

2013 Data Summary

**TABLE 2
2013 TRI DATA SUMMARY
(IN POUNDS)**

	2012	2013
No. of Facilities	60	61
No of Form As	33	33
No of Form Rs	202	195
No. of Chemicals	88	89
On-site Releases		
Air	1,109,211	998,934
Water	3,777,904	2,881,677
Land	306,702	151,956
Total On-Site Releases	5,193,817	4,032,567
Off-Site Transfers		
POTW's	814,866	935,842
Recycle	9,383,706	9,009,366
Energy Recovery	2,556,954	1,874,068
Treatment	196,890	251,834
Disposal	2,419,683	1,506,791
Total Off-Site Transfers	15,372,098	13,577,900
On-Site Waste Mgmt.		
Recycle	9,326,213	11,642,121
Energy Recovery	16,227,012	15,659,902
Treatment	376,100,649	375,430,183
Total On-Site Mgmt.	401,653,874	402,732,206
Total Waste	422,219,789	420,342,673

Delaware 2013 and 2012 TRI totals for on-site releases, off-site transfers, and wastes managed on-site are displayed in Table 2 for direct comparisons. For 2013, 61 facilities submitted 228 reports for 89 different chemicals. Total on-site releases were lower by 22% (1,161,000 pounds). This decrease was primarily driven by reductions in releases of nitrate compounds to water reported by the Delaware City Refinery and Perdue Georgetown, down 775,029 pounds and 141,578 pounds respectively. Off-site transfers were down 12%, with significant reductions in off-site energy recovery and off-site disposal. On-site waste management activities increased by 0.3% compared to 2012. Decreases in on-site energy recovery and on-site treatment were offset by increases in on-site recycling.

Types of Data

Table 2 lists the categories of data reported to Delaware and the EPA under the TRI program. Within the reports received from facilities, the data is broken down into additional sub-categories. For ease of presentation in this report, the data has been grouped into these categories as described below.

On-Site Releases: On-site releases in Delaware are to **air, water, or land**. There are four TRI categories, but one of these, **underground injection** of TRI chemical waste to wells, is not permitted in Delaware. The **release to air** category includes stack releases collected by mechanical means such as vents, ducts, or pipes, and fugitive releases escaping collection, including equipment leaks and evaporation. **Releases to water** are to water bodies, including streams, rivers, lakes, bays, or oceans. This includes releases from contained sources, such as industrial process outflow or open trenches. Releases to water which result from TRI-reportable chemicals in runoff and storm water runoff are also reportable. **Releases to land** are to (1) RCRA (Resource Conservation and Recovery Act) landfills, in which wastes are buried, (2) surface impoundments, which are uncovered holding areas used to volatilize and/or settle waste materials, (3) other land disposal such as waste piles or releases to land such as spills or leaks, (4) land application/treatment in which waste containing a listed chemical is applied to or incorporated into soil, and (5) other non-RCRA landfills.

Off-Site Transfers: Off-site transfers include transfer of chemical waste to **POTWs** (publicly owned treatment works, typically waste water treatment plants), **recycle** operations (five types), **energy recovery** operations (two types), **treatment** operations (six types), and **disposal** (fourteen types). The receiving facilities are separate from the facility generating the waste. These five main categories of off-site transfers cover the types of final off-site management undertaken for each chemical.

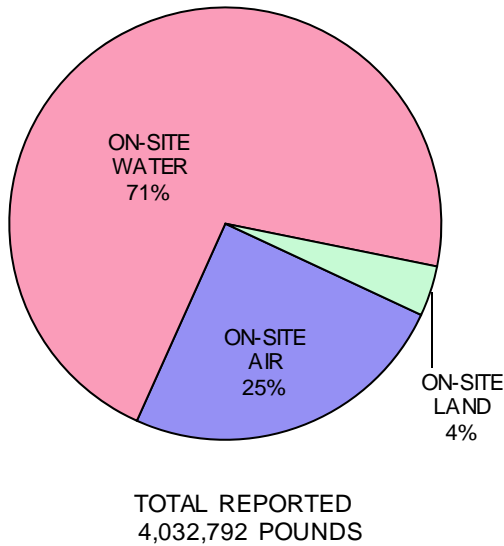
On-Site Waste Management: Waste management operations at the facility generating the waste are categorized to include **recycle**, **energy recovery**, and **treatment**.

The diagram below shows these types of data and how they are related to the four main categories of on- and off-site releases, disposals, and other waste management.



Amounts Reported: The amounts reported are in pounds per year, with a few exceptions, such as dioxins and dioxin like compounds, which are reported in grams. Certain chemical compounds have only the weight of the specific ion or elemental form reported instead of the entire compound, such as nitrate compounds or lead compounds. Also, specific chemicals are only required to be reported in certain states, such as hydrochloric and sulfuric acid, which are only required to be reported as aerosols or gases. For further information on the specific chemical reporting requirements, please refer to the TRI guidance documents at: <http://www2.epa.gov/toxics-release-inventory-tri-program/guidance-documents-tri-reporting>

**FIGURE 1
2013 ON-SITE RELEASES**



On-Site Releases

On-site TRI releases are emissions from a facility to the environment, including emissions to the air, discharges to surface water, and disposal onto or into the ground. These on-site releases to air, water, and land reported under TRI for 2013 made up 1.0% of all TRI-reported waste amounts. The remaining 99% of waste is managed on or off-site as shown in the diagram on the previous page and as seen in Figure 7 on page 13.

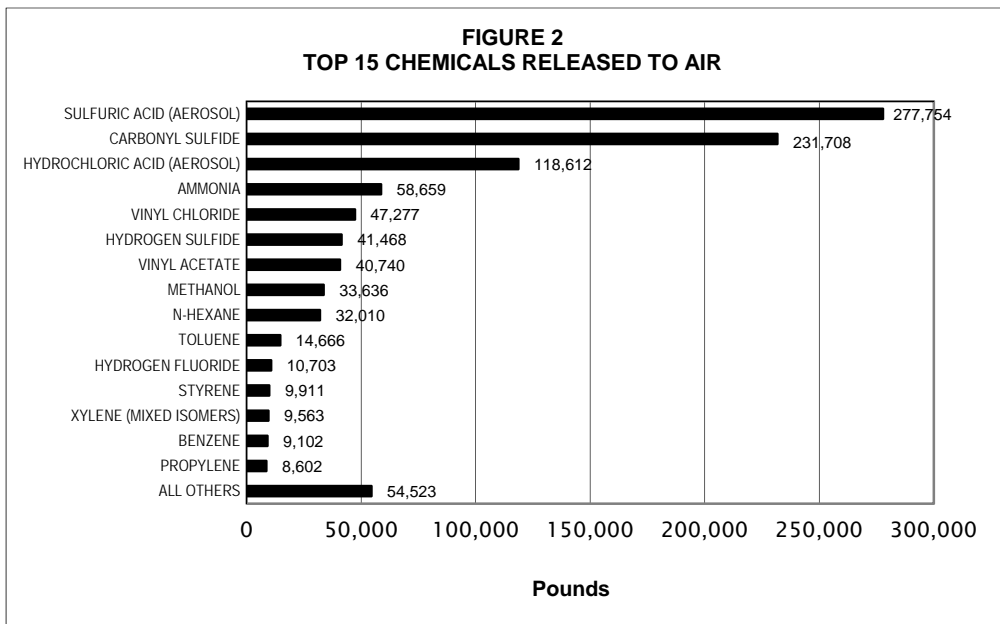
Figure 1 shows the totals of on-site releases reported in Delaware. A large portion, 71% of the total on-site release, is to water. Additional analysis of on-site releases is presented in Figures 2, 3, and 4, which show the top 15 chemicals released to air, water, and land. A trend graph for 2003-2013 for all reported on-site releases is on page 32, and a trend graph for the top five

chemicals is on page 33. Additional detail about on-site releases can be found in Appendices C, E, F, and H.

Releases to Air

Figure 2 depicts the on-site releases to air of the top 15 chemicals compared to the other 56 chemicals that were reported as released to air in 2013. Sulfuric Acid aerosol (gas)

releases, which make up 28% of all on-site releases to air, are released largely in the crude oil refining process by the Delaware City Refinery. Sulfuric acid releases have increased by 66% compared to 2012, with the refinery being in full operation. The



second largest air-release, carbonyl sulfide (23%), is mostly released by the DuPont Edge

Moor facility as a gas by-product of the titanium dioxide production process. Hydrochloric acid aerosol (gas) releases, which rank third in releases to air (12%), are primarily formed as a result of impurities being released within coal and oil used during the combustion process, typically from large electric generating facilities. Hydrochloric acid releases were reduced by 55,937 pounds or 33% compared to 2012 and by almost 1.5 million pounds compared to 2011 or 93%, mainly due to reductions made by the Indian River Generating Station. Ammonia, which ranks fourth in releases to air (8.5%), can be used as a refrigerant for petrochemical, food processing, and chemical facilities and is also a by-product of air pollution control activities. Seven facilities reported releases of ammonia, with Delaware City Refinery releasing the largest amount to air at 51% of the total or 29,968 pounds. Formosa Plastics reported all of the releases to air of vinyl acetate and vinyl chloride, which made up 4.1% and 4.7%, respectively. Vinyl Acetate is a raw material used in certain products, while vinyl chloride is used in the manufacture of polyvinylchloride (PVC). Hydrogen sulfide, which accounted for 4.2% of all on-site releases to air, was predominantly released to air by the Delaware City Refinery (50%) and by the Perdue Georgetown facility (43%). Methanol releases, 3.4% of all releases to air, were reported by nine facilities with BASF Newport reporting the highest amount, 21,996 pounds, or 65%. N-hexane accounted for 3.2% of all releases to air, with the Delaware City Refinery the largest amount, 30,085 pounds or 94%. The remaining chemicals in Figure 2 were each less than 2.0% of total on-site releases to air.

Releases to Water

Releases to water made up the largest portion of on-site releases at 71%. Table 3 shows the total amount of TRI chemicals released to each water body that received a TRI chemical. Not every report to a water body in Table 3 shows a release quantity. In Delaware, 14 of the 78 reports listing a water body as a possible destination for a release to water did not report any quantities actually released

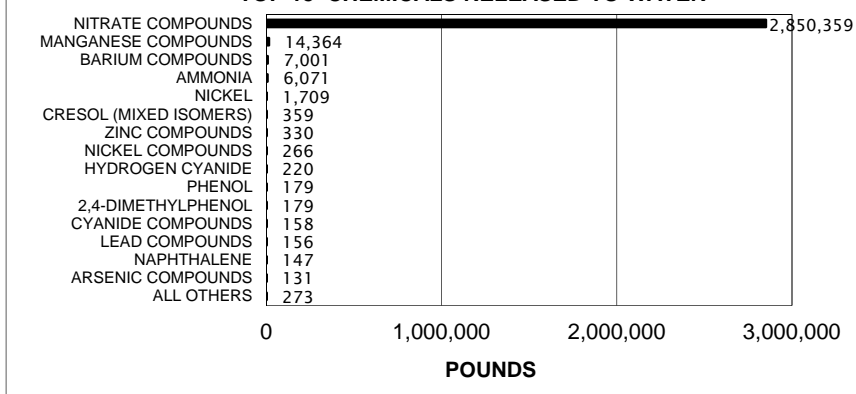
**TABLE 3
TRI CHEMICALS RELEASED TO WATER BY WATER BODY IN 2013**

WATER BODY	NO. OF FACILITIES	NO. OF REPORTS	RELEASE (IN POUNDS)
ARMY CREEK	2	3	90
CHRISTINA RIVER	2	8	0
DELAWARE RIVER	5	52	2,662,551
DRAWYER CREEK TRIBUTARY	1	2	14
ISLAND CREEK	1	5	0
MUDDY RUN	1	1	0
NAAMANS CREEK	1	6	246
SAVANNAH DITCH	1	1	219,000
STATE TOTAL		78	2,881,902

to that water body. These facilities reporting zero for the release amount for a specific chemical met the TRI reporting requirements and did not have an actual release to the body of water, but had the potential of a release.

The Delaware River received 92% of all releases to water, the Savannah Ditch 8%, and

**FIGURE 3
TOP 15 CHEMICALS RELEASED TO WATER**



all the others combined were less than 0.1%. Figure 3 shows the relative relationship of the top 15 TRI chemicals to all other chemicals (30) reported as released to water. This clearly shows the influence that nitrate compounds have on the total. The nitrate compounds category was the top chemical released, (98.9% of the total release to water), followed by manganese compounds (0.50%), barium compounds (0.24%), and ammonia (0.21%). The remaining chemicals released to water were each less than 0.10% of the total releases to water. The Delaware City Refinery reported a release of 2,631,359 pounds of nitrate compounds to water for 2013, and Perdue Georgetown reported 219,000 pounds. The biological treatment of nitrogen-containing substances such as ammonia and animal waste is responsible for the formation of nitrate compounds, which are released to water. Metallic compounds (barium, cobalt, chromium, copper, cyanide, lead, manganese, nickel, vanadium, and zinc) are generally products of fuel combustion, and petroleum, ore and metal refining. The Delaware City Refinery, DuPont Edge Moor, Evraz Claymont Steel, Johnson Controls Battery Plant, and V&S Delaware Galvanizing are the facilities reporting releasing of these metal compounds to water. DuPont Edge Moor reported 99.9% of the manganese compounds and 100% of the barium compounds released to water.

Table 4 shows the total amount of TRI chemicals for 2013 released to each basin in the State

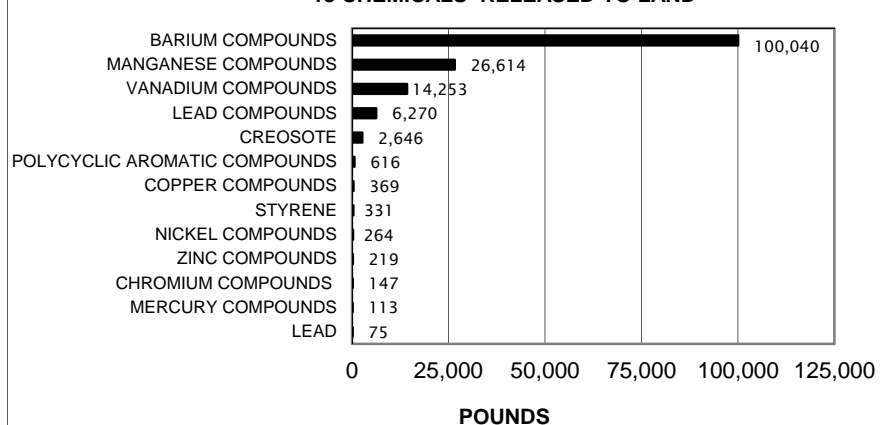
**TABLE 4
TRI CHEMICALS
RELEASED TO WATER BY BASIN**

BASIN	RELEASE (IN POUNDS)	PERCENT
CHESAPEAKE	0	0.0%
DELAWARE BAY	2,859,565	99.2%
INLAND BAYS	0	0.0%
PIEDMONT	22,336	0.8%
STATE TOTAL	2,881,902	100.0%

of Delaware. The Inland Bays include lands that drain into the Indian River Bay/Rehoboth Bay area, then to the Atlantic Ocean. The Piedmont Basin contains lands that drain to the portion of the Delaware River above the City of New Castle. All the receiving streams, except the Island Creek, eventually feed into the Delaware Bay. Island Creek feeds into the Inland Bays and then into the Atlantic Ocean. The total amount released to water decreased

by 896,000 pounds in 2013, largely the result of decreases in the reported release of nitrate compounds by the Delaware City Refinery and the Perdue Georgetown Facility. Additional discussion about these releases can be found in the **Trend Analysis** section starting on page 29.

**FIGURE 4
13 CHEMICALS RELEASED TO LAND**



Releases to Land

Releases to land are shown in Table 2 on page 6. These releases are relatively small, amounting to 4% of total on-site releases. Figure 4 shows the contribution for the 13 chemicals reported as being released to land. Nearly all the releases to land

are metals and metal compounds except for creosote, polycyclic aromatic compounds (PACs), and styrene. Most of the metals and metal compounds reported are formed during combustion from metal impurities that exist in coal or oil, or in the base metal from metal working processes. Barium compounds, manganese compounds, vanadium compounds, and lead compounds, the top 4 metals and metal compounds reported, accounted for 97% of all on-site releases to land and were primarily released by the Indian River Generating Station. Creosote accounts for 2% of all on-site releases to land and was released by Delaware City Refinery. All other chemicals accounted for approximately 1% of the on-site releases to land. Additional discussion about releases to land and their trends can be found in the **Trend Analysis** section starting on page 29.

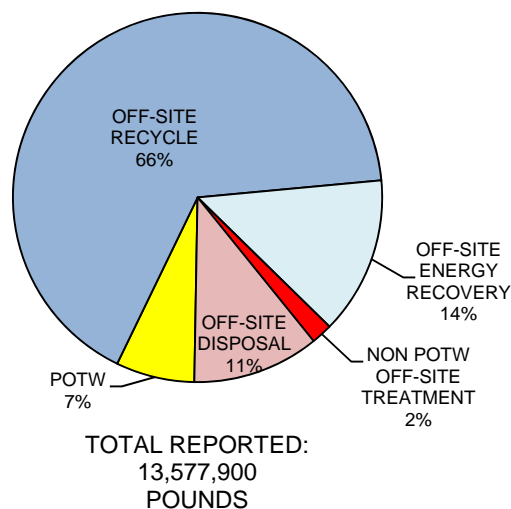
Descriptions of some of the hazards that these chemicals, which were released to air, water, or land, may cause to humans, can be found in the **Chemical Data Fact Sheets** section under **For Further Information** on page 46. Facility specific information is available via the **TRI Facility Profiles**, see **Access to TRI Files** under the **Further Information Section** on page 46.

Off-Site Transfers

Off-site transfers are material transfers to off-site locations for the purpose of disposal, recycling, energy recovery, or treatment. Treatment could be at a private waste treatment facility or at a POTW, typically a city or county wastewater treatment plant. The total amounts of chemical wastes transferred off-site decreased by 12% (1,794,194 pounds) since 2012. Off-site transfers account for 3% of total TRI waste and are 3 times larger than the amount released on-site. Overall increases occurred in treatment and POTWS, and reductions occurred in recycling, energy recovery, and disposals. The largest reductions include Dupont Edge Moor reporting a decrease of 817,090 pounds of manganese compounds being transferred off-site for disposal and the 756,100 pound decrease in n,n-dimethylformamide transferred off-site for recycling by the Rohm & Haas (B2, B3, B8) facility. The largest increase reported was an increase of 522,534 pounds in off-site recycling of lead compounds by reported by the Johnson Controls Battery Plant. Figure 5 shows the relative portions of the five off-site transfer categories. Table 2 on page 6 shows these amounts in tabular form, and **Appendices D and G** provide additional detail about transfers from each facility.

TRI chemicals in wastes are transported by various means from Delaware to their final destinations, many of which

FIGURE 5
2013 OFF-SITE TRANSFERS



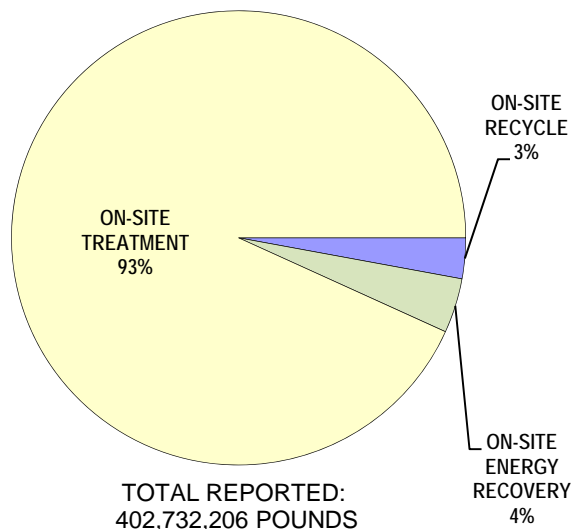
are out-of-state. For 2013, TRI chemicals were sent to 20 states, some as far away as Missouri and Texas, in addition to locations in Delaware. Over 90% of TRI chemicals in all wastes transferred off-site were sent to out-of-state locations for further processing and/or disposal. However, approximately 99% of transfers to POTWs generated by Delaware facilities are treated in Delaware. Off-site transfer to recycle operations accounted for 66% of the amounts within the five categories in off-site transfers, while energy recovery accounted for 13.8%, disposals accounted for 11.1% of the transfers, transfers to POTWs accounted for 6.9%, and non-POTW treatment was 1.9%. Ninety-three percent of the transfers to POTWs were to the City of Wilmington POTW, and all but 10,555 pounds of the 935,842 pounds treated at all POTWs were treated at Delaware POTW facilities. BASF Newport and Air Liquide-Medal combined for 74% of the total TRI chemical transfers to the Wilmington POTW. See page 38 for more information on Delaware facilities receiving TRI chemicals from other Delaware TRI facilities and from out-of-state TRI facilities.

On-Site Waste Management

On-site waste management is the amount of waste that never leaves the facility and is managed by the facility on-site. These activities generally represent a lower risk to the environment, as the materials are typically destroyed on site, although a small fraction may escape treatment and these amounts are reported as on-site releases. The categories of **Treatment, Recycle, and Energy Recovery** are used to define on-site management activities related to TRI chemical wastes. The total amount of TRI chemicals managed on-site is 95.8% of the total TRI chemical waste. Figure 6 shows the portions of these wastes processed on-site. **Appendices D and G** provide additional detail on-site waste management. Facility specific information is available via the **TRI Facility Profiles**, see

Access to TRI Files under the **Further Information Section** on page 46.

**FIGURE 6
2013 ON-SITE WASTE
MANAGEMENT**



Waste Treatment (375,430,183 pounds) includes the amount of toxic material that was destroyed in on-site waste treatment operations. The Delaware City Refinery had the highest total amount of on-site waste treatment, combining for 355,588,228 pounds (95%) of the TRI waste treated on-site. Treatment of hydrogen sulfide at the Delaware City Refinery in the amount of 336,215,341 pounds was the highest single on-site treatment amount.

Recycled waste (11,642,121 pounds) is the quantity of toxic material recovered at the facility and made available for further use. Rohm & Haas

(B2, B3, B8) recycled n,n-dimethylformamide, Air Liquide-Medal recycled methanol and n-hexane, and Orient recycled aniline, with these facilities combining to report 92% of the total amount recycled on-site.

Energy Recovery includes the quantity of toxic material that had heat value and was combusted in some form of energy recovery device such as a heat boiler. The Delaware City Refinery was the only facility in the State to report on-site energy recovery. For 2013, the refinery reported 15,659,902 pounds of TRI chemicals processed on-site for energy recovery, with ammonia accounting for 96% or 15.1 million pounds.

Total TRI Waste

Total TRI waste is the combined total of the on-site release, off-site transfer, and on-site waste management amounts in the TRI chemical reports. Figure 7 provides a perspective of the total TRI chemical waste picture in Delaware. Less than 1% of the total reported TRI waste is released on-site, 3% is transferred off-site for treatment or disposal, and about 96% is managed on-site through treatment, energy recovery, and recycle operations by the facilities generating the waste. Figure 7 shows the relative portions of the various sub-categories of TRI release and waste management.

FIGURE 7
TOTAL 2013 TRI CHEMICAL MANAGEMENT
TOTAL REPORTED: 420,342,898 POUNDS

