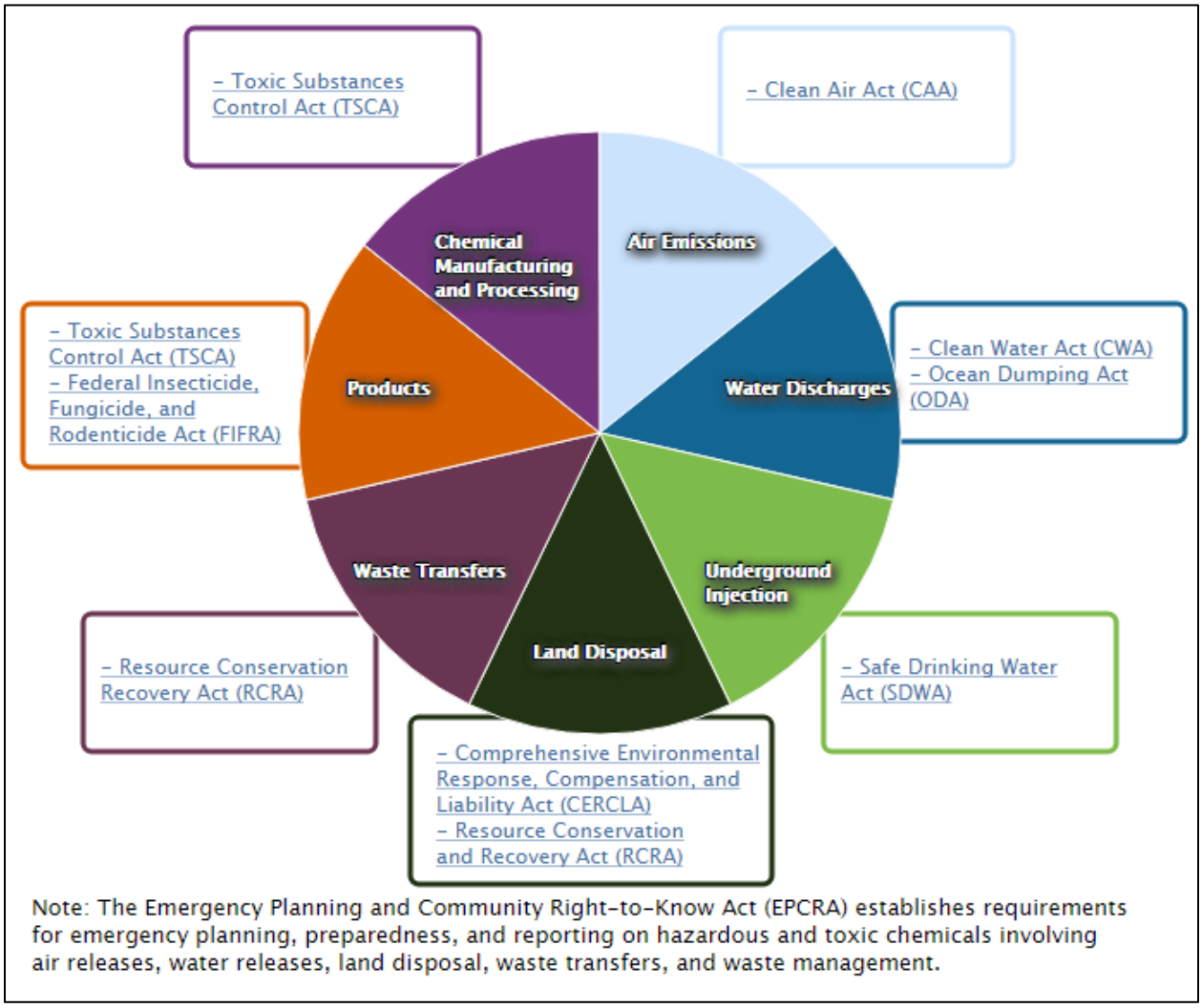
TRI and Beyond

The Toxics Release Inventory (TRI) is a powerful resource that provides the public with information about how toxic chemicals are managed by industrial facilities in the United States. However, there are many other programs at EPA that collect information about chemicals and our environment.

The next figure is an overview of some of the laws that EPA implements and the industrial activities or processes EPA regulates under these laws. While many programs at EPA focus on one area, TRI covers releases to air, water, and land; waste transfers; and waste management activities. As a result, TRI data are especially valuable, as they can be utilized with many other datasets to provide a more complete picture of national trends in chemical use, management and releases.



Note: The Emergency Planning and Community Right-to-Know Act (EPCRA) establishes requirements for emergency planning, preparedness, and reporting on hazardous and toxic chemicals involving air releases, water releases, land disposal, waste transfers, and waste management.

Throughout EPA, offices use TRI data to support their mission to protect human health and the environment. These uses include analyzing TRI data to inform decisions such as when setting program priorities, providing information to stakeholders such as when working with communities toward a common goal, and many others applications as shown in the table below.

Current Uses of TRI Data by EPA Offices and Regions

EPA Office	Promote Pollution Prevention	Make Decisions	Add Context	Identify Potential Violators	Inform Stakeholders
Air and Radiation		X	X		
Land and Emergency Management	X	X	X	X	X
Enforcement and Compliance Assurance		X	X	X	
International and Tribal Affairs		X			X
Chemical Safety and Pollution Prevention	X	X	X	X	X
Water	X	X	X	X	
Inspector General			X		
Environmental Information				X	X
Regions	1, 2, 3, 5, 6, 7, 8, 9	2, 3, 4, 5, 6, 7, 8, 9	2, 3, 4, 5, 6, 9	1, 2, 3, 4, 6, 7, 9, 10	1, 3, 4, 5, 6, 8, 9

This chapter highlights three thematic areas that use TRI data with other data sources:

- Climate Change:
    - A comparison of TRI data and EPA's Greenhouse Gas Reporting Program (GHGRP) data collected under the Clean Air Act (CAA)
- TSCA Work Plan (Priority) Chemicals:
    - An example of how TRI data complements data collected under the Toxic Substances Control Act (TSCA)
- Ozone Depleting Substances:
    - An analysis of TRI air releases for a subset of chemicals further regulated under the Clean Air Act (CAA) to reduce the amount of ozone depleting substances used in the U.S.

Sections in this chapter

Comparing TRI and Greenhouse Gas Emissions

Under the authority of the Clean Air Act, EPA's Greenhouse Gas Reporting Program (GHGRP) requires large emitters of greenhouse gases and suppliers of certain products to submit annual greenhouse gas reports to EPA. Emissions of greenhouse gases lead to elevated concentrations of these gases in the atmosphere, which alter the Earth's radiative balance and contribute to climate change. These elevated concentrations are reasonably anticipated to endanger the public health and welfare of current and future generations. The purpose of the GHGRP is to collect timely, industry-specific data to help us better understand the sources of greenhouse gas emissions. Comparing and integrating GHGRP data with Toxics Release Inventory (TRI) data about chemical releases from industrial facilities can provide a more complete picture of a facility's environmental performance.

What do GWP and CO_2e mean?

Each GHG has an associated global warming potential (GWP). The GWP is a relative measure of how much heat a GHG traps in the atmosphere relative to CO_2 over a given time period. The GWP of CO_2 is one. GHG emissions values are typically expressed in metric tons of carbon dioxide equivalent (CO_2e) so that the impacts of different gases can be directly compared.

In 2015:

- Over 8,000 facilities reported direct emissions of greenhouse gases (GHGs) to the atmosphere, totaling over 3.05 billion metric tons of carbon dioxide equivalent ($mtCO_2e$).
- This represents about half of the 6.87 billion $mtCO_2e$ that EPA estimated were released in the United States from all human-related sources per the 2014 annual U.S. Greenhouse Gas Inventory. The GHGRP does not require direct emissions reporting from all U.S. sources. For example, the transportation sector and agricultural sources of GHG emissions are not included in the GHGRP.
- The primary greenhouse gas reported to the GHGRP was carbon dioxide (CO_2), which is released during fossil fuel combustion and various industrial processes.

What chemicals were reported to GHGRP for 2015?

- Carbon dioxide = 91.3% of the $mtCO_2e$ total
- Methane = 7.2%
- Nitrogen Oxide (N_2O) = 0.9%
- Fluorinated Gases (HFCs, PFCs, SF6) = 0.7%

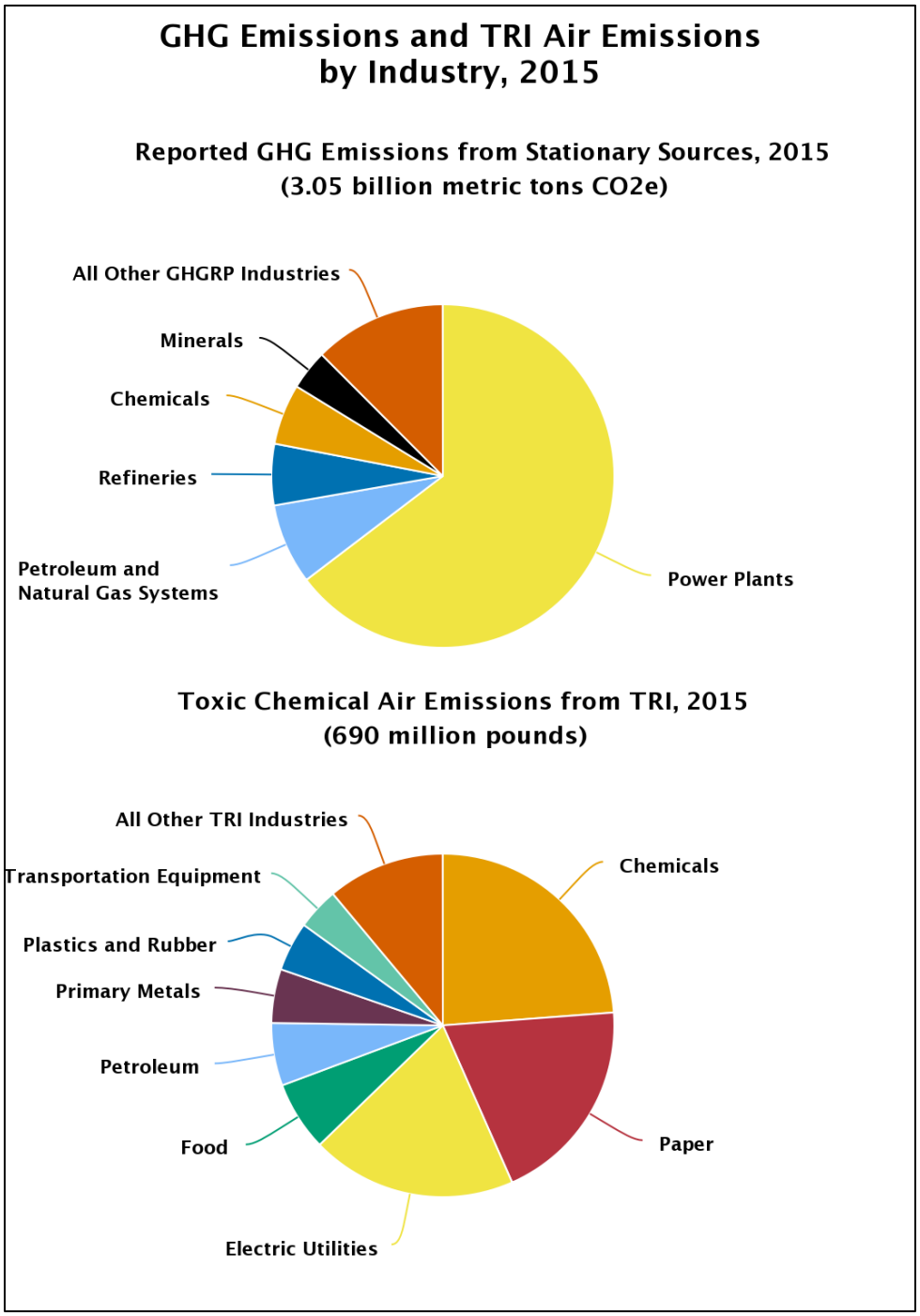
TRI reporting focuses on toxic chemicals and as a result covers different chemicals than does the GHGRP. Some TRI chemicals are a result of combustion of fuels for energy (as most GHG emissions are), but others are used in and released from additional processes ranging from

metal mining to surface cleaning. Analyzing toxic chemical releases reported to TRI and greenhouse gas emissions reported to the GHGRP together creates a more complete picture of emissions at the facility and industrial sector levels.

Note that in addition to differences in the chemicals reported to TRI and GHGRP, there are numerous other program differences including reporting thresholds. For TRI, the reporting threshold for most chemicals is 25,000 pounds manufactured or processed, or 10,000 pounds otherwise used per year, whereas for the GHGRP, the reporting threshold is based on emissions and is generally 25,000 metric tons of carbon dioxide equivalent per year.

Top Sectors Reporting TRI Air Emissions and GHG CO_2e

This figure shows the top sectors reporting air emissions to the Greenhouse Gas Reporting Program (GHGRP) and the Toxics Release Inventory (TRI) in 2015.

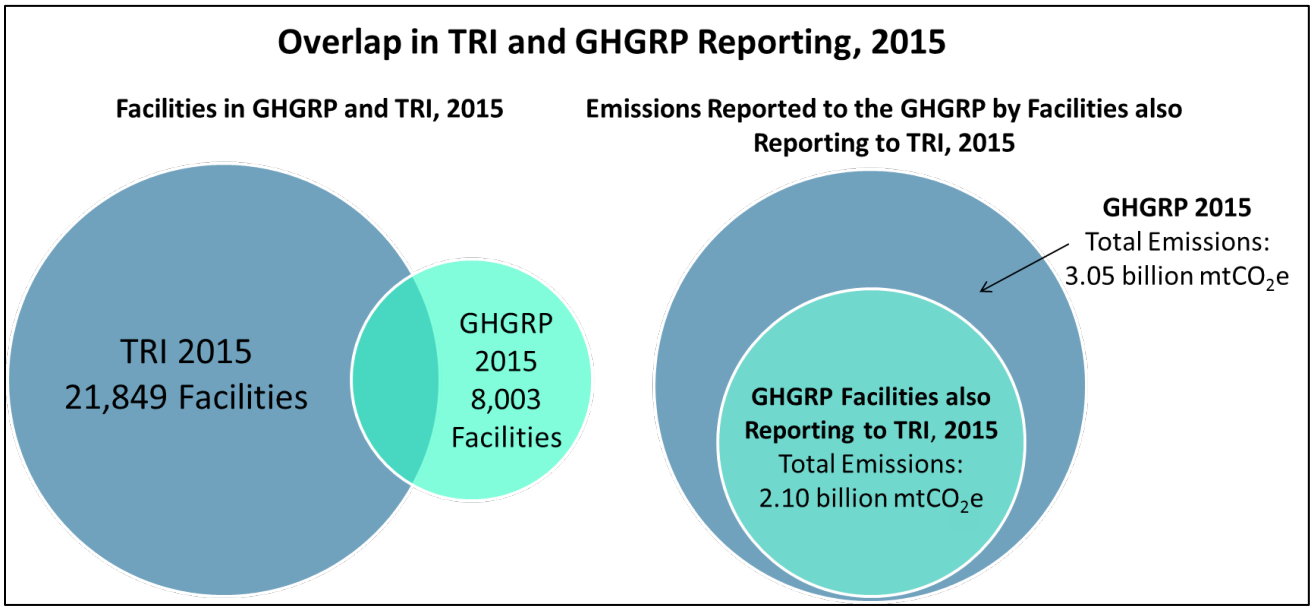


In 2015:

- The top air emitting sectors in TRI are similar, but not identical to, the top emitting sectors covered by the GHGRP.
- While electric utilities are a primary source of air emissions reported to both programs, both the chemical manufacturing and paper sectors report more toxic chemical air emissions than are reported by electric utilities. In prior years, electric utilities were the largest contributor to TRI air emissions, but with shifts in the sector toward natural gas and renewable energy sources, as well as improved emission controls, the sector is no longer the largest contributor to TRI air emissions.

Overlap in TRI and GHGRP Reporting

The figure below shows the overlap between facilities that report to the Toxics Release Inventory (TRI) and the Greenhouse Gas Reporting Program (GHGRP).

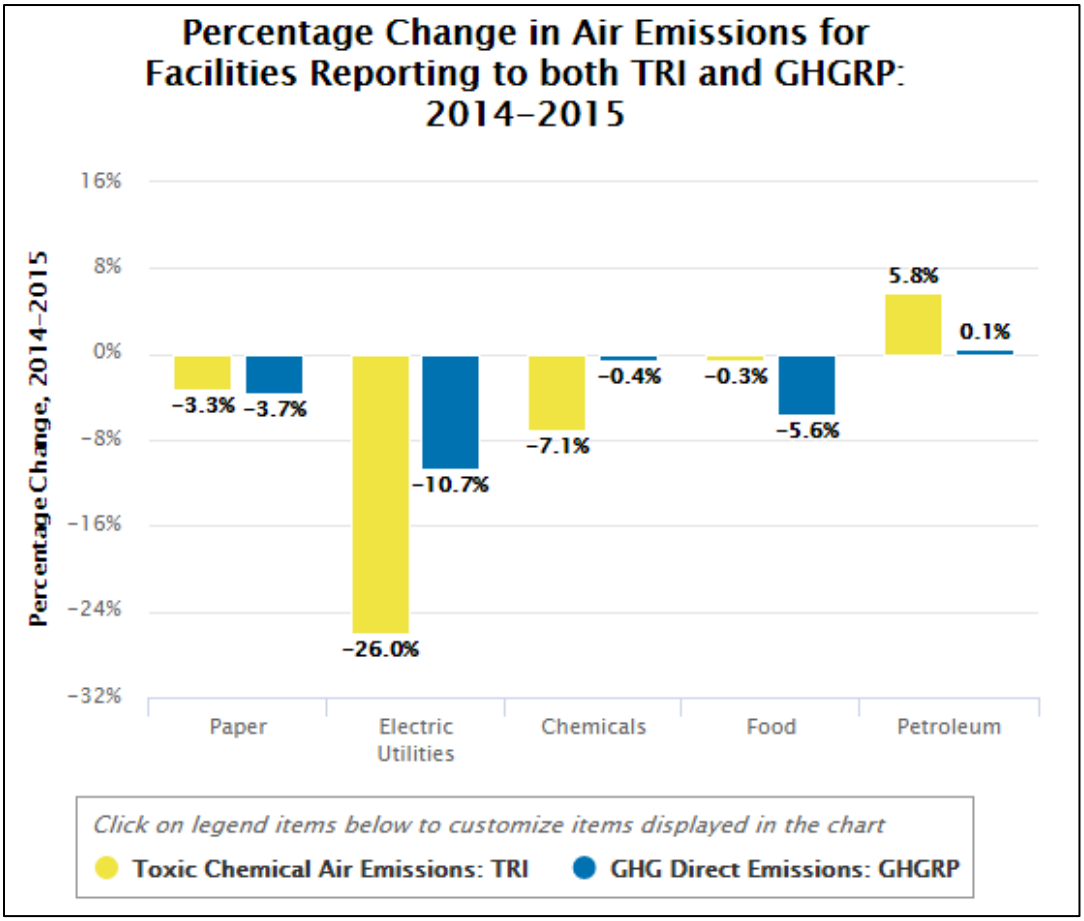


In 2015:

- Almost one-third of the facilities reporting to the GHGRP also reported to the TRI Program.
- However, this subset of GHGRP reporters accounted for 69% of GHGRP emissions, indicating that the facilities reporting the greatest greenhouse gas (GHG) emissions also trigger TRI requirements for reporting on toxic chemicals.

Percentage Change in TRI and GHG Air Emissions

The graph below shows the percentage change in air emissions and greenhouse gas emissions from 2014-2015 for facilities that reported to both the Toxics Release Inventory (TRI) and the Greenhouse Gas Reporting Program (GHGRP).



From 2014 to 2015:

- For the five industry sectors with the greatest TRI-reported air emissions, this figure shows the percentage change in total air emissions for the subset of facilities reporting to both the TRI Program and the GHGRP.
- While based on a consistent subset of facilities, the percentage change in emissions by industry sector varies between the two programs.

- The variations are driven by differences in the types of pollutants reported to the TRI Program and the GHGRP and by the impacts of certain source reduction and pollution control activities. Actions taken by facilities may include:
    - Reduction of fuel consumption, which decreases emissions of both greenhouse gases and toxic chemicals that are byproducts of fuel combustion.
    - Installation of new treatment technology, which may reduce emissions of a specific TRI chemical but does not affect greenhouse gas emissions.

TRI and TSCA

On June 22, 2016, President Obama signed into law the Frank R. Lautenberg Chemical Safety for the 21st Century Act, which amends the Toxic Substances Control Act (TSCA), the Nation's primary chemicals management law. Under the new law, which received bipartisan support in both the U.S. House of Representatives and the Senate, all existing chemicals in commerce and new chemicals entering the market will be reviewed for safety through a risk-based process with increased public transparency.

Prior to the enactment of the revised TSCA, EPA identified 90 chemicals for further assessment under TSCA, referred to as "work plan chemicals". EPA selected these chemicals based on their hazard (e.g., neurotoxic effects), exposure (e.g., detected in biomonitoring programs), or persistence and bioaccumulation characteristics, and their assessment will likely continue under the new TSCA law. Assessments may take the form of conceptual models, analysis plans or risk evaluations and are intended to inform next steps in risk management activities. Of the 90 work plan chemicals, 53 are also TRI-listed, as either a specific chemical or as a member of a chemical category.

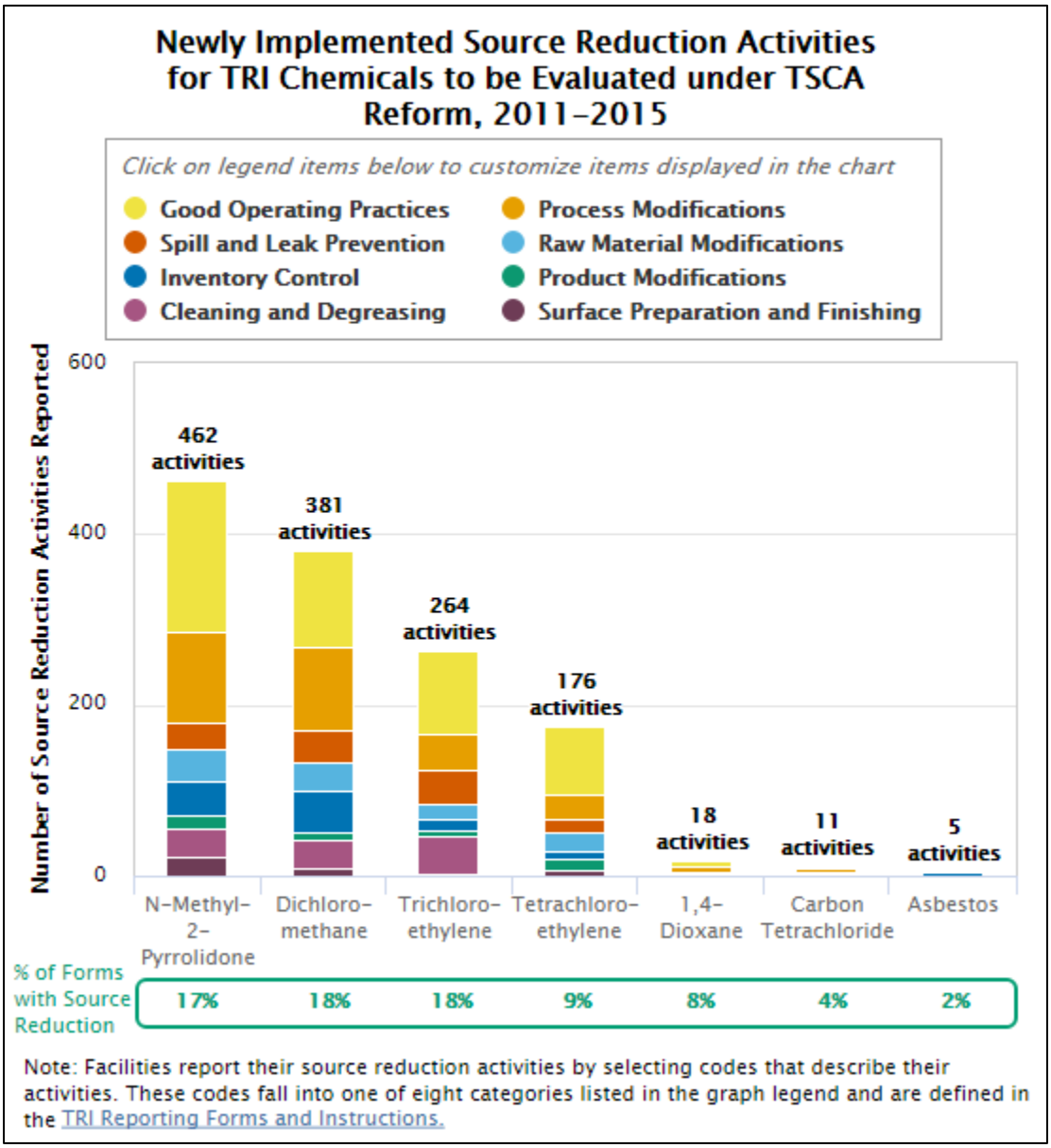
The new law requires EPA to establish a process for prioritizing additional chemicals for risk evaluation. TRI provides valuable information to the TSCA prioritization and evaluation processes and also serves as a tool for tracking the nation's progress toward reduced environmental releases of chemicals with identified risks.

Source Reduction Activities for Chemicals to be Evaluated under TSCA

In November 2016, EPA announced the first ten chemicals it will evaluate for potential risks to human health and the environment under Toxic Substances Control Act (TSCA) reform. Most of these ten chemicals are Toxics Release Inventory (TRI)-listed chemicals where TRI data are currently available, as shown in the table below. Two of these chemicals – 1-bromopropane and hexabromocyclododecane (HBCD) – have been recently added to the TRI chemical list and reporting will begin in 2017 and 2018, respectively.

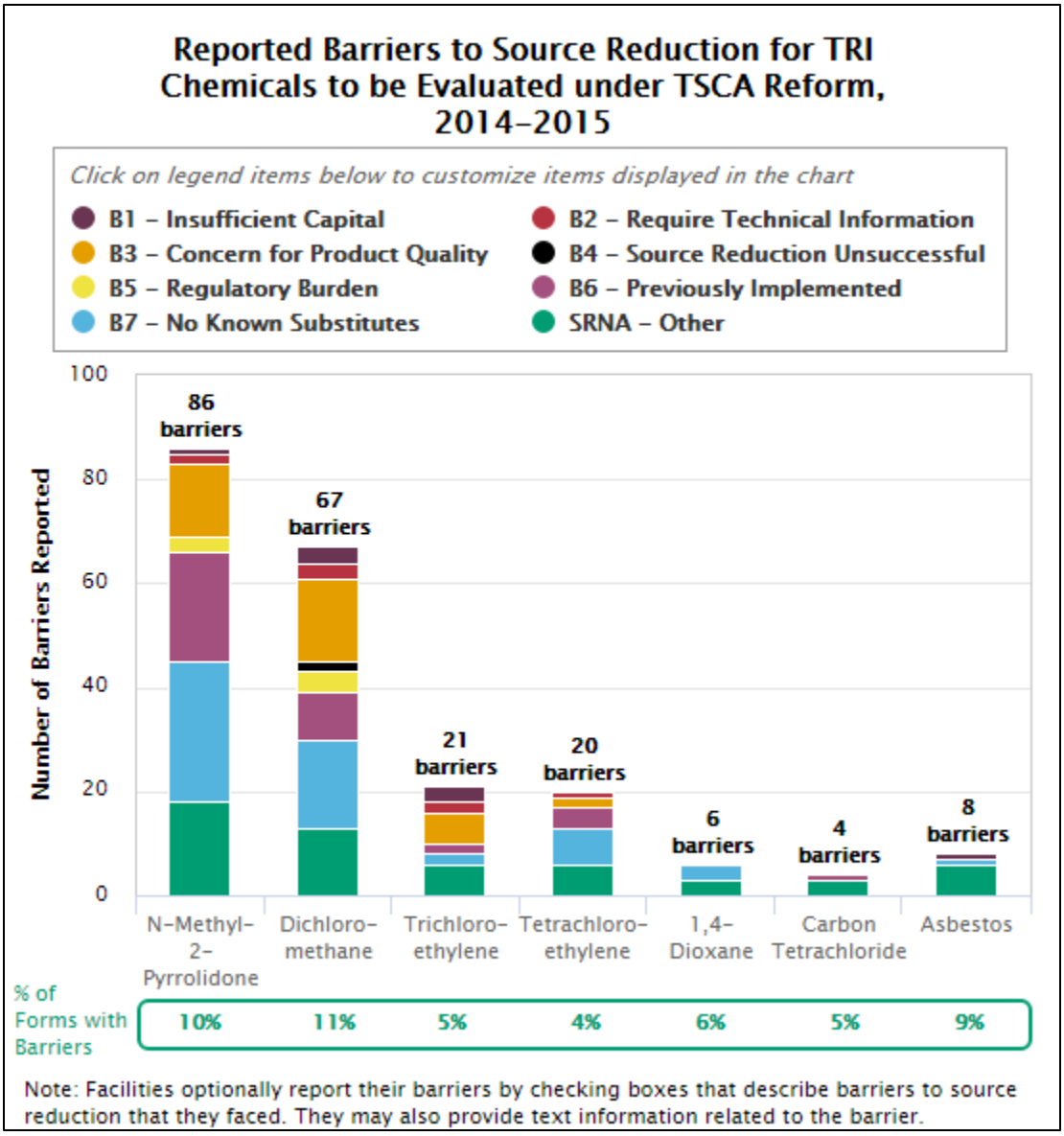
Chemicals to be Evaluated	TRI-listed Chemical?
1,4-Dioxane	Yes
1-Bromopropane	Yes; reporting starts in 2017
Asbestos	Partially; reportable only if in the friable form
Carbon Tetrachloride	Yes
Cyclic Aliphatic Bromide Cluster	Partially; HBCD reporting starts in 2018
Dichloromethane (also called Methylene Chloride)	Yes
N-Methylpyrrolidone (NMP)	Yes
Pigment Violet 29	No
Trichloroethylene (TCE)	Yes
Tetrachloroethylene	Yes

TRI can provide valuable information to the TSCA evaluations such as the types of source reduction activities that TRI filers have implemented to reduce the quantity of the chemical generated as waste, as shown in the figure below.


Newly Implemented Source Reduction Activities for TRI Chemicals to be Evaluated under TSCA Reform, 2011–2015
Click on legend items below to customize items displayed in the chart
Good Operating Practices
Process Modifications
Spill and Leak Prevention
Raw Material Modifications
Inventory Control
Product Modifications
Cleaning and Degreasing
Surface Preparation and Finishing
Number of Source Reduction Activities Reported
600
400
200
0
462 activities
381 activities
264 activities
176 activities
18 activities
11 activities
5 activities
N-Methyl-2-Pyrrolidone
Dichloro-methane
Trichloro-ethylene
Tetrachloro-ethylene
1,4-Dioxane
Carbon Tetrachloride
Asbestos
% of Forms with Source Reduction
17%
18%
18%
9%
8%
4%
2%
Note: Facilities report their source reduction activities by selecting codes that describe their activities. These codes fall into one of eight categories listed in the graph legend and are defined in the TRI Reporting Forms and Instructions.

Barriers to Source Reduction for Chemicals to be Evaluated under TSCA

Since 2014, facilities that report to the Toxics Release Inventory (TRI) have the option to report the barriers they encountered to source reduction. The barriers reported to TRI are shown in the figure below for the seven chemicals that are TRI-listed included in the first chemicals that EPA will evaluate for potential risks to human health and the environment under Toxic Substances Control Act (TSCA) reform.



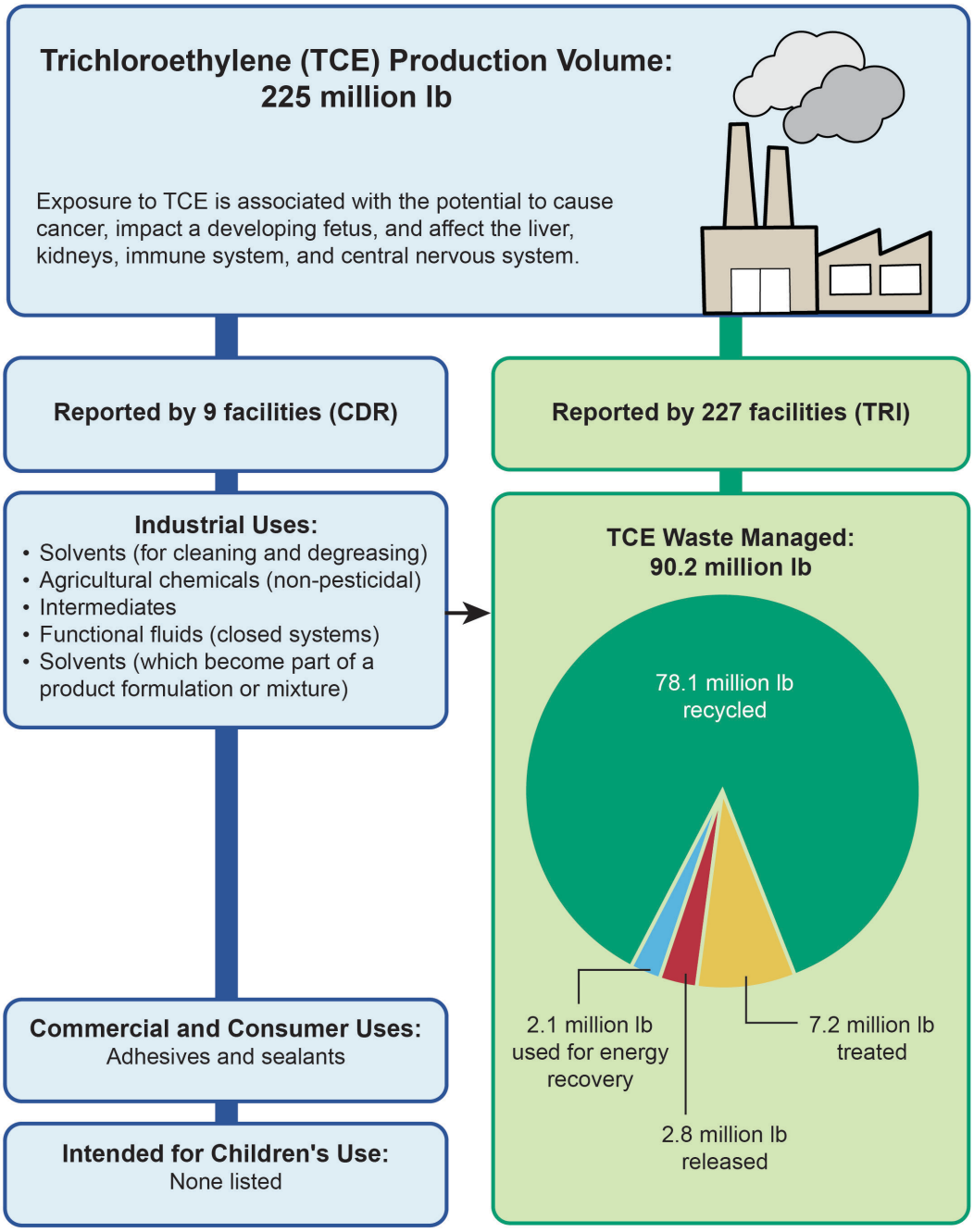
Example: TSCA and TRI Information for Trichloroethylene

Under the Toxic Substances Control Act (TSCA), EPA collects information about the manufacture, including import, and use of chemicals in U.S. commerce through the Chemical Data Reporting (CDR) rule. This information on the production of chemicals complements the Toxics Release Inventory (TRI) data on the management of chemical waste (including releases, recycling, and source reduction). To illustrate how TRI information complements the TSCA chemical assessments, one chemical, trichloroethylene (TCE), is presented as an example.

EPA has undertaken efforts to reduce the risks TCE poses to public health and the environment. For example, EPA has conducted a risk assessment; initiated a rulemaking to eliminate the risk of TCE in aerosol degreasers, as a spotting agent at dry cleaning facilities, and in vapor degreasing operations; and coordinated a voluntary phase out of TCE in arts and crafts spray fixative product marketed to consumers.

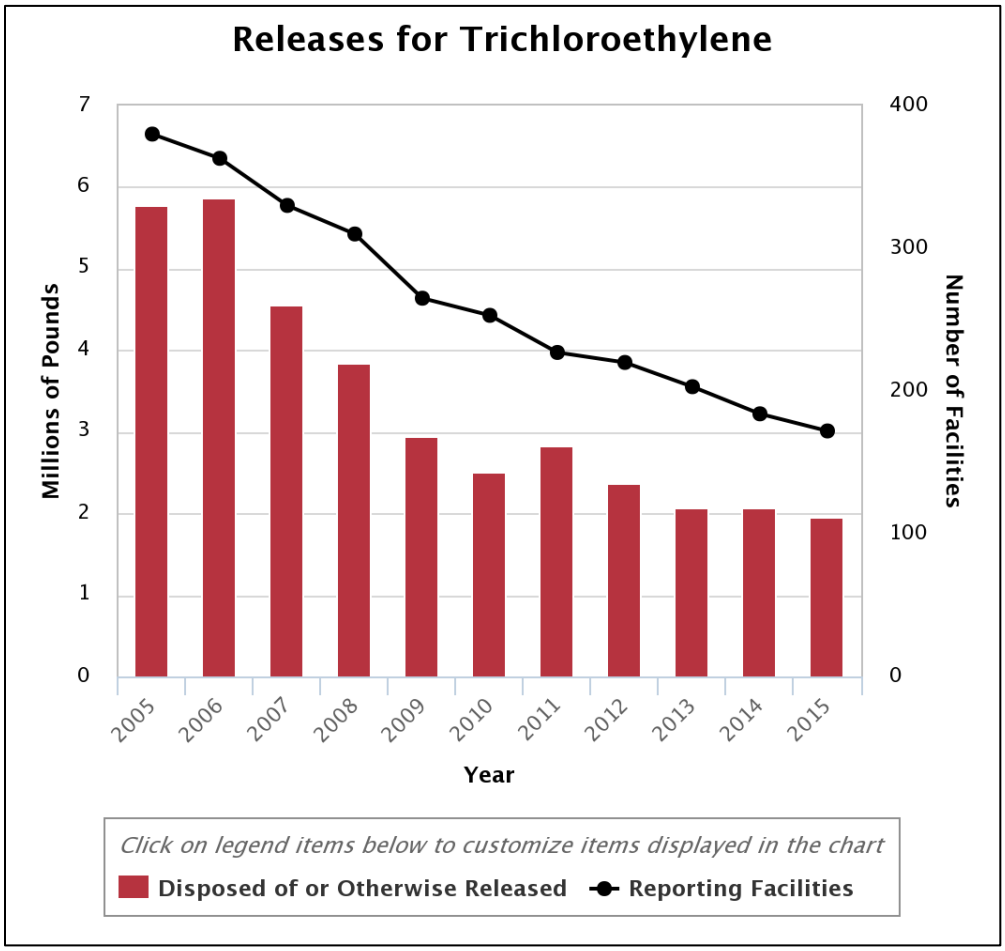
Utilizing the chemical information reported to TRI and collected under the CDR rule together provides a more complete picture of a chemical's lifecycle from sources of import and domestic manufacture to means of final disposition in the environment or products, as shown in this figure.

In 2011 (the most recent year of CDR data which was published in 2012), nine manufacturers, including importers, reported a total production volume of 225 million pounds of TCE manufactured. Industrial uses reported include as a solvent or intermediate in chemical manufacturing. During the same year, 227 facilities filed a TRI form for TCE, reporting a total of 90 million pounds of waste, most of which (87%) was managed through recycling.


Trichloroethylene (TCE) Production Volume:
225 million lb
Exposure to TCE is associated with the potential to cause cancer, impact a developing fetus, and affect the liver, kidneys, immune system, and central nervous system.
Reported by 9 facilities (CDR)
Reported by 227 facilities (TRI)
Industrial Uses:
• Solvents (for cleaning and degreasing)
• Agricultural chemicals (non-pesticidal)
• Intermediates
• Functional fluids (closed systems)
• Solvents (which become part of a product formulation or mixture)
TCE Waste Managed:
90.2 million lb
78.1 million lb recycled
2.1 million lb used for energy recovery
7.2 million lb treated
2.8 million lb released
Commercial and Consumer Uses:
Adhesives and sealants
Intended for Children's Use:
None listed

TRI Releases for Trichloroethylene

The figure below shows the trend in releases of trichloroethylene (TCE) reported to the Toxics Release Inventory (TRI) over the last ten years.



As shown in the figure, since 2005, releases of TCE reported to TRI have decreased by 66%. Much of the reduction is from decreased releases by the Fabricated Metals sector which uses TCE in degreasing. EPA's TRI Pollution Prevention (P2) Spotlight provides additional information on how this sector is reducing their TCE releases. The number of facilities reporting TCE has also declined considerably over this time period.

TRI reporting facilities also provide information on the source reduction activities they implement to generate less waste. From 2011 through 2015, 28% of the facilities reporting TCE reported a source reduction activity; among the most common are:

For More on TCE

To learn more about TCE, where it's found, and EPA's actions to date, see the TSCA webpage on TCE resources.

- cleaning and degreasing modifications, such as changing to aqueous cleaners, and
- process modifications, such as upgrading valves or adding insulation to a degreaser to reduce TCE use and losses.

Use the TRI P2 Search Tool to view descriptions of facilities' activities to reduce TCE wastes. For example, an aircraft component manufacturer replaced the existing steam control valve on their TCE vapor degreaser with an electronically controlled steam valve. This change enabled them to run more parts through the degreaser while reducing TCE consumption.

Ozone Depleting Substances

In the 1970s, scientists concluded that chlorofluorocarbons (CFCs) were depleting the stratospheric ozone layer. The ozone layer in the stratosphere protects life on Earth from the harmful effects from the sun's radiation. This concern about the damage to the ozone layer led to a ban on using CFCs as aerosol propellants. However, in the 1980s, consumption of CFCs continued to increase. Through an international agreement on the Protection of the Ozone Layer and the adoption of the Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol) countries agreed to phase out production and consumption of ozone-depleting substances (ODS). All countries recognized by the United Nations have ratified the Montreal Protocol. Visit EPA's Ozone Protection website for more information.

ODS have lifetimes in the atmosphere long enough to allow them to be transported by global winds into the stratosphere. There, they release chlorine or bromine when they break down, and these chlorine and bromine atoms damage the protective ozone layer.

Congress added two categories of ODS, designated as class I and class II, to the Clean Air Act Amendments in 1990. Many class I and class II ozone-depleting substances are included on the Toxics Release Inventory (TRI) chemical list and, hence, the quantities released to the environment or otherwise managed as waste are reportable to EPA's TRI Program. As shown in the tables below, many ODS also have high global warming potential (GWP).

Ozone-depletion potential (ODP)

represents the ratio of calculated ozone column change for each mass unit of a gas emitted into the atmosphere relative to the calculated depletion for the gas.

Global warming potential (GWP)

represents how much a given mass of a chemical contributes to global warming over a certain time period compared to the same mass of carbon dioxide.

Class I ODS

Releases of **CFCs and other class I ODS**, such as methyl chloroform, carbon tetrachloride, and halons come from use as refrigerants, solvents, foam blowing agents, fire suppression agents and in other applications. The production and import of class I ODS have been phased out[1], though they may still be recovered from existing appliances, reclaimed to industry standards and reused. Class I substances have a higher ozone depletion potential and have been completely phased out in the U.S.; with a few exceptions, this means no one can produce or import class I substances.

EPA regulations issued under the Clean Air Act phaseout the production and import of ozone-depleting substances (ODS), which meet all the reduction targets agreed to under the Montreal Protocol. The U.S. phaseout has operated by reducing in stages the amount of ODS that may be legally produced and imported into the U.S. The ban on production and import of halons took effect January 1, 1994. The ban on production and import of other class I ODS-excluding methyl bromide-took effect on January 1, 1996. Methyl bromide was phased out on January 1, 2005 with exemptions for critical uses and quarantine and preshipment.

Class I Ozone-depleting Substances	TRI Chemical Name	CAS RN	ODP[2]	GWP [3]
CFC-11	Trichlorofluoromethane	75-69-4	1	4,750
CFC-12	Dichlorodifluoromethane	75-71-8	1	10,900
CFC-13	Chlorotrifluoromethane	75-72-9	1	14,420
CFC-113	Freon 113	76-13-1	0.8	6,130
CFC-114	Dichlorotetrafluoroethane	76-14-2	1	10,000
CFC-115	Monochloropentafluoroethane	76-15-3	0.6	7,370
Halon 1211	Bromochlorodifluoromethane	353-59-3	3	1,890
Halon 1301	Bromotrifluoromethane	75-63-8	10	7,140
Halon 2404	Dibromotetrafluoroethane	124-73-2	6	1,640
CCL_4	Carbon tetrachloride	56-23-5	1.1	1,400
Methyl Chloroform	1,1,1-trichloroethane	71-55-6	0.1	146
Methyl bromide	Bromomethane	74-83-9	0.7	5

Class II ODS

Hydrochlorofluorocarbons (HCFCs) are class II ODS that are less damaging to the ozone layer than class I substances, and are currently being phased-out consistent with the Clean Air Act and Montreal Protocol. HCFCs were developed as transitional substitutes from class I substances and are subject to a later phaseout schedule than class I substances. Historically, the most widely used HCFCs were HCFC-22, used as a refrigerant, HCFC-141b, used as a solvent and foam-blowing agent, and HCFC-142b, used as a foam-blowing agent and component in refrigerant blends. The table below shows the phaseout schedule for HCFCs.

U.S. Action to Meet the Montreal Protocol Phaseout Schedule for Class II		
Years to Be Implemented	**Implementation of HCFC Phaseout through Clean Air Act Regulations**	**Percent Reduction in HCFC Consumption and Production from Baseline**
2003	No production or import of HCFC-141b	35.0% (2004)
2010	No production or import of HCFC-142b and HCFC-22, except for use in equipment manufactured before January 1, 2010	75.0%
2015	No production or import of any other HFCFCs, except as refrigerants in equipment manufactured before January 1, 2020	90.0%
2020	No production or import of HCFC-142b and HCFC-22	99.5%
2030	No production or import of any HCFCs	100.0%

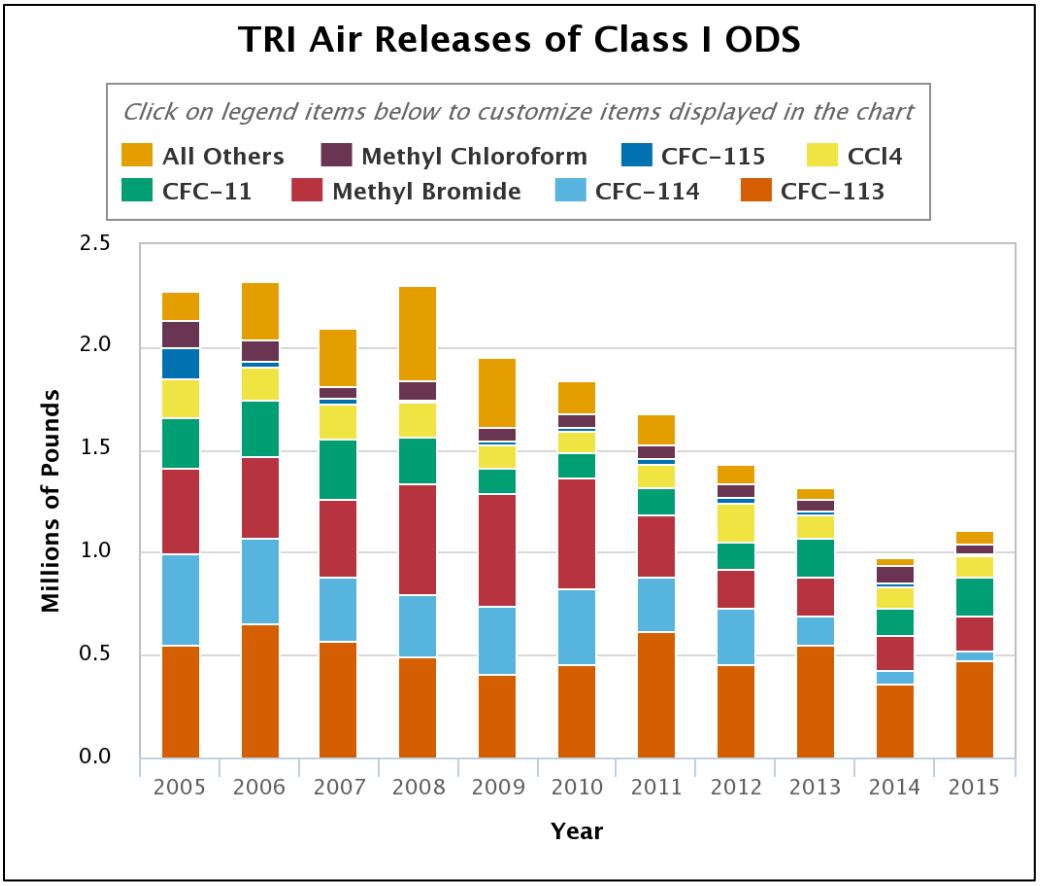
Class II Ozone-depleting Substances	TRI Chemical Name	CAS RN	ODP[2]	GWP[3]
HCFC-21	Dichlorofluoromethane	75-43-4	0.04	151
HCFC-22	Chlorodifluoromethane	75-45-6	0.055	1,810
HCFC-121	1,1,2,2-tetrachloro-1-fluoroethane	354-14-3	0.01-0.04	100
HCFC-123	2,2-dichloro-1,1,1-trifluoroethane	306-83-2	0.02	77
HCFC-123a	1,2-dichloro-1,1,2-trifluoroethane	354-23-4		77
HCFC-123b	1,1-dichloro-1,2,2-trifluoroethane	812-04-4		77
HCFC-124	2-chloro-1,1,1,2-tetrafluoroethane	2837-89-0	0.022	609
HCFC-124a	1-chloro-1,1,2,2-tetrafluoroethane	354-25-6		609
HCFC-132b	1,2-dichloro-1,1-difluoroethane	1649-08-7	0.008-0.05	100
HCFC-133a	2-chloro-1,1,1-trifluoroethane	75-88-7	0.02-0.06	100
HCFC-141b	1,1-dichloro-1-fluoroethane	1717-00-6	0.11	725
HCFC-142b	1-chloro-1,1-difluoroethane	75-68-3	0.065	2,310
HCFC-225ca	3,3-dichloro-1,1,1,2,2-pentafluoropropane	422-56-0	0.025	122

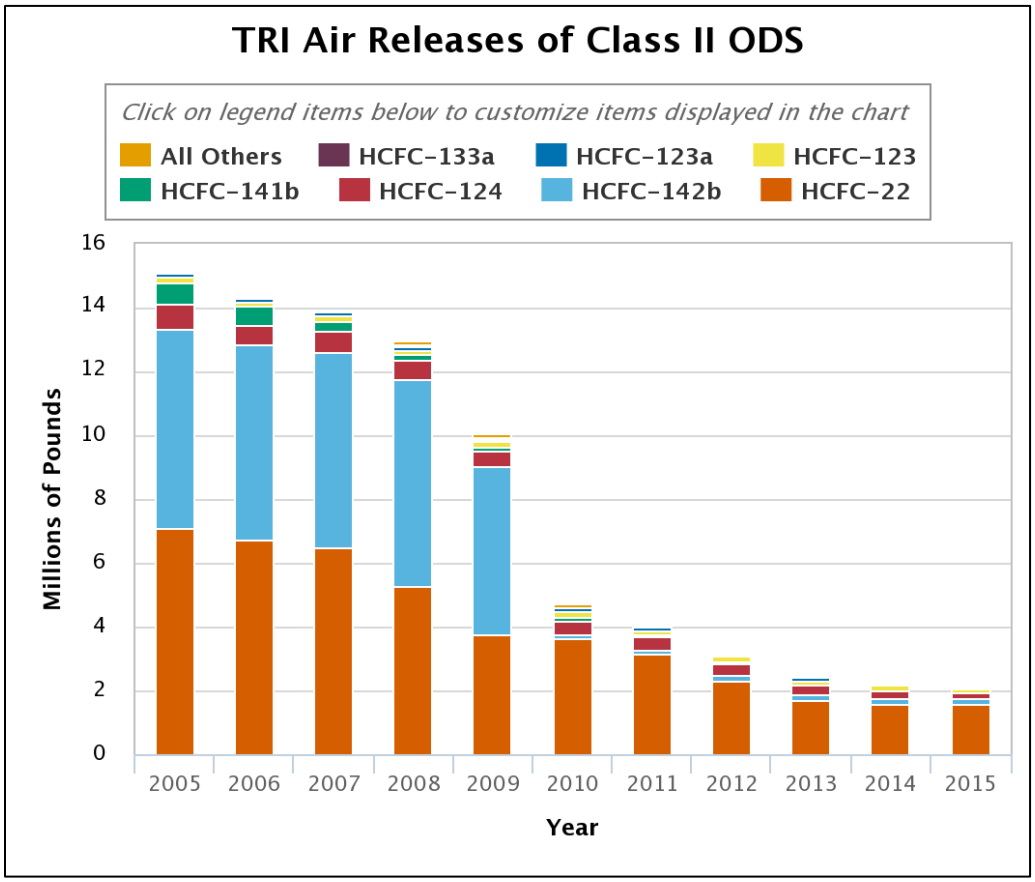
Class II Ozone-depleting Substances	TRI Chemical Name	CAS RN	ODP[2]	GWP[3]
HCFC-225cb	1,3-dichloro-1,1,2,2,3-pentafluoropropane	507-55-1	0.033	595
HCFC-253	3-chloro-1,1,1-trifluoropropane	460-35-5	0.003-0.03	

[1] Under the phaseout there is a limited exception for production and import of controlled substances that are transformed or destroyed. Importers can also petition EPA to import used ODS.
[2] The numbers in this column represent ODP values from Annex A-E of the *Montreal Protocol on Substances that Deplete the Ozone Layer*. Some numbers have been updated through amendments to the Protocol.
[3] The numbers in this column represent GWP values from the Intergovernmental Panel on Climate Change (IPCC) *Fourth Assessment Report: Climate Change 2007* (AR4). The values listed are for direct radiative forcing and can be found in Table 2.14 of the "Physical Science Basis" contribution to the report.

TRI Air Releases of Ozone Depleting Substances, in Pounds

As shown in the figures below, the Toxics Release Inventory (TRI) data demonstrate a decrease in Class I and II ozone depleting substance (ODS) emissions over the past ten years as a result of the adoption of the Montreal Protocol and amendments to the Clean Air Act.




TRI Air Releases of Class II ODS
Click on legend items below to customize items displayed in the chart
All Others
HCFC-133a
HCFC-123a
HCFC-123
HCFC-141b
HCFC-124
HCFC-142b
HCFC-22
Millions of Pounds
0
2
4
6
8
10
12
14
16
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Year