Waste from Source Reduction

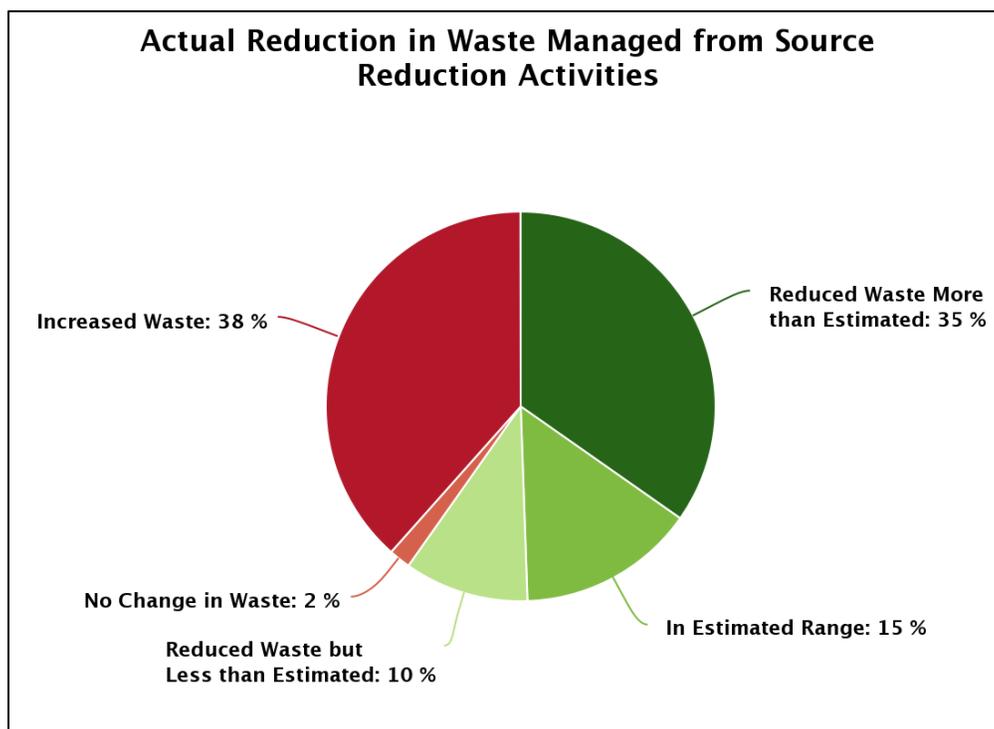
Starting in Reporting Year 2014, for each source reduction activity implemented, facilities may provide an estimate of the expected reduction in quantities of chemical waste managed. This figure shows the association between the source reduction activities implemented in 2015 and the estimated annual reductions in chemical waste that facilities expect to achieve in Reporting Year 2016, which varies by activity:



- 41% of the activities reported that were estimated to achieve 100% reduction (elimination of the chemical) were Raw Material Modifications (e.g. increasing the purity of raw materials).
- 39% of the activities expected to achieve less than a 25% reduction were reported as Good Operating Practices.

Actual Reduction in Production-Related Waste from Source Reduction

The Toxics Release Inventory (TRI) Program looked at what facilities estimated would be their reduction in chemical waste based on their source reduction activities from the 2014 TRI data and compared it to their actual waste management quantities in the 2015 data.



Almost half of facilities that reported a newly implemented source reduction activity in 2014 also estimated the resulting waste reduction for the following year. This figure shows the actual reduction facilities reported in 2015, normalized by production, compared to the estimated reduction in chemical waste managed reported in 2014.

From 2014 to 2015:

- For 50% of source reduction activities, facilities successfully reduced waste within the estimated range reported OR reduced waste more than estimated.
- For 10% of source reduction activities, facilities successfully reduced their waste, but less than estimated.
- For 38% of source reduction activities, not only did facilities *not* meet their estimated reduction but they also increased their waste in 2015.



Example of pollution prevention information related to estimating waste reduction:

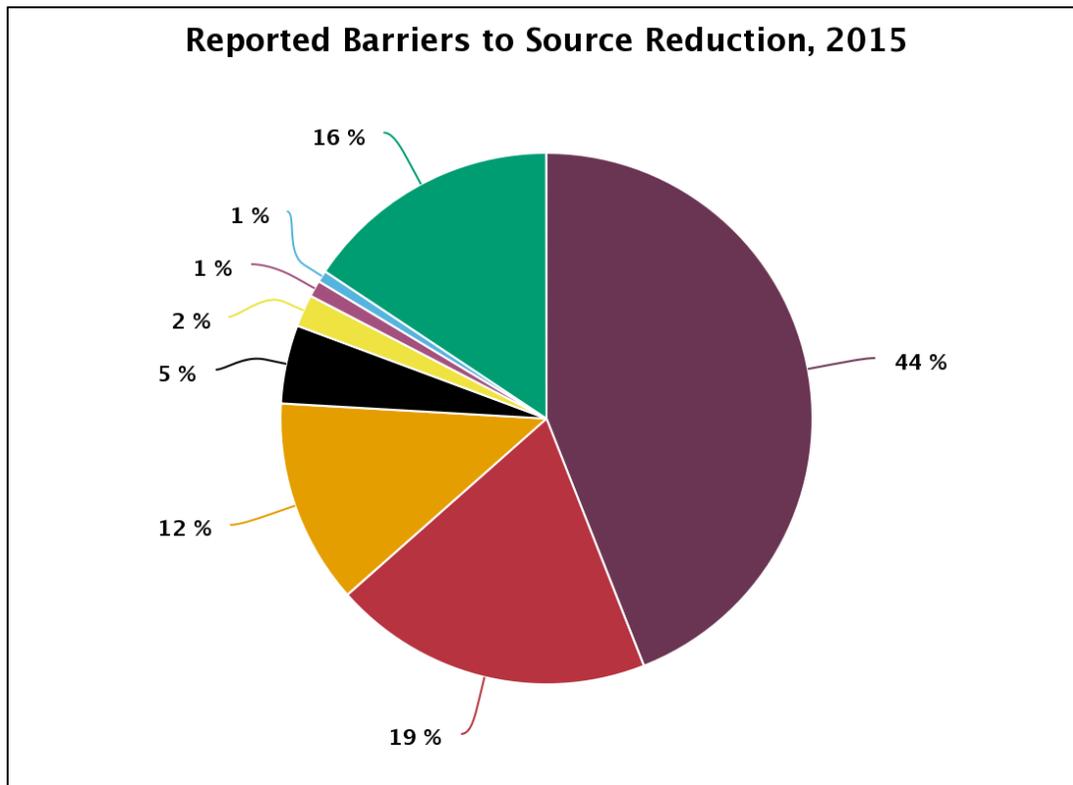
- An electronic connector manufacturer made improvements to its processes in 2014 that use product (lead) more efficiently and estimated a reduction in lead compound waste by 10%. In 2015, they reported a reduction of 25% in production-related waste (normalized for production). [[Click to view facility details in the Pollution Prevention \(P2\) Tool!](#)]

Reported Barriers to Source Reduction

If a facility did not implement new source reduction activities, they can optionally provide information about barriers they faced to source reduction.

In 2015:

- Barriers were reported for 263 chemicals.
- The most common barriers were:
 - the lack of a substitute or alternative for a chemical or process; and
 - previous implementation of source reduction with additional reductions not feasible.





See the list below for examples of reported barriers to source reduction.

No known substitutes or alternative technologies (44%)

Example:

A hardwood flooring manufacturer is unable to eliminate lead waste because trace lead is found naturally in the trees they use as a raw material. [[Click to view facility details in the Pollution Prevention \(P2\) Tool](#)]

Pollution prevention previously implemented - additional reduction does not appear technically or economically feasible (19%)

Example:

A fabricated metal manufacturer had previously implemented several source reduction activities to reduce chromium waste including storm water pollution prevention practices, inventory control, scrap minimization, and engineering design changes to optimize raw material usage. [[Click to view facility details in the P2 Tool](#)]

Concern that product quality may decline as a result of source reduction (12%)

Example:

An aircraft instrument facility found that lead-free solder forms tin whiskers on their circuit cards, which compromises product performance of flight critical hardware. [[Click to view facility details in the P2 Tool](#)]

Insufficient capital to install new source reduction equipment or implement new source reduction activities/initiatives (5%)

Example:

An electroplating facility releases lead compounds from anode dissolution during the chrome plating process. The alternative technology, platinum anodes, are cost prohibitive and have not been shown to increase product quality. [[Click to view facility details in the P2 Tool](#)]

Specific regulatory/permit burdens (2%)

Example:

In order to comply with air permit limits, a food manufacturing facility uses ammonia to reduce NOx emissions from their boiler stacks. [[Click to view facility details in the P2 Tool](#)]

Require technical information on pollution prevention techniques applicable to specific production processes (1%)

Example:

A diagnostic substances manufacturer plans to implement a Green Chemistry team to research alternatives to dichloromethane. [[Click to view facility details in the P2 Tool](#)]

Source reduction activities were implemented but were unsuccessful (1%)

Example:

A paint and coating manufacturer uses a component raw material that contains xylene. In previous years, the facility implemented source reduction by improving operating procedures, but the effort did not yield any measured reduction. The facility was also unsuccessful in getting suppliers to make modifications. [[Click to view facility details in the P2 Tool](#)]

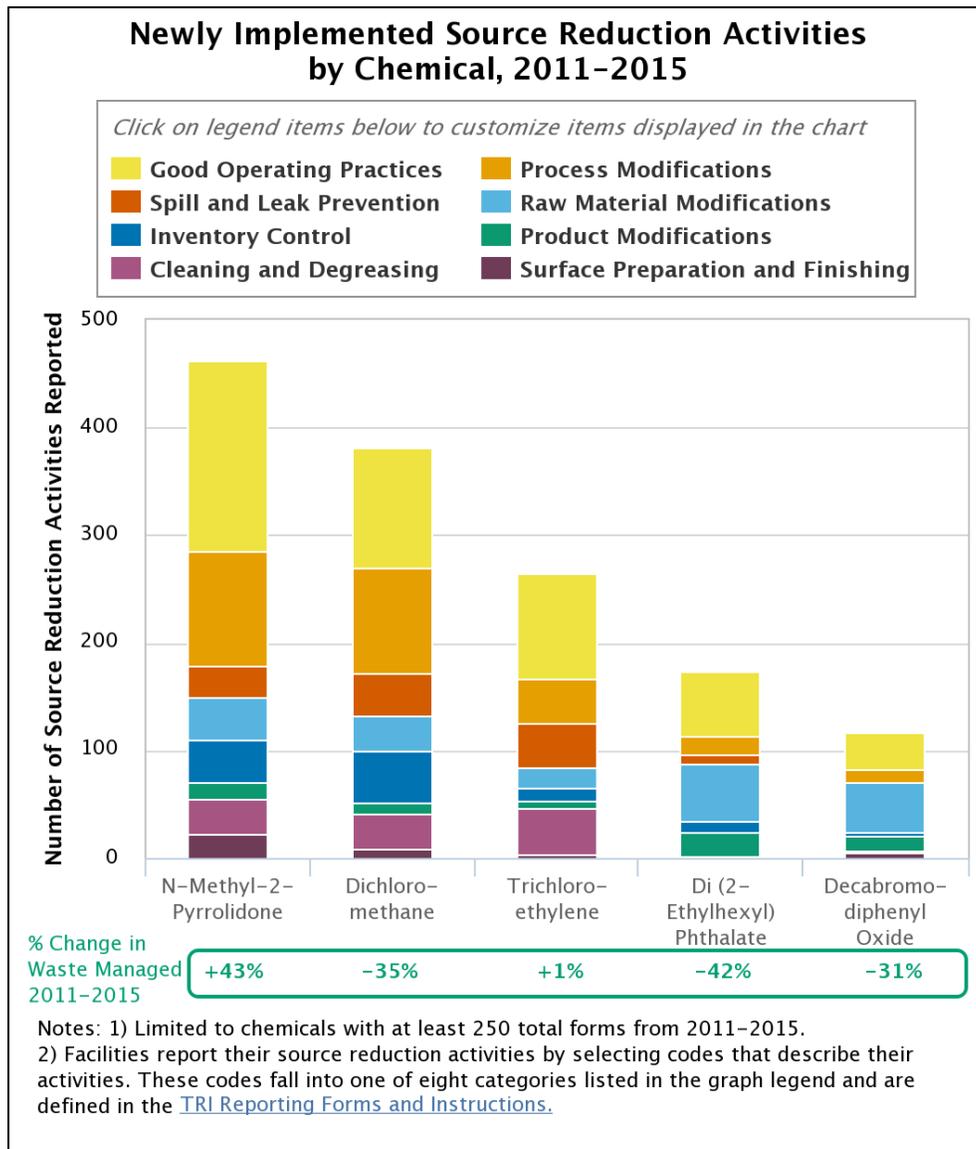
Other, including customer demand (16%)

Example:

A piano string manufacturer generates copper waste when the facility recycles the old strings that customers send them for the facility to duplicate and replace. [[Click to view facility details in the P2 Tool](#)]

Source Reduction Activities by Chemical

For the chemicals with the highest source reduction reporting rates over the last 5 years, this figure shows the types of activities implemented, and the percent change in the quantity of waste managed.



From 2011 to 2015:

- Chemicals with the highest source reduction reporting rate were: N-methyl-2-pyrrolidone, dichloromethane, trichloroethylene, di (2-ethylhexyl) phthalate, and decabromodiphenyl oxide.
- The type of source reduction activity implemented for these chemicals varies depending on their use in industrial operations and the chemical's characteristics. For example:

- **Raw material modification** is commonly reported as a source reduction activity to reduce waste of [di \(2-ethylhexyl\) phthalate](#) (DEHP), a plasticizer, and [decabromodiphenyl oxide](#) (decaBDE), a flame retardant. Many facilities report that they are in the process of replacing both chemicals with environmentally preferable alternatives.
- **Cleaning and degreasing**, including changing to aqueous cleaners, is implemented for common industrial solvents such as [trichloroethylene](#) (TCE), [dichloromethane](#) (DCM, also known as methylene chloride), and [N-methyl-2-pyrrolidone](#) (NMP).
- The quantity of waste managed over the last 5 years decreased considerably for DCM, DEHP, and decaBDE. For the other chemicals shown in the figure, waste quantities have increased. While quantities of waste managed overall increased by 15% over this post-recession time period, the increases in quantities of NMP managed exceeded the average increase in quantity of chemical waste managed. Use of NMP expanded in recent years as a substitute for chlorinated solvents such as DCM.

Facilities may also report additional details to the Toxics Release Inventory (TRI) Program about their source reduction, recycling, or pollution control activities.

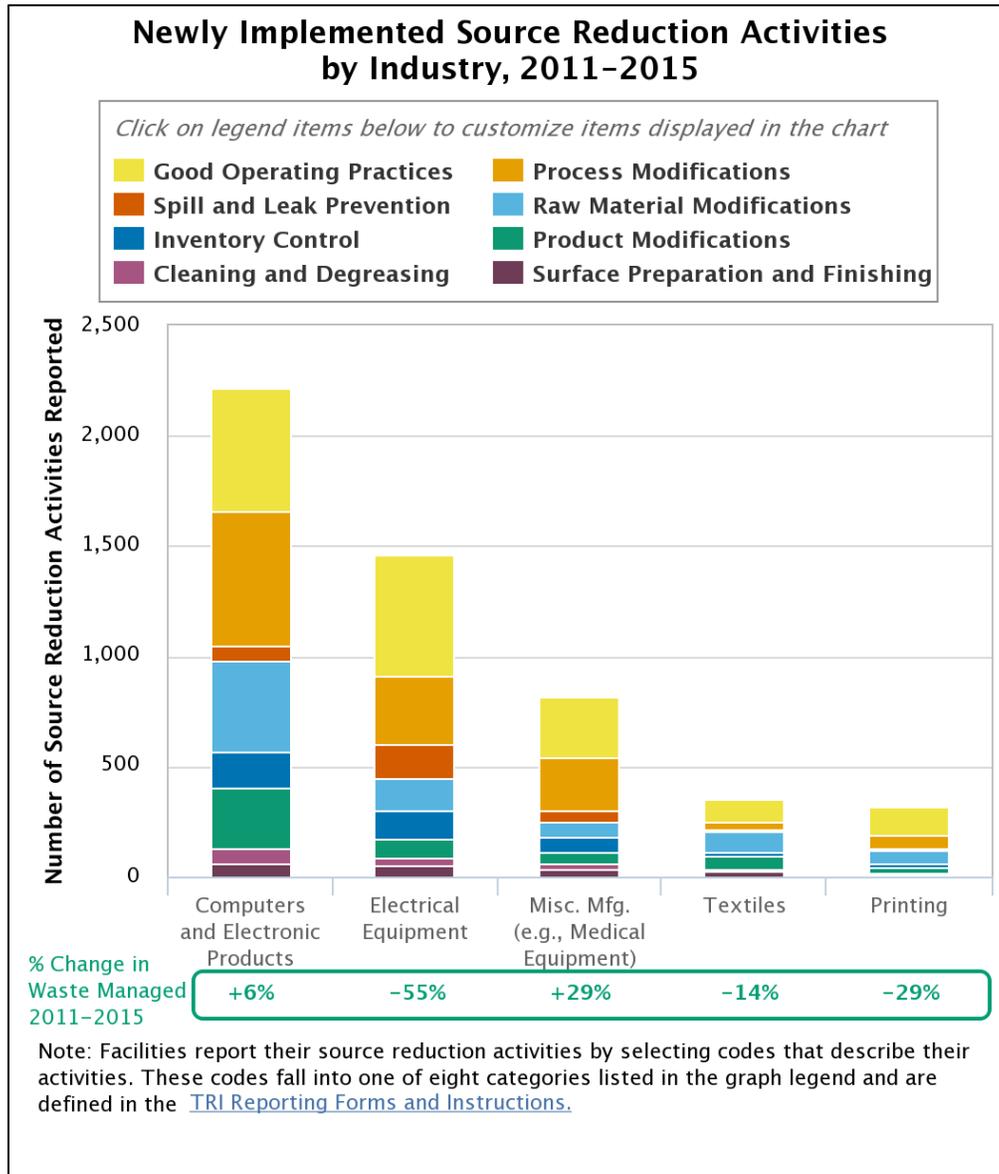
Examples of additional pollution prevention-related information for 2015:

- **[N-methyl-2-pyrrolidone](#)**: A motor vehicle parts manufacturer eliminated use of the chemical as a reducing solvent and when possible started using paints that do not contain N-methyl-2-pyrrolidone. [[Click to view facility details in the Pollution Prevention \(P2\) Tool](#)]
- **[Dichloromethane](#)**: A pesticide manufacturer validated their rinse procedures to minimize the number of dichloromethane rinse cycles required. [[Click to view facility details in the P2 Tool](#)]
- **[Trichloroethylene](#)**: A fabricated metal manufacturer purchased a vacuum vapor degreasing system after evaluating its solvent usage, and they expect to eliminate use of trichloroethylene completely by the end of 2016. [[Click to view facility details in the P2 Tool](#)]
- **[Di \(2-ethylhexyl\) phthalate](#)**: A rubber product manufacturer has been replacing di (2-ethylhexyl) phthalate with more environmentally friendly alternatives for its rubber formulations. [[Click to view facility details in the P2 Tool](#)]
- **[Decabromodiphenyl oxide](#)**: An adhesive manufacturer decreased their decabromodiphenyl oxide waste despite increased production after initiating a product reformulation that replaced the chemical. [[Click to view facility details in the P2 Tool](#)]

You can [view all reported pollution prevention activities and compare facilities' waste management methods and trends for any TRI chemical by using the TRI P2 Search Tool](#).

Source Reduction Activities for Top Industry Sectors

For the industry sectors with the highest source reduction reporting rates over the last 5 years, this figure shows the types of activities implemented, and the percent change in the quantity of waste managed.



From 2011 to 2015:

- The five industry sectors with highest source reduction reporting rates are computers and electronic products, electrical equipment, miscellaneous manufacturing (e.g., medical equipment), textiles, and printing.



- For almost all sectors, “Good operating practices” is the most frequently reported type of source reduction activity. Other commonly reported source reduction activities vary by sector. For example, electrical equipment and computers and electronic products manufacturers frequently reported modifications to their raw materials and product, often associated with the elimination of lead solder.

Facilities may also report additional details to the Toxics Release Inventory (TRI) Program about their source reduction, recycling, or pollution control activities.

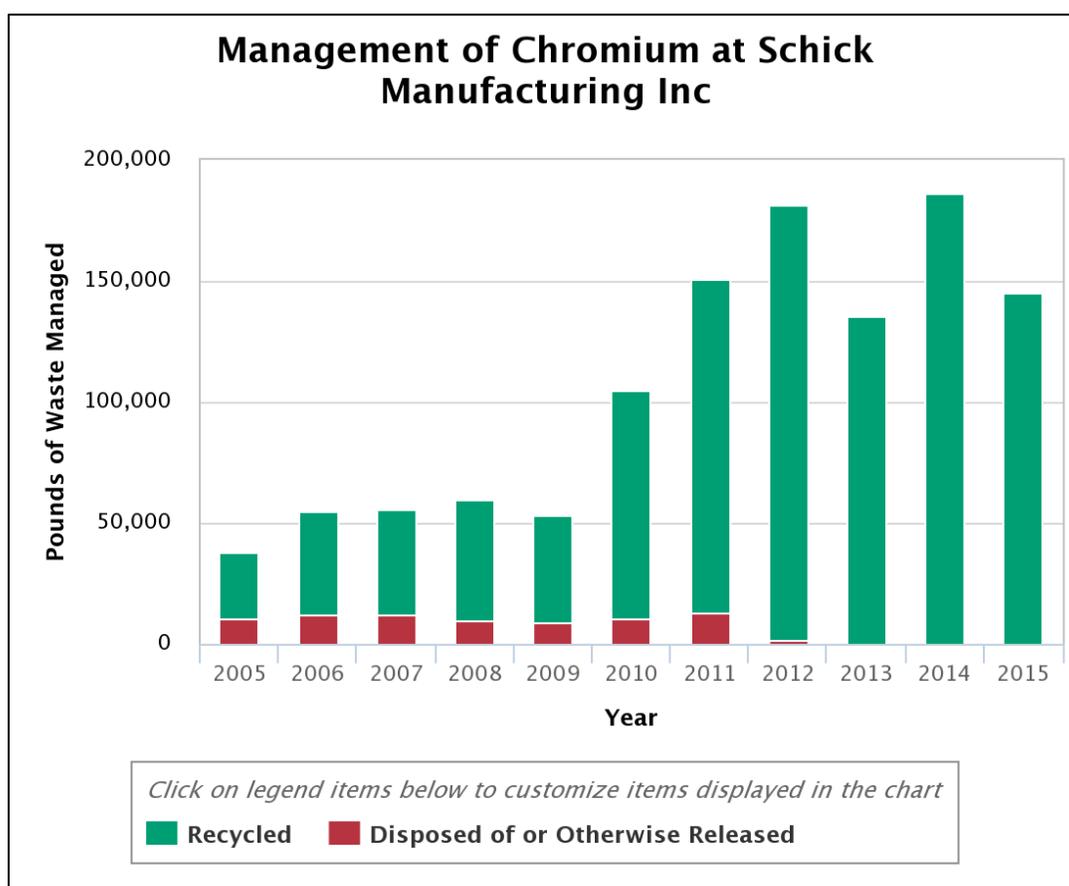
Examples of additional pollution prevention-related information for 2015

- **Computers and Electronic Products:** A circuit assembly manufacturer decreased [lead](#) releases by 78% after educating customers on the benefits of lead-free assemblies. [[Click to view facility details in the Pollution Prevention \(P2\) Tool](#)]
- **Electrical Equipment:** A battery manufacturer upgraded its conveyor system to prevent blockage and loss of [cobalt](#) material due to contamination. [[Click to view facility details in the P2 Tool](#)]
- **Miscellaneous Manufacturing:** A sporting and athletics goods facility decreased [xylene](#) waste by implementing procedures to improve yield and avoid quality problems such as preventing overmixing of paint. [[Click to view facility details in the P2 Tool](#)]
- **Textiles:** A textile finishing mill is continuing to replace [methanol](#) with water-based solvents and in 2015 decreased waste relative to production. [[Click to view facility details in the P2 Tool](#)]
- **Printing:** A gravure printing facility reduced [certain glycol ethers](#) waste by replacing several solvent-based digital ink printers with UV cured ink and latex ink printers that use either no glycol ethers or lowered amounts. [[Click to view facility details in the P2 Tool](#)]

You can [view all reported pollution prevention activities and compare facilities’ waste management methods and trends for any TRI chemical by using the TRI P2 Search Tool](#).

Example of a "Zero Releaser"

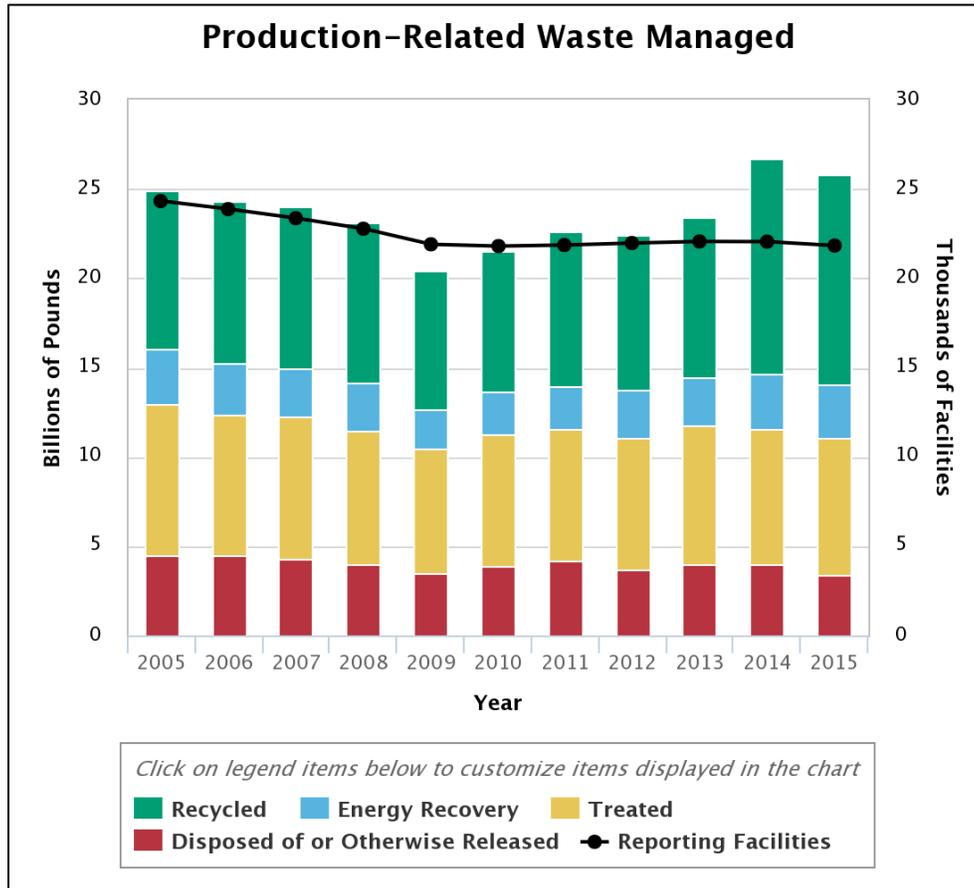
The waste management hierarchy emphasizes the preferred waste management techniques that facilities can utilize to reduce the quantities of toxic chemicals they release or otherwise manage as waste. For example, some facilities may be able to completely eliminate all releases of Toxics Release Inventory (TRI) reportable chemicals while still managing other production-related waste. These "zero releasers" are able to do so by implementing a variety of alternative waste management techniques. An example of a facility that followed the waste management hierarchy and no longer releases certain chemicals is shown below. This example illustrates one of the many ways that facilities can improve current pollution prevention and waste management practices. [Find additional examples for chemicals or sectors by using the TRI Pollution Prevention \(P2\) Search Tool.](#)



[Schick Manufacturing Inc. \(owned by Edgewell Personal Care Co.\) manufactures razor blades.](#) In 2012, the facility implemented a new process change that would eliminate the generation of chromium releases by allowing more material to be recycled, while also reducing use of energy, water, and other chemicals. By 2013, releases of chromium had been reduced to zero and all chromium waste results from recycling stainless steel scrap off-site.

Waste Management Trends

Facilities report the quantities of toxic chemicals they recycle, combust for energy recovery, treat for destruction, and release on- and off-site. This figure shows the trend in these quantities, collectively referred to as the production-related waste managed.



From 2005 to 2015:

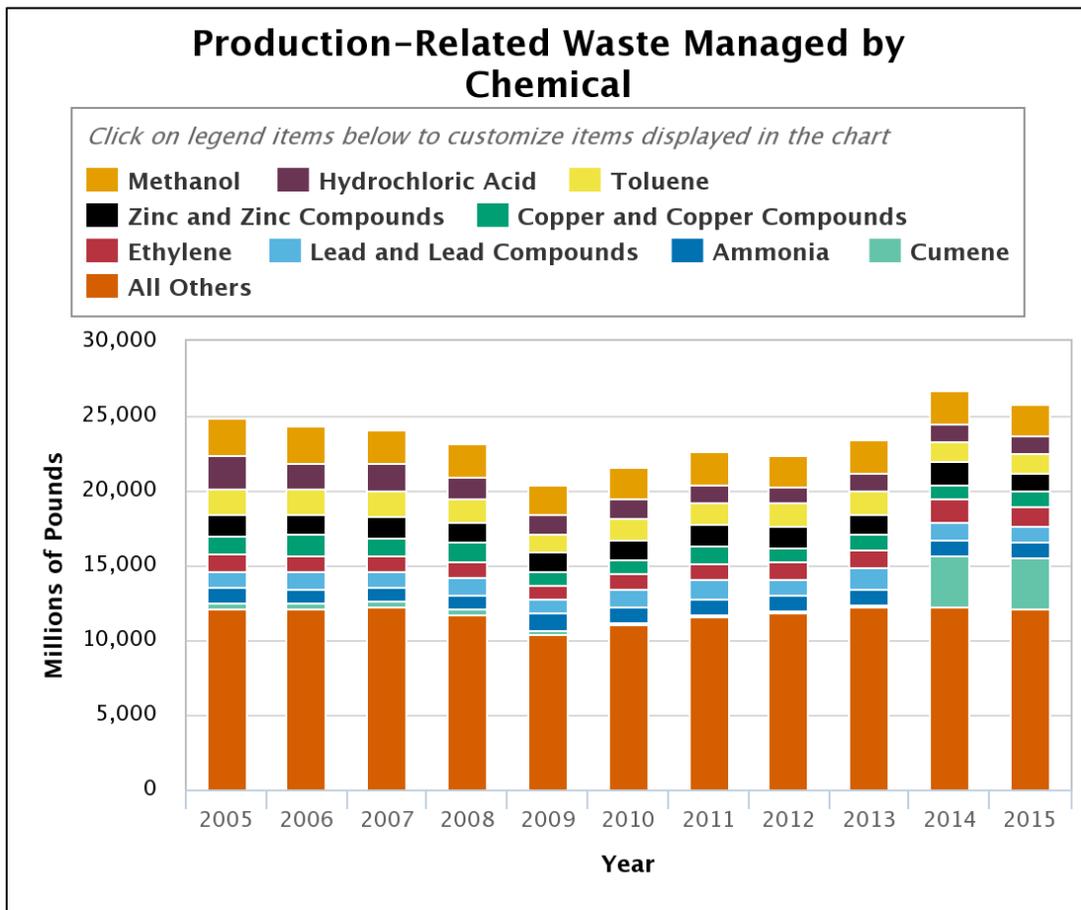
- Production-related waste managed increased by 952 million pounds (4%).
- Disposal and other releases decreased by 1.1 billion pounds (-25%).
- Treatment decreased by 796 million pounds (-9%).
- Energy recovery decreased by 126 million pounds (-4%).
- Recycling increased by almost 3 billion pounds (34%), a trend mostly driven by one facility reporting over 3.4 billion pounds of cumene recycled in 2014 and in 2015 [[Click to view facility details in the Pollution Prevention \(P2\) Tool](#)].



- The number of facilities that report to the Toxics Release Inventory (TRI) Program declined by 10% since 2005, although the count has remained steady at about 21,800 facilities since 2010.
- Since 2009, production-related waste managed has generally been increasing as the U.S. economy has improved.

Production-Related Waste Managed by Chemical

This figure shows the chemicals that were managed as waste in the greatest quantities from 2005-2015.



From 2005 to 2015:

- Most of the top chemicals contributing to production-related waste managed have remained relatively constant since 2005.
- Of the chemicals shown above, facilities reported increased quantities of waste managed for three: cumene, ethylene, and [ammonia](#).
 - Cumene increased by 628%, mostly driven by one facility reporting over 3.4 billion pounds of cumene recycled in 2014 and 2015 [[Click to view facility details in the Pollution Prevention \(P2\) Tool](#)]
 - Ethylene increased by 21%
 - Ammonia held steady, increasing by only 1%

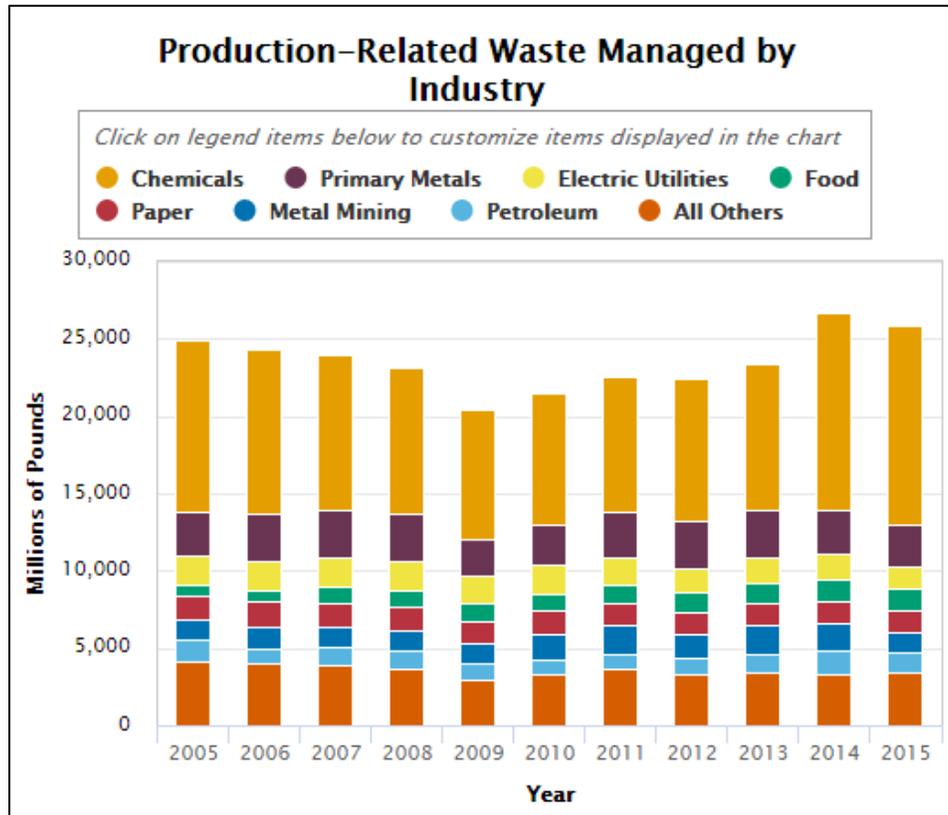


From 2014 to 2015:

- Facilities reported the greatest decreases in overall waste quantities for these chemicals:
 - Zinc and Zinc Compounds, decreased by 364 million pounds (-23%)
 - Lead and Lead Compounds, decreased by 160 million pounds (-13%)

Production-Related Waste Managed by Industry

This figure shows the industry sectors that managed the most waste from 2005-2015.



From 2005 to 2015:

- The contribution of each of the top sectors to production-related waste managed has remained relatively constant since 2005.
- Of the sectors shown in the graph, three increased their quantity of waste managed: chemicals, food, and metal mining.
- Generated waste in some industries fluctuates considerably from year to year, due to changes in production or other factors (e.g., quantities reported by metal mining facilities can change significantly based on changes in the composition of waste rock).

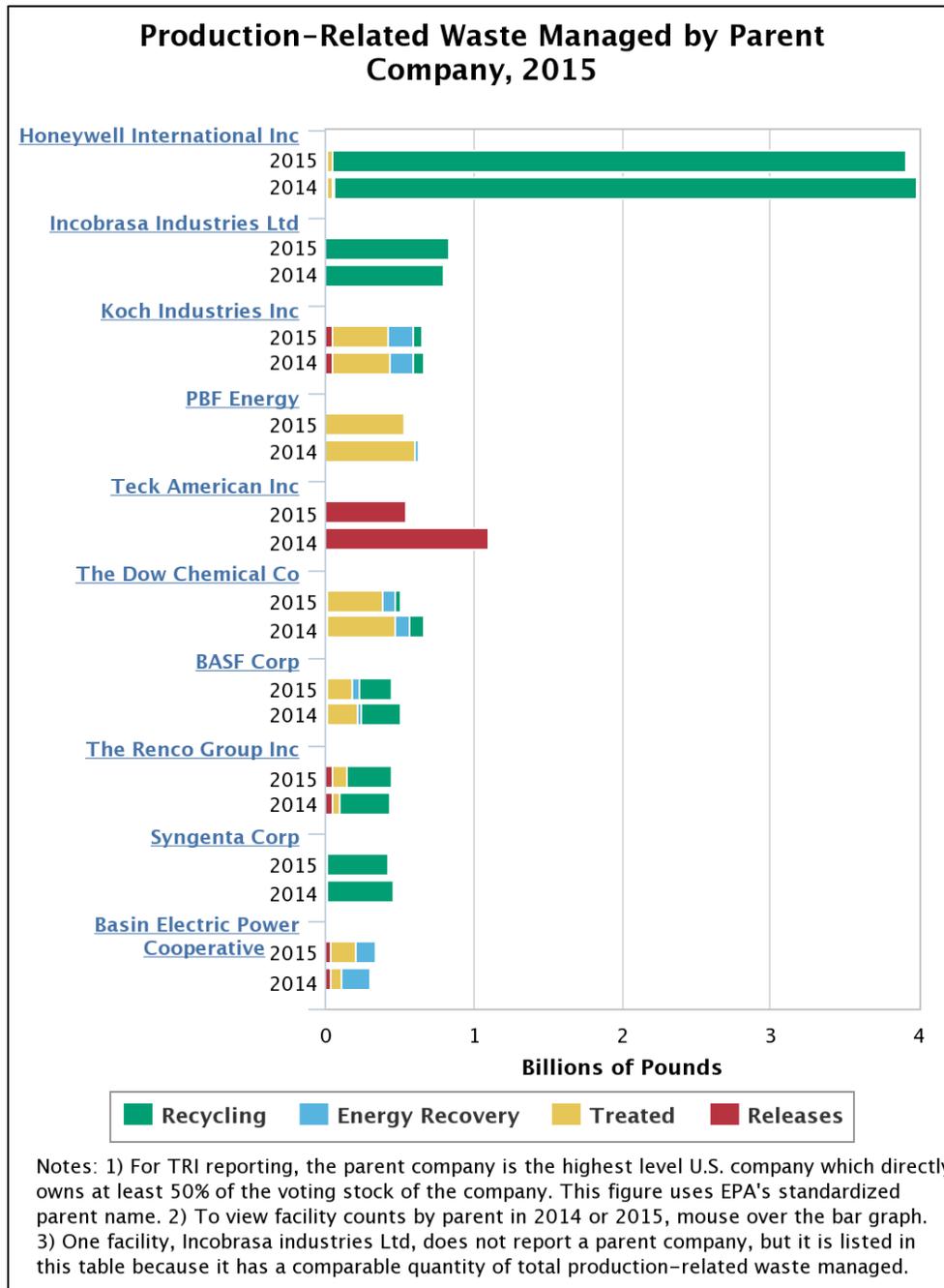
From 2014 to 2015:

- Industry sectors with the greatest reported changes in overall waste quantities are:
 - Metal mining, decreased by 503 million pounds (-27%)
 - Electric utilities, decreased by 245 million pounds (-14%)
 - Petroleum, decreased by 180 million pounds (-12%)



Waste Management by Parent Company

Facilities that report to the Toxics Release Inventory (TRI) provide information on their parent company. For TRI reporting purposes, the parent company is the highest level company located in the United States. This figure shows the parent companies whose facilities reported the most production-related waste for 2015. Production-related waste quantities reported for 2014 are also shown for reference.





These parent companies' TRI-reporting facilities operate in the following industry sectors:

- Metal mining: Teck American
- Soybean processing: Incobrasa
- Multiple sectors, e.g. pulp and paper, petroleum refining, and chemicals: Koch Industries
- Chemical manufacturing: Dow Chemical, Syngenta, BASF, Honeywell International, Basin Electric
- Petroleum refining: PBF Energy
- Metal smelting: The Renco Group

The quantity reported by Honeywell International Inc. can be ascribed primarily to cumene recycling at a facility owned by Honeywell International in Reporting Year 2015. This facility uses cumene as a feedstock to manufacture phenol, a widely used TRI-covered chemical that is produced in very large quantities. This facility is among the largest manufacturers of phenol in North America and has implemented a number of steps to increase its recovery and recycling of cumene.

Most of these top parent companies reported implementing one or more new source reduction activities in 2015. Some of these companies also reported additional (optional) information to TRI about their pollution prevention or waste management activities.

Examples of additional pollution prevention-related information for 2015:

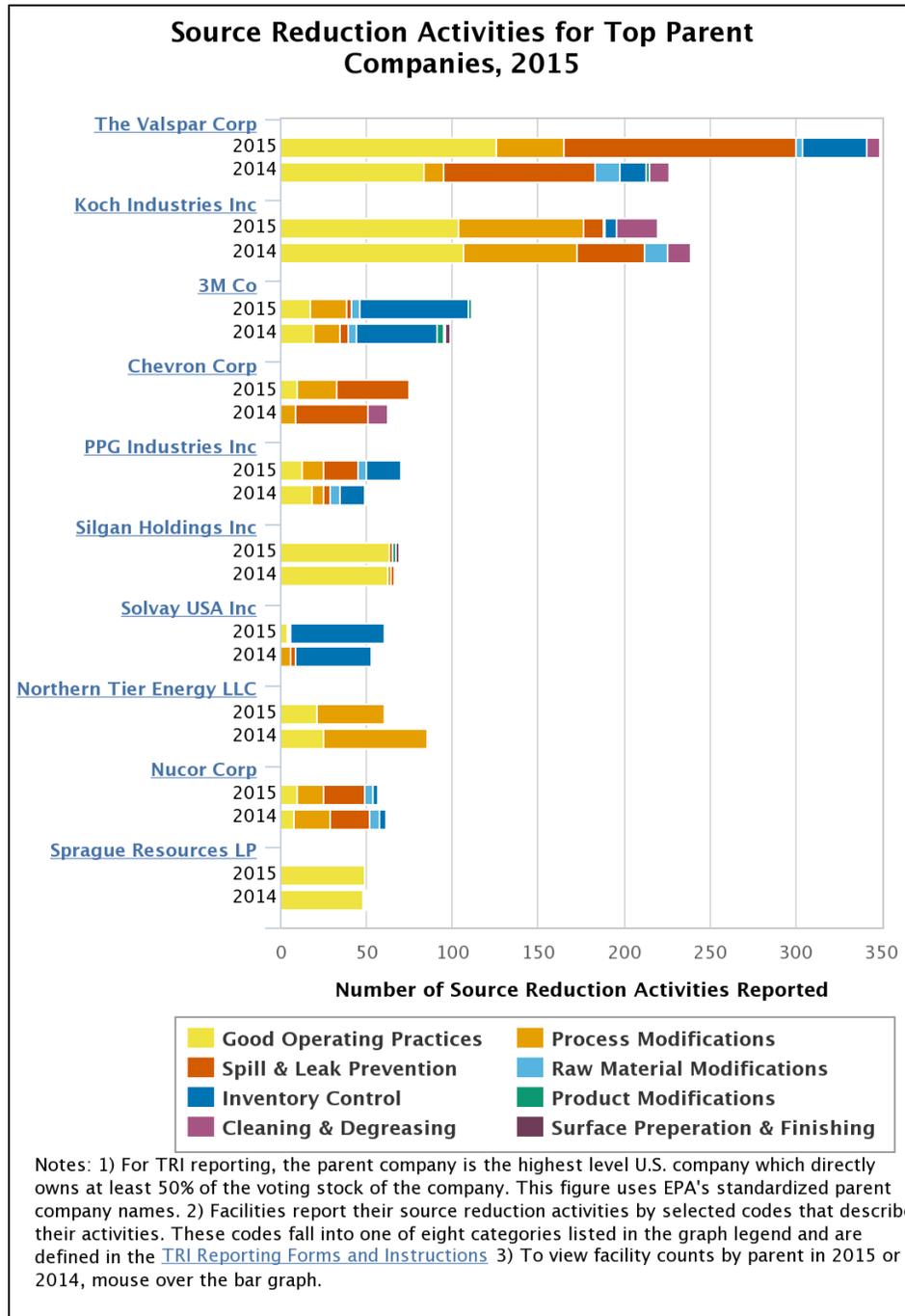
- A Dow Chemical facility decreased [dichloromethane](#) waste after modifying their reactions to reduce excess chemical. (Process Modification) [[Click to view facility details in the Pollution Prevention \(P2\) Tool](#)]
- A Syngenta facility that manufactures pesticides was able to decrease their waste management of [propiconazole](#) by changing production schedule in order to decrease the need for tank washings (Good Operating Practices) [[Click to view facility details in the P2 Tool](#)]

[To conduct a similar type of parent company comparison for a given sector, chemical, or geographic location, use the TRI P2 Search Tool.](#)



Source Reduction Activities by Parent Company

This graph shows the parent companies that implemented the most source reduction activities in 2015. The number of source reduction activities reported in 2014 is also shown for reference.





The parent companies' facilities that reported to the Toxics Release Inventory (TRI) Program primarily operate in the following industries:

- Chemical manufacturing sector: Valspar, Solvay, PPG Industries and 3M
- Multiple sectors, e.g. pulp and paper, petroleum refining, and chemicals: Koch Industries
- Multiple petroleum-related sectors, e.g. petroleum refining, bulk petroleum, chemicals: Chevron
- Metal containers: Silgan Holdings
- Petroleum refining: Northern Tier Energy
- Steel manufacturing: Nucor
- Bulk petroleum industry (store and distribute crude petroleum and petroleum products): Sprague Resources

Good operating practices, such as improving maintenance scheduling and installation of quality monitoring systems, are the most commonly reported source reduction activities for these parent companies. Spill and leak prevention and process modifications are also commonly reported.

Some of these parent companies submitted additional text to EPA with their TRI reports describing their pollution prevention or waste management activities.

Examples of additional pollution prevention-related information for 2015:

- A PPG Industries coatings facility switched to an alternative raw material for which [n-butyl alcohol](#) is not required for its manufacture. (Raw Material Modification) [[Click to view facility details in the Pollution Prevention \(P2\) Tool](#)]
- A Chevron terminal installed spill kits and drain covers in high-risk areas to prevent spills from leaving through storm water drains. (Spill and Leak Prevention) [[Click to view facility details in the P2 Tool](#)]
- Through an employee recommendation, a 3M paper manufacturer reduced the volume of [methyl isobutyl ketone](#) used by switching to a different process catalyst. (Process Modification) [[Click to view facility details in the P2 Tool](#)]

You can [find P2 activities reported by a specific parent company and compare facilities' waste management methods and trends for any TRI chemical by using the TRI P2 Search Tool.](#)