

Use and Market Profile for Asbestos

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Notice

Mention of the names of specific companies, organizations, or entities does not constitute an endorsement by EPA.

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Table of Contents

1. Introduction.....	1-1
1.1 Background.....	1-1
1.2 Methods for CAS Registry Number search.....	1-3
2. Uses.....	2-1
2.1 Methods for Table 2-2: Known Applications of Asbestos	2-1
3. Imports.....	3-24
4. References.....	4-1

1. Introduction

The purpose of this report is to discuss the evidence for current uses of asbestos and products containing asbestos by the consumer, commercial, and industrial sectors within the U.S. The current uses are determined by synthesizing information that is publically available. The primary sources include chemical databases, government reports, Safety Data Sheets (SDSs) or Material Data Safety Sheets (MSDSs), and manufacturer and distributor websites.

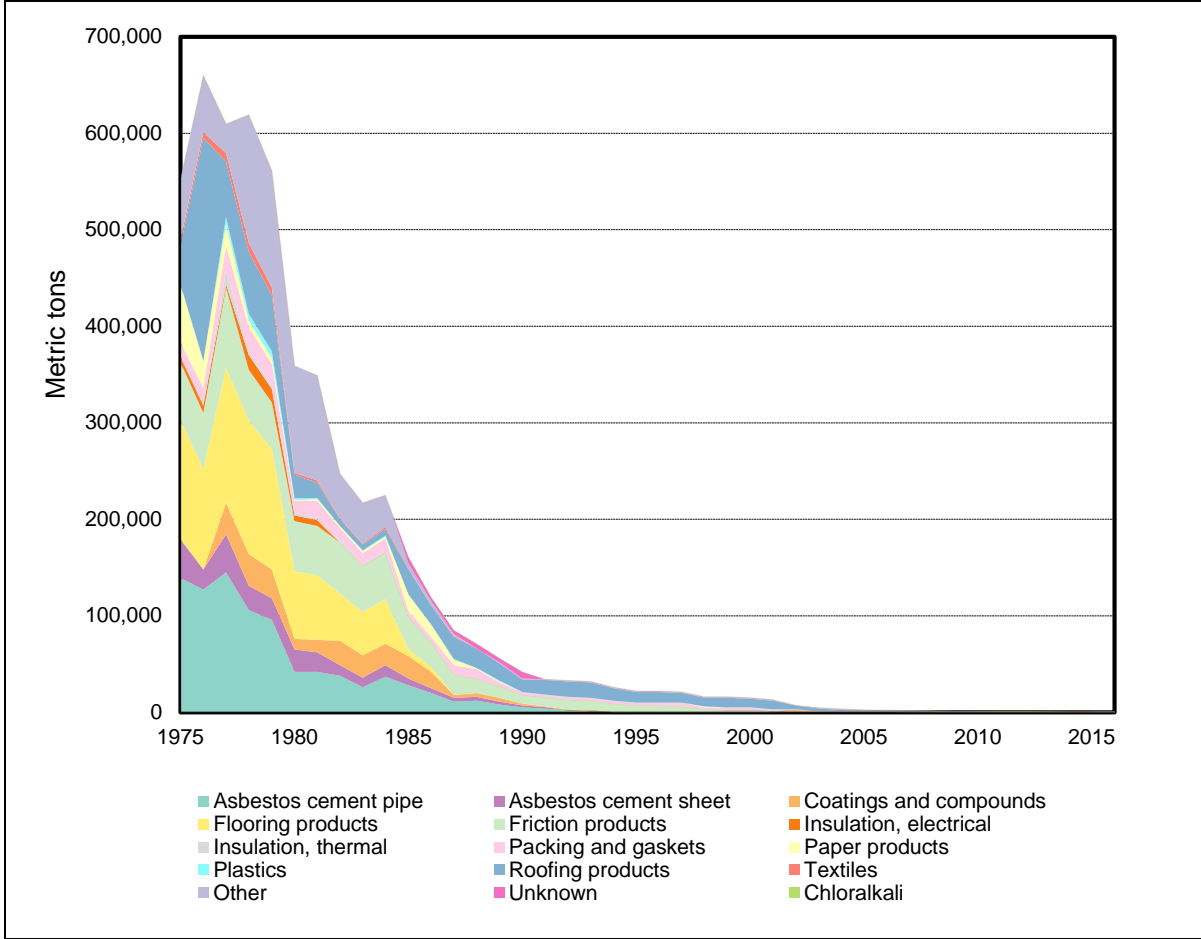
The remainder of this section provides a brief background of regulated asbestiform minerals and their use domestically. Section 2 describes the method for compiling asbestos uses and determining which uses may be ongoing. Section 3 presents information concerning the import values of asbestos and asbestos products.

1.1 Background

Pursuant to 40 FR §763.83, the definition of asbestos includes the asbestiform varieties of six different naturally-occurring fibrous minerals: chrysotile, crocidolite, amosite, anthophyllite, tremolite, and actinolite. These minerals fall into two main groups, the serpentine group, which includes chrysotile, and the amphibole group, which includes the other five minerals (ASTDR 2001). “Asbestiform” refers to mineral fibers with high tensile strength and flexibility (40 FR §763.83), and not all minerals with this quality fit the legal definition of asbestos. For example, the mineral talc can grow in an asbestiform variety, but is not included in the definition of asbestos (40 FR §763.83; IARC 2012). In addition, the minerals tremolite, actinolite, and anthophyllite occur in both asbestiform and non-asbestiform habits, which is why the definition of asbestos must specify the “asbestiform” varieties (IARC 2012).

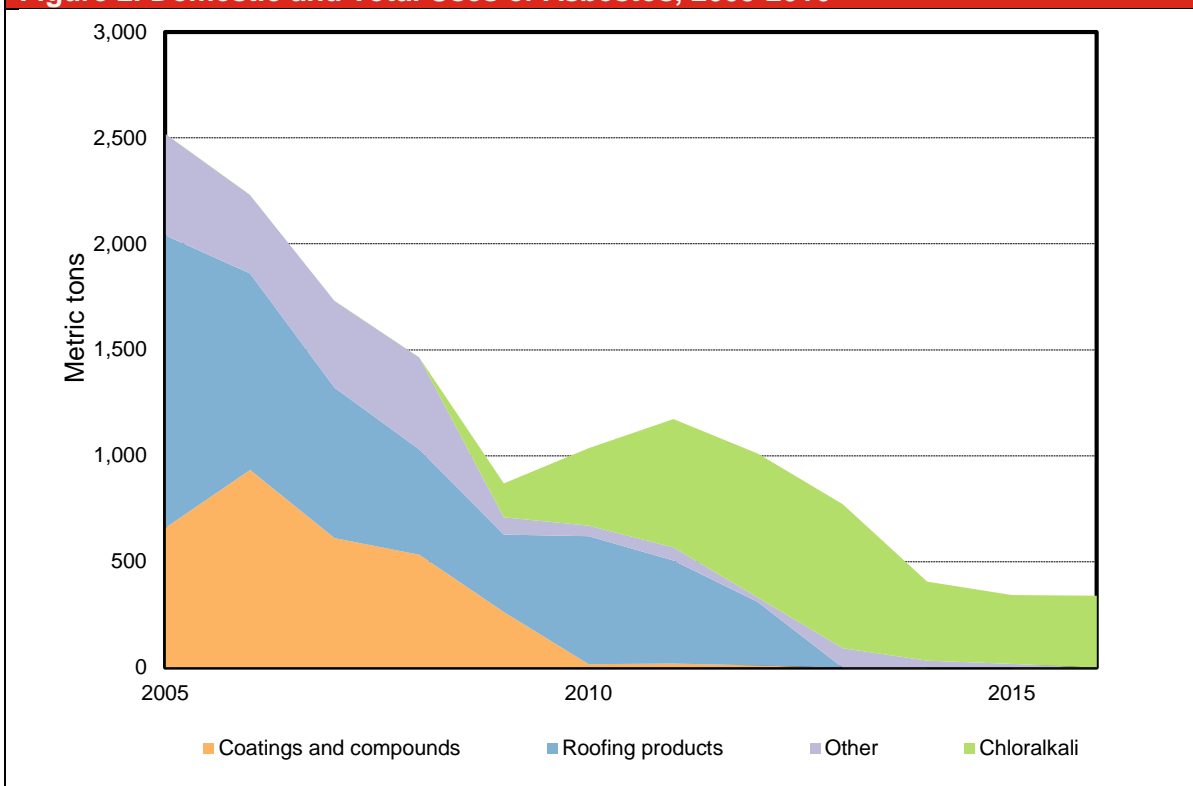
Unmanufactured asbestos fiber consumption in the United States has decreased over the past 30 years (See Figure 1; Flanagan 2017). There have also been large changes in the structure of the market. In 2000, asbestos was primarily used for roofing products and gaskets, 62 percent and 21 percent of the market, respectively. By 2010, the proportion of asbestos used by the chloralkali industry had reached about 35 percent of U.S. consumption, and by 2016 it reached about 100 percent (See ; Flanagan 2016a; Flanagan 2017). The chloralkali industry uses asbestos to manufacture semipermeable diaphragms used in the production of chlorine (Flanagan 2016a). There was insufficient data to identify additional markets (Flanagan 2017).

Figure 1. Domestic and Total Uses of Asbestos, 1975-2016



Source(s):
USGS (2016)

Figure 2. Domestic and Total Uses of Asbestos, 2005-2016



Source(s):
USGS (2016)

The last U.S. producer of asbestos ended production in 2002 due to decline in the U.S. and global markets associated with health and liability concerns (Flanagan 2017). Therefore, the U.S. is dependent on imports to meet manufacturing needs. In 2016, the United States imported 340 metric tons of chrysotile, essentially equivalent to 2015 imports of 343 metric tons (Flanagan 2017). According to the USGS, all about 95 percent of asbestos mineral imports originated from Brazil, with the remainder originating from Russia (Flanagan 2017). The United States imported \$4.63 million of manufactured products that contain asbestos in 2015. Flanagan (2016a) reported imports of asbestos products from countries that have banned asbestos, which is attributed to countries including some non-asbestos products under asbestos Harmonized Tariff Schedule (HTS). If the countries that have banned asbestos allow asbestos products to be re-exported (this is permitted in the U.S.), this would also explain why these countries are exporting regulated asbestos products.

1.2 Methods for CAS Registry Number search

Each of the six mineral forms of asbestos has multiple Chemical Abstract Service Registry Numbers (CAS RNs) (see note in Table 1-1). A list of CAS RNs for asbestos was compiled by searching the National Library of Medicine's ChemIDPlus (2016) database for the types of asbestos defined in 40 FR §763.83. If the record in ChemIDPlus confirmed an asbestiform variety of the mineral, the CAS RN(s) were included in Table 1-1. The list of CAS RNs was cross-referenced with the Chemical and Product Categories (CPCat) Database, the U.S. Occupational Safety and Health Administration's (OSHA) chemical sampling information site, the International Agency for Research on Cancer's

(IARC) Monograph on asbestos, and the Agency for Toxic Substances and Disease Registry's (ASTDR) Toxicological Profile for Asbestos (Dionisio et al. 2015; OSHA2012; IARC 2012; ASTDR 2001). These additional sources provided confirmation for many of the CAS RNs in Table 1-1.

Table 1-1: Asbestos CAS Registry Numbers	
CAS RN¹	Name(s)²
1332-21-4 ³	Asbestos
12413-45-5	Asbestos
329202-13-3	Asbestos
77641-59-9	Asbestos
Serpentine group	
12001-29-5	Chrysotile asbestos
61076-97-9	Chrysotile asbestos
132207-32-0	Asbestos, Chrysotile
Amphibole group	
12001-28-4	Asbestos, crocidolite
132207-34-2	Asbestos, crocidolite
132207-35-3	Asbestos, crocidolite
132207-33-1	Asbestos, crocidolite
53799-46-5	Asbestos, crocidolite
61105-31-5	Asbestos, crocidolite
12172-73-5	Amosite asbestos; grunerite
77536-67-5	Asbestos, anthophyllite
17068-78-9	Anthophyllite
37229-03-1	Anthophyllite
61180-72-1	Anthophyllite
77536-66-4	Asbestos, actinolite
77536-68-6	Asbestos, tremolite
14567-73-8	Tremolite asbestos
60649-53-8	Tremolite asbestos
65452-00-8	Tremolite asbestos
<p>Note(s):</p> <p>¹ Different mineral forms of asbestos have different crystal structures, and therefore may be assigned different CAS RNs for the different structures. It is also possible that a CAS RN for a given mineral has changed, and that some historic CAS RNs are captured in this table.</p> <p>² Names appear as they are listed in ChemIDPlus.</p> <p>³ Reported to 2012 CDR (EPA 2014b).</p> <p>Source(s): 40 FR §763.83; ASTDR (2001); Dionisio et al. (2015); IARC (2012); OSHA2012; NLM (2016)</p>	

2. Uses

This section describes the method for compiling known uses of asbestos and for determining whether or not the use is ongoing. Several uses have declined or ceased in the U.S. due to both voluntary phaseouts and regulations. Table 2-2 provides a list of uses of asbestos, organized by category of use. Table 2-3 presents products distributed and, in many cases manufactured, domestically that correspond to the uses identified in Table 2-2. This is the primary method used to determine if a particular use was ongoing.

2.1 Methods for Table 2-2: Known Applications of Asbestos

In order to construct Table 2-2, known applications of asbestos were reviewed for relevant use/process information regarding asbestos to determine whether the use and manufacturing status was ongoing, historic, or unknown. In addition, specific product information was added to Table 2-3.

The CPCat search results for a given CAS RN may have a section on “Use Information,” which includes a use or process only and/or a section on “Product Information” that lists specific products with company information and a link to the SDS. The CPCat was searched for the asbestos CAS RNs listed in Table 1-1, first for “Use Information” to augment Table 2-2, and then for “Product Information” to augment Table 2-3. Table 2-1 presents the CAS RNs identified in the CPCat and the number of products associated with the chemical. Only eleven of the CAS RNs presented in Table 1-1 were found in the CPCat (see Table 2-1). The CPCat did not include any products associated with two CAS RNs, 132207-32-0 and 132207-33-1.

Table 2-1: Chemical and Product Categories Database	
CAS RN	Number of Products
12001-29-5	2,607
1332-21-4	435
14567-73-8	46
17068-78-9	28
12172-73-5	9
12001-28-4	5
77536-68-6	5
77536-67-5	4
77536-66-4	4
132207-32-0	0
132207-33-1	0

For CAS RN 12001-29-5, 1,549 of the products were listed as defense procurement with unknown manufacturer, and therefore excluded from analysis. A random sample was drawn (using Google’s random number generator) accounting for 10 percent of the remaining 1,057 products. Using 10 percent is reasonable for a representative sample because the current number of unique uses associated with products containing asbestos is likely to be low. A search of the product name and/or company name listed on the SDS was conducted for each product in the sample of 12001-29-5, and for every single product in the remaining 8 CAS RNs with product lists, to determine the product’s use, whether the product was still being sold, and whether the product still contained asbestos. The

majority of products could not be found for sale online. If the use associated with the product was one that had not been previously identified, the use was added to Table 2-2. The “Use or Process Status” was categorized as “Unknown” if a product currently being sold could not be paired with the use category and as “Ongoing” if a product currently being sold could be paired with the use category. The “Use or Process Status” is designated as “Manufacturing” or “Use” to indicate whether individuals in the U.S. appear to be using asbestos to manufacture the product, or using the product. For example, if a use category said “Ongoing (Manufacturing)”, then asbestos is currently being used to manufacture products associated with the use category. Ongoing use is determined if an SDS published since 2015 was located. Older SDSs were considered as proof of ongoing use if the SDS was currently linked on the manufacturer’s website, or the product was available for sale from a distributor and more recent SDSs were not located. It is assumed the presence of an SDS on a distributor’s website indicates that the product is potentially still available for purchase. However, it is also possible that product is no longer being sold but the SDS has not been removed from the website.

The “Use or Process Status” was categorized as “Historic” when the use was banned by a federal regulation or phased out of the marketplace. Typically, the use and manufacturing statuses are the same for any given application category; however, there are some instances in which they differ. For example, in the use category “non-roofing adhesives, sealants and coatings”, the product was not found on the manufacturer’s website, but it was found for sale by a distributor. It is unknown whether the product is still manufactured, but it is still available for purchase. Therefore, the use category “non-roofing adhesives, sealants and coatings” is designated as “Unknown (Manufacturing); Ongoing (Use)”.

Table 2-2: Known Applications of Asbestos

Use or Process	Use or Process Status ¹	Expected Users ²	Description of Use or Process and References
Asbestos Friction Materials			
<p>Asbestos friction materials were used in a variety of industrial and commercial machinery as braking and gear-changing components. This included agricultural equipment such as combines, mining and oil-well-drilling equipment, construction equipment such as cranes and hoists, heavy equipment used in various manufacturing industries, military equipment, marine engine transmissions, elevators, chain saws, and consumer appliances such as lawn mowers, washing machines, and vacuum cleaners (EPA 1989). In 2015, the Environmental Council of the States (ECOS) and motor vehicle industry signed a Memorandum of Understanding (MOU) with EPA to phase out friction materials with greater than 0.10 percent asbestos by weight (EPA 2015a), although the MOU includes exemptions for friction materials used in motorcycles, military vehicles, race cars and other off-road vehicles, collector vehicles, etc. U.S. manufacturers have phased out asbestos use in brake friction materials, but these products were still being imported and sold in the U.S. as recently as 2015 (MEMA 2016; USDOC and USITC 2016).</p>			
Automatic Transmission Friction Components	<p>Unknown (Manufacturing) Unknown (Use) Manufacture, import, processing, and distribution are allowed in the U.S. (EPA 2016). However, there is no evidence of ongoing production.</p>	Commercial	<p>EPA (1989); Mid America International Trading (2016a)</p> <p>An automatic transmission consists of 5 to 15 friction clutches, which are housed, along with gears, in a metal band called the transmission band. Each friction clutch is covered with a thin friction clutch plate which is made from a friction paper that contains asbestos or some other friction material. In addition, a lining, also made from this friction paper, is bonded to the inside of the transmission band. These automatic transmission friction components – friction clutch plates and transmission band linings – are immersed in a fluid environment which dissipates much of the heat generated when gears are changed (EPA 1989).</p>
Brake Blocks	<p>Unknown (Manufacturing) Ongoing (Use) Howard Supply Company (Howard Supply Company 2016) lists asbestos-containing brake blocks as current inventory.</p>	Consumer, Commercial, Industrial	<p>EPA (1989); Howard Supply Company (2016)</p> <p>Brake blocks are brake linings used on the drum brakes of heavy vehicles such as heavy trucks, buses, and off-road vehicles (EPA 1989).</p>
Clutch Facings	<p>Unknown (Manufacturing) Unknown (Use)</p>	Consumer, Commercial	<p>EPA (1989)</p> <p>Clutch facings are made of molded or woven friction materials. Molded facings are used more widely than the woven. Woven clutch facings are used in luxury automobiles and high-performance vehicles. They may also be used in off-road vehicles, such as agricultural tractors and earth-moving equipment, where improved service life is important (EPA 1989).</p>

Table 2-2: Known Applications of Asbestos

Use or Process	Use or Process Status ¹	Expected Users ²	Description of Use or Process and References
Disc Brake Pads	<p>Unknown (Manufacturing) Unknown (Use)</p> <p>Manufacture, import, processing, and distribution is allowed in the U.S. (EPA 2016). However, there is no evidence of ongoing production.</p>	Consumer, Commercial	<p>EPA (1989)</p> <p>Disc brake pads are similar to disk brake linings. However, secondary processing of disc brake pads may have increased exposure to commercial workers in the auto maintenance industry. Activities included installation of pads into new brake assemblies, repackaging for sale to the aftermarket, and retrofitting worn brake pads with new pads for resale (EPA 1989).</p>
Drum Brake Linings and Brake Shoes	<p>Unknown (Manufacturing) Unknown (Use)</p> <p>Manufacture, import, processing, and distribution is allowed in the U.S. (EPA 2016). However, there is no evidence of ongoing production.</p>	Consumer, Commercial	<p>EPA (1989)</p> <p>Asbestos drum brake linings were used to line the outside of the metal “shoes” in a drum brake (EPA 1989).</p>
<p>Asbestos Paper, Board, and Felt</p> <p>Asbestos papers were used to prevent against fire, heat, and corrosion in a variety of consumer, commercial, and industrial applications (EPA 1989). Some types of asbestos paper, board, and felt, including corrugated paper, rollboard, commercial paper, specialty paper, and flooring felt, were banned in the U.S. under TSCA, in the revision to the final 1989 rule (59 FR 33208 1994). Other types of paper, millboard, and felt are not banned (EPA 2016) and may continue to be produced or imported (USDOD and USITC 2016).</p>			
Commercial Paper	<p>Historic (Manufacturing) Historic (Use)</p> <p>Manufacture, import, processing, and distribution are banned in the U.S. under TSCA (59 FR 33208). However, there is an exception for imports with the sole purpose of being shipped outside of the country (59 FR 33208). Asbestos paper, millboard, and/or felt (HTS code 6812920000) were imported from China, Germany, Switzerland, the UK, and/or Japan from 2012 to 2015 (USDOD and USITC 2016). The quantity of commercial paper cannot be determined.</p>	Industrial	<p>EPA (1989); USDOD and USITC (2016)</p> <p>Asbestos insulation paper was used in a variety of industries, such as the steel and aluminum industries. It was used as insulation in furnaces, trough linings, the smelting process, and against hot metal and drippings of molten metal. The glass and ceramic industry used asbestos paper for kiln insulation, as mold liners in foundries, and in the electrical parts and appliance industry for electrical insulation (EPA 1989).</p>

Table 2-2: Known Applications of Asbestos

Use or Process	Use or Process Status ¹	Expected Users ²	Description of Use or Process and References
Corrugated Paper	<p>Historic (Manufacturing) Historic (Use)</p> <p>Manufacture, import, processing, and distribution are banned in the U.S. under TSCA (59 FR 33208). However, there is an exception for imports with the sole purpose of being shipped outside of the country (59 FR 33208). Asbestos paper, millboard, and/or felt (HTS code 6812920000) were imported from China, Germany, Switzerland, the UK, and/or Japan from 2012 to 2015 (USDOC and USITC 2016). The quantity of corrugated paper cannot be determined.</p>	Commercial	<p>EPA (1989); USDOC and USITC (2016)</p> <p>Corrugated asbestos paper was used as thermal insulation for pipe coverings and as block insulation. The paper was also used as an insulator in appliance, hot-water and low-pressure steam pipes, and process lines (EPA 1989).</p>
High-Grade Electrical Paper	<p>Unknown (Manufacturing) Unknown (Use)</p> <p>Asbestos paper, millboard, and/or felt (HTS code 6812920000) were imported from China, Germany, Switzerland, the UK, and/or Japan from 2012 to 2015 (USDOC and USITC 2016). The quantity of high-grade electrical paper cannot be determined.</p>	Commercial, Industrial	<p>EPA (1989); USDOC and USITC (2016)</p> <p>Asbestos electrical paper was used as insulation for high temperature, low voltage applications such as in motors, generators, transformers, switch gears, and other heavy electrical apparatuses (EPA 1989).</p>
Specialty Paper	<p>Historic (Manufacturing) Historic (Use)</p> <p>Cooling tower fill application was forced out of market due to inexpensive substitutes (EPA 1989). Manufacture, import, processing, and distribution are banned in the U.S. under TSCA (59 FR 33208 1994).</p>	Commercial, Industrial	<p>ASTDR (2001); EPA (1989)</p> <p>Asbestos specialty papers include beverage and pharmaceutical filters and cooling tower fill. Asbestos was used in filters for the purification and clarification of liquids. In the beer, wine, and liquor distilling industries asbestos filters were used to remove yeast cells and other microorganisms. Asbestos filters were also used for filtration of some fruit juices (e.g., apple juice) and for special applications in the cosmetics and pharmaceuticals industries (EPA 1989). Use of asbestos filters in preparation of food or pharmaceuticals has been discontinued (ASTDR 2001).</p>

Table 2-2: Known Applications of Asbestos

Use or Process	Use or Process Status ¹	Expected Users ²	Description of Use or Process and References
Millboard	<p>Unknown (Manufacturing) Unknown (Use)</p> <p>Manufacture, import, processing and distribution of asbestos-containing millboard are allowed in the U.S. (EPA 2016). Asbestos paper, millboard, and/or felt (HTS code 6812920000) were imported from China, Germany, Switzerland, the UK, and/or Japan from 2012 to 2015 (USDOD and USITC 2016). The quantity of millboard cannot be determined.</p>	Commercial, Industrial	<p>EPA (1989); USDOD and USITC (2016)</p> <p>Asbestos millboard is a heavy cardboard used for gasketing, insulation, fireproofing, and resistance against corrosion and rot (EPA 1989).</p>
Rollboard	<p>Historic (Manufacturing) Historic (Use)</p> <p>Manufacture, import, processing, and distribution are banned in the U.S. under TSCA (59 FR 33208).</p>	Consumer, Commercial, Industrial	<p>EPA (1989); USDOD and USITC (2016)</p> <p>Rollboard is a thin and flexible material composed of two sheets of paper laminated together with sodium silicate. It was used as a gasket and as a fire-proofing agent for security boxes, safes, and files. Commercial uses included office partitioning and garage paneling. Residential uses included linings for stoves and electric switch boxes (EPA 1989).</p>

Table 2-2: Known Applications of Asbestos

Use or Process	Use or Process Status ¹	Expected Users ²	Description of Use or Process and References
Flooring Felt	<p>Historic (Manufacturing) Historic (Use)</p> <p>Manufacture, import, processing, and distribution are banned in the U.S. under TSCA (59 FR 33208 1994). However, there is an exception for imports with the sole purpose of being shipped outside of the country (59 FR 33208). Asbestos paper, millboard, and/or felt were imported (HTS code 6812920000) from China, Germany, Switzerland, the UK and Japan from 2012 to 2015 (USDOC and USITC 2016). The quantity of flooring felt cannot be determined.</p>	Consumer, Commercial, Industrial	<p>EPA (1989); USDOC and USITC (2016)</p> <p>Asbestos flooring felt is a paper product which was used as a backing for vinyl sheet floor products (EPA 1989).</p>
Roofing Felt	<p>Unknown (Manufacturing) Unknown (Use)</p> <p>Asbestos paper, millboard, and/or felt (HTS code 6812920000) were imported from China, Germany, Switzerland, the UK, and/or Japan from 2012 to 2015 (USDOC and USITC 2016). The quantity of roofing felt cannot be determined. According to Flanagan (2016b), in 2015 roofing products represented part of U.S. asbestos consumption, however, it is not known whether this included roofing felt.</p>	Consumer, Commercial	<p>EPA (1989); Flanagan (2016b); USDOC and USITC (2016)</p> <p>Asbestos roofing felt was used for built-up roofing (EPA 1989).</p>

Table 2-2: Known Applications of Asbestos

Use or Process	Use or Process Status ¹	Expected Users ²	Description of Use or Process and References
Asbestos Cement Materials			
In cement materials, such as Portland cement, asbestos was used as a loose fibrous mixture that helped materials bond together (IARC 2012). In 1975, during the peak world production of asbestos, asbestos cement products such as pipes and cement flat sheet, accounted for about 66% of world asbestos consumption (IARC 2012).			
Asbestos Cement Flat Sheet	Unknown (Manufacturing) Unknown (Use) Manufacture, import, processing and distribution of asbestos cement flat sheet are allowed in the U.S. (EPA 2016).	Commercial	EPA (1989) Asbestos-cement flat sheet was used for construction/utility applications and can be broken down into two categories: ebonized and non-ebonized. Ebonized flat sheet, or asphalt-impregnated flat asbestos-cement sheet (no longer being produced in the U.S.), was once used as a mounting/insulating board for low to medium temperature, high voltage electrical apparatus. Non-ebonized asbestos-cement sheet was used for low voltage applications with no moisture (EPA 1989).
Asbestos-Cement (aka Transite or Fibro cement) Pipes and Fittings	Unknown (Manufacturing) Unknown (Use) According to Grant (2014), products associated with this use are manufactured in Mexico and may be used in Canada and/or the United States.	Commercial, Industrial	EPA (1989); Grant (2014); Tuyaux Logard Inc. (2005) Asbestos-cement pipe was used for pressure pipe (water mains) and non-pressure pipe (sewer line) applications. A small amount of asbestos-cement pipe has been used as conduits for electrical and telephone cables and for laterals from street mains to consumers (EPA 1989). Asbestos-containing pipes were also used in hospitals, high-rise buildings and condos because they were inexpensive, flame retardant and masked the sound of flowing water (Grant 2014). Asbestos-cement is manufactured by laminating a paste of cement and asbestos fibers on a metal spindle. Then, pipe is cured until cement is hydrated, forming a strong, non-porous matrix (Tuyaux Logard Inc. 2005). There is some risk in exposure from cutting the pipes during installation, and later during maintenance (Grant 2014).
Blind Nailing Cement	Unknown (Manufacturing) Unknown (Use) Blind nailing cement products containing asbestos were sold in the U.S. in the 1980s (Kol-Tar Inc. 1988; Monsey Products Co. 1989; Dionisio et al. 2015). There is no evidence of current products containing asbestos.	Consumer, Commercial, Industrial	Kol-Tar Inc. (1988); Monsey Products Co. (1989); United Asphalt Company (2013) Blind nailing cement is a cold-press adhesive used in the laying of roofing paper (United Asphalt Company 2013).
Cement Color	Ongoing (Manufacturing) Ongoing (Use)	Consumer, Commercial, Industrial	Precision Packing Inc. (2015) Colored cement that is mostly composed of limestone and about 30% asbestos, has been produced in the U.S. as of 2015 (Precision Packing Inc. 2015).

Table 2-2: Known Applications of Asbestos

Use or Process	Use or Process Status ¹	Expected Users ²	Description of Use or Process and References
Corrugated Asbestos-Cement Sheet	<p>Unknown (Manufacture) Unknown (Use)</p> <p>Manufacture, import, processing and distribution of corrugated asbestos-cement sheet are allowed in the U.S. (EPA 2016).</p>	Consumer, Commercial, Industrial	<p>EPA (1989)</p> <p>Corrugated asbestos-cement sheet has been used as siding and roofing in factories and warehouses. It has also been used as a lining for waterways, such as water slides in amusement parks and bulkheads in canals, or to keep water away from coastal homes, and for special applications in cooling towers (EPA 1989).</p>
Plastic Cement	<p>Ongoing (Manufacturing) Ongoing (Use)</p>	Commercial, Industrial	DISSCO (2002d); Fields Coatings & Mastics (2003a)
Plastic Asphalt Cement	<p>Ongoing (Manufacturing) Ongoing (Use)</p>	Commercial, Industrial	Fields Coatings & Mastics (2003b)
Plastic Tile Cement	<p>Ongoing (Manufacturing) Ongoing (Use)</p>	Commercial, Industrial	Fields Coatings & Mastics (2003c)
<p>Asbestos Paints, Coatings, Sealants, and Adhesives</p> <p>The main uses of asbestos-containing paints, coatings, sealants, and adhesives were in the building construction, automobile, and aerospace industries (EPA 1989). Block filler paints containing asbestos were used as a coating on stone surfaces, and texture paints containing asbestos were used for patterned or textured surfaces on interior walls and ceilings. Coatings containing asbestos were used in construction to prevent corrosion in underground pipes and structural steel. Asbestos-containing sealants were used in construction for water and sound-proofing, and in the automobile industry for corrosion protection on welds. Asbestos-containing adhesives functioned to bond materials, such as brick, lumber, and glass in the construction industry, and specialized applications, such as bonding hood braces in automobiles (EPA 1989).</p>			
Paints and Enamels	<p>Unknown (Manufacturing) Unknown (Use)</p> <p>There were reported emissions of asbestos in the paints and enamels sector in the 2014 NEI (EPA 2014a). Many companies that previously manufactured asbestos-containing patching compounds (banned in 1977 by the Consumer Product Safety Commission) had also produced asbestos-containing paints. It is likely that these companies removed asbestos from all products at once, and that most asbestos paints have been phased out (EPA 1989).</p>	Consumer, Commercial, Industrial	<p>EPA (2014a)</p> <p>Dow Texas Chemicals and Texas Operations chemical plants were primary reporters of this use in the 2014 NEI (EPA 2014a), however, it is possible that releases were due to removal of asbestos. Therefore, it is unclear whether paints and enamels containing asbestos are still being used or manufactured.</p>

Table 2-2: Known Applications of Asbestos

Use or Process	Use or Process Status ¹	Expected Users ²	Description of Use or Process and References
Automotive Paints	<p>Unknown (Manufacturing) Unknown (Use)</p> <p>Many companies that previously manufactured asbestos-containing patching compounds (banned in 1977 by the Consumer Product Safety Commission) had also produced asbestos-containing paints. It is likely that these companies removed asbestos from all products at once, and that most asbestos paints have been phased out (EPA 1989).</p>	Industrial	<p>Dionisio et al. (2015)</p> <p>According to the CPCat (Dionisio et al. 2015), tremolite asbestos (CAS 14567-73-8) has been used in automotive paint.</p>
Home Paints	<p>Unknown (Manufacturing) Unknown (Use)</p> <p>Many companies that previously manufactured asbestos-containing patching compounds (banned in 1977 by the Consumer Product Safety Commission) had also produced asbestos-containing paints. It is likely that these companies removed asbestos from all products at once, and that most asbestos paints have been phased out (EPA 1989).</p>	Consumer	<p>Dionisio et al. (2015)</p> <p>According to the CPCat (Dionisio et al. 2015), tremolite asbestos (CAS 14567-73-8) and anthophyllite asbestos (17068-78-9) have been used in consumer paints and primers.</p>

Table 2-2: Known Applications of Asbestos

Use or Process	Use or Process Status ¹	Expected Users ²	Description of Use or Process and References
Other Paints, Lacquers, Stains, and Varnishes	<p>Unknown (Manufacturing) Unknown (Use)</p> <p>Many companies that previously manufactured asbestos-containing patching compounds (banned in 1977 by the Consumer Product Safety Commission) had also produced asbestos-containing paints. It is likely that these companies removed asbestos from all products at once, and that most asbestos paints have been phased out (EPA 1989).</p>	Consumer, Commercial, Industrial	<p>Dionisio et al. (2015)</p> <p>According to the CPCat (Dionisio et al. 2015), tremolite asbestos (CAS 14567-73-8) and anthophyllite asbestos (CAS 17068-78-9) have been used in paints, lacquers, and varnishes. This may have been or continue to be a use outside the U.S., as the source given for the data is the Substances Prepared in Nordic Countries (SPIN) database.</p>
Asphalt Coating and Adhesive	<p>Ongoing (Manufacturing) Ongoing (Use)</p> <p>According to Flanagan (2016b), in 2015 coatings and compounds represented part of U.S. asbestos consumption. The specific amount of asphalt coating is not indicated.</p>	Commercial, Industrial	Fields Coatings & Mastics (2003a); Flanagan (2016b)
Culvert Coating	<p>Ongoing (Manufacturing) Ongoing (Use)</p> <p>According to Flanagan (2016b), in 2015 coatings represented part of U.S. asbestos consumption. The specific amount of culvert coating is not indicated.</p>	Commercial, Industrial	DISSCO (2002e); Flanagan (2016b)
Fibred Foundation Coating	<p>Ongoing (Manufacturing) Ongoing (Use)</p> <p>According to Flanagan (2016b), in 2015 coatings represented part of U.S. asbestos consumption. The specific amount of fibred foundation coating is not indicated.</p>	Commercial, Industrial	DISSCO (2002a); Flanagan (2016b); Mid America International Trading (2016a)

Table 2-2: Known Applications of Asbestos

Use or Process	Use or Process Status ¹	Expected Users ²	Description of Use or Process and References
Fibered Roof Coating	Ongoing (Manufacturing) Ongoing (Use) According to Flanagan (2016b), in 2015, roof products represented part of U.S. asbestos consumption. The specific amount of fibered roof coating is not indicated.	Commercial, Industrial	DISSCO (2002c); EPA (1989) Roof coatings are cold-applied liquids which may be brushed or sprayed on roofs or foundations to perform a variety of functions such as waterproofing, weather resistance, and surface rejuvenation (EPA 1989).
Non-roofing Adhesives, Sealants and Coatings	Unknown (Manufacturing) Ongoing (Use) According to Flanagan (2016b), in 2015 coatings and compounds represented part of U.S. asbestos consumption. The specific amount of non-roofing adhesive, sealants, and coatings is not indicated.	Industrial, Commercial	EPA (1989); JACO Areospace & Industrial (2017) The construction and automobile industries were at one time the largest consumers of asbestos containing adhesives, sealants, and coatings. However, the automobile industry has found substitutes for most uses, and the potential remaining uses of asbestos in this industry are limited to specialized products (EPA 1989).
Extruded Sealant Tape	Unknown (Manufacturing) Unknown (Use)	Consumer, Commercial, Industrial	EPA (1989) Asbestos tape can act as a gasket for sealing building windows, automotive windshields, and mobile home windows. It has also been also used in the manufacture of parts for the aerospace industry and in the manufacture of insulated glass (EPA 1989).
Firewall Sealant	Unknown (Manufacturing) Unknown (Use)	Consumer, Commercial, Industrial	3M (2016); D Aircraft Products Inc. (2004); Dionisio et al. (2015); Stabond Corporation (1985) Firewall sealants maintain a fireproof seal in interior building applications, as well as construction and repair of aircraft (3M 2016; D Aircraft Products Inc. 2004).
Consumer Patching Compounds	Historic (Manufacturing) Historic (Use) Consumer patching compounds containing asbestos were banned in 1977 by the Consumer Product Safety Commission.	Consumer	CPSC (1977) Consumer patching compounds were available in dry form (to be mixed with water by the user) or in a ready-mix paste form and were used to cover, seal or mask cracks, joints, holes and similar openings in the trim, walls and ceilings of building interiors (CPSC 1977).

Table 2-2: Known Applications of Asbestos

Use or Process	Use or Process Status ¹	Expected Users ²	Description of Use or Process and References
Potting Compound	<p>Unknown (Manufacturing) Unknown (Use)</p>	Commercial, Industrial	<p>Hercules Inc. (1990); MG Chemicals (2016)</p> <p>Potting compounds are used in electronic devices to protect interior components from water and other chemicals, and hold them in place, preventing physical damage. Potting compounds generally seek to maximize thermal conductivity while meeting flame retardant requirements (MG Chemicals 2016).</p>
Waterproofing Compound	<p>Ongoing (Manufacturing) Ongoing (Use)</p> <p>According to Flanagan (2016b), in 2015 coatings and compounds represented part of U.S. asbestos consumption.</p>	Commercial, Industrial	DISSCO (2002b); Flanagan (2016b)
<p style="text-align: center;">Asbestos Gaskets, Pipeline Wraps, Fillers, Packing, and other Industrial Process Components</p> <p>Asbestos-containing materials have been used in many industrial processes. Gaskets are materials used to seal different components in movable applications, such as engines (EPA 1989). Asbestos gaskets were used mainly to seal connections and prevent fluid leakage. Asbestos packings had a variety of applications including valves and pumps in the electric power, petrochemical, and pulp and paper industries. Other industrial process components identified include clamps for jet engines and electrical brush holders used in motors.</p>			
Beater-Add Gaskets	<p>Unknown (Manufacturing) Unknown (Use)</p> <p>Asbestos gaskets, packing and/or seals (HTS code 6812990020) were imported from Japan, Israel, Mexico, China, Germany, Taiwan, Spain, Finland, Italy, the UK, France, Greece, Ireland, Singapore, Korea, and/or Canada from 2011 to 2015 (USDOC and USITC 2016). The quantity of beater-add gaskets cannot be determined.</p>	Commercial, Industrial	<p>EPA (1989)</p> <p>Gasketing paper is used to fabricate gaskets of customer-specified sizes and dimensions (EPA 1989).</p>

Table 2-2: Known Applications of Asbestos

Use or Process	Use or Process Status ¹	Expected Users ²	Description of Use or Process and References
Gaskets and Bearing Linings	<p>Unknown (Manufacturing) Unknown (Use)</p> <p>Asbestos gaskets, packing and/or seals (HTS code 6812990020) were imported from Japan, Israel, Mexico, China, Germany, Taiwan, Spain, Finland, Italy, the UK, France, Greece, Ireland, Singapore, Korea, and/or Canada from 2011 to 2015 (USDOD and USITC 2016). The quantity of gaskets and bearing linings cannot be determined.</p>	Commercial, Industrial	<p>Dionisio et al. (2015)</p> <p>According to the CPCat (Dionisio et al. 2015), chrysotile (CAS 12001-29-5) is used as an automotive component in gaskets and bearing linings. This may have been or continue to be a use outside the U.S., as the source given for the use is the Substances Prepared in Nordic Countries (SPIN) database.</p>
Gaskets for Fuel Engines	<p>Unknown (Manufacturing) Unknown (Use)</p> <p>Asbestos gaskets, packing and/or seals (HTS code 6812990020) were imported from Japan, Israel, Mexico, China, Germany, Taiwan, Spain, Finland, Italy, the UK, France, Greece, Ireland, Singapore, Korea, and/or Canada from 2011 to 2015 (USDOD and USITC 2016). The quantity of gaskets for fuel engines cannot be determined.</p>	Commercial, Industrial	<p>Dionisio et al. (2015)</p> <p>According to the CPCat (Dionisio et al. 2015), chrysotile (CAS 12001-29-5) is used as an automotive component in gaskets for fuel engines. This may have been or continue to be a use outside the U.S., as the source given for the use is the Substances Prepared in Nordic Countries (SPIN) database.</p>
Sheet Gaskets	<p>Unknown (Manufacturing) Unknown (Use)</p> <p>Asbestos gaskets, packing and/or seals (HTS code 6812990020) were imported from Japan, Israel, Mexico, China, Germany, Taiwan, Spain, Finland, Italy, the UK, France, Greece, Ireland, Singapore, Korea, and/or Canada from 2011 to 2015 (USDOD and USITC 2016). The quantity of sheet gaskets cannot be determined.</p>	Commercial, Industrial	<p>Dionisio et al. (2015); EPA (1989); USDOD and USITC (2016); Virta (2006)</p> <p>Asbestos gaskets were used to seal and prevent the leakage of fluids between solid non-moving surfaces (EPA 1989).</p> <p>Latex asbestos paper can be densified and used for gasketing, but most sheet-packing material is made through a calendaring process on a sheeter machine (Virta 2006).</p>

Table 2-2: Known Applications of Asbestos

Use or Process	Use or Process Status ¹	Expected Users ²	Description of Use or Process and References
Spiral Wound Gaskets	<p>Unknown (Manufacturing) Unknown (Use)</p> <p>Asbestos gaskets, packing and/or seals (HTS code 6812990020) were imported from Japan, Israel, Mexico, China, Germany, Taiwan, Spain, Finland, Italy, the UK, France, Greece, Ireland, Singapore, Korea, and/or Canada from 2011 to 2015 (USDOC and USITC 2016). The quantity of spiral wound gaskets cannot be determined.</p>	Commercial, Industrial	<p>Dionisio et al. (2015); Mercer Gasket & Shim (2017)</p> <p>Spiral wound gaskets are composed of a steel outer ring, a spiral wound sealing strip, and an inner ring also made of steel (Mercer Gasket & Shim 2017).</p>
Asbestos Pipeline Wrap	<p>Unknown (Manufacturing) Unknown (Use)</p>	Industrial	<p>EPA (1989)</p> <p>Pipeline wrap is used by the oil and gas industry for coating its pipelines. The chemical industry uses it for underground hot water and steam piping. Pipeline wrap is occasionally used in above-ground applications, such as for special piping in cooling towers (EPA 1989).</p>
Filler for Acetylene Cylinders	<p>Unknown (Manufacturing) Unknown (Use)</p>	Consumer, Commercial, Industrial	<p>EPA (1989)</p> <p>Asbestos was used to produce filler that is placed in acetylene cylinders. The filler holds the liquefied acetylene gas (acetone) in suspension in the steel cylinder and pulls the acetone up through the tank as the gas is released through the oxyacetylene torch (EPA 1989).</p>
Asbestos Packings	<p>Unknown (Manufacturing) Unknown (Use)</p> <p>Asbestos gaskets, packing and/or seals (HTS code 6812990020) were imported from Japan, Israel, Mexico, China, Germany, Taiwan, Spain, Finland, Italy, the UK, France, Greece, Ireland, Singapore, Korea, and/or Canada from 2011 to 2015 (USDOC and USITC 2016). The quantity of asbestos packings cannot be determined.</p>	Industrial	<p>EPA (1989); USDOC and USITC (2016); Virta (2006)</p> <p>Asbestos packings differ from asbestos gaskets in that they are designated to be dynamic. These packings are used to seal fluids in devices where motion is necessary. Example instances where these have been used are in pumps, valves, compressors, mixers, and hydraulic (piston-type) cylinders. Some of the major areas in which asbestos-containing packing materials have been used are valves and pumps employed in the electric power, petroleum refinery, petrochemical, chemical, nuclear power, and pulp and paper industries (EPA 1989).</p> <p>Packings can be made with loose fibers, which are made of asbestos and binders and then woven into braided products, and made using asbestos yarns (Virta 2006).</p>

Table 2-2: Known Applications of Asbestos

Use or Process	Use or Process Status ¹	Expected Users ²	Description of Use or Process and References
Transportation Equipment Manufacturing	Unknown (Manufacturing) Unknown (Use)	Industrial	Dionisio et al. (2015) According to the CPCat (Dionisio et al. 2015), tremolite (CAS 14567-73-8) and anthophyllite (CAS 17068-78-9) are used in the manufacture of transportation equipment. This may have been or continue to be a use outside the U.S., as the source given for the use is the Substances Prepared in Nordic Countries (SPIN) database.
Clamps for Jet Engines	Unknown (Manufacturing) Unknown (Use)	Commercial, Industrial	Calport Aviation Co. (2016); Mlynarek and Van Orden (2012); Morgan Advanced Materials (2013) Jet engines have historically contained various components, such as gaskets, clamps, o-rings, and insulation that contain asbestos (Mlynarek & Van Orden 2012).
Electrical Brush Holder	Unknown (Manufacturing) Unknown (Use)	Industrial	Crestwood Technology Group (2015); Dionisio et al. (2015); Morgan Advanced Materials (2013) A carbon brush is used in a rotating machine to transfer an electrical current from a moving device to a stationary point. A carbon brush sits in a brush holder that keeps it in position and allows the brush to run on the surface of the commutator in a motor (Morgan Advanced Materials 2013).
Inorganic Chemical Manufacturing Industry			
Asbestos Diaphragm Manufacturing	Ongoing (Manufacturing) Ongoing (Use) ³ According to Flanagan (2016a), the chloralkali industry – which manufactures asbestos diaphragms – accounted for 95% of U.S. asbestos consumption in 2015. CDR 2012 reported use for CAS 1332-21-4 (EPA 2012).	Industrial	American Chemistry Council (2017); EPA (1989); EPA (2012); EPA (2015b); Flanagan (2017) Asbestos Diaphragms (semipermeable membranes) are employed in the chloralkali industry for the production of chlorine and other primary products such as caustic soda (EPA 1989). Westlake Chemical/Axiall Corporation, formerly known as Georgia Gulf Corporation (Business Wire 2013; Axiall Corporation 2016) in Plaquemine, LA reported importing asbestos (CAS RN 1332-21-4) in the 2012 CDR. Since about 100% of asbestos consumption in 2016 was in the chloralkali industry, the company is most likely involved in asbestos diaphragm manufacturing. Occidental Petroleum Corporation and Olin Corporation are also consumers of asbestos for this use (EPA 2015b).

Table 2-2: Known Applications of Asbestos

Use or Process	Use or Process Status ¹	Expected Users ²	Description of Use or Process and References
Asbestos Fibers (Crude, Textiles, Clothing, and Accessories)			
Asbestos textiles have been used in a wide range of products, but many of the traditional products are no longer in production due to various substitute fibers out-competing them. The products that continued to be made in significant quantities using asbestos textiles until at least the 1980s were: woven friction materials, packings and gaskets, and specialty products (EPA 1989).			
Crudes	<p>Unknown (Manufacturing) Unknown (Use)</p> <p>Virta (2006) notes that by the late 1980s demand for crude fibers had begun to diminish, and relatively little crude asbestos is currently sold. Crude chrysotile asbestos fibers were imported from Brazil, China, and/or Hong Kong as recently as 2015 (USITC 2015).</p>	Industrial	<p>USITC (2015); Virta (2006)</p> <p>Crude asbestos fibers were used to produce long fibers for textile work. These fibers, which are flexible and soft, were used as felts in laminates, with resins, to form strong molded sheets that could be used in airplanes and boats (Virta 2006).</p>
Asbestos Clothing/Accessories	<p>Unknown (Manufacturing) Unknown (Use)</p> <p>Manufacture, import, processing and distribution of clothing containing asbestos are allowed in the U.S. (EPA 2016). Asbestos clothing and accessories were imported from China, Taiwan, the Netherlands, Austria, Brazil, and/or Germany from 2011 to 2015 (USDOC and USITC 2016).</p>	Commercial, Industrial	<p>USDOC and USITC (2016)</p>
Asbestos Protective Clothing	<p>Unknown (Manufacturing) Unknown (Use)</p> <p>Manufacture, import, processing and distribution of clothing containing asbestos are allowed in the U.S. (EPA 2016).</p>	Commercial, Industrial	<p>EPA (1989)</p> <p>Asbestos protective clothing, such as gloves, mittens, coats and overalls, has been widespread in laboratories, steel mills, and glass blowing and welding shops. Fully covering asbestos suits have been used to protect workers in very hazardous environments, such as oilwell firemen, steel furnace workers, race car drivers, military aircraft pilots, and astronauts (EPA 1989).</p>

Table 2-2: Known Applications of Asbestos

Use or Process	Use or Process Status ¹	Expected Users ²	Description of Use or Process and References
Asbestos Footwear	Unknown (Manufacturing) Unknown (Use) Asbestos footwear was imported from Italy, China, and/or Hong Kong from 2013 to 2014 (USDOC and USITC 2016).	Commercial, Industrial	USDOC and USITC (2016)
Miscellaneous Applications			
Artificial Ash	Historic (Manufacturing) Historic (Use) Artificial ash containing asbestos was banned in 1977 by the Consumer Product Safety Commission.	Consumer	CPSC (1977) Decorative components of household artificial gas-powered fireplaces (CPSC 1977).
Asbestos Arc Chutes	Unknown (Manufacturing) Unknown (Use)	Industrial	EPA (1989) Ceramic arc chutes containing asbestos were produced by General Electric and were used to guide electric arcs in motor starter units in electric generating plants (EPA 1989).
Asbestos Reinforced Plastics	Unknown (Manufacturing) Unknown (Use) According to Flanagan (2016b) in 2015 plastics represented part of U.S. asbestos consumption.	Industrial	EPA (1989); Virta (2006) Asbestos-reinforced plastics were used for electro-mechanical parts in the automotive and appliance industries and as high-performance plastics for the aerospace industry. More recently, asbestos was only used in plastics when the presence of the asbestos-imparted reinforcing properties is critical to the performance of the plastic (EPA 1989). Asbestos can be in the form of a mat, paper or cloth, to form laminates with resins like polyesters, phenolics, thermosetting silicones, melamines, and furanes (Virta 2006).
Asbestos Separators in Fuel Cells and Batteries	Unknown (Manufacturing) Unknown (Use)	Industrial	EPA (1989) In very specialized aerospace applications, asbestos functioned as an insulator and separator between the negative and positive terminals of a fuel cell/battery (EPA 1989).

Table 2-2: Known Applications of Asbestos

Use or Process	Use or Process Status ¹	Expected Users ²	Description of Use or Process and References
Thermal Batteries	Unknown (Manufacturing) Unknown (Use)	Military	Diem (1987) Thermal (heat-activated) batteries are used in various weapons and other military-related items. Some thermal batteries with calcium/calcium chromate electrochemistry contained asbestos in the form of a tight, nonfriable paper (Diem 1987).
Vinyl-Asbestos Floor Tile	Unknown (Manufacturing) Unknown (Use)	Consumer, Commercial, Industrial	EPA (1989) Vinyl-asbestos floor tile was used in commercial, residential, and institutional buildings. It was often used in heavy traffic areas such as supermarkets, department stores, commercial plants, and kitchens (EPA 1989).
Ceramics Additive	Unknown (Manufacturing) Unknown (Use)	Commercial, Industrial	Trademarks 411 (1984) Additive for ceramic mixtures (Trademarks 411 1984)
Crayons	Historic (Manufacturing) Historic (Use) Voluntarily removed from market; not formally banned (CPSC 2000).	Consumer	CPSC (2000) Wax-based drawing implement (CPSC 2000).
Papier Mache	Historic (Manufacturing) Historic (Use) Voluntarily removed from market; not formally banned (CPSC 1983).	Consumer	CPSC (1983) Modeling clay meant for school art programs (CPSC 1983).
Food Additive	Unknown (Manufacturing) Unknown (Use)	Industrial	ASTDR (2001); Dionisio et al. (2015); FDA (2014); IARC (2012) According to the CPCat (Dionisio et al. 2015), crocidolite asbestos (CAS 12001-28-4), chrysotile (CAS 12001-29-5), and asbestos (CAS 1332-21-4) have been used in food additives. FDA allows for asbestos use in indirect food additives such as adhesives and components of coatings, polymers, and phenolic resins in molded articles (ASTDR 2001). In addition, asbestos may be listed as a food additive due to its mineral deposit proximity, and therefore potential to contaminate talc, which is an intentional additive to foods such as rice and chewing gum (FDA 2014; IARC 2012).

Table 2-2: Known Applications of Asbestos

Use or Process	Use or Process Status ¹	Expected Users ²	Description of Use or Process and References
Hair Dryers	Historic (Manufacturing) Historic (Use) Voluntarily removed from market; not formally banned (CPSC 1979).	Consumer, Commercial	CPSC (1979) Both household and salon quality hair dryers (CPSC 1979).
Heat Guns	Unknown (Manufacturing) Unknown (Use) Heat guns containing asbestos were recalled by the (CPSC 1980).	Consumer	CPSC (1980) Primarily used by model aircraft enthusiasts (CPSC 1980).
Missile Liner	Unknown (Manufacturing) Unknown (Use)	Industrial	EPA (1989) Missile liner is an asbestos-rubber compound which was used to coat the interior of rocket motors (EPA 1989).
Pesticide	Historic (Manufacturing) Historic (Use) Not formally banned, but no federally registered pesticide products contain asbestos CAS RNs in Table I-1 (National Pesticide Information Retrieval System 2016; EPA 2017).	Consumer	Dionisio et al. (2015); National Pesticide Information Retrieval System (2016) According to the CPCat (Dionisio et al. 2015), tremolite asbestos (CAS 14567-73-8) and anthophyllite asbestos (CAS 17068-78-9) were used in pesticides related to pet flea and tick removal, and asbestos (CAS 1332-21-4) was a pesticide inert ingredient. No federally registered pesticide products currently contain asbestos as an active ingredient (National Pesticide Information Retrieval System 2016) or inert ingredient (EPA 2017).
Tent Grommet	Unknown (Manufacturing) Unknown (Use) The U.S. Defense Logistics Agency procured an asbestos grommet product from Kidde Technologies, Inc. as recently as 2009 (GovTribe Inc. 2017).	Military	Jones (1897); R M Engineered Products Inc. (1992) Asbestos grommets were invented for use in military tents. The grommet is inserted in the roof of the tent, and the stove pipe passes through it. Asbestos was used in this context due to its fire resistance and flexibility (Jones 1897).

Note(s):

¹ For manufacturing status: *Historic* means the manufacturing of products for this use is either banned or phased out; *Ongoing* means there is a current product in Table 2-3 and the manufacturer is located in the U.S.; *Unknown* means there is some evidence that the manufacturing status is ongoing or historic, but not enough to confirm. For use status: *Historic* means the manufacture, import, processing and/or distribution of products for this use is either banned or phased out; *Ongoing* means there is a current product in Table 2-3; *Unknown* means there is some evidence that the use is ongoing or historic, but not enough to confirm.

² Determination of the *Expected Users* associated with a use or process is based on EPA’s best judgement if the users are not explicitly defined in the resource(s) cited.

³ Although the study team did not find an SDS for the asbestos diaphragms use category, EPA designated this use as “ongoing” because the American Chemistry Council submitted a public comment to the Asbestos TSCA Review and Scoping docket (Docket ID: EPA-HQ-OPPT-2016-0736) indicating this use to be ongoing (American Chemistry Council 2017).

Table 2-3: Sample of Products that Contain Asbestos

Use	Expected Users	Product	Percent Concentration	Location/ Ownership ¹	Manufacturer and Distributor Information	Details
Brake Blocks	Consumer, Commercial, Industrial	Silverline “SP” Brake Blocks	Unknown	U.S./ U.S.	Manufacturer: Stewart and Stevenson http://www.stewartandstevenson.com/ Distributor: Howard Supply Company https://www.howard-supply.com/	EPA (1989) Brake blocks are brake linings used on the drum brakes of heavy vehicles - heavy trucks, buses, and heavy off-road vehicles (EPA 1989)
Asbestos-cement (aka Transite or Fibrocement) Pipes and Fittings	Commercial, Industrial	Type 1 Asbestos-cement pipe	15-25% (Virta 2006)	Mexico/Canada (distributor)	Manufacturer: Unknown Distributor for Canadian Sales: Tuyaux Logard Inc. http://www.logard.com/	Grant (2014); Tuyaux Logard Inc. (2005) Pipes are used in hospitals, high-rise buildings and condos (Grant 2014).
Plastic Cement	Commercial Industrial	DISSCO 560 Plastic Cement	10-15% (DISSCO 2002d)	U.S./ U.S. (DISSCO 2016)	Manufacturer: Denver Industrial Sales & Service Company http://www.dissco.net/ Distributor: Unknown	
Plastic Asphalt Cement	Commercial Industrial	C200 RoofBond Plastic Asphalt Cement	4-12% (Fields Coatings & Mastics 2003b)	U.S./U.S. (Fields Coatings & Mastics 2016)	Manufacturer: Fields Coatings & Mastics http://fieldscorp.com/ Distributor: Unknown	
Plastic Tile Cement	Commercial Industrial	C240 TileBond Plastic Tile Cement	4-12% (Fields Coatings & Mastics 2003c)	U.S./U.S. (Fields Coatings & Mastics 2016)	Manufacturer: Fields Coatings & Mastics http://fieldscorp.com/ Distributor: Unknown	
Cement Color	Consumer, Commercial, Industrial	Cement Color Color-Paks Kolor Enhancer	<30.1% ⁸	U.S./U.S.	Manufacturer: Ash Grove Cement Company ⁷ Distributor: Brock White Construction https://www.brockwhite.com/	
Asphalt Coating & Adhesive	Commercial Industrial	C100 RoofCoat Asphalt Coating & Adhesive	1-5% (Fields Coatings & Mastics 2003a)	U.S./U.S. (Fields Coatings & Mastics 2016)	Manufacturer: Fields Coatings & Mastics http://fieldscorp.com/ Distributor: Unknown	

Table 2-3: Sample of Products that Contain Asbestos						
Use	Expected Users	Product	Percent Concentration	Location/ Ownership ¹	Manufacturer and Distributor Information	Details
Culvert Coating	Commercial Industrial	DISSCO 590 Culvert Coating	5-12% (DISSCO 2002e)	U.S./ U.S. (DISSCO 2016)	Manufacturer: Denver Industrial Sales & Service Company http://www.dissco.net/ Distributor: Unknown	
Fibred Foundation Coating	Commercial, Industrial	DISSCO 520 Fibred Foundation Coating	5 – 10% (DISSCO 2002a)	U.S./ U.S. (DISSCO 2016)	Manufacturer: Denver Industrial Sales & Service Company http://www.dissco.net/ Distributor: Unknown	
Fibred Roof Coating	Commercial Industrial	DISSCO 550 Fibred Roof Coating	8-15% (DISSCO 2002c)	U.S./ U.S. (DISSCO 2016)	Manufacturer: Denver Industrial Sales & Service Company http://www.dissco.net/ Distributor: Unknown	
Non-roofing Adhesives, Sealants and Coatings	Commercial, Industrial	Reliabond r-398	3.5% (CIBA GEIGY Composite Materials 1985)	U.S./ U.S. ²	Manufacturer: Hexcel (formerly CIBA GEIGY Composite Materials) http://www.hexcel.com/Resources/DataSheets/Adhesive Distributor: JACO Aerospace & Industrial http://www.e-aircraftsupply.com/	CIBA GEIGY Composite Materials (1985); Mid America International Trading (2016a) Asbestos composite adhesive (Mid America International Trading 2016a)
Waterproofing Compound	Commercial, Industrial	DISSCO 540 Mastic Waterproofing Compound	5-12% (DISSCO 2002b)	U.S./ U.S. (DISSCO 2016)	Manufacturer: Denver Industrial Sales & Service Company http://www.dissco.net/ Distributor: Unknown	

Table 2-3: Sample of Products that Contain Asbestos

Use	Expected Users	Product	Percent Concentration	Location/Ownership ¹	Manufacturer and Distributor Information	Details
Gaskets ⁶	Commercial, Industrial	DURA GEN II	“Asbestos content varies depending on the use, with higher fiber levels associated with higher-temperature applications” (Virta 2006).	Not found ⁴	Manufacturer: Unknown Distributor: Mid America International Trading http://midamericainternationaltrading.com/	Mid America International Trading (2016b) DURA GEN II is a compressed gasket material made of chrysotile fibers with synthetic and natural elastomers acting as the binders (Mid America International Trading 2016b).
Thermal Batteries	Military ⁵	Thermal (THR) Battery	<1%	Unknown ³	Manufacturer and date unidentified	

Note(s):

¹ Unless otherwise specified, Hoover’s database of proprietary business information is the source for the Location/Ownership determination (Dun & Bradstreet 2016).

² According to Hexcel company website, Ciba Geigy was acquired by Hexcel in 1996 (Hexcel 2016). Hexcel is based in the U.S. However, Reliabond r-398 is not on their website. The product is available through an industrial distributor: JACO Aerospace & Industrial (JACO Aerospace & Industrial 2017).

³ The information found on the thermal battery indicates that the military is the main user. The SDS, which is distributed by the military, does not include the manufacturer’s name or an SDS publishing date. The study team has found no additional information concerning the location and ownership of the manufacturer. The study team could not confirm the current use of this product because there is not enough publically available information to determine if this product’s use by the military is current or historic. Because the SDS is missing information and is distributed by the military, it is possible that its use is confidential.

⁴ Since capturing pdfs of this product website, the website has been inaccessible. Additional research has not helped to determine the location and ownership of this product’s manufacturer.

⁵ The study team only found SDS and use descriptions for this product by the military. While SDS and descriptions of this use were old, the study team was not able to find publically available data concerning the military’s current use of asbestos thermal batteries. However, the study team did not find thermal batteries containing asbestos available for purchase online.

⁶ Based on the limited product information, the study team was not able to determine which specific use category applied to this product. The manufacturer’s website is no longer available.

⁷ Precision Packaging Inc. (located in Little Rock, AR) is the preparer of this SDS. Precisions Packaging Inc. does not have an independent website; they are a branch of Ash Grove Materials Corporation, which is a subsidiary of Ash Grove Cement Company (Dun & Bradstreet 2016).. However, Kolor Enhancer is not on their website. The SDS for the product is available on the website of an industrial distributor: Brock White Construction.

3. Imports

Asbestos is imported to the U.S. as a raw material and as part of various articles. These import categories are represented by HTS codes that provide broad categories for different types of articles that contain asbestos. HTS codes also define certain product types that are similar to asbestos-containing articles, but without the asbestos.

U.S. imports for consumption of products composed largely of asbestos have been included in Table 3-1. Only asbestos articles are included in this table. Raw asbestos imports are not included.

Table 3-1. U.S. Imports for Consumption of Products with Basis of Asbestos in 2016					
HTS Code	Category	Value¹	Quantity (kilograms)	Major sources	Percent of category total
6812.80.10.00	Crocidolite footwear	\$2,825	12	Italy ³	100% of weight
6812.80.90.00	Articles of crocidolite not elsewhere specified	\$89,384	178,240	China	100% of weight
6812.91.90.00	Asbestos clothing, accessories and headgear exc. footwear	\$15,814	250	Mexico	100% of weight
6812.92.00.00	Asbestos paper, millboard and felt	\$75,024	N/A	Japan ³	90% of value
6812.93.00.00	Compressed asbestos fiber jointing, in sheets or rolls	\$51,830	N/A	China	76% of value
6812.99.00.02	Asbestos yarn and thread	\$18,945	266	Spain ³	96% of weight
6812.99.00.03	Asbestos cords and string, including plaited	\$12,287	213	China	100% of weight
6812.99.00.04	Asbestos woven or knitted fabric	\$19,064	183	Italy ³ , United Kingdom ³	100% of weight
6812.99.00.10	Asbestos articles for use in civil aircraft	\$8,531	N/A	China	76% of value
6812.99.00.20	Asbestos gaskets, packing and seals	\$258,202	15,868	China, Israel ³ , Japan ³	85% of weight
6812.99.00.55	Asbestos articles not elsewhere specified	\$93,877	N/A	Canada	70% of value
6813.20.00.10	Brake linings and pads for use in civil aircraft	\$144,983	N/A	France	48% of value
6813.20.00.15	Brake linings and pads of asbestos	\$1,661,074	N/A	China, Germany ³	44% of value
6813.20.00.20	Friction material and articles for use in civil aircraft	\$4,602,813	N/A	Japan ³	99.5% of value
6813.20.00.25	Friction materials and articles	\$857,251	N/A	China	71% of value
Source(s): United States International Trade Commission 2017					
Note(s):					
¹ U.S. customs declared value					
² Percentage contribution of major import sources, by weight or value					
³ Country has imposed ban on asbestos. Material may have been misclassified as asbestos or transshipped.					

Using HTS data, a number of non-asbestos products were found that have an equivalent HTS code for asbestos-containing products. The HTS code equivalencies are listed in Table 3-2 below.

Table 3-2. Non-Asbestos HTS Code Equivalencies		
HTS Code	Category	Non-Asbestos Equivalent HTS Code/Category
6811.40.00.00	Asbestos-cement products	6811.81.00.00 Corrugated sheets 6811.82.00.00 Other sheets, panels, tiles and similar articles 6811.89.10.00 Tubes, pipes and tube or pipe fittings 6811.89.90.00 Other articles
6812.93.90.00 ^a	Compressed asbestos fiber jointing, in sheets or rolls	4823.90.60.00 Gaskets, washers and other seals of coated paper or cardboard 4823.90.80.00 Gaskets, washers and other seals of uncoated paper or paperboard or of webs of cellulose fiber 5911.90.00.40 Cords, braids and the like of a kind used in industry as packing or lubricating material 8484.00.00.00 Gaskets and similar joints of metal sheeting combined with other material or of two or more layers of metal; sets or assortments of gaskets and similar joints, dissimilar in composition, put up in pouches, envelopes or similar packings; mechanical seals
6812.99.00.20 ^a	Gaskets, packing, and seals	Same list as for 6812.93.90.00
6813.20.00.10	Brake linings and pads, civil aircraft	6813.81.10.00 Brake linings and pads (civil aircraft)
6813.20.00.15	Brake lining sand pads, other	6813.81.50.00 Brake linings and pads (other)
6813.20.00.20	Other friction materials, civil aircraft	6813.89.10.00 Other friction materials (civil aircraft)
6813.20.00.25	Other friction materials	6813.89.50.00 Other friction materials
<p>Source(s): United States International Trade Commission (2017)</p> <p>Note(s): ^a Non-asbestos equivalent HTS codes for this category are speculative, and not explicitly defined as being related within the HTS codex.</p>		

In addition to the HTS codes above, there are numerous other HTS codes related to asbestos, outlined in Table 3-1. However, those codes not included in Table 3-2 do not have readily apparent non-asbestos equivalencies, making an assessment of asbestos to non-asbestos imports ratios impractical.

Table 3-3 presents the dollar import values for the above HTS codes, the corresponding non-asbestos HTS codes, and the percent value of asbestos products compared to the combined value of the asbestos HTS code imports and corresponding non-asbestos HTS codes(s) imports. Note that the HTS codes for asbestos-cement and gaskets, washers and seals each have four corresponding non-asbestos HTS codes. A breakdown of the non-asbestos import values for these codes is presented in Table 3-4 and Table 3-5.

Table 3-3: Asbestos and Non-Asbestos Equivalent Articles' Import Values: 2012-2016 (USD)^a

Asbestos HTS Code (Non-asbestos)	Category	Data description	2012	2013	2014	2015	2016
6811.40.00.00 ^b (6811.81.00.00; 6811.82.00.00; 6811.89.10.00; 6811.89.90.00)	Cement products	Asbestos imports	\$582,413	\$990,532	\$689,187	\$122,787	\$0
		Non-asbestos imports	\$60,560,242	\$71,822,753	\$88,395,161	\$82,946,285	\$112,250,053
		% asbestos of combined imports	0.96%	1.38%	0.78%	0.15%	0.00%
6812.93.00.00 ^c (4823.90.60.00; 4823.90.80.00; 5911.90.00.40; 8484.00.00.00)	Compressed asbestos fiber jointing, in sheets or rolls	Asbestos imports	\$365,023	\$46,286	\$40,785	\$59,401	\$51,830
		Non-asbestos imports	\$267,196,823	\$279,214,863	\$298,477,269	\$291,480,270	\$271,342,038
		% asbestos of combined imports	0.14%	0.02%	0.01%	0.02%	0.02%
6812.99.00.20 ^c (Same as 6812.93.00.00)	Gaskets, packing, and seals	Asbestos imports	\$154,800	\$140,290	\$285,039	\$191,152	\$258,202
		Non-asbestos imports	\$267,196,823	\$279,214,863	\$298,477,269	\$291,480,270	\$271,342,038
		% asbestos of combined imports	0.06%	0.05%	0.10%	0.07%	0.10%
6813.20.00.10 (6813.81.00.10)	Brake Linings and pads, civil aircraft	Asbestos imports	\$306,563	\$410,292	\$495,845	\$105,750	\$144,983
		Non-asbestos imports	\$6,061,675	\$8,855,562	\$6,905,782	\$12,438,425	\$10,141,886
		% asbestos of combined imports	4.81%	4.43%	6.70%	0.84%	1.41%
6813.20.00.15 (6813.81.00.50)	Brake lining sand pads, other	Asbestos imports	\$1,709,638	\$1,378,664	\$1,796,951	\$1,413,008	\$1,618,527
		Non-asbestos imports	\$150,089,133	\$148,781,560	\$161,988,695	\$206,360,035	\$193,455,888
		% asbestos of combined imports	1.13%	0.92%	1.10%	0.68%	0.83%
6813.20.00.20 (6813.89.00.10)	Other friction materials, civil aircraft	Asbestos imports	\$25,919	\$106,524	\$160,475	\$317,416	\$4,602,813
		Non-asbestos imports	\$251,078	\$166,356	\$910,217	\$5,486,011	\$5,720,129
		% asbestos of combined imports	9.36%	39.04%	14.99%	5.47%	44.59%
6813.20.00.25 (6813.89.00.50)	Other friction materials	Asbestos imports	\$1,155,834	\$663,120	\$811,560	\$1,757,114	\$857,251
		Non-asbestos imports	\$31,162,024	\$31,012,797	\$31,668,491	\$21,050,092	\$14,533,184
		% asbestos of combined imports	3.58%	2.09%	2.50%	7.70%	5.57%
TOTAL			\$4,300,190 \$515,320,975 0.83%	\$3,735,708 \$539,853,891 0.69%	\$4,279,842 \$588,345,615 0.72%	\$3,966,628^d \$619,761,118 0.64%	\$7,533,606 \$607,443,178 1.23%

Source(s):

United States International Trade Commission (2017)

Note(s):^a Actual dollars^b The asbestos code 6811.40.00.00 has four non-asbestos equivalent HTS codes. The breakdown of the non-asbestos imports is presented in Table 3-4.^c The asbestos codes 6812.93.00.00 and 6812.99.00.20 have four non-asbestos equivalent HTS codes. The breakdown of the non-asbestos imports is presented in Table 3-5. Since the same equivalent codes are listed for both of these codes, they are only considered once when calculating the totals for non-asbestos codes.^d The value presented in this table of total asbestos imports for 2015 is \$3.7 million. While Flanagan (2016a), (quoted in Section 1.1) estimates the total value of imported products that contain asbestos in 2015 to be \$4.63 million. This discrepancy is due to that fact that Flanagan (2016a) presents the imports of all of the products containing asbestos while this table does not include the value of products containing asbestos that are classified in an HTS code for which it was ambiguous which non-asbestos HTS code(s) were equivalent. Thus, for example, the table does not include categories such as products for use in civil aircraft; woven or knitted fabric; paper, millboard and felt; yarn and thread; and cord and string.

Table 3-4: Non-Asbestos HTS Code Import Values for Cement Products (USD)^a					
Non-Asbestos HTS Code	2012	2013	2014	2015	2016
6811.81.00.00 – Corrugated sheets	\$177,873	\$246,888	\$67,932	\$64,988	\$205,482
6811.82.00.00 – Other sheets, panels, tiles and similar articles	\$52,307,338	\$63,688,459	\$77,913,646	\$71,060,900	\$102,970,038
6811.89.10.00 – Tube, pipes and tube or pipe fittings	\$462,813	\$123,970	\$137,065	\$702,998	\$920,624
6811.89.90.00 – Other articles	\$7,612,218	\$7,763,436	\$10,276,518	\$11,117,399	\$8,153,909
TOTAL	\$60,560,242	\$71,822,753	\$88,395,161	\$82,946,285	\$112,250,053
Source(s): United States International Trade Commission (2017)					
Note(s): ^a Actual dollars					

Table 3-5: Non-Asbestos HTS Code Import Values for Gaskets, Washers, Seals, and Compressed Fiber Jointing (USD)^a					
Non-Asbestos HTS Code	2012	2013	2014	2015	2016
4823.90.60.00 – Gaskets, washers and other seals of coated paper or cardboard	\$2,230,393	\$1,791,569	\$2,215,572	\$1,682,719	\$2,028,114
4823.90.80.00 – Gaskets, washers and other seals of uncoated paper or paperboard or of webs of cellulose fiber	\$2,831,082	\$3,131,945	\$3,233,295	\$2,917,152	\$2,938,005
5911.90.00.40 – Cords, braids and the like of a kind used in industry as packing or lubricating material	\$3,428,277	\$4,629,037	\$4,866,892	\$5,292,020	\$6,020,012
8484.00.00.00 – Gaskets and similar joints of metal sheeting combined with other material or of two or more layers of metal; sets or assortments of gaskets and similar joints, dissimilar in composition, put up in pouches, envelopes or similar packings; mechanical seals	\$258,707,071	\$269,662,312	\$288,161,510	\$281,588,379	\$260,355,907
TOTAL	\$267,196,823	\$279,214,863	\$298,477,269	\$291,480,270	\$271,342,038
Source(s): United States International Trade Commission (2017)					
Note(s): ^a Actual dollars					

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Use and Market Profile for 1-Bromopropane

Contract # EP-W-16-009

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Chemistry, Economics, and Sustainable Strategies Division
Office of Pollution, Prevention, and Toxics
U.S. Environmental Protection Agency
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Use and Market Profile for 1-Bromopropane

Table of Contents

1.	Introduction	1-1
2.	Producers, Production, Import Volume, and Prices	2-1
2.1	US Producers and Importers	2-1
2.2	US Production Volume	2-3
2.3	Import Volume	2-3
2.4	Prices	2-3
3.	Use Information and Market Trends	3-1
3.1	Use in Vapor Degreasers	3-1
3.2	Use in Spray Adhesives	3-1
3.3	Use in Aerosol Solvents	3-1
3.4	Use in Dry Cleaning	3-2
3.5	Other Uses	3-2
4.	Market Trends	4-1
4.1	Vapor Degreasers	4-1
4.2	Spray Adhesives	4-1
4.3	Aerosol Solvents	4-2
4.4	Dry Cleaning Solvents	4-2
5.	References	5-1

List of Tables

Table 1-1: Chemical Name, Synonyms, and CAS Number.....	1-2
Table 2-1: 2016 CDR Manufacturers and Importers of 1-BP.....	2-1
Table 2-2: Production Volume Data for 1-BP from 1986 – 2015 (Pounds)	2-3
Table 3-1: 2016 CDR Industrial Use Data for 1-BP	3-3
Table 3-2: 2016 Commercial and Consumer Use Data for 1-BP.....	3-4

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1. Introduction

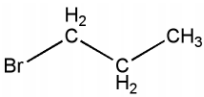
1-Bromopropane (1-BP) is a colorless, sweet-scented organic solvent. It is typically manufactured by reacting n-propyl alcohol with hydrogen bromide or by dehydrating propanol with bromine or hydrogen bromide in the presence of a catalyst (NTP, 2003). 1-BP is used primarily as a solvent cleaner in vapor, immersion, and aerosol degreasing operations to clean optics, electronics, and metals (NTP, 2016). 1-BP is also used as a dry cleaning solvent and as a solvent for aerosol-applied adhesives in industries such as foam cushion manufacturing (NTP, 2016). 1-BP also has other minor uses where a nonflammable fast-drying solvent is desired as a cleaner or vehicle (e.g. flame retardant, refrigerant flush).

1-BP use has increased in recent years because it is a substitute for ozone-depleting chemicals and suspect carcinogens (NTP, 2016). 1-BP in the dry-cleaning industry started in response to states considering and pursuing actions to ban the use of perchloroethylene (perc) (Blando et al., 2010). In fact, some 1-BP dry cleaning solvents have been marketed and sold as “green” or “environmentally responsible” drop-in substitutes to perc in dry cleaning applications (Davig’s Custom Cleaners, n.d.; Enviro Tech, 2013a). In the past, 1-BP was used as a solvent for fats, waxes, or resins and as an intermediate in pharmaceutical, insecticide, quaternary ammonium compound, flavor, and fragrance synthesis (NTP, 2016). Despite its uses in a variety of applications, this use and market profile focuses primarily on 1-BP use in vapor degreasing, spray adhesive, aerosol solvent applications, and as a solvent in the dry cleaning industry. A selection of other minor uses is also briefly addressed.

1-BP is now reasonably anticipated to be a human carcinogen based on sufficient evidence of carcinogenicity from studies in experimental animals (NTP, 2016). Therefore, EPA has selected 1-BP as one of the first ten chemicals to be evaluated under the Lautenberg Chemical Safety for the 21st Century Act, which amended the Toxic Substances Control Act (TSCA) and was passed in 2016. 1-BP is also considered a reproductive toxicant that causes sterility and harms developing fetuses. Other health effects include nerve damage, weakness, pain, numbness, and paralysis (CARB, 2009). 1-BP is a volatile organic compound (VOC) and human exposure to 1-BP occurs most frequently in occupational settings through inhalation or dermal exposure (NTP, 2016).

This market profile summarizes information about the use of 1-BP in vapor degreasing, spray adhesives, aerosol solvents, dry cleaning, and other uses with a focus on recent trends and forecasted growth. Information on 1-BP’s producers, production, and import was retrieved from EPA’s non-confidential 2016 Chemical Data Reporting (CDR) database. Abt Associates reviewed potential sources provided by EPA’s subject matter expert to analyze the trends and growth of 1-BP use. These sources were supplemented with data from solvents, adhesive, dry cleaning and laundry trade associations including the Halogenated Solvents Industry Association (HSIA), the Association of the European Adhesive and Sealant Industry (FEICA), American Drycleaner, and Laundry and Cleaning News International. Academic and government reports, such as the Toxics Use Reduction Institute (TURI)’s *Assessment of Alternatives to Perchloroethylene for the Dry Cleaning Industry* and the National Toxicology Program (NTP)’s *Report on Carcinogens, Fourteenth Edition for 1-Bromopropane*, were also used to help profile the 1-BP market. Abt Associates did not directly contact any trade associations or manufacturers, as this was not part of the technical direction.

Table 1-1: Chemical Name, Synonyms, and CAS Number

CAS RN	106-94-5		
Synonyms	1-BP; Propyl bromide; n-propyl bromide (nPB); Propane, 1-bromo-; <i>normal</i> propyl bromide		
Molecular Formula	C ₃ H ₇ Br		
Structure			
Trade Names¹	Dry Cleaning	Solvent Degreasers	Spray Adhesives
	DrySolv®; Fabrisolv™ XL	ZEP POWERSOLV 5000; NU TRI CLEAN; EnSolv®	K-Grip 503 Spray Adhesive; Normac® 900R
Source: NTP, 2013; TURI, 2012; EPA, 2017a			

2. Producers, Production, Import Volume, and Prices

2.1 US Producers and Importers

The most recently-collected EPA production information, the 2016 CDR data, indicates that there are two companies that manufacture, six that import 1-BP in the United States, and one that did not disclose its activities (EPA, 2017c). Table 2-1 contains a list of U.S. 1-BP manufacturers and importers. For the 2016 CDR cycle, manufacturers of certain chemicals were required to report information about those chemicals manufactured in amounts of 25,000 pounds or more at each of their sites during calendar years 2012-2015.

Table 2-1: 2016 CDR Manufacturers and Importers of 1-BP

Company	City	State	Manufacture	Import
Albemarle Corporation	Magnolia	AR	Yes	No
CBI	CBI	CBI	No	Yes
CBI	CBI	CBI	No	Yes
Chemtura Corporation	El Dorado	AR	Yes	No
Custom Synthesis, LLC	Anderson	SC	No	Yes
ICL-IP America Inc.	St. Louis	MO	CBI	CBI
MC International, LLC	Miami	FL	No	Yes
Phoenix Chemical Company	Calhoun	GA	No	Yes
Superior Oil Company, Inc.	Indianapolis	IN	ND	ND
Wego Chemical and Mineral Corp.	Great Neck	NY	No	Yes

ND = No Data; the company did not provide the requested information.
CBI = Confidential business information
Source: EPA, 2017c

The Hazardous Substances Data Bank also lists Diaz Chemical Corporation as a possible manufacturer of the chemical (NLM, 2009). Companies that have or are marketing 1-BP solvent blends and other products include (EPA, 2017a and EPA, 2017c):

- ACL, Inc.
- Albatross USA, Inc.
- Albemarle Corporation
- American Industries, Inc.
- American Polywater Corporation
- Amity International
- ATCO International
- Blair Rubber Company
- Chemtura Corporation
- Choice Brand Adhesives
- CRC Industries

- Custom Synthesis, LLC
- DiversiTech Corporation
- Dow Chemical Company
- Ecolink
- Enviro Tech International
- Flexbar Machine Corporation
- ICL-IP America
- ITW
- Maple Leaf Sales II, Inc.
- MC International, LLC
- MicroCare
- MRO Solutions L.L.C.
- NewStar Adhesives
- Omega Industrial Supply
- OMEGA Engineering
- Osborn/ Jason Incorporated
- Parts Cleaning Technologies
- Pettyjohn's Solutions
- Phoenix Chemical Company
- PLZ Aeroscience
- QuestSpecialty Corporation
- Reliance Specialty Products
- Satellite City, Inc.
- Sherwin-Williams Company
- Slide Products, Inc.
- Technical Chemical Company
- United Laboratories, Inc.
- Vantage Specialty Chemicals, Inc.
- Wego Chemical and Mineral Corp.
- West Penetone Inc.
- Wolff Industries, Inc.
- Zep Inc.

While 1-BP has recently been listed as a chemical required to be reported to the Toxics Release Inventory (TRI), reports have not yet been submitted and data are not available. According to the final rule that added 1-BP to the TRI, EPA expects 140 facilities to report under 23 different industrial sectors (EPA, 2017a).

2.2 US Production Volume

Table 2-2 presents the production volume data for 1-BP reported to the EPA over the past 30 years. While the reporting threshold for manufacturing information was 25,000 pounds starting with the 2006 IUR, the reporting threshold for manufacturing information was 10,000 pounds from 1986 to 2002.

Table 2-2: Production Volume Data for 1-BP from 1986 – 2015 (Pounds)

Chemical	1986	1990	1994	1998	2002	2006	2011	2015
1-BP	10K- <500K	10K- <500K	500K- <1M	1M- <10M	1M- <10M	1M- <10M	15,348,727	25,887,235

Source: EPA, No Date; EPA, 2010b; EPA, 2013b; EPA, 2017a

1-BP has seen a tremendous and steady increase in production volume from 1986 to 2015. 1-BP's use may have recently increased in many industrial applications because the chemical is used as an alternative to chlorinated solvents. 1-BP was reported as used as a solvent for cleaning or degreasing for the 2016 CDR (EPA, 2017c).

2.3 Import Volume

Import volumes for 1-BP reported to the 2016 CDR were claimed confidential and are therefore not publically available. Import data for the chemical from other sources indicate that 9.2 million pounds of brominated derivatives of acyclic hydrocarbons were imported into the U.S. in 2013 (NTP, 2013). Import data for 1-BP alone were not located, and therefore the category "brominated derivatives of acyclic hydrocarbons" includes import volumes for chemicals other than 1-BP. In 2013, 15.6 million pounds of brominated derivatives of acyclic hydrocarbons were imported into the U.S. (NTP, 2016).

2.4 Prices

An industry estimate of the price of 1-BP ranges from \$40/gallon (Raccon, 2010 as cited in TURI, 2012) to \$64/gallon (NEFA, 2011 as cited in TURI, 2012). A more recent investigation of the price of 1-BP estimates that the cost of ultra-pure and laboratory grade 1-BP ranges from approximately \$59/gallon to \$267/gallon (or \$77.80/5000ml to \$352.26/5000ml) (EPA, 2017a). There are other costs associated with 1-BP use in dry cleaning apart from purchasing the raw material. To use 1-BP as a dry cleaning solvent, a new machine specifically for 1-BP use can be purchased, or maintenance can be done on existing perc equipment to convert it for 1-BP use. Otherwise, the 1-BP solvent can be used in a perc dry cleaning machine that is 3rd generation or higher that has been modified with a secondary vapor control (CARB, 2009; TURI, 2012). There are currently five generations of dry cleaning machines, which evolved as new safety technologies were introduced to help minimize the negative effects of dry cleaning solvents on human health and the environment (CDC/NIOSH, 1997; ECSA, 2016). The secondary vapor control reduces the amount of residual solvent in the machine cylinder at the end of the dry cycle, thus minimizing worker exposure to dry cleaning solvents. The cost of a new dry cleaning machine that is manufactured exclusively for 1-BP use ranges from \$40,000 to \$60,000, while the estimated cost of converting existing equipment from perc to 1-BP ranges from \$1,500 to \$5,000 (Raccon, 2010 as cited in TURI, 2012). A more recent estimate of the cost of retrofitting existing perc machinery for 1-BP use is \$2,000 to \$3,000 depending on the condition of the equipment according to a technical and product development manager for DrySolv® (WFI, 2011).

3. Use Information and Market Trends

Table 3-1 and Table 3-2 present the industrial and consumer use data reported under the 2016 CDR for 1-BP (EPA, 2017c). 1-BP is reported to have commercial uses in electrical and electronic products, cleaning and furnishing care products, non-pesticidal agricultural products, metal products, and adhesive and sealant products. Industrial uses include cleaning or degreasing, chemical intermediates, and as non-pesticidal agricultural products.

3.1 Use in Vapor Degreasers

1-BP is primarily used as a vapor degreaser for cleaning optics electronics, plastics, and metals (NTP, 2016 and CDC, 2013). Its prevalence is partly due to its ability to thoroughly clean difficult soils from many substrates, compatibility with many metals, low tendency to cause corrosion, and ability to be used in most modern vapor degreasing equipment (ICF, 2004; UNEP, 2001; Williams et al., 2016).

Enviro Tech International manufactures the EnSolv® and Tech Kleen® brands, which are 1-BP-based solvents used in a variety of cleaning applications, including vapor degreasing (Enviro Tech, 2017a). Other 1-BP-based vapor degreaser manufacturers include Albemarle Corporation (ABZOL®), Amity International (Leksol), Vantage Specialty Chemicals (LENIUM), and Reliance Specialty Products (EnTron™ and GenTech™) (Albemarle, 2012; EPA, 2017a).

3.2 Use in Spray Adhesives

1-BP adhesives are primarily used in foam cushion manufacturing and for laminates, to a lesser degree (NTP, 2016 and HSIA, 2010). Several years ago, approximately one-third of all foam cushion manufacturers used 1-BP-based glues (Urbina, 2013). Some workers suffered severe nerve damage from this use of 1-BP (Urbina, 2013), and conversations with industry have suggested that the use of 1-BP in spray adhesives has therefore declined (Enviro Tech, 2017b). 1-BP adhesive manufacturers in the U.S. include, Maple Leaf Sales II (K-Grip 503 Premium Adhesive), Blair Rubber Company (Normac® 900R-NPB), Choice Brand Adhesives (CBA-751G), ITW (STA'-PUT® SP4H), Satellite City (NCF Accelerator), and New Star Adhesives (EverStrong™ ES38 and ES138) (EPA, 2017a).

3.3 Use in Aerosol Solvents

1-BP aerosol solvents are often used to spot-clean electrical or electronic equipment, aircraft maintenance, or synthetic fiber production (FR, 2007 as cited in NTP, 2013).

American Polywater Corporation manufactures Type TR™ Cleaner/Degreaser Aerosol (TR-16), which is composed of 95% 1-BP by weight (American Polywater Corporation, n.d.). Zep manufactures both Power Solv 5000 Degreaser and NU TRI CLEAN, two other 1-BP based aerosol solvent degreasers (Zep, Inc. 2017a and Zep, Inc. 2017b). Their applications include use on brake parts, diesel and internal combustion engines, marine motors and power tools, circuit boards and electrical contacts, and refrigeration and air conditioning equipment (Zep, Inc. 2017a and Zep, Inc. 2017b). Other 1-BP aerosol solvent manufacturers include CRC Industries (Super Degreaser™ and Cable Clean® Degreaser), ITW (LPS® Instant Super Degreaser), Quest Specialty Corporation (5020 Quick Solv Solvent Degreaser and 5489 PCA II), ACL (Precision Rinse NS), American Industries (Solv), DiversiTech Corporation (CBC II

Contact Cleaner), MRO Solutions (525 Contact Cleaner), Omega Industrial Supply (Enviro-Tac and Mega Safe), Sherwin-Williams (Sprayon® EL2846 Non-Chlorinated Electrical Degreaser), and PLZ Aeroscience (Sprayway® N-Propyl Bromide Safety Solvent) (EPA, 2017a).

3.4 Use in Dry Cleaning

One of the most commonly used 1-BP products in dry cleaning is DrySolv®. DrySolv® is a mixture of 1-BP (>87% by weight) and nitromethane and 1,2-butylene oxide (<5%) (Enviro Tech, 2013b). The product is manufactured by Enviro Tech International, a small company with an estimated 10-49 employees and sales of \$5 to \$9.9 million (InsideView, 2013; ThomasNet, 2013). DrySolv® evolved from EnSolv®, a 1-BP degreasing and cleaning solvent used in various industries including aerospace, precision engineering, medical equipment, and electronics (Childers, 2008).

1-BP is also used as a spot cleaner for dry cleaning, fabrics, and textiles with manufacturers including Albatross USA (Everblum Gold Cleaning Fluid and S.P.I.F. II Ink Remover) and Pettyjohn's Solutions® (Homerun Cleaning Fluid) (EPA, 2017a).

3.5 Other Uses

In addition to the primary uses listed above, 1-BP is used in a number of smaller applications. These applications include: non-pesticidal agricultural products, insulation, lubricants/cutting oils, mold cleaning and release agents, refrigerant flush, temperature indicators, asphalt production, and use as a chemical intermediate (EPA, 2017a).

Products include THERMAX XARMOR™ insulation from the Dow Chemical Company; Cutting Oil, NFC Mold Cleaner, Resin Remover, Thermoset Mold Release, Quick Paintable Mold Release, and Quick Silicone Mold Release from Slide Products; Silicone Mold Release from CRC Industries; Johnsen's® Premium A/C Flush Non-Flammable; and OmegaLaq® Green (EPA, 2017a).

Table 3-1: 2016 CDR Industrial Use Data for 1-BP

Manufacturing Site	Type of Processing	Industrial Use Data		
		Sector	Industrial Use	% of Prod. Vol.
Albemarle Corporation (South Plant)	Processing as a reactant	All Other Basic Inorganic Chemical Manufacturing	Intermediates	1
	Processing - incorporation into formulation, mixture, or reaction product	All Other Chemical Product and Preparation Manufacturing	Solvents (for cleaning or degreasing)	41
	Processing - repackaging	All Other Chemical Product and Preparation Manufacturing	Solvents (for cleaning or degreasing)	40
	Use - non-incorporative activities	Fabricated Metal Product Manufacturing	Solvents (for cleaning or degreasing)	41
CBI	Processing - incorporation into formulation, mixture, or reaction product	Agriculture, Forestry, Fishing and Hunting	Agricultural chemicals (non pesticidal)	100
CBI	ND	ND	ND	ND
Custom Synthesis, LLC	Processing - incorporation into formulation, mixture, or reaction product	Electrical Equipment, Appliance, and Component Manufacturing	Solvents (for cleaning or degreasing)	100
Chemtura Corporation (Great Lakes Chemical – Central)	Processing as a reactant	All Other Basic Organic Chemical Manufacturing	Intermediates	50
	Processing as a reactant	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	Intermediates	25
	Processing - incorporation into formulation, mixture, or reaction product	Soap, Cleaning Compound, and Toilet Preparation Manufacturing	Solvents (for cleaning or degreasing)	25
ICL-IP America Inc.	Processing - incorporation into formulation, mixture, or reaction product	Computer and Electronic Product Manufacturing	Solvents (for cleaning or degreasing)	100
MC International, LLC	Processing - incorporation into formulation, mixture, or reaction product	Adhesive Manufacturing	Solvents (which become part of product formulation or mixture)	100
	Processing - incorporation into article	Construction	Solvents (which become	100

Manufacturing Site	Type of Processing	Industrial Use Data		
		Sector	Industrial Use	% of Prod. Vol.
			part of product formulation or mixture)	
Phoenix Chemical Company	Processing - repackaging	NKRA	NKRA	100
Superior Oil Company, Inc.				
Wego Chemical and Mineral Corp.	Processing - incorporation into formulation, mixture, or reaction product	Services	Solvents (for cleaning or degreasing)	100

ND = No Data; the company did not provide the requested information; NKRA = Not known or reasonably ascertainable.
Source: EPA, 2017c

Table 3-2: 2016 Commercial and Consumer Use Data for 1-BP

Manufacturing Site	Commercial and Consumer Use Data		
	Commercial or Consumer Use	CDR Product Category	% of Prod. Vol.
Albemarle Corporation (South Plant)	N/A	N/A	N/A
CBI	NKRA	Agricultural products (non pesticidal)	100
CBI	Commercial	Other (industrial cleaning solvent)	100
Custom Synthesis, LLC	Commercial	Electrical and electronic products	50
	Commercial	Metal products not covered elsewhere	50
Chemtura Corporation (Great Lakes Chemical – Central)	N/A	N/A	N/A
ICL-IP America Inc.	Commercial	Electrical and electronic products	100
MC International, LLC	Both	Adhesives and sealants	NKRA
Phoenix Chemical Company	N/A	N/A	N/A
Superior Oil Company, Inc.	N/A	N/A	N/A
Wego Chemical and Mineral Corp.	Commercial	Cleaning and Furniture Care Products	100

N/A = Not applicable; NKRA = Not known or reasonably ascertainable.
Source: EPA, 2017c

4. Market Trends

In July 2013, U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) and the National Institute for Occupational Safety and Health (NIOSH) issued a hazard alert to urge employers that use 1-BP to take appropriate steps to protect workers from exposure (DOL, 2013). According to OSHA reports, 1-bromopropane usage has increased over the past 20 years due to new industrial applications involving its use as a substitute for ozone-depleting chemicals or suspect carcinogens (NTP, 2016; OSHA, 2013). However, it is not clear from these reports which industrial sectors are seeing increases in 1-BP uses. For example, these increases may be in the dry-cleaning industry in response to states considering and pursuing actions to ban the use of tetrachloroethylene (Perc) (NTP, 2013 and DOD, 2013). 1-BP use may also be increasing as a result of regulations on trichloroethylene (TCE) (NY Times, 2013 and DOD, 2013), as 1-BP is an effective drop in substitute for TCE is solvent and vapor degreasing applications (TURI, 2011). The sections below discuss the available market data for 1-BP use in vapor degreasers, spray adhesives, and aerosol solvents.

4.1 Vapor Degreasers

In the 1980s and early 1990s, 1,1,1-trichloroethane (also known as methyl chloroform or TCA), methylene chloride, and CFC-113 were the dominant solvents used in vapor degreasing (TURI, 1996). However, both methyl chloroform and CFC-113 were phased-out in 1996 to comply with the Montreal Protocol. Furthermore, methylene chloride is a suspected carcinogen and is considered a hazardous air pollutant under the 1991 Clean Air Act Amendments (TURI, 1996). As part of EPA's Significant New Alternatives Policy (SNAP) Program, EPA issued a final rule in 2007 determining 1-BP to be an acceptable substitute to methyl chloroform and CFC-113 in the solvent cleaning sector in industrial equipment for metals cleaning, electronics cleaning, or precision cleaning (EPA, 2013a). 1-BP is a drop-in substitute for TCA and TCE in vapor degreasing and therefore regulatory restrictions on those two chemicals could lead to a significant increase in the use of 1-BP in vapor degreasing.

4.2 Spray Adhesives

Global demand volume for adhesives and sealants increased by 2.8% in 2012 and was expected to grow at a rate of 3.5-4% through 2013 (FEICA, 2013). Approximately 100 to 280 businesses in the adhesives, coatings, and ink sector used 1-BP-based products in 2002 (EPA, 2007). Users of 1-BP adhesives tend to be small businesses, as they often do not possess the resources to undergo fire-proofing to accompany cheaper but flammable adhesive alternatives (EPA, 2007). Volume estimates of 1-BP adhesives ranged from less than 1.5 million pounds to 2 million pounds per year (Tattersall, 2005 as cited in EPA, 2007; Kenyon, 2001 as cited in EPA, 2007). Note that these estimates do not necessarily pertain to solely spray adhesives.

TCA had been the dominant adhesive before being phased out by the Montreal Protocol in 1990 (Adams, 2008). Alternatives to TCA include water-based adhesives and methylene chloride. However, water-based adhesives perform poorly and methylene chloride is subject to strict OSHA TWA exposure limits (Adams, 2008). 1-BP gained popularity as an alternative to both of these options because it is non-flammable, fast-drying, and works well in foam-fabricating formulations (Adams, 2008).

In 2007, EPA proposed to list 1-BP as an unacceptable alternative to CFC-113 and TCA for adhesive solvents (EPA, 2013a). Furthermore, many in the industry have voluntarily halted use of 1-BP, including

Protonique, Great Lakes, and Atofina (Urbina, 2013). Current production and use data for 1-BP spray adhesives could not be found.

4.3 Aerosol Solvents

An estimated 1,000 to 5,000 businesses used 1-BP-based aerosol solvents in 2002 (EPA, 2007). The Consumer Specialty Products Association (CSPA) conducted a survey of 29 member businesses that use 1-BP-based aerosol solvent products and estimated that 690,900 pounds of aerosol solvents were sold by 8 companies per year (CSPA, 2007). CSPA acknowledged that although this figure did not represent the entire market, it did capture a significant portion of 1-BP industrial aerosol products (CSPA, 2007). This figure was consistent with EPA estimates of 0.5-2 million pounds of 1-BP aerosols sold per year (Tattersall, 2005 as cited in EPA, 2007; Kenyon, 2001 as cited in EPA, 2007). The Halogenated Solvents Industry Association estimated in 2010 that 1-BP solvents in the U.S. were growing at a rate of 15-20% per year (HSIA, 2010). Note that it is unclear whether this estimate refers to just aerosol solvents, or all cleaning solvents.

CFC-113 has historically been the dominant cleaning solvent (ICF, 2004). However, CFCs were phased out in 1996 under the Montreal Protocol (EPA, 2010a). In 2007, EPA proposed to list 1-BP as an unacceptable substitute for ozone-depleting substances, including CFC-113, in aerosol solvent applications (EPA, 2013a). Many industry members have also voluntarily discontinued use of 1-BP as an aerosol solvent due to potential health risks, including Atofina, Great Lakes Chemical, and Honeywell (EIA, 2003). Current production and use of 1-BP aerosol solvents is unclear; in 2017 Enviro Tech estimated that yearly use of 1-BP in solvent uses was less than 1.8 million pounds per year (Enviro Tech, 2017b).

4.4 Dry Cleaning Solvents

1-BP is considered a drop-in replacement for perc in existing dry cleaning machinery (TURI, 2012). Perc has historically been the standard dry cleaning solvent due to its effectiveness, ease of use, and relatively low cost (TURI, 2012). However, perc is a toxic chemical and its use is associated with human health and environmental concerns. The chemical is a likely human carcinogen and causes reproductive, developmental, and neurological effects in humans. As a result of these factors, many states have taken action to manage perc's use in dry cleaning (EPA, 2012). It is likely that these regulations have helped drive the switch to 1-BP for many dry cleaners, which has led to increased use of the chemical.

At the end of 2007, the California Air Resources Board (CARB) passed the Airborne Toxic Control Measure for Emissions of Perchloroethylene (Perc) from Dry Cleaning Operations (Dry Cleaning ATCM) into law. The Dry Cleaning ATCM requires all perc dry cleaning facilities in California with machines at co-residential facilities to be removed by January 1, 2023 (CARB, 2009). The law also requires perc dry cleaning machines that are 15 years or older to be removed by 2023 beginning July 1, 2010. Literature provided to affected dry cleaning facilities by CARB listed 1-BP as one of the seven available perc alternatives (CARB, 2009).

Although California is the only state with a perc ban currently in place, other states have taken action to restrict the use of perc in dry cleaning operations. Illinois is currently considering an amendment to its Environmental Protection Act to eliminate perc dry cleaning machines by 2030. The bill was passed by the Illinois State Senate in 2011 and is now being debated in the House (Illinois General Assembly,

2012). Perc bans have also been proposed in New Jersey and New York. In 2007, the New Jersey Department of Environmental Protection proposed an amendment to the Control and Prohibition of Air Pollution and Toxic Substances to eliminate the use of perc by 2021 (NJ DEP, 2007). New York also announced legislation in 2007 to ban perc use in dry cleaning (Smith, 2007). However, the legislation in both of these states has not proceeded since the initial announcements. Although only some states have passed or proposed perc bans, many states have tightened requirements pertaining to perc dry cleaning, such as stricter reporting and inspection standards and increased fees for perc purchases. On the national level, the use of perc in co-residential dry cleaning facilities is being phased out by 2020 as a result of the National Perchloroethylene Air Emission Standards for Dry Cleaning Facilities issued in 2006 (EPA, 2006).

Information on recent 1-BP market trends was located in literature distributed by the dry cleaning industry. Articles published by American Drycleaner as well as Laundry and Cleaning News International were utilized to help profile the industry's current climate on 1-BP use. Abt Associates did not directly contact trade associations or manufacturers to retrieve market information, as we wanted technical direction from EPA before doing so.

It is likely that very few dry cleaning establishments in the United States use 1-BP as a dry cleaning solvent. According to figures from the Drycleaning and Laundry Institute (DLI) cited in 2009, only about 50 dry cleaning systems in the United States are using DrySolv® compared to 70% of the market that still uses perc, 27% using hydrocarbon, and 2% using GreenEarth (Vince, 2009).¹ In a recent comment, Enviro Tech (the maker of DrySolv®) estimated that fourteen or less dry cleaning establishments use 1-BP as dry cleaning solvent (Enviro Tech, 2017b). State level dry cleaning trends of 1-BP use are captured under the Massachusetts Department of Environmental Protection (MassDEP)'s Environmental Results Program. From 2008 to 2011, it was reported that 13 of the 51 cleaners under the program indicated that they have eliminated the use of perc and have switched to 1-BP (TURI, 2012).

Findings from a survey conducted by AmericanDrycleaner.com about dry cleaning solvent systems in 2014 found that no respondents used DrySolv (Beggs, 2012). The other solvents reported as used by respondents were perc (69.9%), high-flash point hydrocarbon (23.7%), GreenEarth (6.5%), liquid CO₂ (2.2%), Solvair (1.1%), and other (15.1%) (Beggs, 2012). A previous survey in 2012 by AmericanDrycleaner.com indicated that 1.1% of respondents used DrySolv® (Beggs, 2012). Note that the survey is not necessarily representative of the entire dry cleaning industry because many dry cleaners speak English as a second language and therefore neither read nor are surveyed by English-language publications.²

¹ In a 2017 comment, DLI estimated that 60% of the dry cleaning market used perc as a dry cleaning solvent. Use of 1-BP as dry cleaning solvent was not mentioned and is likely very low (DLI/NCA, 2017).

² In a survey of King County (Seattle), WA dry cleaners, Whittaker and Johanson found that over 80% of dry cleaners in King County were Korean (Whittaker and Johanson, 2011)

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Use and Market Profile for Carbon Tetrachloride

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Table of Contents

1.	Introduction	1
1.1	Overview of Carbon Tetrachloride	1
1.2	Historical Use of Carbon Tetrachloride	1
1.3	Existing Regulations	3
1.4	Montreal Protocol	4
2.	Production and Producers	5
2.1	Current U.S. Production Volume	5
2.2	Historical U.S. Production Volume	5
2.3	U.S. Facility and Company-Level Production Data.....	5
2.3.1	Chemical Data Reporting	5
2.3.2	Toxics Release Inventory	6
2.3.3	Other Facilities That May Produce Carbon Tetrachloride	7
3.	Use Information and Market Trends.....	9
3.1	Historical Use.....	9
3.2	Use Information from 2012 CDR	10
4.	Toxic Release Inventory	14
5.	National Emissions Inventory.....	22
6.	References	24
	Appendix 1: Reported Activities and Uses on TRI Form R.....	25

List of Tables and Appendices

Table 1: Chemical Name, Synonyms, and CASRN.....	1
Table 2: Federal Regulations and Guidelines Concerning Carbon Tetrachloride	3
Table 3: U.S. Production of Carbon Tetrachloride (million lb).....	Error! Bookmark not defined.
Table 4: National Production Volume Data for Carbon Tetrachloride from 1986-2012 (pounds).....	5
Table 6: 2012 CDR Production Volume Data for Carbon Tetrachloride (Pounds)	6
Table 7: 2014 Select TRI Manufacturers and Importers of Carbon Tetrachloride	7
Table 8: 2012 CDR Use and Production Data for Carbon Tetrachloride	11
Table 9: Facilities Manufacturing Carbon Tetrachloride Derivatives (2012 CDR).....	13
Table 11: Summary of 2014 TRI Activity or Use by Number of Facilities for Carbon Tetrachloride.....	15
Table 12: Summary of 2014 NAICS Codes Associated with Carbon Tetrachloride.....	15
Table 13: Detailed 2014 TRI Activity or Use for Carbon Tetrachloride by Facility.....	17
Table 14: Summary of 2014 NEI Carbon Tetrachloride Emissions Including Top Industry Sectors and Facilities	22

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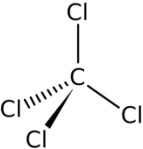
1. Introduction

Carbon tetrachloride is the subject of this use and market profile. This report provides an overview (Section 1), U.S. producers, production, and import volume (Section 2), use information and market trends (Section 3), and Toxic Release Inventory data (Section 4) for this chemical.

1.1 Overview of Carbon Tetrachloride

Carbon tetrachloride (CCl₄) is a colorless, sweet-smelling organic compound that is primarily used as a feedstock to manufacture hydrofluorocarbon (HFC) and hydrofluoroolefin (HFO) refrigerants, including HFC-245fa, HFC-365mfc (UNEP, 2016a) and HFO-1234yf/ze (IHS Chemical, 2016a). Carbon tetrachloride has minor laboratory, petroleum refining, and pharmaceutical manufacturing applications (NTP, 2016). Key identification details of carbon tetrachloride are listed in Table 1.

Table 1: Chemical Name, Synonyms, and CASRN

CAS RN	56-23-5
Synonyms	Benziform, Carbon chloride, Carbon tet, Methane tetrachloride, Methane, tetrachloro-, Methyl tetrachloride, Perchloromethane, Tetrachloromethane (IUPAC)
Molecular Formula	CCl ₄
Structure	
Trade Names	Benzinoform, Carbona, Fasciolin, Flukoids, Freon 10, Halon 1040, Necotorina, Necatorine, R 10 (refrigerant), Tetrafinol, Tetraform, Tetrasol, Univerm, Vermoestricid
Source:	NLM (n.d.)

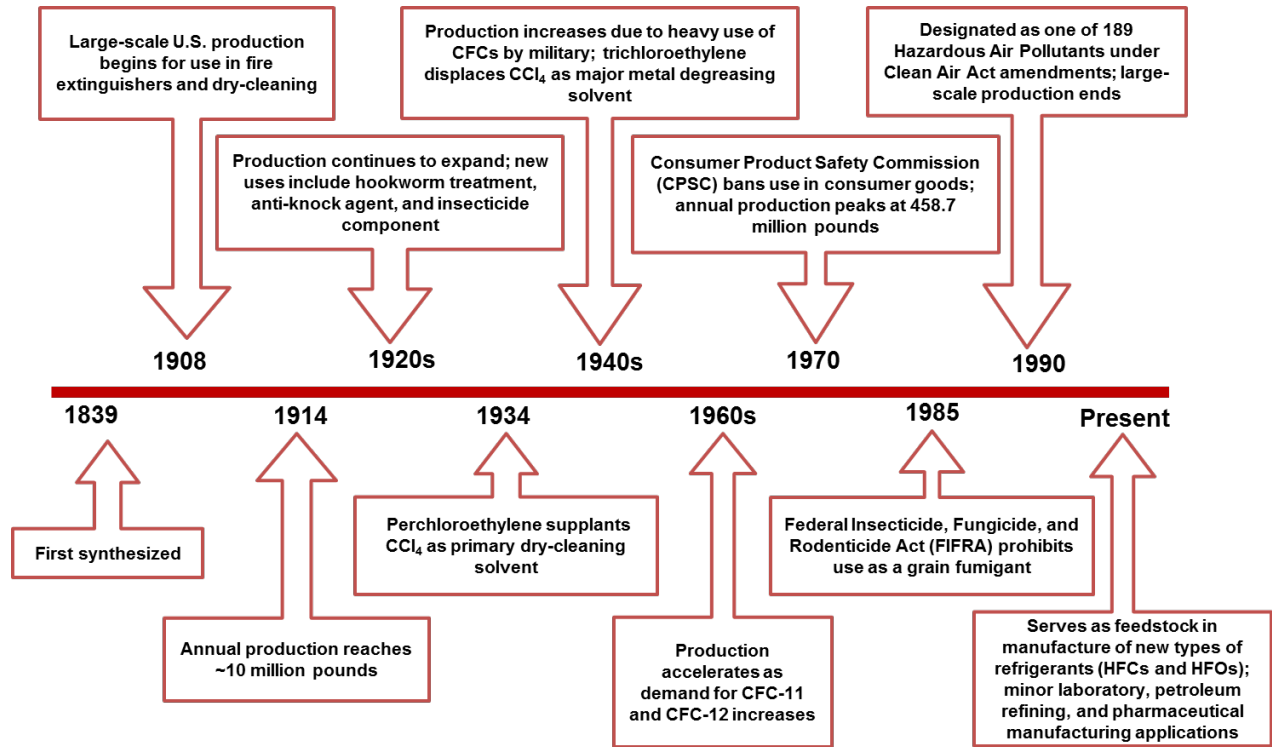
1.2 Historical Use of Carbon Tetrachloride

Carbon tetrachloride was first synthesized in 1839 by the French chemist Henri Victor Regnault in the reaction of chloroform with chlorine in sunlight. Large scale production in the U.S. began by Warner Chemical and Dow Chemical in 1908. Its first major industrial or commercial uses were as a fire extinguisher fluid and dry-cleaning solvent. Carbon tetrachloride served as a metal degreaser and solvent in the production of rubber as well (Doherty, 2000; Holbrook, 2000).

In the 1950s, the most important use of carbon tetrachloride became as a feedstock in the production of chlorofluorocarbon (CFC) refrigerants (Doherty, 2000). Other historical uses included as a grain fumigant, anti-knock agent in gasoline, hookworm treatment, anesthetic, insecticide component, and industrial solvent (Hall, 1921; Hardin, 1954; Daft, 1991; Doherty, 2000). Due to its potential to cause adverse health effects, carbon tetrachloride and mixtures containing it were banned from consumer products by the Consumer Product Safety Commission (CPSC) in 1970 (Holbrook, 2000). Production of carbon tetrachloride continued to decline with the implementation of the Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol) through the 1990 Clean Air Act amendments, which banned carbon tetrachloride's emissive uses and phased out CFCs for all but explicitly permitted uses

(Doherty, 2000). Figure 1 summarizes key events associated with carbon tetrachloride and its uses over time.

Figure 1: Carbon Tetrachloride Timeline



Source: Doherty (2000); Holbrook (2000)

1.3 Existing Regulations on Carbon Tetrachloride

Many U.S. Federal agencies have issued regulations or guidelines concerning carbon tetrachloride. Table 2 summarizes these regulations as of 2016.

Table 2: Federal Regulations and Guidelines Concerning Carbon Tetrachloride

Agency or Regulation	Description of Regulation or Guideline
Coast Guard, Department of Homeland Security	Minimum requirements have been established for safe transport of carbon tetrachloride on ships and barges.
Consumer Product Safety Commission (CPSC)	Carbon tetrachloride and mixtures containing it (with the exception of chemicals containing unavoidable residues of carbon tetrachloride that do not result in atmospheric concentrations of carbon tetrachloride greater than 10 ppm) are banned from consumer products.
Department of Transportation (DOT)	Carbon tetrachloride is considered a hazardous material and marine pollutant, and special requirements have been set for marking, labeling, and transporting this material.
Clean Air Act (EPA)	<i>National Emission Standards for Hazardous Air Pollutants:</i> Listed as a hazardous air pollutant. <i>New Source Performance Standards:</i> Manufacture of carbon tetrachloride is subject to certain provisions for the control of volatile organic compound emissions. <i>Urban Air Toxics Strategy:</i> Identified as one of 33 hazardous air pollutants that present the greatest threat to public health in urban areas. Carbon tetrachloride is regulated as a Class I substance for stratospheric ozone protection.
Clean Water Act (EPA)	<i>Effluent Guidelines:</i> Listed as a toxic pollutant. <i>Water Quality Criteria:</i> Based on fish or shellfish and water consumption = 0.4 µg/L; based on fish or shellfish consumption only = 5 µg/L. Designated a hazardous substance.
Comprehensive Environmental Response, Compensation, and Liability Act (EPA)	Reportable quantity (RQ) = 10 lb.
Emergency Planning and Community Right-To-Know Act (EPA)	<i>Toxics Release Inventory:</i> Listed substance subject to reporting requirements.
Federal Insecticide, Fungicide, and Rodenticide Act	All registrations for use as a pesticide have been cancelled.
Resource Conservation and Recovery Act (EPA)	<i>Characteristic Hazardous Waste:</i> Toxicity characteristic leaching procedure (TCLP) threshold = 0.5 mg/L. <i>Listed Hazardous Waste:</i> : Waste codes for which the listing is based wholly or partly on the presence of carbon tetrachloride = U211, F001, F024, F025, K016, K019, K020, K021, K073, K116, K150, K151, K157. Listed as a hazardous constituent of waste.
Safe Drinking Water Act (EPA)	Maximum contaminant level (MCL) = 0.005 mg/L.

Agency or Regulation	Description of Regulation or Guideline
Food and Drug Administration (FDA)	Maximum permissible level in bottled water = 0.005 mg/L. All medical devices containing or manufactured with carbon tetrachloride must contain a warning statement that the compound may destroy ozone in the atmosphere.
Mine Safety and Health Administration	Carbon tetrachloride use is banned in metal and non-metal surface and underground mines.
Occupational Safety and Health Administration (OSHA)	While this section accurately identifies OSHA's legally enforceable PELs for this substance in 2010, specific PELs may not reflect the more current studies and may not adequately protect workers. Permissible exposure limit (PEL) = 10 ppm. Ceiling concentration = 25 ppm. Acceptable peak exposure = 200 ppm (maximum duration = 5 min in any 4 h). Carbon tetrachloride cannot be used as a fire extinguishing agent where employees may be exposed.
American Conference of Governmental Industrial Hygienists (ACGIH)	Threshold limit value – time-weighted average (TLV-TWA) = 5 ppm. Threshold limit value – short-term exposure limit (TLV-STEL) = 10 ppm. Potential for dermal absorption.
National Institute for Occupational Safety and Health (NIOSH)	Short-term exposure limit (STEL) = 2 ppm (12.6 mg/m ³) (60-min exposure). Immediately dangerous to life and health (IDLH) limit = 200 ppm. Listed as a potential occupational carcinogen.
Source: NTP (2016)	

1.4 Montreal Protocol

Carbon tetrachloride is also regulated under the Montreal Protocol because of its classification as an ozone-depleting substance (ODS). Enacted in 1987, this international treaty aims to protect the ozone layer by phasing out ODS. Member countries, including the U.S., were required to have a 100 percent reduction in the production and consumption of carbon tetrachloride by January 1, 1996, with possible exemptions (UNEP, 2016b). Exemptions may include use as a feedstock, used substances (recovered and reclaimed), essential uses, and others listed in the *Handbook on Data Reporting under the Montreal Protocol* (1999).

2. Production and Producers

This section examines current and historical U.S. production volume of carbon tetrachloride and facility level data for manufacturers of carbon tetrachloride.

2.1 U.S. Production Volume

In the U.S., large-scale production of carbon tetrachloride began in 1908 (Doherty, 2000). By 1914, almost 10 million pounds were being produced annually (Doherty, 2000). Production is reported to have peaked in 1970 at 458.7 million pounds (Holbrook, 2000).

The subsections below provide historical and recent U.S. Production volume from publically available data from the 1986-2006 Inventory Update Reporting (IUR) rule and the 2012 Chemical Data Reportign (CDR) (reflecting 2011 production data).

2.1.1 IUR and CDR

Table 3 presents the historic U.S. production volume data for carbon tetrachloride submitted by companies under the non-confidential 1986, 1990, 1994, 1998, 2002, and 2006 Inventory Update Reporting (IUR) rule and the 2012 CDR (reflecting 2011 production data). While the reporting threshold for manufacturing information was 25,000 pounds for the 2006 IUR and 2012 CDR, the reporting threshold for manufacturing information was 10,000 pounds from 1986 to 2002.

Table 3: CDR U.S. Production Volume Data for Carbon Tetrachloride from 1986-2012 (lb)

1986	1990	1994	1998	2002	2006	2011
>500M – 1B	>500M – 1B	>100M – 500M	>100M – 500M	>100M – 500M	100M- <500M	149,927,241
Source: U.S. EPA (n.d.); U.S. EPA (2010); U.S. EPA (2014a)						

2.2 U.S. Import and Export Data

Imports of carbon tetrachloride fell from 242 million pounds in 1989 to 0 in 1996. On the export side, U.S. exports decreased from 116 million pounds in 1989 to 3.8 million pounds in 2008 (NTP, 2016).

Specific companies identified as importers of carbon tetrachloride include Dow Chemical Co, Enterprise Products (U.S. EPA, 2014b), and INEOS USA (U.S. EPA, 2014a).

2.3 U.S. Facility and Company-Level Production Data

2.3.1 Chemical Data Reporting

U.S. production volume data for carbon tetrachloride reported in the 2012 CDR is presented in Table 6 by producer for the years 2011 and 2010 (past). For the 2012 CDR, represented by the year 2011, nine facilities reported production volumes of carbon tetrachloride, three of which withheld their facility identity as confidential business information (CBI). Note that other sites may manufacture or import carbon tetrachloride but are not listed in the public CDR database because they claimed their production as CBI. Other sites might not be listed due to having had production volumes below the 25,000 lb annual

reporting threshold. CDR also provides exemption due to manufacturing carbon tetrachloride as an impurity with no commercial purpose and for non-isolated intermediates.

Table 4: 2012 CDR Production Volume Data for Carbon Tetrachloride (Pounds)

Company	Location	Manufactured Volume	Imported Volume	Past Production Volume (2010)
INEOS USA, LLC	Wilmington, DE	0	763,400	92,400
Shin-Etsu	Plaquemine, LA	2,480,599	0	1,293,461
Syngenta Corp	Saint Gabriel, LA*	CBI	0	CBI
The Dow Chemical Co	Freeport, TX*	CBI	0	CBI
The Dow Chemical Co	Pittsburg, CA*	CBI	0	CBI
The Dow Chemical Co	Plaquemine, LA*	CBI	0	CBI
CBI	CBI	CBI	CBI	CBI
CBI	CBI	CBI	CBI	CBI
CBI	CBI	CBI	CBI	CBI

CBI = confidential business information
 * = reported to import or manufacture carbon tetrachloride to TRI in RY2014
Source: U.S. EPA (2014a)

2.3.2 Toxics Release Inventory

In total, 27 U.S. facilities reported manufacturing or importing carbon tetrachloride to the TRI for Reporting Year (RY) 2014. A full list of all TRI reporters is provided in Table 13. Like CDR, TRI facilities must report manufacture of carbon tetrachloride above 25,000 lb per year (along with release and waste management data); however, TRI does not have an exemption for manufacture as an impurity or non-isolated intermediate.

A select list of TRI facilities that report producing or importing carbon tetrachloride is given in Table 7. These facilities are either matched to a CDR facility reporting carbon tetrachloride (in italics) or indicate a deliberate use on-site of carbon tetrachloride. These deliberate uses include:

- Processing as a reactant;
- Processing as a formulation component;
- Processing as repackaging for further distribution;
- On-site use as a chemical processing aid; or
- On-site use as a manufacturing aid.

**Table 5: 2014 Select TRI Manufacturers and Importers of Carbon Tetrachloride
(Facilities in italics are matched to 2012 CDR reporting for carbon tetrachloride)**

Facility ¹	Maximum Amount On-Site (lb)	Manufacturing Activities	Processing and Otherwise Use
Occidental Chemical Holding Corp - Geismar Plant Occidental Chemical Holding Corp Geismar, LA 70734	50,000,000- 99,999,999	Produce, Used Processed, Sale Distribution, Byproduct	Reactant, Manufacture Aid
<i>Dow Chemical Co The Dow Chemical Co Pittsburg, CA 94565</i>	<i>10,000,000- 49,999,999</i>	<i>Produce, Used Processed, Byproduct</i>	<i>Reactant, Chemical Processing Aid, Manufacture Aid</i>
Occidental Chemical Corp Occidental Chemical Holding Corp Wichita, KS 67215	1,000,000- 9,999,999	Produce, Used Processed, Sale Distribution	Repackaging, Ancillary
<i>The Dow Chemical Co - Louisiana Operations The Dow Chemical Co Plaquemine, LA 70764</i>	<i>1,000,000- 9,999,999</i>	<i>Produce, Used Processed, Sale Distribution, Byproduct, Manufacture Impurity</i>	<i>Reactant, Chemical Processing Aid, Ancillary</i>
Westlake Vinyls Inc Westlake Chemical Corp Calvert City, KY 42029	1,000,000- 9,999,999	Produce, Used Processed	Reactant, Ancillary
<i>Dow Chemical Co Freeport Facility The Dow Chemical Co Freeport, TX 77541</i>	<i>1,000,000- 9,999,999</i>	<i>Produce, Imported, Byproduct, Manufacture Impurity</i>	<i>Reactant, Process Impurity, Chemical Processing Aid, Ancillary</i>
Enterprise Products Operating LLC Enterprise Products Operating LLC Mont Belvieu, TX 77580	100,000- 999,999	Imported, Used Processed	Chemical Processing Aid
Formosa Plastics Corp Texas Formosa Plastics Corp USA Point Comfort, TX 77978	100,000- 999,999	Produce, Used Processed, Manufacture Impurity	Formulation Component, Process Impurity
<i>Syngenta Crop Protection LLC Saint Gabriel Facility Syngenta Corp Saint Gabriel, LA 70776</i>	<i>100,000- 999,999</i>	<i>Produce, Byproduct</i>	<i>Chemical Processing Aid</i>
Dover Chemical Corp ICC Industries Inc Dover, OH 44622	100,000- 999,999	Produce, Manufacture Impurity	Manufacture Aid
Oxy Vinyls LP La Porte VCM Plant Occidental Chemical Holding Corp La Porte, TX 77571	10,000- 99,999	Produce, Byproduct	Reactant, Manufacture Aid
Westlake Vinyls Co Westlake Chemical Corp Geismar, LA 70734	1,000- 9,999	Produce, Sale Distribution, Byproduct, Manufacture Impurity	

2.3.3 Other Facilities That May Produce Carbon Tetrachloride

While facilities are able to claim CBI to withhold their identity for public releases of CDR data, other publicly available resources may be used to identify facilities that deliberately manufacture and use or sell

chemicals. For example, such a facility may be identified using TRI data if they have reported significant maximum amounts of on-site quantities and/or deliberate uses including:

- manufacture for sale or distribution;
- processing as a reactant; or
- repackaging for distribution into commerce.

Company publications, such as sustainability reports, safety data sheets (SDS), and product details, may also indicate manufacture or sale of a chemical. This section explores other facilities that are not identified through the public CDR data..

Occidental Chemical Holding Corp

Three facilities owned by Occidental Chemical Holding reported manufacturing carbon tetrachloride to TRI in 2014 but were not matched to any 2012 CDR facilities publicly reporting carbon tetrachloride:

- Occidental Chemical Holding Corp - Geismar Plant; Geismar, LA 70734
 - Maximum amount on-site: 50,000,000 - 99,999,999 lb
 - Produce, Used Processed, Sale Distribution, Byproduct, Reactant, Manufacture Aid
- Occidental Chemical Corp; Wichita, KS 67215
 - Maximum amount on-site: 1,000,000 - 9,999,999 lb
 - Produce, Used Processed, Sale Distribution, Repackaging, Ancillary
- Oxy Vinyls LP La Porte VCM Plant; La Porte, TX 77571
 - Maximum amount on-site: 10,000 - 99,999 lb
 - Produce, Byproduct, Reactant, Manufacture Aid

Company publications strongly support that Occidental Chemical Holding Corp is a primary producer and supplier of carbon tetrachloride.

- “OxyChem produces one grade of carbon tetrachloride as Technical Grade manufactured at both Wichita, KS and Geismar, LA facilities”(OxyChem, 2014).
- “OxyChem manufactures carbon tetrachloride at facilities in Geismar, Louisiana and Wichita, Kansas” (OxyChem, 2013).

Based on TRI and company publications, the Geismar Plant and Wichita facility appear to be primary manufacturers of carbon tetrachloride.

Formosa Plastics Corp USA

One facility owned by Formosa Plastics Corp USA reported manufacturing carbon tetrachloride in 2012 but was not matched a 2012 CDR facility publicly reporting carbon tetrachloride:

- Formosa Plastics Corp Texas; Point Comfort, TX 77978
 - Maximum amount on-site: 100,000 - 999,999 lb
 - Produce, Used Processed, Manufacture Impurity, Formulation Component, Process Impurity

An MSDS for ‘light ends, wet’ indicates that carbon tetrachloride is present at a 10-20% concentration in a mixture manufactured by this facility (Formosa Plastics Corporation, 2007).

Westlake Chemical Corp

Two facilities owned by Westlake Chemical Corp reported manufacturing carbon tetrachloride to TRI in 2014, but were not matched to any 2012 CDR facilities reporting carbon tetrachloride:

- Westlake Vinyls Inc; Calvert City, KY 42029
 - Maximum amount on-site: 1,000,000- 9,999,999
 - Produce, Used Processed, Reactant, Ancillary
- Westlake Vinyls Co; Geismar, LA 70734
 - Maximum amount on-site: 1,000 - 9,999
 - Produce, Sale Distribution, Byproduct, Manufacture Impurity

An MSDS describes an EDC (ethylene dichloride) intermediate feedstock that contains 2-50% carbon tetrachloride (Westlake Chemical, 2015). TRI reporting indicates that carbon tetrachloride is produced for sale and distribution by the Geismar facility; however, no secondary sources confirm that Westlake Chemical Corp supplies carbon tetrachloride. Thus, it is possible that one or both of the Westlake Chemical Corp facilities are listed as CBI in 2012 CDR.

ICC Industries/Dover Chemical Corp

One facility owned by ICC Industries reported manufacturing carbon tetrachloride in 2012 but was not matched to a 2012 CDR facility publicly reporting carbon tetrachloride:

- Dover Chemical Corp; Dover, OH 44622
 - Maximum amount on-site: 100,000- 999,999
 - Produce, Manufacture Impurity Manufacture Aid

In 2014, the Dover Chemical Corp plant released “heavy chlorinated wax material that contains carbon tetrachloride as a byproduct” (Mizer, 2014). Further, a National Pollutant Discharge Elimination System (NPDES) permit for the facility allows for loading of carbon tetrachloride (Ohio EPA, 2015). Given that the facility reports use as a manufacturing aid, it is unlikely that ICC Industries supplies carbon tetrachloride.

3. Use Information and Market Trends

The primary use of carbon tetrachloride is as a chemical feedstock for the production of chlorinated and fluorinated compounds. Other minor known uses include use as an industrial solvent and in pharmaceutical manufacturing, agrochemical processes, petroleum refining, laboratory applications, and fats, oils, and rubber processing (OxyChem, 2013; NTP, 2016).

3.1 Historical Use

In the 1950s, the percentage use of carbon tetrachloride by sector was as follows: CFC production (50%), metal cleaning (15%), grain fumigation (7%), dry-cleaning (5%), and other uses (23%). CFC production took over more of the market once the use of carbon tetrachloride in consumer products and grain fumigants was banned. By the 1990s, CFC production accounted for 98% of the total demand of carbon tetrachloride (Doherty, 2000).

With the enactment of the Montreal Protocol, production and consumption of carbon tetrachloride were expected to be virtually eliminated. However, carbon tetrachloride is now being used as a feedstock to

make new types of refrigerants that do not deplete the ozone layer, such as HFC-245fa, HFC-365mfc, and HFO-1234y. As previously mentioned, the use of ODS as a feedstock may be permitted under the Montreal Protocol, assuming the ODS are totally transformed in the process. In 2014, carbon tetrachloride made up 18.3% of ozone-depleting substances used as feedstock by countries that are part of the Montreal Protocol (UNEP, 2016a).

3.2 Use Information from 2012 CDR

Table 8 shows the industrial uses of carbon tetrachloride from 2012 CDR data (U.S. EPA, 2014a). Types of processing and industrial uses include:

- Processing as a reactant:
 - Intermediates
 - Process regulators
- Use-non-incorporative activities:
 - Processing aids, not otherwise listed
 - Not known or reasonably ascertainable
 - Laboratory chemicals

Reported sectors processing or using carbon tetrachloride include:

- All Other Basic Organic Chemical Manufacturing;
- All Other Chemical Product and Preparation Manufacturing; and
- Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing.

No consumer uses are listed in the CDR, in line with the prohibition of carbon tetrachloride in products intended for home use (HSDB, 2014).

Table 6: 2012 CDR Use and Production Data for Carbon Tetrachloride

Manufacturing Site	Type of Processing	Industrial Use Data		
		Sector	Industrial Use	Percent of Production Volume
Dow Chemical Co Freeport Facility The Dow Chemical Co 2301 N Brazosport Blvd Freeport, TX 77541	Use-non-incorporative activities	All Other Basic Organic Chemical Manufacturing	Processing aids, not otherwise listed	1
	Processing as a reactant	All Other Basic Organic Chemical Manufacturing	Intermediates	100
Dow Chemical Co The Dow Chemical Co 901 Loveridge Rd Pittsburg, CA 94565	Processing as a reactant	All Other Basic Organic Chemical Manufacturing	Intermediates	100
The Dow Chemical Co - Louisiana Operations The Dow Chemical Co 21255 La Hwy 1 S Plaquemine, LA 70764	Use-non-incorporative activities	All Other Basic Organic Chemical Manufacturing	Processing aids, not otherwise listed	100
INEOS USA, LLC 2036 Foulk Rd Suite 204 Wilmington, DE 19810	Processing as a reactant	All Other Chemical Product and Preparation Manufacturing	Intermediates	100
Shin-Etsu 26270 Highway 405, River Rd South Plaquemine, LA 70764	Use-non-incorporative activities	All Other Chemical Product and Preparation Manufacturing	Not known or reasonably ascertainable	100
Syngenta Crop Protection LLC Saint Gabriel Facility Syngenta Corp 3905 Hwy 75 Saint Gabriel, LA 70776	Use-non-incorporative activities	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	Processing aids, not otherwise listed	100
CBI	Processing as a reactant	CBI	Intermediates	CBI
CBI	Processing as a reactant	All Other Basic Organic Chemical Manufacturing	Intermediates	100
CBI	Use-non-incorporative activities	CBI	Laboratory chemicals	CBI
		CBI	Process regulators	CBI
	Processing as a reactant	CBI	Intermediates	CBI
Source: U.S. EPA (2014a)				

3.3 Use as Feedstock

3.3.1 Derivatives Manufactured

The primary use of carbon tetrachloride is as a feedstock in the production of fluorinated compounds. Approximately 98% of carbon tetrachloride was used for CFCs production in the 1990s (Doherty, 2000) but it is now primarily used for the production of HFCs (IHS Chemical, 2016a). No evidence was found to suggest that more than 2% is currently being used for non-reactant uses.

Carbon tetrachloride may be used as a feedstock for making the following derivative chemicals. Note that alternate reaction pathways may be available for some, if not all, of these chemicals.

- HFC-245fa (1,1,1,3,3-pentafluoropropane, CAS: 460-73-1) (UNEP, 2016a);
- HFC-365mfc (1,1,1,3,3-pentafluorobutane, CAS: 406-58-6) (UNEP, 2016a);
- HFC-236fa (1,1,1,3,3,3-hexafluoropropane, CAS: 690-39-1) (UNEP, 2016a);
- HFO-1234yf (2,3,3,3-tetrafluoro-1-propene, CAS: 754-12-1) (IHS Chemical, 2016a);
- HFO-1234ze ((1E)-1,3,3,3-tetrafluoro-1-propene, CAS: 29118-24-9) (IHS Chemical, 2016a); and
- Perchloroethylene (Tetrachloroethene, CAS: 127-18-4) (UNEP, 2016a).

Although CFC-11 and CFC-12 were also identified as directly manufactured from carbon tetrachloride, they are now only manufactured in China for use as aerosol in metered dose inhalers. HFC and HFO derivatives are primarily used as refrigerants or foam propellants (IHS Chemical, 2016a).

3.3.2 Facilities Manufacturing Derivatives

All U.S. facilities reporting manufacture of known carbon tetrachloride derivatives are listed in Table 9. Numerous reaction routes are possible for some if not all chemicals above, so not all facilities manufacturing these chemicals will necessarily use carbon tetrachloride as a feedstock. Processing as a reactant was reported by seven TRI facilities (see Table 11) for RY2014; however, only three facilities of these seven facilities are identified in Table 9.

Table 7: Facilities Manufacturing Carbon Tetrachloride Derivatives (2012 CDR)

Company	Location	Manufactured Volume (lb)	Imported Volume
HFC-245a (CAS: 460-73-1)			
Honeywell International Inc	Geismar, LA	45,395,380	0
Rubicon	Geismar, LA	0	CBI
HFC-365mfc (CAS:406-58-6)			
Solvay America Inc	Houston, TX	CBI	CBI
HFO-1234yf (CAS: 754-12-1)			
Honeywell International Inc	Buffalo, NY	97,680	0
Honeywell International Inc	Danville, IL	0	29,080
HFC-236fa (CAS: 690-39-1)			
E I Du Pont De Nemours & Co	Wilmington, DE	0	CBI
HFO-1234ze (CAS: 29118-24-9)			
Honeywell International Inc	Buffalo, NY	1,726,730	0
Perchloroethylene (CAS: 127-18-4)			
Solvchem Inc	Pearland, TX	508,284	0
Shin Etsu	Plaquemine, LA	339,297	0
Trinternational Inc	Seattle, WA	0	29,100
Lord Corp	CBI	CBI	CBI
PPG Industries Inc	Lake Charles, LA	CBI	0
The Dow Chemical Co	Freeport, TX*	CBI	0
The Dow Chemical Co	Midland, MI*	0	CBI
The Dow Chemical Co	Plaquemine, LA*	CBI	0
CBI	CBI	CBI	CBI
CBI	CBI	CBI	CBI
CBI	CBI	CBI	CBI

* Facilities reporting 'processing as a reactant' for carbon tetrachloride activities to TRI in RY2014.

3.4 Other Uses

Carbon tetrachloride has limited other uses for which little information is available. Carbon tetrachloride is believed to be used as a solvent or processing aid. Use as a chemical or mechanical processing aid was reported by TRI facilities in the following sectors (see Table 12 and Table 13 for detailed information):

- Natural Gas Liquid Extraction (NAICS 211112)
- All Other Basic Organic Chemical Manufacturing (NAICS 325199)
- Pesticide and Other Agricultural Chemical Manufacturing (NAICS 325320)
- All Other Miscellaneous Chemical Product and Preparation Manufacturing (NAICS 325998)

Use as an article component was reported by one facility in Hazardous Waste Treatment and Disposal (NAICS 562211). Given the reporting facility disposes of hazardous waste, the reported activity likely is related to its waste treatment or disposal rather than indicating a deliberate use of carbon tetrachloride.

Use as a formulation component was reported by one facility in Plastics Material and Resin Manufacturing (NAICS 325211). However, the facility also indicated it was manufactured and processed as an impurity, so this use does not appear deliberate.

Small amounts of carbon tetrachloride are used in laboratory and analytical settings. Members of the Montreal Protocol voted to allow the production and consumption of carbon tetrachloride for these purposes in 1997 (Nordic Council of Ministers, 2003; U.S. EPA, 2016).

4. Toxic Release Inventory

Facilities manufacturing, processing, or otherwise using carbon tetrachloride are required to report releases to EPA's Toxic Release Inventory (TRI). For Reporting Year (RY) 2014, 41 facilities reported carbon tetrachloride, 40 using TRI Form R and 1 using TRI Form A¹.

A summary of the RY 2014 on-site activities and uses reported for carbon tetrachloride on TRI Form Rs is provided in Table 11. These data describe the manufacturing, processing, and otherwise use activities occurring at a facility with the chemical. Waste management quantities of carbon tetrachloride in RY2014 totaled 25.3 million lb (U.S. EPA, 2014b), including:

- 131,424 lb released to the environment;
- 4,057,035 lb used for energy recovery;
- 5,106,905 lb recycled; and
- 16,063,528 lb treated for destruction.

Appendix 1: Reported Activities and Uses on TRI Form R provides detail on the information reported on this section.

A summary of facilities reporting carbon tetrachloride by NAICS sector and their on-site activities and uses is provided in Table 12. Carbon tetrachloride was reported by 17 unique NAICS sectors, with the most common being All Other Basic Organic Chemical Manufacturing (325199) and Hazardous Waste Treatment and Disposal (562211) with nine facilities reporting in each sector.

Table 13 lists each RY 2014 TRI facility reporting carbon tetrachloride, the maximum amount of the chemical present at the facility per year, and the reported on-site activities and uses of carbon tetrachloride. The 'Facility' column is hyperlinked the corresponding RY 2014 report.

¹ The TRI Form R is the standard TRI reporting form that includes full details about releases, waste management, and on-site activities and uses. The TRI Form A is a shorted certification statement where reporters certify that total waste management including releases did not exceed 500 lb and does not include the same release, waste management or on-site activities and uses data.

Table 8: Summary of 2014 TRI Activity or Use by Number of Facilities for Carbon Tetrachloride

Activity	Category	Number of Facilities Reporting
Manufacture	Produce	26
	Imported	2
	Used Processed	8
	Sale Distribution	4
	Byproduct	18
	Manufacture Impurity	9
Process	Reactant	7
	Article Component	1
	Formulation Component	1
	Repackaging	2
	Process Impurity	3
Otherwise Use	Chemical Processing Aid	5
	Manufacture Aid	4
	Ancillary	18
Source: U.S. EPA (2014b)		

Table 9: Summary of 2014 NAICS Codes Associated with Carbon Tetrachloride

NAICS Code	NAICS Description	Number of TRI Facilities	Facilities Reporting On-Site Activities
211112	Natural Gas Liquid Extraction	1	Imported: 1 Used Processed: 1 Chemical Processing Aid: 1
212393	Other Chemical and Fertilizer Mineral Mining	1	Produce: 1 Manufacture Impurity: 1
321219	Reconstituted Wood Product Manufacturing	1	Produce: 1 Byproduct: 1
325110	Petrochemical Manufacturing	1	Produce: 1 Used Processed: 1 Byproduct: 1
325120	Industrial Gas Manufacturing	1	Reactant: 1

NAICS Code	NAICS Description	Number of TRI Facilities	Facilities Reporting On-Site Activities
325180	Other Basic Inorganic Chemical Manufacturing	2	Produce: 2 Used Processed: 1 Sale Distribution: 1 Byproduct: 1 Repackaging: 1 Ancillary: 1
325194	Cyclic Crude, Intermediate, and Gum and Wood Chemical Manufacturing	1	Produce: 1 Byproduct: 1
325199	All Other Basic Organic Chemical Manufacturing	9	Produce: 9 Imported: 1 Used Processed: 3 Sale Distribution: 2 Byproduct: 8 Manufacture Impurity: 2 Reactant: 5 Process Impurity: 1 Chemical Processing Aid: 2 Manufacture Aid: 2 Ancillary: 5
325211	Plastics Material and Resin Manufacturing	6	Produce: 6 Used Processed: 1 Sale Distribution: 1 Byproduct: 3 Manufacture Impurity: 4 Formulation Component: 1 Process Impurity: 2 Ancillary: 1
325320	Pesticide and Other Agricultural Chemical Manufacturing	3	Produce: 3 Used Processed: 1 Byproduct: 2 Manufacture Impurity: 1 Reactant: 1 Chemical Processing Aid: 2 Manufacture Aid: 1
325998	All Other Miscellaneous Chemical Product and Preparation Manufacturing	1	Produce: 1 Manufacture Impurity: 1 Manufacture Aid: 1
327310	Cement Manufacturing	1	Ancillary: 1
327992	Ground or Treated Mineral and Earth Manufacturing	1	Ancillary: 1
331410	Nonferrous Metal (except Aluminum) Smelting and Refining	1	Produce: 1 Byproduct: 1
424690	Other Chemical and Allied Products Merchant Wholesalers	1	<i>Not Reported (Form A)</i>

NAICS Code	NAICS Description	Number of TRI Facilities	Facilities Reporting On-Site Activities
562211	Hazardous Waste Treatment and Disposal	9	Article Component: 1 Repackaging: 1 Ancillary: 8
562213	Solid Waste Combustors and Incinerators	1	Ancillary: 1

Source: U.S. EPA (2014b); NAICS Association (2016)

Table 10: Detailed 2014 TRI Activity or Use for Carbon Tetrachloride by Facility

Facility ¹	Maximum Amount On-Site (lb)	Activity or Use
Axiall LLC Axiall Corp 26100 Hwy 405 S Plaquemine, LA 70764 325211 Plastics Material and Resin Manufacturing	100,000 - 999,999	Produce, Byproduct
Eagle Us 2 LLC Axiall Corp 1300 PPG Dr Westlake, LA 70669 325180 Other Basic Inorganic Chemical Manufacturing	100,000 - 999,999	Produce, Byproduct
Georgia Gulf Lake Charles LLC Axiall Corp 1600 VCM Plant Rd Westlake, LA 70669 325110 Petrochemical Manufacturing	10,000 - 99,999	Produce, Used Processed, Byproduct
BASF Corp BASF Corp 8404 Hwy 75 Geismar, LA 70734 325199 All Other Basic Organic Chemical Manufacturing	1,000 - 9,999	Produce, Byproduct
Chemical Solvents Inc--Denison Facility Chemical Solvents Inc 1010 Old Denison Ave Cleveland, OH 44109 562211 Hazardous Waste Treatment and Disposal	10,000 - 99,999	Ancillary
Chemtron Corp 35850 Schneider Ct Avon, OH 44011 562211 Hazardous Waste Treatment and Disposal	1,000 - 9,999	Ancillary
Shintech Plaquemine Plant C-K Tech Inc 26270 Hwy 405 Plaquemine, LA 70764 325211 Plastics Material and Resin Manufacturing	1,000,000 - 9,999,999	Produce, Byproduct
Clean Harbors Aragonite LLC Clean Harbors Inc 11600 North Aptus Rd Grantsville, UT 84029 562211 Hazardous Waste Treatment and Disposal	100,000 - 999,999	Ancillary

Facility ¹	Maximum Amount On-Site (lb)	Activity or Use
Clean Harbors Deer Park LLC Clean Harbors Inc 2027 Independence Parkway South La Porte, TX 77571 562211 Hazardous Waste Treatment and Disposal	100,000 - 999,999	Article Component
Clean Harbors El Dorado LLC Clean Harbors Inc 309 American Cir Union El Dorado, AR 71730 562211 Hazardous Waste Treatment and Disposal	10,000 - 99,999	Repackaging, Ancillary
Clean Harbors Environmental Services Inc Clean Harbors Inc 2247 S Hwy 71 Kimball, NE 69145 562211 Hazardous Waste Treatment and Disposal	10,000 - 99,999	Ancillary
Enterprise Products Operating LLC Enterprise Products Operating LLC 10207 FM 1942 Mont Belvieu, TX 77580 211112 Natural Gas Liquid Extraction	100,000 - 999,999	Imported, Used Processed, Chemical Processing Aid
Formosa Plastics Corp Louisiana Formosa Plastics Corp USA Gulf States Rd Baton Rouge, LA 70805 325211 Plastics Material and Resin Manufacturing	100,000 - 999,999	Produce, Manufacturer Impurity, Ancillary
Formosa Plastics Corp Texas Formosa Plastics Corp USA 201 Formosa Dr Point Comfort, TX 77978 325211 Plastics Material and Resin Manufacturing	100,000 - 999,999	Produce, Used Processed, Manufacturer Impurity, Formula Component, Process Impurity
Giant Cement Co Giant Cement Holding Inc Hwy 453 & I-26 (654 Judge St) Harleyville, SC 29448 327310 Cement Manufacturing	10,000 - 99,999	Ancillary
Heritage Thermal Services Heritage-WTI LLC 1250 St George St East Liverpool, OH 43920 562213 Solid Waste Combustors and Incinerators	10,000 - 99,999	Ancillary
Dover Chemical Corp ICC Industries Inc 3676 Davis Rd Dover, OH 44622 325998 All Other Miscellaneous Chemical Product and Preparation Manufacturing	100,000 - 999,999	Produce, Manufacturer Impurity, Manufacturer Aid
Occidental Chemical Corp Occidental Chemical Holding Corp 4133 Hwy 361 Gregory, TX 78359 325199 All Other Basic Organic Chemical Manufacturing	10,000 - 99,999	Produce, Byproduct, Ancillary

Facility ¹	Maximum Amount On-Site (lb)	Activity or Use
Occidental Chemical Corp Occidental Chemical Holding Corp 6200 S Ridge Rd Wichita, KS 67215 325180 Other Basic Inorganic Chemical Manufacturing	1,000,000 - 9,999,999	Produce, Used Processed, Sale Distribution, Repackaging, Ancillary
Occidental Chemical Holding Corp - Geismar Plant Occidental Chemical Holding Corp 8318 Ashland Rd Geismar, LA 70734 325199 All Other Basic Organic Chemical Manufacturing	50,000,000 - 99,999,999	Produce, Used Processed, Sale Distribution, Byproduct, Reactant, Manufacturer Aid
Oxy Vinyls LP Deer Park-VCM Plant Occidental Chemical Holding Corp 5900 Hwy 225 Gate 8A Deer Park, TX 77536 325199 All Other Basic Organic Chemical Manufacturing	10,000 - 99,999	Produce, Byproduct, Ancillary
Oxy Vinyls LP La Porte VCM Plant Occidental Chemical Holding Corp 2400 Miller Cutoff Rd La Porte, TX 77571 325199 All Other Basic Organic Chemical Manufacturing	10,000 - 99,999	Produce, Byproduct, Reactant, Manufacturer Aid
Ross Incineration Services Inc Ri Technologies Inc 36790 Giles Rd Grafton, OH 44044 562211 Hazardous Waste Treatment and Disposal	10,000 - 99,999	Ancillary
Rubicon LLC 9156 Highway 75 Geismar, LA 70734 325194 Cyclic Crude, Intermediate, and Gum and Wood Chemical Manufacturing	100 - 999	Produce, Byproduct
Sabic Innovative Plastics US LLC Sabic US Holdings LP One Plastics Dr Burkville, AL 36752 325211 Plastics Material and Resin Manufacturing	10,000 - 99,999	Produce, Manufacturer Impurity, Process Impurity
GB Biosciences Corp Syngenta Corp 2239 Haden Rd Houston, TX 77015 325320 Pesticide and Other Agricultural Chemical Manufacturing	1,000 - 9,999	Produce, Manufacturer Impurity
Syngenta Crop Protection LLC Saint Gabriel Facility Syngenta Corp 3905 Hwy 75 Saint Gabriel, LA 70776 325320 Pesticide and Other Agricultural Chemical Manufacturing	100,000 - 999,999	Produce, Byproduct, Chemical Processing Aid

Facility ¹	Maximum Amount On-Site (lb)	Activity or Use
Chemours Belle Plant The Chemours Co Fc LLC 901 W Dupont Ave Belle, WV 25015 325199 All Other Basic Organic Chemical Manufacturing	0 - 99	Produce, Byproduct
Chemours El Dorado The Chemours Co Fc LLC 322 Southfield Cutoff Rd El Dorado, AR 71730 325120 Industrial Gas Manufacturing	100,000 - 999,999	Reactant
Dow Chemical Co Freeport Facility The Dow Chemical Co 2301 N Brazosport Blvd Freeport, TX 77541 325199 All Other Basic Organic Chemical Manufacturing	1,000,000 - 9,999,999	Produce, Imported, Byproduct, Manufacturer Impurity, Reactant, Process Impurity, Chemical Processing Aid, Ancillary
Dow Chemical Co The Dow Chemical Co 901 Loveridge Rd Pittsburg, CA 94565 325320 Pesticide and Other Agricultural Chemical Manufacturing	10,000,000 - 49,999,999	Produce, Used Processed, Byproduct, Reactant, Chemical Processing Aid, Manufacturer Aid
The Dow Chemical Co - Louisiana Operations The Dow Chemical Co 21255 La Hwy 1 S Plaquemine, LA 70764 325199 All Other Basic Organic Chemical Manufacturing	1,000,000 - 9,999,999	Produce, Used Processed, Sale Distribution, Byproduct, Manufacturer Impurity, Reactant, Chemical Processing Aid, Ancillary
The Dow Chemical Co Grand Bayou Operations The Dow Chemical Co Louisiana Hwy 70 Paincourtville, LA 70391 212393 Other Chemical and Fertilizer Mineral Mining	0 - 99	Produce, Manufacturer Impurity
US Magnesium LLC The Renco Group Inc 12819 N Skull Valley Rd Grantsville, UT 84029 331410 Nonferrous Metal (except Aluminum) Smelting and Refining	10,000 - 99,999	Produce, Byproduct
Norlite LLC Tradebe Treatment & Recycling LLC 628 S Saratoga St Cohoes, NY 12047 327992 Ground or Treated Mineral and Earth Manufacturing	100 - 999	Ancillary

Facility ¹	Maximum Amount On-Site (lb)	Activity or Use
Unilin US MDF 149 Homanit USA Rd Mount Gilead, NC 27306 321219 Reconstituted Wood Product Manufacturing	0 - 99	Produce, Byproduct
Univar USA Inc Kansas City Univar USA Inc 2000 Guinotte Ave Kansas City, MO 64120 424690 Other Chemical and Allied Products Merchant Wholesalers	NA	NA
Veolia ES Technical Solutions LLC Port Arthur Facility Veolia Environmental Services Hwy 73 3.5 Miles W of Taylor Bayou Port Arthur, TX 77640 562211 Hazardous Waste Treatment and Disposal	10,000-99,999	Ancillary
Veolia ES Technical Solutions LLC Veolia Environmental Services 7 Mobile Ave Sauget, IL 62201 562211 Hazardous Waste Treatment and Disposal	1,000-9,999	Ancillary
Westlake Vinyls Co Westlake Chemical Corp 36045 Hwy 30 Geismar, LA 70734 325211 Plastics Material and Resin Manufacturing	1,000-9,999	Produce, Sale Distribution, Byproduct, Manufacturer Impurity
Westlake Vinyls Inc Westlake Chemical Corp 2468 Ind US Trial Pkwy Calvert City, KY 42029 325199 All Other Basic Organic Chemical Manufacturing	1,000,000-9,999,999	Produce, Used Processed, Reactant, Ancillary

Source: U.S. EPA (2014b)

¹ The 'Facility' column is hyperlinked to the corresponding RY 2014 report hosted on EPA's Envirofacts server.

5. National Emissions Inventory

The National Emissions Inventory (NEI) estimates the total air emissions of criteria pollutants, criteria precursors, and hazardous air pollutants in the United States. The tri-annual NEI datasets are compiled by EPA using data collected by state, local and tribal air agencies. The most recent NEI dataset was released in December 2016 based on emissions estimated for calendar year 2014.

A summary of the carbon tetrachloride emissions in the 2014 NEI is provided in Table 14. This table is grouped by NAICS code sectors at the 4-digit level and is limited to industry sectors with at least 1,000 pounds of carbon tetrachloride emissions. Of the 11 NAICS-4 industry sectors shown, Basic Chemical Manufacturing (3251) is the highest emitter of carbon tetrachloride followed by Pulp, Paper and Paperboard Mills (3221). The top emitting facilities are also presented in the table, limited to facilities with least 1,000 pounds of carbon tetrachloride emissions. In total, 3,246 facilities were listed in the NEI with data for carbon tetrachloride emissions. Many facilities, however, had near zero emissions; 2,204 facilities had less than below 1 lb released.

Table 11: Summary of 2014 NEI Carbon Tetrachloride Emissions Including Top Industry Sectors and Facilities

NAICS Code and Description / Facility Name and Location	Carbon Tetrachloride Emissions (lb)
3251 - Basic Chemical Manufacturing	89,961
Rubicon LLC - Geismar Plant (Geismar, LA)	27,800
Occidental Chemical Corporation - Geismar Plant (Geismar, LA)	16,526
OxyChem - Wichita (Wichita, KS)	12,262
The Dow Chemical Co - Louisiana Operations (Plaquemine, LA)	6,179
Texas Operations (Eastman Chemical Company) (Longview, TX)	4,755
Dover Chemical Corp (Dover, OH)	3,863
BASF Corp - Geismar Site (Geismar, LA)	2,895
Cabot Corp (Tuscola, IL)	2,540
Dow Texas Operations Freeport (Clute, TX)	2,489
Honeywell International Inc - Baton Rouge Plant (Baton Rouge, LA)	2,441
Eagle US 2 LLC - Lake Charles Complex (Westlake, LA)	2,206
Greens Bayou Plant (Houston, TX)	1,992
Westlake Vinyls Co LP (Geismar, LA)	1,156
All Other Facilities (30)	2,856
3221 - Pulp, Paper, and Paperboard Mills	49,024
Rayonier Performance Fibers, LLC (Fernandina Beach, FL)	8,892
Domtar Paper Co LLC - Hawesville Operations (Hawesville, KY)	3,863
International Paper Company (Cantonment, FL)	3,599
Westrock CP LLC (Florence, SC)	3,011
Domtar Paper Co LLC Marlboro Mill (Bennettsville, SC)	2,718
IP Valliant Paper Mill (Valliant, OK)	2,686
Georgia-Pacific LLC-Crossett Paper Oper (Crossett, AR)	2,430

NAICS Code and Description / Facility Name and Location	Carbon Tetrachloride Emissions (lb)
Evergreen Packaging - Pine Bluff (Pine Bluff, AR)	2,203
Georgia Pacific (Pennington, AL)	1,411
International Paper Georgetown Mill (Georgetown, SC)	1,282
Resolute FP US INC (Catawba, SC)	1,267
Verso Paper – Androscoggin Mill (Jay, ME)	1,157
All Other Facilities (95)	14,504
3252 - Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	5,350
Formosa Plastics Corp Louisiana (Baton Rouge, LA)	2,315
Shintech Louisiana LLC - Shintech Plaquemine Plant (Plaquemine, LA)	1,913
All Other Facilities (12)	1,123
2211 - Electric Power Generation, Transmission and Distribution (154 facilities)	5,118
3253 - Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	5,071
Dow Chemical Company (Pittsburg, CA)	3,471
Syngenta Crop Protection LLC - St Gabriel Plant (St. Gabriel, LA)	1,600
All Other Facilities (3)	0
3211 - Sawmills and Wood Preservation (126 facilities)	2,963
2213 - Water, Sewage and Other Systems (501 facilities)	2,816
3259 - Other Chemical Product and Preparation Manufacturing	2,647
Westlake Vinyls Inc (Calvert City, KY)	2,646
All Other Facilities (5)	0
3212 - Veneer, Plywood, and Engineered Wood Product Manufacturing (85 facilities)	2,524
4862 - Pipeline Transportation of Natural Gas (156 facilities)	2,007
5622 - Waste Treatment and Disposal (597 facilities)	1,098
All Other Industries (1,452 facilities)	6,280
Total (3,246 facilities)	174,859
Source: U.S. EPA (2016)	

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Appendix 1: Reported Activities and Uses on TRI Form R

Table 11, Table 12, and Table 13 include data derived from TRI Form R, Part II, Section 3: Activities and Uses of the EPCRA Section 313 Chemical at the Facility. These data qualitatively indicate the manufacture, processing, or otherwise use activities of the chemical at the reporting facility. The list below provides definitions for the activities listed in these tables.

Manufacture (Section 3.1)

- *"Produce"* indicates the toxic chemical was created by the facility. A toxic chemical is considered manufactured even if the toxic chemical is created unintentionally or exists only for a short period of time. (Section 3.1a)
- *"Imported"* indicates that the chemical is imported by the facility into the Customs Territory of the United States. (Section 3.1b)
- *"Sale Distribution"* indicates that the chemical is produced or imported specifically for sale or distribution outside the manufacturing facility. (Section 3.1c)
- *"Used Processed"* indicates that the chemical is produced or imported and then further processed or otherwise used at the same facility. (Section 3.1d)
- *"Byproduct"* indicates the toxic chemical is produced coincidentally during the manufacture, process, or otherwise use of another chemical substance or mixture and, following its production, is separated from that other chemical substance or mixture. This includes toxic chemicals that may be created as the result of waste management. (Section 3.1e)
- *"Manufacture Impurity"* indicates the facility produces the reported chemical as a result of the manufacture, processing, or otherwise use of another chemical, but does not separate the chemical, and it remains primarily in the mixture or product with that other chemical. (Section 3.1f)

Process (Section 3.1)

- *"Reactant"* indicates the toxic chemical is used in chemical reactions to create another chemical substance or product that is then sold or otherwise distributed to other facilities. Some examples of reactants include feedstocks, raw materials, intermediates, and initiators. (Section 3.2a)
- *"Formulation Component"* indicates the toxic chemical is used as an ingredient in a product mixture to enhance performance of the product during its use, such as dyes in ink, solvents in

paint, additions, reaction diluents, initiators, inhibitors, emulsifiers, surfactants, lubricants, flame retardants, and rheological modifiers. (Section 3.2b)

- “*Article Component*” indicates the toxic chemical becomes an integral part of an article distributed into commerce, such as copper in wire or resins in a plastic pen or the pigment components of paint applied to a chair that is sold. (Section 3.2c)
- “*Repackaging*” indicates the toxic chemical has been received by the facility and subsequently prepared for distribution into commerce in a different form, state, or quantity than it was received, such as petroleum being transferred from a storage tank to tanker trucks. (Section 3.2d)
- “*Process Impurity*” indicates the facility processed the reported chemical but did not separate it, and it remains as an impurity in the primary mixture or trade name product. (Section 3.2e)

Otherwise Use (Section 3.1)

- “*Chemical Processing Aid*” indicates the toxic chemical is used to aid in the manufacture or synthesis of another chemical substance such that it comes into contact with the product during manufacture, but is not intended to remain with or become part of the final product or mixture. Some examples of chemical processing aids are process solvents, catalysts, solution buffers, inhibitors, and reaction terminators. (Section 3.3a)
- “*Manufacture Aid*” indicates the toxic chemical is used to aid in the manufacturing process but does not come into contact with the product during manufacture. Some examples include valve lubricants, refrigerants, metalworking fluids, coolants, and hydraulic fluids. (Section 3.3b)
- “*Ancillary*” indicates that the chemical is used at the facility for purposes other than aiding chemical processing or manufacturing. (Section 3.3c)

Use and Market Profile for 1,4-Dioxane

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Economic and Policy Analysis Branch

Chemistry, Economics, and Sustainable Strategies Division
Office of Pollution, Prevention, and Toxics
U.S. Environmental Protection Agency
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Use and Market Profile for 1,4 Dioxane

Table of Contents

1.	Introduction	1
2.	Producers, Production and Import Volume.....	2
2.1	US Producers and Importers	2
2.2	US Production Volume	2
3.	Use Information and Market Trends.....	5
3.1	1,4-Dioxane Use.....	5
3.1.1	Occupational vs. Consumer Uses.....	5
3.2	1,4-Dioxane as a Byproduct in Consumer Products	12
3.3	Use a Stabilizer with 1,1,1-Trichloroethane.....	13
3.4	Summary of All Uses.....	13
3.5	Comparison with EU data	17
4.	Toxics Release Inventory Data	19
5.	References	27

List of Tables and Figures

Table 1: Chemical Name, Synonyms, and CAS Number	1
Table 2: 2016 CDR Production Volume Data for 1,4-Dioxane (123-91-1) (lb/yr)	3
Table 3: 1986-2016 National Production Volume Data for 1,4-Dioxane (Millions of Pounds).....	4
Table 4: Industrial Process and Product Uses for 1,4-Dioxane Identified by EPA’s Office of Solid Waste and Emergency Response, 2006	6
Table 5: 2016 CDR Industrial Use Data	7
Table 6: 2016 CDR Consumer Use Data	7
Table 7: BASF Tradename Product Groups and Example Trade Name Products containing 1,4-dioxane..	8
Table 8: Amount of 1,4-dioxane as an Impurity in Consumer Products.....	13
Table 9: Summary of All Uses.....	14
Table 10: Comparison with EU Data.....	17
Table 11: 2015 TRI Activity and Use for 1,4-Dioxane (CAS 123-91-1), by Facility	19
Table 12: Number of 2015 TRI Facilities Reporting 1,4-Dioxane, by Activity or Use.....	25
Table 13: Production-Related Waste and Number of Facilities Reporting 1,4-Dioxane to TRI in 2015, by Industry	26
Figure 1: The Formation of 1,4-Dioxane Through Ethoxylation.....	12

Contributors


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1. Introduction

1,4-dioxane is a clear liquid solvent with a faint pleasant odor (ATSDR, 2012). It is used primarily as a solvent in the manufacture of other chemicals, but is also produced as a byproduct in chemicals used in cosmetics, detergents, and shampoos (ATSDR, 2012). The chemical is also used in a variety of other applications, including as an extraction medium for animal and vegetable oils, as a chemical intermediate, and as a part of a catalyst in the production of plastics (ECHA, 2002). In the past, 1,4-dioxane was used extensively as a stabilizer in 1,1,1-trichloroethane. However, the prevalence of the chemical is steadily decreasing due to the phase-out of 1,1,1-trichloroethane under the 1995 Montreal Protocol (ECHA, 2002).

1,4-dioxane is considered a probable carcinogen based on cancer studies in experimental animals. Various forms of cancers were observed in rats and mice exposed to drinking water containing 1,4-dioxane (NTP, 2011). Short-term exposure effects include eye and nose irritation, as well as kidney and liver effects at high exposure levels (ATSDR, 2012). Long-term exposure may lead to nasal cavity, liver, or kidney damage (ATSDR, 2012).

Table 1: Chemical Name, Synonyms, and CAS Number

CAS RN	123-91-1
Synonyms	1,4-dioxacyclohexane; diethylene dioxide; diethylene ether; diethylene-1,4-dioxide; dioxane; dioxyethylene ether; glycoethylene ether; NE 220; p-dioxane; tetrahydro-1,4-dioxane; tetrahydro-p-dioxane
Molecular Formula	C ₄ H ₈ O ₂
Structure	
Source: ECHA, 2002	

2. Producers, Production and Import Volume

2.1 US Producers and Importers

Public data from the 2016 Chemical Data Reporting (CDR) rule indicate that four sites manufacture or import 1,4-dioxane in the United States (EPA, 2017a). BASF Corporation indicated one site in Louisiana as a manufacturer of 1,4 dioxane and another site in Ohio did not report their activity. While another firm, Tedia Company reported both the manufacture and import of the chemical and a possible third firm (claimed as confidential business information (CBI)) reported as an importer (EPA, 2017a). The 2006 Hazardous Substances Data Bank also listed Ferro Corporation as a possible manufacturer of the chemical; however, Ferro sold its fine chemical business to Novolyte, in 2008, and therefore it is likely that Novolyte took over Ferro's production of 1,4-dioxane (Ferro, 2014; NLM, 2006). In turn, Novolyte was acquired by BASF in 2012 (BASF, 2012; BASF, 2017).

2.2 US Production Volume

The four public reporting sites withheld their 2015 production volumes for 1,4-dioxane in the public 2016 CDR database for CBI reasons (See Table 2; EPA, 2017a). Tedia Company reported an export volume of about 80,900 pounds per year, while the other three sites either claimed the information as CBI or did not report it (EPA, 2017a). BASF provided a public comment indicating that it is the only "intentional manufacturer" of 1,4-dioxane in the U.S. (BASF, 2017). It also is possible that other sites manufacture or import the chemical but may have production volumes below the 25,000 pound reporting threshold for CDR reporting, and therefore are not included in the public database. Production volumes of specific end products containing 1,4-dioxane were not found. The inability to locate this information is likely due to the limited existing information about the concentration of 1,4-dioxane in end products that contain the chemical.

Table 2: 2016 CDR Production Volume Data for 1,4-Dioxane (123-91-1) (lb/yr)

Manufacturing Site	Parent Company	Activity (Domestically Manufactured or Imported)	Manufacture Volume	Import Volume	Export Volume	Total Production Volume			
						2012	2013	2014	2015
BASF Corp 111 W Irene Rd Zachary, LA 70791	BASF Corp	Manufactured	Withheld	Withheld	CBI	Withheld	Withheld	Withheld	Withheld
BASF Corp 5000 Estecreek Dr Cincinnati, OH 45232	BASF Corp	NDR	Withheld	Withheld	CBI	Withheld	Withheld	Withheld	Withheld
CBI	CBI	Imported	Withheld	Withheld	NDR	Withheld	Withheld	Withheld	Withheld
Tedia Company Inc (1409030683) 1000 Tedia Way Fairfield, OH 45014	Tedia Company Inc.	Both	Withheld	Withheld	80,893	Withheld	Withheld	Withheld	Withheld
<p>Source(s): EPA, 2017a Notes(s): CBI = Confidential business information NDR = No data reported Withheld = "Withheld" in the CDR public database indicates that the total production volume of a chemical was unable to be aggregated in order to protect to CBI claims.</p>									

Despite claims of CBI, BASF provided the following annual production volumes for 1,4-dioxane from the Zachary, Louisiana site and notes that it supplies approximately 30-40 customers in the U.S. (BASF, 2017):

- 2012: 673,600 lbs
- 2013: 854,430 lbs
- 2014: 289,600 lbs
- 2015: 908,700 lbs
- 2016: 438,000 lbs

Table 3 presents the national production volume of 1,4-dioxane submitted by companies under the non-confidential 1986, 1994, 1998, and 2002 Inventory Update Reporting (IUR) rule and the 2012 and 2016 CDR.

Table 3: 1986-2016 National Production Volume Data for 1,4-Dioxane (Millions of Pounds)

1986 IUR	1990 IUR	1994 IUR	1998 IUR	2002 IUR	2006 IUR	2012 CDR	2016 CDR
10-50	10-50	1-10	1-10	1-10	1-10	Withheld	1-10
Source(s): EPA, 2002; EPA, 2006a; EPA, 2012a; EPA, 2017a							

3. Use Information and Market Trends

3.1 1,4-Dioxane Use

1,4-dioxane is used for a variety of applications, including as a solvent for chemical processing, as a laboratory reagent, a chemical intermediate, an extraction medium for fats and oils, and as part of a polymerization catalyst (ATSDR, 2012). As a solvent 1,4-dioxane is capable of solubilizing most organic compounds, water in all proportions, and many inorganic compounds (Ullman's 2012 and EPA, 2014). Additionally, it is used as a solvent mainly in the production of waxes, fat, lacquers, varnishes, cleaning and detergent preparations, adhesives, cosmetics, deodorant fumigants, emulsions and polishing compositions, and the pulping of wood (ECHA, 2002). Other uses as a solvent include in laboratory histological preparations, in scintillation counters (radiation detectors), dye baths paints, varnishes, stains, printing compositions, and paint and varnish removers (EPA, 2006b). Beyond 1,4-dioxane's use as a solvent, 1,4-dioxane can be used as a wetting and dispersing agent in textile processing, as a degreasing agent, surface treating agent, and a dehydrating agent (NTP, 2011; EPA, 2013a; EPA, 2014, EPA, 2006b). It may also be used as a chemical intermediate and as part of a catalyst in the polymerization of plastics (ECHA, 2002). 1,4-dioxane is also used in the production process of products such as pharmaceuticals, PET plastic, rubber, insecticides, herbicides, cements, deodorant fumigants, magnetic tape, and adhesives (NTP, 2011; ATSDR, 2012).

3.1.1 Occupational vs. Consumer Uses

The most common occupational use of 1,4-dioxane is in the extraction and purification of pharmaceuticals. Additional occupational uses of the chemical include its use as a

- Wetting and dispersing agent in textile processing (Ferro Corporation, 2006; ECHA, 2002)
- Dye baths and stain in printing compositions (Ferro Corporation, 2006)
- Some cleaning and detergent preparations, adhesives, cosmetics, deodorants, fumigants, emulsions, and polishing agents (Ferro Corporation, 2006; ECHA, 2002)
- Some lacquers, paints, varnishes, and paint and varnish removers (Ferro Corporation, 2006; ECHA, 2002)
- Solvent for fats oils, waxes, resins, and adhesives (Ferro Corporation, 2006; Mohr, 2010)
- Reaction media in various organic synthesis reactions (Ferro Corporation, 2006)
- Stabilizer for chlorinated solvents (Ferro Corporation, 2006)
- Photosensitive resins and magnetic tape production (ECHA, 2002; Mohr, 2010)
- Mobile phase in liquid chromatography
- Cellulose acetate membrane production (Mohr, 2010)
- Liquid scintillation cocktails (Mohr, 2010)
- Tissue preservative (Mohr, 2010)
- Flame retardant production (Mohr, 2010)

Under the 2016 CDR, the chemical is reported to be used as a processing aid for industrial activities and pharmaceutical medicine manufacturing, and as a laboratory chemical, (EPA, 2017a). According to the Aerospace Industries Association, which is a trade association representing over 330 manufacturers and suppliers, aerospace defense products may contain 1,4-dioxane in production formations for adhesives (both structural and non-structural); alkaline, aqueous, and emulsion cleaners; marking inks; solders; lubricants; coolants, aerosols; laboratory reagents and photo resists (as an impurity or in trace amounts);

sol-gel conversion coatings; conformal coatings for printed wiring assemblies; resins; primers; and as critical elements required for non-destructive testing such as for fluorescent penetrant (metallic articles) or ultrasonic inspection (usually for composite components) (AIA, 2017).

No consumer uses of 1,4-dioxane were reported for the 2016 CDR (EPA, 2017a). However, 1,4-dioxane is an unintentional impurity in consumer cosmetics/toiletries, household detergents, pharmaceuticals, foods, agricultural and veterinary products, and ethylene glycol-based antifreeze coolants, because it is a byproduct of certain ethoxylated substances (see Section 3.2 for more information).

Table 4 contains a list of industrial process uses and consumer and commercial product uses as identified by EPA’s Office of Solid Waste and Emergency Response (EPA, 2006b). Table 5 presents industrial use data and Table 6 presents commercial use data for 1,4-dioxane from the 2016 public CDR database.

Table 7 presents example BASF products containing 1,4-dioxane.

Table 4: Industrial Process and Product Uses for 1,4-Dioxane Identified by EPA’s Office of Solid Waste and Emergency Response, 2006

Uses
<i>Industrial Process Uses</i>
Solvent for specific applications in biological procedures (histology)
Solvent used in impregnating cellulose acetate membranes used as filters
Reaction medium solvent in organic chemical manufacturing
Solvent used in microscopy
Wetting and dispersing agent in textile process
By-product formed during esterification of polyester
<i>Uses in Commercial Products</i>
Solvent in paints, lacquer, and varnish remover
Solvent in stain and printing compositions
Solvent in liquid scintillation counters (radiation detectors/counters)
Solvent in resins, oils, rubber chemicals, sealants, adhesives, waxes, and cements
Surface treating agent for artificial leather
“Inert” ingredient in pesticides and fumigants
Purifying agent in pharmaceuticals
Impurity in antifreeze, including aircraft de-icing fluid formulations
Impurity in some consumer products (such as deodorants, shampoos, and cosmetics) that incorporate ethoxylated fatty alcohol sulfates
Source: EPA, 2006b

Table 5: 2016 CDR Industrial Use Data

Parent Company	Manufacturing Site	Sector	Function Category	Industrial Use	Percent of Production Volume
BASF Corporation	BASF Corp 111 W Irene Rd Zachary, LA 70791	Wholesale and retail trade	Other (specify)	Processing—repackaging	CBI
		All other basic organic chemical manufacturing	Processing aids, not otherwise listed	Use—non-incorporative activities	CBI
		Pharmaceutical and medicine manufacturing	Processing aids, not otherwise listed	Use—non-incorporative activities	CBI
BASF Corporation	BASF Corp 5000 Estecreek Dr Cincinnati, OH 45232	NDR	NDR	NDR	NDR
CBI	CBI	NDR	NDR	NDR	NDR
Tedia Company Inc.	Tedia Company Inc (1409030683) 1000 Tedia Way Fairfield, OH 45014	Pharmaceutical and medicine manufacturing	Functional fluids (closed systems)	NKRA	100
		Wholesale and retail trade	Laboratory chemicals	NKRA	100
		Services	Laboratory chemicals	NKRA	100
<p>Source(s): EPA, 2017a Note(s): CBI= Confidential business information; NDR = No data reported; NKRA = Not known or reasonably ascertainable</p>					

Table 6: 2016 CDR Consumer Use Data

Parent Company	Manufacturing Site	Consumer Use Product Category	Commercial or Consumer Use	Percent of Production Volume
BASF Corporation	BASF Corp 111 W Irene Rd Zachary, LA 70791	NKRA	NKRA	CBI
BASF Corporation	BASF Corp 5000 Estecreek Dr Cincinnati, OH 45232	NDR	NDR	NDR
CBI	CBI	Other	Commercial	100
Tedia Company Inc.	Tedia Company Inc (1409030683) 1000 Tedia Way Fairfield, OH 45014	NKRA	NKRA	100
<p>Source(s): EPA, 2017a Note(s): CBI = Confidential business information; NDR = No data reported; NKRA = Not known or reasonably ascertainable</p>				

Table 7: BASF Tradename Product Groups and Example Trade Name Products containing 1,4-dioxane

Example Trade Name Product	1, 4 dioxane levels (ppm)	Product Group	Function	Potential End Use	Typical use levels (%)
Pluriol E 400	<25, many <5	Polyethylene glycols (MW=200-8,000). The Pluriol E types are water-soluble polyether alcohols.	Solubilizers, lubricants, dispersants and mold release agents in a variety of applications. Can also be used to modify the viscosity of liquids, and can be used as heat-transfer and hydraulic fluids. Also used as intermediates in organic syntheses.	Commercial and consumer laundry, dish wash, hard surface, and I&I cleaning. Industrial applications as a lubricant, ink solvent, paintball fill, foam reducer in processing, ceramic binder. Anti-foamer in food, skin cream base, personal lubricant, laxative base, excipient in pharmaceutical products.	Typically, less than 5%, up to 10%
Pluronic F 68	<25, many <5	Block copolymers, using ethylene and propylene oxide as monomers	Wetting, emulsification, cleaning, gel formation, detergency, foaming, defoaming, solubilization, and dispersion stabilizing.	Antifreeze, cutting and grinding fluids, industrial processing, latex paints, spray cleaners, automatic dish wash, metal cleaning, water treatment, fermentation, paper processing, household and industrial detergents.	Typically, less than 5%, up to 10%
Tetronic 904	<25, many <5	Nonionic tetra functional block copolymers, using amine based reactants and largely ethylene oxide and propylene oxide	Wetting, emulsification, cleaning, gel formation, detergency, foaming, defoaming, solubilization, and dispersion stabilizing.	Cutting and grinding fluids, asphalt systems, emulsifiable concentrate pesticide formulas, high emulsions, emulsion polymerization processes, skin care products.	Typically, less than 5%, up to 10%
Lutensol TDA 6	<25, many <5	Nonionic alcohol based ethoxylates	Emulsifiers, wetting agents, dispersants, synthetic latex stabilizers and detergents in formulating cleaning products. Some dually suited for textile scouring and dyeing, industrial and institutional and specialties. The lower ethoxylate members of the series are also used as chemical intermediates for conversion to anionic phosphate, sulfate and carboxylate surfactants. Also widely used as primary emulsifiers for acrylic and vinyl emulsion polymerization and	Main area of application is in detergents and cleaners for household, industrial and institutional use.	Typically, less than 5%, up to 10%

Example Trade Name Product	1, 4 dioxane levels (ppm)	Product Group	Function	Potential End Use	Typical use levels (%)
			for asphalt emulsion systems.		
Plurafac LF 221	<25, many <5	Oxo-alcohol alkoxyates (some modified)	The Plurafac LF types are compatible with other nonionic surfactants. Can also be used in combination with anionic and cationic surfactants. They do not react with calcium, magnesium or any of the other cations in hard water, no with soluble alkali salts, anionic polymers such as carboxymethyl cellulose, or polycarboxylates.	Low foaming non-ionic surfactants for hard surface, commercial laundry, food service.	Typically, less than 5%, up to 10%
Standapol ES 2	<25	Fatty Alcohol Ether Sulfates, Low Mole Liquid (~26% active)	Used as a primary surfactant. The inclusion of ethylene oxide offers enhanced mildness compared to standard sodium lauryl sulfate while providing good flash foam characteristics and good viscosity response.	Personal care use in shampoo, bath, and personal cleanser. TSCA uses in dishwashing and light duty detergents.	Typically <15%
Texapon N 70	<50, most <25	Fatty Alcohol Ether Sulfates, Low Mole Liquid (~70% active)	Used as a primary surfactant. The inclusion of ethylene oxide offers enhanced mildness compared to standard sodium lauryl sulfate while providing good flash foam characteristics and good viscosity response. Some shipped as a high active (~70% FAES) flowable paste, which offers the formulator advantages in terms of reduced freight costs, less in-plant handling expense,	Personal care use in shampoo, bath, and personal cleaners. TSCA uses in dishwashing and light duty detergents.	Typically <5%

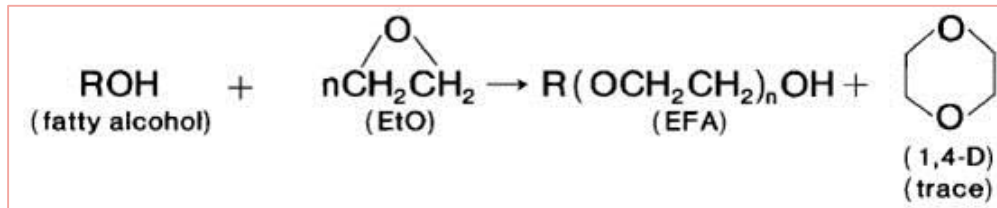
Example Trade Name Product	1, 4 dioxane levels (ppm)	Product Group	Function	Potential End Use	Typical use levels (%)
			maximized storage efficiency, and the ability to produce more concentrated formulations.		
Mapeg 400 DO	<25, some <5	Polyethylene Glycol Ester (mono or diester of a fatty acid or oil reacted with a polyethylene glycol).	Generally emulsifiers or pearlizers, stabilizers and viscosity control agents.	Can be used in liquid soaps, as emulsifiers, pearlizers, stabilizers, solubilizers, and viscosity control agents. They also find use in the metalworking, pulp and paper, textile, household and institutional industries.	Typically, less than 5%, up to 10%
T-Maz 20	Generally <25, some <5	Ethoxylated sorbitan monolaurate	Ethylene oxide addition gives a water soluble, oil and water emulsifier. Ethoxylated sorbitan fatty acid esters (polysorbates) are hydrophilic surfactants.	Can be used as a solubilizer and emulsifier of oils and fragrances, as a wetting agent, viscosity modifier, anti-stat, stabilizer and dispersing agent. Can also be used in the textile and metalworking industries.	Typically <5%
Dehydol LS 30	< 20, some <5	Nonionic fatty alcohol ethoxylates, smaller mole size are base for manufacture of fatty alcohol ether sulfates.	Degreaser	Hard surface cleaning and manual dish detergents, laundry detergents, I&I cleaners	Typically, less than 5%, up to 10%

Example Trade Name Product	1, 4 dioxane levels (ppm)	Product Group	Function	Potential End Use	Typical use levels (%)
Eumulgin (product line)	Most < 10	Cetyl stearyl alcohol, lauryl myristyl alcohol, castor oil, etc. ethoxylates	Emulsifiers, solubilizers and stabilizers	Uses in the personal care industry for hair: shampoos, including baby shampoos, hair conditioning and treatment, styling, coloring; body: shower and bath products, baby and kids cleansing, handcare, face cleansing and care and color cosmetics, sun protection and after sun care. Home care uses include hard surface cleaning, limited special detergents and I&I cleaners	Typically <5%
<p>Note(s): This table was transcribed from BASF's public comment submitted on March 15, 2017</p> <p>Source(s): BASF, 2017</p>					

3.2 1,4-Dioxane as a Byproduct in Consumer Products

1,4-dioxane may also be found in consumer products as an unintentional byproduct of ethoxylated emulsifiers during the manufacture of cosmetics, detergents, food packaging materials, foaming agents, emulsifiers, and solvents (FDA, 2007; Environment Canada, 2010; Mohr, 2010). Ethoxylation is an industrial process in which ethylene oxide is added to alcohols and phenols to produce ethylene polymers which are surfactants. Surfactants are compounds that lower surface tension between two liquids or a liquid and a solid, and are used in a variety of industrial and consumer applications including in cosmetics and detergents. 1,4-dioxane is produced when ethylene oxide is condensed during the development of these surfactants (Environment Canada, 2010). For example, 1,4-dioxane may be formed when sodium laurel sulfate, is converted to the less-harsh chemical sodium laureth sulfate Figure 1 below contains the equation for the production of 1,4-dioxane (1,4 D) through the ethoxylation, where of fatty alcohols and combined with ethylene oxide (EtO) to produce the surfactant ethoxylated fatty acid (EFA).

Figure 1: The Formation of 1,4-Dioxane Through Ethoxylation



Source: Environment Canada, 2010

According to the American Coatings Association, whose membership represents over 90% of the total domestic production of paints and coatings in the U.S., 1,4-dioxane is not intentionally added to paints, coatings, caulks, sealants, adhesives, lacquers or varnishes (ACA, 2017). It is only present as a trace-level contaminant found in some raw materials that are manufactured using ethylene oxide such as ethoxylated surfactants, defoamers, wax additives, tints, primer, pigments, and resins (ACA, 2015; ACA, 2017).

Products found to contain levels of 1,4-dioxane include shampoo, conditioner, liquid hand soap, body wash, skin moisturizer, and baby lotion (Environment Canada, 2010). 1,4-dioxane has also been found in consumer laundry detergents; however, as a result of California's Proposition 65 law, these products were reformulated from containing up to 89 parts per million (ppm) of 1,4-dioxane to less than 25 ppm in early 2013 to meet the labeling standards under California's Proposition 65 (ENS, 2013). Although many manufacturers remove 1,4-dioxane through vacuum stripping in consumer cosmetics and household products, FDA stated 1,4-dioxane may still be present in significant amounts in some products (ATSDR, 2012). For example, tests conducted by the Campaign for Safe Cosmetics reveal concentrations of 1,4-dioxane ranging from 1.5-12 ppm in children's bath products and from 2.0-23 ppm in adult bath products (Campaign for Safe Cosmetics, 2007). BASF also aims to limit residual levels of 1,4-dioxane in household cleaning products below 25 ppm and personal care products below 10 ppm (BASF, 2017). FDA does not believe the levels of 1,4-dioxane present in cosmetic products, such as shampoo and body wash, pose a significant risk to consumers, as the products which contain 1,4-dioxane do not remain in contact with the skin for a long period of time (FDA, 2007). Furthermore, ethoxylated food additives such as polysorbate 80, polysorbate 65, polysorbate 60, and polyethylene glycol may contain 1,4-dioxane as an impurity, however levels of 1,4-dioxane in foods containing these additives are expected to be low due to

the volatility of 1,4-dioxane (Environment Canada, 2010). The chemical may also be found on foods treated with pesticides containing 1,4-dioxane (EPA, 2013b).

Table 8: Amount of 1,4-dioxane as an Impurity in Consumer Products

Product	Amount of 1,4 Dioxane in Product	Category
Children’s Bath Products and Shampoo	1.5 ppm – 12 ppm	Campaign for Safe Cosmetics, 2007
Adult Bath Products and Shampoo	1.0 ppm – 23 ppm	Campaign for Safe Cosmetics, 2007
Tide Laundry Detergent	< 25 ppm	ENS, 2013

1,4-dioxane is also found as an impurity in ethylene glycol based antifreeze and aircraft deicing fluids as a result of the degradation of common antifreeze compounds (EPA, 2013b, NH DES, 2011, and ANICNAS, 1998). 1,4-dioxane is produced as a trace impurity from the manufacture of polyethylene glycol which is manufactured from ethylene glycol and it likely that in a solution of concentrated ethylene glycol, trace impurities of 1,4-dioxane spontaneously appear (ANICNAS, 1998 and Abt, 2014).

3.3 Use a Stabilizer with 1,1,1-Trichloroethane

Historically, 1,4-dioxane was primarily used as a stabilizer in chlorinated solvents such as 1,1,1-trichloroethane (NTP, 2011). When 1,1,1-trichloroethane was applied to bare metal it reacted with aluminum to produce hydrogen chloride and vinylidene chloride. 1,4-dioxane was the primary inhibitor of these reactions (Ullman’s, 2012). This use as a stabilizer comprised 90 percent of all 1,4-dioxane use and the chemical was used at concentrations of 3.5 percent. However, 1,1,1-trichloroethane was phased out under the 1995 Montreal Protocol (ATSDR, 2012). The only exceptions for this phase-out are for essential applications such as medical devices and aviation safety (ATSDR, 2006). No public data are available on the production volumes of 1,1,1-trichloroethane, as 2012 and 2016 CDR data are reported as CBI/Withheld (EPA, 2012a, 2017a).

In addition, 1,1,1-trichloroethane is allowed to be used as feedstock for the production of the chemicals HFC-143a, HCFC-142b and HCFC-141b (UNEP, 2016). However, production of HCFC-141b and HCFC-142b has since been phased out as well, under the Montreal Protocol (EPA, 2010). Given these regulations, it is likely that 1,4-dioxane is no longer significantly used in conjunction with 1,1,1-trichloroethane (ECHA, 2002). Although most applications of 1,1,1-trichloroethane are phased out under the Montreal Protocol, 2015 TRI data indicate 102,357 lbs of 1,1,1-trichloroethane were released from 26 facilities (EPA, 2015a). Eight of these facilities also reported releasing 1,4-dioxane. Therefore, it is possible that 1,4-dioxane is still used a stabilizer for 1,1,1-trichloroethane at some of these sites.

3.4 Summary of All Uses

Table 9, below, contains a list of all end uses and products discussed in this chapter, with the exception of the phased out use as a stabilizer for chlorinated solvents.

Table 9: Summary of All Uses

Use	End Product(s)	Amount of 1,4-Dioxane in End Product
Processing Solvent	<ol style="list-style-type: none"> 1. Waxes 2. Fats 3. Lacquers and varnishes 4. Cleaning and detergent preparations 5. Adhesives 6. Cosmetics 7. Deodorant fumigants 8. Emulsions and polishing compositions 9. Wood pulp/cellulose 	<ol style="list-style-type: none"> 1. Insufficient Information 2. Insufficient Information 3. Insufficient Information 4. Insufficient Information 5. Insufficient Information 6. 6-34 ppm (Black, 2001); n.d.-487 ppm (ECHA, 2002) 7. Insufficient Information 8. Insufficient Information 9. Insufficient Information
Reaction Medium Solvent	<ol style="list-style-type: none"> 1. Organic chemicals 	<ol style="list-style-type: none"> 1. Insufficient Information
Solvent of Unspecified Type	<ol style="list-style-type: none"> 1. Fluid for scintillation counter (radiation detector) samples 2. Tissue preservative in histology 3. Cellulose acetate membranes used as filters 4. Dye baths 5. Paints, and primers 6. Waxes, resins, adhesives (e.g. sol-gel conversion coating) 7. Lacquers, varnishes, and stains 8. Printing compositions 9. Paint and varnish removers 10. Laboratory reagent (e.g., chromatography, NMR) 11. Coatings for wiring assemblies 12. Solder 	<ol style="list-style-type: none"> 1. Insufficient Information 2. Insufficient Information 3. Insufficient Information 4. Insufficient Information 5. Insufficient Information 6. 1E-7% in Sol-gel (AIA, 2017), 0.5-3% in adhesives (Mohr, 2010) 7. Insufficient Information 8. Insufficient Information 9. Insufficient Information 10. Insufficient Information 11. Insufficient Information 12. Insufficient Information
Extraction medium	<ol style="list-style-type: none"> 1. Animal and vegetable oils 	<ol style="list-style-type: none"> 1. Insufficient Information
Inert ingredient	<ol style="list-style-type: none"> 1. Pesticides and fumigants 	<ol style="list-style-type: none"> 1. Insufficient Information

Use	End Product(s)	Amount of 1,4-Dioxane in End Product
Chemical intermediate	<ol style="list-style-type: none"> 1. Pharmaceuticals 2. PET plastic 3. Rubber 4. Insecticides and herbicides 5. Cements 6. Deodorant fumigants 7. Adhesives, magnetic tape 	<ol style="list-style-type: none"> 1. 100-380 ppm (ECHA, 2002) 2. Insufficient Information 3. Insufficient Information 4. Insufficient Information 5. Insufficient Information 6. Insufficient Information 7. Household adhesives: 1.0-2.8 w/w% (ATSDR, 2012)
Polymerization catalyst	<ol style="list-style-type: none"> 1. Plastics (unspecified plastic type) 	<ol style="list-style-type: none"> 1. Insufficient Information
Dehydrating agent	<ol style="list-style-type: none"> 1. Unknown 	<ol style="list-style-type: none"> 1. N/A (End product unknown)
Wetting and dispersing agent	<ol style="list-style-type: none"> 1. Textiles 	<ol style="list-style-type: none"> 1. Insufficient Information
Degreasing agent	<ol style="list-style-type: none"> 1. Emulsion cleaners 	<ol style="list-style-type: none"> 1. N/A (End product unknown)

Use	End Product(s)	Amount of 1,4-Dioxane in End Product
Unintentional Impurity	1. Food (as a result of food additives or pesticides)	1. Ethoxylated food additives: <10 ppm (ECHA, 2002)
	2. Cosmetics	2. 6-34 ppm (Black, 2001); n.d.-487 ppm (ECHA, 2002)
	3. Agricultural/veterinary products	3. <<10 ppm (ECHA, 2002)
	4. Industrial detergents, surfactants, emulsifiers	4. <25 ppm (BASF, 2017)
	5. Household detergents	5. 6-160 ppm (ASTDR, 2012), <25 ppm (BASF, 2017)
	6. Pharmaceuticals	6. Insufficient Information
	7. Antifreeze and deicing products	7. 0.1-3.4 ppm (ASTDR, 2012); 0.1-22 ppm (ECHA, 2002)
	8. Architectural paints, caulks, sealants, adhesives	8. 0.1-10 ppm ^a (BASF, 2017)
	9. Brush/rolling additive	9. 0.191 ppm (ACA, 2017)
	10. Low VOC cleaner	10. 0.644 ppm (ACA, 2017)
	11. White coating	11. 0.0316 ppm (ACA, 2017))
	12. HR white coating	12. 0.018 ppm (ACA, 2017)
	13. Aluminum cleaner	13. 0.06 ppm (ACA, 2017)
	14. Painting stripe defoaming additive	14. 4 ppm (ACA, 2017)
	15. Acrylic copolymer latex	15. 1 ppm (ACA, 2017)
	16. Non-chrome primer	16. 0.0196 ppm (ACA, 2017)
	17. Vinyl cleaner	17. 0.0498 ppm (ACA, 2017))
	18. Low VOC wax & grease remover	18. 0.644 ppm (ACA, 2017)
	19. Aluminum cleaner	19. 0.06 ppm (ACA, 2017)
	20. Metal cleaner	20. 0.16 ppm (ACA, 2017)
	21. Leather and vinyl cleaner	21. 0.768 ppm (ACA, 2017)
	22. Architectural industrial coatings	22. 0.02 ppm-5.4 ppm (ACA, 2017)
	23. Industrial coating	23. <30 ppm (ACA, 2017)
	24. Flame retardant	24. Insufficient Information
<p>Note(s): BASF notes that the concentration of 1,4-dioxane is much lower, “but dependent on the concentration of the surfactant used in the formulated coating” Sources: ACA, 2017; AIA, 2017; ATSDR, 2012; BASF, 2017; Black, 2001; ECHA, 2002; EPA, 2017b; and Mohr, 2010.</p>		

3.5 Comparison with EU data

Table 10, below contains a comparison of uses and production information identified in the EU's Risk Assessment Report 1,4-Dioxane (ECHA, 2002) and uses identified by various US sources.

Table 10: Comparison with EU Data

Category	EU*	US**
<i>Production and Manufacture Information</i>		
Chemical Domestically Manufactured	Yes: 4.41 to 5.51 million pounds (in 1997)	Yes: Production Volume is withheld (in 2015)
Chemical Exported	Yes: 1.27 million pounds (in 1997)	Yes: Tedia Company reported exporting about 81,000 lbs in 2015.
Import Volume	Unknown: No import information is reported	Unknown: No import information is reported
Manufacturer(s)	1) BASF AG in Ludwigshafen, Germany	1) BASF at Zachary, LA site and Tedia Company
<i>Use Information</i>		
Ongoing Uses		
Processing solvent in the production of waxes, fat, lacquers, varnishes, cleaning and detergent preparations, adhesives, cosmetics, deodorant fumigants, emulsions and polishing compositions, and the pulping of wood	X	X
Solvent in fluid for scintillation counter (radiation detector) samples		X
Solvent for specific applications in biological procedures (histology)		X
Solvent used in impregnating cellulose acetate membranes used as filters	X	X
Solvent in dye baths, lacquers, paints, waxes, varnishes, stains, printing compositions, and paint and varnish removers		X
Laboratory reagent (e.g., mobile phase in chromatography)	X	X
Extraction medium for animal and vegetable oils	X	X
“Inert” ingredient in pesticides and fumigants	X	X
Reaction medium solvent in organic chemical manufacturing		X
Chemical intermediate in the process of pharmaceuticals, PET plastic, rubber, insecticides, herbicides, cements, deodorant fumigants, magnetic tape, and adhesives		X
As part of a catalyst for the polymerization of plastics		X

Category	EU*	US**
Dehydrating agent		X
Wetting and dispersing agent in textile production		X
Degreasing agent		X
Cryoscopic determination	X	
Measuring optical activity	X	
Phased Out Uses		
Stabilizer for chlorinated solvents used for degreasing, electronics manufacturing, and metal finishing	X	X
<i>Byproduct in Consumer Product Information</i>		
Found as an Impurity in:		
Food (as a result of food additives or pesticides)	X	X
Cosmetics	X	X
Agricultural/veterinary products	X	
Household detergent	X¹	X
Industrial detergents	X²	X
Pharmaceuticals		X
Therapeutic products	X	
Antifreeze and deicing products		X
Sources: * ECHA, 2002 ** ATSDR, 2012; EPA, 2006b; and EPA, 2017a Notes: 1. Use is listed as “household products” 2. Use is listed as “industrial applications”		

4. Toxics Release Inventory Data

Facilities manufacturing or processing over 25,000 lb or otherwise using over 10,000 lb of 1,4-dioxane are required to report releases to EPA's Toxic Release Inventory (TRI). Under the most recent TRI for the year 2015, 49 sites reported releasing quantities of 1,4-dioxane at their facilities. Table 11 presents each reporting facility, the maximum amount of the chemical present at the facility per year, and how 1,4-dioxane is produced or used at the facility. A site listed as "Produce" under the Activity or Use column indicates that 1,4-dioxane was created at the facility and not purchased from an outside source.

Table 11: 2015 TRI Activity and Use for 1,4-Dioxane (CAS 123-91-1), by Facility

Facility	Maximum Amount of Chemical (lbs)	NAICS Industry Code	Activity or Use
HUNTSMAN INTERNATIONAL LLC 101 CONCRETE ST HOUSTON, TX 77012	100,000 - 999,999	325110 Petrochemical Manufacturing	Produce Manufacture Impurity
ALBEMARLE CORP WEST PLANT 1550 HWY 371 S MAGNOLIA, AR 71753	100,000 - 999,999	325180 is not a valid 2007 NAICS code	Chem Processing Aid
ECO-SERVICES OPERATIONS 1301 AIRLINE HWY BATON ROUGE, LA 70805	10,000 - 99,999	325180 is not a valid 2007 NAICS code	Ancillary
ALBEMARLE CORP SOUTH PLANT 2270 HWY 79 S MAGNOLIA, AR 71753	1,000 - 9,999	325180 is not a valid 2007 NAICS code	Process Impurity
BASF CORP 111 W IRENE RD ZACHARY, LA 70791	1,000,000 - 9,999,999	325199 All Other Basic Organic Chemical Manufacturing	Produce Sale Distribution
ALDRICH CHEMICAL CO LLC 5485 COUNTY RD V SHEBOYGAN FALLS, WI 53085	10,000 - 99,999	325199 All Other Basic Organic Chemical Manufacturing	Repackaging Chem Processing Aid
HUNTSMAN PETROCHEMICAL LLC PORT NECHES FACILITY 6001 HWY 366 PORT NECHES, TX 77651	1,000 - 9,999	325199 All Other Basic Organic Chemical Manufacturing	Produce Byproduct
COIM USA INC 286 MANTUA GROVE RD BUILDING # 1 WEST DEPTFORD, NJ 8066	1,000 - 9,999	325199 All Other Basic Organic Chemical Manufacturing	Produce Byproduct
ST CHARLES OPERATIONS (TAFT/STAR) UNION CARBIDE CORP 355 LA HWY 3142 (GATE 1) HAHNVILLE, LA 70057	1,000 - 9,999	325199 All Other Basic Organic Chemical Manufacturing	Produce Sale Distribution Manufacture Impurity Reactant Ancillary

Facility	Maximum Amount of Chemical (lbs)	NAICS Industry Code	Activity or Use
THE DOW CHEMICAL CO - LOUISIANA OPERATIONS 21255 LA HWY 1 S PLAQUEMINE, LA 70764	0 - 99	325199 All Other Basic Organic Chemical Manufacturing	Produce Byproduct Manufacture Impurity Formulation Component Process Impurity Manufacture Aid
INEOS OXIDE A DIV OF INEOS AMERICAS LLC 21255A HWY 1 S PLAQUEMINE, LA 70765	0 - 99	325199 All Other Basic Organic Chemical Manufacturing	Produce Sale Distribution Manufacture Impurity
UNION CARBIDE CORP SEADRIFT PLANT 7501 N HWY 185 SEADRIFT, TX 77983	0 - 99	325199 All Other Basic Organic Chemical Manufacturing	Produce Manufacture Impurity Formulation Component Process Impurity Manufacture Aid
MITSUBISHI POLYESTER FILM INC 2001 HOOD RD GREER, SC 29650	10,000 - 99,999	325211 Plastics Material and Resin Manufacturing	Produce Byproduct
NAN YA PLASTICS CORP AMERICA 140 E BEULAH RD LAKE CITY, SC 29560	1,000 - 9,999	325211 Plastics Material and Resin Manufacturing	Produce Byproduct
M&G POLYMERS USA LLC STATE RT 2 APPLE GROVE, WV 25502	1,000 - 9,999	325211 Plastics Material and Resin Manufacturing	Produce Manufacture Impurity
DAK AMERICAS LLC COOPER RIVER PLANT 3350 CYPRESS GARDENS RD MONCKS CORNER, SC 29461	1,000 - 9,999	325211 Plastics Material and Resin Manufacturing	Produce Byproduct
DAK AMERICAS LLC-COLUMBIA SITE 570 K AVE GASTON, SC 29053	1,000 - 9,999	325211 Plastics Material and Resin Manufacturing	Produce Byproduct
AURIGA POLYMERS INC- SPARTANBURG FACILITY 1550 DEWBERRY RD SPARTANBURG, SC 29307	1,000 - 9,999	325211 Plastics Material and Resin Manufacturing	Produce Byproduct
INVISTA SA RL-WILMINGTON 4600 HWY 421 N WILMINGTON, NC 28401	1,000 - 9,999	325211 Plastics Material and Resin Manufacturing	Produce Byproduct Manufacture Impurity
EASTMAN CHEMICAL CO TENNESSEE OPERATIONS 100 EASTMAN RD KINGSPORT, TN 37660	1,000 - 9,999	325211 Plastics Material and Resin Manufacturing	Produce Byproduct Chem Processing Aid

Facility	Maximum Amount of Chemical (lbs)	NAICS Industry Code	Activity or Use
DAK AMERICAS MISSISSIPPI INC 3303 PORT & HARBOR DR BAY SAINT LOUIS, MS 39520	100 - 999	325211 Plastics Material and Resin Manufacturing	Produce Byproduct
REICHHOLD LLC 2 54 WAMSLEY RD JACKSONVILLE, FL 32254	0 - 99	325211 Plastics Material and Resin Manufacturing	Produce Byproduct
EASTMAN CHEMICAL CO SOUTH CAROLINA OPERATIONS 500 K AVENUE GASTON, SC 29053	0 - 99	325211 Plastics Material and Resin Manufacturing	Produce Byproduct
DAK AMERICAS LLC 3216 CEDAR CREEK RD FAYETTEVILLE, NC 28312	0 - 99	325211 Plastics Material and Resin Manufacturing	Produce Manufacture Impurity
ALPHAPET INC 1301 FINLEY ISLAND ROAD DECATUR, AL 35601	0 - 99	325211 Plastics Material and Resin Manufacturing	Produce Byproduct
BAYER CROSCIENCE LP PO BOX 1005 INSTITUTE, WV 25112	1,000 - 9,999	325320 Pesticide and Other Agricultural Chemical Manufacturing	Ancillary
AMRI RENSSLAER INC 33 RIVERSIDE AVE RENSSELAER, NY 12144	10,000 - 99,999	325412 Pharmaceutical Preparation Manufacturing	Chem Processing Aid
ALERE SAN DIEGO 9975 SUMMERS RIDGE RD SAN DIEGO, CA 92121	*	325412 Pharmaceutical Preparation Manufacturing	*
STEPAN CO MILLSDALE ROAD 22500 STEPAN DR ELWOOD, IL 60421	100,000 - 999,999	325613 Surface Active Agent Manufacturing	Produce Sale Distribution Byproduct
SOLVAY USA INC 3440 FAIRFIELD AVE BALTIMORE, MD 21226	1,000 - 9,999	325613 Surface Active Agent Manufacturing	Produce Byproduct Manufacture Impurity Process Impurity
AIR PRODUCTS PERFORMANCE MANUFACTURING INC 337 VINCENT DR MILTON, WI 53563	0 - 99	325613 Surface Active Agent Manufacturing	Produce Byproduct Manufacture Impurity
LEXMARK INTERNATIONAL INC 6555 MONARCH RD LONGMONT, CO 80503	1,000 - 9,999	325992 Photographic Film, Paper, Plate, and Chemical Manufacturing	Manufacture Aid

Facility	Maximum Amount of Chemical (lbs)	NAICS Industry Code	Activity or Use
BUCKMAN LABORATORIES INC 14664 E STATE HWY 47 CADET, MO 63630	10,000 - 99,999	325998 All Other Miscellaneous Chemical Product and Preparation Manufacturing	Produce Byproduct Manufacture Impurity
TRISEP CORP 6325 LINDMAR DR GOLETA, CA 93117	10,000 - 99,999	326199 All Other Plastics Product Manufacturing	Formulation Component
HOLCIM (US) INC HOLLY HILL PLANT 2173 GARDNER BLVD HOLLY HILL, SC 29059	1,000 - 9,999	327310 Cement Manufacturing	Ancillary
BUZZI UNICEM USA- GREENCASTLE PLANT 3301 S COUNTY RD 150 W GREENCASTLE, IN 46135	1,000 - 9,999	327310 Cement Manufacturing	Repackaging Ancillary
SAINT GOBAIN ABRASIVES INC 200 COMMERCE DR MONTGOMERYVILLE, PA 18936	1,000 - 9,999	327910 Abrasive Product Manufacturing	Manufacture Aid
GE OSMONICS INC 5951 CLEARWATER DR MINNETONKA, MN 55343	1,000 - 9,999	333999 All Other Miscellaneous General Purpose Machinery Manufacturing	Chem Processing Aid
BMCA CEDAR CITY LLC (BMCA) 5080 W HWY 56 CEDAR CITY, UT 84721	100,000 - 999,999	423330 Roofing, Siding, and Insulation Material Merchant Wholesalers	Article Component
UNIVAR USA INC MORRISVILLE BRANCH 200 DEAN SIEVERS PL MORRISVILLE, PA 19067	*	424690 Other Chemical and Allied Products Merchant Wholesalers	*
UNIVAR USA INC - TOLEDO BRANCH 30450 TRACY RD WALBRIDGE, OH 43465	*	424690 Other Chemical and Allied Products Merchant Wholesalers	*
CLEAN HARBORS ARAGONITE LLC 11600 NORTH APTUS ROAD GRANTSVILLE, UT 84029	10,000 - 99,999	562211 Hazardous Waste Treatment and Disposal	Ancillary
CLEAN HARBORS EL DORADO LLC 309 AMERICAN CIR UNION EL DORADO, AR 71730	10,000 - 99,999	562211 Hazardous Waste Treatment and Disposal	Repackaging Ancillary

Facility	Maximum Amount of Chemical (lbs)	NAICS Industry Code	Activity or Use
TM DEER PARK SERVICES LP 2525 BATTLEGROUND RD DEER PARK, TX 77536	10,000 - 99,999	562211 Hazardous Waste Treatment and Disposal	Ancillary
CLEAN HARBORS DEER PARK LLC 2027 INDEPENDENCE PARKWAY SOUTH LA PORTE, TX 77571	10,000 - 99,999	562211 Hazardous Waste Treatment and Disposal	Article Component
CHEMICAL WASTE MANAGEMENT OF THE NORTHWEST INC 17629 CEDAR SPRINGS LN ARLINGTON, OR 97812	10,000 - 99,999	562211 Hazardous Waste Treatment and Disposal	Ancillary
VEOLIA ES TECHNICAL SOLUTIONS LLC PORT ARTHUR FACILITY HWY 73, 3.5 MILES W OF TAYLOR BAYOU PORT ARTHUR, TX 77640	1,000 - 9,999	562211 Hazardous Waste Treatment and Disposal	Ancillary
ROSS INCINERATION SERVICES INC 36790 GILES RD GRAFTON, OH 44044	1,000 - 9,999	562211 Hazardous Waste Treatment and Disposal	Ancillary
HERITAGE THERMAL SERVICES 1250 ST GEORGE ST EAST LIVERPOOL, OH 43920	1,000 - 9,999	562213 Solid Waste Combustors and Incinerators	Ancillary

Facility	Maximum Amount of Chemical (lbs)	NAICS Industry Code	Activity or Use
<p>Source: EPA, 2015a and 2015b</p> <p>Notes: *No chemical quantities or uses reported</p> <p>“<i>Ancillary</i>” indicates the toxic chemical is used at the facility for purposes other than as a manufacturing aid or chemical processing aid, such as cleaners, degreasers, lubricants, fuels, toxic chemicals used for treating wastes, and toxic chemicals used to treat water at the facility.</p> <p>“<i>Article component</i>” indicates the toxic chemical becomes an integral part of an article distributed into commerce, such as copper in wire or resins in a plastic pen, or the pigment components of paint applied to a chair that is sold.</p> <p>“<i>Byproduct</i>” indicates the toxic chemical is produced coincidentally during the manufacture, process, or otherwise use of another chemical substance or mixture and, following its production, is separated from that other chemical substance or mixture. This includes toxic chemicals that may be created as the result of waste management.</p> <p>“<i>Chemical Processing Aid</i>” indicates the toxic chemical is used to aid in the manufacture or synthesis of another chemical substance such that it comes into contact with the product during manufacture, but is not intended to remain with or become part of the final product or mixture. Some examples of chemical processing aids are process solvents, catalysts, solution buffers, inhibitors, and reaction terminators.</p> <p>“<i>Formulation component</i>” indicates the toxic chemical is used as an ingredient in a product mixture to enhance performance of the product during its use, such as dyes in ink, solvents in paint, additions, reaction diluents, initiators, inhibitors, emulsifiers, surfactants, lubricants, flame retardants, and rheological modifiers.</p> <p>“<i>Manufacture aid</i>” indicates the toxic chemical is used to aid in the manufacturing process but does not come into contact with the product during manufacture. Some examples include valve lubricants, refrigerants, metalworking fluids, coolants, and hydraulic fluids.</p> <p>“<i>Manufacture impurity</i>” indicates whether the facility produces the reported chemical as a result of the manufacture, processing, or otherwise use of another chemical, but does not separate the chemical and it remains primarily in the mixture or product with that other chemical.</p> <p>“<i>Process impurity</i>” indicates whether the facility processed the reported chemical but did not separate it and it remains as an impurity in the primary mixture or trade name product.</p> <p>“<i>Produce</i>” indicates the toxic chemical was created by the facility. A toxic chemical is considered manufactured even if the toxic chemical is created unintentionally or exists only for a short period of time.</p> <p>“<i>Reactant</i>” indicates the toxic chemical is used in chemical reactions to create another chemical substance or product that is then sold or otherwise distributed to other facilities. Some examples of reactants include feedstocks, raw materials, intermediates, and initiators.</p> <p>“<i>Repackaging</i>” indicates the toxic chemical has been received by the facility and subsequently prepared for distribution into commerce in a different form, state, or quantity than it was received, such as petroleum being transferred from a storage tank to tanker trucks.</p> <p>“<i>Sale distribution</i>” indicates the toxic chemical is produced or imported specifically for sale or distribution outside the manufacturing facility.</p>			

Table 12 presents the number of TRI facilities reporting each use for 2015.

Table 12: Number of 2015 TRI Facilities Reporting 1,4-Dioxane, by Activity or Use

Activity or Use	Number of Facilities
Ancillary	12
Article Component	2
Byproduct	18
Chemical Processing Aid	5
Formulation Component	3
Manufacture Aid	4
Manufacture Impurity	11
Process Impurity	4
Produce	25
Reactant	1
Repackaging	3
Sale Distribution	4
Source: EPA, 2015a	

1,4-dioxane is primarily produced as a byproduct, impurity, or intermediate in the manufacture of other chemicals. Byproducts produced or imported in volumes above 25,000 lbs are required to be reported to the CDR unless the byproduct is used for a separate commercial purpose after manufacture (EPA, 2012b). The industries reporting the most 1,4-dioxane to TRI as waste managed include NAICS 325211: Plastics Material and Resin Manufacturing, NAICS 327310: Cement Manufacturing, and NAICS 325110: Petrochemical Manufacturing as show in Table 13. All TRI facilities in these industries reported the production of 1,4-dioxane as a byproduct except for cement manufacturing facilities which used the chemical for repackaging or as an ancillary material. The total production related 1,4-dioxane waste reported to TRI was 4.2 million pounds in 2015.

Table 13: Production-Related Waste and Number of Facilities Reporting 1,4-Dioxane to TRI in 2015, by Industry

Activity or Use	Number of Facilities	Total Production-Related Waste Managed (lb)
325211: Plastics Material and Resin Manufacturing	13	1,817,024
325199: All Other Basic Organic Chemical Manufacturing	11	320,958
562211: Hazardous Waste Treatment and Disposal	7	239,621
325613: Surface Active Agent Manufacturing	3	47,657
327310: Cement Manufacturing	2	955,533
325412: Pharmaceutical Preparation Manufacturing	2	26,736
424690: Other Chemical and Allied Products Merchant Wholesalers	2	*
327910: Abrasive Product Manufacturing	1	19,886
333999: All Other Miscellaneous General Purpose Machinery Manufacturing	1	36,576
423330: Roofing, Siding, and Insulation Material Merchant Wholesalers	1	10
326199: All Other Plastics Product Manufacturing	1	21
325320: Pesticide and Other Agricultural Chemical Manufacturing	1	82
562213: Solid Waste Combustors and Incinerators	1	114,475
325992: Photographic Film, Paper, Plate, and Chemical Manufacturing	1	11,155
325110: Petrochemical Manufacturing	1	633,218
325998: All Other Miscellaneous Chemical Product and Preparation Manufacturing	1	1,718
Total	49	4,224,670
Source: EPA, 2015a Note: * No quantities reported		

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Use and Market Profile for Hexabromocyclododecane (HBCD)

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Table of Contents

1.	Introduction	1
1.1	Overview of HBCD	1
1.2	Existing Regulations	2
1.2.1	U.S. Regulations.....	2
1.2.2	International Regulations	3
1.3	Future Market Trends Resulting from Regulatory Actions	4
2.	Production of HBCD	5
2.1	Production Volume and Imports	5
2.2	Manufacturers and Importers of HBCD.....	5
2.3	Recent Developments for HBCD Manufacturers.....	9
2.4	Price	10
3.	Uses of HBCD	12
3.1	Use in Expanded Polystyrene Foam (EPS) and Extruded Polystyrene Foam (XPS).....	12
3.2	Use in Textiles	12
3.3	Use in High Impact Polystyrene (HIPS)	13
3.4	Other Identified Uses	13
3.5	Summary of All Uses.....	14
4.	Substitutes	19
4.1	Flame Retardant in Polystyrene Foam	19
4.1.1	Chemical Substitutes.....	19
4.1.2	Product Substitutes.....	20
4.2	Flame Retardant in Textiles	21
4.3	Flame Retardant in High-Impact Polystyrene (HIPs)	21
5.	Waste Management	23
5.1	Recycling EPS and XPS	23
	References.....	24
	Appendix.....	28

List of Tables

Table 1: Chemical Name, Synonyms, and CAS Number	1
Table 2: HBCD Production and Importation (lbs/yr, IUR and CDR data)	5
Table 3: 2016 CDR Production Data	7
Table 4: Percent HBCD in Commercial and Consumer Products	14
Table 5: Uses of HBCD	15
Table 6: 2016 CDR Industrial Use Data	17
Table 7: 2016 CDR Consumer and Commercial Use Data.....	18
Table 8: Potential Alternatives to HBCD in EPS and XPS identified in 2014 DfE Alternatives Assessment	20

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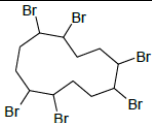
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1. Introduction

1.1 Overview of HBCD

Hexabromocyclododecane (HBCD) is a category of brominated flame retardants commonly used in extruded polystyrene foam (XPS), expanded polystyrene foam (EPS), and to a lesser extent, in textiles and high-impact polystyrene (HIPS) used in electrical applications (EPA, 2014). It consists of 18 hydrogen and 6 bromine atoms bound to a ring of 12 carbon atoms. This profile focuses on two chemicals; hexabromocyclododecane (CASRN 25637-99-4) and 1,2,5,6,9,10-hexabromocyclododecane (CASRN 3194-55-6). HBCD is found to be toxic to aquatic organisms and may cause potential human health concerns such as reproductive, developmental, and neurological effects (EPA, 2014). HBCD is an additive flame retardant, meaning it is physically combined with the material being treated rather than being chemically bonded. Therefore, there is potential for migration within and from the polymer matrix.

Table 1: Chemical Name, Synonyms, and CAS Number

CAS RN	25637-99-4; 3194-55-6
Synonyms	Cyclododecane, hexabromo- (CA Index Name for CAS RN 25637-99-4); Cyclododecane, 1,2,5,6,9,10-hexabromo- (CA Index Name for CAS RN 3194-55-6); HBCD; HBCDD
Molecular Formula	$C_{12}H_{18}Br_6$
Structure	
Trade Names	Saytex®HP-900; FR-1206; CD-75PC
Sources:	EPA, 2014; Albemarle, 2000; ICL-IP, 2014; Chemtura, 2013

In 2009 EPA began the Action Plan process, which set out to summarize available hazard, exposure, and use information on certain chemicals, outline the risks that each chemical may present, and identify the specific steps the Agency could take to address those concerns. In 2010 EPA released an Action Plan for HBCD and initiated the following actions to help manage the risk that may be presented by HBCD:

1. Issued a proposed Significant New Use Rule (SNUR) that would consider use of HBCD in consumer textiles, other than for use in motor vehicles, a significant new use.
2. Initiated a rule making to add HBCD to the Toxics Release Inventory (TRI)
3. Conducted a Design for the Environment (DfE) Alternatives Assessment

In June of 2014, the DfE alternatives assessment was published for HBCD, identifying viable alternatives in EPS and XPS foam. The Significant New Use Rule went into effect November 23, 2015. HBCD will be part of the TRI in the 2017 reporting year.

EPA has identified HBCD as a priority chemical for further risk assessment, believing the risk assessment will inform potential actions identified in the work plan. The chemicals selected for further review were chosen based on evidence of potential bioaccumulation, environmental persistence, and adverse developmental effects in humans and animals (EPA, 2013a).

This report provides an overview (Section 1), describes the production of HBCD for the U.S. market (Section 2), use information (Section 3), substitutes (Section 4), and known waste management of HBCD products (Section 5).

1.2 Existing Regulations

1.2.1 U.S. Regulations

The use of HBCD in XPS and EPS is largely driven by the ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials, which regulates flame spread of plastic insulation in buildings. ASTM E 84 is typically used in conjunction with the 1976 Uniform Building Code (UBC), which requires a thermal barrier to separate the room interior and foam insulation (Babrauskas et al., 2012)¹. While none of the standards specifically require the use of flame retardants, they are typically added to the XPS and EPS so that the foam will meet the standards' flammability requirements (EPA, 2014).

UL 94 is the predominant standard driving flame retardant use in electronic products. It is a voluntary flammability standard which requires electronic components to withstand a small scale ignition source (UL, 2013). Components are classified based on how long they continue to burn after ignition. Flame retardants are often used in electronic components requiring high levels of flame resistance (Lowell Center for Sustainable Production, 2005). Television sets in the U.S. require a V-0 classification, which requires electrical components to self-extinguish within 10 seconds of ignition (UL IDES, n.d.; Weil and Levchik, 2009).

No federal regulation limiting the use of HBCD currently exists in the United States. However, in 2012 EPA proposed a Significant New Use Rule under TSCA Section 5(1)(2) to require manufacturers/importers to report any significant new use of HBCD (CASRN 25637-99-4 and 3194-55-6) in consumer textiles other than use in motor vehicles (EPA, 2012b). Furthermore, California recently passed Assembly Bill 127, which requires the State Fire Marshal to review and propose an update to the current flammability standards for building insulation materials by July 1, 2015 (ACC, 2013). While the law itself does not alter state flammability standards, it does order a reassessment of the role of flame retardants in building safety. Additionally, the HBCD chemical category, covering both CASRNs, has been added to the list of EPCRA Section 313 Chemicals (Toxics Release Inventory), effective for reporting year 2017, reports due July 1, 2018.²

With regards to HBCD use in motor vehicle textiles, the Global Automotive Declarable Substance List (GADSL), a voluntary program, lists HBCD as a substance declarable at 0.1% by weight (GADSL, 2011). The major auto industry manufacturers have established similar restricted substance management

¹ Research has shown that ASTM E 84 is often an unreliable indicator of fire safety in building insulation foam, as the presence of a fire barrier meeting building code standards often will provide a high level of fire protection that renders the flame resistance of the insulation redundant. In other words, flame retardants provide no added benefit to building insulation foam if properly protected by a fire barrier (Babrauskas et al. 2012). HBCD use is also influenced by the ASTM C578 performance requirement for Rigid, Cellular Polystyrene Thermal Insulation, which includes XPS and EPS foam.

² <https://www.epa.gov/toxics-release-inventory-tri-program/addition-hexabromocyclododecane-hbcd-category-tri-list-final>

standards (RSMS) that require notification of all parts and materials that have greater than 0.1% HBCD content to be listed (Ford, 2010). HBCD is listed as one of the substances that “shall be restricted in or excluded from parts, materials, equipment, packaging, office supplies, machinery and/or tooling” (Ford, 2010). Some of the major auto industry manufacturers refer to the GADSL as chemicals to be included in their own substance management standards (Chrysler, 2006; GM, 2008). In addition, Federal Mogul is a global supplier of automotive products and in their RSMS, adapted from the Ford RSMS (Ford, 2010), they designate HBCD as “Prohibited”, which means the chemical shall not be supplied in any products at a threshold greater than 0.1% in vehicle interior fabrics by July 1, 2011 (Federal Mogul, 2010).

1.2.2 International Regulations

HBCD is listed under Annex I of Regulation (EC) No 850/2004 effective March 21, 2016.³ This regulation prohibits HBCD’s production, use, import and export from the European Union, with the following exceptions:

- Presence of no more than 100 mg/kg as an unintentional trace contaminant in substances, mixtures, articles or flame-retarded parts of articles. This is subject to review by the Commission by March 22, 2019
- Production of HBCD for the manufacture of expanded polystyrene articles subject to authorization under REACH. This is allowed until November 26, 2019
- Use of expanded polystyrene and extruded polystyrene in buildings with certain conditions. This prohibits its production, use, import and export of the chemicals. However, a five-year exemption is provided for the production and use of HBCD in expanded polystyrene and extruded polystyrene in buildings.

Furthermore, HBCD is recommended to be reviewed for the EU Directive’s list of banned substances under the restriction of hazardous substances (RoHS) in electrical and electronic equipment (Chemical Watch, 2013). Additionally, the WEEE (Waste Electrical and Electronic Equipment) directive in the European Union requires the separation of plastics containing brominated flame retardants prior to recycling (UNECE, 2010). In Europe, plastic that cannot be recycled is typically incinerated. However, it was discovered that plastics treated with brominated flame retardants produced brominated dioxin compounds during incineration. This has led plastic producers to move away from adding brominated flame retardants into their products (Hirschler, 2010).

In October 2016, Canada amended the Prohibition of Certain Toxic Substances Regulations to include HBCD. The rulemaking prohibits the manufacture, import, use, sale, and offer for sale of HBCD and products containing HBCD as of January 1, 2017 and would apply to all Canadians, including chemical manufacturers, material processors, importers of product components and finished products and the general public (Environment Canada, 2012). These regulations came into effect in December 2016, with time-limited exemptions provided to industry to allow the phase-out of HBCD from their processes.

HBCD is also subject to mandatory reporting requirements in Japan under the Chemical Substances Control Law (CSCL) (BSEF, 2012). In Ukraine, HBCD is registered on the hazardous chemical list based on health effects (UNECE, 2010).

³ http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2016.055.01.0004.01.ENG

In May 2013, HBCD was added to the United Nation's Stockholm Convention list of Persistent Organic Pollutants (C&EN, 2013). The chemical is scheduled to be eliminated by the countries who have ratified the Stockholm Convention starting in 2014, with uses in expanded or extruded polystyrene building insulation in the EU being phased out by 2019 (KemI, 2013). HBCD will also be subject to labeling requirements for building insulation products and cannot be exported from the EU (C&EN, 2013; Stokstad, 2013). Currently 178 countries and the EU have ratified the Stockholm Convention. The following countries have *not* ratified the Stockholm convention and therefore may still continue to produce and use HBCD; 1) Bhutan, 2) Equatorial Guinea, 3)Haiti, 4)Iraq, 5)Israel, 6)Italy, 7)Malaysia, 8)South Sudan, 9)Turkmenistan, 10)United States of America, and 11) Uzbekistan (Stockholm Convention, 2008).

1.3 Future Market Trends Resulting from Regulatory Actions

EPA expects future use of HBCD to decrease worldwide as the result of forthcoming international regulations. HBCD is currently regulated under Annex I of REACH, prohibiting many uses now and exempting XPS and EPS insulation through 2019. In addition, in May 2013, HBCD was added to the United Nation's Stockholm Convention list of Persistent Organic Pollutants (C&EN, 2013). The chemical is scheduled to be eliminated by all 178 countries that have ratified the Stockholm Convention starting in 2014, with uses in expanded or extruded polystyrene building insulation in the EU being phased out by 2019 (KemI, 2013). However, the United States is not a signatory of the Stockholm Convention and therefore the ban is not applicable to the United States.

Given that the use of HBCD is going to be phased out in the majority of the world, including the EU, Canada, Australia, and most of Asia, it is likely that most processors and users of HBCD with international markets will phase out the use of HBCD rather than endure the cost of maintaining a separate supply chain for the United States. So while the Stockholm convention ban does not apply to the US, it is expected that U.S. usage and production of HBCD will remain stagnant or most likely decline as a result of international regulation. For example, in response to regulations under REACH the auto industry has formed a consortium to help U.S. manufacturers understand the new requirements; develop tools, processes and best practices; and coordinate compliance efforts (AIAG, 2011). It is likely that as companies discontinue the use of HBCD in European cars to comply with the REACH regulation, and therefore they will discontinue its use in North American automobiles as well. (AIAG, 2011).

2. Production of HBCD

This section discusses the production volume and uses of the Hexabromocyclododecane (HBCD) and Related Chemicals Cluster. The 2016 Chemical Data Reporting (CDR) production, import, and export volumes for these chemicals are listed in Table 3. Additional details on production volume for HBCD can be found in Section 2.1. Use information can be found in Section 3 for HBCD and potential alternatives to HBCD are discussed in Section 4.

2.1 Production Volume and Imports

Table 2 presents Historical Inventory Update Rule (IUR) and 2012 and 2016 public Chemical Data Reporting (CDR) production volume data (EPA, 2006; 2017). The 2016 CDR data indicate that in 2015, between 1 and 10 million lbs. of HBCD were manufactured in or imported into the United States; the precise volume is unknown as some data are claimed as TSCA Confidential Business Information (CBI) (EPA, 2017). This report relies on 2016 CDR data for discussion of site-specific information. For both CAS numbers, site-specific production volumes were withheld as TSCA Confidential Business Information (CBI) for the 2011 reporting year.

Six firms, comprised of nine sites are identified by the 2016 CDR database as manufacturers or importers of HBCD: Albemarle Corporation, BASF Corporation, Campine nv, Chemtura Corporation, The Dow Chemical Company, and Styropek USA (EPA, 2017). Albemarle manufactured HBCD flame retardants under the Saytex®HP-900 trade name (Albemarle Corporation, 2000). All import and manufacture information for these six companies is withheld in the 2016 CDR (EPA, 2017).

Table 2: HBCD Production and Importation (lbs/yr, IUR and CDR data)

CAS RN	Year							
	1986	1990	1994	1998	2002	2006	2011	2015
25637-99-4	10K - 500K	No Reports	No Reports	10K - 500K	10K - 500K	No Reports	CBI	1M-10M
3194-55-6	>1M - 10M	>1M - 10M	>10M - 50M	>10M - 50M	>10M - 50M	10M - < 50M	CBI	1M-10M

Notes:
The total volume (domestically manufactured and imported) of the chemical used at the reporting site. This number represents the volume of the chemical that did not leave the manufacturing site.
Sources: EPA, n.d.; EPA, 2006; EPA, 2012a; and EPA, 2017

2.2 Manufacturers and Importers of HBCD

Six firms, comprised of nine sites are identified by the 2016 CDR as manufacturers or importers of HBCD: Albemarle Corporation, BASF Corporation, Campine nv, Chemtura Corporation, The Dow Chemical Company, and Styropek USA, Inc (EPA, 2017). Albemarle manufactured HBCD flame retardants under the Saytex®HP-900 trade name (Albemarle, 2000). No trade literature has indicated the trade names of BASF or Dow Chemical's product. HBCD is also produced by ICL-IP⁴ and Chemtura under the trade names FR-1206 and CD-75PM™ (ICL-IP, 2014; Chemtura 2013). For more detailed

⁴ ICL-IP did not report the manufacture or import of HBCD in the 2016 CDR.

information on manufacturers of HBCD who reported for the 2016 CDR collection period, see Table 3. International and domestic manufacturers of HBCD, as reported in the *Directory of World Chemical Producers*, are summarized in Table A- 1 (Chemical Information Services, 2015).

Table 3: 2016 CDR Production Data

CAS RN	Manufacturing Site	Activity (Domestically Manufactured or Imported)	Volume Exported (lb)	Volume Used on the Site (lb) ¹	2012 Total Production Volume (lb/yr)	2013 Total Production Volume (lb/yr)	2014 National Production Volume (lb/yr)	2015 Total Production Volume (lb/yr)
25637-99-4	BASF Corporation 100 Park Ave Florham Park, NJ 07932	Imported	CBI	CBI	Withheld	Withheld	Withheld	Withheld
	Chemtura Corporation 199 Benson Road Middlebury, CT 06762-3218	ND	CBI	CBI	Withheld	Withheld	Withheld	Withheld
	Chemtura Corporation 324 Southfield Cutoff El Dorado, AR 71730	Manufactured	CBI	CBI	Withheld	Withheld	Withheld	Withheld
	Styropek USA, Inc 16945 Northchase Dr Houston, TX 77060	Imported	0	0	Withheld	Withheld	Withheld	Withheld
3194-55-6	Albemarle Corp. West Plant 1550 Hwy. 371 W. Magnolia, AR 71753	Manufactured	CBI	CBI	Withheld	Withheld	Withheld	Withheld
	Albemarle Corporation 451 Florida Street Baton Rouge, LA 70801-1765	ND	CBI	CBI	Withheld	Withheld	Withheld	Withheld
	Campine nv, Durr Marketing Associates Inc. 211 Huff Ave Greensburg, PA 15601	Imported	333,517	0	Withheld	Withheld	Withheld	Withheld
	Campine nv 172 Pactiv Way Winchester, VA 22603	Imported	0	202,647	Withheld	Withheld	Withheld	Withheld
	The Dow Chemical Company 2020 Dow Center Midland, MI 48674	Imported	0	0	Withheld	Withheld	Withheld	Withheld

Hexabromocyclododecane (HBCD)

¹The total volume (domestically manufactured and imported) of the chemical used at the reporting site. This number represents the volume of the chemical that did not leave the manufacturing site.

ND = No Data; the company did not provide the requested information.

N/A = Not Applicable; the imported chemical was never physically at the site

"Withheld" in the CDR public database indicates that the national production volume of a chemical was unable to be aggregated in order to protect to CBI claims.

Source: EPA, 2017

2.3 Recent Developments for HBCD Manufacturers

Four of the six companies reporting to the 2016 CDR have indicated either partial or complete replacement of HBCD in their product lines. No direct data were available to quantify these changes, however, personal communications and press releases summarizing these actions for each company are noted in the subsections below. Two companies, Campine nv and Styropek USA did not report the manufacture or import of HBCD in the 2012 CDR, but did report in the 2016 CDR.

The Dow Chemical Company

Dow Chemical Company has developed an HBCD alternative and has licensed it to other HBCD users and producers.

- Dow developed and licensed the “BLUEDGE technology [that] is incorporated in Emerald Innovation 3000™ marketed by the Chemtura Corporation, FR-122P marketed by ICL and GreenCrest™ marketed by the Albemarle Corporation.”⁵ BASF is also using the replacement Dow technology.⁶

Dow Chemical imported HBCD (based on the CDR data) in 2011 and used it in XPS manufacture. However, Dow expects to provide an HBCD-free XPS insulation in the near future.

- “By 2018, extruded polystyrene (XPS) insulation will be available in North America without the extremely toxic flame retardant, hexabromocyclododecane (HBCD). [On November 16, 2016], Dow Chemical announced plans to construct a new manufacturing plant in Burley, Idaho, which will produce XPS insulation with its own [HBCD-alternative] flame retardant.”⁷

BASF

BASF reports it would “switch its entire [HBCD] portfolio to the new flame retardant by the end of 2014”⁸. In 2015, “BASF and Alpek swapped polymer businesses in the Americas, with BASF acquiring the polyurethane business of Polioles - a joint venture of BASF and Alpek - and Alpek getting BASF's EPS business in the Americas.”⁹

Albemarle

“Albemarle Corporation ... is discontinuing production of its hexabromocyclododecane (HBCD)-based flame retardants so that it can focus on supplying GreenCrest® polymeric fire safety solutions, a sustainable alternative to HBCD. GreenCrest, which is based on technology licensed from Dow Global Technologies LLC, is commercially available in both powder and compacted grades for use in expanded (EPS) and extruded (XPS) polystyrene foam applications. Albemarle first began supplying commercial

⁵ <http://building.dow.com/en-us/newsroom/2016/20161117a> (November 17, 2016)

⁶ <http://www.plasticstoday.com/content/basf-switches-greener-polyfr-flame-retardant-ps-insulation-foam-portfolio/9557530021539> (November 25, 2014)

⁷ <https://www.pharosproject.net/blog/show/224/hbcd-free-at-last> (July 8, 2016)

⁸ <http://www.chemanager-online.com/en/news-opinions/headlines/basf-opposes-extension-hbcd-flame-retardants> (June 20, 2014)

⁹ <https://www.icis.com/resources/news/2015/04/02/9873260/largest-eps-producer-in-the-americas-now-named-styropek-usa/>

quantities of GreenCrest to the market in Q1 2013.”¹⁰

In a recent phone conversation with EPA, Albemarle Corporation confirmed they stopped manufacturing HBCD between 2014 and 2016 (Albemarle Corporation, 2017).

Chemtura

Chemtura is discontinuing all HBCD manufacture. “Chemtura will permanently discontinue production of HBCD-based flame retardants during, or prior to, the fourth quarter of 2015. Sales of HBCD will continue until inventories are depleted.”¹¹

Campine nv

Campine nv is a Belgian company specializing in:

- Lead Recycling: Recycling of spent lead batteries and waste into high quality bullion, antimonial and soft lead, and special alloys;
- Antimony: Production of antimony oxides as synergists in the flame retardancy of plastics and as catalyst in PET production; and
- Plastics: Production of flame-retardant concentrates, masterbatches and compounds, mainly for the electrical & electronic, cable, automotive and packaging industries.”¹²

No specific information was available concerning the use of HBCD in their plastics applications.

Styropek USA

In 2015, Mexican petrochemical producer, Alpek acquired BASF’s EPS business in North and South America. Under the new name, Styropek USA, the company is the largest producer of EPS in the Americas, as of April 2015.

“Styropek USA, based in Houston, now operates the 165,000 tonne/year EPS plant in Altamira, Mexico, formerly run by Polioles. In addition to the plant in Mexico, Styropek also operates three EPS units in South America - in Brazil, Argentina and Chile - that adds up to 230,000 tonnes/year in total capacity, the company said. Other large EPS producers include NOVA Chemicals at 126,500 tonnes/year, Flint Hills Resources at 120,000 tonnes/year and Styrochem at 76,680 tonnes/year, according to ICIS plants and projects.”¹³

2.4 Price

Obtaining accurate bulk chemical prices can be difficult. Suppliers often require registration and other information before providing price quotes. Chemical prices may be volatile and quotes for the same chemical vary greatly depending on factors such as manufacturer, location, quantity, grade, delivery mode, time of year, and other variables. In addition, chemical purchasers frequently enter into long term contracts with suppliers, and these contracts may have much lower prices than spot prices. While, many

¹⁰ <http://finance.yahoo.com/news/albemarle-discontinue-production-hbcd-based-210500597.html> (May 4, 2016)

¹¹ <http://investor.chemtura.com/releasedetail.cfm?releaseid=936673> (October 14, 2015)

¹² <http://www.campine.biz/index.php/homepage/our-group>

¹³ <https://www.icis.com/resources/news/2015/04/02/9873260/largest-eps-producer-in-the-americas-now-named-styropek-usa/> (April 02, 2015)

lab supply companies provide online price quotes for small volumes of chemicals, these prices tend to be significantly higher than bulk prices.

3. Uses of HBCD

HBCD has several current and historic uses as a flame retardant in polystyrene foam, textiles, and high impact polystyrene. The chemical has been in production since the 1960's, but historic market data of products containing HBCD are not available (Climate and Pollution Agency, 2010).

TSCA defines the conditions of use as “the circumstances, as determined by the Administrator, under which a chemical substance is intended, known, or reasonably foreseen to be manufactured, processed, distributed in commerce, used, or disposed of” (TSCA § 3). EPA identified the conditions of use through a limited search of readily available data sources, including but not limited to: information collected under the 2016 CDR rule, information from Agency databases, other U.S. Government agencies, publicly available information from states, and published literature and scientific journals. A public meeting was held February 14, 2017 for stakeholders to provide information on the conditions of use for the first 10 chemicals and EPA has also held over 40 outreach meetings with stakeholders to collect information on conditions of use.

3.1 Use in Expanded Polystyrene Foam (EPS) and Extruded Polystyrene Foam (XPS)

HBCD is used as a flame retardant in expanded polystyrene foam (EPS) and extruded polystyrene foam (XPS) (Weil and Levchik, 2009; UNEP, 2010). Use in EPS and XPS accounted for 95% of all HBCD applications in the past decade (UNEP, 2010; EPA, 2014).

The building and construction industry uses EPS and XPS in thermal insulation boards and laminates for sheathing products. EPS prevents freezing, provides a stable fill material, and creates high-strength composites in construction applications. XPS foam board is used mainly for roofing applications and architectural molding. HBCD is used in both types of foams because it is highly effective at low use level and, therefore, maintains the insulation properties of EPS and XPS (Morose, 2006). EPS boards contain approximately 0.5% HBCD by weight in the final product, and XPS boards contain 0.5-1% HBCD by weight (Morose, 2006; Extruded Polystyrene Foam Association, 2011 via EPA, 2014).

Through the impact of international bans, and the availability of alternatives, and reported industry use statements, use of HBCD in EPS and XPS is declining or no longer occurring in the U.S. The XPS Association (XPSA) highlights that three main U.S. manufacturers of XPS have announced their intention to discontinue manufacturing HBCD: Israel Chemicals Ltd., Albemarle, and Chemtura (XPSA, 2017). The status of the use of HBCD in XPS is unknown. The EPS Industry Alliance, which represents all major North American manufacturers of EPS, reports that its members have phased out HBCD in the production of EPS resins (EPS Industry Alliance, 2017). An estimated 80-85% of EPS rigid foam insulation manufactured in the U.S. is supplied by EPS Industry Alliance members (EPS Industry Alliance, 2017). Furthermore, according to the American Chemistry Council, EPS resin manufacturers no longer have supplies of HBCD, except for importation (Reiter, 2017).

3.2 Use in Textiles

In the U.S., HBCD was historically used as a flame retardant in the back coating of textiles. Information gathered from research, industry, and consumer product organizations, however, has lead EPA to believe that HBCD is no longer used in consumer textile applications outside of the auto industry. EPA received information from a group of textile formulators that the end uses of HBCD-containing textiles are for

military, institutional, and aviation applications, such as durable carpet tiles for hospitals or prisons (Friddle, 2011 and EPA, 2012b). Use in this application is quite small; in 2005 only 1 percent of HBCD was used in textiles in the U.S. (EPA, 2012b).

Within the U.S. auto industry, EPA found that a small amount of HBCD is used in floor mats, headliners, and possibly other interior fabrics in automobiles made or imported to the U.S. (EPA, 2012b). However, in 2017, EPA received a public comment from the Alliance of Automobile Manufacturers stating that HBCD is no longer used in automobile manufacturing (2017). HBCD may still be used in coatings of certain components, such as dashboards and headliners and in solder paste in interior circuits. This chemical may also be present adhesives and foams (Alliance of Automobile Manufacturers, 2017). Members of the Motor and Equipment Manufacturers Association report that HBCD is not used in the manufacturing process of any automotive components (2017). As of 2015, members had “nearly phased out completely the use of HBCD” (Motor and Equipment Manufacturers Association, 2017).

3.3 Use in High Impact Polystyrene (HIPS)

In both the U.S. and Europe, HBCD is used as a flame retardant in high impact polystyrene (HIPS) for electrical and electronic appliances, such as audio-visual equipment, refrigerator lining, and some wire and cable applications (Morose, 2006 and ECHA, 2009). Use in television sets is the predominant application of HIPS (Weil and Levchik, 2009).

3.4 Other Identified Uses

Review of the Chemical and Product Categories database¹⁴ shows two historical use of HBCD not previously identified:

- Use in “INTERLITE FIRE RETARDANT WB WHITE (HF 4510H/4509H),” produced by International Paint and Courtaulds Coatings. This product is a flame resistant paint coating containing HBCD. The most recent available MSDS for the product is from 1992¹⁵, suggesting that it is not currently in the market place.
- Use in “rubber and plastic products”. The specific identity of this product is unknown at this time.

From June 2012 to March 2017, the use of HBCD in children’s clothing, car seats, blankets, toys, and toy vehicles was reported 48 times to Washington State under state law (Toxic-Free Future, 2017).

Other consumer products contain HBCD as well. An EPS insulation product sold by major retailers, contains HBCD, according to its SDS (Carlisle Construction Materials, 2015).

The Australian Department of Health and Aging also reports that minimal amounts of HBCD are imported into the country already incorporated into various articles, such as inkjet printers, projectors, scanners, ventilation units for offices, compact fluorescent lights, and LCD digital audiovisual systems (ADHA, 2012). There is no data to indicate that HBCD is used in the U.S. for these purposes.

¹⁴ <https://actor.epa.gov/cpcat/faces/search.xhtml>

¹⁵ <http://siri.org/msds/f2/cbb/cbbpl.html>

3.5 Summary of All Uses

Table 4 provides a summary of the percent HBCD found in commercial and consumer products.

Table 4: Percent HBCD in Commercial and Consumer Products

Use	Percent HBCD by Weight
EPS Insulation	0.5
XPS Insulation	0.5-1
Textile Back Coatings	10-25
HIPS	1-7
Source: Morose, 2006; EPA, 2013b; EC, 2008	

Table 5 provides a summary of HBCD uses and potential end products as presented in the EU risk assessment report (EC, 2008). Although the EU market and industry for HBCD are considered to be similar to those in the U.S., differences do exist in building technologies, climate, and consumption patterns, limiting the comparison of the two markets.

The 2016 CDR data for industrial uses of HBCD are presented in and consumer and commercial uses are presented in Table 7.

Table 5: Uses of HBCD

Material ¹	Use/ Function ¹	Percent of HBCD Production Volume ²	End Products ¹	Ongoing Use in the United States
EPS	Insulation	45%	Construction, insulation boards,(packaging material)	Yes; based on use in construction insulation boards in 2016 CDR data ²
			Packaging material (minor use and not in food packaging)	Unknown; it is unclear if packaging is treated with flame retardants in the United States ³
			Insulation boards (against cold or warm) of transport vehicles e.g. lorries and caravans	Possibly; based on use in insulation boards in 2016 CDR data ²
			Insulation boards in building constructions e.g. houses' walls, cellars and indoor ceilings and "inverted roofs" (outdoor)	Yes; based on use in construction insulation boards in 2016 CDR data ²
			Insulation boards against frost heaves of road and railway embankments	Possibly; based on use in insulation boards in 2016 CDR data ²
XPS	Insulation	51%	Construction, insulation boards	Yes; based on use in construction insulation boards in 2016 CDR data ²
			Insulation boards (against cold or warm) of transport vehicles e.g. lorries and caravans	Possibly; based on use in insulation boards in 2016 CDR data ²
			Insulation boards in building constructions e.g. houses' walls, cellars and indoor ceilings and "inverted roofs" (outdoor)	Yes; based on use in construction insulation boards in 2016 CDR data ²
			Insulation boards against frost heaves of road and railway embankments	Possibly; based on use in insulation boards in 2016 CDR data ²
HIPS	Electrical and electronic parts	2%	Electric housings for VCR	Possibly, based on use in electronic plastics in 2016 CDR ²
			Electrical and electronic equipment e.g. distribution boxes for electrical lines	Possibly, based on use in electronic plastics in 2016 CDR ²
			Video cassette housings	Possibly, based on use in electronic plastics in 2016 CDR ²

Material ¹	Use/ Function ¹	Percent of HBCD Production Volume ²	End Products ¹	Ongoing Use in the United States
Polymer dispersion on cotton or cotton/synthetic blends	Textile coating agent	2%	Upholstery fabric	Historic Use in the United States ⁴
			Bed mattress ticking	Historic Use in the United States ⁴
			Flat and pile upholstered furniture (residential and commercial furniture)	Historic Use in the United States ⁴
			Upholstery seatings in transportation	Possibly, based industry response to SNUR ²
			Draperies, and wall coverings	Historic Use in the United States ⁴
			Interior textiles e.g. roller blinds	Historic Use in the United States ⁴
			Automobile interior textiles	Possibly, based industry response to SNUR ²
<p>Note: The uses in this table describe recorded HBCD applications for both the U.S. and other countries. Given that HBCD will be phase-out internationally under REACH and the Stockholm Convention, it is unclear to what extent HBCD is currently used in these applications outside of the U.S.</p> <p>Sources:</p> <ol style="list-style-type: none"> 1) EC, 2008 2) EPA, 2017 3) EPA, 2013b 4) EPA, 2012b 				

Table 6: 2016 CDR Industrial Use Data

Chemical	Manufacturing/ Importing Company	Site State	Industrial Function Category	Type of Processing or Use	Industrial Sectors	Percent of Production Volume
25637-99-4	BASF Corporation	NJ	Other (specify)	Processing—incorporation into article	Construction	CBI
	Chemtura Corporation	CT	NDR	NDR	NDR	NDR
		AR	Flame retardants	Processing—incorporation into article	Plastic material and resin manufacturing	50
					Construction	50
					Plastic material and resin manufacturing	50
	Styropek USA, Inc	TX	Flame retardants	Processing—incorporation into formulation, mixture, or reaction product	Plastics product manufacturing	14
					Construction	86
	3194-55-6	Albemarle Corp.	AR	Flame retardants	Processing—incorporation into article	Construction
Processing—incorporation into formulation, mixture, or reaction product					Construction	1
AR		Intermediates	Processing as a reactant	All other basic inorganic chemical manufacturing	6	
Albemarle Corporation		LA	NDR	NDR	NDR	NDR
Campine nv		PA	Flame retardants	Processing—incorporation into article	Construction	100
		VA	Flame retardants	Processing—incorporation into article	Construction	100
The Dow Chemical Company		MI	Flame retardants	Processing—incorporation into article	Construction	100
Source, EPA, 2017						

Table 7: 2016 CDR Consumer and Commercial Use Data

Manufacturing/Importing Company	Site State	Product Category	Consumer/Commercial Use	Used in Product(s) Intended for Children	Percent of Production Volume
BASF Corporation	NJ	Building/construction materials not covered elsewhere	Commercial	No	CBI
			Both	No	CBI
Chemtura Corporation	CT	NDR	NDR	NDR	NDR
	AR	Building/construction materials not covered elsewhere	Commercial	No	100
Styropek USA, Inc	TX	Building/construction materials not covered elsewhere	Commercial	No	86
		Electrical and electronic products	Commercial	No	14
Albemarle Corp.	AR	Building/construction materials not covered elsewhere	Consumer	No	1
			Commercial	No	1
Albemarle Corporation	LA	NDR	NDR	NDR	NDR
Campine nv	PA	NDR	NDR	NDR	NDR
	VA	NDR	NDR	NDR	NDR
The Dow Chemical Company	MI	NDR	NDR	NDR	NDR
Notes: 1) Building and construction materials with district consumer/commercial categories in the CDR data include: Building/construction materials - wood and engineered wood products Source, EPA, 2017					

4. Substitutes

4.1 Flame Retardant in Polystyrene Foam

4.1.1 Chemical Substitutes

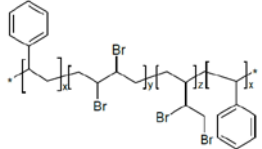
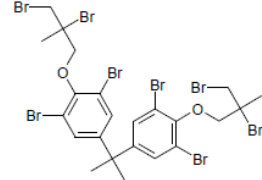
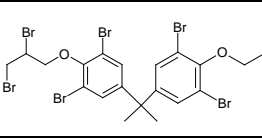
In 2014, EPA's Design for the Environment (DfE) program published an Alternatives Assessment for HBCD (EPA, 2014). In this analysis, three flame retardants were identified as being potentially commercially viable alternatives to HBCD in extruded polystyrene (XPS) and expanded polystyrene (EPS) building insulation: butadiene styrene brominated copolymer (CASRN 1195978-93-8), TBBPA-bis-brominated ether derivative (CASRN 97416-84-7), and TBBPA bis(2,3-dibromopropyl) ether (TBBPA-DBPE) (CASRN 21850-44-2). Although other chemicals were considered for inclusion in the alternatives assessment, they were ultimately excluded because they either did not allow EPS and/or XPS to meet flammability standards or they could not be integrated into the EPS and/or XPS manufacturing process.

In 2011 The Dow Chemical Company introduced a line of butadiene styrene copolymer (Polymeric Flame Retardants) for use in extruded polystyrene (XPS) and expanded polystyrene (EPS) foam insulation (Dow, 2011). The chemical is marketed as a drop-in replacement for HBCD with comparable flammability performance (Esposito, 2013; Chemtura, 2012). Chemtura has already begun production of the polymeric flame retardant under the trade name Emerald™3000 (Chemtura, 2012). Dow Chemical has also licensed the polymeric flame retardant technology to ICL-IP (trade name FR-122P) and Albemarle (trade name GreenCrest™), which are scheduled to begin production in 2014 (Esposito, 2013; Chemical Watch, 2013; Albemarle 2012). With the additional production capacity of ICL-IP and Albemarle, it is anticipated that the polymeric flame retardants have the potential to replace HBCD in XPS and EPS foams in three to five years (EPA, 2014). Both ICL-IP and Great Lakes Solutions anticipate that production volumes of FR-122P and Emerald™3000 will each reach 10,000 tonnes per year at the end of 2014 (Chemical Watch, 2013). Manufacturers are varied in their projections of how this new chemical will affect the cost competitiveness of the EPS and XPS market, and the impact on the price of XPS and EPS will likely be unclear until the polymeric flame retardants are more integrated in the market (EPA, 2014). Dow predicts, however, that production of all polymeric flame retardants will reach 20,000 tonnes per year by the end of 2014 and that production capacity will meet demand for flame retardants resulting from the EU phase-out of HBCD beginning 2015 (Chemical Watch, 2013). Because the chemical is a polymer, manufacturers are not required to report production or use data for the CDR (EPA, 2014).

The TBBPA-bis-brominated ether derivative is produced under the trade name Pyroguard SR-130 (EPA, 2014). However, it is unclear how commercially viable the product is. 2016 CDR data are not available for this chemical, possibly due to its recent entry into the market (EPA, 2014). Further details on the EPA Alternatives Assessment chemicals are listed in Table 8.

TBBPA-DBPE is produced under the trade names Pyroguard SR 720 and Saytex HP-800 (EPA, 2014). The 2017 CDR identifies 7 sites that manufacture or import TBBPA-DBPE and a national production volume of 10 – 50 million pounds per year (EPA, 2017).

Table 8: Potential Alternatives to HBCD in EPS and XPS identified in 2014 DfE Alternatives Assessment

CAS RN	Preferred Chemical Abstract Index Name	Common Names and Acronyms ^b	Molecular Formula	Structure
1195978-93-8	Butadiene styrene brominated copolymer	Emerald Innovation™3000; FR122P; GreenCrest™	$(C_8H_9)_x(C_4H_6Br_2)_y(C_4H_6Br_2)_z$	
97416-84-7	TBBPA-bis brominated ether derivative	TBBPA; Pyroguard SR-130; SR-130	$C_{23}H_{24}Br_8O_2$	
21850-44-2	TBBPA bis (2,3-dibromopropyl) ether	TBBPA-DBPE; Pyroguard SR 720; SAYTEX HP-800	$C_{21}H_{20}Br_8O_2$	

Source: EPA, 2014

Additionally, in his report Morose identified some commercially available bromide flame retardants which may be used in EPS foam. But, Morose did not assess the effectiveness of these chemicals in this application when compared with HBCD (Morose, 2006). Therefore, it is unknown if these chemicals are drop-in chemical substitutes for HBCD in EPS foam. These chemicals are:

- tetrabromo-cyclooctane (CAS 31454-48-5)
- dibromoethyldibromo- cyclohexane (CAS 3322-93-8)
- TBBPA (CAS 79-94-7)

Weil and Levchik (2009) indicate that both tetrabromo-cyclooctane and dibromoethyldibromo-cyclohexane have limited applications in styrene foam, indicating that they may not be used in the same applications as HBCD. Tetrabromo-cyclooctane and dibromoethyldibromo-cyclohexane were not included in the final EPA Alternatives Assessment for HBCD because the thermal stabilities of the chemicals are incompatible with the operating temperature requirements of XPS foam manufacture. Furthermore, dibromoethyldibromo-cyclohexane has been noted as a persistent, bioaccumulative, and toxic (PBT) chemical by polystyrene manufacturers (EPA, 2014).

In the updated literature search, another alternative was discovered, DOW BLUEEDGE™ Polymeric Flame Retardant Technology. DOW BLUEEDGE is a “stable, high molecular weight, non-hazardous polymer” with an improved environment, health, and safety profile compared to other alternatives. It is intended for use in XPS and EPS foams.

4.1.2 Product Substitutes

Alternative materials may be used in place of XPS and EPS foam to insulate buildings. Polyester and polyether polyols may be used to produce insulation boardstock from rigid foam. These products are not treated with bromide flame retardants, but rather other chemicals; tris monochloropropyl phosphate (CAS 26248-87-3), tris chloroethyl phosphate (CAS 115-96-8), and RB-79 (diol made from tetrabromo phthalic

anhydride) (CAS 20566-35-2) (Morose, 2006). Phenolic foam, which is produced by combining formaldehyde and phenol, may also be used (Morose, 2006). When using this alternative insulation a thermal barrier must be used (Morose, 2006). Thermal barriers are fire resistant coatings and coverings that separate the insulation material from the building, materials used as thermal barriers include, gypsum boards, plasters, and coatings, cement plasters, perlites board, cellulose or mineral fiber coatings, and select plywoods (ECHA, 2009). Intumescent systems may also be used. Intumescent systems combine various compounds that react together, in the event of a fire, to form a carbon foam (ECHA, 2009). The foam is thicker than the original coating, and has a low thermal conductivity (ECHA, 2009). Although combining non-flame retardant-treated foam with an appropriate thermal barrier will often sufficiently meet building code or flammability standards, U.S. manufacturers typically only sell flame retardant-treated building insulation foam (EPA, 2014).

Polyisocyanurate foams may also be used as an alternative to XPS or EPS foam in building insulation. These foams are typically available as spray foam or board insulation and contain 5-14% of the flame retardant tris(chloropropyl)phosphate (TCPP) (EPA, 2014). Although it is most frequently used in roof insulation, polyisocyanurate foams are also used in cavity walls and sheathing (EPA, 2014). However, it should be noted that the isocyanate group is currently identified as an EPA Action Plan chemical and may cause adverse human health effects (EPA, 2014). Materials such as perlite and mineral wool/rockwool may also be used as alternative rigid board insulation (EPA, 2014).

Other substitutes include alternative insulation types such as, blanket, foamed-in-place, loose-fill, and reflective insulation (EPA, 2014).

4.2 Flame Retardant in Textiles

Several chemicals may be used as alternatives for HBCD in textile applications. For textile backing these include:

- deca-BDE (CAS 1163-19-5) (ECHA, 2009)
- chloroparaffins (CAS 63449-39-8; 85535-85-9) (ECHA, 2009)
- ammonium polyphosphate (CAS 68333-79-9; 14728-39-9) (ECHA, 2009)
- diammonium phosphate (Posner, 2006)
- intumescent systems (Posner, 2006)
- nitrogen-based organic flame retardants (UNECE, 2010)
- reactive phosphorus constituents (ECHA, 2009)

While intumescent systems are considered a commercial alternative to HBCD in textile backing, they do not prevent ignition and flame spread. Most of the commercially available intumescent systems are water soluble and are consequently removed during soaking prior to flame testing (Posner, 2006). The costs of deca-BDE and chlorinated paraffins are expected to be comparable or slightly lower than that for HBCD (ECHA, 2009). However, these substitutes also have significant health and environmental concerns.

4.3 Flame Retardant in High-Impact Polystyrene (HIPS)

There are several alternatives to HBCD for use in HIPS. Deca-BDE (CAS 1163-19-5) is currently the most widely used flame retardant in HIPS (Weil and Levchik, 2009) and is also used in electronic wire insulation. Other chemicals used in HIPS include both halogenated flame retardants used in conjunction

with antimony trioxide (ATO) and organic aryl phosphorus compounds (ECHA, 2009). Halogenated flame retardants used with ATO include:

- Deca-BDE/ATO (CAS 1163-19-5)
- Decabromo Diphenyl Ethane (TDE) /ATO (CAS 84852-53-9)
- Ethylene bistetrabromo-phthalimide (EBTPI) /ATO (CAS 32588-76-4)

The organic aryl phosphorus compounds are:

- Triphenyl phosphate (TPP) (CAS 115-86-6)
- Resorcinol bis diphenylphosphate (RDP) (CAS 125997-21-9; 57583-54-7)
- Bisphenol-A bis(diphenyl phosphate) (BAPP) (CAS 1181028-79-5)
- Diethylphosphinic acid, aluminium salt (CAS 225789-38-8)
- Diphenyl cresyl phosphate (CAS 26444-49-5)

5. Waste Management

5.1 Recycling EPS and XPS

To date, little is known by EPA about the recycling of products containing HBCD. Schlummer et al. (2016) describes that EPS and XPS in construction insulation materials is rarely recycled for numerous reasons, including that insulation waste is typically not separated from mixed waste stream and most insulation containing HBCD is still in place. Schlummer et al. (2016) describes technologies available at the laboratory and small scale to separate HBCD and recycle polystyrene.

However, reuse and recycling is available in the US for consumers through removal of insulation during re-roofing projects. Two companies were identified that directly reuse (e.g., reuse without reforming) XPS and EPS insulation, and recycle (e.g., melting and inserting into the manufacturing process) is available:

- Green Insulation Group: <http://www.greeninsulationgroup.com/products/>
- Nationwide Foam Recycling: <http://nationwidefoam.com/what-you-can-recycle.cfm>

According to a conversation with Nationwide Foam Recycling, which is owned by Conigliaro Industries, Inc., their plant recycles all EPS insulation and reuses all XPS insulation. Once processed, their recycled EPS roofing insulation is taken to polystyrene product manufacturers, notably picture frame manufacturers, mostly in China but also in domestic markets. The company also delivers recycled roofing material to other local EPS recycling plants that may use different processes. The company reuses XPS roofing material due the special equipment needed to recycle XPS and indicated that XPS is rarely recycled in the U.S. It was estimated that the majority (>50%) of XPS roofing material is sent to landfills or waste energy plants. Nationwide Foam Recycling processes 90,000 pounds/year of EPS standard packaging and 10,000 pounds/year of EPS roofing material and estimated that 10-20% of EPS roofing material is recycled nationally. Processing estimates for XPS material were not provided (Nationwide Foam Recycling, 2017).

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Appendix

Table A- 1 provides a list of domestic and international manufacturers of HBCD as of 2015 (Chemical Information Services, 2015).

Table A- 1. Worldwide Manufacturers of HBCD

Country	Company	CAS RN	Website
Canada	Toronto Research Chemicals Inc. 2 Brisbane Road North York, ON M3J 2J8	3194-55-6	www.trc-canada.com
China	Yuanping Changyuan Chemicals Co., Ltd. Room 1309, Wufeng Building, 11 Zhenxing Street National Hi-Tech Industrial Zone Taiyuan, Shanxi Province 030006	3194-55-9	www.yuanpingint.com
	Weifang Changda Chemical Industry Co., Ltd (Qingdao Office) R.M.20, B Shenyue Building, 9 Shandong Road Qingdao, 266071	3194-55-10	
	Shandong Moris Chemical Co., Ltd. Room 1608, 360 Synotower Building Weifang City, Shandong Province 261041	3194-55-11	www.morischem.com
	Hunan Yixiang Chemical Industrial Co., Ltd. (Liuyang Chemical Corp.) Changsha National Biomedical Industrial Base 410329	3194-55-12	www.hnyxchem.com.cn
	Xinjin Sensen Metal Powder Factory Penliuzuo Town, Xinji City Hebei Province 052360	3194-55-13	www.lead-nitrate.com
	Shuyanshi Huatai Chemical Factory Zaxia Chemical Zone Shuyang 223600	3194-55-14	www.huatai-chem.com
	Oceanchem Group Room 819-821, Jinjang Building 5608, Xinhua Road Weifang, Shandong 261041	3194-55-15	www.oceanchem-group.com
	Shandong Dadi Salt Chemical Group Ltd. Chahe Village, Hou Town Shouguang City, Shandong Province 262725	3194-55-16	

Hexabromocyclododecane (HBCD)

Country	Company	CAS RN	Website
	Shanghai Luojin Chemicals Co., Ltd. RM2103, Charity Plaza, 88 Caoxi Road (N) Shanghai 200030	3194-55-17	
	Shandong WNN Industrial Co., Ltd. Room 511, Finance Service Center, Jiankang East Street Weifang, Shandong 261041	3194-55-18	www.wnncn.com
	Weifang Brother Chemical Co., Ltd. Weifang Ocean Chemical Development Zone Weifang, 262737	3194-55-19	www.oceanchemical.com
	Jiangyin Haida Fine Chemical Plant Huashi Town Jiangyin, Jiangsu Province 214421	3194-55-20	www.haidachem.com
	Weifang Haihua Yuanda Fine Chemical Co., Ltd. Binhai Development Weifang City, Shandong	3194-55-21	
	Lianyungang Marine Chemical Co., Ltd. Banqiao Industrial Park Lianyungang City, Jiangsu Province	25637-99-7	www.seabr.com
Netherlands	ICL-IP Europe Fosfaatweg 48 1013 BM Amsterdam	3194-55-22	www.icl-industrial.com
	ICL-IP Terneuzen B.V. Postbus 318 4530 AH Terneuzen	25637-99-8	
Brazil	Chemtura Industria Quimica do Brasil Ltda. Avenida Brasil 5333, Distrito Industrial 13505-600 Rio Claro (SP)	25637-99-4	
U.S.	APAC Pharmaceutical, LLC 6851 Oak Hall Lane, Suite 101 Columbia, MD 21045	3194-55-7	www.apacpharma.com
	Sarchem Laboratories, Inc. 5012 Industrial Road Farmingdale, NJ, 07727	3194-55-8	www.sarchemlabs.com
	Great Lakes Solutions 1801 US Highway 52 West West Lafayette, IN 47906	25637-99-5	www.greatlakes.com
	Chemtura Corporation (Formerly Great Lakes Chemical Corp) 1801 US Highway 52 West West Lafayette, IN 47906	25637-99-6	www.chemtura.com

Source: Chemical Information Services, 2015

Use and Market Profile for Methylene Chloride

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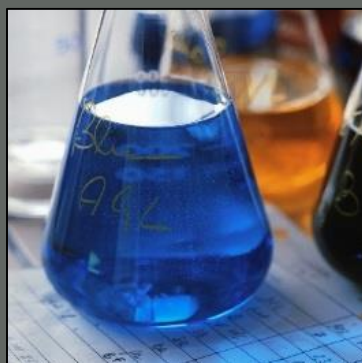


Table of Contents

1. Introduction	1
1.1 Overview of Methylene Chloride.....	1
2. Chemical Databases: CDR and TRI.....	3
2.1 Chemical Data Reporting.....	3
2.1.1 CDR Information – Major Manufacturers and/or Importers.....	3
2.1.2 CDR Information – Industrial Processing and Use Information.....	4
2.1.3 CDR Information – Consumer and Commercial Use Information	7
2.1.4 Historical U.S. Production Volume.....	9
2.2 Toxics Release Inventory	10
2.2.1 Total Number of Methylene Chloride Facilities Reporting to TRI.....	10
3. Use Information and Market Trends.....	12
3.1 Uses of Methylene Chloride	12
3.2 Products.....	16
3.3 Methylene Chloride Market Trends	61
References.....	62

List of Tables

Table 1-1: Chemical Name, Synonyms, and CASRN for Methylene Chloride.....	2
Table 2-1. Methylene Chloride Manufacturers and Importers.....	3
Table 2-2. Methylene Chloride Industrial Use Information.....	5
Table 2-3. Methylene Chloride Consumer and Commercial Use Information.....	8
Table 2-4. National Production Volume Data for Methylene Chloride from 1986-2012 (lbs.).....	9
Table 2-5: Summary of 2015 Activity or Use by Number of Facilities for Methylene Chloride.....	10
Table 2-6: TRI Activity and Use Definitions.....	11
Table 3-1 Known Applications of Methylene Chloride.....	13
Table 3-2: Sample of Products that Contain Methylene Chloride	17

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1. Introduction

Methylene chloride is the subject of this use and market profile. Under the Toxic Substance Control Act (TSCA), EPA recently proposed a Section 6 rulemaking for the use of methylene chloride in paint and coating removal by industrial users, commercial outdoor users, commercial users in residences, and consumer users. This report details historic and current uses of methylene chloride.

Section 1 provides an overview of methylene chloride, Section 2 details U.S. producers, production, and import volumes, and Section 3 presents use information and market trends.

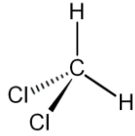
1.1 Overview of Methylene Chloride

Methylene chloride, also commonly known as dichloromethane or DCM, is a volatile, colorless liquid with a sweet odor (ATSDR, 2000). It is used as a solvent in paint strippers and removers, as a process solvent in the manufacture of pharmaceuticals and film coatings, as a metal cleaning and finishing solvent, as an agent in urethane foam blowing, and as a propellant in aerosols for paints, insect sprays, and automotive products (EPA, 2000). Methylene chloride has also had applications as an extraction solvent for spice oleoresins and hops, as a postharvest fumigant for grains and strawberries, and as a degreening agent for citrus fruits (EPA, 2000). Methylene chloride is no longer an active ingredient in any registered pesticide products, according to the National Library of Medicine's Hazardous Substance Data Bank; however, it may be used as an inert ingredient in pesticide products with applications in growing crops (HSDB, 2015).

Acute exposure to methylene chloride is associated with adverse nervous system effects, such as decreased visual, auditory, and motor functions. Animals chronically exposed to methylene chloride experience liver, kidney, and cardiovascular system damage. EPA classifies methylene chloride as a probable carcinogen (EPA, 2000).

Because paint and coating removal make up the highest human exposures to methylene chloride, EPA recently conducted a risk assessment to evaluate health risks to consumers and workers using methylene chloride in paint removers, as well as bystanders in the workplace and in homes where these products are used. The Agency found that acute exposures to workers, consumers, and bystanders can result in neurotoxicity and harmful effects to the central nervous system. Chronic exposure can lead to liver toxicity, liver cancer, and lung cancer (EPA, 2015a).

Table 1-1: Chemical Name, Synonyms, and CASRN for Methylene Chloride

Chemical Name	Methylene chloride
CASRN	75-09-2
Synonyms	4-01-00-00035 (Beilstein Handbook Reference); AI3-01773; BRN 1730800; Caswell No. 568; CCRIS 392; DCM; Dichloromethane; EC 200-838-9; EINECS 200-838-9; EPA Pesticide Chemical Code 042004; F 30 (chlorocarbon); HCC 30; HSDB 66; Methane dichloride; Methane, dichloro-; Methylene bichloride; Methylene chloride; Methylene dichloride; NCI-C50102; NSC 406122; R 30 (refrigerant); RCRA waste number U080; UN 1593; UNII-588X2YUY0A
Trade Name(s)*	Aerotherne MM; Freon 30; Khladon 30; Metaclen; Narkotil; Solaesthin; Soleana VDA; Solmethine
Molecular Formula	CH ₂ Cl ₂
Structure	 <p>The structure shows a central carbon atom (C) bonded to two hydrogen atoms (H) and two chlorine atoms (Cl). One hydrogen atom is positioned above the carbon, and the other is to the right. One chlorine atom is to the left, and the other is below the carbon. The bonds are represented by lines, with the chlorine atoms shown using wedge and dash notation to indicate their three-dimensional orientation.</p>

*Not a complete list

Source: NLM (2016)

2. Chemical Databases: CDR and TRI

2.1 Chemical Data Reporting

The Chemical Data Reporting (CDR) Rule under TSCA requires U.S. manufacturers and importers to provide EPA with information on the chemicals they manufacture or import into the United States. For the 2012 CDR cycle, data collected per chemical include the company name, volume of each chemical manufactured/imported, the number of workers at each site, and information on whether the chemical is used in the Commercial, Industrial, and/or consumer sector. However, only companies that manufactured or imported 25,000 pounds or more at each of their sites during the 2011 calendar year were required to report information under the CDR rule (EPA, 2014).

2.1.1 CDR Information – Major Manufacturers and/or Importers

The 2012 non-confidential CDR includes nine manufacturers and importers of methylene chloride (see Table 2-1). Some information, including two company records, is claimed as CBI—one is an importer and one claims CBI for both manufacturing and importing information. Of the seven non-CBI companies, four are importers, one is a manufacturer, and two both import and manufacture methylene chloride. The 2012 national production volume of methylene chloride is 261,469,894 pounds per year (EPA, 2014).

Table 2-1. Methylene Chloride Manufacturers and Importers								
Company	Site State	NAICS Code	Manufacture (lb./yr.)	Import (lb./yr.)	Never at Site?	Volume (used at site; lb./yr.)	Concentration	Number of Workers
Colonial Group Inc.	GA	424710	0	139,292	NO	0	90% +	50 - 99
Dimmid Inc.	NY	424690	0	1,378,080	YES	N/A	< 1%	NR
Dow Chemical Company	MI	325211	0	CBI	YES	N/A	90% +	NKRA
	CA	325211	CBI	0	NR	CBI	90% +	NR
	TX	325211	CBI	0	NR	CBI	90% +	NKRA
Greenchem Industries LLC.	FL	424690	0	CBI	CBI	N/A	90% +	NKRA
Henkel Corp	NC	325613	0	51,096	NO	51,096	90% +	25 - 49
Occidental Chemical Holding Corporation	LA	213112	CBI	0	NR	CBI	CBI	< 10
	KS	213112	CBI	CBI	CBI	CBI	CBI	50 - 99
SolvChem Inc.	TX	424690	945,900	0	NR	945,900	90% +	100 - 499
CBI	CBI	CBI	0	18,878,000	YES	N/A	90% +	500 - 999
CBI	CBI	CBI	CBI	CBI	CBI	CBI	90% +	NKRA

Source: Dunn & Bradstreet (2015); EPA (2014)

Notes: CBI = Confidential Business Information

N/A= Not Applicable

NKRA= Not Known or Reasonably Ascertainable

NR= Not Reported

2.1.2 CDR Information – Industrial Processing and Use Information

Table 2-2 presents the industrial processing and use information for U.S. manufacturers and importers of methylene chloride, according to the 2012 CDR. Methylene chloride is used as a solvent for cleaning and degreasing, as a propellant and blowing agent, and as a processing agent in a wide variety of sectors including the petrochemical manufacturing, adhesive manufacturing, and chemical manufacturing sectors. Some data were claimed as confidential business information in the 2012 CDR (EPA, 2014).

Table 2-2. Methylene Chloride Industrial Use Information								
Manufacturing/ Importing Company	Site Name and Address	NAICS code	Type of Process	Industrial Sector	Industrial Function Category	Percent of Production Volume	Number of Sites	Number of Workers
Colonial Group Inc.	Colonial Chemical Solutions, Inc. 916 W Lathrop Savannah, GA 31402	424710	Processing-incorporation into formulation, mixture, or reaction product	Petrochemical Manufacturing	Processing aids, not otherwise listed	100	< 10	50 - 99
Dimmid Inc.	Dimmid Inc. 4635 Bedford Avenue Brooklyn, NY 11235	424690	NR	NR	NR	NR	NR	NR
Dow Chemical Company	The Dow Chemical Company 901 Loveridge Rd Pittsburg, CA 94565	325211	NR	NR	NR	NR	NR	NR
Dow Chemical Company	The Dow Chemical Company 2020 Dow Center Midland, MI 48674	325211	Processing-incorporation into formulation, mixture, or reaction product	All Other Basic Organic Chemical Manufacturing	Solvents (for cleaning or degreasing)	10	NKRA	NKRA
Dow Chemical Company	The Dow Chemical Company - Freeport 2310 N Brasoport Blvd Freeport, TX 77541	325211	Processing-incorporation into formulation, mixture, or reaction product	All Other Basic Organic Chemical Manufacturing	Solvents (for cleaning or degreasing)	10	NKRA	NKRA
Greenchem Industries LLC	Greenchem Industries LLC 222 Clematis St. Suite 207 West Palm Beach, FL 33401	424690	NKRA	NKRA	NKRA	90	NKRA	NKRA
Henkel Corp	Henkel Corp 485 Cedar Springs Rd Salisbury, NC 28147	325613	Use-non-incorporative activities	Adhesive Manufacturing	Solvents (for cleaning or degreasing)	100	< 10	25 - 49
Occidental Chemical Holding Corporation	Occidental Chemical Corp Geismar Plant 8318 Ashland Rd Geismar, LA 70734-3513	213112	Use-non-incorporative activities	CBI	Solvents (for cleaning or degreasing)	CBI	< 10	< 10
Occidental Chemical Holding Corporation	Occidental Chemical Corporation 6200 S. Ridge Rd Wichita, KS 67215	213112	Use-non-incorporative activities	CBI	Processing aids, specific to petroleum production	CBI	< 10	50 - 99

Table 2-2. Methylene Chloride Industrial Use Information								
Manufacturing/ Importing Company	Site Name and Address	NAICS code	Type of Process	Industrial Sector	Industrial Function Category	Percent of Production Volume	Number of Sites	Number of Workers
SolvChem Inc.	Solvents & Chemicals 4704 Shank Rd Pearland, TX 77581	424690	Processing-incorporation into formulation, mixture, or reaction product	All Other Chemical Product and Preparation Manufacturing	Solvents (which become part of product formulation or mixture)	100	< 10	100 - 499
CBI	CBI	CBI	NKRA	NKRA	NKRA	100	NKRA	NKRA
CBI	CBI	CBI	Processing-incorporation into formulation, mixture, or reaction product	All Other Chemical Product and Preparation Manufacturing	Propellants and blowing agents	30	250 - 999	500 - 999

Source: Dunn & Bradstreet (2015); EPA (2014)

Notes: CBI = Confidential Business Information

N/A= Not Applicable

NKRA= Not Known or Reasonably Ascertainable

NR= Not Reported

2.1.3 CDR Information – Consumer and Commercial Use Information

Table 2-3 presents the consumer and commercial uses of methylene chloride as reported to the 2012 CDR. Much of the information is claimed as confidential, not reported, or denoted as “not known or reasonably ascertainable.” The 2012 CDR indicates that methylene chloride has known applications in the following product categories: adhesives and sealants, automotive care, paints and coatings, and metal products. No CDR records indicate that methylene chloride is used in products intended for use by children (EPA, 2014).

Table 2-3. Methylene Chloride Consumer and Commercial Use Information

Manufacturing /Importing Company	Site State	Commercial/ Consumer Use	Used in Children Products	Product Category	Percent of Production Volume	Concentration	Number of Workers
CBI	CBI	NR	NR	NR	NR	NR	NR
CBI	CBI	Consumer	No	Paints and Coatings	20	1% - < 30%	25 - 49
Colonial Group Inc	GA	NR	NR	NR	NR	NR	NR
Dimmid Inc	NY	NR	NR	NR	NR	NR	NR
Dow Chemical Co	CA	NR	NR	NR	NR	NR	NR
	MI	NR	NR	NR	NR	NR	NR
	TX	NR	NR	NR	NR	NR	NR
Greenchem Industries LLC	FL	NKRA	No	NKRA	90	NKRA	NKRA
	FL	Both	NKRA	Adhesives and Sealants	10	NKRA	NKRA
Henkel Corp	NC	NR	NR	NR	NR	NR	NR
Occidental Chemical Holding Corporation	LA	Commercial	No	Metal Products not covered elsewhere	CBI	60% - < 90%	NKRA
	LA	Both	No	Paints and Coatings	CBI	30% - < 60%	NKRA
	KS	Both	No	Paints and Coatings	CBI	30% - < 60%	NKRA
	KS	Commercial	No	Metal Products not covered elsewhere	CBI	60% - < 90%	NKRA
	KS	Both	No	Automotive Care Products	CBI	60% - < 90%	NKRA
SolvChem Inc.	TX	NR	NR	NR	NR	NR	NR

Sources: Dunn & Bradstreet (2015); EPA (2014)

Notes: CBI = Confidential Business Information

N/A= Not Applicable

NKRA= Not Known or Reasonably Ascertainable

NR= Not Reported

2.1.4 Historical U.S. Production Volume

Table 2-4 presents historic U.S. production volume data for methylene chloride submitted by companies under the non-confidential 1986, 1990, 1994, 1998, 2002, and 2006 Inventory Update Reporting (IUR) rule and the 2012 CDR. While the reporting threshold for manufacturing information was 25,000 pounds for the 2006 IUR and 2012 CDR, the reporting threshold for manufacturing information was 10,000 pounds from 1986 to 2002.

Table 2-4. National Production Volume Data for Methylene Chloride from 1986-2012 (lbs.)						
1986	1990	1994	1998	2002	2006	2012
>500M - 1B	>500M - 1B	>100M - 500M	>100M - 500M	>100M - 500M	100M -<500M	261,469,894

Source: EPA (n.d.-a); EPA (2010); EPA (2014)

Note: M = Million; B = Billion

2.2 Toxics Release Inventory

Facilities manufacturing, processing, or otherwise using methylene chloride are required to report releases to EPA's Toxics Release Inventory (TRI). Included in the TRI data is the maximum amount of chemical present at each facility each year and the activity or use of the chemical at each facility. Table 2-6 presents the definitions for activity and use according to EPA's TRI Program.

2.2.1 Total Number of Methylene Chloride Facilities Reporting to TRI

In 2015, 274 sites reported releasing quantities of methylene chloride at their facilities. Table 2-5 presents a summary of the reported activities and uses, aggregated from all the sites manufacturing, processing, and otherwise using methylene chloride. The data presented in Table 2-5 suggest that methylene chloride is primarily used as an ancillary chemical, a chemical processing aid, and as a formulation component. Note that twenty-one facilities reported releasing quantities of methylene chloride at their facilities in 2015 but did not report the associated activity or use (EPA, 2015b).

Appendix A presents maximum amount of chemicals per facility and reported activities or uses for facilities reporting to TRI in 2015. Note that facilities may report more than one activity or use.

Table 2-5: Summary of 2015 Activity or Use by Number of Facilities for Methylene Chloride	
Activity or Use	Number of Facilities
Ancillary	92
Chemical Processing Aid	80
Formulation Component	63
Repackaging	50
Manufacture Aid	30
Produce	21
Reactant	15
Byproduct	12
Process Impurity	12
Imported	8
Manufacture Impurity	8
Sale Distribution	8
Used Processed	8
Article Component	6
Not Reported	21

Source: EPA (2015c)

Note: Facilities may report more than one activity or use; therefore the sum of the number of facilities reporting each activity/use will be greater than the total number of facilities reporting methylene chloride releases.

Table 2-6: TRI Activity and Use Definitions	
Activity or Use	TRI Definition
<i>Ancillary</i>	Indicates that the chemical is used at the facility for purposes other than aiding chemical processing or manufacturing
<i>Article Component</i>	Indicates the toxic chemical becomes an integral part of an article distributed into commerce, such as copper in wire or resins in a plastic pen, or the pigment components of paint applied to a chair that is sold
<i>Byproduct</i>	Indicates the toxic chemical is produced coincidentally during the manufacture, process, or otherwise use of another chemical substance or mixture and, following its production, is separated from that other chemical substance or mixture. This includes toxic chemicals that may be created as the result of waste management
<i>Chemical Processing Aid</i>	Indicates the toxic chemical is used to aid in the manufacture or synthesis of another chemical substance such that it comes into contact with the product during manufacture, but is not intended to remain with or become part of the final product or mixture. Some examples of chemical processing aids are process solvents, catalysts, solution buffers, inhibitors, and reaction terminators
<i>Formulation Component</i>	Indicates the toxic chemical is used as an ingredient in a product mixture to enhance performance of the product during its use, such as dyes in ink, solvents in paint, additions, reaction diluents, initiators, inhibitors, emulsifiers, surfactants, lubricants, flame retardants, and rheological modifiers
<i>Imported</i>	Indicates that the chemical is imported by the facility into the Customs Territory of the United States
<i>Manufacture Aid</i>	Indicates the toxic chemical is used to aid in the manufacturing process but does not come into contact with the product during manufacture. Some examples, include valve lubricants, refrigerants, metalworking fluids, coolants, and hydraulic fluids
<i>Manufacture Impurity</i>	Indicates whether the facility produces the reported chemical as a result of the manufacture, processing, or otherwise use of another chemical, but does not separate the chemical and it remains primarily in the mixture or product with that other chemical
<i>Process Impurity</i>	Indicates whether the facility processed the reported chemical but did not separate it and it remains as an impurity in the primary mixture or trade name product
<i>Produce</i>	Indicates the toxic chemical was created by the facility. A toxic chemical is considered manufactured even if the toxic chemical is created unintentionally or exists only for a short period of time
<i>Reactant</i>	Indicates the toxic chemical is used in chemical reactions to create another chemical substance or product that is then sold or otherwise distributed to other facilities. Some examples of reactants, include feedstocks, raw materials, intermediates, and initiators
<i>Repackaging</i>	Indicates the toxic chemical has been received by the facility and subsequently prepared for distribution into commerce in a different form, state, or quantity than it was received, such as petroleum being transferred from a storage tank to tanker trucks
<i>Sale Distribution</i>	Indicates that the chemical is produced or imported specifically for sale or distribution outside the manufacturing facility
<i>Used Processed</i>	Indicates that the chemical is produced or imported and then further processed or otherwise used at the same facility

Source: EPA (n.d.-b)

3. Use Information and Market Trends

Methylene chloride has a wide-range of uses, including in sealants, automotive products, and paint removers. EPA has thoroughly investigated paint removers containing methylene chloride in previous work, thus while this is a significant use, it will not be discussed in depth in this use and market profile.

Section 3.1 describes the uses of methylene chloride, while Section 3.2 lists specific products that contain this chemical. Market trends are discussed in Section 3.3.

Use information, market trends, and products for methylene chloride were primarily compiled using the EPA Office of Chemical Safety and Pollution Prevention's *Preliminary Information on Manufacturing, Processing, Distribution, Use, and Disposal: Methylene Chloride* (EPA, 2017) and EPA's *Market Profile and Use Analysis of Methylene Chloride* (EPA, 2012).

3.1 Uses of Methylene Chloride

Methylene chloride has known applications as a process solvent in paint removers and the manufacture of pharmaceuticals and film coatings. It is used as an agent in urethane foam blowing and in the manufacture of hydrofluorocarbon refrigerants, such as HFC-32. It can also be found in aerosol propellants and in solvents for electronics manufacturing, metal cleaning and degreasing, and furniture finishing. Additionally, it has been used for agricultural and food processing purposes such as an extraction solvent for spice oleoresins, hops, and for the removal of caffeine from coffee, a degreening agent for citrus fruits, and a postharvest fumigant for grains and strawberries (Processing Magazine, 2015; EPA, 2000).

In 2005, the use percentages of methylene chloride by sector were as follows: paint stripping and removal (30%), adhesives (22%), pharmaceuticals (11%), metal cleaning (8%), aerosols (8%), chemical processing (8%), flexible polyurethane foam (5%), and miscellaneous (8%) (ICIS Chemical Business, 2005).

Today, the leading application for methylene chloride is as a solvent in the production of pharmaceuticals and polymers. An estimated 35 percent of consumption is attributable to pharmaceuticals and chemical processing, with pharmaceutical production accounting for roughly 30 percent of methylene chloride's use. Other applications include metal cleaning, production of HFC-32, and as an ingredient in adhesives and paint removers. Foam blowing is a minor use of methylene chloride (IHS Markit, 2016).

Table 3-1 Known Applications of Methylene Chloride

Use or Process	Use or Process Status^a	Expected Users^b	Source/ Comment Number
Adhesives ^c	Ongoing	Consumer, Commercial, Industrial	EPA-HQ-OPPT-2016-0742-0033 Product found (see Table 3-2 ^d)
Adhesive remover	Ongoing	Consumer, Commercial, Industrial	Product found (see Table 3-2)
Aerosol propellant	Unknown	Consumer, Commercial, Industrial	(EPA, 2012)
Automotive air conditioner leak sealer	Ongoing	Consumer, Commercial	Product found (see Table 3-2)
Automotive air conditioner refrigerant	Ongoing	Consumer, Commercial	Product found (see Table 3-2)
Automotive air conditioner treatment	Ongoing	Consumer, Commercial	Product found (see Table 3-2)
Automotive parts cleaner	Ongoing	Consumer, Commercial	Product found (see Table 3-2)
Automotive aftermarket products ^e	Ongoing	Consumer, Commercial	EPA-HQ-OPPT-2016-0742-0005
Batteries (nickel-cadmium) ^f	Ongoing	Consumer, Commercial	EPA-HQ-OPPT-2016-0742-0035
Brush cleaner	Ongoing	Consumer, Commercial	Product found (see Table 3-2)
Carbon remover	Ongoing	Consumer, Commercial	Product found (see Table 3-2)
Chemical intermediate ^g	Ongoing	Industrial	(EPA, 2017); EPA-HQ-OPPT-2016-0742-0008
Chemical processor for polycarbonate resins and cellulose triacetate (photographic film)	Unknown	Industrial	(EPA, 2012); (EPA, 2017)
Cleaner and degreaser	Unknown	Consumer, Commercial, Industrial	(EPA, 2012); (EPA, 2017)
Coil cleaner	Ongoing	Consumer, Commercial	Product found (see Table 3-2)
Cold pipe insulation spray	Ongoing	Consumer, Commercial	Product found (see Table 3-2)
Extraction solvent for oils, waxes, fats, spices, coffee, and hops	Unknown^h	Consumer, Industrial	21 C.F.R. § 173.255(c); (HHS, 2000)
Feedstock in the production of fluorocarbons, such as the refrigerant HFC-32 (Hydrofluorocarbon-32)	Unknown	Industrial	(EPA, 2012); EPA-HQ-OPPT-2016-0742-0019; EPA-HQ-OPPT-2016-0742-0023
Flexible polyurethane foam manufacturing	Unknown	Consumer, Industrial	(EPA, 2012)
Formulated products	Unknown	Industrial	(EPA, 2012)
Furniture refinisher	Ongoing	Consumer, Commercial, Industrial	Product found (see Table 3-2)
Herbicide	Unknown	Consumer	(EPA, 2017)
Laboratory chemical	Ongoing	Industrial	Product found (see Table 3-2)
Leather tanning	Unknown	Industrial	(EPA, 2017)
Lubricant	Ongoing	Consumer, Commercial	Product found (see Table 3-2)
Metal products	Unknown	Consumer, Commercial	(EPA, 2014)

Table 3-1 Known Applications of Methylene Chloride

Use or Process	Use or Process Status ^a	Expected Users ^b	Source/ Comment Number
Novelty item	Ongoing	Consumer	Product found (see Table 3-2)
Paints and coatings ⁱ	Unknown	Consumer, Commercial, Industrial	EPA-HQ-OPPT-2016-0742-0025
Paint remover ^j	Ongoing	Consumer, Commercial, Industrial	Product found (see Table 3-2)
Pharmaceuticals (tablet coatings, etc.)	Unknown	Consumer, Industrial	(EPA, 2012)
Plastic processing	Unknown	Commercial, Industrial	(EPA, 2017)
Primer ^k	Ongoing	Consumer, Commercial	EPA-HQ-OPPT-2016-0742-0009
Printed circuit boards	Ongoing	Commercial, Industrial	EPA-HQ-OPPT-2016-0742-0017
Printing (press lubricant and cleaner)	Ongoing	Commercial, Industrial	(EPA, 2017); Product found (see Table 3-2)
Processing aid	Unknown	Industrial	(EPA, 2014)
Propellant and blowing agent ^l	Unknown	Industrial	(EPA, 2014)
Repackaging	Unknown	Industrial	(EPA, 2017)
Sealant	Ongoing	Consumer, Commercial, Industrial	Product found (see Table 3-2)
Shoe polish	Unknown ^m	Consumer, Commercial	(NRDC, 2010)
Solvent, carrier (textile industry)	Unknown	Industrial	(EPA, 2017)
Solvent (other) ⁿ	Ongoing	Consumer, Commercial, Industrial	EPA-HQ-OPPT-2016-0742-0036
Taxidermy	Unknown	Commercial	(EPA, 2017)
Textile treatment	Ongoing	Commercial, Industrial	Product found (see Table 3-2)
Toys, playground and sporting equipment	Unknown	Consumer	(EPA, 2017)
Water repellent	Unknown ^m	Consumer, Commercial	(NRDC, 2010)
Weld spatter protectant	Ongoing	Commercial, Industrial	Product found (see Table 3-2)
Wood stains and other wood working uses	Unknown ^o	Consumer, Commercial	(EPA, 2017)

Notes:

^a Unless otherwise noted, *Ongoing* uses were determined based on current products and their applications (see Table 3-2). *Unknown* uses were identified from EPA's 2012 Market Profile and Use Analysis of Methylene chloride (EPA, 2012).

^b Determination of the *Expected Users* associated with a use or process is based on the study team's best judgement if the users are not explicitly defined in the resource(s) cited.

^c Industrial adhesives have applications in variety of industries. According to a public comment submitted by ITW Polymers Sealants, methylene chloride may be used in products designed to bond decorative laminate, wood, particle board, metal, plywood, rubber, molded fiber glass, galvanized steel, cork, glass, or rigid plastics. Additionally, the firm reports selling a product used as a pressure sensitive adhesive in the furniture upholstery industry.

^d Table 3-2 is a reference to the methylene chloride product table found in *Draft: Use and Market Profile for Methylene Chloride and NMP* delivered to EPA March 1, 2017.

^e According to a public comment submitted by Motor & Equipment Manufacturers Association (MEMA), automotive aftermarket products may include: rust preventers, anti-spatters, degreasers, adhesives, acrylic additives, and sealants.

^f According to a public comment submitted by Saft America Incorporated, nickel-cadmium batteries have applications for aviation, telecommunications, railway, and stand-by power.

^g According to a public comment submitted by the Vinyl Institute (VI), the company produces about two pounds of mixed chlorinated organic liquids (a portion of which is methylene chloride) for every 100 pounds of vinyl chloride produced. VI also indicated that it does not attempt to isolate methylene chloride in any of the intermediary processes for commercial use or as an intermediate feedstock for other processes.

^h According to a 2000 Health and Human Services report, methylene chloride has been used as an extraction solvent for spices oleoresins, hops, and in the removal of caffeine from coffee. However, this use is reportedly no longer active due to health concerns (HHS, 2000). According to 21 C.F.R. § 173.255(c), methylene chloride is still permissible in small quantities in certain foods.

ⁱ According to a public comment submitted by the American Coatings Association, its members (which represent over 90% of total domestic production of paints and coatings in the U.S.) are phasing methylene chloride out of all consumer products. Historically, methylene chloride was an ingredient in the production of consumer and commercial paints and coatings. Almost all of the coating products that intentionally contain methylene chloride are formulated for industrial use only.

^j Denotes uses currently being considered for Section 6 actions under the Toxic Substances Control Act (TSCA).

^k According to a public comment submitted by Jowat Corporation, this firm imports primer from their parent company for distribution in the U.S.

^l The 2012 CDR indicates that methylene chloride is used as a processing aid in a wide variety of sectors including the petrochemical manufacturing, adhesive manufacturing, and chemical manufacturing sectors.

^m According to the National Resources Defense Council, methylene chloride may have had applications as a water repellent and shoe polish spray (NRDC, 2010). These uses have not been confirmed.

ⁿ According to a public comment submitted by the Dow Chemical Company, methylene chloride solvents may be used in a range of applications, including industrial catalyst products to pesticide products.

^o Methylene chloride may be used in wood stains, however this use has not been confirmed with current products (EPA, 2017).

3.2 Products

In addition to paint removers, which will not be discussed in detail in this profile, many other products intended for consumer, commercial, and industrial use contain methylene chloride. Three main categories of products that contain methylene chloride are adhesives, lubricants, and automotive cleaners. Table 3-2 provides representative examples of products containing methylene chloride identified through review of a previous EPA market profile (EPA, 2012). This product list is just a sample and is not comprehensive.

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Adhesive	Industrial	HMS ^b	40-70	Liquid	Manufacturer: 3M Example Distributor: None found	
Adhesive	Industrial	3M™ Hi-Strength Non-Flammable 98NF Bulk Adhesive, Red	60-85	Liquid	Manufacturer: 3M http://m.3m.com/wps/portal/3M/en_US/mAdhesives/Tapes/Products/~/3M-Hi-Strength-Non-Flammable-98-NF-Red-55-gal-54-Drum-1-per-case-Bulk?N=5396314+3291638463+4294871362&rt=d Example Distributor: Able Industrial Products, Inc. http://able123.com/index.php?main_page=product_info&cPath=5_159_161&products_id=22116&zenid=5c12135fb9623d7efccc77578cc22f9d&psrid=225765002	Industrial adhesive for use in high pressure laminate for countertops, edge banding, specialty vehicle flooring, wood furniture, and trade show displays
Adhesive	Consumer, Commercial	3M™ Foam Fast 74NF Cylinder Spray Adhesive, Clear	40-70	Liquid	Manufacturer: 3M http://solutions.3m.com/wps/portal/3M/en_US/Adhesives/Tapes/Products/~/3M-Foam-Fast-74-Spray-Adhesive?N=5396314+3291638463+3293242449&rt=rud Example Distributor: Amazon https://www.amazon.com/3M-74-Spray-Adhesive-Clear/dp/B000WSH5EO	Bonds foam and fabric

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Adhesive	Industrial	3M™ Hi-Strength Non-Flammable 98NF Cylinder Spray Adhesive, Clear	55-75	Liquid	<p>Manufacturer: 3M http://solutions.3m.com/wps/portal/3M/en_US/Adhesives/Tapes/Products/~3M-Hi-Strength-Non-Flammable-98-NF-Cylinder-Spray-Adhesive-Clear-Large-Cylinder-Net-Wt-37-lbs-1-per-case-NOT-FOR-CONSUMER-RETAIL-SALE-OR-USE?N=5396314+3291638463+4294871254&rt=rud</p> <p>Example Distributor: EIS Inc. http://www.eis-inc.com/suppliers/productdetail.asp?prod_nbr=3MA98NFCLG</p>	Typically used in construction, woodworking, RVs, manufactured housing, and specialty vehicle applications
Adhesive	Commercial, Industrial	Camie 313B Upholstery Adhesive	80-90	Liquid	<p>Manufacturer: Camie-Campbell, Inc. http://www.camie.com/content/fast-tack-upholstery-adhesive-bulk</p> <p>Example Distributor: Industrial Tape & Supply Company https://industrialtape.com/catalog/product/1511-camie-313-b-fast-tack-upholstery-adhesive.html</p>	Formulated to bond foam to foam, as well as foam to fabric, wood, particle board, cardboard, metal, and fiberglass
Adhesive	Commercial, Industrial	Closed Cell Spray Foam Adhesive (DP 2595)	40-50	Liquid	<p>Manufacturer: Design Polymeric http://designpoly.com/products/</p> <p>Example Distributor: General Insulation Company http://www.generalinsulation.com/products/insulation-products/mastics-coatings/design-polymeric-dp-2595-closed-cell-foam-spray-adhesive/</p>	

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Adhesive	Commercial, Industrial	Duct Liner Spray Adhesive (DP 2590/DP 2590 CA)	30-60	Liquid	<p>Manufacturer: Design Polymeric http://designpoly.com/products/</p> <p>Example Distributor: General Insulation Company http://www.generalinsulation.com/products/insulation-products/mastics-coatings/design-polymeric-dp-2502-water-based-duct-liner-adhesive/</p>	
Adhesive	Commercial, Industrial	GP1-40BL Adhesive (DIV01001)	45-55	Liquid	<p>Manufacturer: DiversiTech http://www.diversitech.com/Product?id=01t80000002s7g2AAA</p> <p>Example Distributor: Baker Distributing, Inc. https://www.bakerdist.com/diversitech-gp1-40bl-pro-air-spray-adhesive-38-pound-disposable-cylinder-divgp140bl-16862</p>	
Adhesive	Commercial, Industrial	QuickStick™	40-70	Liquid	<p>Manufacturer: Ductmate Industries http://ductmate.com/product.aspx?id=30</p> <p>Example Distributor: None found</p>	
Adhesive	Commercial, Industrial	QuickStick™ High Strength Spray Adhesive	40-70	Liquid	<p>Manufacturer: Ductmate Industries http://ductmate.com/product.aspx?id=31</p> <p>Example Distributor: None found</p>	
Adhesive	Commercial	Elgen AE-77	40-70	Liquid	<p>Manufacturer: Elgen Manufacturing http://www.elgenmfg.com/m8/128--ae-77.html</p> <p>Example Distributor: None found</p>	Designed for bonding fiberglass duct liner to metal ductwork

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Adhesive	Commercial, Industrial	NauticGrip™ HM Canister	40-50	Aerosol	<p>Manufacturer: GTA-NHT, Inc. - NorthStar http://www.northstarchemicals.com/literature/NauticGrip/PI/NG%20HM%20PIaero_cani.pdf</p> <p>Example Distributor: None found</p>	Designed for bonding decorative laminates to particleboard but may also be used on a variety of other substrates including veneers, fabrics, upholstery, foam, headliners, glass and mirrors, cork, tile, fiberglass, and plastics
Adhesive	Commercial, Industrial	NorthStar Chemicals NS925 Canister	40-50	Aerosol	<p>Manufacturer: GTA-NHT, Inc. - NorthStar http://www.northstarchemicals.com/literature/NorthStar/PI/NS925%20PIaero_cani.pdf</p> <p>Example Distributor: None found</p>	Designed for bonding decorative laminates to particleboard but may also be used on a variety of other substrates including veneers, fabrics, upholstery, foam, headliners, glass and mirrors, cork, tile, fiberglass, and plastics
Adhesive	Commercial, Industrial	NorthStar NS 980N Bulk	50-65	Liquid	<p>Manufacturer: GTA-NHT, Inc. - NorthStar http://www.northstarchemicals.com/literature/NorthStar/PI/NS980N%20BULK%20PI%20.pdf</p> <p>Example Distributor: None found</p>	Designed for bonding decorative laminates to particleboard but may also be used on a variety of other substrates including veneers, fabrics, upholstery, foam, headliners, glass and mirrors, cork, tile, fiberglass, and plastics
Adhesive	Commercial, Industrial	NorthStar NS975 Bulk	65-75	Liquid	<p>Manufacturer: GTA-NHT, Inc. - NorthStar http://www.northstarchemicals.com/literature/NorthStar/PI/NS975%20%20bulk%20PI.pdf</p> <p>Example Distributor: None found</p>	Designed for bonding decorative laminates to particleboard but may also be used on a variety of other substrates including veneers, fabrics, upholstery, foam, headliners, glass and mirrors, cork, tile, fiberglass, and plastics
Adhesive	Commercial, Industrial	NS 925N Canister	60-70	Aerosol	<p>Manufacturer: GTA-NHT, Inc. - NorthStar http://www.northstarchemicals.com/literature/NorthStar/PI/NS925N%20canister%20PI.pdf</p> <p>Example Distributor: None found</p>	Designed for bonding decorative laminates to particleboard but may also be used on a variety of other substrates including veneers, fabrics, upholstery, foam, headliners, glass and mirrors, cork, tile, fiberglass, and plastics

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Adhesive	Commercial, Industrial	NS 980N Canister	60-70	Aerosol	<p>Manufacturer: GTA-NHT, Inc. - NorthStar http://www.northstarchemicals.com/literature/NorthStar/PI/NS%20980N%20Canister%20PI.pdf</p> <p>Example Distributor: None found</p>	Designed for bonding decorative laminates to particleboard but may also be used on a variety of other substrates including veneers, fabrics, upholstery, foam, headliners, glass and mirrors, cork, tile, fiberglass, and plastics
Adhesive	Commercial, Industrial	NS920 Canister	40-50	Aerosol	<p>Manufacturer: GTA-NHT, Inc. - NorthStar http://www.northstarchemicals.com/literature/NorthStar/PI/NS920-PI032014.pdf</p> <p>Example Distributor: None found</p>	Designed for bonding laminates and veneers with a minimum thickness of 10 mm to particleboard
Adhesive	Commercial, Industrial	PB920 Canister	40-50	Aerosol	<p>Manufacturer: GTA-NHT, Inc. - NorthStar http://www.northstarchemicals.com/literature/Premier/PI/PB920-HPLV-Canister%20PI.pdf</p> <p>Example Distributor: None found</p>	Designed for bonding laminates and veneers with a minimum thickness of 10 mm to particleboard
Adhesive	Commercial, Industrial	Premier Bond PB925 High Strength/High Temperature Aerosol	40-50	Aerosol	<p>Manufacturer: GTA-NHT, Inc. - NorthStar http://www.northstarchemicals.com/literature/Premier/PI/PB925%20aerosol-can%20new%20PI.pdf</p> <p>Example Distributor: None found</p>	Designed for bonding decorative laminates to particleboard but may also be used on a variety of other substrates including veneers, fabrics, upholstery, foam, headliners, glass and mirrors, cork, tile, fiberglass and plastics
Adhesive	Commercial, Industrial	Premier Bond™ PB980N Bulk	50-65	Liquid	<p>Manufacturer: GTA-NHT, Inc. - NorthStar http://www.northstarchemicals.com/literature/Premier/PI/PB980N%20BULK_PI.pdf</p> <p>Example Distributor: None found</p>	Designed for bonding decorative laminates to particleboard but may also be used on a variety of other substrates including veneers, fabrics, upholstery, foam, headliners, glass and mirrors, cork, tile, fiberglass and plastics

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Adhesive	Commercial, Industrial	Premier PB975 Bulk	65-75	Liquid	<p>Manufacturer: GTA-NHT, Inc. - NorthStar http://www.northstarchemicals.com/literature/Premier/PI/PB975-bulk-PI.pdf</p> <p>Example Distributor: None found</p>	Designed for bonding decorative laminates to particleboard but may also be used on a variety of other substrates including veneers, fabrics, upholstery, foam, headliners, glass and mirrors, cork, tile, fiberglass and plastics
Adhesive	Commercial, Industrial	Premier TM PB925N Canister	60-70	Aerosol	<p>Manufacturer: GTA-NHT, Inc. - NorthStar http://www.northstarchemicals.com/literature/Premier/PI/PB925N%20aerosol%20canister%20PI.pdf</p> <p>Example Distributor: None found</p>	Designed for bonding decorative laminates to particleboard but may also be used on a variety of other substrates including veneers, fabrics, upholstery, foam, headliners, glass and mirrors, cork, tile, fiberglass and plastics
Adhesive	Commercial, Industrial	StarStuk TM HM Canister	40-50	Liquid	<p>Manufacturer: GTA-NHT, Inc. - Northstar http://www.northstarchemicals.com/products/ss-aerosol.html</p> <p>Example Distributor: Wurth Louis and Company https://www.wurthlac.com/storefront/adhesives-lubricants/adhesives/contact-adhesives/starstuk-hm-high-strength-contact-adhesive/prodNRCHMR.html</p>	Designed for bonding decorative laminates to particleboard but may also be used on a variety of other substrates including veneers, fabrics, upholstery, foam, headliners, glass and mirrors, cork, tile, fiberglass and plastics
Adhesive	Commercial, Industrial	StarStuk TM HNF 80 Canister	60-70	Aerosol	<p>Manufacturer: GTA-NHT, Inc. - NorthStar http://www.northstarchemicals.com/literature/StarStuk/PI/HNF%2080%20Canister%20PI.pdf</p> <p>Example Distributor: None found</p>	Designed for bonding decorative laminates to particleboard but may also be used on a variety of other substrates including veneers, fabrics, upholstery, foam, headliners, glass and mirrors, cork, tile, fiberglass and plastics

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Adhesive	Commercial, Industrial	StarStuk™ HPLV Canister	40-50	Aerosol	<p>Manufacturer: GTA-NHT, Inc. - NorthStar http://www.northstarchemicals.com/literature/StarStuk/PI/SS_HPLV%20Canister%20PI%20.pdf</p> <p>Example Distributor: None found</p>	Designed for bonding laminates and veneers with a minimum thickness of 10 mm to particleboard
Adhesive	Commercial, Industrial	Premier™ PB924N Canister	60-70	Aerosol	<p>Manufacturer: GTA-NHT, Inc.- Northstar http://www.northstarchemicals.com/literature/Premier/PI/PB924N%20canister-aerosol%20PI.pdf</p> <p>Example Distributor: None found</p>	Designed for bonding decorative laminates to particleboard but may also be used on a variety of other substrates including veneers, fabrics, upholstery, foam, headliners, glass, cork, fiberglass and plastics
Adhesive	Commercial, Industrial	STA'-PUT 1535 Contact Adhesive	55-75	Liquid	<p>Manufacturer: ITW Polymers Sealants North America http://itwstaput.com/products/non-flammable-contact-adhesives/c1535</p> <p>Example Distributor: None found</p>	Formulated to bond urethane foam to wood or fabrics
Adhesive	Commercial, Industrial	STA'-PUT S100 Contact Adhesive	55-75	Liquid	<p>Manufacturer: ITW Polymers Sealants North America http://itwstaput.com/products/non-flammable-contact-adhesives/s100/</p> <p>Example Distributor: None found</p>	Formulated for use in bonding decorative laminates, plywood, particleboard, and rigid plastics
Adhesive	Commercial, Industrial	STA'-PUT S120 Contact Adhesive	75-90	Liquid	<p>Manufacturer: ITW Polymers Sealants North America http://itwstaput.com/products/non-flammable-contact-adhesives/s120/</p> <p>Example Distributor: None found</p>	Suitable for bonding decorative laminate, wood, particleboard, metal, rubber, hardboard, and plywood

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Adhesive	Commercial, Industrial	STA'-PUT S170/S171 Contact Adhesive	45-70	Liquid	<p>Manufacturer: ITW Polymers Sealants North America http://itwstaput.com/products/non-flammable-contact-adhesives/s170-s171/</p> <p>Example Distributor: None found</p>	Formulated for bonding decorative laminates, plywood, particleboard polyurethane foam, and rigid plastics
Adhesive	Commercial, Industrial	STA'-PUT S200 Aerosol Adhesive	45-70	Aerosol	<p>Manufacturer: ITW Polymers Sealants North America http://itwstaput.com/products/flammable-contact-adhesives/s200/</p> <p>Example Distributor: None found</p>	Bonds high pressure laminates to various substrates
Adhesive	Commercial, Industrial	STA'-PUT SPH Aerosol Adhesive	35-60	Aerosol	<p>Manufacturer: ITW Polymers Sealants North America http://itwstaput.com/products/flammable-contact-adhesives/sph-aerosol-canister/</p> <p>Example Distributor: None found</p>	Bonds decorative laminate, wood products, molded fiberglass, galvanized steel, cork, and glass
Adhesive	Commercial, Industrial	STA'-PUT SPH Canister Adhesive	35-60	Aerosol	<p>Manufacturer: ITW Polymers Sealants North America http://itwstaput.com/products/flammable-contact-adhesives/sph-aerosol-canister/</p> <p>Example Distributor: None found</p>	Bonds decorative laminate, wood products, molded fiberglass, galvanized steel, cork, and glass
Adhesive	Commercial, Industrial	STA'-PUT SPH Contact Adhesive	65-80	Liquid	<p>Manufacturer: ITW Polymers Sealants North America http://itwstaput.com/products/non-flammable-contact-adhesives/sph/</p> <p>Example Distributor: None found</p>	Bonds decorative laminate, wood products, molded fiberglass, galvanized steel, cork, and glass

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Adhesive	Commercial, Industrial	STA'-PUT SPHS Canister Adhesive	55-75	Aerosol	Manufacturer: ITW Polymers Sealants North America http://itwstaput.com/products/non-flammable-contact-adhesives/sphs/ Example Distributor: None found	Bonds laminate, wood products, most metals, urethane foams, and particleboard
Adhesive	Commercial, Industrial	STA'-PUT SPM Aerosol Adhesive	45-70	Aerosol	Manufacturer: ITW Polymers Sealants North America http://itwstaput.com/products/flammable-contact-adhesives/spm/ Example Distributor: None found	
Adhesive	Commercial, Industrial	EverStrong ES800 Contact Adhesive - Bulk	65-80	Liquid	Manufacturer: NewStar Adhesives Inc http://www.newstaradhesivesusa.com/everstrong-es800 Example Distributor: None found	Bonds decorative laminates and veneers, fiberglass, glass, cork, particle board, and foam
Adhesive	Commercial, Industrial	EverStrong ES130 Contact Adhesive - Air Assist Canister	80-100	Aerosol	Manufacturer: NewStar Adhesives, Inc. http://www.newstaradhesivesusa.com/es-130 Example Distributor: None found	Bonds decorative laminates and veneers, fiberglass, glass, upholstery, fabrics, foam, auto headliners, cork, and particle board
Adhesive	Commercial, Industrial	EverStrong ES30 Contact Adhesive - Aerosol and Canister	40-50	Aerosol	Manufacturer: NewStar Adhesives, Inc. http://www.newstaradhesivesusa.com/es-30-canister Example Distributor: Spokane Hardware Supply, Inc. https://www.thehardwarehut.com/catalog-product.php?p_ref=327856	Bonds decorative laminates and veneers, fiberglass, glass, upholstery, fabrics, foam, auto headliners, cork, and particle board

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Adhesive	Commercial, Industrial	EverStrong ES35 Contact Adhesive - Aerosol and Canister	60-70	Aerosol	Manufacturer: NewStar Adhesives, Inc. http://www.newstaradhesivesusa.com/es-35 Example Distributor: None found	Bonds decorative laminates and veneers, fiberglass, glass, upholstery, fabrics, foam, auto headliners, cork, and particle board
Adhesive	Commercial, Industrial	Tensorgrip A20 Plasticizer Resistant Crosslinking Contact Adhesive	30-60	Aerosol	Manufacturer: Quin Global ^c http://www.tensorglobal.com/usa/products/?category=3&subcat=49&productid=40 Example Distributor: None found	Formulated for bonding vinyl, rubber, and plastics
Adhesive	Commercial, Industrial	Tensorgrip A40N Non-Flam Low Profile Contact Adhesive	60-100	Aerosol	Manufacturer: Quin Global ^c http://www.tensorglobal.com/usa/products/?category=3&subcat=43&productid=3 Example Distributor: None found	Formulated for bonding aircraft synthetic leather (i.e. ultra leather) and thin fabrics
Adhesive	Commercial, Industrial	Tensorgrip F30N Non-Flam Pressure Sensitive Foam & Fabric Adhesive	60-100	Aerosol	Manufacturer: Quin Global ^c http://www.tensorglobal.com/usa/products/?category=6&subcat=30&productid=187 Example Distributor: None found	For temporary or permanent bonds to porous or non-porous substrates
Adhesive	Commercial, Industrial	Tensorgrip F70N Non-Flam Aggressive Pressure Sensitive Adhesive	60-100	Aerosol	Manufacturer: Quin Global ^c http://www.tensorglobal.com/usa/products/?category=6&subcat=29&productid=188 Example Distributor: None found	For pressure-sensitive bonding of porous substrates

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Adhesive	Commercial, Industrial	Tensorgrip H20N Non-Flam Duct Liner Adhesive	60-100	Aerosol	<p>Manufacturer: Quin Global^c http://www.tensorglobal.com/usa/products/?category=5&subcat=26&productid=8</p> <p>Example Distributor: None found</p>	Formulated to bond a wide variety of insulation to the interior and exterior of ductwork
Adhesive	Commercial, Industrial	Tensorgrip L10 High Temp Contact Adhesive	30-60	Aerosol	<p>Manufacturer: Quin Global^c http://www.tensorglobal.com/usa/products/?category=7&subcat=54&productid=9</p> <p>Example Distributor: None found</p>	Formulated for bonding laminate on porous or tough-to-bond materials
Adhesive	Commercial, Industrial	Tensorgrip L10N Non-Flam High Temp Contact Adhesive	60-100	Aerosol	<p>Manufacturer: Quin Global^c http://www.tensorglobal.com/usa/products/?category=7&subcat=31&productid=10</p> <p>Example Distributor: None found</p>	Formulated for bonding decorative HPL (high pressure laminate) to a variety of substrates
Adhesive	Commercial, Industrial	Tensorgrip L71 Plasticizer Resistant Crosslinking Contact Adhesive	30-60	Aerosol	<p>Manufacturer: Quin Global^c http://www.tensorglobal.com/usa/products/?category=7&subcat=54&productid=63</p> <p>Example Distributor: None found</p>	Formulated for bonding vinyl, rubber, and plastics
Adhesive	Commercial, Industrial	Tensorgrip L72N	30-60	Aerosol	<p>Manufacturer: Quin Global^c http://www.tensorglobal.com/usa/products/?category=7&subcat=54&productid=134</p> <p>Example Distributor: None found</p>	Formulated for bonding vinyl, rubber, and plastics

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Adhesive	Commercial, Industrial	Tensorgrip M80N	60-100	Aerosol	<p>Manufacturer: Quin Global^c http://www.tensorglobal.com/usa/products/?category=2&subcat=48&productid=128</p> <p>Example Distributor: None found</p>	Formulated for a variety of marine applications and interior boat outfitting
Adhesive	Commercial, Industrial	Tensorgrip P302 Non-Flam High Temp Contact Adhesive	60-100	Aerosol	<p>Manufacturer: Quin Global^c http://www.tensorglobal.com/usa/products/?category=69&subcat=70&productid=29</p> <p>Example Distributor: None found</p>	Adhesive for use with foam, insulation, and laminate
Adhesive	Commercial, Industrial	Tensorgrip P305 Non-Flam Pressure Sensitive Adhesive	30-60	Aerosol	<p>Manufacturer: Quin Global^c http://www.tensorglobal.com/usa/products/?category=69&subcat=70&productid=137</p> <p>Example Distributor: None found</p>	
Adhesive	Commercial, Industrial	Tensorgrip P309 Non-Flam Pressure-Sensitive Adhesive	60-100	Aerosol	<p>Manufacturer: Quin Global^c http://www.tensorglobal.com/usa/products/?category=69&subcat=70&productid=189</p> <p>Example Distributor: None found</p>	
Adhesive	Commercial, Industrial	Tensorgrip P310 Pressure Sensitive Adhesive	30-60	Aerosol	<p>Manufacturer: Quin Global^c http://www.tensorglobal.com/usa/products/?category=69&subcat=70&productid=176</p> <p>Example Distributor: None found</p>	
Adhesive	Commercial, Industrial	Tensorgrip P311 Non-Flam Pressure Sensitive Adhesive	60-100	Aerosol	<p>Manufacturer: Quin Global^c http://www.tensorglobal.com/usa/products/?category=69&subcat=70&productid=177</p> <p>Example Distributor: None found</p>	For temporary or low-stress permanent bonds

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Adhesive	Commercial, Industrial	Tensorgrip P801 Plasticizer Resistant Crosslinking Contact Adhesive	30-60	Aerosol	<p>Manufacturer: Quin Global^c http://www.tensorglobal.com/usa/products/?category=69&subcat=70&productid=135</p> <p>Example Distributor: None found</p>	Formulated for bonding vinyl, plastics, and other substrates susceptible to plasticizer migration
Adhesive	Commercial, Industrial	Tensorgrip P807 Snowflake Single-Sided Crosslinking Contact Adhesive	30-60	Aerosol	<p>Manufacturer: Quin Global^c http://www.tensorglobal.com/usa/products/?category=69&subcat=70&productid=132</p> <p>Example Distributor: None found</p>	Formulated to bond vinyl and rubber without causing plasticizer migration
Adhesive	Commercial, Industrial	UT-R20 Hardener	60-75	Liquid	<p>Manufacturer: Rema Tip Top - North America</p> <p>Example Distributor: Motion Industries https://www.motionindustries.com/productDetail.jsp?sku=02588934</p>	Hardens cements and adhesives
Adhesive	Commercial, Industrial	Parabond M-363 Seam Sealer	50-100	Liquid	<p>Manufacturer: Royal Coatings and Specialty Polymers http://www.royaladhesives.com/products.asp?divison_id=8&products_id=487</p> <p>Example Distributor: Floorz-N-More http://floorz-n-more.com/index.php?main_page=product_info&products_id=7172</p>	Recommended for seaming various types of carpet in a direct glue down installation, double glue down applications, and stretch-in installation involving synthetic backings

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Adhesive	Consumer, Commercial	SCIGRIP® 3 Solvent Cement for Acrylic	75-90	Liquid	<p>Manufacturer: SCIGRIP Smarter Adhesive Solutions http://scigrip.com/products/search?q=3+solvent&go=GO</p> <p>Example Distributor: Amazon https://www.amazon.com/SCIGRIP-10799-Acrylic-Solvent-Water-thin/dp/B00466V8F0</p>	Cement for bonding acrylic
Adhesive	Consumer, Commercial	SCIGRIP® 4 Solvent Cement for Acrylic	30-60	Liquid	<p>Manufacturer: SCIGRIP Smarter Adhesive Solutions http://scigrip.com/products/search?q=4+solvent&go=GO</p> <p>Example Distributor: Amazon https://www.amazon.com/SCIGRIP-Acrylic-Solvent-Cement-Water-thin/dp/B000KZUTEM</p>	Cement for bonding acrylic
Adhesive	Consumer, Commercial	SCIGRIP® 16 Solvent Cement for Acrylic	30-60	Liquid	<p>Manufacturer: SCIGRIP Smarter Adhesive Solutions http://www.scigrip.com/products/search?q=SCIGRIP+16+%E2%80%93+Acrylic+Cement&go=GO</p> <p>Example Distributor: Amazon https://www.amazon.com/SCIGRIP-10319-Acrylic-Cement-Low-VOC/dp/B0046768VS</p>	Cement for bonding acrylic
Adhesive	Commercial, Industrial	FiberWeld	Not Specified	Aerosol	<p>Manufacturer: Westech Aerosol Corporation http://www.ok2spray.com/fiberweld.php</p> <p>Example Distributor: None found</p>	

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Adhesive	Commercial, Industrial	HPC-15-38C	Not Specified	Aerosol	<p>Manufacturer: Westech Aerosol Corporation http://www.ok2spray.com/wt-hp15.php</p> <p>Example Distributor: None found</p>	
Adhesive remover	Commercial	Crown Solu-Strip Adhesive Remover	80-90	Liquid	<p>Manufacturer: Packaging Service Co., Inc. http://www.packserv.com/products/crown/removers/</p> <p>Example Distributor: Cox Hardware http://www.coxhardware.com/p-15693-solu-strip-semi-paste-adhesive-remover-gallon.aspx</p>	
Adhesive remover	Consumer, Commercial	Zinsser Adhesive Remover	50-75	Liquid	<p>Manufacturer: Rust-Oleum Corp. https://www.rustoleum.com/product-catalog/consumer-brands/zinsser/paint-strippers-and-graffiti-removers/adhesive-remover</p> <p>Example Distributor: Menard's https://www.menards.com/main/paint/cleaners-thinners-removers/paint-stain-cleaners/strippers-removers/zinsser-reg-adhesive-remover-1-gal/p-1444452994440.htm</p>	Removes hardened mastic and adhesives
Adhesive remover	Commercial, Industrial	Hel-Gel Orange	<8	Liquid	<p>Manufacturer: The Cleaner Image</p> <p>Example Distributor: VacAway https://store.vacaway.com/hel-gel-orange-quarts-p78.aspx</p>	Removes gum, tape residue, and other adhesives

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Automotive air conditioner leak sealer	Consumer, Commercial	IDQ MRL-3	<1	Aerosol	<p>Manufacturer: IDQ Operating, Inc. http://acprocold.com/product/mrl-3-ac-pro-super-seal/</p> <p>Example Distributor: AutoZone http://www.autozone.com/a-c-charging-and-refrigerant-freon/a-c-stop-leak/quest-r-134a-super-seal-kit/298542_0_0</p>	
Automotive air conditioner refrigerant	Consumer, Commercial	IDQ ACP-100	<1	Aerosol	<p>Manufacturer: IDQ Operating, Inc. http://acprocold.com/product/acp-100-ac-pro/</p> <p>Example Distributor: Amazon https://www.amazon.com/ACP-100-Professional-Synthetic-Conditioning-Refrigerant/dp/B007USCM7E</p>	
Automotive air conditioner refrigerant	Consumer, Commercial	IDQ ACP-100CA	<1	Aerosol	<p>Manufacturer: IDQ Operating, Inc. http://acprocold.com/product/acp-100ca-ac-pro/</p> <p>Example Distributor: Amazon https://www.amazon.com/ACP-100CA-Professional-Formula-Solution-Refrigerant/dp/B007USCMD8</p>	
Automotive air conditioner refrigerant	Consumer, Commercial	IDQ ACP-101	<1	Aerosol	<p>Manufacturer: IDQ Operating, Inc. http://acprocold.com/product/acp-101-ac-pro-r-134a/</p> <p>Example Distributor: Amazon https://www.amazon.com/ACP-101-Professional-Synthetic-Conditioning-Refrigerant/dp/B009TC9PG0</p>	

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Automotive air conditioner refrigerant	Consumer, Commercial	IDQ ACP-102	<1	Aerosol	<p>Manufacturer: IDQ Operating, Inc. http://acprocold.com/product/acp-102-ac-pro-r-134a/</p> <p>Example Distributor: Amazon https://www.amazon.com/ACP-102-Professional-Synthetic-Conditioning-Refrigerant/dp/B007USCMJM</p>	
Automotive air conditioner refrigerant	Consumer, Commercial	IDQ ACP-102CA	<1	Aerosol	<p>Manufacturer: IDQ Operating, Inc. http://acprocold.com/product/acp-102ca-ac-pro-r-134a/</p> <p>Example Distributor: Amazon https://www.amazon.com/ACP-102CA-Professional-Formula-R-134a-Refrigerant/dp/B007USCMSI</p>	
Automotive air conditioner refrigerant	Consumer, Commercial	IDQ ACP-105	<1	Aerosol	<p>Manufacturer: IDQ Operating, Inc. http://acprocold.com/product/acp-105-ac-pro-with-advanced-stop-leak/</p> <p>Example Distributor: MID Hardware http://midhardware.com/hardware/product_info.php/products_id/831024</p>	
Automotive air conditioner refrigerant	Consumer, Commercial	IDQ ACP-110	<1	Aerosol	<p>Manufacturer: IDQ Operating, Inc. http://acprocold.com/product/acp-110_recharge_retrofit_kit/</p> <p>Example Distributor: Amazon https://www.amazon.com/ACP-110-R134a-Recharge-Retrofit-Kit/dp/B00LTKF35W</p>	

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Automotive air conditioner refrigerant	Consumer, Commercial	IDQ ACP-307	<1	Aerosol	<p>Manufacturer: IDQ Operating, Inc. http://acprocold.com/product/acp-307-ac-pro-high-mileage-refrigerant-134a/</p> <p>Example Distributor: AutoZone http://www.autozone.com/a-c-charging-and-refrigerant-freon/a-c-system-cleaner/interdynamics-12-oz-a-c-pro-high-mileage/823743_0_0</p>	
Automotive air conditioner treatment	Consumer, Commercial	A/C Pro® Rejuvenator A/C System Treatment	<3	Aerosol	<p>Manufacturer: IDQ Operating, Inc. http://acprocold.com/product/17899-ac-pro-rejuvenator-ac-system-treatment/</p> <p>Example Distributor: AutoZone http://www.autozone.com/a-c-charging-and-refrigerant-freon/r134a-refrigerant/a-c-pro-c-pro-a-c-treatment-system/819967_0_0</p>	Eliminates A/C system impurities, seals and helps prevent rubber leaks, and boosts cooling capacity
Automotive air conditioner treatment	Consumer, Commercial	A/C Pro® Accu-Cool A/C Recharging Kit	<3	Aerosol	<p>Manufacturer: IDQ Operating, Inc. http://acprocold.com/product/18018-ac-pro-accu-cool-ac-system-recharge-kit/</p> <p>Example Distributor: None found</p>	Replaces lost R-134a refrigerant and oil in automotive A/C systems
Automotive parts cleaner	Commercial	B-00002 BTS BRAKE PARTS & METAL CLEANER	25-35	Aerosol	<p>Manufacturer: Apex International Group, Inc. http://www.btsindustries.com/productsCleaners.php</p> <p>Example Distributor: Dodge Packaging Specialties, Inc. https://www.dodgepackaging.net/index.php/product/bts-brake-parts-cleaner-non-flamable/</p>	Brake cleaner

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Automotive parts cleaner	Commercial	Berryman Brake Parts Cleaner (1401, 1405, and 1455)	60-70	Liquid	<p>Manufacturer: Berryman Products, Inc. https://www.berrymanproducts.com/products/cleaning-degreasing/berryman-brake-cleaner/</p> <p>Example Distributor: O'Reilly Auto Parts http://www.oreillyauto.com/site/c/detail/BRY0/1401.oap</p>	Brake cleaner
Automotive parts cleaner	Commercial	Berryman Brake Parts Cleaner (1420)	60-70	Aerosol	<p>Manufacturer: Berryman Products, Inc. https://www.berrymanproducts.com/products/cleaning-degreasing/berryman-brake-cleaner/</p> <p>Example Distributor: O'Reilly Auto Parts http://www.oreillyauto.com/site/c/detail/BRY0/1420.oap?pt=N0450</p>	Brake cleaner
Automotive parts cleaner	Consumer, Commercial	Brake & Contact Cleaner (Bulk)	30-60	Aerosol	<p>Manufacturer: BG Products Inc. https://www.bgprod.com/catalog/brakes/bg-402-brake-contact-cleaner/</p> <p>Example Distributor: None found</p>	Brake cleaner
Automotive parts cleaner	Consumer, Commercial	High Performance Brake Clean Free (80-928)	10-20	Aerosol	<p>Manufacturer: Kimball-Midwest http://catalog.kimballmidwest.com/guide/kimball-midwest-product-catalog/80-22.php</p> <p>Example Distributor: None found</p>	Brake cleaner

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Automotive parts cleaner	Consumer, Commercial	Gunk Carburetor Parts Cleaner – Chlorinated (M4814H)	20 - <30	Aerosol	<p>Manufacturer: RSC Chemical Solutions http://www.gunk.com/products/cat_det.asp</p> <p>Example Distributor: Shamrock Supply Co. https://www.shamrocksupply.com/itemDetailFilterPH.action?RFP=IFD&IDP=Y&codeId=10258359</p>	
Automotive parts cleaner	Consumer, Commercial	Gunk Brake Parts Cleaner – Chlorinated (M720)	40 - <50	Aerosol	<p>Manufacturer: RSC Chemical Solutions http://www.gunk.com/products/cat_det.asp</p> <p>Example Distributor: Amazon https://www.amazon.com/Gunk-M720-Chlorinated-Brake-Cleaner/dp/B000ABGA0I</p>	
Automotive parts cleaner	Consumer, Commercial	Gunk Carb Medic Carburetor Cleaner (M4814/M4824)	60 - <70	Aerosol	<p>Manufacturer: RSC Chemical Solutions http://www.gunk.com/products/DET_M4814.ASP</p> <p>Example Distributor: Amazon https://www.amazon.com/Gunk-M4824-Carb-Medic-Carburetor-Cleaner/dp/B002008O7O</p>	
Automotive parts cleaner	Consumer, Commercial, Industrial	Sprayway Industrial Gasket Remover No. 719	60-80	Aerosol	<p>Manufacturer: Sprayway, Inc. http://www.spraywayinc.com/sites/default/files/downloads/SW-industrial-MRO-black.pdf</p> <p>Example Distributor: Engman-Taylor https://www.engman-taylor.com/Sprayway-SW719/PD1075320</p>	

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Brush cleaner	Consumer, Commercial	Jasco Brush Cleaner	<1	Liquid	<p>Manufacturer: W.M. Barr http://midamericainternationaltrading.com/</p> <p>Example Distributor: Lowe's https://www.lowes.com/pd/Jasco-Brush-Cleaner-1-Quart/50298107</p>	Removes hardened latex and oil-based paint, enamel, varnish, shellac, lacquer, and polyurethane
Brush cleaner	Consumer, Commercial	Klean Strip Brush Cleaner	<1	Liquid	<p>Manufacturer: W.M. Barr http://www.kleanstrip.com/product/brush-cleaner</p> <p>Example Distributor: Home Depot http://www.homedepot.com/p/Klean-Strip-1-gal-Brush-Cleaner-GBC12/100269885</p>	
Carbon remover	Commercial, Industrial	Sokoff	60-65	Liquid	<p>Manufacturer: Champion Chemical Company</p> <p>Example Distributor: Central Restaurant Products http://www.centralrestaurant.com/Heavy-Duty-Carbon-Remover---One-Quart-c101p11210.html</p>	For use on stoves and grills
Carbon remover	Commercial, Industrial	Carbon Off Dip Tank Solution (10102DTS1)	60-100	Liquid	<p>Manufacturer: Quest Specialty Corporation http://questspecialty.com/tech-sheets/Foodservice/Carbon-Off%20tech_All-QS.pdf</p> <p>Example Distributor: None found</p>	Designed for repeated treatment of multiple utensils, including waffle bakers, woks, popcorn kettles, and deep fryers

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Carbon remover	Consumer, Commercial	Carbon Off (106190001-20AR)	40-70	Aerosol	<p>Manufacturer: Quest Specialty Corporation http://www.questspecialty.com/products/106190001-20AR-Carbon-Off-Heavy-Duty-Carbon-Remover.html</p> <p>Example Distributor: Jendco Safety Supply https://www.jendcosafety.com/carbon-off-heavy-duty-carbon-remover-20-oz-aerosol-106190001/</p>	Dissolves carbon buildup from metal surfaces
Carbon remover	Commercial, Industrial	Zepresto	>30-<50	Liquid	<p>Manufacturer: Zep Inc. http://www.apmengineparts.com/036236.html</p> <p>Example Distributor: Associated Fuel Systems, Inc. https://associatedfuelsystems.com/product/zepresto-two-phase-small-parts-cleaner/</p>	Used to clean, degrease, and strip metal parts
Carbon remover	Consumer, Commercial, Industrial	Zep Automotive Carb Spray	>50-<70	Aerosol	<p>Manufacturer: Zep Inc. http://www.zepautomotive.com/product/Carb-Cleaner</p> <p>Example Distributor: Blain Supply, Inc. https://www.farmandfleet.com/products/910694-zep-automotive-carb-cleaner.html</p>	Removes dirt, gum, and varnish deposits from engine carburetors
Coil cleaner	Consumer, Commercial	Cal-Blast™ (4132-20)	60-100	Aerosol	<p>Manufacturer: Nu-Calgon http://www.nucalgon.com/products/aerosols/coil-cleaners/cal-blast</p> <p>Example Distributor: Amazon https://www.amazon.com/Aerosol-Cal-Blast-Condenser-Coil-Cleaner/dp/B01FBXMI1O</p>	

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Coil cleaner	Commercial	Blowout	60-100	Aerosol	<p>Manufacturer: Vapco Products Inc. http://www.vapcoproducts.com/products/BLO-1-Blowout-Aerosol-Coil-Cleaner.html</p> <p>Example Distributor: TopJet Sales http://www.topjetsales.com/vapco-blowout-coil-cleaner</p>	
Cold pipe insulation spray	Consumer, Commercial	No Sweat (5880)	30-60	Aerosol	<p>Manufacturer: Quest Specialty Corporation http://questspecialty.com/products/5880-No-Sweat-Cold-Pipe-Insulation-Spray.html</p> <p>Example Distributor: Aerosol Store http://www.aerosolstore.com/no-sweat-cold-pipe-insulation-spray.html</p>	
Cold pipe insulation spray	Consumer, Commercial	Surround (5880)	30-60	Aerosol	<p>Manufacturer: Quest Specialty Corporation http://www.questspecialty.com/products/5880-Surround-Cold-Pipe-Insulation-Spray.html</p> <p>Example Distributor: Amazon https://www.amazon.com/Quest-Chemical-Surround-Insulation-Spray/dp/B007A1E7AQ</p>	
Degreaser	Consumer, Commercial, Industrial	Zipp	5	Aerosol	<p>Manufacturer: The Rector Seal Corp. http://www.rectorseal.com/zipp/</p> <p>Example Distributor: Amazon https://www.amazon.com/Rectorseal-82642-14-Ounce-Aerosol-Degreaser/dp/B005E0LR0I</p>	Removes oil and grease from electrical equipment and small mechanical parts

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Degreaser	Commercial, Industrial	Zep Formula 300	>10 - <20	Liquid	<p>Manufacturer: Zep Inc.</p> <p>Example Distributor: Associated Fuel Systems, Inc. https://associatedfuelsystems.com/product/zep-formula-300-1case/</p>	For cleaning electric motors, generators, switches, office machinery, process and production equipment and machinery, tools, automotive electrical components, PC boards, and other water-sensitive damaged parts
Furniture refinisher	Consumer, Commercial, Industrial	Kutzit	20-25	Liquid	<p>Manufacturer: Savogran http://www.savogran.com/removers.html</p> <p>Example Distributor: Amazon https://www.amazon.com/Savogran-Kutzit-Paint-Varnish-Remover/dp/B001CESJLK</p>	For refinishing fine furniture and antiques
Furniture refinisher	Consumer, Commercial, Industrial	Klean Strip Klean Kutter	25-35	Liquid	<p>Manufacturer: W.M. Barr http://www.kleanstrip.com/product/klean-kutter-refinisher</p> <p>Example Distributor: Ace Hardware http://www.acehardware.com/product/index.jsp?productId=53177186</p>	Dissolves and removes most clear finishes such as varnish, lacquer, polyurethane, and shellac from all types of wood
Laboratory chemical	Industrial	GC - MS Semi-Vol Analyzer Checkout Mix, Part Number 5190-0473	>90	Liquid	<p>Manufacturer: Agilent Technologies, Inc. http://www.agilent.com/store/productDetail.jsp?catalogId=5190-0473</p> <p>Example Distributor: BGB http://www.bgb-info.com/product.php?productid=1124544</p>	Used in gas chromatogram

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Laboratory chemical	Industrial	GC EU PAH Std 250 µg/mL, Part Number 5190-0487	>25 - <45	Liquid	<p>Manufacturer: Agilent Technologies, Inc. http://www.agilent.com/store/productDetail.jsp?catalogId=5190-0487</p> <p>Example Distributor: None found</p>	Used in gas chromatogram
Laboratory chemical	Industrial	HPLC Flushing Solvent, Part Number G1969-85026	>10 - <25	Liquid	<p>Manufacturer: Agilent Technologies, Inc. http://www.agilent.com/store/en_US/Prod-G1969-85026/G1969-85026</p> <p>Example Distributor: None found</p>	Used in high performance liquid chromatography
Laboratory chemical	Industrial	GC/MS Pesticide Analyzer Internal Standard, Part Number 5190-0472	>90	Liquid	<p>Manufacturer: Agilent Technologies, Inc. http://www.agilent.com/store/en_US/Prod-5190-0472/5190-0472?navAction=push&catId=SubCat2ECS_32499&pCatName=Standards&navCount=2</p> <p>Example Distributor: None found</p>	Used in gas chromatogram
Laboratory chemical	Industrial	PAH Mixture, Part Number 8500-5963	>90	Liquid	<p>Manufacturer: Agilent Technologies, Inc. http://www.agilent.com/store/productDetail.jsp?catalogId=8500-5963</p> <p>Example Distributor: None found</p>	
Laboratory chemical	Industrial	Residual Solvent Revised Method 467 Class 2A, Part Number 5190-0492	<0.3	Liquid	<p>Manufacturer: Agilent Technologies, Inc. http://www.agilent.com/store/productDetail.jsp?catalogId=5190-0492</p> <p>Example Distributor: None found</p>	

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Laboratory chemical	Industrial	Semi-Volatiles GCMS Tuning Standard, Part Number 8500-5995	>90	Liquid	<p>Manufacturer: Agilent Technologies, Inc. http://www.agilent.com/store/productDetail.jsp?catalogId=8500-5995</p> <p>Example Distributor: None found</p>	Used in gas chromatogram
Laboratory chemical	Industrial	Test Standard - DB-624 Capillary-Megabore, Part Number 200-0113	>90	Liquid	<p>Manufacturer: Agilent Technologies, Inc. http://www.agilent.com/store/productDetail.jsp?catalogId=200-0113</p> <p>Example Distributor: Thomas Scientific http://www.thomasci.com/Laboratory-Supplies/Chromatography-Standards/_J-and-W-GC-Column-Test-Standards</p>	Used in gas chromatogram
Laboratory chemical	Industrial	Dichloromethane (5275, H572, H570, H485, H077, 4884, 4883, 4881, 4879)	99-100	Liquid	<p>Manufacturer: Avantor Performance Materials, Inc. https://www.avantormaterials.com/commerce/product.aspx?id=4295018440</p> <p>Example Distributor: None found</p>	
Laboratory chemical	Commercial, Industrial	Composite Unleaded Gasoline Solution	90-100	Liquid	<p>Manufacturer: Chem Service, Inc. https://www.chemservice.com/store/solutions/composite-unleaded-gasoline-solution-s-csrgo606-1ml.html</p> <p>Example Distributor: None found</p>	
Lubricant	Commercial, Industrial	Foremost 606-ES Dry Moly	Proprietary	Aerosol	<p>Manufacturer: Delta Foremost Chemical Corporation http://www.deltaforemost.com/search/FM%20606-ES%20Dry%20Moly%20-%20Brochure.pdf</p> <p>Example Distributor: None found</p>	Lubricates cables and chains and prevents rust

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Lubricant	Commercial, Industrial	Foremost 607-ES Hi-Temp Anti-Seize Copper Base Aerosol	Proprietary	Aerosol	<p>Manufacturer: Delta Foremost Chemical Corporation http://www.deltaforemost.com/search/FM%20607-ES%20High-Temp%20Anti-Seize%20-%20Brochure.pdf</p> <p>Example Distributor: None found</p>	Protects metal parts in diesel and gasoline engines, metal molding and plastic extruding equipment, and marine engines
Lubricant	Consumer, Commercial	Multi-Purpose Lubricant	30-60	Aerosol	<p>Manufacturer: Fehr Bros Industries, Inc. http://www.fehr.com/fehr-multi-purpose-lube-blue-x-12-cans-16970</p> <p>Example Distributor: Endurance Hardware http://www.endurancehardware.com/16970x1.html</p>	Door and operator lubricant
Lubricant	Commercial	Liquid MoliGuard (6002)	60-100	Liquid	<p>Manufacturer: Quest Specialty Corporation http://www.questspecialty.com/products/6002-Moli-Guard-Dry-Film-Lubricant.html</p> <p>Example Distributor: None found</p>	Dry film lubricant
Lubricant	Commercial	MoliGuard (5440/54410/54490)	60-100	Aerosol	<p>Manufacturer: Quest Specialty Corporation http://www.questspecialty.com/products/5440-Moli-Guard-Dry-Moly-Lubricant.html</p> <p>Example Distributor: Aerosol Store http://www.aerosolstore.com/moli-guard-dry-lubricant-spray.html</p>	Dry film lubricant
Lubricant	Commercial	Lubri Dry A	60-100	Aerosol	<p>Manufacturer: Superco Specialty Products http://supercoproducts.com/Products-Specialty-Lubricants.htm</p> <p>Example Distributor: None found</p>	Adheres well to all metals, most plastics, glass and rubber

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Novelty item	Consumer	Red Retro Happy Dippy Drinking Bird	Not Specified	Liquid	<p>Manufacturer: C&H Solutions</p> <p>Example Distributor: Amazon https://www.amazon.com/Famous-Lucky-Drinking-Bird-Magic/dp/B00L9ICV8Q/ref=sr_1_216?ie=UTF8&qid=1484589250&sr=8-216&keywords=methylene+chloride</p>	Using thermodynamics, the bird constantly bobs. Glass tube contains methylene chloride.
Paint remover	Consumer, Commercial	AST Paint and Varnish Remover	44-78	Aerosol	<p>Manufacturer: Anti-Seize Technology http://www.antiseize.com/ast-pvr-heavy-duty-paint-and-varnish-remover</p> <p>Example Distributor: Amazon https://www.amazon.com/ANTI-SEIZE-TECHNOLOGY-17052-AST-PVR-Varnish/dp/B00LM8YYWE</p>	Dissolves cements, carbon deposits, dried oils, and greases and strips paint, varnish, and decals
Paint remover	Industrial	B17 Industrial Paint Remover	55-65	Liquid	<p>Manufacturer: Benco Sales, Inc. https://www.bencosales.com/powder-coating-and-aircraft-strippers/b17-powder-coating-stripper</p> <p>Example Distributor: MIT Powder Coatings http://www.mitpowdercoatings.com/benco-b17-industrial-paint-powder-coating-stripper-55-gallons-shipping-included/</p>	

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Paint remover	Consumer, Commercial	Husky 1229 Vandalism Mark & Stain Remover	40-60	Aerosol	<p>Manufacturer: Canberra Corp http://canberracorp.com/products/husky-1229</p> <p>Example Distributor: Dalton & Co. https://daltonandco.com/product/husky-aerosol-vandalism-mark-stain-remover-1-can/</p>	
Paint remover	Consumer, Commercial	Vandalism Mark & Stain Remover	40-60	Aerosol	<p>Manufacturer: Claire Manufacturing http://clairemfg.com/content/vandalism-mark-stain-remover</p> <p>Example Distributor: Amazon https://www.amazon.com/Claire-C-870-Vandalism-Remover-Aerosol/dp/B005R4JRBW</p>	
Paint remover	Commercial, Industrial	Foremost 550 Strip-Spray	Proprietary	Aerosol	<p>Manufacturer: Delta Foremost Chemical Corporation http://www.deltaforemost.com/search/FM%20550%20Strip-Spray%20-%20Brochure.pdf</p> <p>Example Distributor: None found</p>	Paint stripper formulated for easy removal of defective automotive topcoats
Paint remover	Commercial, Industrial	Foremost 1011 Tuf-Strip	Proprietary	Liquid	<p>Manufacturer: Delta Foremost Chemical Corporation http://www.deltaforemost.com/search/FM%201011%20Tuf-Strip%20-%20Brochure.pdf</p> <p>Example Distributor: None found</p>	Used to remove paint, varnish, grime, and asphalt deposits from all metals

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Paint remover	Commercial, Industrial	Foremost 2154-ES X-Mark Remover	Proprietary	Aerosol	<p>Manufacturer: Delta Foremost Chemical Corporation http://www.deltaforemost.com/search/FM%202154-ES%20X-Mark%20Remover%20-%20Brochure.pdf</p> <p>Example Distributor: None found</p>	Removes lipstick, crayon, stencil inks, ball point and marker inks, scotch tape and residue, pencil, and scuff marks
Paint remover	Consumer, Commercial	Permatex Paint Stripper	40-70	Aerosol	<p>Manufacturer: ITW Permatex https://www.permatex.com/products/cleaners-degreasers/specialty-cleaners-cleaners-degreasers/permatex-paint-stripper/</p> <p>Example Distributor: Amazon https://www.amazon.com/Permatex-80577-Decal-Stripper-Aerosol/dp/B000HBI9RI</p>	Removes decals, stickers, and paint
Paint remover	Commercial	Crown Handi-Strip Liquid	45-55	Liquid	<p>Manufacturer: Packaging Service Co., Inc. http://www.packserv.com/products/crown/removers/</p> <p>Example Distributor: None found</p>	
Paint remover	Consumer, Commercial	Crown Handi-Strip Semi-Paste Remover	35-40	Liquid	<p>Manufacturer: Packaging Service Co., Inc. http://www.packserv.com/products/crown/removers/</p> <p>Example Distributor: Lowe's https://www.lowes.com/pd/Crown-32-fl-oz-Semi-Paste-Multi-Surface-Paint-Remover/3029985</p>	

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Paint remover	Commercial	Crown Tuff-Strip Semi-Paste Remover	65-75	Liquid	<p>Manufacturer: Packaging Service Co., Inc. http://www.packserv.com/products/crown/removers/</p> <p>Example Distributor: Cox Hardware http://www.coxhardware.com/p-5846-tuff-strip-semi-paste-heavy-duty-paint-remover-18-oz.aspx</p>	
Paint remover	Commercial, Industrial	Eldorado PR-3500	>50 - <75	Liquid	<p>Manufacturer: PPG Aerospace http://www.ppgaerospace.com/Products/Coatings-Removers-Cleaners/Surface-Solutions/Solvents-Cleaners/Eldorado-PR-3500-Paint-Remover,-Epoxy-Systems.aspx</p> <p>Example Distributor: Pilots HQ LLC http://pilotshq.com/prc-desoto-eldorado-3500-paint-remover-pr3500gl-p-10541.html</p>	Used to strip aircraft primers, epoxy, polyurethane, and other organic coatings from metal surfaces
Paint remover	Commercial, Industrial	Ruthless (6030)	60-100	Liquid	<p>Manufacturer: Quest Specialty Corporation http://questspecialty.com/products/6030-Ruthless-Paint-Varnish-Remover.html</p> <p>Example Distributor: None found</p>	Intended for use on metal, brick, terrazzo, ceramic, and wood surfaces to remove paint, lacquer, enamel, varnish, labels, silicone, and carbon deposits
Paint remover	Consumer, Commercial	Ruthless (5580/5590)	40-70	Aerosol	<p>Manufacturer: Quest Specialty Corporation http://www.questspecialty.com/products/5580-Ruthless-Paint-Remover.html</p> <p>Example Distributor: Aerosol Store http://www.aerosolstore.com/ruthless-paint-remover.html</p>	Removes paint, decals and labels from all surfaces

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Paint remover	Consumer, Commercial	Zinsser Brush & Roller Wash	50-100	Liquid	<p>Manufacturer: Rust-Oleum Corp. https://webcache.googleusercontent.com/search?q=cache:zjgBwfP_DAwJ:https://www.rustoleum.com/product-catalog/consumer-brands/zinsser/paint-strippers-and-graffiti-removers/brush-and-roller-wash+&cd=3&hl=en&ct=clnk&gl=us</p> <p>Example Distributor: Home Depot http://www.homedepot.com/p/Zinsser-1-qt-Brush-and-Roller-Wash-6-Pack-42094/205163872</p>	
Paint remover	Consumer, Commercial	Zinsser Power Stripper	50-75	Aerosol	<p>Manufacturer: Rust-Oleum Corp. https://www.rustoleum.com/product-catalog/consumer-brands/zinsser/paint-strippers-and-graffiti-removers/power-stripper</p> <p>Example Distributor: Menard's https://www.menards.com/main/paint/cleaners-thinners-removers/paint-stain-cleaners/strippers-removers/zinsser-reg-stripfast-power-stripper-spray-18-oz/p-1444452990252.htm</p>	Removes paint, stain, lacquer, varnish epoxy, and polyurethane from wood, metal, masonry, and marine surfaces
Paint remover	Consumer, Commercial	Prepaint Deglosser	35-40	Liquid	<p>Manufacturer: Savogran http://www.savogran.com/heavy-duty-cleaning.html</p> <p>Example Distributor: Jamestown Distributors https://www.jamestowndistributors.com/userportal/show_product.do?pid=63902</p>	Cleans oil, grease, and paint remover sludge from wood and metal, and heel marks, dirt, and pencil marks from new wood

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Paint remover	Consumer, Commercial, Industrial	5F5	65-70	Liquid	<p>Manufacturer: Savogran http://www.savogran.com/removers.html</p> <p>Example Distributor: Amazon https://www.amazon.com/SAVOGRAN-50001-Gallon-Paint-Remover/dp/B0031KI18O</p>	Paint and varnish remover for industrial, marine, and consumer use
Paint remover	Consumer, Commercial, Industrial	Strypeeze Original	25-30	Liquid	<p>Manufacturer: Savogran http://www.savogran.com/removers.html</p> <p>Example Distributor: Amazon https://www.amazon.com/Savogran-01102-Strypeeze-Semi-Paste-Stripper/dp/B001003UEM</p>	Recommended for removing latex and oil-based paints, varnish, and lacquers
Paint remover	Consumer, Commercial, Industrial	SuperStrip	80-85	Liquid	<p>Manufacturer: Savogran http://www.savogran.com/removers.html</p> <p>Example Distributor: Amazon https://www.amazon.com/Savogran-01132-SuperStrip-Stripper-Varnish/dp/B002OTNSIG</p>	For stripping concrete workshop floors or removing tile mastic
Paint remover	Consumer, Commercial	39913 Urethane Bumper Stripper	70-100	Aerosol	<p>Manufacturer: SEM Products, Inc. https://www.semproducts.com/refinish-paint-strippers/urethane-bumper-stripper</p> <p>Example Distributor: Amazon https://www.amazon.com/SEM-39913-Urethane-Bumper-Stripper/dp/B000I1NWGA</p>	Removes refinish materials from flexible parts

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Paint remover	Consumer, Commercial	77713 Urethane Bumper Stripper (XXX Bumper Stripper)	70-100	Aerosol	<p>Manufacturer: SEM Products, Inc. https://www.semproducts.com/refinish-paint-strippers/xxx-bumper-stripper-77713</p> <p>Example Distributor: Amazon https://www.amazon.com/SEM-77713-XXX-Bumper-Stripper/dp/B003TQH91A</p>	Removes refinish materials from flexible parts
Paint remover	Consumer, Commercial	SPT TM 615 Heavy Duty Paint Remover Aerosol	62.04	Aerosol	<p>Manufacturer: Sprayon Products http://www.sprayon.com/product-categories/industrial-specialty-products/heavy-duty-paint-remover-with-methylene-chloride-aerosol-sp615</p> <p>Example Distributor: Amazon https://www.amazon.com/Sprayon-SP615-REMOVER-Aerosol-S00615000/dp/B00DRHTHUC</p>	Removes paint finishes, urethanes, varnish, and shellac
Paint remover	Consumer, Commercial	Paint Stripper	60-80	Aerosol	<p>Manufacturer: Sprayway Inc. http://www.spraywayinc.com/content/paint-stripper</p> <p>Example Distributor: None found</p>	Use on brick, tile, steel, brass, chrome, porcelain, and many other surfaces
Paint remover	Commercial	Super Strip A	40-70	Aerosol	<p>Manufacturer: Superco Specialty Products http://supercoproducts.com/Products-Specialty-Strippers.htm</p> <p>Example Distributor: None found</p>	Paint and varnish remover; removes graffiti from brick and concrete

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Paint remover	Consumer, Commercial	Zar Paint and Varnish Remover	60-100	Paste/ Gel Liquid	<p>Manufacturer: United Gilsonite Laboratories http://cleaningandmaintenance.ugl.com/?page_id=12#</p> <p>Example Distributor: Home Depot http://www.homedepot.com/p/ZAR-1-pt-Paint-and-Varnish-Remover-2-Pack-209112/203887497</p>	
Paint remover	Consumer, Commercial	Jasco Premium Remover	88	Aerosol	<p>Manufacturer: W.M. Barr http://midamericainternationaltrading.com/</p> <p>Example Distributor: Amazon https://www.amazon.com/Jasco-Bix-EJBP00206-Premium-Remover/dp/B000BZTFQY</p>	For use on wood, metal, concrete, and masonry
Paint remover	Consumer, Commercial	Goof Off All Purpose Paint Stripper	30-40	Liquid	<p>Manufacturer: W.M. Barr http://www.gooffproducts.com/product/paint-removers-strippers</p> <p>Example Distributor: Lowe's https://www.lowes.com/pd/Goof-Off-1-Quart-Semi-Paste-Multi-Surface-PaintRemover/50298089</p>	
Paint remover	Consumer, Commercial, Industrial	Goof Off Pro Paint Stripper Aerosol	70-95	Aerosol	<p>Manufacturer: W.M. Barr http://www.gooffproducts.com/product/paint-removers-strippers</p> <p>Example Distributor: Lowe's https://www.lowes.com/pd/Goof-Off-18-oz-Spray-Multi-Surface-Paint-Remover/50298103</p>	

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Paint remover	Consumer, Commercial	Jasco Premium Paint and Epoxy Remover	60-100	Liquid	<p>Manufacturer: W.M. Barr http://www.jasco-help.com/product/premium-paint-epoxy-remover</p> <p>Example Distributor: Home Depot http://www.homedepot.com/p/Jasco-1-qt-Premium-Paint-and-Epoxy-Remover-QJBPO0202/202247418</p>	Removes paint, varnish, lacquer, shellac, epoxy, urethane, latex or any synthetic coating. Can be used on wood, metal, concrete, and masonry.
Paint remover	Consumer, Commercial	Klean-Strip Peeler	60-100	Aerosol	<p>Manufacturer: W.M. Barr http://www.kleanstrip.com/product/aircraft-peeler</p> <p>Example Distributor: Amazon https://www.amazon.com/Kleanstrip-EFS459-Aircraft-Peeler-Basecoat/dp/B0015DSJWW</p>	For use on aircraft
Paint remover	Consumer, Commercial, Industrial	Klean Strip Heavy Bodied Metal & Masonry Paint Remover	75-85	Liquid	<p>Manufacturer: W.M. Barr http://www.kleanstrip.com/product/metal-masonry-paint-remover</p> <p>Example Distributor: MSC Industrial https://www.mscdirect.com/webapp/wcs/stores/ervlet/browse/tnpla/70250642</p>	
Paint remover	Consumer, Commercial, Industrial	Klean-Strip Naked Gun Spray Gun Paint Remover	30-60	Liquid	<p>Manufacturer: W.M. Barr http://www.kleanstrip.com/product/naked-gun-spray-gun-paint-remover</p> <p>Example Distributor: Amazon https://www.amazon.com/Remover-Paint-Spray-Naked-Gun-2pack/dp/B00WS7ZP6M</p>	

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Paint remover	Consumer, Commercial	Klean Strip Adhesive Remover / Klean Strip Premium Stripper	60-100	Liquid	<p>Manufacturer: W.M. Barr http://www.kleanstrip.com/product/premium-stripper</p> <p>Example Distributor: Home Depot http://www.homedepot.com/p/Klean-Strip-1-gal-KS-3-Premium-Stripper-GKS3/100144685</p>	
Paint remover	Consumer, Commercial	Klean Strip Premium Sprayable Stripper	60-100	Liquid	<p>Manufacturer: W.M. Barr http://www.kleanstrip.com/product/premium-sprayable-stripper</p> <p>Example Distributor: Home Depot http://www.homedepot.com/p/Klean-Strip-1-qt-Premium-Sprayable-Stripper-QKS221/100187054</p>	
Paint remover	Consumer, Commercial, Industrial	Klean-Strip Color Change Stripper	40-60	Liquid	<p>Manufacturer: W.M. Barr http://www.kleanstrip.com/product/premium-color-change-stripper</p> <p>Example Distributor: Home Depot http://www.homedepot.com/p/Klean-Strip-1-gal-Color-Change-Stripper-GKCC00326/100406365</p>	
Paint remover	Consumer, Commercial	Premium Stripper (Aerosol)	70-95	Aerosol	<p>Manufacturer: W.M. Barr http://www.kleanstrip.com/product/premium-stripper-aerosol</p> <p>Example Distributor: Walmart https://www.walmart.com/ip/Klean-Strip-Premium-Paint-Stripper/17208799</p>	

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Paint remover	Consumer, Commercial	Klean-Strip Strip X Stripper	30-40	Liquid	<p>Manufacturer: W.M. Barr http://www.kleanstrip.com/product/strip-x-stripper</p> <p>Example Distributor: Home Depot http://www.homedepot.com/p/Klean-Strip-1-qt-Strip-X-Stripper-QSX6/100179578</p>	
Paint remover	Consumer, Commercial	Klean Strip Aircraft Low Odor Paint Remover	80-90	Liquid	<p>Manufacturer: W.M. Barr http://www.wmbarr.com/product.aspx?catid=82&prodid=239</p> <p>Example Distributor: Coastal Tool Supply http://www.coastaltoolsupply.com/product/KLE-GAR777.html?gclid=CJXP07yHhNICFcGLswo dAXMMZA</p>	
Paint remover	Consumer, Commercial	Klean Strip Aircraft Paint Remover (Aerosol)	60-100	Aerosol	<p>Manufacturer: W.M. Barr http://www.wmbarr.com/product.aspx?catid=82&prodid=135</p> <p>Example Distributor: Amazon https://www.amazon.com/Klean-Strip-EAR322-Aerosol-Aircraft-18-Ounce/dp/B000VI13L6</p>	Removes a wide range of finishes from the metal surfaces of automobiles, trucks, and cycles
Paint remover	Consumer, Commercial	Klean Strip Aircraft Paint Remover (Liquid)	60-100	Liquid	<p>Manufacturer: W.M. Barr http://www.wmbarr.com/product.aspx?catid=82&prodid=136</p> <p>Example Distributor: Amazon https://www.amazon.com/GAR343-KLEAN-STRIP-Aircraft-Stripper-Gallon/dp/B004Y1KX9E</p>	Removes a wide range of finishes from the metal surfaces of automobiles, trucks, and cycles

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Paint remover	Commercial, Industrial	Klean Strip Aircraft Paint Remover for Flexible Plastic	60-100	Aerosol	<p>Manufacturer: W.M. Barr http://www.wmbarr.com/product.aspx?catid=82&prodid=45 Example Distributor: Amazon https://www.amazon.com/Kleanstrip-EUP367-Aircraft-Remover-Plastic-2c/dp/B002GUPA16</p>	
Paint remover	Consumer, Commercial, Industrial	Klean-Strip Fiberglass Paint Remover	10-30	Liquid	<p>Manufacturer: W.M. Barr http://www.wmbarr.com/product.aspx?catid=82&prodid=113 Example Distributor: Auto Body Toolmart http://www.autobodytoolmart.com/klean-strip-fiberglass-paint-stripper-gaf354-p-14857.aspx</p>	For use on aircraft
Paint remover	Consumer, Commercial	KWIK Liquid No Wash	20-30	Liquid	<p>Manufacturer: W.M. Barr http://www.wmbarr.com/product.aspx?catid=15&prodid=60 Example Distributor: Castle Wholesalers http://www.castlewholesalers.com/KWIK-LIQUID-NO-WASH-CLN-950-Paint-Varnish-Remover-5-Gal.html</p>	
Paint remover	Commercial, Industrial	KWIK Marine Paint & Varnish Remover	60-100	Liquid	<p>Manufacturer: W.M. Barr http://www.wmbarr.com/product.aspx?catid=15&prodid=59 Example Distributor: Merritt Supply https://www.merrittsupply.com/product/kwik-marine-paint-varnish-remover-gallon-pn-kwik-01/</p>	

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Paint remover	Consumer, Commercial	Goof Off Liquid Stripper	60-100	Liquid	<p>Manufacturer: W.M. Barr http://www.gooffproducts.com/product/paint-removers-strippers Example Distributor: Lowe's https://www.lowes.com/pd/Goof-Off-1-Gallon-Liquid-Multi-Surface-Paint-Remover/50298101</p>	
Paint remover	Consumer, Commercial, Industrial	Zep Automotive Paint Remover Spray	>50 - <70	Aerosol	<p>Manufacturer: Zep Inc. http://www.zepautomotive.com/product/Paint-Remover Example Distributor: Advance Auto Parts http://shop.advanceautoparts.com/p/zep-automotive-paint-remover-spray-zaa7299/10668017-P</p>	
Paint remover	Commercial, Industrial	Zep Paint Remover Spray Gel	>50 - <70	Aerosol	<p>Manufacturer: Zep Inc. http://www.zepdistribution.com/product/zepprofessional/aerosol-paint-remover Example Distributor: HomElectrical http://www.homeelectrical.com/zep-professional-paint-remover-spray-gel-20-oz.zpp-r18201.1.html</p>	
Printing lubricant	Commercial, Industrial	Smash	30-60	Liquid	<p>Manufacturer: Allied Pressroom Products http://www.alliedchem.com/index.php/offset-printing/offset-pressroom-aids/smash Example Distributor: FUJIFILM North America Corp. https://www.fujifilmdirect.com/index.php/offset-printing/pressroom-1/smash-blanket-fix-8-ounce-can.html</p>	Used in the printing industry as a lubricant. This product is used to even out the surface of the blanket of a printing press.

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Printing lubricant	Commercial, Industrial	No. 14 Blanket Saver	65-85	Liquid	<p>Manufacturer: Hurst Chemical Company https://www.hurstchemical.com/downloads/Hurst_Product_Guide_2017.pdf</p> <p>Example Distributor: Printing Equipment & Supply http://stores.printingequipmentandsupply.com/hurst-blanket-saver/</p>	Used in the printing industry as a lubricant. This product is used to even out the surface of the blanket of a printing press.
Sealant	Consumer, Commercial	Permatex Copper Spray-A-Gasket	10-30	Aerosol	<p>Manufacturer: ITW Permatex https://www.permatex.com/products/gasketing/gasket-sealants/permatex-copper-spray-a-gasket-hi-temp-sealant/</p> <p>Example Distributor: Amazon https://www.amazon.com/Permatex-80697-Gasket-Hi-Temp-Adhesive/dp/B000HBNUDQ</p>	
Textile treatment	Commercial, Industrial	Everblum Special Cleaning Fluid (1005, 1006, and 1008)	35-45	Liquid	<p>Manufacturer: Albatross USA Inc. http://albatross-usa.com/everblumcleaningfluid.aspx</p> <p>Example Distributor: None found</p>	Removes oil, grease, pencil, chalk, dirt, crayon, adhesive, cosmetic, and food stains from fabrics
Textile treatment	Commercial, Industrial	AlbaChem Superkleen S.P.I.F.	85-95	Liquid	<p>Manufacturer: Albatross USA Inc. http://albatross-usa.com/superkleenspifcuredinkremover.aspx</p> <p>Example Distributor: ScreenPrintingSupply.com https://www.screenprintingsupply.com/Albatross-SuperKleen-SPIF-Spot-Remover-Fluid_p_15376.html</p>	Removes plastisol and water-based inks, flock lettering, and adhesives from all textiles

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Textile treatment	Commercial, Industrial	ALLOPAR® Spot Lifter 2	40-50	Aerosol	<p>Manufacturer: Allopar LLC http://www.allopar.com/2015/05/14/allopar-spot-lifter-2/</p> <p>Example Distributor: None found</p>	Spot remover for textiles
Textile treatment	Commercial, Industrial	TS-VLR	72-86	Liquid	<p>Manufacturer: Tekmar http://tekmarltd.com/products/spot-cleaning/ts-vlr/</p> <p>Example Distributor: Tech Support Screen Printing Supplies, LLC https://store.techsupportsp.com/collections/tekmar-chemicals</p>	Vinyl letter remover
Textile treatment	Commercial, Industrial	TS-3	70 - <90	Liquid	<p>Manufacturer: Tekmar http://tekmarltd.com/products/spot-cleaning/chemicals/formula-ts-3/</p> <p>Example Distributor: ScreenPrintingSupply.com https://www.screenprintingsupply.com/Tekmar-TS-3-Spot-Removal-Fluid_p_6287.html</p>	Removes cured plastisol, water-based, puff, flock adhesives, and many other ink types from fabrics
Textile treatment	Commercial, Industrial	TS-1	72 - <90	Liquid	<p>Manufacturer: Tekmar http://tekmarltd.com/products/spot-cleaning/chemicals/formula-ts-1/</p> <p>Example Distributor: ScreenPrintingSupply.com https://www.screenprintingsupply.com/Tekmar-TS-1-Textstyle-Formula-Spot-Cleaning-Fluid_p_15443.html</p>	Removes grease, oil, dirt, marking pencil, lipstick, cosmetics, and other soils from fabrics

Table 3-2: Sample of Products that Contain Methylene Chloride

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Description
Weld spatter protectant	Commercial, Industrial	Radnor Solvent Based Anti-Spatter	>90	Aerosol	<p>Manufacturer: Radnor</p> <p>Example Distributor: Airgas Inc. https://www.airgas.com/p/RAD64000100</p>	Prevents spatter build up in welding operations
Weld spatter protectant	Commercial, Industrial	WL™541 Dry Weld Spatter Protectant Aerosol	89.4	Aerosol	<p>Manufacturer: Sprayon Products http://www.sprayon.com/product-categories/industrial-welding-products/dry-weld-spatter-protectant-with-methylene-chloride-aerosol-wl541</p> <p>Example Distributor: Applied Industrial Technologies https://www.applied.com/c-sprayon-s00541000/p/101529401</p>	
Weld spatter protectant	Commercial, Industrial	WL™542 Wet Weld Spatter Protectant Aerosol	94.4	Aerosol	<p>Manufacturer: Sprayon Products https://www.applied.com/c-sprayon-s00542000/p/101532288</p> <p>Example Distributor: MHS Industrial Supply http://www.mhsindustrial.com/WL542-WET-WELD-SPATTER-PROTECTANT-_p_175674.html</p>	
Weld spatter protectant	Consumer, Commercial, Industrial	Nozzle Kleen #2 Aerosol	>90	Aerosol	<p>Manufacturer: Weld-Aid Products http://www.weldaid.com/nozzle-kleen-2/</p> <p>Example Distributor: Amazon https://www.amazon.com/Weld-Aid-Nozzle-Kleen-Anti-Spatter-Liquid-16/dp/B008RA5DYI</p>	

Notes:

^a Determination of the expected users associated with a use or process is based on EPA's best judgement if the users are not explicitly defined in the resource(s) cited.

^b HMS was not found on 3M's website or for purchase online. However, because the SDS was updated on 2/21/2017, the product is presumably still available.

^c Quin Global manufactures a variety of spray adhesives for sale in the US, UK, and Australia. All Quin Global products in this table are ones that Quin Global indicates are available in the US. However, for the most part, the distributors they link to from their site do not appear to currently have the products available for purchase.

3.3 Methylene Chloride Market Trends

In addition to its use in paint strippers and removers, which are not discussed in this report, methylene chloride is widely used as a solvent in the production of pharmaceuticals and chemical processing, as well as metal cleaning and the production of HFC-32 (IHS Markit, 2016). Due to increasing government regulations and environmental and human health concerns, the use of methylene chloride has been declining in the U.S. (ICIS Chemical Business, 2005). Consumption of methylene chloride decreased from a high of approximately 540 million pounds in the mid-1980s (EPA, n.d.-a) to about 261 million pounds in 2011 (EPA, 2014).

However, greater production of the non-ozone depleting refrigerant HFC-32 is expected to offer increased global demand for methylene chloride in the future (Processing Magazine, 2015). Global consumption of all chlorinated methanes, including methylene chloride, is anticipated to grow by 2.0 percent annually from 2016 to 2021 (IHS Markit, 2016). By 2020, the global methylene chloride market is projected to reach a value of \$892.9 million (Processing Magazine, 2015). Much of this predicted growth is associated with Asian countries as a result of increased demand for solvents from end-users in pharmaceutical, HFC-32, and chemical processing industries (Processing Magazine, 2015).

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Appendix A : Detailed TRI data

Table A - 1: Detailed 2015 TRI Activity or Use for Methylene Chloride by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
3M Cottage Grove Center 10746 Innovation Rd Cottage Grove, MN 55016	10,000-99,999	Reactant, Formulation Component, Ancillary
3V Sigma USA 888 Woodstock St Georgetown, SC 29440	1,000,000-9,999,999	Chemical Processing Aid
AbbVie - North Chicago Facility 1401 Sheridan Rd North Chicago, IL 60064	100,000-999,999	Produce, Byproduct, Chemical Processing Aid, Ancillary
Agilent Technologies Boulder 5555 Airport Blvd Boulder, CO 80301	10,000-99,999	Chemical Processing Aid
Agilent Technologies Inc. 91 Blue Ravine Rd Folsom, CA 95630	1,000-9,999	Chemical Processing Aid
Air Products & Chemicals Inc. Electronics Specialty Materials 357 Marian Ave Tamaqua, PA 18252	1,000-9,999	Ancillary
Albemarle Corp 2858 Back Vail Rd Tyrone, PA 16686	100,000-999,999	Chemical Processing Aid
Albemarle Corp South Plant 2270 Hwy 79 S Magnolia, AR 71753	1,000,000-9,999,999	Reactant
Alcami Corp (Formerly Cambridge Major Laboratories) W132 N10550 Grant Dr Germantown, WI 53022	10,000-99,999	Chemical Processing Aid
Alcore Inc - Lakeside 1502 Quarry Dr Edgewood, MD 21040	1,000-9,999	Manufacture Aid
Aldrich Chemical Co LLC 5485 County Rd V Sheboygan Falls, WI 53085	10,000-99,999	Repackaging, Chemical Processing Aid
Alza Corp 700 Eubanks Drive Vacaville, CA 95688	10,000-99,999	Manufacture Aid
AMC International 310 Brookhollow Ind Blvd Dalton, GA 30721	10,000-99,999	Ancillary
American Jetway Corp 34136 Myrtle Wayne, MI 48184	100,000-999,999	Formulation Component
Ampac Fine Chemicals LLC Hwy 50 & Hazel Rd Rancho Cordova, CA 95670	100,000-999,999	Chemical Processing Aid
Amri Rensselaer Inc. 33 Riverside Ave Rensselaer, NY 12144	10,000-99,999	Chemical Processing Aid
Amvac Chemical Co 12650 Hwy 43 N Axis, AL 36505	NR	NR

Table A - 1: Detailed 2015 TRI Activity or Use for Methylene Chloride by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Amylin Ohio LLC 8814 Trade Port Dr West Chester, OH 45071	100,000-999,999	Chemical Processing Aid
Anatrace 434 W D US Sel Dr Maumee, OH 43537	1,000-9,999	Chemical Processing Aid, Manufacture Aid
Applied Biosystems LLC 6055 Sunol Blvd Pleasanton, CA 94566	1,000-9,999	Chemical Processing Aid
Arkema Inc. 4444 Ind US Trial Pkwy Calvert City, KY 42029	1,000,000-9,999,999	Reactant
Arrow Cryogenics 1671 93rd Ln NE Blaine, MN 55449	10,000-99,999	Ancillary
Ash Grove Cement Co 4343 Hwy 108 Foreman, AR 71836	1,000-9,999	Ancillary
Ash Grove Cement Co 1801 N Santa Fe Chanute, KS 66720	1,000-9,999	Ancillary
Astro Chemicals Inc. 126 Memorial Dr Springfield, MA 01104	100,000-999,999	Repackaging
ATK-Allegany Ballistics Lab (Niroop) 210 WV State Rt 956 Rocket Center, WV 26726	10,000-99,999	Ancillary
Augusta Fiberglass Coatings Inc. 86 Lake Cynthia Rd Blackville, SC 29817	10,000-99,999	Chemical Processing Aid
Avantor Performance Materials 7001 Martin Luther King Blvd Paris, KY 40361	100,000-999,999	Repackaging
Axiall LLC 26100 Hwy 405 S Plaquemine, LA 70764	100,000-999,999	Produce, Byproduct
Bachem Americas Inc. 1271 Avenida Chelsea Vista, CA 92081	1,000-9,999	Chemical Processing Aid
Bachem Americas Inc. 3132 Kashiwa St Torrance, CA 90505	10,000-99,999	Chemical Processing Aid
Bell Laboratories Inc. 3699 Kinsman Blvd Madison, WI 53704	1,000-9,999	Chemical Processing Aid
Benco Sales Inc. 123 Stout Dr Crossville, TN 38555	1,000,000-9,999,999	Article Component
Berg Lacquer Co 3150 E Pico Blvd Los Angeles, CA 900233632	0-99	Formulation Component, Repackaging, Ancillary
Berryman Products Inc. 3800 E Randol Mill Rd Arlington, TX 76011	10,000-99,999	Formulation Component, Repackaging,

Table A - 1: Detailed 2015 TRI Activity or Use for Methylene Chloride by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Bimax Inc. 158 Industrial Rd Glen Rock, PA 17327	10,000-99,999	Chemical Processing Aid, Manufacture Aid
Boulder Scientific Co Mead Facility 598 Third St Mead, CO 80542	10,000-99,999	Formulation Component, Chemical Processing Aid, Manufacture Aid
Braxton Manufacturing Co Inc. 858 Echo Lake Rd Watertown, CT 06795	1,000-9,999	Ancillary
Brenntag Great Lakes LLC 14765 W Bobolink Ave Menomonee Falls, WI 53051	NR	NR
Brenntag Mid-South 2000 E Pettigrew St Durham, NC 27703	NR	NR
Brenntag Mid-South Inc. 3200 Moon Station Rd Kennesaw, GA 30144	NR	NR
Brenntag Northeast Inc. 81 W Huller Ln Reading, PA 19605	100,000-999,999	Formulation Component, Repackaging
Brenntag Southwest Inc. Lancaster 704 E Wintergreen Rd Lancaster, TX 75134	100,000-999,999	Repackaging
Buckman Laboratories Inc. 1256 N McLean Blvd Memphis, TN 38108	1,000-9,999	Produce, Manufacture Impurity, Process Impurity
Buzzi Unicem USA - Cape Girardeau 2524 S Sprigg St Cape Girardeau, MO 63703	10,000-99,999	Ancillary
Buzzi Unicem USA - Greencastle Plant 3301 S County Rd 150 W Greencastle, IN 46135	10,000-99,999	Repackaging, Process Impurity, Ancillary
C S Bio Co 20 Kelly Ct Menlo Park, CA 94025	1,000-9,999	Chemical Processing Aid
Calgon Carbon Corp 15024 US 23 Catlettsburg, KY 41129	1,000-9,999	Produce, Manufacture Impurity, Ancillary
Callahan Chemical Co 18 Industrial Rd Walpole, MA 02081	10,000-99,999	Repackaging
Cambrex Charles City Inc. 1205 11th St Charles City, IA 50616	100,000-999,999	Chemical Processing Aid, Manufacture Aid
Cambridge Isotope Laboratories Inc. 50 Frontage Rd Andover, MA 01810	1,000-9,999	Reactant, Article Component, Formulation Component, Chemical Processing Aid, Manufacture Aid
Carestream Health Inc. - ISC B-14 1669 Lake Ave Eastman Business Park Building 14 Rochester, NY 14615	1,000-9,999	Chemical Processing Aid
Cayman Chemical Co Inc. 1180 E Ellsworth Rd Ann Arbor, MI 48108	10,000-99,999	Reactant, Formulation Component

Table A - 1: Detailed 2015 TRI Activity or Use for Methylene Chloride by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Cedarburg Pharmaceuticals Inc. 870 Badger Cir Grafton, WI 53024	10,000-99,999	Chemical Processing Aid
Celanese Acetate LLC - Celco Plant 3520 Virginia Ave Narrows, VA 24124	100,000-999,999	Manufacture Aid
Central Plains Cement Co 2609 N 145th E Ave Tulsa, OK 74116	NR	NR
ChemDesign Products Inc. 2 Stanton St Marinette, WI 54143	10,000-99,999	Reactant
Chemical Solvents Inc. Denison Facility 1010 Old Denison Ave Cleveland, OH 44109	10,000-99,999	Ancillary
Chemical Solvents Jennings Rd Facility 3751 Jennings Rd Cleveland, OH 44109	100,000-999,999	Ancillary
Chemical Waste Management of the Northwest Inc. 17629 Cedar Springs Ln Arlington, OR 97812	10,000-99,999	Ancillary
Chemisphere Corp 2101 Clifton Ave Saint Louis, MO 63139	1,000,000-9,999,999	Formulation Component, Repackaging
Chemours Co - Fayetteville Works 22828 NC Hwy 87 W Fayetteville, NC 28306	100,000-999,999	Manufacture Aid
Chemsolv Inc. 1140 Industry Ave Se Roanoke, VA 24013	NR	NR
Chemtron Corp 35850 Schneider Ct Avon, OH 44011	1,000-9,999	Ancillary
Cherokee Pharmaceuticals LLC 100 Avenue C Riverside, PA 17868	100,000-999,999	Chemical Processing Aid
CLCM-St Francis (Formerly Masd & Kitzinger) 3950 S Pennsylvania Ave Saint Francis, WI 53235	1,000-9,999	Ancillary
Clean Harbors Aragonite LLC 11600 North Aptus Rd Grantsville, UT 84029	1,000,000-9,999,999	Ancillary
Clean Harbors Deer Park LLC 2027 Independence Parkway South La Porte, TX 77571	1,000,000-9,999,999	Article Component
Clean Harbors El Dorado LLC 309 American Cir Union El Dorado, AR 71730	1,000,000-9,999,999	Produce, Byproduct, Repackaging, Ancillary
Clean Harbors Environmental Services Inc. 2247 S Hwy 71 Kimball, NE 69145	10,000-99,999	Ancillary
Clean Harbors Recycling Services of Chicago LLC 1445 W 42nd Chicago, IL 60609	100,000-999,999	Process Impurity

Table A - 1: Detailed 2015 TRI Activity or Use for Methylene Chloride by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Clean Harbors Recycling Services of Ohio LLC 581 Milliken Dr SE Hebron, OH 43025	100,000-999,999	Imported, Used Processed, Formulation Component, Ancillary
Colstrip Steam Electric Station Willow Ave Colstrip, MT 59323	0-99	Produce, Byproduct, Ancillary
Comcast Urethane 425 Leggitt Rd Marshall, MI 49068	NR	NR
Commerce Industrial Chemicals Inc. 3420 W Mill Rd Milwaukee, WI 53209	1,000-9,999	Repackaging
Continental Cement Co LLC 10107 Hwy 79 Hannibal, MO 63401	10,000-99,999	Ancillary
Corden Pharma Colorado Inc. 2075 N 55th St Boulder, CO 80301	100,000-999,999	Chemical Processing Aid, Manufacture Aid
CORPAK MedSystems 1001 Asbury Dr Buffalo Grove, IL 60089	1,000-9,999	Article Component, Formulation Component, Chemical Processing Aid, Manufacture Aid
Covidien LP 195 McDermott Rd North Haven, CT 06473	100-999	Ancillary
CR Bard 428 Power House Rd Moncks Corner, SC 29461	100,000-999,999	Ancillary
Cytec Industrial Materials 5350 S 129th E Ave Tulsa, OK 74134	10,000-99,999	Ancillary
Dap Products Inc. 875 N Third St Tipp City, OH 45371	100,000-999,999	Formulation Component
Dapco Industries 2500 Bishop Cir E Dexter, MI 48130	1,000-9,999	Ancillary
Daubert Chemical Co 4700 S Central Ave Chicago, IL 60638	10,000-99,999	Formulation Component
Demunno/Kerdoon Inc. 2000 North Alameda Street Compton, CA 90222	1,000-9,999	Repackaging, Process Impurity, Ancillary
Doremus Terminal LLC 128 Doremus Ave Newark, NJ 07105	NR	NR
Dow Chemical Co 901 Loveridge Rd Pittsburg, CA 94565	100,000-999,999	Formulation Component, Repackaging, Chemical Processing Aid,
Dow Chemical Co Freeport Facility 2301 N Brazosport Blvd Freeport, TX 77541-3257	10,000,000-49,999,999	Produce, Imported, Used Processed, Sale Distribution, Byproduct, Manufacture Impurity, Chemical Processing Aid, Ancillary
DSM Nutritional Products 1000 County Rd 227A Freeport, TX 77541	100,000-999,999	Chemical Processing Aid

Table A - 1: Detailed 2015 TRI Activity or Use for Methylene Chloride by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Duna USA Inc. 4210 FM 1405 Baytown, TX 77523	1,000-9,999	Ancillary
DuPont Pontchartrain Works 586 Hwy 44 La Place, LA 70068	10,000-99,999	Formulation Component
DuPont Sabine River Works Farm Rd 1006 Orange, TX 77630	1,000-9,999	Ancillary
E R Squibb & Sons LLC One Squibb Dr North Brunswick, NJ 08902	10,000-99,999	Chemical Processing Aid
Eagle Chemicals Inc. 2550 Bobmeyer Rd Hamilton, OH 45015	NR	NR
Eastman Chemical Co Texas Operations 300 Kodak Blvd Longview, TX 75602	1,000-9,999	Produce, Manufacture Impurity
Ebonite International Inc. 1813 W 7th St Hopkinsville, KY 42240	1,000-9,999	Ancillary
EMCO Chemical Distributors Inc. 2100 Commonwealth Ave North Chicago, IL 60064	10,000-99,999	Formulation Component, Repackaging
EMCO Chemical Distributors Inc. 8601 95th St Pleasant Prairie, WI 53158	10,000-99,999	Formulation Component, Repackaging
EMD Millipore Corp 11 Prescott Rd Jaffrey, NH 03452	10,000-99,999	Manufacture Aid
EMD Millipore Corp 2909 Highland Ave Cincinnati, OH 45212	100,000-999,999	Imported, Used Processed, Formulation Component, Repackaging
Emerald Performance Materials LLC 1550 County Rd 1450 N Henry, IL 61537	10,000-99,999	Chemical Processing Aid
Emerald Services Inc. 1825 E Alexander Ave Tacoma, WA 98421	1,000-9,999	Process Impurity
Ensign-Bickford Aerospace & Defense Co State Rt 175 PO Box 219 Graham, KY 42344	10,000-99,999	Chemical Processing Aid,
Essroc Cement Corp State Rd 25 South 3084 W Cr 225 S Logansport, IN 46947	10,000-99,999	Ancillary
Eurofins MWG Operon Inc. 2211 Seminole Dr Huntsville, AL 35805	1,000-9,999	Chemical Processing Aid
Euticals Inc 2460 W Bennett St Springfield, MO 65807	100,000-999,999	Chemical Processing Aid
Evonik Corp Tippecanoe Laboratories 1650 Lilly Rd Lafayette, IN 47909	10,000-99,999	Formulation Component, Chemical Processing Aid, Manufacture Aid, Ancillary

Table A - 1: Detailed 2015 TRI Activity or Use for Methylene Chloride by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Fenwal International Inc. Rd 122 Km 0.5 San German, PR 683	10,000-99,999	Manufacture Aid
Fisher Scientific Co LLC 1 Reagent Ln Fair Lawn, NJ 07410	10,000-99,999	Formulation Component, Repackaging
Fisher Scientific Co LLC 755 Rt 202 Bridgewater, NJ 08807	1,000,000-9,999,999	Repackaging
Foley Cellulose LLC 1 Buckeye Dr Perry, FL 32348	1,000-9,999	Ancillary
Four Star Chemical 3137 E. 26th St Vernon, CA 90058	NR	NR
G & M Manufacturing Corp 111 S Main St Crystal Lake, IL 60014	1,000-9,999	Ancillary
GBC Metals LLC Somers Thin Strip 215 Piedmont St Waterbury, CT 06706	10,000-99,999	Ancillary
General Dynamics Ordnance & Tactical Systems Inc. I Area 6658 Rt 148 Marion, IL 62959	1,000-9,999	Article Component
General Plastics Manufacturing Co 4910 Burlington Way Tacoma, WA 98409	1,000-9,999	Ancillary
Great Lakes Chemical - Central 2226 Haynesville Hwy El Dorado, AR 71730	10,000-99,999	Reactant, Formulation Component
GTA-NHT Inc. 19 Smiley Ingram Rd Cartersville, GA 30121	10,000-99,999	Formulation Component
Hampford Research Inc. 54 Veterans Blvd Stratford, CT 06615	10,000-99,999	Chemical Processing Aid
Harris Paints Corp 25 C Street Minillas Industrial Park Bayamon Pr Bayamon, PR 959	NR	NR
Helmitin Inc. 11110 Airport Rd Olive Branch, MS 38654	10,000-99,999	Repackaging
Henkel Corp 825 Cedar Springs Rd Salisbury, NC 28147	10,000-99,999	Chemical Processing Aid
Heraeus Precious Metals NA Daychem LLC 970 Ind Us Trial Park Dr Vandalia, OH 45377	1,000-9,999	Chemical Processing Aid
Heritage Thermal Services 1250 St George St East Liverpool, OH 43920	10,000-99,999	Ancillary
Hexcel Corp 5400 S 6800 W West Valley City, UT 84119	10,000-99,999	Ancillary

Table A - 1: Detailed 2015 TRI Activity or Use for Methylene Chloride by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Holcim (US) Inc. Holly Hill Plant 2173 Gardner Blvd Holly Hill, SC 29059	1,000-9,999	Ancillary
Honeywell Burdick & Jackson 1953 S Harvey St Muskegon, MI 49442	100,000-999,999	Formulation Component, Repackaging, Ancillary
Hospira Boulder Inc. - A Pfizer Co 4884 Sterling Dr Boulder, CO 80301	100-999	Chemical Processing Aid, Ancillary
Hubbard-Hall Inc. 589 S Leonard St Waterbury, CT 06708	10,000-99,999	Repackaging
IDEX Health & Science LLC 110 Halcyon Dr Bristol, CT 06010	1,000-9,999	Ancillary
IDQ Operating Inc. 2901 Kingsley Rd Garland, TX 75041	10,000-99,999	Formulation Component
Illumina 5200 Illumina Way San Diego, CA 92122	100,000-999,999	Chemical Processing Aid
Indianhead Plating Inc. 1610 Palmer St Chippewa Falls, WI 54729	10,000-99,999	Ancillary
Industrial Chemicals Corp 4711 W 58th Ave Arvada, CO 80002	NR	NR
Interstate Chemical Co Inc. 2797 Freedland Rd Hermitage, PA 16148	10,000-99,999	Formulation Component, Repackaging
IPS Corp 17109 S Main St Gardena, CA 90248	10,000-99,999	Formulation Component
ITW Polymers Sealants NA 56 Air Station Industrial Park Rockland, MA 02370	100,000-999,999	Formulation Component
Johnson Matthey 2001 Nolte Dr West Deptford, NJ 08066	10,000-99,999	Process Impurity, Chemical Processing Aid
Johnson Matthey Inc. 900 Schuylkill River Rd Conshohocken, PA 19428	100,000-999,999	Chemical Processing Aid
Johnson Matthey Pharma Services 25 Patton Rd Devens, MA 01434	10,000-99,999	Chemical Processing Aid
Johnson Matthey Pharma Services 70 Flagship Dr North Andover, MA 01845	10,000-99,999	Chemical Processing Aid
Kemper System America Inc. 1200 N America Dr West Seneca, NY 14224	100,000-999,999	Imported, Used Processed, Repackaging
Keystone Cement Co Rt 329 Bath, PA 18014	1,000-9,999	Ancillary

Table A - 1: Detailed 2015 TRI Activity or Use for Methylene Chloride by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
King Systems Corp 15011 Herriman Blvd Noblesville, IN 46060	1,000-9,999	Manufacture Aid
Kitchenman Terminal Co 180 Canal Rd Fairless Hills, PA 19030	10,000-99,999	Repackaging
KKSP Precision Machining LLC 10790 Green Bay Rd Pleasant Prairie, WI 53158	10,000-99,999	Ancillary
KKSP Precision Machining 650 Hathaway St East China, MI 48054	10,000-99,999	Ancillary
K-SOLV LP 1007 Lakeside Dr Channelview, TX 77530	NR	NR
LaFarge NA (Including Systech Env Corp) 11435 County Rd 176 Paulding, OH 45879	10,000-99,999	Process Impurity, Ancillary
Lanco Manufacturing Corp Urb Aponte # 5 San Lorenzo, PR 754	10,000-99,999	Formulation Component
Lear Corp 1110 Woodmere Ave Traverse City, MI 49686	1,000-9,999	Ancillary
Lone Star Specialties LLC 6412 Us Hwy 259 S Lone Star, TX 75668	NR	NR
Lord Corp 601 South St Saegertown, PA 16433	10,000-99,999	Formulation Component, Chemical Processing Aid
Mallinckrodt LLC 3600 N 2nd St Saint Louis, MO 63147	100,000-999,999	Chemical Processing Aid
McGean-Rohco Inc. 38521 Schoolcraft Ave Livonia, MI 48150	10,000-99,999	Formulation Component
McLaughlin Gormley King 4001 Peavey Rd Chaska, MN 55318	10,000-99,999	Ancillary
Montana Silversmiths 1 Sterling Ln Columbus, MT 59019	100-999	Manufacture Aid
NCH Corp Mohawk Labs Div 7401 E 33rd St Indianapolis, IN 46226	NR	NR
NCH Corp Mohawk Labs Div 2730 Carl Rd Irving, TX 75062	10,000-99,999	Formulation Component, Repackaging
Nektar Therapeutics 1112 Church St Huntsville, AL 35801	1,000-9,999	Chemical Processing Aid
Nexeo Solutions LLC 8500 S Willow Springs Rd Willow Springs, IL 60480	100,000-999,999	Repackaging

Table A - 1: Detailed 2015 TRI Activity or Use for Methylene Chloride by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Nexeo Solutions LLC 2011 Turner St Lansing, MI 48906	10,000-99,999	Repackaging
Nexeo Solutions LLC 3930 Glenwood Dr Charlotte, NC 28208	1,000-9,999	Repackaging
Nexeo Solutions LLC 3930 Glenwood Dr Charlotte, NC 28208	1,000-9,999	Repackaging
Nexeo Solutions LLC - Doraville 4550 Ne Expressway Doraville, GA 30340	100,000-999,999	Repackaging
Nitto Denko Avecia 8560 Reading Rd Cincinnati, OH 45215	1,000-9,999	Chemical Processing Aid, Manufacture Aid
Noramco Inc 500 Swedes Landing Rd Wilmington, DE 19801	10,000-99,999	Chemical Processing Aid
Norlite LLC 628 S Saratoga St Cohoes, NY 12047	100,000-999,999	Ancillary
Nov Fiber Glass Systems - Burkburnett 1004 Ameron Rd Burkburnett, TX 76354	10,000-99,999	Formulation Component, Ancillary
Occidental Chemical Corp 6200 S Ridge Rd Wichita, KS 67215	1,000,000-9,999,999	Produce, Sale Distribution
Occidental Chemical Holding Corp - Geismar Plant 8318 Ashland Rd Geismar, LA 70734	50,000,000-99,999,999	Produce, Sale Distribution
Oldcastle Precast Inc. 801 S Pine St Madera, CA 93637	1,000-9,999	Formulation Component
Olin Blue Cube Freeport TX 2301 N Brazosport Blvd. Freeport, TX 77541	10,000,000-49,999,999	Produce, Imported, Used Processed, Sale Distribution, Byproduct, Manufacture Impurity, Chemical Processing Aid, Ancillary
Oxy Vinyls LP Deer Park - VCM Plant 5900 Hwy 225 Gate 8a Deer Park, TX 77536	100-999	Produce, Byproduct
Pacira Pharmaceuticals Inc. 10450 Science Center Dr San Diego, CA 92121	1,000-9,999	Manufacture Aid
Packaging Services Co Inc. (Pearland Facility) 1904 Mykawa Rd Pearland, TX 77581	100,000-999,999	Produce, Sale Distribution, Formulation Component, Repackaging
Patheon 101 Technology Pl Florence, SC 29501	10,000-99,999	Chemical Processing Aid, Ancillary
Patheon API Manufacturing Inc. 309 Delaware St Greenville, SC 29605	10,000-99,999	Chemical Processing Aid, Ancillary
Patheon Puerto Rico Inc. State Rd 670 Km 2.7 Manati, PR 674	100,000-999,999	Manufacture Aid, Ancillary

Table A - 1: Detailed 2015 TRI Activity or Use for Methylene Chloride by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
PCI Synthesis 9 Opportunity Way Newburyport, MA 01950	10,000-99,999	Chemical Processing Aid, Manufacture Aid, Ancillary
Penn Fishing Tackle Manufacturing Co 3028 W Hunting Park Ave Philadelphia, PA 19132	100-999	Ancillary
Pfizer Pharmaceuticals LLC Hwy #2 Km 58.2 Barceloneta, PR 617	100,000-999,999	Reactant, Chemical Processing Aid
Pharmacia & Upjohn Co LLC A Subsidiary Of Pfizer Inc 7171 Portage Rd Kalamazoo, MI 49001	1,000,000-9,999,999	Produce, Imported, Used Processed, Byproduct, Repackaging, Chemical Processing Aid, Manufacture Aid, Ancillary
Pharmco Products 58 Vale Rd Brookfield, CT 06804	10,000-99,999	Repackaging
Phoenix Chemical Co 202 Gee Rd Calhoun, GA 30701	NR	NR
Plaze Inc. 1000 Integram Dr Pacific, MO 63069	1,000-9,999	Formulation Component
Plaze Inc. 105 Bolte Ln Saint Clair, MO 63077	1,000-9,999	Formulation Component
Plaze Inc. 113 Bolte Ln Saint Clair, MO 63077	1,000-9,999	Formulation Component
Polypeptide Laboratories Inc. 365 Maple Ave Torrance, CA 90503	10,000-99,999	Chemical Processing Aid
Polypeptide Laboratories San Diego 9395 Cabot Dr San Diego, CA 92126	1,000-9,999	Chemical Processing Aid
Precision Tube Co LLC 287 Wissahickon Ave North Wales, PA 19454	10,000-99,999	Manufacture Aid
Pregis Innovative Packaging Inc. 300 Harris Rd Wurtland, KY 41144	10,000-99,999	Chemical Processing Aid
Pride Solvent & Chemical Co of NY Inc. 6 Long Island Ave Holtsville, NY 11742	10,000-99,999	Repackaging
Pride Solvents & Chemical Co of New Jersey 211 Randolph Ave Avenel, NJ 07001	NR	NR
Promega Biosciences LLC 277 Granada Dr San Luis Obispo, CA 93401	1,000-9,999	Chemical Processing Aid
Quadrant Chemical Corp 200 Industrial Blvd McKinney, TX 75069	100,000-999,999	Formulation Component
Quaker City Chemicals 7360 Milnor St Philadelphia, PA 19136	NR	NR

Table A - 1: Detailed 2015 TRI Activity or Use for Methylene Chloride by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
QuestSpecialty Corp 2001 E Tom Green St Brenham, TX 77833	10,000-99,999	Formulation Component, Ancillary
QuestVapco Corp 401 Marshall Rd Valley Park, MO 63088-1898	10,000-99,999	Formulation Component, Ancillary
Radiator Specialty Co 600 Radiator Rd Indian Trail, NC 28079	100,000-999,999	Formulation Component, Repackaging
Ramcel Engineering Co 2926 Macarthur Blvd Northbrook, IL 60062	10,000-99,999	Ancillary
Regis Technologies Inc. 8210 N Austin Ave Morton Grove, IL 60053	10,000-99,999	Chemical Processing Aid
Rhodes Technologies 498 Washington St Coventry, RI 02816	10,000-99,999	Chemical Processing Aid
Roche Carolina Inc. 6173 E Old Marion Hwy Building 806 Florence, SC 29506	100,000-999,999	Chemical Processing Aid, Ancillary
Roche Molecular Systems Inc. 1080 US Hwy 202 S Branchburg, NJ 08876	1,000-9,999	Chemical Processing Aid
Rochester Precision Optics LLC 850 John St West Henrietta, NY 14586	100-999	Manufacture Aid
Ross Incineration Services Inc. 36790 Giles Rd Grafton, OH 44044	10,000-99,999	Ancillary
Rubicon LLC 9156 Highway 75 Geismar, LA 70734	1,000-9,999	Produce, Manufacture Impurity
Rustoleum Corp 7850 Ohio River Rd Lesage, WV 25537	10,000-99,999	Formulation Component
Sabic Innovative Plastics Mt Vernon LLC 1 Lexan Ln Mount Vernon, IN 47620	1,000,000-9,999,999	Produce, Byproduct, Formulation Component, Chemical Processing Aid, Ancillary
Sabic Innovative Plastics US LLC One Plastics Dr Burkville, AL 36752	1,000,000-9,999,999	Formulation Component, Chemical Processing Aid
SAFC Inc 1101 Kettle Moraine Trail Verona, WI 53593	10,000-99,999	Chemical Processing Aid, Manufacture Aid, Ancillary
Safc Inc. 645 Science Dr. Madison, WI 53711	1,000-9,999	Chemical Processing Aid, Manufacture Aid, Ancillary
Safety Coatings Inc. 20180 Safety Ln Foley, AL 36535	1,000-9,999	Formulation Component
Sartorius Stedim Filters Inc. Pr # 128 Int Pr # 372 Barriada Lluveras Yauco, PR 698	100,000-999,999	Formulation Component, Chemical Processing Aid

Table A - 1: Detailed 2015 TRI Activity or Use for Methylene Chloride by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Savogran Co 259 Lenox St Norwood, MA 02062	10,000-99,999	Article Component
Shield Packaging Co Inc. 50 Oxford Ave Dudley, MA 01571	10,000-99,999	Formulation Component, Ancillary
SI Group Inc. 725 Cannon Bridge Rd Orangeburg, SC 29115	100,000-999,999	Reactant
Siegfried USA LLC 33 Industrial Park Rd Pennsville, NJ 08070	10,000-99,999	Chemical Processing Aid
Sigma Life Sciences 9186 Six Pines Suite 100 The Woodlands, TX 77380	10,000-99,999	Chemical Processing Aid
Sigma-Aldrich Manufacturing LLC 3300 S Second St Saint Louis, MO 63118	10,000-99,999	Formulation Component, Repackaging, Chemical Processing Aid
Sigma-Tau Pharmasource Inc. 6925 Guion Rd Indianapolis, IN 46268	100,000-999,999	Chemical Processing Aid
Slocum Adhesives Corp 1409 Buchanan St Lynchburg, VA 24501	100,000-999,999	Formulation Component
Sunnyside Corp 225 Carpenter Ave Wheeling, IL 60090	100,000,000-499,999,999	Formulation Component, Repackaging
Superior Fiberglass & Resins 1030 All Pro Dr Elkhart, IN 46514	NR	NR
Superior Oil Co Inc. 400 W Regent St Indianapolis, IN 46225	100,000-999,999	Formulation Component, Repackaging
Superior Solvents & Chemicals 3023 Arnold Tenbrook Rd Arnold, MO 63010	100,000-999,999	Formulation Component, Repackaging
Superior Solvents & Chemicals 320 Northpointe Dr Fairfield, OH 45014	NR	NR
Superior Solvents & Chemicals 518 Swinging Bridge Rd Old Hickory, TN 37138	100,000-999,999	Formulation Component, Repackaging
Supreme Lake Manufacturing Inc. 455 Atwater St Plantsville, CT 06479	1,000-9,999	Ancillary
Systech Environmental Corp 1420 S Cement Plant Rd Fredonia, KS 66736	1,000-9,999	Process Impurity, Ancillary
Teva Pharmaceuticals USA 5000 Snyder Dr Mexico, MO 65265	100,000-999,999	Chemical Processing Aid
The Dow Chemical Co 1790 Building Midland, MI 48667	100,000-999,999	Reactant, Process Impurity, Chemical Processing Aid, Manufacture Aid, Ancillary

Table A - 1: Detailed 2015 TRI Activity or Use for Methylene Chloride by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
The Dow Chemical Co - Louisiana Operations 21255 LA Hwy 1 S Plaquemine, LA 70764	10,000-99,999	Produce, Sale Distribution, Byproduct, Reactant, Formulation Component, Process Impurity, Chemical Processing Aid, Manufacture Aid, Ancillary
The Dow Chemical Co Grand Bayou Operations Louisiana Hwy 70 Paincourtville, LA 70391	0-99	Process Impurity, Ancillary
Thermo Fisher Scientific Milwaukee LLC 2202 N Bartlett Ave Milwaukee, WI 53202	10,000-99,999	Chemical Processing Aid, Manufacture Aid,
Tiarco Chemical 315 Echelon Rd Greenville, SC 29605	10,000-99,999	Reactant
Tier Environmental LLC 7013 Krick Rd Bedford, OH 44146	100,000-999,999	Repackaging
TM Deer Park Services LP 2525 Battleground Rd Deer Park, TX 77536	0-99	Ancillary
Total Petrochemicals & Refining USA Inc. 1818 Independence Pkwy S La Porte, TX 77571	100-999	Ancillary
Tradebe Treatment & Recycling LLC 4343 Kennedy Ave East Chicago, IN 46312	10,000-99,999	Produce, Imported, Manufacture Impurity, Repackaging, Process Impurity, Ancillary
Trelleborg Offshore US Inc. 13827 W Hardy Rd Houston, TX 77060	10,000-99,999	Formulation Component, Chemical Processing Aid
U.S. Naval Air Station North Island Mc Cain Blvd San Diego, CA 92135	10,000-99,999	Ancillary
United Gilsonite Laboratories 1396 Jefferson Ave Dunmore, PA 18509	10,000-99,999	Formulation Component
Unither Manufacturing LLC 755 Jefferson Rd Rochester, NY 14623	10,000-99,999	Manufacture Aid
Univar USA Inc. 7050 W 71st St Bedford Park, IL 60638	100,000-999,999	Repackaging
Univar USA Inc. 8500 W 68 th St Bedford Park, IL 60501	NR	NR
Univar USA Inc. - San Jose 2256 Junction Ave San Jose, CA 95131	1,000,000-9,999,999	Formulation Component, Repackaging, Ancillary
Univar USA Spartanburg Facility 2750 Southport Rd Spartanburg, SC 29302	100,000-999,999	Repackaging
UPM Pharmaceuticals Inc. 501 5th St Bristol, TN 37620	1,000-9,999	Manufacture Aid
US DOD USAF Hill AFB 6044 Dogwood Ave Hill AFB, UT 84056	100,000-999,999	Produce, Byproduct, Ancillary

Table A - 1: Detailed 2015 TRI Activity or Use for Methylene Chloride by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
US DOD USAF Robins AFB 775 Macon St Building 1555 Robins AFB, GA 31098	10,000-99,999	Ancillary
Vandemark Chemical Inc. 1 N Transit Rd Lockport, NY 14094	10,000-99,999	Reactant, Chemical Processing Aid, Ancillary
Vanderbilt Chemicals LLC-Murray Div 396 Pella Way Murray, KY 42071	100,000-999,999	Reactant
Veolia ES Technical Solutions LLC 1704 W 1st St Azusa, CA 91702	100,000-999,999	Repackaging
Veolia ES Technical Solutions LLC 9131 E 96th Ave Henderson, CO 80640	100,000-999,999	Repackaging
Veolia ES Technical Solutions LLC 7 Mobile Ave Sauget, IL 62201	10,000-99,999	Ancillary
Veolia ES Technical Solutions LLC 125 Factory Ln Middlesex, NJ 08846	100,000-999,999	Formulation Component, Repackaging, Ancillary
Veolia ES Technical Solutions LLC 4301 Infirmiry Rd West Carrollton, OH 45449	1,000,000-9,999,999	Ancillary
Veolia ES Technical Solutions LLC Port Arthur Facility Hwy 73 3.5 Miles W of Taylor Bayou Port Arthur, TX 77640	10,000-99,999	Ancillary
Vertrauen Chemie Solutions Inc. 2170 Buoy Street Memphis, TN 38113	100,000-999,999	Formulation Component, Ancillary
Volunteer Adhesive Corp 570 Industrial Dr Lafayette, TN 37083	10,000-99,999	Formulation Component
Webb Chemical Service Corp 2708 Jarman Muskegon Heights, MI 49444	100,000-999,999	Imported, Used Processed, Sale Distribution, Repackaging
Western Bonded Products Inc. Flex Foam 617 N 21st Avenue Phoenix, AZ 85009	10,000-99,999	Formulation Component
Westlake Vinyls Co 36045 Hwy 30 Geismar, LA 70734	100-999	Produce, Sale Distribution, Byproduct, Manufacture Impurity
Westlake Vinyls Inc. 2468 Ind US Trial Pkwy Calvert City, KY 42029	1,000-9,999	Produce, Used Processed, Reactant,
Wylchem US Inc. 2114 Larry Jeffers Rd Elgin, SC 29045	0-99	Ancillary
WM Barr & Co Inc. 2105 Channel Ave Memphis, TN 38109	1,000,000-9,999,999	Formulation Component, Ancillary
WM Steinen Manufacturing Co 29 E Halsey Rd Parsippany, NJ 07054	1,000-9,999	Ancillary

Table A - 1: Detailed 2015 TRI Activity or Use for Methylene Chloride by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
WRR Environmental Services Co Inc. 5200 Ryder Rd Eau Claire, WI 54701	10,000-99,999	Formulation Component, Ancillary
Wyeth 64 Maple St Rouses Point, NY 12979	10,000-99,999	Chemical Processing Aid
Xerox Corp 800 Phillips Rd Webster, NY 14580	100,000-999,999	Chemical Processing Aid

Source: EPA (2015b)

Note: NR = Not Reported



Use and Market Profile for N- methylpyrrolidone (NMP)

Contract # EP-W-16-009
WA #2-01

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Prepared for:
Economic and Policy Analysis Branch
Chemistry, Economics, and
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Office of Chemical Safety and
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U.S. Environmental Protection Agency
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Table of Contents

1.	Introduction	1
1.1	Overview of NMP	1
2.	Chemical Databases: CDR and TRI	2
2.1	Chemical Data Reporting.....	2
2.1.1	CDR Information – Major Manufacturers and/or Importers.....	2
2.1.2	CDR Information – Industrial Processing and Use Information.....	4
2.1.3	CDR Information – Consumer and Commercial Use Information	8
2.1.4	Historical U.S. Production Volume.....	10
2.2	Toxics Release Inventory.....	11
2.2.1	Total Number of NMP Facilities Reporting to TRI	11
3.	Use Information and Market Trends.....	13
3.1	Uses of NMP.....	13
3.2	Products.....	17
3.3	NMP Market Trends	40
	References.....	42

List of Tables

Table 1-1: Chemical Name, Synonyms, and CASRN for NMP	1
Table 2-1: NMP Manufacturers and Importers	2
Table 2-2: NMP Industrial Use Information	5
Table 2-3: NMP Consumer and Commercial Use Information	9
Table 2-4: National Production Volume Data for NMP from 1986-2012 (lbs.)	10
Table 2-5: Summary of 2015 Activity or Use by Number of Facilities for NMP	11
Table 2-6: TRI Activity and Use Definitions	12
Table 3-1 Known Applications of NMP	14
Table 3-2: Sample of Products that Contain NMP	18
Table 3-3: U.S. Supply/Demand for 1-Methylpyrrolidone (thousands of metric tons)	Error! Bookmark not defined.

Contributors

The EPA subject matter expert responsible for this report is Judith Brown of the Economic and Policy Analysis Branch; Chemistry, Economics, and Sustainable Strategies Division; Office of Pollution Prevention and Toxics. Analytical and draft preparation support was provided by Alice Tome, and other employees of Abt Associates, Inc. under EPA Contract No. EP-W-16-009.

1. Introduction

N-methylpyrrolidone (NMP) is the subject of this use and market profile. Under the Toxic Substance Control Act (TSCA), EPA recently proposed a Section 6 rulemaking for the use of NMP in paint and coating removal by industrial users, commercial outdoor users, commercial users in residences, and consumer users. This report details historic and current uses of NMP.

Section 1 provides an overview of NMP, Section 2 details U.S. producers, production, and import volumes, and Section 3 presents use information and market trends.

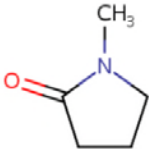
1.1 Overview of NMP

NMP is a basic compound with a mild amine odor (WHO, 2001). NMP is used in many applications, including paint and coating removal, petrochemical processing, engineering plastic coatings, agricultural chemicals, electronic cleaning, and industrial/domestic cleaning (EPA, 2015a). NMP is also used in the manufacture of some pigments, cosmetics, drugs, insecticides, herbicides, and fungicides (WHO, 2001).

Acute exposure to NMP can result in skin and eye irritation, while prolonged or repeated skin contact is associated with dermatitis. NMP may have toxic effects on human reproduction; additionally, inhalation and dermal exposure may result in both developmental and male reproductive toxicity. Rats exposed to NMP in inhalation and dermal studies experienced increased preimplantation losses and other adverse reproductive effects. NMP is not considered a carcinogen and has only weak mutagenic potential (WHO, 2001).

Humans are primarily exposed to NMP through paint and coating removal products. In 2015, EPA conducted a risk assessment to evaluate health risks to consumers and workers exposed to NMP from these products. Pregnant women and women of childbearing age were identified as particularly sensitive subpopulations (EPA, 2015a).

Table 1-1: Chemical Name, Synonyms, and CASRN for NMP

Chemical Name	NMP
CASRN	872-50-4
Synonyms	NMP; 1-Methyl-2-pyrrolidone; 1-Methyl-5-pyrrolidinone; 1-Methylazacyclopentan-2-one; 1-Methylpyrrolidinone; 1-Methylpyrrolidone 2-Pyrrolidinone, 1-methyl-; AI3-23116; CCRIS 1633; EC 212-828-1; EINECS 212-828-1; HSDB 5022; M-Pyrol; Methylpyrrolidone; N-Methyl-2-pyrrolidinone; N-Methyl-2-pyrrolidone; N-Methyl-gamma-butyrolactam; N-Methylpyrrolidinone; N-Methylpyrrolidone; NMP; NSC 4594; UNII-JR9CE63FPM
Trade Name(s)*	Agsorex 1
Molecular Formula	C ₅ H ₉ NO
Structure	

*Not a complete list

Sources: NLM (2016); NCBI (n.d.)

2. Chemical Databases: CDR and TRI

2.1 Chemical Data Reporting

The Chemical Data Reporting (CDR) Rule under TSCA requires U.S. manufacturers and importers to provide EPA with information on the chemicals they manufacture or import into the United States. For the 2012 CDR cycle, data collected per chemical include the company name, volume of each chemical manufactured/imported, the number of workers at each site, and information on whether the chemical is used in the commercial, industrial, and/or consumer sector. However, only companies that manufactured or imported 25,000 pounds or more at each of their sites during the 2011 calendar year were required to report information under the CDR rule (EPA, 2014).

2.1.1 CDR Information – Major Manufacturers and/or Importers

The 2012 non-confidential CDR includes twenty U.S. manufacturers and importers of NMP (see Table 2-1). Three companies claimed CBI. Of the non-CBI companies, eleven are importers, four are manufacturers, one company both manufactures and imports, and the last company claims both manufacture and import status as confidential. The 2012 national production volume of NMP is 184,703,045 pounds per year (EPA, 2014).

Table 2-1: NMP Manufacturers and Importers

Company	Site State	NAICS Code	Manufacture (lb/yr)	Import (lb/yr)	Never at Site?	Volume (used at site; lb/yr)	Concentration	Number of Workers
Altana	CT	325998	0	CBI	NO	0	60% - < 90%	<10
	MO	325998	0	176,370	NO	176,370	90% +	50-99
Ashland Inc.	TX	325998	CBI	0	NR	CBI	90% +	100-499
BASF Corp	LA	325199	CBI	0	NR	CBI	90% +	100-499
	NJ	325199	0	CBI	YES	CBI	1% - < 30%	<10
Bayer Group	PA	325211	0	CBI	YES	N/A	CBI	<10
Cytec Industries, Inc.	NJ	325211	0	37,873	YES	N/A	1% - < 30%	<10
DSM	MA	325311	0	39,862	NO	0	90% +	10-24
Henkel Corp	NC	325613	0	36,209	NO	0	90% +	25-49
Itochu International Inc.	NY	424310	0	44,313	YES	N/A	90% +	<10
Johnson Controls Advanced Power Solutions	MI	335911	0	314,808	NO	314,808	90% +	100-499
Lyondell Chemical Company	TX	325199	CBI	CBI	CBI	CBI	CBI	CBI
Nova Molecular Technologies Inc.	TX	325212	CBI	0	NR	0	90% +	<10
OM Group Inc.	MN	551112	114,048	0	NR	114,048	60% - < 90%	10-24
Stahl USA	MA	325520	0	44,571	YES	N/A	90% +	<10
Superior Essex Inc.	IN	335921	0	32,303	NO	16,598	60% - < 90%	10-24

Table 2-1: NMP Manufacturers and Importers

Company	Site State	NAICS Code	Manufacture (lb/yr)	Import (lb/yr)	Never at Site?	Volume (used at site; lb/yr)	Concentration	Number of Workers
Taminco Global Chemical Corp	PA	325199	0	CBI	YES	N/A	90% +	25-49
Toray Holding (USA) Inc.	WA	325211	587,000	0	NR	587,000	90% +	100-499
Vinmar Overseas Ltd.	TX	424690	0	1 ^a	NO	1 ^a	90% +	<10
CBI	CBI	CBI	CBI	CBI	CBI	CBI	90% +	<10
CBI	CBI	CBI	0	116,402	NO	116,402	60% - < 90%	<10
CBI	CBI	CBI	CBI	CBI	CBI	CBI	CBI	CBI

Source: Dunn & Bradstreet (2015); EPA (2014)

Notes: CBI = Confidential Business Information

N/A= Not Applicable

NKRA= Not Known or Reasonably Ascertainable

NR= Not Reported

a. The Vinmar Overseas Ltd. import volume appears to be misreported. It is presented here as it appears in the database.

2.1.2 CDR Information – Industrial Processing and Use Information

Table 2-2 presents the industrial processing and use information for U.S. manufactures and importers of NMP according to the 2012 CDR. NMP has a wide variety of uses in various industrial sectors. NMP has applications as a solvent, a paint additive, a plating agent, an adhesive and sealant chemical, and for other processing uses. NMP is used in a variety of industry sectors including paint and coating manufacturing, transportation equipment manufacturing, agricultural chemical manufacturing, computer and electrical equipment manufacturing, pharmaceutical manufacturing, and other chemical manufacturing sectors (EPA, 2014).

Table 2-2: NMP Industrial Use Information

Manufacturing/ Importing Company	Site Name and Address	NAICS code	Type of Process	Industrial Sector	Industrial Function Category	Percent of Production Volume	Number of Sites	Number of Workers
Altana	BYK - Chemie USA 524 South Cherry St Wallingford, CT 06492- 4455	325998	Processing- incorporation into formulation, mixture, or reaction product	Adhesives Manufacturing	Adhesives and sealant chemicals	11	10 - 24	NKRA
Altana	Elantas PDG Inc. 5200 N. Second St Saint Louis, MO 63147- 3122	325998	Processing- incorporation into article	Computer and Electronic Product Manufacturing	Other (specify)	100	< 10	100 - 499
Ashland Inc.	ISP Technologies Inc. 4501 Attwater Ave Texas City, TX 77590	325998	Processing- incorporation into formulation, mixture, or reaction product	All Other Chemical Product and Preparation Manufacturing	Solvents (which become part of product formulation or mixture)	5	25 - 99	NKRA
BASF Corp	BASF Corp 8404 River Rd Highway 75 Geismar, LA 70734	325199	Use-non- incorporative activities	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	Processing aids, not otherwise listed	CBI	10 - 24	100 - 499
BASF Corp	BASF Corp 100 Campus Dr Florham Park, NJ 07932- 1089	325199	Processing- incorporation into article	Transportation Equipment Manufacturing	Paint additives and coating additives not described by other categories	CBI	< 10	50 - 99
Bayer Group	Bayer Material Science 100 Bayer Rd Pittsburgh, PA 15205-9741	325211	NR	NR	NR	NR	NR	NR
Cytec Industries Inc.	Cytec Industries Inc. 5 Garret Mountain Plaza West Paterson, NJ 07424	325211	NR	NR	NR	NR	NR	NR
DSM	DSM Neoresins 730 Main Street Wilmington, MA 01887- 3366	325311	NR	NR	NR	NR	NR	NR

Table 2-2: NMP Industrial Use Information

Manufacturing/ Importing Company	Site Name and Address	NAICS code	Type of Process	Industrial Sector	Industrial Function Category	Percent of Production Volume	Number of Sites	Number of Workers
Henkel Corp	Henkel Corp 485 Cedar Springs Rd Salisbury, NC 28147	325613	NR	NR	NR	NR	NR	NR
Itochu International Inc.	Itochu Chemicals America Inc. (Head Office) 360 Hamilton Avenue, 6th Floor White Plains, New York, NY 10601-1811	424310	NR	NR	NR	NR	NR	NR
Johnson Controls Advanced Power Solutions	Johnson Controls APS Production, Inc. 70 West 48th St Holland, MI 49423	35911	Processing- incorporation into article	Electrical Equipment, Appliance, and Component Manufacturing	Solvents (which become part of product formulation or mixture)	100	< 10	100 - 499
Lyondell Chemical Company	Lyondell Channelview Facility Lyondell Chemical Company Channelview, TX 77530- 2681	325199	Processing- incorporation into formulation, mixture, or reaction product	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	Solvents (which become part of product formulation or mixture)	1	< 10	100 - 499
Nova Molecular Technologies Inc.	Nova Molecular Technologies Inc. 10200 Bay Area Boulevard Pasadena, TX 77507-1852	325212	Processing- incorporation into formulation, mixture, or reaction product	All Other Chemical Product and Preparation Manufacturing	Solvents (for cleaning or degreasing)	100	< 10	25 - 49
OM Group Inc.	OMG Electronic Chemicals Inc. 5630 Pioneer Creek Dr. Maple Plain, MN 553599002	551112	Processing- incorporation into formulation, mixture, or reaction product	All Other Chemical Product and Preparation Manufacturing	Plating agents and surface treating agents	100	< 10	10 - 24
Stahl USA	Permuthane - Div of Stahl USA 13 Corwin St. Peabody, MA 01960	325520	NR	NR	NR	NR	NR	NR

Table 2-2: NMP Industrial Use Information

Manufacturing/ Importing Company	Site Name and Address	NAICS code	Type of Process	Industrial Sector	Industrial Function Category	Percent of Production Volume	Number of Sites	Number of Workers
Superior Essex Inc.	Essex Group, Inc. 1601 Wall Street Divisional Office Fort Wayne, IN 46802	335921	NR	NR	NR	NR	NR	NR
Taminco Global Chemical Corp	Taminco Inc. 7540 Windsor Dr Allentown, PA 18106	325199	Processing as a reactant	Pharmaceutical and Medicine Manufacturing	Other (specify)	90	< 10	10 - 24
Toray Holding (USA) Inc.	Toray Composites America 19002 50th Avenue East Tacoma, WA 98446-3752	325211	Use-non- incorporative activities	Transportation Equipment Manufacturing	Solvents (for cleaning or degreasing)	100	< 10	100 - 499
Vinmar Overseas Ltd.	Vinmar International, Ltd. 16800 Imperial Valley Drive Houston, TX 77060-3159	424690	NR	NR	NR	NR	NR	NR
CBI	CBI	CBI	NKRA	NKRA	NKRA	100	NKRA	NKRA
CBI	CBI	CBI	Processing- incorporation into formulation, mixture, or reaction product	Paint and Coating Manufacturing	Paint additives and coating additives not described by other categories	100	< 10	< 10
CBI	CBI	CBI	NR	NR	NR	NR	NR	NR

Sources: Dunn & Bradstreet (2015); EPA (2014)

Notes: CBI = Confidential Business Information

N/A= Not Applicable

NKRA= Not Known or Reasonably Ascertainable

NR= Not Reported

2.1.3 CDR Information – Consumer and Commercial Use Information

Table 2-3 presents the 2012 CDR records of consumer and commercial uses of NMP. Most information is not reported, claimed as confidential business information, or denoted as “not known or reasonably ascertainable.” The 2012 CDR indicates that NMP is used in various consumer and commercial products including: adhesives and sealants, batteries, electrical and electronic products, paints and coatings, fabric, textile, leather, and metal products. No CDR records indicate that NMP is used in products intended for use by children (EPA, 2014).

Table 2-3: NMP Consumer and Commercial Use Information

Manufacturing /Importing Company	Site State	Commercial/ Consumer Use	Used in Children Products	Product Category	Percent of Production Volume	Concentration	Number of Workers
Altana	CT	Commercial	No	Paints and Coatings	5	< 1%	NKRA
	CT	Consumer	NKRA	Paints and Coatings	0	< 1%	NKRA
	MO	Commercial	No	Metal Products not covered elsewhere	7	60% - < 90%	25 - 49
	MO	Commercial	No	Electrical and Electronic Products	90	30% - < 60%	100 - 499
	MO	Commercial	No	Adhesives and Sealants	3	60% - < 90%	10 - 24
Ashland Inc.	TX	NR	NR	NR	NR	NR	NR
BASF Corp	LA	NR	NR	NR	NR	NR	NR
	NJ	NR	NR	NR	NR	NR	NR
Bayer Group	PA	NR	NR	NR	NR	NR	NR
CBI	CBI	NKRA	NKRA	NKRA	100	NKRA	NKRA
CBI	CBI	NR	NR	NR	NR	NR	NR
CBI	CBI	NR	NR	NR	NR	NR	NR
Cytec Industries Inc.	NJ	NR	NR	NR	NR	NR	NR
DSM	MA	NR	NR	NR	NR	NR	NR
Henkel Corp	NC	NR	NR	NR	NR	NR	NR
Itochu International Inc.	NY	NR	NR	NR	NR	NR	NR
Johnson Controls Advanced Power Solutions	MI	Both	No	Batteries	100	90% +	100 - 499
Lyondell Chemical Company	TX	NKRA	NKRA	NKRA	NKRA	NKRA	NKRA
Nova Molecular Technologies Inc.	TX	NR	NR	NR	NR	NR	NR
OM Group Inc.	MN	Commercial	NKRA	Electrical and Electronic Products	100	30% - < 60%	1000 - 9999
Stahl USA	MA	NR	NR	NR	NR	NR	NR
Superior Essex Inc.	IN	NR	NR	NR	NR	NR	NR
Taminco Global Chemical Corp	PA	NR	NR	NR	NR	NR	NR

Table 2-3: NMP Consumer and Commercial Use Information							
Manufacturing /Importing Company	Site State	Commercial/ Consumer Use	Used in Children Products	Product Category	Percent of Production Volume	Concentration	Number of Workers
Toray Holding (USA) Inc.	WA	Commercial	No	Fabric, Textile, and Leather Products not covered elsewhere	100	< 1%	NKRA
Vinmar Overseas Ltd.	TX	NR	NR	NR	NR	NR	NR

Source: Dunn & Bradstreet (2015); EPA (2014)
Notes: CBI = Confidential Business Information
 N/A= Not Applicable
 NKRA= Not Known or Reasonably Ascertainable
 NR= Not Reported

2.1.4 Historical U.S. Production Volume

Table 2-4 presents historic U.S. production volume data for NMP submitted by companies under the non-confidential 1986, 1990, 1994, 1998, 2002, and 2006 Inventory Update Reporting (IUR) rule and the 2012 CDR. While the reporting threshold for manufacturing information was 25,000 pounds for the 2006 IUR and 2012 CDR, the reporting threshold for manufacturing information was 10,000 pounds from 1986 to 2002.

Table 2-4. National Production Volume Data for NMP from 1986-2012 (lbs.)						
1986	1990	1994	1998	2002	2006	2012
>10M - 50M	>50M - 100M	>50M - 100M	>100M - 500M	>100M - 500M	100M -<500M	184,703,045

Source: EPA (n.d.-a); EPA (2010); EPA (2014)
Note: M = Million; B = Billion

2.2 Toxics Release Inventory

Facilities manufacturing, processing, or otherwise using NMP are required to report releases to EPA's Toxics Release Inventory (TRI). Included in the TRI data is the maximum amount of chemical present at each facility each year and the activity or use of the chemical at each facility. Table 2-6 presents the definitions for activity and use according to EPA's TRI Program.

2.2.1 Total Number of NMP Facilities Reporting to TRI

In 2015, 391 sites reported releasing quantities of NMP at their facilities. Table 2-5 presents a summary of the reported activities and uses, aggregated from all the sites manufacturing processing and otherwise using NMP. The data presented in Table 2-5 suggest that NMP is primarily used as an ancillary chemical, a formulation component, and a chemical processing aid. Note that sixty-six facilities reported releasing quantities of NMP at their facilities in 2015 but did not report the associated activity or use (EPA, 2015b).

Appendix A presents the maximum amount of chemicals per facility and reported activities or uses for facilities reporting to TRI in 2015.

Table 2-5: Summary of 2015 Activity or Use by Number of Facilities for NMP	
Activity or Use	Number of Facilities
Ancillary	133
Formulation Component	94
Chemical Processing Aid	89
Manufacture Aid	57
Repackaging	36
Sale Distribution	10
Article Component	9
Produce	8
Process Impurity	8
Imported	7
Reactant	6
Used Processed	6
Byproduct	1
Manufacture Impurity	1
Not Reported	66

Source: EPA (2015c)

Note: Facilities may report more than one activity or use; therefore the sum of the number of facilities reporting each activity/use will be greater than the total number of facilities reporting NMP releases.

Table 2-6: TRI Activity and Use Definitions

Activity or Use	TRI Definition
<i>Ancillary</i>	Indicates that the chemical is used at the facility for purposes other than aiding chemical processing or manufacturing
<i>Article Component</i>	Indicates the toxic chemical becomes an integral part of an article distributed into commerce, such as copper in wire or resins in a plastic pen, or the pigment components of paint applied to a chair that is sold
<i>Byproduct</i>	Indicates the toxic chemical is produced coincidentally during the manufacture, process, or otherwise use of another chemical substance or mixture and, following its production, is separated from that other chemical substance or mixture. This includes toxic chemicals that may be created as the result of waste management
<i>Chemical Processing Aid</i>	Indicates the toxic chemical is used to aid in the manufacture or synthesis of another chemical substance such that it comes into contact with the product during manufacture, but is not intended to remain with or become part of the final product or mixture. Some examples of chemical processing aids are process solvents, catalysts, solution buffers, inhibitors, and reaction terminators
<i>Formulation Component</i>	Indicates the toxic chemical is used as an ingredient in a product mixture to enhance performance of the product during its use, such as dyes in ink, solvents in paint, additions, reaction diluents, initiators, inhibitors, emulsifiers, surfactants, lubricants, flame retardants, and rheological modifiers
<i>Imported</i>	Indicates that the chemical is imported by the facility into the Customs Territory of the United States
<i>Manufacture Aid</i>	Indicates the toxic chemical is used to aid in the manufacturing process but does not come into contact with the product during manufacture. Some examples, include valve lubricants, refrigerants, metalworking fluids, coolants, and hydraulic fluids
<i>Manufacture Impurity</i>	Indicates whether the facility produces the reported chemical as a result of the manufacture, processing, or otherwise use of another chemical, but does not separate the chemical and it remains primarily in the mixture or product with that other chemical
<i>Process Impurity</i>	Indicates whether the facility processed the reported chemical but did not separate it and it remains as an impurity in the primary mixture or trade name product
<i>Produce</i>	Indicates the toxic chemical was created by the facility. A toxic chemical is considered manufactured even if the toxic chemical is created unintentionally or exists only for a short period of time
<i>Reactant</i>	Indicates the toxic chemical is used in chemical reactions to create another chemical substance or product that is then sold or otherwise distributed to other facilities. Some examples of reactants, include feedstocks, raw materials, intermediates, and initiators
<i>Repackaging</i>	Indicates the toxic chemical has been received by the facility and subsequently prepared for distribution into commerce in a different form, state, or quantity than it was received, such as petroleum being transferred from a storage tank to tanker trucks
<i>Sale Distribution</i>	Indicates that the chemical is produced or imported specifically for sale or distribution outside the manufacturing facility
<i>Used Processed</i>	Indicates that the chemical is produced or imported and then further processed or otherwise used at the same facility

Source: EPA (n.d.-b)

3. Use Information and Market Trends

NMP has a wide-range of uses, including in sealants, automotive products, and paint removers. EPA has thoroughly investigated paint removers containing NMP in previous work, thus while it is a significant application, it will not be discussed in depth in this use and market profile.

Section 3.1 describes the uses of NMP, while Section 3.2 lists specific products that contain this chemical. Market trends are discussed in Section 3.3.

Use information, market trends, and products for NMP were primarily compiled using EPA Office of Chemical Safety and Pollution Prevention's (OCSPP) *Preliminary Information on Manufacturing, Processing, Distribution, Use, and Disposal: N-Methylpyrrolidone (NMP)* (2017) and EPA's *Market Profile and Use Analysis of 1-Methylpyrrolidone* (2012).

3.1 Uses of NMP

NMP's primary commercial use is in paints and paint/coating/adhesive strippers. It has other minor commercial uses in pesticides, solvents, cleaners, reagents, sealers, adhesives, and grouts. However, there is also substantial use of NMP as a solvent for semiconductor fabrication and lithium ion battery manufacturing. Table 3-1 includes uses from the 2012 CDR (EPA, 2014), the 2017 EPA Office of Chemical Safety and Pollution Prevention (OCSPP's) *Preliminary Information on Manufacturing, Processing, Distribution, Use, and Disposal: N-Methylpyrrolidone* (2017), and the 33 public comments available as of April 18th, 2017.

Table 3-1 Known Applications of NMP

Use or Process	Use or Process Status^a	Expected Users^b	Source/ Comment Number
Additives	Ongoing	Consumer, Commercial, Industrial	Product found (see Table 3-2 ^c)
Adhesive removers	Ongoing	Consumer, Commercial	Product found (see Table 3-2)
Adhesives	Ongoing	Consumer, Commercial, Industrial	Product found (see Table 3-2)
Agrochemical/fertilizer manufacturing	Ongoing	Commercial, Industrial	(EPA, 2015a); EPA-HQ-OPPT-2016-0743-0010; EPA-HQ-OPPT-2016-0743-0031; EPA-HQ-OPPT-2016-0743-0029
Automotive cleaning	Ongoing	Consumer, Commercial	(EPA, 2017)
Binding agents	Ongoing	Industrial	Product found (see Table 3-2)
Bone grafts	Ongoing	Consumer, Commercial, Industrial	Product found (see Table 3-2)
Cast materials	Ongoing	Commercial, Industrial	Product found (see Table 3-2)
Chemical extraction	Ongoing	Industrial	(EPA, 2017)
Cleaner/degreasers	Ongoing	Consumer, Commercial, Industrial	Product found (see Table 3-2)
Cleaners (electronics)	Ongoing	Commercial, Industrial	Product found (see Table 3-2)
Cleaning wipes	Ongoing	Consumer, Commercial, Industrial	Product found (see Table 3-2)
Coating removers	Ongoing	Consumer, Commercial	Product found (see Table 3-2)
Cosmetics	Ongoing	Consumer	Product found (see Table 3-2)
Electronic products: semiconductors, computer components	Ongoing	Industrial	(EPA, 2014)
Engineering plastic coatings	Ongoing	Industrial	(EPA, 2015a)
Fabrics, textiles, and clothing	Ongoing	Consumer, Commercial	(EPA, 2014); (EPA, 2017)
Gasket removers	Ongoing	Commercial	Product found (see Table 3-2)
Glazing materials	Ongoing	Commercial	Product found (see Table 3-2)
Grouts	Ongoing	Consumer, Commercial	Product found (see Table 3-2)
Hair sprays and air fresheners	Historic	Consumer, Commercial	EPA-HQ-OPPT-2016-0743-0031
Hydraulic fracking	Ongoing	Industrial	(EPA, 2017); EPA-HQ-OPPT-2016-0743-0029
Hydrophilic coatings	Ongoing	Commercial	Product found (see Table 3-2)
Industrial and laboratory solvents	Ongoing	Industrial	Product found (see Table 3-2)
Inks and dyes	Ongoing	Commercial, Industrial,	Product found (see Table 3-2)
Laundry spot removal	Ongoing	Consumer, Commercial	(EPA, 2012); EPA-HQ-OPPT-2016-0743-0029

Table 3-1 Known Applications of NMP

Use or Process	Use or Process Status^a	Expected Users^b	Source/ Comment Number
Leather cleaners/maintenance	Ongoing	Consumer, Commercial	Product found (see Table 3-2)
Lithium ion batteries	Ongoing	Industrial	Product found (see Table 3-2)
Lubricant adhesives	Ongoing	Consumer, Commercial	Product found (see Table 3-2)
Metal fatigue determination	Ongoing	Industrial	EPA-HQ-OPPT-2016-0743-0028; EPA-HQ-OPPT-2016-0743-0029
Metal finishing	Ongoing	Industrial	(EPA, 2017)
Nail polish removers/solvents	Ongoing	Consumer, Commercial, Industrial	Product found (see Table 3-2)
Optical plastic lens manufacturing	Ongoing	Industrial	(EPA, 2017)
Paint removers ^d	Ongoing	Consumer, Commercial	Product found (see Table 3-2)
Paints, stains, and coatings	Ongoing	Consumer, Commercial	Product found (see Table 3-2)
Pesticides, fungicides, herbicides	Ongoing	Consumer, Commercial, Industrial	Product found (see Table 3-2)
Petrochemical processing	Ongoing	Industrial	Product found (see Table 3-2)
Pharmaceuticals	Ongoing	Consumer, Commercial, Industrial	(EPA, 2014); EPA-HQ-OPPT-2016-0743-0031; EPA-HQ-OPPT-2016-0743-0029
Plating agent	Ongoing	Industrial, Commercial	(EPA, 2014)
Polymer manufacturing	Ongoing	Industrial	EPA-HQ-OPPT-2016-0743-0010; EPA-HQ-OPPT-2016-0743-0031; EPA-HQ-OPPT-2016-0743-0015; EPA-HQ-OPPT-2016-0743-0027; EPA-HQ-OPPT-2016-0743-0017;
Reagents	Ongoing	Industrial	Product found (see Table 3-2)
Resin removers	Ongoing	Commercial	Product found (see Table 3-2)
Resins	Ongoing	Commercial, Industrial	Product found (see Table 3-2)
Sealers and sealants	Ongoing	Consumer, Commercial	Product found (see Table 3-2)
Soldering materials	Ongoing	Industrial	Product found (see Table 3-2)
Solvents	Ongoing	Consumer, Commercial, Industrial	Product found (see Table 3-2)
Spinning agent for PVC and PV	Ongoing	Industrial	(EPA, 2017)
Surface Preparation	Ongoing	Commercial, Industrial	Product found (see Table 3-2)
Textiles and clothing	Ongoing	Commercial	EPA-HQ-OPPT-2016-0743-0029

Table 3-1 Known Applications of NMP

Use or Process	Use or Process Status^a	Expected Users^b	Source/ Comment Number
Transportation equipment manufacturing	Ongoing	Industrial	(EPA, 2014)
Wire enamel manufacturing	Ongoing	Industrial	EPA-HQ-OPPT-2016-0743-0027
Wood finish and floor coatings	Ongoing	Consumer, Commercial, Industrial	(EPA, 2012); EPA-HQ-OPPT-2016-0743-0038
Wood preservatives	Ongoing	Commercial, Industrial	Product found (see Table 3-2)

Notes:

^a Unless otherwise noted, *Ongoing* uses were determined based on current products and their applications (see Table 3-2). *Unknown* uses were identified from EPA's 2012 Market Profile and Use Analysis of NMP (EPA, 2012) and CCD's Use Dossier for NMP (EPA, 2017). *Historic* uses were determined based on confirmation from a public comment that a chemical no longer has certain applications in an industry.

^b Determination of the *Expected Users* associated with a use or process is based on the study team's best judgement if the users are not explicitly defined in the resource(s) cited.

^c Table 3-3 is a reference to the NMP product table found in *Draft: Use and Market Profile for Methylene Chloride and NMP*, delivered to EPA March 1, 2017.

^d Denotes uses currently being considered for Section 6 actions under the Toxic Substances Control Act (TSCA).

3.2 Products

In addition to paint removers, which will not be discussed in detail in this profile, many other products intended for consumer, commercial, and industrial use contain NMP. Three main categories of products that contain NMP are textile spot removers, sealants, and automotive cleaners. Table 3-2 provides representative examples of products containing NMP identified through review of a previous EPA market profile (EPA, 2017). This product list is just a sample and is not comprehensive.

Table 3-2: Sample of Products that Contain NMP						
Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Details
Additive	Commercial	BYK-410	48 - 49	Liquid	Manufacturer/Distributor: BYK Additives & Instruments https://www.byk.com/en/additives/additives-by-name/byk-d-410.php	Rheology additive, coating thickener
Adhesive	Consumer, Commercial	Azek Adhesive	>85	Liquid	Manufacturer: Azek Adhesive Products Example Distributor: Lowes https://www.lowes.com/pd/AZEK-AZEK-Adhesive/50414654	
Adhesive	Consumer, Commercial	D9100, D9100SW, D9180	<0.3	Polyurethane film	Manufacturer: Berry Plastics http://catalog.berryplastics.com/products/adhesiv/moisture-barrier-tape/adhesiv352d9100 Example Distributor: None found	Pressure-sensitive adhesive
Adhesive	Consumer, Commercial	THERMOSET MA-511	1	Solid, Paste	Manufacturer: LORD http://www.lord.com/products-and-solutions/electronic-materials/thermoset-ma-511-epoxy-adhesivesealant Example Distributor: None found	
Adhesive remover	Consumer	Goof Off Super Glue Remover	19.7	Liquid	Manufacturer: Goof Off Products http://www.gooffproducts.com/product/pro-strenght-super-glue-remover Example Distributor: Grainger https://www.grainger.com/product/40CP09	Super Glue removal

Table 3-2: Sample of Products that Contain NMP

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Details
Adhesive remover	Consumer	Citristrip Low VOC Adhesive Remover	1-10	Liquid	<p>Manufacturer: W.M. Barr http://www.citristrip.com/product/adhesive-remover</p> <p>Example Distributor: Amazon https://www.amazon.com/Citri-Strip-QCAR30397-Adhesive-Remover-1-Quart/dp/B001PA4TSS</p>	
Binding agent	Industrial	ALBERDINGK U 801	5-6	Liquid	<p>Manufacturer: AlberdingK http://www.alberdingkusa.com/products/characteristics.html</p> <p>Example Distributor: None found</p>	
Bone graft	Commercial	easy-graft CLASSIC (biolinker portion)	85	Liquid	<p>Manufacturer: Sunstar Degradable Solutions AG http://www.degradablesolutions.com/products/easy-graft.html</p> <p>Example Distributor: None found</p>	Dental bone graft substitute
Bone graft	Consumer, Commercial, Industrial	easy-graft CLASSIC (biolinker portion)	85	Liquid	<p>Manufacturer: Sunstar Guidor http://us.guidor.com/guidorr-easy-grafr-classic-alloplastic-bone-grafting-system.html</p> <p>Example Distributor: None found.</p>	
Cast materials	Industrial	Nycast Type 6 Cast Nylon and Type 12 Cast Nylon	<5	Solid	<p>Manufacturer: Cast Nylons Limited http://www.castnylon.com/cast-nylon-standard-grades-nycast-6-PA.html</p> <p>Example Distributor: None found</p>	Lightweight material that has high compression strength and impact resistance. It is easy to machine and has a wide variety of applications particularly as a bearing material.

Table 3-2: Sample of Products that Contain NMP

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Details
Cast materials	Industrial	Cast Nylon (industrial use)	<5	Solid	<p>Manufacturer: Cast Nylons Limited http://www.castnylon.com/cast-nylon-standard-grades-nycast-6-PA-MoS2.html</p> <p>Example Distributor: US Plastic http://www.usplastic.com/catalog/item.aspx?itemid=23726&catid=668</p>	
Cast materials	Commercial, Industrial	Polyurethane Curative WC-788 Part B-180	0.13	Liquid	<p>Manufacturer/Distributor: BJB Enterprises https://bjbenterprises.com/index.php/wc-788-a-b/</p>	Polyurethane curative
Cleaner (electronics)	Commercial, Industrial	CircuitWorks Conformal Coating Remover Pen	5-7	Liquid	<p>Manufacturer/Distributor: Allied Electronics http://www.alliedelec.com/chemtronics-cw9400/70219346/?mkwid=sd800CQTe&pcriid=30980760979&gclid=COHJtOPxqNICFYyLswod7AwIeA</p>	
Cleaner/degreaser	Consumer, Commercial	BORE CLEANING FOAM, BCF-3	4.50	Aerosol	<p>Manufacturer/Distributor: Midway USA http://ads.midwayusa.com/product/272019/break-free-foaming-bore-cleaning-solvent-3-oz-aerosol</p>	
Cleaner/degreaser	Consumer	CR-10 Gun Barrel Cleaner	Not Specified	Liquid	<p>Manufacturer/Distributor: Midway USA http://ads.midwayusa.com/product/179403/barnes-cr-10-copper-bore-cleaning-solvent</p>	Gun barrel cleaner
Cleaner/degreaser	Commercial, Industrial	Gunk HydroSeal II Heavy Duty Parts Cleaner	2	Liquid	<p>Manufacturer/Distributor: RSC Chemical Solutions http://www.gunk.com/products/cat_det.asp</p>	Parts cleaner

Table 3-2: Sample of Products that Contain NMP

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Details
Cleaner/degreaser	Commercial, Industrial	B.G. Air Intake System Cleaner	15-40	Liquid	<p>Manufacturer: BG Products https://www.bgprod.com/catalog/gasoline-fuel-system/bg-air-intake-system-cleaner/</p> <p>Example Distributor: Amazon https://www.amazon.com/BG-Air-Intake-System-Cleaner/dp/B01DD22OSM/ref=sr_1_1</p>	Air intake system cleaner
Cleaner/degreaser	Industrial	CHEM-CREST 121	90-95	Liquid	<p>Manufacturer: Crest Ultrasonics http://www.crest-ultrasonics.com/chem-crest-121/</p> <p>Example Distributor: None found</p>	
Cleaner/degreaser	Consumer, Commercial	Green Bean Clean	25-50	Liquid	<p>Manufacturer: Dayton Superior http://www.daytonsuperior.com/products/chemicals?name=green-bean-clean-</p> <p>Example Distributor: Runyon Surface Prep http://www.runyonsurfaceprep.com/Green-Bean-Clean.item</p>	
Cleaner/degreaser	Consumer, Commercial	RaLex Oven Cleaner	1-5	Liquid	<p>Manufacturer: Prestige 2007 http://www.prestige2007.com/en/product.php?id=30</p> <p>Example Distributor: None found</p>	
Cleaner/degreaser	Consumer, Commercial	Foam & Resin Cleaner TLS 77	41	Liquid	<p>Manufacturer: T&L Specialty Chemicals http://www.tlspecialty.com/cleaners.html</p> <p>Example Distributor: None found</p>	Foam and resin cleaner

Table 3-2: Sample of Products that Contain NMP

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Details
Cleaner/degreaser	Consumer, Commercial	OIL - BASED STAINLESS STEEL CLEANER & POLISH	1-5	Liquid	<p>Manufacturer: US Chemicals http://www.uschemical.com/product-category/products/</p> <p>Example Distributor: None found</p>	Stainless steel cleaner
Cleaning wipes	Consumer, Commercial, Industrial	Sprayway Cleaner Wipes	15-25	Solid	<p>Manufacturer: Sprayway http://www.spraywayinc.com/content/industrial-strength-cleaner-wipes</p> <p>Example Distributor: Walmart https://www.walmart.com/ip/Sprayway-963-Industrial-Strength-Cleaner-Pre-moistened-Wipes-9.5-x-12-in-Tub-40-wipes/49678894</p>	Industrial strength cleaning wipes
Coating	Commercial	Hydrophilic Coating Formula B	<2.5	Liquid	<p>Manufacturer: Coatings2Go http://coatings2go.com/c2g_products/hydrophilic-products/</p> <p>Example Distributor: None found</p>	Hydrophilic coating
Coating	Consumer, Commercial	Marine Instant Galvanize	<0.3	Liquid, aerosol	<p>Manufacturer: CRC Industries http://www.crcindustries.com/products/marine-instant-galvanize-13-wt-oz-06054.html</p> <p>Example Distributor: Amazon https://www.amazon.com/CRC-06039-Marine-Instant-Galvanize/dp/B000M8IG06</p>	

Table 3-2: Sample of Products that Contain NMP

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Details
Coating	Commercial	Bright Zinc-It® Instant Cold Galvanize	<0.3	Liquid, aerosol	<p>Manufacturer: CRC Industries http://www.crcindustries.com/products/bright-zinc-it-174-light-duty-instant-cold-galvanize-13-wt-oz-18414.html</p> <p>Example Distributor: Amazon https://www.amazon.com/CRC-18414-Bright-Instant-Galvanize/dp/B000M8NZ2U</p>	
Coating	Commercial	Isolflex 760 Lockcoat Aromatic Part A	3	Liquid	<p>Manufacturer: LymTal International http://www.lymtal.com/doc_lists/docMembraneCoatingSystem.html</p> <p>Example Distributor: None found</p>	
Coating remover	Consumer, Commercial	Dynasolve CU-6	40-60	Liquid	<p>Manufacturer: Dynaloy http://www.dynaloy.com/products/dynasolve-cu-6</p> <p>Example Distributor: Spray Poly Parts http://www.spraypolyparts.com/Dynasolve-CU-6_SOLVENT.html</p>	Polyurethane remover
Coating remover	Consumer, Commercial	3M SkyRestore by Elixair Cured Sealant Remover	20-30	Liquid, Gel	<p>Manufacturer: Elixair http://www.elixair.com/products/skyrestore</p> <p>Example Distributor: None found</p>	Sealant remover
Coating remover	Commercial, Industrial	Remover PG	>99	Liquid	<p>Manufacturer: MicroChem http://microchem.com/pdf/removerpg.pdf</p> <p>Example Distributor: Fischer Scientific https://www.fishersci.com/shop/products/microchem-remover-pg-4/nc9893682</p>	Designed to remove PMGI, PMMA, Su-8 and others from various substrates including Si, SiO ₂ , and GaAs.

Table 3-2: Sample of Products that Contain NMP

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Details
Cosmetic	Consumer	Cargo Texaslash Mascara, Black	Not Specified	Liquid	<p>Manufacturer: Cargo Cosmetics http://www.cargocosmetics.com/makeup/eyes/mascara/texaslash-mascara.html</p> <p>Example Distributor: Dermstore http://www.dermstore.com/product_TexasLash_13347.htm</p>	
Film remover	Consumer, Commercial	Epoxy Grout Film Remover	30-60	Liquid	<p>Manufacturer/Distributor: Miracle Sealants Company http://miraclesealants.com/index.php?option=com_virtuemart&view=productdetails&virtuemart_product_id=62&Itemid=224</p>	
Fungicide	Consumer, Commercial, Industrial	SUBDUE GR	<5	Solid	<p>Manufacturer: Syngenta http://www.greencastonline.com/product/subdue-gr-fungicide/labels-sds/turf</p> <p>Example Distributor: Amazon https://www.amazon.com/Subdue-GR-Granular-Fungicide-lbs/dp/B00HQ1JMP0</p>	Granular fungicide
Gasket remover	Commercial	Gasket Remover	10-20	Liquid	<p>Manufacturer: CRC Industries http://www.crcindustries.com/products/gasket-remover-12-wt-oz-05021.html</p> <p>Example Distributor: Amazon https://www.amazon.com/CRC-05021-Technician-Gasket-Remover/dp/B000M8IE6W</p>	

Table 3-2: Sample of Products that Contain NMP

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Details
Glazing material	Commercial	AQUACREME	2.10	Liquid	<p>Manufacturer: Faux FX http://www.fauxfx.com/Pages/A_AquacremePage.html</p> <p>Example Distributor: Faux Marketplace https://fauxmarketplace.netlout-secure.com/catalog/product_info.php?products_id=580</p>	
Herbicide	Commercial, Industrial	MATADOR	Not Specified	Liquid	<p>Manufacturer: Loveland Products http://www.lovelandproducts.com/product/matador-0</p> <p>Example Distributor: None found</p>	
Herbicide	Commercial, Industrial	Enforcer Formula 777 E.C. Weed Killer	1-5	Liquid	<p>Manufacturer: Zep Inc. http://www.zepdistribution.com/product/enforcer/formula-777-e-c-weed-killer</p> <p>Example Distributor: Clean It Supply https://www.cleanitsupply.com/p-100815/enforcer-formula-777-ec-weed-killer-non-cropland-5-gal-pail-amr1048551.aspx</p>	Weed killer
Ink and dyes	Commercial, Industrial	CN816Series	<5	Liquid	<p>Manufacturer: HP http://h22235.www2.hp.com/hpinfo/globalcitizenship/environment/productdata/lfmsdsuseng.html</p> <p>Example Distributor: None found</p>	Ink thinner
Inks and dyes	Consumer, Commercial	ALL-WEATHER Plastic Ear Tag Marker	10-20	Solid	<p>Manufacturer: Markal http://www.markal.com/ink-markers/all-weather-plastic-tag-marker/</p> <p>Example Distributor: JD Industrial Supply http://www.jdindustrialsupply.com/laco-livestock-plastic-ear-tag-marker.html</p>	Weather-resistant marker for polyurethane tags

Table 3-2: Sample of Products that Contain NMP

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Details
Inks and dyes	Commercial, Industrial	LEATHER FINISH BLACK W-3000	2-5	Liquid	<p>Manufacturer: Suede Products http://www.suedeproducts.com/SprayProducts.htm</p> <p>Example Distributor: Suede Products http://www.suedeproducts.com/OrderForm.htm</p>	Leather dye
Inks and dyes	Industrial	FR-1 RED CONCENTRATE	97-98	Liquid	<p>Manufacturer: United Initiators^b</p> <p>Example Distributor: None found</p>	Dye
Inks and dyes	Commercial, Industrial	Silver Conductive Ink - Standard	<15	Liquid	<p>Manufacturer: Voxel8 http://support.voxel8.co/hc/en-us/articles/208004096-Working-with-the-Conductive-Silver-Ink-Solvent</p> <p>Example Distributor: None found</p>	Silver conductive ink for 3D printable electronics
Leather cleaner/maintenance	Consumer, Commercial	Filler	4	Liquid	<p>Manufacturer: https://leathermagic.com/individual-items-3/</p> <p>Example Distributor: None found</p>	Leather repair compound
Leather cleaner/maintenance	Consumer	Mothers Leather Cleaner 06412	0.1-1	Liquid	<p>Manufacturer: Mothers: Polishes Waxes Cleaners https://store.mothers.com/shop/product-line/mothers-classic/leather-cleaner/</p> <p>Example Distributor: Amazon https://www.amazon.com/Mothers-06412-Leather-Cleaner-oz/dp/B0007RDVGQ/ref=sr_1_1</p>	

Table 3-2: Sample of Products that Contain NMP

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Details
Leather cleaner/maintenance	Consumer, Commercial	Mothers Leather Cleaner	<1	Liquid	<p>Manufacturer: Mothers: Polishes Waxes Cleaners http://www.mothers.com/02_products/06412_d.html#&slider1=10</p> <p>Example Distributor: None found</p>	
Lithium ion battery	Consumer, Commercial, Industrial	Lenmar DLCR511	0-1	Solid	<p>Manufacturer: Lenmar http://batterycentral.lenmar.com/BF/ResultList?id=4&manu=Lenmar&model=DLC511&serId=0&sserId=0&catId=2</p> <p>Example Distributor: Walmart https://www.walmart.com/ip/Lenmar-DLC511-Replacement-Battery-for-Canon-BP-511A/24547575#about-item</p>	
Lithium ion battery	Consumer, Commercial, Industrial	Lenmar DLKA5	0-1	Solid	<p>Manufacturer: Lenmar http://batterycentral.lenmar.com/BF/BrowseModels?id=4&manu=Lenmar&serId=0&sserId=0</p> <p>Example Distributor: Amazon https://www.amazon.com/Lenmar-Replacement-EasyShare-Replaces-KLIC-5001/dp/B0002RPROU</p>	
Lithium ion battery	Consumer, Commercial, Industrial	Lenmar DLO40B	0-1	Solid	<p>Manufacturer: Lenmar http://batterycentral.lenmar.com/BF/BrowseModels?id=4&manu=Lenmar&serId=0&sserId=0</p> <p>Example Distributor: Office Depot http://www.officedepot.com/a/products/469830/Lenmar-Battery-For-Olympus-LI-40B/</p>	

Table 3-2: Sample of Products that Contain NMP

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Details
Lithium ion battery	Consumer, Commercial, Industrial	Lenmar DLCR123	0-1	Solid	<p>Manufacturer: Lenmar http://batterycentral.lenmar.com/BF/BrowseModels?id=4&manu=Lenmar&serId=0&sserId=0</p> <p>Example Distributor: Office Depot http://www.officedepot.com/a/products/573660/Lenmar-CR123-Digital-Camera-Battery-For/</p>	
Adhesive	Consumer, Commercial	DSB 1520 Adhesive Lubricant	Not Specified	Liquid	<p>Manufacturer/Distributor: D.S. Brown http://store.dsbrown.com/dsb-1520-lube-adhesive.html</p>	Lubricant adhesive
Nail polish remover/solvent	Consumer	All or 1 Artificial Nail Remover - Various (Lemon, Orange, Lemon Extracts, Orange Oil)	Not Specified	Not Specified	<p>Manufacturer: Kiss USA http://www.kissusa.com/nails/glues-tools/removers/all-or-one-artificial-nail-remover-by-kiss</p> <p>Example Distributor: Amazon https://www.amazon.com/Kiss-Artificial-Nail-Remover-00086/dp/B00G5P77PU</p>	
Paint	Consumer, Commercial, Industrial	Staticide Premium ESD Paint	4-7	Liquid	<p>Manufacturer: ACL Staticide http://www.aclstaticide.com/staticide_premium_esd_paint.html</p> <p>Example Distributor: Digi-Key http://www.digikey.com/products/en?keywords=5700W1</p>	Paint for concrete
Paint	Industrial	MIL-DTL-64159B Type II/III Component B, Catalyst	1-5	Liquid	<p>Manufacturer: MILSPRAY Military Technology http://www.milspray.com/products-services/touch-up-paint-coatings/usar/sds</p> <p>Example Distributor: None found</p>	Touch-up military paint

Table 3-2: Sample of Products that Contain NMP

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Details
Paint	Consumer, Commercial, Industrial	PETTIT VIVID GREEN 1361	Not Specified	Liquid	<p>Manufacturer: Petit Marine Paint http://www.pettitpaint.com/product.asp?id=14</p> <p>Example Distributor: West Marine https://www.westmarine.com/buy/pettit-paints--vivid-bright-colored-hybrid-antifouling-paint--P004_121_001_520?recordNum=10</p>	
Paint	Consumer, Commercial	Pettit Vivid Green 1361	Not Specified	Liquid	<p>Manufacturer: Petit Marine Paint http://www.pettitpaint.com/product.asp?id=14</p> <p>Example Distributor: Boater's Land http://www.boatersland.com/petvividg-grn.html?gclid=CNmZz52RsdICFY1XDQodox0KXQ</p>	Marine boat paint
Paint	Consumer	Sherwin-Williams Wood Classics Interior Waterborne Polyurethane Varnish, Gloss	2	Liquid	<p>Manufacturer: Sherwin-Williams https://www.sherwin-williams.com/homeowners/products/wood-classics-waterborne-polyurethane-varnish</p> <p>Example Distributor: Home Depot http://www.homedepot.com/p/Citristrip-17-oz-Safer-Paint-and-Varnish-Stripper-ECG73807/100164441</p>	
Paint remover	Commercial, Industrial	Safety Strip 5896B	<80	Liquid	<p>Manufacturer: Brulin http://brulin.com/productdetails.aspx?pid=143&cid=44</p> <p>Example Distributor: SkyGeek http://www.skygeek.com/brulin-safety-strip-5896b-aerospace-specification-stripper.html</p>	

Table 3-2: Sample of Products that Contain NMP

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Details
Paint remover	Consumer	Citristrip Paint & Varnish Remover-old product	20-40	Liquid	<p>Manufacturer: Citristrip http://www.citristrip.com/product/stripping-aerosol</p> <p>Example Distributor: Home Depot http://www.homedepot.com/p/Citristrip-17-oz-Safer-Paint-and-Varnish-Stripper-ECG73807/100164441</p>	
Paint remover	Consumer, Commercial, Industrial	Peel Away 5 Soy Based	25-30	Liquid	<p>Manufacturer: Dumond Chemicals Inc. https://www.dumondchemicals.com/pro-peel-away-5.html</p> <p>Example Distributor: Amazon https://www.amazon.com/PEEL-Industrial-Strength-Coating-Remover/dp/B00552GRNC</p>	
Paint remover	Consumer, Commercial	Jasco Green Paint Brush Cleaner	<5	Liquid	<p>Manufacturer: Jasco http://www.jasco-help.com/product/jasco-green-brush-cleaner</p> <p>Example Distributor: Lowes https://www.lowes.com/pd/Jasco-Green-Brush-Cleaner-1-Quart/50298115</p>	Paint Brush Cleaner
Paint remover	Consumer	Klean-Strip Graffiti Remover	40-60	Liquid	<p>Manufacturer: Klean Strip http://www.kleanstrip.com/product/graffiti-removerekgr16698</p> <p>Example Distributor: Walmart https://www.walmart.com/ip/Klean-Strip-Premium-Paint-Stripper/17208799</p>	

Table 3-2: Sample of Products that Contain NMP

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Details
Paint remover	Consumer	Zinsser Magic Strip Paint & Varnish Remover	9	Liquid	<p>Manufacturer: Rust-Oleum https://www.rustoleum.com</p> <p>Example Distributor: Home Depot http://www.homedepot.com/p/Zinsser-1-2-gal-Magic-Strip-Paint-and-Varnish-Remover-Case-of-4-42072/205163867</p>	
Paint remover	Consumer	Savogran Biodegradable Strypeeze	40-45	Liquid	<p>Manufacturer: The Savogran Company http://www.savogran.com/removers.html</p> <p>Example Distributor: Amazon https://www.amazon.com/Savogran-02603-2GAL-GRN-Strypeeze/dp/B000BZX1IW</p>	
Paint remover	Consumer	Spray Graffiti Remover	25-30	Liquid	<p>Manufacturer: The Savogran Company http://www.savogran.com/removers.html</p> <p>Example Distributor: Amazon https://www.amazon.com/dp/B000VB7ZWY</p>	
Paints, stains, and coatings	Consumer, Commercial	Gloss Topcoat Concentrate/TC-1	9-10	Liquid	<p>Manufacturer/Distributor: Advanced Leather Solutions http://advleather.com/professionalproducts.html#topcoats</p>	Top-coating
Paints, stains, and coatings	Commercial, Industrial	HPS-108AE1 High Performance Silver Ink	0-5	Liquid	<p>Manufacturer/Distributor: Novacentrix http://store.novacentrix.com/product_p/hps-108ae1.htm</p>	Commercial ink (nano)
Paints, stains, and coatings	Commercial, Industrial	JP-K81 Printing Ink	1-5	Liquid	<p>Manufacturer: Hitachi America http://www.hitachi.com.sg/ice/products/inkjet_printers/ink/specs2.html</p> <p>Example Distributor: None found</p>	Printing ink

Table 3-2: Sample of Products that Contain NMP

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Details
Paints, stains, and coatings	Commercial, Industrial	Thinner 2732	30-60	Liquid	Manufacturer: Nazdar Ink Technologies ^b Example Distributor: None found	Ink thinner
Paints, stains, and coatings	Consumer, Commercial	DUPLI-COLOR® Clear Truck Bed Coating (Aerosol)	0.28	Liquid, aerosol	Manufacturer: Dupli-Color https://duplicolor.com/product/clear-truck-bed-coating Example Distributor: AutoZone http://www.autozone.com/paint-and-body/truck-bed-coating/dupli-color-16-5-oz-clear-truck-bed-coating/812686_0_0	
Pesticide	Commercial, Industrial	Prentox CFT Legumine Fish Toxicant	10	Liquid	Manufacturer: Central Garden & Pet: Zoecon division http://www.zoecon.com/products/residuals/cft-legumine-fish-toxicant Example Distributor: None found	Piscicide
Pesticide	Consumer, Commercial, Industrial	Tekko Pro	20	Liquid	Manufacturer: Control Solutions Inc. https://www.controlsolutionsinc.com/products/tekko-pro/ Example Distributor: EPest Supply http://www.epestsupply.com/product/811120/Tekko-Pro-Insect-Growth-Regulator/#.WLWtk2_yuCg	Insect growth regulator
Pesticide	Commercial, Industrial	LongRange	30	Liquid	Manufacturer: Merial http://thelongrangelook.com/ Example Distributor: Valley Vet https://www.valleyvet.com/ct_detail.html?pgguid=b5f8fd3b-e12a-42c8-b8cf-87cc4fe73202	Parasiticide

Table 3-2: Sample of Products that Contain NMP

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Details
Pesticide	Consumer, Commercial, Industrial	Sergeants PetArmor Plus IGR	20-40	Liquid	<p>Manufacturer: Sergeants (PetArmor) https://www.petarmor.com/for-dogs/</p> <p>Example Distributor: Amazon https://www.amazon.com/Pet-Armor-Plus-Flea-Topical/dp/B00JU0KEIO</p>	Flea and tick treatment for dogs
Coating	Industrial	HD 8820	<1	Liquid	<p>Manufacturer: HD MicroSystems http://www.hdmicrosystems.com/ec/liquid-polyimides-and-pbo-precursors/products/sub-products/hd-8800-series.html</p> <p>Example Distributor: None found</p>	Polyimide coating for semi-conductor industry
Resin	Commercial, Industrial	STOPGAP F76 RESIN	<1	Liquid	<p>Manufacturer: F-Ball http://www.f-ball.com/en/product/stopgap-f76/</p> <p>Example Distributor: Internet Flooring Supplies https://internetflooringsupplies.co.uk/one-coat-surface-membrane-154.html</p>	Component of epoxy resin based system
Resin	Commercial	United Coatings Kymax Coating	1-5	Liquid	<p>Manufacturer: GAF https://www.gaf.com/Roofing/Commercial/Products/Liquid_Applied_Roofing/Roof_Coating/UC_Kymax_Coating</p> <p>Example Distributor: None found</p>	PVDF fluoropolymer
Resin	Industrial	Skybond® 705 Polyimide Resin	60-63	Liquid	<p>Manufacturer: Industrial Summit Technology http://www.istusa.com/skybond/</p> <p>Example Distributor: None found</p>	Polyimide resin
Resin remover	Consumer, Commercial	Slide Resin Remover Aerosol	35-40	Liquid	<p>Manufacturer/Distributor: Slide Products http://www.slideproducts.com/resin-remover-mold-cleaner-no-41914.html</p>	Aerosol resin remover

Table 3-2: Sample of Products that Contain NMP

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Details
Resin remover	Commercial	Slide Bulk Resin Remover	30-50	Liquid	Manufacturer/Distributor: Slide Products http://www.slideproducts.com/resin-remover-mold-cleaner-no-41914.html	Resin remover and mold cleaner
Rust inhibitor for steel	Commercial, Industrial	Formgard TJ 450	Not Specified	Liquid	Manufacturer/Distributor: Nox-crete http://www.nox-crete.com/products/formgard-tj/	
Sealant	Commercial, Industrial	MT Concrete Seal	1 - < 3	Liquid	Manufacturer: Hillyard https://b2b.hillyard.com/productdetail/index/grid/wsa/C~11789,PL~11821,PD~HIL0049200 Example Distributor: Sanitary Supply https://www.sanitarysupplycorp.com/p-2590-hillyard-concrete-seal-mt-dries-clear-5-gallon-pail-hil0049207-sold-as-1-pail.aspx	Concrete floor coating
Sealant	Commercial, Industrial	Enviroseal Acrylic Sealer; # FL-2126-D	0.1 - <1	Liquid	Manufacturer: PEN Products http://www.in.gov/idoc/penproducts/files/Chemical_Products_REV_AUG142015.pdf Example Distributor: None found	Floor sealant
Sealer	Commercial	MSP Seam Sealer	< 1 Proprietary	Solid, Paste	Manufacturer: 3M http://3mcollision.com/products/sound-deadening/3m-msp-seam-sealer-08369-white.html#moreInfoDetails Example Distributor: Amazon https://www.amazon.com/3M-08369-Ultrapro-Sealer-Flexpack/dp/B00063X29W	Automotive seam sealer

Table 3-2: Sample of Products that Contain NMP

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Details
Sealer	Consumer, Commercial, Industrial	Leak Seal-Clear	0.1-1	Liquid	<p>Manufacturer: Rust-oleum http://www.rustoleum.com/product-catalog/industrial-brands/specialty/v2100-system-leakseal-aerosol</p> <p>Example Distributor: Zoro https://www.zoro.com/rust-oleum-leak-seal-1375-oz-clear-aerosol-can-267453/i/G5180271/</p>	Aerosol leak sealer
Soldering material	Commercial, Industrial	TSF 6522 TACKY SOLDERING FLUX	1 -2.5	Liquid	<p>Manufacturer: Kester http://www.kester.com/products/product/tsf-6522</p> <p>Example Distributor: Digi-Key http://www.digikey.com/products/en?mpart=300403&v=117</p>	Tack soldering flux is formulated to be used with a rotating disc, a doctor blade, or a drum fluxer
Solvent	Consumer, Commercial	LOCTITE SF 75326 CLEAN UP	60-100	Liquid	<p>Manufacturer: Acklands Grainger https://www.acklandsgrainger.com/en/product/LOCTITE-SF-75326-CLEAN-UP-SOLV-753/ /R-LCT75326</p> <p>Example Distributor: None found</p>	
Solvent	Commercial, Industrial	S-6032A Immersion Cleaner	60-80	Liquid	<p>Manufacturer: Superior Oil Company http://www.superioroil.com/Solvents_and_Chemicals/3/</p> <p>Example Distributor: None found</p>	
Solvent	Consumer, Commercial	Power Charge	30-40	Liquid	<p>Manufacturer: U.N. X. Incorporated^b</p> <p>Example Distributor: None found</p>	Solvent laundry detergent

Table 3-2: Sample of Products that Contain NMP

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Details
Solvent	Industrial	Reclaimed NMP	99.50	Liquid	<p>Manufacturer: Veolia http://www.veolianorthamerica.com/en/our-services/waste-services/n-methylpyrrolidone-sale</p> <p>Example Distributor: None found</p>	
Coating	Commercial, Industrial	LIQUID 2 POWDER	<1	Liquid	<p>Manufacturer/Distributor: Power Buy the Pound https://www.powderbuythepound.com/liquid_2_powder_-1_pint.html</p>	Powder coating surface preparation
Wood finish	Commercial	BonaSport Super Sport	<5	Liquid	<p>Manufacturer: BonaKemi USA Inc https://www.bona.com/en-US/Bona-Professional/Sport/Waterborne-Finishes--Sealers/Bona-SuperSport-Finish/</p> <p>Example Distributor: Amazon https://www.amazon.com/Bona-SuperSport-Finish-Gloss-Gallon/dp/B00OTRWB7A</p>	Wood gym floor finish
Wood finish	Commercial	Buckeye Equity	<1	Liquid	<p>Manufacturer: Buckeye International https://www.buckeyeinternational.com/products/floor-finishes/equity</p> <p>Example Distributor: None found</p>	Floor finish enhancer
Wood finish	Consumer, Commercial	Buckeye Arena 200	1-5	Liquid	<p>Manufacturer: Buckeye International https://www.buckeyeinternational.com/products/reflections-wood-floor-care/arena-200#/program-info</p> <p>Example Distributor: None found</p>	Wood floor coating

Table 3-2: Sample of Products that Contain NMP

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Details
Wood finish	Consumer	Cabot Interior Waterbased Gloss Floor Finish; Product Code: Valspar 144.0008070.007	5-10	Liquid	<p>Manufacturer: Cabot Premium Woodcare http://www.cabotstain.com/products/product/Water-borne-Polyurethane.html</p> <p>Example Distributor: Essential Hardware http://www.essentialhardware.com/valspar-144.0008070.007-water-based-floor-finish-gloss-158441.html</p>	
Wood finish	Consumer	Cabot Interior Waterbased Satin Floor Finish; Product Code: 144.0008072.007	5-10	Liquid	<p>Manufacturer: Cabot Premium Woodcare http://www.cabotstain.com/products/product/Water-borne-Polyurethane.html</p> <p>Example Distributor: Hardware World https://www.hardwareworld.com/p38h1vd/Satin-Floor-Finish-Water-Borne-Clear-Gallon</p>	
Wood finish	Consumer	Cabot Interior Waterbone Gloss Polyurethane; Product Code: 144.0008080	5-10	Liquid	<p>Manufacturer: Cabot Premium Woodcare http://www.cabotstain.com/products/product/Water-borne-Polyurethane.html</p> <p>Example Distributor: Essential Hardware http://www.essentialhardware.com/valspar-144.0008080.005-water-base-polyurethane-clear-157850.html</p>	
Wood finish	Consumer	Cabot Interior Waterbased Semi-Gloss Floor Finish; Product Code: 144.0008077.007	5-10	Liquid	<p>Manufacturer: Cabot Premium Woodcare http://www.cabotstain.com/products/product/Water-borne-Polyurethane.html</p> <p>Example Distributor: Tools Chest http://www.toolschest.com/jnsn45834.html?utm_medium=CPA&utm_campaign=commissionjunction&utm_source=affiliate</p>	

Table 3-2: Sample of Products that Contain NMP

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Details
Wood finish	Consumer	Cabot Interior Waterbased Semi-Gloss Polyurethane; Product Code: 144.0008087	5-10	Liquid	<p>Manufacturer: Cabot Premium Woodcare http://www.cabotstain.com/products/product/Water-borne-Polyurethane.html</p> <p>Example Distributor: Amazon https://www.amazon.ca/Water-Borne-Polyurethane-8087-1G-Semigloss/dp/B000OI9AVS</p>	
Wood finish	Consumer, Commercial	Clear Gloss Protective Finish	1.71	Liquid	<p>Manufacturer: Minwax http://www.minwax.com/wood-products/clear-protective-finishes/interior/minwax-polyacrylic-protective-finish</p> <p>Example Distributor: Home Depot http://www.homedepot.com/p/Minwax-1-qt-Gloss-Polyacrylic-Protective-Finish-65555444/202061479</p>	
Wood finish	Consumer, Commercial	Vara HD Spar Varnish Semi-Gloss VA	1-2.5	Liquid	<p>Manufacturer: Rust-Oleum http://www.rustoleum.com/</p> <p>Example Distributor: Home Depot http://www.homedepot.com/p/Varathane-1-qt-Clear-Semi-Gloss-Water-Based-Exterior-Spar-Varnish-Case-of-2-266321/203368887</p>	Top coat/varnish
Wood finish	Consumer, Commercial	Zar Exterior Water Based Polyurethane - All Gloss Levels ^b	3-7	Liquid	<p>Manufacturer: United Gilsonite Laboratories http://www.ugl.com/sitemap.php</p> <p>Example Distributor: Amazon https://www.amazon.com/United-Gilsonite-Water-Based-Exterior-Polyurethane/dp/B003KILYHM#feature-bullets-btf</p>	

Table 3-2: Sample of Products that Contain NMP

Use	Expected Users ^a	Product	Percent Conc.	Form	Manufacturer and Distributor Information	Details
Wood preservative	Commercial, Industrial	MP400-EXT	<1	Solid	<p>Manufacturer: Osmose http://www.osmose.com/documents/MP400-EXT%20product%20information%20bulletin.pdf</p> <p>Example Distributor: Poles.com http://poles.com/External/MP400ext/4gallonbox</p>	Wood preservative for utility poles

^a Determination of the expected users associated with a use or process is based on EPA's best judgement if the users are not explicitly defined in the resource(s) cited.

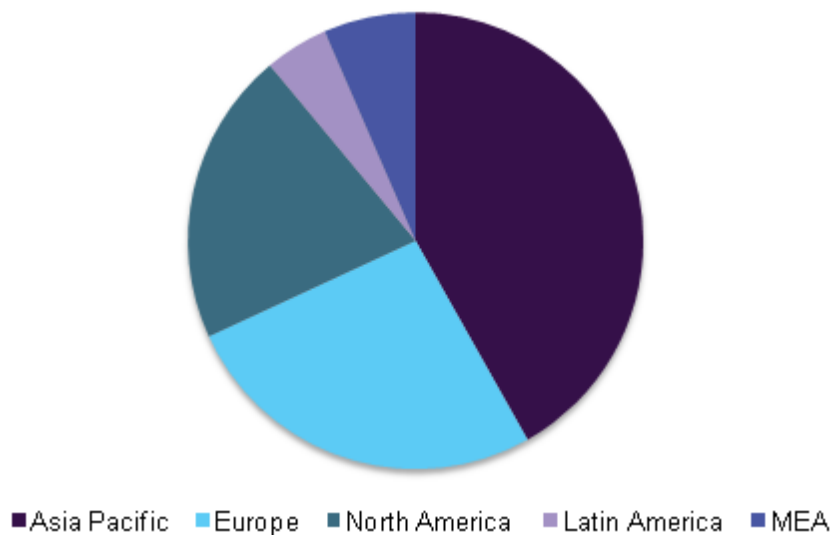
^b Could not confirm continued manufacture. Product SDSs are from 2015 or December of 2014.

3.3 NMP Market Trends

NMP is used heavily in paint removers, as a solvent/reagent in the electronics and pharmaceutical industries, as a solvent for hydrocarbon recovery in the petrochemical processing industry, and for desulfurization of natural gas (Future Market Insights, 2015; Global Newswire, 2016). It is also used in pesticides, solvents, cleaners, reagents, sealers, adhesives, and grouts (See Table 3-2). While paint removers represent a large product category for NMP, they are not covered in this report, as this use is covered in detail in previous reports (EPA, 2015c). This market trends section will focus on the use of NMP in the electronics, pharmaceuticals, and petrochemical industries.

NMP is a key cleaning component in the manufacture of semiconductors used in electronics, and in the manufacture of printed circuit boards. As the demand for consumer electronics rises, especially in the Asia Pacific region, the global NMP market is expected to grow as well. While this rise in demand is primarily concentrated in the Asia Pacific region, this increase in use is likely to be mirrored in other regions to a lesser degree (Grand View Research, 2016).

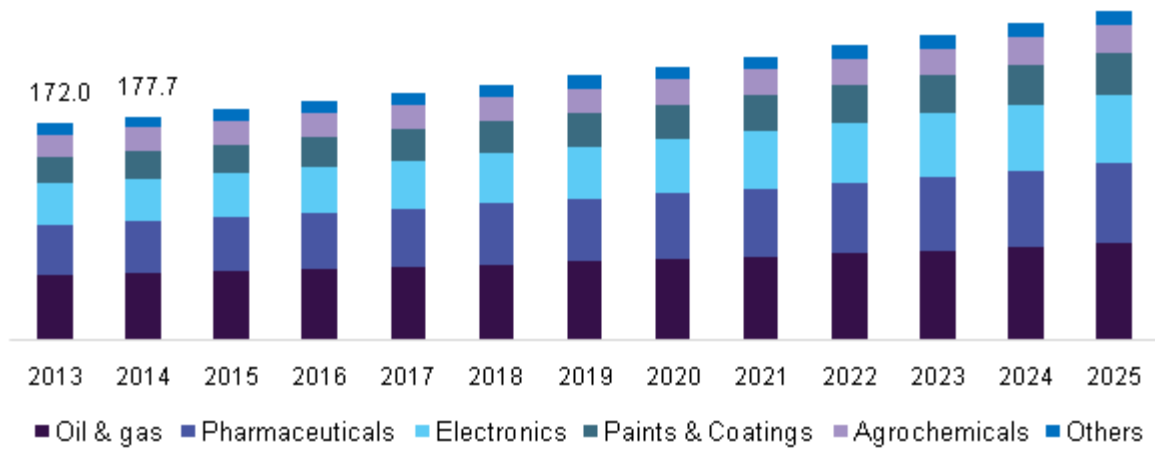
Figure 1. Global NMP Market Share, by region 2015 (%)



Source: Grand View Research (2016)

U.S. NMP market revenue is expected to increase over the next ten years. Despite variations in the oil and gas industry, NMP is primarily used in downstream processes, allowing it to be more resilient to market volatility in this sector. Electronic- and pharmaceutical-related revenue is also expected to grow (Grand View Research, 2016).

Figure 2. U.S. NMP Market Revenue, by application, 2013-2025 (million USD)



Source: Grand View Research (2016)

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Appendix A : Detailed TRI Data

Table A - 1: Detailed 2015 TRI Activity or Use for NMP by Facility		
Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
3M Co - Brownwood 4501 Hwy 377 S Brownwood, TX 76801	10,000-99,999	Formulation Component
3M Co - Nevada 2120 E Austin Blvd Nevada, MO 64772	1,000-9,999	Chemical Processing Aid
3M Co - Greenville 1400 Perimeter Rd Greenville, SC 29605	1,000-9,999	Ancillary
3M Co - Hutchinson 905/915 Adams St SE Hutchinson, MN 55350	1,000-9,999	Manufacture Aid
3M Cottage Grove Center 10746 Innovation Rd Cottage Grove, MN 55016	10,000-99,999	Ancillary
Absolute Coatings Inc. 38 Portman Rd New Rochelle, NY 10801	10,000-99,999	Formulation Component, Repackaging
Adjuvants Unlimited LLC 3633 Charles Page Blvd Tulsa, OK 74127	10,000-99,999	Formulation Component
Advanced Polymer Technology 109 Conica Ln Harmony, PA 16037	10,000-99,999	Chemical Processing Aid
Air Liquide Advanced Separations 305 Water St Newport, DE 19804	10,000-99,999	Chemical Processing Aid
Air Products 11444 Lackland Rd Saint Louis, MO 63146	10,000-99,999	Chemical Processing Aid
Albaugh Inc. 4900 Stockyards Expressway Saint Joseph, MO 64504	NR	NR
Albemarle Corp 2858 Back Vail Rd Tyrone, PA 16686	1,000,000-9,999,999	Formulation Component
Alberdingk Boley Inc. 6008 West Gate City Boulevard Greensboro, NC 27407	10,000-99,999	Chemical Processing Aid
Aldrich Chemical Co LLC 5485 County Rd V Sheboygan Falls, WI 53085	NR	NR
Allcoat Technology Inc. 100 Eames St Wilmington, MA 01887	100,000-999,999	Formulation Component, Ancillary
Allied Tube & Conduit Corp 16100 S Lathrop Ave Harvey, IL 60426	10,000-99,999	Chemical Processing Aid
American & Efird LLC Plant 05 & 15 601 American St Mount Holly, NC 28120	1,000-9,999	Manufacture Aid

Table A - 1: Detailed 2015 TRI Activity or Use for NMP by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
American Polymers Corp DBA Polycoat Products 14722 Spring Ave Santa Fe Springs, CA 90670	NR	NR
American Refining Group Inc. 77 N Kendall Ave Bradford, PA 16701	100,000-999,999	Chemical Processing Aid
Ampac Fine Chemicals LLC Hwy 50 & Hazel Rd Rancho Cordova, CA 95670	100,000-999,999	Chemical Processing Aid
Amri Rensselaer Inc. 33 Riverside Ave Rensselaer, NY 12144	10,000-99,999	Chemical Processing Aid
Anadigics Inc. 141 Mount Bethel Rd Warren, NJ 07059	1,000-9,999	Manufacture Aid
Arlon Electronic Materials 9433 Hyssop Dr Rancho Cucamonga, CA 91730	1,000-9,999	Chemical Processing Aid, Ancillary
Armstrong Flooring Inc. Lancaster Plant 1067 Dillerville Rd Lancaster, PA 17603	NR	NR
Arrow Adhesives Co 5457 Spalding Dr Norcross, GA 30092	1,000-9,999	Formulation Component
Ashland Inc. 410 Old Pelzer Rd Piedmont, SC 29673	NR	NR
Ask Chemicals LP 2191 W 110th St Cleveland, OH 44102	10,000-99,999	Formulation Component
Avago Technologies Inc.4380 Ziegler Rd Fort Collins, CO 80525	100,000-999,999	Manufacture Aid
Avantor Performance Materials 7001 Martin Luther King Blvd Paris, KY 40361	100,000-999,999	Repackaging
Avery Dennison Information & Brand Management Div 524 Rt 303 Orangeburg, NY 10962	1,000-9,999	Chemical Processing Aid
Axalta Coating Systems LLC - Fort Madison Plant 803 35th St Fort Madison, IA 52627	10,000-99,999	Formulation Component
Axalta Coating Systems LLC - Mount Clemens Plant 400 Groesbeck Hwy Mount Clemens, MI 48043	1,000-9,999	Formulation Component
Bachem Americas Inc. 1271 Avenida Chelsea Vista, CA 92081	100-999	Chemical Processing Aid
Bachem Americas Inc. 3132 Kashiwa St Torrance, CA 90505	1,000-9,999	Chemical Processing Aid
Baker Petrolite Corp 16950 Wallisville Rd Houston, TX 77049	10,000-99,999	Formulation Component
Barton Solvents Inc. El Dorado Branch 2601 Pioneer Drive El Dorado, KS 67042	10,000-99,999	Formulation Component, Repackaging

Table A - 1: Detailed 2015 TRI Activity or Use for NMP by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Barton Solvents Inc. Kansas City 901 S 66th Terrace Kansas City, KS 66111	10,000-99,999	Formulation Component, Repackaging
BASF Corp 205 S James St Newport, DE 19804	100,000-999,999	Chemical Processing Aid
BASF Corp 8404 Hwy 75 Geismar, LA 70734	100,000-999,999	Produce, Sale Distribution, Chemical Processing Aid
BASF Corp 1609 Biddle Ave Wyandotte, MI 48192-3729	100,000-999,999	Formulation Component, Ancillary
BASF Corp 1175 Martin St Greenville, OH 45331	10,000-99,999	Manufacture Aid
BASF Total Petrochemicals LLC NE of Intersection of Hwy 73 & Hwy 366 Port Arthur, TX 77642	1,000,000-9,999,999	Chemical Processing Aid
Baxalta US Inc. - GA 505 Baxalta Pkwy Social Circle, GA 30025	0-99	Manufacture Aid
Bayer Crop Science 8400 Hawthorn Rd Kansas City, MO 64120	NR	NR
Bemis Films 2251/2450/2451 Badger Ave Oshkosh, WI 54904	1,000-9,999	Ancillary
Bemis Wisconsin LLC 718 High St New London, WI 54961	10,000-99,999	Ancillary
Betco Corp 1001 Brown Ave Toledo, OH 43607	1,000-9,999	Formulation Component
BG Products El Dorado Manufacturing Facility 2415 Pioneer Dr El Dorado, KS 67042	NR	NR
BG Products Inc. 701 S Wichita Wichita, KS 67213	NR	NR
Boeing Commercial Airplanes - Everett 3003 W Casino Rd Everett, WA 98204	1,000-9,999	Ancillary
Brady Worldwide Inc. 2230 W Florist Ave Glendale, WI 53209	10,000-99,999	Manufacture Aid
Brenntag Great Lakes LLC 14765 W Bobolink Ave Menomonee Falls, WI 53051	NR	NR
Brenntag Northeast Inc. 81 W Huller Ln Reading, PA 19605	NR	NR
Buckeye International Inc. 2700 Wagner Pl Maryland Heights, MO 63043	NR	NR

Table A - 1: Detailed 2015 TRI Activity or Use for NMP by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Buzzi Unicem USA - Greencastle Plant 3301 S County Rd 150 W Greencastle, IN 46135	100-999	Repackaging, Ancillary
BYK USA Inc. 524 S Cherry St Wallingford, CT 06492	10,000-99,999	Imported, Used Processed, Sale Distribution, Formulation Component, Repackaging
Callahan Chemical Co 18 Industrial Rd Walpole, MA 02081	10,000-99,999	Repackaging
Calsonic Kansei NA Inc. 201 Garrett Pkwy Lewisburg, TN 37091	10,000-99,999	Chemical Processing Aid
Cambrex Charles City Inc. 1205 11th St Charles City, IA 50616	10,000-99,999	Chemical Processing Aid, Manufacture Aid
Caterpillar Inc. Mapleton Plant 8826 W Rt 24 Mapleton, IL 61547	NR	NR
CCL Container - Aerosol Div One Llodio Dr Hermitage, PA 16148	1,000-9,999	Manufacture Aid, Ancillary
CCL Label Inc. 29485 Hwy 76 E Clinton, SC 29325	1,000-9,999	Manufacture Aid
Central Plains Cement Co 2609 N 145th E Ave Tulsa, OK 74116	NR	NR
Chemetall US Inc. 1100 Technology Dr Jackson, MI 49201	1,000-9,999	Formulation Component
Chemical Solvents Inc. -Denison Facility 1010 Old Denison Ave Cleveland, OH 44109	10,000-99,999	Ancillary
Chemical Solvents Jennings Rd Facility 3751 Jennings Rd Cleveland, OH 44109	10,000-99,999	Ancillary
Chemisphere Corp 2101 Clifton Ave Saint Louis, MO 63139	NR	NR
Chemsolv Inc. 1140 Industry Ave SE Roanoke, VA 24013	NR	NR
Chemtura Corp 1000 Convery Blvd Perth Amboy, NJ 08861	10,000-99,999	Reactant
Chevron Phillips Chemical Co LP Borger Plant Spur 119 E Borger, TX 790070968	10,000-99,999	Chemical Processing Aid
Chromaflo Technologies Corp 2600 Michigan Ave Ashtabula, OH 44004	10,000-99,999	Formulation Component
CJB Industries Inc. CS Plant 2114 Cypress St Valdosta, GA 31601	10,000-99,999	Formulation Component

Table A - 1: Detailed 2015 TRI Activity or Use for NMP by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
CJB Industries Inc. Gh Plant 701 Gil Harbin Industrial Blvd Valdosta, GA 31601	10,000-99,999	Formulation Component
CI Hawthay & Sons Corp 638 Summer St Lynn, MA 01905	10,000-99,999	Formulation Component, Ancillary
Clean Harbors Aragonite LLC 11600 North Aptus Rd Grantsville, UT 84029	100,000-999,999	Ancillary
Clean Harbors Deer Park LLC 2027 Independence Parkway South La Porte, TX 77571	100,000-999,999	Article Component
Clean Harbors El Dorado LLC 309 American Cir Union El Dorado, AR 71730	100,000-999,999	Repackaging, Ancillary
Clean Harbors Environmental Services Inc. 2247 S Hwy 71 Kimball, NE 69145	10,000-99,999	Ancillary
Clean Harbors Recycling Services of Chicago LLC 1445 W 42nd Chicago, IL 60609	100,000-999,999	Process Impurity
Clean Harbors Recycling Services of Ohio LLC 581 Milliken Dr Se Hebron, OH 43025	100,000-999,999	Formulation Component, Ancillary
Commercial Merchandising Corp 1337 J Wood Branch Dr Charlotte, NC 28273	100-999	Formulation Component
Commonwealth Laminating & Coating Inc. 345 Beaver Creek Dr Martinsville, VA 24112	100,000-999,999	Chemical Processing Aid
Continental Cement Co LLC 10107 Hwy 79 Hannibal, MO 63401	10,000-99,999	Ancillary
Contract Packaging Inc. 13100 Independence Dr Covington, GA 30014	10,000-99,999	Formulation Component
Control Solutions Inc. 5903 Genoa Red Bluff Rd Pasadena, TX 77507	NR	NR
Corden Pharma Colorado Inc. 2075 N 55th St Boulder, CO 80301	100,000-999,999	Chemical Processing Aid, Manufacture Aid
Core Molding Technologies 800 Manor Park Dr Columbus, OH 43228	1,000-9,999	Ancillary
CPFilms - Plant II 4129 The Great Rd Fieldale, VA 24089	10,000-99,999	Chemical Processing Aid
CPFilms Inc.-Axton Facility 47 Brenda Dr Axton, VA 24054	10,000-99,999	Chemical Processing Aid
Cree Inc. 4600 Silicon Dr Durham, NC 27703	10,000-99,999	Chemical Processing Aid

Table A - 1: Detailed 2015 TRI Activity or Use for NMP by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Cree Research Triangle Park 3026 Cornwallis Rd Research Triangle Park, NC 27709	10,000-99,999	Chemical Processing Aid
Cytec Olean Inc. 1405 Buffalo St Olean, NY 14760	10,000-99,999	Ancillary
Cytec Solvay Composite Materials 4300 Jackson St Greenville, TX 75402	100,000-999,999	Ancillary
Dap Products Inc. 875 N Third St Tipp City, OH 45371	100,000-999,999	Formulation Component
Daubert Chemical Co 4700 S Central Ave Chicago, IL 60638	10,000-99,999	Formulation Component
Denka Performance Elastomer LLC 560 Highway 44 La Place, LA 70068	10,000-99,999	Formulation Component, Chemical Processing Aid, Ancillary
Diodes Inc. FabTech 777 N W Blue Pkwy Suite 350 Lees Summit, MO 64086	1,000-9,999	Ancillary
DMI - Columbus LLC 1600 Northside Ind US Trial Blvd Columbus, GA 31904	1,000-9,999	Ancillary
Dow Chemical Co 901 Loveridge Rd Pittsburg, CA 94565	1,000,000-9,999,999	Chemical Processing Aid, Manufacture Aid
Dpix LLC 1635 Aeroplaza Dr Colorado Springs, CO 80916	10,000-99,999	Manufacture Aid
DSM Coating Resins Inc. 730 Main St Wilmington, MA 01887	100,000-999,999	Formulation Component, Ancillary
DuBois Chemicals 1329 W 400 N Fairland Rd Shelbyville, IN 46176	10,000-99,999	Ancillary
DuBois Chemicals 476 Clay St Chilton, WI 53014	10,000-99,999	Ancillary
DuBois Chemicals Inc. 3630 E Kemper Rd Sharonville, OH 45241	10,000-99,999	Formulation Component
DuPont EKC Technology 2520 Barrington Ct Hayward, CA 94545	10,000-99,999	Formulation Component, Repackaging
DuPont Electronic Polymers 1515 Nicholas Rd Dayton, OH 45417	10,000-99,999	Formulation Component
DuPont Parlin Plant Cheesequake Rd Parlin, NJ 08859	100,000-999,999	Formulation Component, Manufacture Aid
DuPont Pontchartrain Works 586 Hwy 44 La Place, LA 70068	10,000-99,999	Formulation Component, Chemical Processing Aid, Ancillary

Table A - 1: Detailed 2015 TRI Activity or Use for NMP by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
DuPont Sabine River Works Farm Rd 1006 Orange, TX 77630	10,000-99,999	Ancillary
DuPont Spruance Plant U.S. Hwy 1 At Cogbill Rd Richmond, VA 23234	1,000,000-9,999,999	Chemical Processing Aid
DuPont Towanda Plant 192 Patterson Blvd Towanda, PA 18848	1,000-9,999	Formulation Component, Chemical Processing Aid
Dynaloy LLC 6445 Olivia Ln Indianapolis, IN 46226	10,000-99,999	Formulation Component,
Eau Claire Co - Operative Oil Co 4970 Kane Rd Eau Claire, WI 54703	NR	NR
Eco-Services Operations 1301 Airline Hwy Baton Rouge, LA 70805	10,000-99,999	Ancillary
Eden Custom Processing LLC 328 Summit Rd Eden, NC 27288	100,000-999,999	Repackaging
EI LLC 2865 N Cannon Blvd Kannapolis, NC 28083	1,000-9,999	Formulation Component
Elantas Pdg Inc. 5200 N Second St Saint Louis, MO 63147	1,000,000-9,999,999	Formulation Component, Repackaging, Ancillary
Elektrisola Inc. 126 High St Boscawen, NH 03303	10,000-99,999	Manufacture Aid
Elpaco Coatings Corp 1378 Kingsland Ave Pagedale, MO 63133	100-999	Article Component, Formulation Component
Emagin Corp Hudson Valley Research Park 2070 Rt 52 Bldg 334 Hopewell Junction, NY 12533	0-99	Repackaging, Chemical Processing Aid, Ancillary
EMD Millipore Corp 80 Ashby Rd Bedford, MA 01730	10,000-99,999	Chemical Processing Aid
EMD Performance Materials Corp 50-70 Meister Ave Somerville, NJ 08876	100,000-999,999	Formulation Component, Repackaging
Emerald Services Inc. 1825 E Alexander Ave Tacoma, WA 98421	1,000-9,999	Formulation Component, Repackaging, Process Impurity
Engineered Polymer Solutions Inc. DBA Valspar Coatings 90 Carson Rd Birmingham, AL 35215	10,000-99,999	Formulation Component
Engineered Polymer Solutions Inc. 1400 N State St Marengo, IL 60152	10,000-99,999	Formulation Component
Entegris Inc. 706 Ho Us Ton Clinton Dr Burnet, TX 78611	10,000-99,999	Formulation Component, Repackaging

Table A - 1: Detailed 2015 TRI Activity or Use for NMP by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
EQ Detroit Inc. 1923 Frederick Detroit, MI 48211	1,000-9,999	Ancillary
EQ Florida Inc. 2002 Orient Rd Tampa, FL 33619	10,000-99,999	Process Impurity
EQ Resource Recovery Inc. 36345 Van Born Rd Romulus, MI 48174	100,000-999,999	Formulation Component
Essential Industries Inc. 28391 Essential Rd Merton, WI 53056	NR	NR
Essex Group Inc. 3200 Essex Dr Franklin, IN 46131	10,000-99,999	Formulation Component, Manufacture Aid, Ancillary
Essex Group Inc. 800 W Mitchell St Kendallville, IN 46755	10,000-99,999	Chemical Processing Aid, Ancillary
Essex Group Inc. 120 Se Pkwy Franklin, TN 37064	10,000-99,999	Formulation Component, Ancillary
Essex Group Inc. Chemical Processing Plant 1601 Wall St Fort Wayne, IN 46802	10,000-99,999	Chemical Processing Aid, Ancillary
Essex Group Inc. Chemical Processing Plant 1601 Wall St Fort Wayne, IN 46802	100,000-999,999	Imported, Sale Distribution, Formulation Component, Ancillary
Exal Corp 1 Performance Pl Youngstown, OH 44502	10,000-99,999	Ancillary
ExxonMobil Baytown Chemical Plant 5000 Bayway Dr Baytown, TX 77520	100-999	Ancillary
ExxonMobil Chemical Co Baytown Olefins Plant 3525 Decker Dr Baytown, TX 77520	0-99	Ancillary
ExxonMobil Refining & Supply Baton Rouge Refinery (Part) 4045 Scenic Hwy Baton Rouge, LA 70805	100,000-999,999	Chemical Processing Aid, Ancillary
ExxonMobil Refining & Supply Baytown Refinery 2800 Decker Dr Baytown, TX 775202099	1,000,000-9,999,999	Produce, Byproduct, Process Impurity, Chemical Processing Aid, Ancillary
Faurecia Interior Systems Saline LLC 7700 Michigan Ave Saline, MI 48176	1,000-9,999	Ancillary
Faurecia Interior Systems - Fraser Plant 17801 E 14 Mile Rd Fraser, MI 48026	100-999	Chemical Processing Aid
FCA US Toledo Assembly Complex 4400 Chrysler Dr Toledo, OH 43608	1,000-9,999	Manufacture Aid, Ancillary
Fisher Scientific Co LLC 755 Rt 202 Bridgewater, NJ 08807	10,000-99,999	Repackaging

Table A - 1: Detailed 2015 TRI Activity or Use for NMP by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Flint Group NA Corp 104 National Dr Anniston, AL 36207	1,000-9,999	Formulation Component
FlipChip International LLC 3701 E. University Drive Phoenix, AZ 85034	1,000-9,999	Manufacture Aid
FMC Corp Hwy 17 E Wyoming, IL 61491	NR	NR
Ford Motor Co Dearborn Truck Plant 3001 Miller Rd Dearborn, MI 48120	1,000-9,999	Article Component, Manufacture Aid, Ancillary
Ford Motor Co Kentucky Truck Plant 3001 Chamberlain Ln Louisville, KY 40241	1,000-9,999	Article Component, Manufacture Aid, Ancillary
Ford Motor Company Kansas City Assembly Plant 8121 E US Hwy 69 Claycomo, MO 64119	10,000-99,999	Manufacture Aid, Ancillary
Fortron Industries LLC 4600 Hwy 421 North Wilmington, NC 28401	1,000,000-9,999,999	Reactant, Chemical Processing Aid,
Franklin International 2020 Bruck St Columbus, OH 43207	10,000-99,999	Ancillary
Freescale Semiconductor - Chandler 1300 N Alma School Rd Ch404 Chandler, AZ 85224	1,000-9,999	Manufacture Aid, Ancillary
Freescale Semiconductor - Ed Bluestein Facility 3501 Ed Bluestein Blvd Austin, TX 78721	1,000-9,999	Manufacture Aid
Freescale Semiconductor Oak Hill Facility 6501 William Cannon Dr W Austin, TX 78735	1,000-9,999	Manufacture Aid
Fujifilm Electronic Materials USA Inc. 80 Circuit Dr North Kingstown, RI 02852	10,000-99,999	Formulation Component
Fujifilm Hunt Chemicals USA Inc. 411 Manufacturer's Rd Dayton, TN 37321	10,000-99,999	Formulation Component, Ancillary
Fujifilm Manufacturing USA Inc. 20 W 14th Ave North Kansas City, MO 64116	1,000-9,999	Formulation Component, Repackaging
Fujifilm Ultra Pure Solutions 1200 W Jackson Rd Carrollton, TX 75006	10,000-99,999	Formulation Component, Repackaging
GE Healthcare Bio-Sciences Corp 14 Walkup Dr Westborough, MA 01581	1,000-9,999	Chemical Processing Aid
GE Osmonics 760 Shadowridge Drive Vista, CA 92083	1,000-9,999	Chemical Processing Aid
Ge Osmonics Inc. 5951 Clearwater Dr Minnetonka, MN 55343	1,000-9,999	Chemical Processing Aid

Table A - 1: Detailed 2015 TRI Activity or Use for NMP by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
General Motors LLC Bowling Green Assembly Plant 600 Corvette Dr Bowling Green, KY 42101	10,000-99,999	Chemical Processing Aid
Global Communication Semiconductor LLC 23155 Kashiwa Ct Torrance, CA 90505	1,000-9,999	Chemical Processing Aid, Ancillary
GlobalFoundries US 2 LLC E Fishkill Facility 2070 Rt 52 Hopewell Junction, NY 12533	100,000-999,999	Repackaging, Chemical Processing Aid, Ancillary
GlobalFoundries US 2 LLC - Vermont Facility 1000 River St Essex Junction, VT 05452	10,000-99,999	Chemical Processing Aid, Ancillary
GM Orion Assembly Center 4555 Giddings Rd Lake Orion, MI 48359	1,000-9,999	Manufacture Aid, Ancillary
GM Truck Group Flint Assembly Plant G-3100 Van Slyke Rd Flint, MI 48551	0-99	Ancillary
GM Truck Group Flint Assembly Plant G-3100 Van Slyke Rd Flint, MI 48551	0-99	Ancillary
GM Truck Group Flint Assembly Plant G-3100 Van Slyke Rd Flint, MI 48551	1,000-9,999	Chemical Processing Aid, Ancillary
GMC Truck Group Arlington Assembly Plant 2525 E Abrams St Arlington, TX 76010	10,000-99,999	Chemical Processing Aid, Ancillary
GVS NA 125 Flanders Rd Westborough, MA 01581	100,000-999,999	Chemical Processing Aid
Haartz Corp 87 Hayward Rd Acton, MA 01720	1,000-9,999	Chemical Processing Aid
Harrells Inc. 720 Kraft Rd Lakeland, FL 33815	10,000-99,999	Formulation Component
HD Microsystems LLC 250 Cheesequake Rd C/O DuPont Building 424 Parlin, NJ 08859	100,000-999,999	Formulation Component, Ancillary
Headway Technologies Inc. 497 S. Hillview Drive Milpitas, CA 95035	10,000-99,999	Manufacture Aid
Helena Industries Inc. 434 Fenn Rd Cordele, GA 31015	NR	NR
Helena Industries Inc. 3525 Vandalia Rd Des Moines, IA 50317	NR	NR
Henkel Corp 1345 Gasket Dr Elgin, IL 60120	NR	NR
Henkel Corp 825 Cedar Springs Rd Salisbury, NC 28147	10,000-99,999	Chemical Processing Aid

Table A - 1: Detailed 2015 TRI Activity or Use for NMP by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Henkel Corp 167 Batchelder Rd Seabrook, NH 03874	NR	NR
Henkel Corp 421 London Rd Delaware, OH 43015	1,000-9,999	Formulation Component
Hexcel Corp 1214 W Hwy 84 Casa Grande, AZ 85122	100,000-999,999	Chemical Processing Aid, Ancillary
Hexcel Corp 31815 Great Western Drive Windsor, CO 80550	100-999	Manufacture Aid
Hexcel Corp 5400 S 6800 W West Valley City, UT 84119	10,000-99,999	Formulation Component, Ancillary
Hexion Inc. 6200 Campground Rd Louisville, KY 40216	10,000-99,999	Ancillary
HGST Inc. 5601 Great Oaks Parkway San Jose, CA 95119	100,000-999,999	Ancillary
Holcim (US) Inc. Holly Hill Plant 2173 Gardner Blvd Holly Hill, SC 29059	1,000-9,999	Ancillary
Honda Of America Manufacturing Inc. 11000 State Rt 347 East Liberty, OH 43319	1,000-9,999	Chemical Processing Aid, Manufacture Aid, Ancillary
Honda Of America Manufacturing Inc. 24000 Honda Pkwy Marysville, OH 430409251	1,000-9,999	Chemical Processing Aid, Manufacture Aid, Ancillary
Honeywell Electronic Chemicals LLC 6760 W Chicago St Chandler, AZ 85226	1,000,000-9,999,999	Repackaging
Hubbard-Hall Inc. 1101 Compton Bridge Rd Inman, SC 29349	NR	NR
Huntsman Advanced Materials Americas Inc. 555 Huntsman Rd McIntosh, AL 36553	10,000-99,999	Formulation Component, Chemical Processing Aid, Ancillary
Hutchinson Technology Inc. 2435 Alpine Rd Eau Claire, WI 54703	10,000-99,999	Chemical Processing Aid
Hydranautics 401 Jones Rd Oceanside, CA 920581216	1,000-9,999	Manufacture Aid
Hydrite Chemical Co 114 N Main St Cottage Grove, WI 53527	100,000-999,999	Formulation Component, Repackaging
Hydrite Chemical Co 7300 W Bradley Rd Milwaukee, WI 53223	NR	NR
Infineon Technologies Americas Corp 41915 Business Park Dr Temecula, CA 92590	100-999	Chemical Processing Aid

Table A - 1: Detailed 2015 TRI Activity or Use for NMP by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Infinera Corp 1322 Bordeaux Dr Sunnyvale, CA 94089	1,000-9,999	Manufacture Aid
Infrared Products - L-3 3414 Herrmann Dr Garland, TX 75041	10,000-99,999	Ancillary
Innovative Micro Technology 75 Robin Hill Rd Goleta, CA 93117	1,000-9,999	Ancillary
Intel Corp 4500 S Dobson Rd Mail Stop: Oc4-005 Chandler, AZ 85248	1,000-9,999	Ancillary
Intel Corp 4100 Sara Rd M S Rr5-491 Rio Rancho, NM 87124	1,000-9,999	Ancillary
Intel Corp - Aloha Campus 3585 SW 198th Ave Aloha, OR 97007	10,000-99,999	Ancillary
Intel Corp - Ronler Acres Campus 2501 NW 229th St Hillsboro, OR 97124	10,000-99,999	Ancillary
Intel Massachusetts Inc. 75 Reed Rd Hudson, MA 01749	1,000-9,999	Ancillary
Intersil Corp 1650 Robert J. Conlan Blvd Palm Bay, FL 32905	1,000-9,999	Chemical Processing Aid, Manufacture Aid
Inteva Products - Adrian Operations 1450 E Beecher St Adrian, MI 49221	1,000-9,999	Manufacture Aid, Ancillary
ISP Technologies Inc. 4501 Attwater Ave Texas City, TX 77590	1,000,000-9,999,999	Produce, Used Processed, Sale Distribution, Formulation Component
IST (USA) Corp 250 Cheesecake Rd Parlin, NJ 08859	10,000-99,999	Reactant, Formulation Component
IWG High Performance Conductor Inc. 13230 N Main St Trenton, GA 30752	10,000-99,999	Chemical Processing Aid, Ancillary
Jacam Manufacturing 2013 LLC North Plant 1656 Ave Q Sterling, KS 67579	NR	NR
JH Rhodes Co Inc. 10 Ward St Vernon, NY 13476	10,000-99,999	Ancillary
Johnson Controls Aps Production Inc. 70 West 48th St Holland, MI 49423	100,000-999,999	Manufacture Aid
KMG Electronic Chemicals Inc. 2340 Bert Dr Hollister, CA 95023	10,000-99,999	Formulation Component, Repackaging,
Knox Fertilizer Co Inc. 2660 E 100 S Knox, IN 46534	NR	NR

Table A - 1: Detailed 2015 TRI Activity or Use for NMP by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Koch Agronomic Services LLC 39 Bremen Ave Saint Louis, MO 63147	10,000-99,999	Formulation Component,
Koch Membrane Systems Inc. 850 Main St Wilmington, MA 01887	10,000-99,999	Chemical Processing Aid,
Koppers Performance Chemicals 3450 Fite Rd Millington, TN 38053	NR	NR
K-Solv LP 1007 Lakeside Dr Channelview, TX 77530	NR	NR
Lacamas Laboratories Inc, 3625 N Suttle Rd Portland, OR 97217	100,000-999,999	Chemical Processing Aid
LA-CO Industries Inc, 1201 Pratt Blvd Elk Grove Village, IL 60007	NR	NR
Lafarge Na (Including Systech Env Corp) 11435 County Rd 176 Paulding, OH 45879	10,000-99,999	Process Impurity, Ancillary
Lexmark International Inc. 6555 Monarch Rd Longmont, CO 80503	10,000-99,999	Ancillary
LG Chem Michigan Inc. 1 LG Way Holland, MI 49423	10,000-99,999	Imported, Used Processed, Sale Distribution, Article Component
Loveland Products Inc. - Billings (Formerly Transbas) 1525 Lockwood Rd Billings, MT 59101	NR	NR
Lubrizol Advanced Materials 550 Moore Rd Avon Lake, OH 44012	10,000-99,999	Formulation Component
Lubrizol Corp Painesville Plant 155 Freedom Rd Painesville, OH 44077	10,000-99,999	Formulation Component
Lyondell Chemical Co 2502 Sheldon Rd Channelview, TX 77530	100,000-999,999	Produce, Sale Distribution
M/A-Com Technology Solutions 100 Chelmsford St Lowell, MA 01851	1,000-9,999	Ancillary
MacDermid Inc. 1221 Farrow Ave Ferndale, MI 48220	1,000-9,999	Formulation Component, Repackaging
Material Sciences Corp 2300 E Pratt Blvd Elk Grove Village, IL 60007	1,000-9,999	Manufacture Aid
Maxim Fab North 14320 SW Jenkins Rd Beaverton, OR 97005	1,000-9,999	Imported, Used Processed, Manufacture Aid
Maxim Integrated Products 4350 S Beltwood Pkwy Dallas, TX 75244	1,000-9,999	Manufacture Aid

Table A - 1: Detailed 2015 TRI Activity or Use for NMP by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Mcadoo & Allen Div Quaker Color Div Mcadoo & Allen Div 201 S Hellertown Ave Quakertown, PA 18951	10,000-99,999	Formulation Component, Ancillary
Medsource Trenton LLC (DBA Lake Region Medical) 13024 N Main St Trenton, GA 30752	1,000-9,999	Chemical Processing Aid
Mercedes-Benz US International Inc. 1 Mercedes Dr Vance, AL 35490	1,000-9,999	Article Component, Manufacture Aid, Ancillary
Micrel LLC 1849 Fortune Drive San Jose, CA 95131	100-999	Ancillary
Micron Technology Inc. 8000 S Federal Way Boise, ID 83716	10,000-99,999	Article Component, Manufacture Aid, Ancillary
MOC Products Co Inc. 12306 Montague St Pacoima, CA 91331	NR	NR
Mondi Jackson LLC 14591 State Hwy. 177 Jackson, MO 63755	10,000-99,999	Ancillary
Monument Chemical Kentucky LLC 2450 Olin Rd Brandenburg, KY 40108	1,000-9,999	Chemical Processing Aid
Motiva - Port Arthur Refinery 2555 Savannah Ave Port Arthur, TX 77640	100,000-999,999	Chemical Processing Aid
Multi-Color Corp 2281 S Us 31 Scottsburg, IN 47170	10,000-99,999	Formulation Component, Ancillary
Multi-Color Corp - Norwood 4500 Beech St Cincinnati, OH 45212	1,000-9,999	Chemical Processing Aid
Nation Ford Chemical Co 2300 Banks St Fort Mill, SC 29715	10,000-99,999	Chemical Processing Aid
NB Coatings Inc. 3000 E 170th St Lansing, IL 60438	10,000-99,999	Formulation Component
Nexeo Solutions LLC 20915 S Wilmington Ave Carson, CA 90810	100,000-999,999	Repackaging
Nexeo Solutions LLC 2461 Crocker Circle Fairfield, CA 94533	NR	NR
Nexeo Solutions LLC 5125 W Hanna Ave Tampa, FL 33634	10,000-99,999	Repackaging
Nexeo Solutions LLC 8500 S Willow Springs Rd Willow Springs, IL 60480	100,000-999,999	Repackaging
Nexeo Solutions LLC 3930 Glenwood Dr Charlotte, NC 28208	10,000-99,999	Repackaging

Table A - 1: Detailed 2015 TRI Activity or Use for NMP by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Nexeo Solutions LLC 3930 Glenwood Dr Charlotte, NC 28208	10,000-99,999	Repackaging
Nexeo Solutions LLC 1842 Enterprise Pkwy Twinsburg, OH 44087	100,000-999,999	Repackaging
Nexeo Solutions LLC 2788 Glendale-Milford Rd Evendale, OH 45241	NR	NR
Nexeo Solutions LLC 8901 Old Galveston Rd Houston, TX 77034	NR	NR
Nexeo Solutions LLC - Carteret 350 Roosevelt Ave Carteret, NJ 07008	NR	NR
Nexeo Solutions LLC - Doraville 4550 Ne Expressway Doraville, GA 30340	NR	NR
Nissan NA Inc. Smyrna Manufacturing Plant 983 Nissan Dr Smyrna, TN 37167	10,000-99,999	Chemical Processing Aid
Niteo Products LLC 720 Vaiden Dr Hernando, MS 38632	NR	NR
Norlite LLC 628 S Saratoga St Cohoes, NY 12047	100-999	Ancillary
Nufarm Americas Inc. - Alsip 11901 South Austin Avenue Alsip, IL 60803	NR	NR
Nufarm Americas Inc (Db a Riverdale Chemical) 220 E 17th St Chicago Heights, IL 60411	10,000-99,999	Produce, Used Processed, Sale Distribution, Reactant, Formulation Component
Omnium Blytheville 400 Terra Rd Blytheville, AR 72315	10,000-99,999	Formulation Component
Oracle Flexible Packaging Liberty/Freedom Complex 220 Polo Rd Winston Salem, NC 27105	1,000-9,999	Manufacture Aid, Ancillary
O'Sullivan Films Inc. 1944 Valley Ave Winchester, VA 22601	10,000-99,999	Chemical Processing Aid
Owosso Graphic Arts 151 N Delaney Rd Owosso, MI 48867	10,000-99,999	Chemical Processing Aid
Pall Corp 8780 Ely Rd Pensacola, FL 32514	10,000-99,999	Manufacture Aid
Pall Filtration & Separations Group Inc. 4116 Sorrento Valley Blvd San Diego, CA 92121	1,000-9,999	Chemical Processing Aid
Parker Hannifin Corp 2340 Eastman Ave Oxnard, CA 93030	1,000-9,999	Formulation Component, Chemical Processing Aid

Table A - 1: Detailed 2015 TRI Activity or Use for NMP by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
PerkinElmer Medical Imaging 2175 Mission College Blvd Santa Clara, CA 95054	100-999	Ancillary
Perry Foam Products 2335 S 30th St Lafayette, IN 47909	1,000-9,999	Manufacture Aid
Pico Chemical Corp 400 E 16th St Chicago Heights, IL 60411	NR	NR
Plastic Omnium Auto Exteriors LLC - Anderson 5100 Old Pearman Dairy Rd Anderson, SC 29625	1,000-9,999	Ancillary
Platte Chemical Co 917 Platte Rd Greenville, MS 38704	1,000,000-9,999,999	Formulation Component
Polar Semiconductor LLC 2800 E Old Shakopee Rd Bloomington, MN 55425	1,000-9,999	Manufacture Aid
Polynt Composites USA Inc. 920 E 14th Ave North Kansas City, MO 64116	NR	NR
Porcelen Ltd Ct LLC 129 Leeder Hill Dr Hamden, CT 06517	10,000-99,999	Manufacture Aid
PPG Industries Inc. - Oak Creek 10800 S 13th St Oak Creek, WI 53154	1,000-9,999	Formulation Component
PPG Industries Ohio Inc. 3800 W 143 St Cleveland, OH 44111	1,000-9,999	Formulation Component
Premold Corp 5657 Frontier Rd Oconomowoc, WI 53066	0-99	Ancillary
Qorvo Florida Inc. 1818 S Hwy 441 Apopka, FL 32703	1,000-9,999	Ancillary
Qorvo US Inc. 7908 Piedmont Triad Pkwy Greensboro, NC 27409	10,000-99,999	Manufacture Aid,
Quadrant EPP USA Inc. 2120 Fairmont Ave Reading, PA 19605	1,000-9,999	Formulation Component
Qualcomm Mems Technologies 2581 Junction Ave San Jose, CA 95134	100-999	Manufacture Aid,
Raytheon Co 350 - 362 Lowell St Andover, MA 01810	1,000-9,999	Ancillary
Rea Magnet Wire Co 2800 Concord Rd Lafayette, IN 47909	10,000-99,999	Chemical Processing Aid, Ancillary
Rea Magnet Wire Co 4300 New Haven Ave Fort Wayne, IN 46803	10,000-99,999	Chemical Processing Aid, Ancillary

Table A - 1: Detailed 2015 TRI Activity or Use for NMP by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Reclaimed Energy Div Superior Oil Co Inc. 1500 Western Ave Connersville, IN 47331	10,000-99,999	Formulation Component, Repackaging, Ancillary
Red Wing Shoe Co One Red Wing Dr Potosi, MO 63664	1,000-9,999	Manufacture Aid,
Red Wing Shoe Plant 2 135 Cannon River Dr Red Wing, MN 55066	1,000-9,999	Manufacture Aid,
Reichhold LLC 2 6350 E Collins Rd Morris, IL 60450	10,000-99,999	Formulation Component, Ancillary
Rho Chemical Co Inc. 30 Industry Ave Joliet, IL 60435	NR	NR
Rogers Corporation - Woodstock 245 Woodstock Rd Woodstock, CT 06281	1,000-9,999	Ancillary
Rohm & Haas Electronic Materials LLC 455 Forest St Marlborough, MA 01752	10,000-99,999	Formulation Component, Chemical Processing Aid, Ancillary
Rohm & Haas Electronic Materials CMP Inc. - B5 B6 351 Bellevue Rd Newark, DE 19713	10,000-99,999	Ancillary
Rohm & Haas Electronic Materials CMP Inc. B7 B15 50 Bellevue Rd Newark, DE 19713	1,000-9,999	Ancillary
Ross Incineration Services Inc. 36790 Giles Rd Grafton, OH 44044	10,000-99,999	Ancillary
Rustoleum Corp 7850 Ohio River Rd Lesage, WV 25537	10,000-99,999	Formulation Component
S & S Plating Co 5614 Nunn St Houston, TX 77087	10,000-99,999	Chemical Processing Aid, Ancillary
Safety-Kleen Systems Inc. 1200 Sylvan St Linden, NJ 07036	10,000-99,999	Produce, Sale Distribution, Formulation Component
Saft America 13575 Waterworks St Jacksonville, FL 32221	10,000-99,999	Article Component, Manufacture Aid
Saginaw Metal Casting Operations 1629 N Washington St Saginaw, MI 48601	10,000-99,999	Manufacture Aid
Saint-Gobain Performance Plastics 386 Metacom Ave Bristol, RI 02809	10,000-99,999	Chemical Processing Aid
Samsung Austin Semiconductor 12100 Samsung Blvd Austin, TX 78754	10,000-99,999	Ancillary
Schirm USA Inc. 2801 Oak Grove Rd Ennis, TX 75119	NR	NR

Table A - 1: Detailed 2015 TRI Activity or Use for NMP by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Scotts Co 563 S Crown Hill Rd Orrville, OH 44667	10,000-99,999	Formulation Component
Seagate Technology 7801 Computer Ave Bloomington, MN 55435	10,000-99,999	Ancillary
Sensient Colors LLC 2515 N Jefferson Ave Saint Louis, MO 63106	10,000-99,999	Chemical Processing Aid
Sherwin-Williams Co 14 Industrial Park Flora, IL 62839	10,000-99,999	Formulation Component
Sherwin-Williams Co 630 E 13th Andover, KS 67002	1,000-9,999	Formulation Component
Sherwin-Williams Co 2121 New World Dr Columbus, OH 43207	1,000-9,999	Formulation Component
Shintech Inc. 5618 Hwy 332 E Freeport, TX 77541	NR	NR
Skyworks Solutions Inc . 2427 W Hillcrest Dr Newbury Park, CA 91320	10,000-99,999	Ancillary
Skyworks Solutions Inc. 20 Sylvan Rd Woburn, MA 01801	10,000-99,999	Chemical Processing Aid
Solvay Specialty Polymers USA Spur 119E Borger, TX 79008	1,000,000-9,999,999	Manufacture Aid
Solvay Specialty Polymers USA LLC 50 Akron Dr Greenville, SC 29605	100,000-999,999	Reactant, Chemical Processing Aid
Sonoco Flexible Packaging 6502 S US Hwy 31 Edinburgh, IN 46124	1,000-9,999	Ancillary
Southwestern Plating Co Inc. 1312 Halpern Houston, TX 77009	10,000-99,999	Chemical Processing Aid, Ancillary
Specialty Services Complex 233 Hoyt Rd Waxahachie, TX 75167	NR	NR
Spectrolab Inc. 12500 Gladstone Ave Sylmar, CA 91342	1,000-9,999	Manufacture Aid
Strongwell - Chatfield Div 1610 Hwy 52 S Chatfield, MN 55923	1,000-9,999	Ancillary
Subaru Of Indiana Automotive Inc. 5500 State Rd 38e Lafayette, IN 47905	10,000-99,999	Chemical Processing Aid
Sumco Southwest Corp 19801 N Tatum Blvd Phoenix, AZ 85050	10,000-99,999	Ancillary

Table A - 1: Detailed 2015 TRI Activity or Use for NMP by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Sunnyside Corp 225 Carpenter Ave Wheeling, IL 60090	NR	NR
Superior Fiberglass & Resins 1030 All Pro Dr Elkhart, IN 46514	NR	NR
Superior Oil Co Inc. 400 W Regent St Indianapolis, IN 46225	NR	NR
Superior Solvents & Chemicals 4211 Bramers Ln Louisville, KY 40216	NR	NR
Superior Solvents & Chemicals 2055 E Blaine St Springfield, MO 65803	NR	NR
Superior Solvents & Chemicals 320 Northpointe Dr Fairfield, OH 45014	NR	NR
Superior Solvents & Chemicals 518 Swinging Bridge Rd Old Hickory, TN 37138	NR	NR
Symrise Inc. 1636 B Us Hy Park Rd Goose Creek, SC 29445	10,000-99,999	Chemical Processing Aid
Syngenta Crop Protection LLC Saint Gabriel Facility 3905 Hwy 75 Saint Gabriel, LA 70776	100,000-999,999	Chemical Processing Aid
Syngenta Crop Protection LLC Omaha Plant 4111 Gibson Rd Omaha, NE 68107	NR	NR
Systech Environmental Corp 1420 S Cement Plant Rd Fredonia, KS 66736	1,000-9,999	Process Impurity, Ancillary
Tarr Acquisition LLC 4115 W Turney Ave Phoenix, AZ 85019	10,000-99,999	Formulation Component, Repackaging
Tem-Tex Solvents Corp 4208 S General Bruce Dr Temple, TX 76502	NR	NR
Tessengerlo Kerley Inc. Fresno Plant 5427 E Central Ave Fresno, CA 93725	100,000-999,999	Formulation Component, Repackaging
Texas Instruments 6412 Us Hwy 75 S Sherman, TX 75090	1,000-9,999	Chemical Processing Aid, Ancillary
Texas Instruments Inc. 13500 N Central Expressway Dallas, TX 75243	100,000-999,999	Produce, Sale Distribution, Manufacture Aid,
The Dow Chemical Co 1790 Building Midland, MI 48667	10,000-99,999	Formulation Component, Chemical Processing Aid, Ancillary
TM Deer Park Services LP 2525 Battleground Rd Deer Park, TX 77536	10,000-99,999	Ancillary

Table A - 1: Detailed 2015 TRI Activity or Use for NMP by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Toray Composites (America) 19002 50th Ave E Tacoma, WA 98446	10,000-99,999	Ancillary
Toyota Industries Compressor Parts America Co 500 Valentine Ind US Trial Pkwy Pendergrass, GA 30567	10,000-99,999	Imported, Used Processed
TPC Group 2102 Spur 136 Port Neches, TX 77651	100,000-999,999	Chemical Processing Aid
Tradebe Treatment & Recycling LLC 4343 Kennedy Ave East Chicago, IN 46312	100-999	Produce, Imported, Manufacturing, Process Impurity, Ancillary
Trelleborg Coated Systems US Inc. -DBA Uretek Po Box 326 New Haven, CT 06513	100,000-999,999	Manufacture Aid
Triquint Semiconductor Texas LP 500 W Renner Rd Richardson, TX 75080	1,000-9,999	Chemical Processing Aid
TSE Industries Inc. 5260 113th Ave N Clearwater, FL 33760	10,000-99,999	Formulation Component, Ancillary
TTM Technologies Inc. 234 Cashman Dr Chippewa Falls, WI 54729	1,000-9,999	Manufacture Aid
Turf Care Supply Corp 422 Webster Turn Dr Sebring, FL 33870	NR	NR
Turf Care Supply Corp 100 Picoma Rd Martins Ferry, OH 43935	NR	NR
TXI Operations LP 245 Ward Rd Midlothian, TX 76065	100,000-999,999	Ancillary
Ultra Pure Solutions 11225 Commercial Pkwy Castroville, CA 95012	10,000-99,999	Formulation Component, Repackaging,
Union Specialties Inc. 3 Malcolm Hoyt Dr Newburyport, MA 01950	10,000-99,999	Reactant
United Initiators Inc. 334 Phillips 311 Rd Helena, AR 72342	NR	NR
United Paint & Chemical 24671 Telegraph Rd Southfield, MI 48033	10,000-99,999	Formulation Component
Univar USA Inc. 2600 S Garfield Ave Commerce, CA 90040	NR	NR
Univar USA Inc. 8500 W 68 th St Bedford Park, IL 60501	NR	NR
Univar USA Inc. Providence Branch Harborside Blvd Providence, RI 02905	NR	NR

Table A - 1: Detailed 2015 TRI Activity or Use for NMP by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Univar USA Inc. Morrisville Branch 200 Dean Sievers Pl Morrisville, PA 19067	NR	NR
Univar USA Inc. Norcross Facility 2145 Skyland Ct Norcross, GA 30071	NR	NR
Univar USA Inc. Romulus Branch 13395 Huron River Dr Romulus, MI 48174	NR	NR
UOP LLC 2100 E Orangethrope Ave Anaheim, CA 92806	10,000-99,999	Chemical Processing Aid
US DOD USAF Robins AFB 775 Macon St Building 1555 Robins AFB, GA 31098	1,000-9,999	Ancillary
US Navy NAS Whidbey Island Ault Field 1115 W Lexington St B103 Oak Harbor, WA 982783500	10,000-99,999	Ancillary
US Navy Naval Air Station Corpus Christi 8851 Ocean Dr Corpus Christi, TX 78419	10,000-99,999	Ancillary
Veolia ES Technical Solutions LLC 1704 W 1st St Azusa, CA 91702	10,000-99,999	Repackaging
Veolia ES Technical Solutions LLC 9131 E 96th Ave Henderson, CO 80640	1,000,000-9,999,999	Repackaging
Veolia ES Technical Solutions LLC 7 Mobile Ave Sauget, IL 62201	1,000-9,999	Ancillary
Veolia ES Technical Solutions LLC 125 Factory Ln Middlesex, NJ 08846	100,000-999,999	Formulation Component, Repackaging, Ancillary
Veolia ES Technical Solutions LLC 4301 Infirmiry Rd West Carrollton, OH 45449	1,000,000-9,999,999	Ancillary
Veolia ES Technical Solutions LLC Port Arthur Facility Hwy 73 3.5 Miles W of Taylor Bayou Port Arthur, TX 77640	10,000-99,999	Ancillary
Vertrauen Chemie Solutions Inc. 2170 Buoy Street Memphis, TN 38113	NR	NR
Vibration Control Technologies 1496 Gerber St Ligonier, IN 46767	10,000-99,999	Manufacture Aid
Volkswagen Group of America Chattanooga Operations LLC 8001 Volkswagen Drive Chattanooga, TN 37416	10,000-99,999	Article Component, Ancillary
Von Roll Austral Inc. 1055 Shadix Industrial Way Douglasville, GA 30134	100,000-999,999	Formulation Component, Process Impurity
W L Gore & Associates Inc. 501 Vieves Way Elkton, MD 21921	100,000-999,999	Ancillary

Table A - 1: Detailed 2015 TRI Activity or Use for NMP by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use
Wacker Chemical Corp Polymers Div 854 North Main Street Calvert City, KY 42029	NR	NR
Wafertech LLC 5509 NW Parker St Camas, WA 98607	1,000-9,999	Ancillary
Webb Chemical Service Corp 2708 Jarman Muskegon Heights, MI 49444	NR	NR
Wego Chemical & Mineral Corp 239 Great Neck Rd Great Neck, NY 11021	100,000-999,999	Imported, Sale Distribution
Western Digital Fremont 44100 Osgood Rd Fremont, CA 94539	100,000-999,999	Manufacture Aid
Whitford Corp 47 Park Ave Elverson, PA 19520	10,000-99,999	Formulation Component, Ancillary
Winnebago Industries Inc. 605 W Crystal Lake Rd Forest City, IA 50436	1,000-9,999	Ancillary
Worthen Industries Inc. Upaco Div 3 E Spitbrook Rd Nashua, NH 03060	10,000-99,999	Formulation Component, Ancillary
WRR Environmental Services Co Inc. 5200 Ryder Rd Eau Claire, WI 54701	100,000-999,999	Formulation Component, Ancillary
XALT Energy LLC 2700 South Saginaw Rd Midland, MI 48640	100,000-999,999	Chemical Processing Aid
Yanfeng Automotive Interiors PMSC & CW Southview 1600 S Washington Ave Holland, MI 49423	1,000-9,999	Chemical Processing Aid

Source: EPA (2015b)

Note: NR = Not Reported



Use and Market Profile for Tetrachloroethylene

Contract # EP-W-16-009

June 2017

Prepared for:

Albert Monroe

Economic and Policy Analysis Branch
Chemistry, Economics, and
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Table of Contents

1.	Introduction	1
1.1	Overview of Tetrachloroethylene	1
1.2	Existing Regulations	2
2.	Producers, Production, and Import Volume.....	3
2.1	US Producers and Importers	4
2.2	US Production Volume	5
3.	Use Information and Market Trends.....	9
3.1	Use in Chemical Intermediates	9
3.2	Use in Dry Cleaning.....	9
3.3	Use in Metal Cleaning and Vapor Degreasing.....	10
3.4	Use Information from 2016 CDR	10
3.5	Comparison with EU Data	16
4.	Supply Chain and End-Products	16
5.	Toxics Release Inventory Data	17
6.	References	39

List of Tables

Table 1: Chemical Name, Synonyms, and CASRN for Tetrachloroethylene	1
Table 2: Federal Regulations and Guidelines Concerning Tetrachloroethylene (as of 2014)	2
Table 3: 2016 CDR Manufacturers and Importers of Tetrachloroethylene	4
Table 4: 2016 CDR Production Volume Data for Tetrachloroethylene.....	6
Table 5: National Production Volume Data for Tetrachloroethylene from 1986-2015 (Pounds).....	9
Table 6: 2016 CDR Industrial Use and Production Data for Tetrachloroethylene	11
Table 7: 2016 CDR Consumer and Commercial Use and Production Data for Tetrachloroethylene.....	14
Table 8: Tetrachloroethylene Uses in the US vs. the EU.....	16
Table 9: Summary of Sectors and Uses from End-Products Containing Tetrachloroethylene	16
Table 10: Summary of 2015 TRI Activity or Use by Number of Facilities for Tetrachloroethylene.....	17
Table 11: Production-Related Waste and Number of Facilities Reporting Tetrachloroethylene to TRI in 2015, by Industry	18
Table 12: Detailed 2015 TRI Activity or Use for Tetrachloroethylene by Facility	19

Contributors

The EPA subject matter expert responsible for this report is Albert Monroe of the Economic and Policy Analysis Branch; Chemistry, Economics, and Sustainable Strategies Division; Office of Pollution Prevention and Toxics. Analytical and draft preparation support was provided by Abt Associates, Inc. under EPA Contract No. EP-W-16-009.

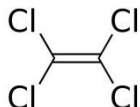
1. Introduction

1.1 Overview of Tetrachloroethylene

Tetrachloroethylene (or Perc) is a colorless, nonflammable organic solvent used in a variety of applications, including cleaning textiles in dry cleaning facilities, degreasing metal parts, and serving as a process solvent for desulfurizing coal (Hickman, 2000). Perc was also used extensively as an intermediate in the manufacture of chlorofluorocarbon (CFC) refrigerants until the Montreal Protocol banned production of CFCs for all but explicitly permitted uses in 1995 (Mannsville Chemical Products Corp., 1999). Its primary use now is a chemical intermediate, specifically as the raw material for the production of hydrofluorocarbon (HFC) 134a, which has replaced CFCs (ICIS, 2011). It is also used in the production of hydrochlorofluorocarbons (HCFCs) 123 and 124, as well as HFC 125 (ICIS, 2011). Perc is usually produced as a co-product along trichloroethylene or carbon tetrachloride from hydrocarbons, partially chlorinated hydrocarbons, and chlorine (Hickman, 2000).

Perc is reasonably anticipated to be a human carcinogen based on results from experimental animal studies (NTP, 2014). Rats and mice dosed with Perc orally or via inhalation exposure had increased incidences of kidney, liver, and lymphoid tumors. Human studies have suggested an association between Perc exposure from drinking water and cancer, but uncertainties exist in these data. In the short-term, exposure to Perc can irritate the skin, eyes, and upper respiratory tract. Headache, dizziness, drowsiness, ataxia, and mood changes have been reported from acute inhalation exposure to Perc. At higher levels of exposure, coma and seizures have occurred. Dry cleaning workers exposed to 8-15 ppm Perc had deficits in short-term memory tests for visual designs, reaction times, perceptual function, attention, and intellectual function. Long-term exposure to Perc may damage the liver and kidneys (NTP, 2014; ATSDR, 2014). EPA conducted an Integrated Risk Information System (IRIS) assessment on Perc which was last revised in February 2012 (U.S. EPA, 2012).

Table 1: Chemical Name, Synonyms, and CASRN for Tetrachloroethylene

CAS RN	127-18-4
Synonyms	Perchloroethylene (perc); 1,1,2,2-tetrachloroethylene; 1,1,2,2-Tetrachloroethene; 4-01-00-00715 (Beilstein Handbook Reference); AI3-01860; BRN 1361721; Carbon bichloride; Carbon dichloride; Caswell No. 827; CCRIS 579; Czterochloroetylen; Dilatin PT; EC 204-825-9; EINECS 204-825-9; EPA Pesticide Chemical Code 078501; Ethene, tetrachloro-; Ethylene tetrachloride; Ethylene, tetrachloro-; HSDB 124; NCI-C04580; NSC 9777; PCE; Perawin; Perchloorethyleen, per; Perchlor; Perchloraethylen, per; Perchlorethylene, per; Perchloroethylene; PERK; RCRA waste number U210; Tetrachlooretheen; Tetrachloraethen; Tetrachlorethylene; Tetrachloroethene; Tetrachloroethylene; Tetrachloroethylene (IUPAC); Tetrachloroetene; UN 1897; UNII-TJ904HH8SN
Molecular Formula	C ₂ Cl ₄
Structure	

Trade Names	Ankilostin; Antisal 1; Dee-Solve; Didakene; Dowper; ENT 1860; Fedal-Un; Nema; Percdene; Percosolv; Perklone; PerSec; Tetlen; Tetracap; Tetraleno; Tetravec; Tetroguer; Tetropil; Perawin; Tetralex; Dowclene EC
Source: ATSDR, 2014; National Library of Medicine (NLM) n.d.	

1.2 Existing Regulations

As of 2014, a number of U.S. Federal agencies have issued regulations or guidelines concerning Perc as described in Table 2.

Table 2: Federal Regulations and Guidelines Concerning Tetrachloroethylene (as of 2014)

Agency or Regulation	Description of Regulation or Guideline
Coast Guard, Department of Homeland Security	Minimum requirements have been established for safe transport of tetrachloroethylene on ships and barges.
Consumer Product Safety Commission (CPSC)	Visual novelty devices containing tetrachloroethylene have labeling requirements.
Department of Transportation (DOT)	Tetrachloroethylene is considered a hazardous material and a marine pollutant, and special requirements have been set for marking, labeling, and transporting this material, including transporting it in tank cars.
Clean Air Act (EPA)	<i>National Emission Standards for Hazardous Air Pollutants:</i> Listed as a hazardous air pollutant. <i>New Source Performance Standards:</i> Manufacture of tetrachloroethylene is subject to certain provisions for the control of volatile organic compound emissions. <i>Urban Air Toxics Strategy:</i> Identified as one of 33 hazardous air pollutants that present the greatest threat to public health in urban areas
Clean Water Act (EPA)	<i>Effluent guidelines:</i> Listed as a toxic pollutant. <i>Water quality criteria:</i> Based on fish or shellfish and water consumption = 0.69 µg/L; based on fish or shellfish consumption only = 3.3 µg/L.
Comprehensive Environmental Response, Compensation, and Liability Act (EPA)	Reportable quantity (RQ) = 100 lb.
Emergency Planning and Community Right-To-Know Act (EPA)	<i>Toxics Release Inventory:</i> Listed substance subject to reporting requirements.
Resource Conservation and Recovery Act (EPA)	<i>Characteristic Hazardous Waste:</i> Toxicity characteristic leaching procedure (TCLP) threshold = 0.7 mg/L. <i>Listed Hazardous Waste:</i> Waste codes for which the listing is based wholly or partly on the presence of tetrachloroethylene = U210, F001, F002, F024, F025, K016, K019, K020, K073, K116, K150, K151.

Agency or Regulation	Description of Regulation or Guideline
	Listed as a hazardous constituent of waste.
Safe Drinking Water Act (EPA)	Maximum contaminant level (MCL) = 0.005 mg/L.
Food and Drug Administration (FDA)	Maximum permissible level in bottled water = 0.005 mg/L.
Occupational Safety and Health Administration (OSHA)	Permissible exposure limit (PEL) = 100 ppm. Ceiling concentration = 200 ppm (5 min in any 3 h). Acceptable peak exposure = 300 ppm.
American Conference of Governmental Industrial Hygienists (ACGIH)	Threshold limit value – time-weighted average (TLV-TWA) = 25 ppm. Threshold limit value – short-term exposure limit (TLV-STEL) = 100 ppm.
National Institute for Occupational Safety and Health (NIOSH)	Recommends that workplace exposure levels of substance be minimized. Immediately dangerous to life and health (IDLH) limit= 150 ppm. Listed as a potential occupational carcinogen.
Source: NTP, 2014	

The state of California’s Air Resources Board (ARB) identified Perc as a toxic air contaminant in 1991 and in response, adopted the Airborne Toxic Control Measure for Emissions of Perc from Dry Cleaning Operations (Dry Cleaning ATCM) to reduce emissions (ARB, 2016). Though emissions had been reduced by about 70%, the ARB passed an amendment in 2007 that mandates the phase-out of Perc from all dry cleaning machines and related equipment by January 1, 2023 (ARB, 2016). A \$10,000 grant is available to individual dry cleaning facilities to switch from Perc dry cleaning systems to non-toxic and non-smog forming systems such as water-based and CO₂ cleaning systems (ARB, 2007).

Outside the U.S., the Canadian government has created regulations to prevent Perc spills, manage the way residues and wastewater containing Perc are collected and disposed of, and require the use of dry cleaning machines that recover more Perc (Environment and Climate Change Canada, 2015). Canada has also created an allowance system that sets limits on the quantities of Perc that can be used each year in degreasing operations based on historical uses (Environment and Climate Change Canada, 2016). The European Union (EU) conducted a risk assessment on Perc but has not yet made regulatory decisions regarding the chemical (ECHA, n.d.).

This memo provides an overview of the U.S. producers, production, and import volume of Perc (Section 2), use information and market trends (Section 3), supply chain and end-product information (Section 4) and Toxic Release Inventory data (Section 5).

2. Producers, Production, and Import Volume

Perc was first prepared in 1821 with U.S. commercial production beginning in 1925. U.S. production quickly rose to 1.1 million pounds in 1941 and peaked in 1980 at 763 million pounds. While annual production declined by 60% from 1980 to 1993, U.S. demand grew from 280 million pounds to 318 million pounds from 1996 to 1999 (NTP, 2014).

As of 2009, Perc was manufactured by 15 companies worldwide including 3 in the U.S. and was distributed by 115 suppliers including 43 in the U.S. U.S. imports have ranged from 140 million pounds in 1985, about 75 million pounds in 1990, and only 26.5 million pounds in 2012. U.S. exports have increased from 22 million pounds in 1985 to an average of 50 million pounds from 1998 to 2008 to 83.8 million pounds in 2012 (NTP, 2014; ATSDR, 2014).

2.1 US Producers and Importers

Table 3 contains U.S. manufacturers and importers for Perc as listed in the public 2016 Chemical Data Reporting (CDR) data (U.S. EPA, 2017a). For the 2016 CDR cycle, manufacturers of certain chemicals were required to report information about those chemicals manufactured (including imported) in amounts of 25,000 pounds or more at each of their sites during calendar year 2015. The 2016 CDR indicates that 22 sites manufactured or imported Perc in the U.S. in 2015 (U.S. EPA, 2017a).

Table 3: 2016 CDR Manufacturers and Importers of Tetrachloroethylene

Company	City	State	Manufacture	Import
Allchem Industries Holding Corp	Gainesville	FL	No	Yes
Axiall Corporation	Westlake	LA	Yes	No
LORD Corporation	Cary	NC	No	Yes
MAK Chemicals Inc.	Passaic	NJ	NDR	NDR
Olin Corporation	Clayton	MO	NDR	NDR
Olin Corporation	Freeport	TX	Yes	No
Olin Corporation	Plaquemine	LA	Yes	No
Sempre Avant LLC	Pearland	TX	Yes	No
Solvay USA Inc	Princeton	NJ	No	Yes
Superior Oil Company, Inc	Indianapolis	IN	NDR	NDR
Tarr LLC	Portland	OR	No	Yes
Transchem, Inc.	Carlsbad	CA	No	Yes
United Refining Company	Warren	PA	No	Yes
Univar INC.	Redmond	WA	NDR	NDR
Wego Chemical Group	Great Neck	NY	No	Yes
CBI	CBI	CBI	No	Yes
CBI (Site: Occidental Chemical Corp)	Geismar	LA	CBI	CBI
CBI (Site: Tricon International, LTD)	Houston	TX	No	Yes
CBI (Site: Geon Oxy Vinyl)	Laporte	TX	CBI	CBI
CBI (Site: TRInternationa Inc)	Seattle	WA	No	Yes
CBI (Site: CRC Industries)	Warminster	PA	NDR	NDR
CBI (Site: Greenchem)	West Palm Beach	FL	CBI	CBI

Notes: CBI = confidential business information; NDR = no data reported
Source: U.S. EPA, 2017a

2.2 US Production Volume

Table 4 presents the 2012, 2013, 2014, and 2015 production volume data by producer, as reported in the public 2016 CDR. It is possible that other sites manufacture or import the chemicals, but are not listed in the public CDR database, because they may have claimed their production as CBI or had production volumes below the 25,000-pound annual reporting threshold.

Table 4: 2016 CDR Production Volume Data for Tetrachloroethylene

Company	Site	Manufactured Volume	Imported Volume	2012 Total Production Volume	2013 Total Production Volume	2014 Total Production Volume	2015 Total Production Volume ^a
Allchem Industries Holding Corp	Allchem Industries Industrial Chemicals Group, Inc 6010 NW 1st Pl Gainesville, FL 32607	Withheld	Withheld	Withheld	Withheld	Withheld	Withheld
Axiall Corporation	Axiall Corporation 1300 Ppg Drive Westlake, LA 70669	Withheld	Withheld	Withheld	Withheld	Withheld	Withheld
LORD Corporation	LORD Corporation 111 Lord Dr Cary, NC 27511	Withheld	Withheld	Withheld	Withheld	Withheld	Withheld
MAK Chemicals Inc.	MAK Chemicals Inc 90 Dayton Ave Passaic, NJ 07055	Withheld	Withheld	Withheld	Withheld	Withheld	Withheld
Olin Corporation	Blue Cube Operations LLC 21255 Highway 1 S Plaquemine, LA 707650150	Withheld	Withheld	Withheld	Withheld	Withheld	Withheld
Olin Corporation	Olin Blue Cube 2301 N. Brazosport Blvd. Freeport, TX 77541	Withheld	Withheld	Withheld	Withheld	Withheld	Withheld
Olin Corporation	Olin Corporation 190 Carondelet Plz Clayton, MO 63105	Withheld	Withheld	Withheld	Withheld	Withheld	Withheld
Sempre Avant LLC	Solvents & Chemicals 4704 Shank Rd. Pearland, TX 77581	Withheld	Withheld	Withheld	Withheld	Withheld	Withheld

Company	Site	Manufactured Volume	Imported Volume	2012 Total Production Volume	2013 Total Production Volume	2014 Total Production Volume	2015 Total Production Volume ^a
Solvay USA Inc	Solvay USA Inc 504 Carnegie Ctr Princeton, NJ 08540	Withheld	Withheld	Withheld	Withheld	Withheld	Withheld
Superior Oil Company, Inc	Superior Oil Company, Inc. 1402 N. Capitol Ave. Indianapolis, IN 46202	Withheld	Withheld	Withheld	Withheld	Withheld	Withheld
Tarr LLC	Tarr Incorporated 2429 N. Borthwick Portland, OR 97227-1704	Withheld	Withheld	Withheld	Withheld	Withheld	Withheld
Transchem, Inc.	Transchem Corporate 2141 Palomar Airport Rd Carlsbad, CA 92011	Withheld	Withheld	Withheld	Withheld	Withheld	Withheld
United Refining Company	United Refining Company 15 Bradley Street Warren, PA 16365	Withheld	Withheld	Withheld	Withheld	Withheld	Withheld
Univar Inc.	Univar USA Inc 17411 Ne Union Hill Rd. Redmond, WA 98052	Withheld	Withheld	Withheld	Withheld	Withheld	Withheld
Wego Chemical Group	Wego Chemical & Mineral Corp 239 Great Neck Road Great Neck, NY 11021-3301	Withheld	Withheld	Withheld	Withheld	Withheld	Withheld
CBI	CBI	Withheld	Withheld	Withheld	Withheld	Withheld	Withheld
CBI	CRC Industries Inc 885 Louis Drive Warminster, PA 18974-2869	Withheld	Withheld	Withheld	Withheld	Withheld	Withheld

Company	Site	Manufactured Volume	Imported Volume	2012 Total Production Volume	2013 Total Production Volume	2014 Total Production Volume	2015 Total Production Volume ^a
CBI	Geon Oxy Vinyl Laporte Plant 2400 Miller Cutoff Road Laporte, TX 77571-9759	Withheld	Withheld	Withheld	Withheld	Withheld	Withheld
CBI	Greenchem 222 Clematis St West Palm Beach, FL 33401	Withheld	Withheld	Withheld	Withheld	Withheld	Withheld
CBI	Occidental Chemical Corp Geismar Plant 8318 Ashland Road Geismar, LA 70734-3513	Withheld	Withheld	Withheld	Withheld	Withheld	Withheld
CBI	Tricon International, Ltd 777 Post Oak Blvd, Suite 550 Houston, TX 77056	Withheld	Withheld	Withheld	Withheld	Withheld	Withheld
CBI	TRInternational Inc 600 Stewart Street Seattle, WA 98101	Withheld	Withheld	Withheld	Withheld	Withheld	Withheld

Note: The 2015 total production volume (domestically manufactured and imported) of the chemical used at the reporting site represents the volume of the chemical that did not leave the manufacturing site.
 "Withheld" in the CDR public database indicates that the national production volume of a chemical was unable to be aggregated in order to protect to CBI claims.
 Source: U.S. EPA, 2017a

Table 5 presents the historic U.S. production volume data for tetrachloroethylene submitted by companies under the non-confidential 1986, 1990, 1994, 1998, 2002, and 2006 Inventory Update Reporting (IUR) rule and the 2012 and 2016 CDR. While the reporting threshold for manufacturing information was 25,000 pounds starting with the 2006 IUR, the reporting threshold for manufacturing information was 10,000 pounds from 1986 to 2002.

Table 5: National Production Volume Data for Tetrachloroethylene from 1986-2015 (Pounds)

1986	1990	1994	1998	2002	2006	2011	2015
>500M – 1B	>500M – 1B	>100M – 500M	>100M – 500M	>100M – 500M	500M- <1B	420,694,838	324,240,744
Source: U.S. EPA, n.d.; U.S. EPA 2010; U.S. EPA, 2014; U.S. EPA, 2017b							

3. Use Information and Market Trends

Tetrachloroethylene has a variety of applications. Its known uses include: solvent for dry cleaning, vapor degreasing, cleaning/degreasing metals, fats, greases, waxes, rubbers, gums, decaffeinating coffee; extraction solvent (oils, fat); flotation solvent (coal separation); heat exchange fluid; in copying machines; vermifuge; drying agent; scouring agent, sizing agent, and desizing agent in textiles; intermediate in manufacturing of trichloroacetic acid, fluorocarbons, paint removers, printing inks; blowing agent adjuvant in food-contact foamed PS; in food packaging adhesives; and antihelmintic drug (veterinary medicine) (Synapse Information Resources, Inc., 2009).

In the 1970s, Perc was used domestically for dry cleaning and textile processing (58%), metal cleaning (18%), chemical intermediates (12%), and other uses (12%). Perc use in the dry cleaning industry declined in the 1990s due to government regulation concerning workplace exposure. Currently, Perc is primarily used as a chemical intermediate (65%) and as a cleaning solvent in dry cleaning (15%) and metal cleaning (10%) (NTP, 2014). Demand for Perc peaked in the 1980s due to its use as a feedstock in the phase-out of CFCs under the Montreal Protocol and tighter equipment and solvent recovery in the dry cleaning and metal cleaning industries so these industries used less solvent (Hickman, 2000).

3.1 Use in Chemical Intermediates

Perc's largest use is as a chemical intermediate in the production of fluorinated compounds. It is the raw material for producing hydrofluorocarbon (HFC) refrigerants (134a and 125), which are alternatives to chlorofluorocarbon (CFC) and hydrochlorofluorocarbon (HCFC). It is also used in the production of HCFCs 123 and 124 (ICIS, 2011). Perc was heavily used to manufacture trichlorotrifluoroethane (CFC-113) until CFC-113 was drastically reduced in the U.S. by the Montreal Protocol (Mannsville Chemical Products Corp., 1999). Perc is still used to make smaller quantities of CFC-113 for Montreal Protocol-exempt uses (Honeywell, 2017).

3.2 Use in Dry Cleaning

Beginning in the 1930s, perc became the dominant solvent used in dry cleaning facilities. Perc is non-flammable and effectively dissolves fats, greases, waxes, and oils without harming natural or human-made fibers. These properties enabled it to replace traditional petroleum solvents. (Dow, 2008; ATSDR, 2014; Tirsell, 2000). The demand for perc dry cleaning solvents has steadily declined as a result of the

improved efficiency of dry cleaning equipment, increased chemical recycling, the popularity of wash-and-wear fabrics that eliminate the need for dry cleaning (ATSDR, 2014).

Approximately 60% of dry cleaning machines now use perc as a solvent (DLI/NCA, 2017). In recent years, there is some evidence of a significant shift away from perc in dry cleaning. In 1991, EPA estimated that 83% of all dry cleaning facilities used perc as solvent (EPA, 1991). In 2008, the Halogenated Solvents Industry Association (HSIA) estimated that 70% of dry cleaners used perc as dry cleaning solvent (HSIA, 2008). Similarly, in 2011, King County, WA conducted a profile of the dry cleaning industry and found that 69% of respondents (105 of the 152 respondents) used perc in their primary machine (Whittaker and Johanson, 2011). According to the dry cleaning industry, a majority of new perc dry cleaning machines are sold in locations where local fire codes preclude the use of Class III combustible alternative solvents or where the nature of the dry cleaning operation requires the use of perc. (DLI/NCA, 2017).

In 2006, EPA issued an air toxics regulation under the Clean Air Act mandating that dry cleaners reduce their emissions of perc and facilities located in residential buildings phase out its use by 2020 (ATSDR, 2014; U.S. EPA, 2016a). To support California's phase-out of Perc in dry cleaning systems by 2023, ARB identified a number of alternative dry cleaning solvents including: Water-based cleaning, Carbon dioxide (CO₂), Hydrocarbon solvent (DF-2000™ Fluid, EcoSolv®, and Shell Sol 140 HT), GreenEarth® solvent (composed of volatile methyl siloxane), Propylene glycol ether (Rynex™ or Rynex3), Stoddard solvent, and PureDry® solvent (a blend of hydrocarbon and chemical additive) (ARB, 2007).

3.3 Use in Metal Cleaning and Vapor Degreasing

Perc is also used as a vapor and liquid degreasing agent. It can be used to dissolve many organic compounds, select inorganic compounds and high-melting pitches and waxes making it ideal for cleaning contaminated metal parts and other fabricated materials (ATSDR, 2014). It is a very good solvent for greases, fats, waxes, oils, bitumen, tar and many natural and synthetic resins for use in chemical cleaning systems, degreasing light and heavy metals, degreasing pelts and leather (tanning), extraction of animal and vegetable fats and oils, and textile dyeing (solvent for dye baths) (Stoye, 2000).

3.4 Use Information from 2016 CDR

Table 6 indicates the industrial uses of Perc from 2016 CDR data including in basic organic chemical manufacturing of intermediates and solvents (for cleaning or degreasing); petroleum refineries; paint and coating manufacturing; pesticide, fertilizer, and other agricultural chemical manufacturing; petrochemical manufacturing; adhesive manufacturing; fabricated metal production; soap cleaning compound, and toilet preparation manufacturing; and industrial gas manufacturing (U.S. EPA, 2017a).

Table 6: 2016 CDR Industrial Use and Production Data for Tetrachloroethylene

Manufacturing Site	Sector	Function Category	Type of Processing or Use	Percent of Production Volume
Allchem Industries Holding Corp. 6010 NW 1st Pl Gainesville, FL 32607	Fabricated metal product manufacturing	Solvents (for cleaning and degreasing)	Use—non-incorporative activities	NKRA
Axiall Corporation 1300 Ppg Drive Westlake, LA 70669	All other basic organic chemical manufacturing	Solvents (for cleaning and degreasing)	Processing—repackaging	CBI
	Industrial gas manufacturing	Functional fluids (closed systems)	Processing as a reactant	CBI
	Petroleum refineries	Intermediates	Processing as a reactant	CBI
	Wholesale and retail trade	Solvents (for cleaning and degreasing)	Processing as a reactant	CBI
CRC Industries Inc ¹ 885 Louis Drive Warminster, PA 18974-2869	NDR	NDR	NDR	NDR
Geon Oxy Vinyl Laporte Plant ¹ 2400 Miller Cutoff Road Laporte, TX 77571-9759	All other basic organic chemical manufacturing	Intermediates	Processing as a reactant	100
Greenchem ¹ 222 Clematis St West Palm Beach, FL 33401	NKRA	NKRA	NKRA	40
	Soap, cleaning compound, and toilet preparation manufacturing	Solvents (for cleaning and degreasing)	Processing—incorporation into formulation, mixture, or reaction product	60
LORD Corporation 111 Lord Dr Cary, NC 27511	Adhesive manufacturing	Adhesives and sealant chemicals	Processing—incorporation into formulation, mixture, or reaction product	100
MAK Chemicals Inc. 90 Dayton Ave Passaic, NJ 07055	Wholesale and retail trade	Solvents (which become part of product formulation or mixture)	Processing as a reactant	100
Occidental Chemical Corp ¹ 8318 Ashland Road Geismar, LA 70734-3513	CBI	Intermediates	Processing as a reactant	CBI
	CBI	Intermediates	Processing as a reactant	CBI

Manufacturing Site	Sector	Function Category	Type of Processing or Use	Percent of Production Volume
	CBI	Solvents (which become part of product formulation or mixture)	Processing—incorporation into formulation, mixture, or reaction product	CBI
	CBI	Intermediates	Processing—repackaging	CBI
Olin Corporation 21255 Highway 1 S Plaquemine, LA 707650150	All other basic organic chemical manufacturing	Intermediates	Processing as a reactant	80
	All other basic organic chemical manufacturing	Solvents (for cleaning and degreasing)	Use—non-incorporative activities	10
	Paint and coating manufacturing	Solvents (which become part of product formulation or mixture)	Processing—incorporation into formulation, mixture, or reaction product	2
	Pesticide, fertilizer, and other agricultural chemical manufacturing	Processing aids, not otherwise listed	Use—non-incorporative activities	4
	Petrochemical manufacturing	Processing aids, specific to petroleum production	Use—non-incorporative activities	4
Olin Corporation 190 Carondelet Plz Clayton, MO 63105	NDR	NDR	NDR	NDR
Olin Corporation 2301 N. Brazosport Blvd. Freeport, TX 77541	All other basic organic chemical manufacturing	Intermediates	Processing as a reactant	80
	All other basic organic chemical manufacturing	Solvents (for cleaning and degreasing)	Use—non-incorporative activities	10
	Paint and coating manufacturing	Solvents (which become part of product formulation or mixture)	Processing—incorporation into formulation, mixture, or reaction product	2
	Pesticide, fertilizer, and other agricultural chemical manufacturing	Processing aids, not otherwise listed	Use—non-incorporative activities	4

Manufacturing Site	Sector	Function Category	Type of Processing or Use	Percent of Production Volume
	Petrochemical manufacturing	Processing aids, specific to petroleum production	Use—non-incorporative activities	4
Sempre Avant LLC 4704 Shank Rd. Pearland, TX 77581	All other chemical product and preparation manufacturing	Solvents (which become part of product formulation or mixture)	Processing—incorporation into formulation, mixture, or reaction product	100
Solvay USA Inc 504 Carnegie Ctr Princeton, NJ 08540	Fabricated metal product manufacturing	Solvents (for cleaning and degreasing)	Processing—incorporation into formulation, mixture, or reaction product	100
Superior Oil Company, Inc. 1402 N. Capitol Ave. Indianapolis, IN 46202	NDR	NDR	NDR	NDR
Tarr LLC 2429 N. Borthwick Portland, OR 97227-1704	NKRA	NKRA	NKRA	100
Transchem, Inc. 2141 Palomar Airport Rd Carlsbad, CA 92011	NDR	NDR	NDR	NDR
Tricon International, Ltd ¹ 777 Post Oak Blvd, Suite 550 Houston, TX 77056	Wholesale and retail trade	CBI	Processing—incorporation into formulation, mixture, or reaction product	CBI
TRInternational Inc 600 Stewart Street Seattle, WA 98101	NKRA	NKRA	NKRA	NKRA
United Refining Company 15 Bradley Street Warren, PA 16365	Petroleum refineries	Solvents (for cleaning and degreasing)	Processing—incorporation into formulation, mixture, or reaction product	100
Univar Inc. 17411 Ne Union Hill Rd. Redmond, WA 98052	NDR	NDR	NDR	NDR
Wego Chemical & Mineral Group 239 Great Neck Road Great Neck, NY 11021-3301	Soap, cleaning compound, and toilet preparation manufacturing	Solvents (for cleaning and degreasing)	Processing—incorporation into formulation, mixture, or reaction product	100
CBI	NDR	NDR	NDR	NDR

Manufacturing Site	Sector	Function Category	Type of Processing or Use	Percent of Production Volume
Notes: ¹ Parent company names are presented in the first column except in the cases when the company claims their name as CBI, but reports the site name. In these cases, the site name is presented in the first column. CBI = confidential business information; NDR = no data reported; NKRA= not known or reasonably ascertainable Source: U.S. EPA, 2017a				

Table 7 contains consumer and commercial use data for Perc from the 2016 CDR database. Only nine of the 22 manufacturing sites reported consumer and commercial product categories including automotive care products, cleaning and furnishing care products, and lubricants and greases (U.S. EPA, 2017a).

Table 7: 2016 CDR Consumer and Commercial Use and Production Data for Tetrachloroethylene

Manufacturing Site	Consumer Use Product Category	Commercial Use Product Category	Commercial or Consumer Use	Percent of Production Volume
Allchem Industries Holding Corp 6010 NW 1st Pl Gainesville, FL 32607	NDR			
Axiall Corporation 1300 Ppg Drive Westlake, LA 70669	NDR			
CRC Industries Inc ¹ 885 Louis Drive Warminster, PA 18974-2869	NDR			
Geon Oxy Vinyl Laporte Plant ¹ 2400 Miller Cutoff Road Laporte, TX 77571-9759	NDR			
Greenchem ¹ 222 Clematis St West Palm Beach, FL 33401	NDR	Cleaning and furnishing care products	Commercial	60
		NKRA	NKRA	40
LORD Corporation 111 Lord Dr Cary, NC 27511	NDR			
MAK Chemicals Inc. 90 Dayton Ave Passaic, NJ 07055	NDR	Other	Commercial	100
Occidental Chemical Corp ¹ Geismar Plant 8318 Ashland Road Geismar, LA 70734-3513	Automotive care products	Automotive care products	Both	CBI
Olin Corporation 190 Carondelet Plz	NDR			

Manufacturing Site	Consumer Use Product Category	Commercial Use Product Category	Commercial or Consumer Use	Percent of Production Volume
Clayton, MO 63105				
Olin Corporation 21255 Highway 1 S Plaquemine, LA 707650150	NDR	Cleaning and furnishing care products	Commercial	10
Olin Corporation 2301 N. Brazosport Blvd. Freeport, TX 77541	NDR	Cleaning and furnishing care products	Commercial	10
Sempre Avant LLC 4704 Shank Rd. Pearland, TX 77581	NDR			
Solvay USA Inc 504 Carnegie Ctr Princeton, NJ 08540	NDR			
Superior Oil Company, Inc 1402 N. Capitol Ave. Indianapolis, IN 46202	NDR			
Tarr LLC 2429 N. Borthwick Portland, OR 97227-1704	NKRA			
Transchem, Inc. 2141 Palomar Airport Rd Carlsbad, CA 92011	NDR	Lubricants and greases	Commercial	100
Tricon International, Ltd ¹ 777 Post Oak Blvd, Suite 550 Houston, TX 77056	CBI	CBI	CBI	CBI
TRInternational Inc ¹ 600 Stewart Street Seattle, WA 98101	NKRA			
United Refining Company 15 Bradley Street Warren, PA 16365	NDR	Lubricants and greases	Commercial	100
Univar Inc. 17411 Ne Union Hill Rd. Redmond, WA 98052	NDR			
Wego Chemical Group 239 Great Neck Road Great Neck, NY 11021-3301	NDR	Cleaning and furnishing care products	Commercial	100
CBI	NDR	Other	Commercial	100
Notes: CBI = confidential business information; NDR = no data reported; NKRA = not known or reasonably ascertainable; N/A = non-applicable ¹ . Parent company names are presented in the first column except in the cases when the company claims their name as CBI, but reports the site name. In these cases, the site name is presented in the first column. Source: U.S. EPA, 2017a				

3.5 Comparison with EU Data

Table 8 presents a comparison of the use and production volume information identified in the EU's Risk Assessment Report Tetrachloroethylene (ECHA, 2005) and the uses identified in the U.S.

Table 8: Tetrachloroethylene Uses in the US vs. the EU

Use	Percentage of Production Volume	
	US	EU
Chemical Intermediate	60	18
Dry Cleaning	18	38
Surface Preparation/Cleaning	18	9
Oil Refining Catalyst	2	0
Export	0	34
Other	2	1
Total	100	100

Source: ECHA, 2005; Dow, 2008

4. Supply Chain and End-Products

Perc's supply chain is influenced by manufacturers and importers of the chemical, and the end products in which it is used. Table 9 presents an overview of the industry sectors and uses for the end-products containing Perc identified in this analysis. A more detailed spreadsheet with information on specific products containing Perc is attached as a separate file. While not a complete list, this information provides a glimpse of the manufacturers, importers, and end-products containing Perc as identified by EPA CPCat data, the National Institute for Health's (NIH) Household Product Database, the State Coalition for Remediation of Drycleaners, and other resources including Google searches for which Material Safety Data Sheets (MSDS) could be readily found. EPA CPCat data included over 700 products manufactured by over 400 companies. The Household Product Database contained 37 products from the categories of arts and crafts, auto products, commercial/institutional, home maintenance, and inside the home.

Table 9: Summary of Sectors and Uses from End-Products Containing Tetrachloroethylene

Sectors	End-Product Uses
Arts and Crafts	Adhesives
Automotive and Marine	Brake cleaners; engine degreasers; lubricants for brakes, engines, and other metal parts; penetrating oils; tire inflator and sealers; marine cleaner and degreasers; gasket removers
Carpet Cleaning	Spotting and stain removers
Dry Cleaning	Solvents; detergents; additives; spotting agents
Equipment Degreasing and Cleaning	Cleaners and degreasers for cables, motors, and other metal parts

Sectors	End-Product Uses
Fabrics and Textiles	Water and stain repellants; textile inks; fabric protectors; ink removers; suede protectors; shoe waterproofing and adhesives
Electronic and Optics	Electronic and component cleaners; specialty cleaners
Vapor Degreasing and General Cleaning	Vapor degreasers; general purpose cleaners and degreasers; mold cleaners; polishing agents (wood, stone, metal); wood cleaners
Paints and Coatings	Vandal mark removers; masking papers; coatings; paint strippers; spray snow; sealants
Petroleum	Oil refining catalysts
Guns	Gun oil or lubricants; ammunition sealants; gun cleaners
Laboratories	Laboratory applications (evaluation tests; calibration)
Source: EPA CPCat, NIH Household Product Database, State Coalition for Remediation of Drycleaners, and other resources including Google searches; U.S. EPA, 2017b.	

5. Toxics Release Inventory Data

Facilities manufacturing, processing, or otherwise using tetrachloroethylene are required to report releases to EPA's Toxic Release Inventory (TRI). Under the most recent TRI for the year 2015, 216 sites reported releasing quantities of tetrachloroethylene at their facilities. Table 12 presents each reporting facility, the maximum amount of the chemical present at the facility per year, and how tetrachloroethylene is produced or used at the facility. A key to the activities and uses is provided at the bottom of the table. A summary of the activity or use of tetrachloroethylene by number of facilities is provided in Table 10 and a summary of industries with facilities reporting tetrachloroethylene is provided in Table 11.

Table 10: Summary of 2015 TRI Activity or Use by Number of Facilities for Tetrachloroethylene

Activity or Use	Number of Facilities
Ancillary	73
Article Component	3
Byproduct	15
Chemical Processing Aid	74
Formulation Component	30
Imported	6
Manufacture Aid	22
Manufacture Impurity	5
Process Impurity	12
Produce	21

Reactant	17
Repackaging	28
Sale Distribution	7
Used Processed	10
Source: U.S. EPA, 2015	

Table 11: Production-Related Waste and Number of Facilities Reporting Tetrachloroethylene to TRI in 2015, by Industry

NAICS Industry Code	Number of Facilities	Production-Related Waste (lb)
325180 Other basic inorganic chemical manufacturing	3	34,043,947
325199 All Other Basic Organic Chemical Manufacturing	15	9,643,014
336413 Other Aircraft Parts and Auxiliary Equipment Manufacturing	7	6,951,921
336411 Aircraft Manufacturing	3	4,464,186
562211 Hazardous Waste Treatment and Disposal	16	2,791,757
325211 Plastics Material and Resin Manufacturing	5	2,299,181
327310 Cement Manufacturing	11	1,813,750
562920 Materials Recovery Facilities	2	940,551
325520 Adhesive Manufacturing	5	722,136
562213 Solid Waste Combustors and Incinerators	1	364,255
325998 All Other Miscellaneous Chemical Product and Preparation Manufacturing	13	172,286
424690 Other Chemical and Allied Products Merchant Wholesalers	24	140,860
314999 All Other Miscellaneous Textile Product Mills	1	112,960
324191 Petroleum Lubricating Oil and Grease Manufacturing	3	91,633
327992 Ground or Treated Mineral and Earth Manufacturing	1	91,426
325120 Industrial Gas Manufacturing	2	54,305
928110 National Security	1	52,948
324110 Petroleum Refineries	68	45,256
336214 Travel Trailer and Camper Manufacturing	1	37,845
332119 Metal Crown, Closure, and Other Metal Stamping (except Automotive)	1	28,468
336412 Aircraft Engine and Engine Parts Manufacturing	1	22,783
562219 Other Nonhazardous Waste Treatment and Disposal	1	22,571
332813 Electroplating, Plating, Polishing, Anodizing, and Coloring	2	21,254
325110 Petrochemical Manufacturing	6	18,740
332215 Metal kitchen cookware, utensil, cutlery, and flatware (except precious) manufacturing	1	16,050
332999 All Other Miscellaneous Fabricated Metal Product Manufacturing	1	14,486
325611 Soap and Other Detergent Manufacturing	3	12,387

NAICS Industry Code	Number of Facilities	Production-Related Waste (lb)
339992 Musical Instrument Manufacturing	1	11,749
332992 Small Arms Ammunition Manufacturing	1	11,544
332812 Metal coating, engraving (except jewelry and silverware), and allied services to manufacturers	1	11,237
335991 Carbon and Graphite Product Manufacturing	1	10,485
332721 Precision Turned Product Manufacturing	1	6,603
325510 Paint and Coating Manufacturing	2	4,633
325612 Polish and Other Sanitation Good Manufacturing	3	1,163
333992 Welding and Soldering Equipment Manufacturing	1	1,007
336611 Ship Building and Repairing	1	365
221112 Fossil Fuel Electric Power Generation	1	4
212393 Other Chemical and Fertilizer Mineral Mining	1	*
325311 Nitrogenous Fertilizer Manufacturing	1	*
541712 Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology)	1	*
326150 Urethane and Other Foam Product (except Polystyrene) Manufacturing	1	*
424710 Petroleum Bulk Stations and Terminals	1	*
Total	216	65,049,746
Source: U.S. EPA, 2015		
Note: *No quantities reported		

Table 12: Detailed 2015 TRI Activity or Use for Tetrachloroethylene by Facility

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use	NAICS Industry Code
THE DOW CHEMICAL CO GRAND BAYOU OPERATIONS LOUISIANA HWY 70 PAINCOURTVILLE, LA 70391	0 - 99	Produce Byproduct Ancillary	212393 Other Chemical and Fertilizer Mineral Mining
PHIFER INC 4400 KAULOOSA AVE TUSCALOOSA, AL 35401	10,000 - 99,999	Ancillary	314999 All Other Miscellaneous Textile Product Mills
PHILLIPS 66 CO-BAYWAY REFINERY 1400 PARK AVE LINDEN, NJ 7036	10,000 - 99,999	Imported Used Processed Chem Processing Aid	324110 Petroleum Refineries
PAULSBORO REFINING CO LLC 800 BILLINGSPO RT RD PAULSBORO, NJ 8066	1,000 - 9,999	Chem Processing Aid Ancillary	324110 Petroleum Refineries
UNITED REFINING CO 15 BRADLEY ST WARREN, PA 16365	*	*	324110 Petroleum Refineries

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use	NAICS Industry Code
MONROE ENERGY LLC- TRAINER REFINERY 4101 POST RD TRAINER, PA 19061	10,000 - 99,999	Imported Used Processed Chem Processing Aid	324110 Petroleum Refineries
PHILADELPHIA ENERGY SOLUTIONS REFINING PHILADELPHIA REFINERY 3144 PASSYUNK AVE PHILADELPHIA, PA 19145	100,000,000 - 499,999,999	Chem Processing Aid	324110 Petroleum Refineries
DELAWARE CITY REFINERY 4550 WRANGLE HILL RD DELAWARE CITY, DE 19706	0 - 99	Chem Processing Aid	324110 Petroleum Refineries
VALERO REFINING CO - TENNESSEE LLC 2385 RIVERPORT ROAD MEMPHIS, TN 38109	10,000 - 99,999	Repackaging Chem Processing Aid	324110 Petroleum Refineries
CHEVRON PRODUCTS CO PASCAGOULA REFINERY 250 IND US TRIAL RD PASCAGOULA, MS 39581	10,000 - 99,999	Chem Processing Aid	324110 Petroleum Refineries
CATLETTSBURG REFINING LLC 11631 US RT 23 CATLETTSBURG, KY 41129	1,000 - 9,999	Process Impurity Chem Processing Aid Ancillary	324110 Petroleum Refineries
LIMA REFINING CO 1150 S METCALF ST LIMA, OH 45804	10,000 - 99,999	Manufacture Aid	324110 Petroleum Refineries
BP PRODUCTS NORTH AMERICA WHITING BUSINESS UNIT 2815 INDIANAPOLIS BLVD WHITING, IN 46394	1,000 - 9,999	Chem Processing Aid	324110 Petroleum Refineries
COUNTRYMARK REFINING & LOGISTICS LLC 1200 REFINERY RD MOUNT VERNON, IN 47620	10,000 - 99,999	Chem Processing Aid	324110 Petroleum Refineries
MARATHON PETROLEUM CO LP - MICHIGAN REFINING DIV 1300 S FORT ST HES DEPT DETROIT, MI 48217	0 - 99	Ancillary	324110 Petroleum Refineries
ST PAUL PARK REFINING CO LLC 301 ST PAUL PARK RD SAINT PAUL PARK, MN 55071	10,000 - 99,999	Chem Processing Aid	324110 Petroleum Refineries

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use	NAICS Industry Code
FLINT HILLS RESOURCES PINE BEND LLC 13775 CLARK RD ROSEMOUNT, MN 55068	100,000 - 999,999	Reactant Manufacture Aid	324110 Petroleum Refineries
TESORO MANDAN REFINERY 900 OLD RED TRAIL NE MANDAN, ND 58554	1,000 - 9,999	Chem Processing Aid	324110 Petroleum Refineries
CHS INC LAUREL REFINERY 803 HWY 212 S LAUREL, MT 59044	10,000 - 99,999	Chem Processing Aid Ancillary	324110 Petroleum Refineries
PHILLIPS 66 CO BILLINGS REFINERY 401 S 23RD ST BILLINGS, MT 59101	10,000 - 99,999	Chem Processing Aid	324110 Petroleum Refineries
EXXONMOBIL OIL CORP JOLIET REFINERY INTERSTATE 55 & ARSENAL RD EAST CHANNAHON, IL 60410	10,000 - 99,999	Manufacture Aid	324110 Petroleum Refineries
WOOD RIVER REFINERY 900 S CENTRAL AVE ROXANA, IL 62084	100,000 - 999,999	Chem Processing Aid	324110 Petroleum Refineries
MARATHON PETROLEUM CO LP ILLINOIS REFINING DIV 100 MARATHON AVE ROBINSON, IL 62454	10,000 - 99,999	Chem Processing Aid	324110 Petroleum Refineries
HOLLYFRONTIER EL DORADO REFINING LLC 1401 S DOUGLAS RD EL DORADO, KS 67042	1,000 - 9,999	Chem Processing Aid	324110 Petroleum Refineries
COFFEYVILLE RESOURCES REFINING & MARKETING 400 N LINDEN COFFEYVILLE, KS 67337	10,000 - 99,999	Produce Used Processed Article Component Chem Processing Aid	324110 Petroleum Refineries
CHS MCPHERSON REFINERY 2000 S MAIN ST MCPHERSON, KS 67460	10,000 - 99,999	Chem Processing Aid	324110 Petroleum Refineries
PHILLIPS 66 - ALLIANCE REFINERY 15551 HIGHWAY 23 BELLE CHASSE, LA 70037	100 - 999	Ancillary	324110 Petroleum Refineries
VALERO REFINING - NEW ORLEANS LLC 14902 RIVER RD NORCO, LA 70079	1,000 - 9,999	Chem Processing Aid	324110 Petroleum Refineries

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use	NAICS Industry Code
MARATHON PETROLEUM CO LP 4663 W AIRLINE HWY GARYVILLE, LA 70051	100 - 999	Chem Processing Aid	324110 Petroleum Refineries
VALERO REFINING - MERAUX LLC MERAUX REFINERY 2500 E ST BERNARD HWY MERAUX, LA 70075	1,000 - 9,999	Chem Processing Aid Manufacture Aid	324110 Petroleum Refineries
MOTIVA ENTERPRISES LLC NORCO REFINERY 15536 RIVER RD NORCO, LA 70079	10,000 - 99,999	Chem Processing Aid	324110 Petroleum Refineries
CHALMETTE REFINING LLC 500 W ST BERNARD HWY CHALMETTE, LA 70043	100,000 - 999,999	Chem Processing Aid Ancillary	324110 Petroleum Refineries
CITGO PETROLEUM CORP 1601 HWY 108 E SULPHUR, LA 70665	10,000 - 99,999	Chem Processing Aid	324110 Petroleum Refineries
PHILLIPS 66 LAKE CHARLES REFINERY 2200 OLD SPANISH TRAIL WESTLAKE, LA 70669	10,000 - 99,999	Reactant	324110 Petroleum Refineries
ALON REFINING KROTZ SPRINGS INC HWY 105 S KROTZ SPRINGS, LA 70750	10,000 - 99,999	Chem Processing Aid	324110 Petroleum Refineries
EXXONMOBIL REFINING & SUPPLY BATON ROUGE REFINERY (PART) 4045 SCENIC HWY BATON ROUGE, LA 70805	1,000 - 9,999	Formulation Component Chem Processing Aid	324110 Petroleum Refineries
CALUMET LUBRICANTS & WAXES LLC 3333 MIDWAY ST SHREVEPORT, LA 71109	*	*	324110 Petroleum Refineries
LION OIL CO 1,000 MCHENRY AVE EL DORADO, AR 71730	10,000 - 99,999	Chem Processing Aid	324110 Petroleum Refineries
WYNNEWOOD REFINING CO 906 S POWELL AVE WYNNEWOOD, OK 73098	10,000 - 99,999	Chem Processing Aid	324110 Petroleum Refineries
VALERO REFINING CO - OKLAHOMA VALERO ARDMORE REFINERY ONE VALERO WAY ARDMORE, OK 73401	10,000 - 99,999	Chem Processing Aid Manufacture Aid Ancillary	324110 Petroleum Refineries

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use	NAICS Industry Code
HOLLYFRONTIER TULSA REFINING LLC EAST FACILITY 902 W 25TH ST TULSA, OK 74107	1,000 - 9,999	Chem Processing Aid	324110 Petroleum Refineries
PHILLIPS 66 PONCA CITY SITE 1,000 S PINE ST PONCA CITY, OK 746017501	1,000 - 9,999	Reactant Chem Processing Aid Ancillary	324110 Petroleum Refineries
PHILLIPS 66 CO SWEENEY REFINERY COMPLEX 8189 OLD FM 524 OLD OCEAN, TX 77463	1,000 - 9,999	Chem Processing Aid	324110 Petroleum Refineries
EXXONMOBIL REFINING & SUPPLY BAYTOWN REFINERY 2800 DECKER DR BAYTOWN, TX 775202099	10,000 - 99,999	Chem Processing Aid Ancillary	324110 Petroleum Refineries
DEER PARK REFINING LP 5900 HWY 225 EAST DEER PARK, TX 77536	1,000 - 9,999	Ancillary	324110 Petroleum Refineries
MARATHON PETROLEUM CO LP 502 10TH ST S TEXAS CITY, TX 77590	100 - 999	Chem Processing Aid	324110 Petroleum Refineries
VALERO REFINING-TEXAS LP 1301 LOOP 197 S TEXAS CITY, TX 77590	10,000 - 99,999	Chem Processing Aid	324110 Petroleum Refineries
BLANCHARD REFINING CO LLC 2401 5TH AVE S TEXAS CITY, TX 77590	10,000 - 99,999	Chem Processing Aid	324110 Petroleum Refineries
BLANCHARD REFINING CO LLC 2401 5TH AVE S TEXAS CITY, TX 77590	0 - 99	Article Component	324110 Petroleum Refineries
PREMCO REFINING GROUP INC PORT ARTHUR 1801 S GULFWAY DR PORT ARTHUR, TX 77640	0 - 99	Reactant Chem Processing Aid	324110 Petroleum Refineries
MOTIVA-PORT ARTHUR REFINERY 2555 SAVANNAH AVE PORT ARTHUR, TX 77640	10,000 - 99,999	Chem Processing Aid	324110 Petroleum Refineries
EXXONMOBIL OIL BEAUMONT REFINERY E END OF BURT ST BEAUMONT, TX 77701	10,000 - 99,999	Chem Processing Aid Ancillary	324110 Petroleum Refineries

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use	NAICS Industry Code
FLINT HILLS RESOURCES CORPUS CHRISTI LLC - WEST PLANT 2825 SUNTIDE RD CORPUS CHRISTI, TX 78409	10,000 - 99,999	Produce Byproduct Reactant Ancillary	324110 Petroleum Refineries
VALERO REFINING-TEXAS LP CORPUS CHRISTI WEST PLANT 5900 UP RIVER RD CORPUS CHRISTI, TX 78407	100,000 - 999,999	Chem Processing Aid	324110 Petroleum Refineries
PHILLIPS 66 CO BORGER REFINERY STATE HWY SPUR 119 N BORGER, TX 790070271	100 - 999	Process Impurity Chem Processing Aid	324110 Petroleum Refineries
WESTERN EL PASO REFINERY 6500 TROWBRIDGE DR EL PASO, TX 79905	10,000 - 99,999	Chem Processing Aid	324110 Petroleum Refineries
SUNCOR ENERGY COMMERCE CITY REFINERY 5801 BRIGHTON BLVD COMMERCE CITY, CO 80022	100,000 - 999,999	Process Impurity Ancillary	324110 Petroleum Refineries
HOLLYFRONTIER CHEYENNE REFINING LLC 2700 E. 5TH STREET CHEYENNE, WY 82007	100 - 999	Chem Processing Aid	324110 Petroleum Refineries
BIG WEST OIL LLC 333 W CENTER ST NORTH SALT LAKE, UT 84054	10,000 - 99,999	Chem Processing Aid	324110 Petroleum Refineries
CHEVRON PRODUCTS CO - SALT LAKE REFINERY 2351 NORTH 1100 WEST SALT LAKE CITY, UT 84116	10,000 - 99,999	Chem Processing Aid	324110 Petroleum Refineries
CHEVRON PRODUCTS CO DIV OF CHEVRON USA INC 324 W EL SEGUNDO BLVD EL SEGUNDO, CA 90245	10,000 - 99,999	Chem Processing Aid	324110 Petroleum Refineries
PHILLIPS 66 LOS ANGELES REFINERY WILMINGTON PLANT 1660 W ANAHEIM ST WILMINGTON, CA 90744	10,000 - 99,999	Reactant Chem Processing Aid	324110 Petroleum Refineries
ULTRAMAR INC WILMINGTON REFINERY 2402 E. ANAHEIM STREET WILMINGTON, CA 90744	10,000 - 99,999	Chem Processing Aid	324110 Petroleum Refineries

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use	NAICS Industry Code
TESORO LOS ANGELES REFINERY-CARSON OPERATIONS 2350 E 223RD ST CARSON, CA 90810	10,000 - 99,999	Chem Processing Aid	324110 Petroleum Refineries
VALERO REFINING CO-CALIFORNIA BENICIA REFINERY 3400 E SECOND ST BENICIA, CA 94510	10,000 - 99,999	Chem Processing Aid	324110 Petroleum Refineries
SHELL OIL PRODUCTS US-MARTINEZ REFINERY 3485 PACHECO BLVD MARTINEZ, CA 94553	10,000 - 99,999	Chem Processing Aid	324110 Petroleum Refineries
CHEVRON PRODUCTS CO RICHMOND REFINERY 841 CHEVRON WAY RICHMOND, CA 94801	10,000 - 99,999	Chem Processing Aid Ancillary	324110 Petroleum Refineries
CHEVRON PRODUCTS CO-HAWAII REFINERY 91-480 MALAKOLE ST KAPOLEI, HI 96707	1,000 - 9,999	Chem Processing Aid	324110 Petroleum Refineries
TESORO REFINING & MARKETING CO LLC W MARCH POINT RD ANACORTES, WA 98221	1,000 - 9,999	Manufacture Aid	324110 Petroleum Refineries
PHILLIPS 66 FERNDALE REFINERY 3901 UNICK RD FERNDALE, WA 98248	100 - 999	Chem Processing Aid	324110 Petroleum Refineries
BP CHERRY POINT REFINERY 4519 GRANDVIEW RD BLAINE, WA 98230	100,000 - 999,999	Chem Processing Aid	324110 Petroleum Refineries
SAFETY-KLEEN SYSTEMS INC 601 RILEY RD EAST CHICAGO, IN 46312	1,000 - 9,999	Process Impurity	324191 Petroleum Lubricating Oil and Grease Manufacturing
CHAMPION BRANDS LLC 1001 GOLDEN DR CLINTON, MO 64735	1,000 - 9,999	Ancillary	324191 Petroleum Lubricating Oil and Grease Manufacturing
BG PRODUCTS EL DORADO MANUFACTURING FACILITY 2415 PIONEER DR EL DORADO, KS 67042	*	*	324191 Petroleum Lubricating Oil and Grease Manufacturing
DUPONT PONTCHARTRAIN WORKS 586 HWY 44 LA PLACE, LA 70068	1,000 - 9,999	Formulation Component	325110 Petrochemical Manufacturing

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use	NAICS Industry Code
GEORGIA GULF LAKE CHARLES LLC 1600 VCM PLANT RD WESTLAKE, LA 70669	10,000 - 99,999	Produce Byproduct Ancillary	325110 Petrochemical Manufacturing
EXXONMOBIL CHEMICAL BATON ROUGE CHEMICAL PLANT (PART) 4999 SCENIC HWY BATON ROUGE, LA 70805	100,000 - 999,999	Ancillary	325110 Petrochemical Manufacturing
EXXONMOBIL CHEMICAL CO BAYTOWN OLEFINS PLANT 3525 DECKER DR BAYTOWN, TX 77520	1,000 - 9,999	Ancillary	325110 Petrochemical Manufacturing
EXXONMOBIL BAYTOWN CHEMICAL PLANT 5000 BAYWAY DR BAYTOWN, TX 77520	100 - 999	Process Impurity Ancillary	325110 Petrochemical Manufacturing
EXXONMOBIL OIL CORP BEAUMONT CHEMICAL PLANT 2775 GULF STATES RD BEAUMONT, TX 77701	0 - 99	Ancillary	325110 Petrochemical Manufacturing
HONEYWELL INTERNATIONAL INC GEISMAR PLANT 5525 HWY 3115 CARVILLE, LA 70721	100,000 - 999,999	Reactant	325120 Industrial Gas Manufacturing
THE CHEMOURS CO FC LLC HWY 361 GREGORY, TX 78359	10,000,000 - 49,999,999	Reactant	325120 Industrial Gas Manufacturing
OCCIDENTAL CHEMICAL CORP NIAGARA PLANT 4700 BUFFALO AVE NIAGARA FALLS, NY 14304	100,000 - 999,999	Chem Processing Aid Ancillary	325180 Other basic inorganic chemical manufacturing
EAGLE US 2 LLC 1300 PPG DR WESTLAKE, LA 70669	10,000,000 - 49,999,999	Produce Used Processed Sale Distribution Byproduct Reactant Ancillary	325180 Other basic inorganic chemical manufacturing
ECO-SERVICES OPERATIONS 1301 AIRLINE HWY BATON ROUGE, LA 70805	10,000 - 99,999	Ancillary	325180 Other basic inorganic chemical manufacturing
EASTERN COLOR & CHEMICAL CO 35 LIVINGSTON ST PROVIDENCE, RI 2904	100 - 999	Repackaging	325199 All Other Basic Organic Chemical Manufacturing

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use	NAICS Industry Code
APOLLO TECHNOLOGIES 1850 S COBB INDUSTRIAL BLVD SMYRNA, GA 30082	*	*	325199 All Other Basic Organic Chemical Manufacturing
AVANTOR PERFORMANCE MATERIALS 7001 MARTIN LUTHER KING BLVD PARIS, KY 40361	10,000 - 99,999	Repackaging	325199 All Other Basic Organic Chemical Manufacturing
WESTLAKE VINYL INC 2468 IND US TRIAL PKWY CALVERT CITY, KY 42029	100,000 - 999,999	Produce Used Processed Reactant	325199 All Other Basic Organic Chemical Manufacturing
THE DOW CHEMICAL CO 1790 BUILDING MIDLAND, MI 48667	100,000 - 999,999	Produce Byproduct Chem Processing Aid Ancillary	325199 All Other Basic Organic Chemical Manufacturing
OCCIDENTAL CHEMICAL HOLDING CORP - GEISMAR PLANT 8318 ASHLAND RD GEISMAR, LA 70734	50000000 - 99,999,999	Produce Sale Distribution	325199 All Other Basic Organic Chemical Manufacturing
THE DOW CHEMICAL CO - LOUISIANA OPERATIONS 21255 LA HWY 1 S PLAQUEMINE, LA 70764	10,000,000 - 49,999,999	Produce Used Processed Sale Distribution Byproduct Reactant Chem Processing Aid Ancillary	325199 All Other Basic Organic Chemical Manufacturing
BLUE CUBE OPERATIONS LLC - PLAQUEMINE SITE 21255 HIGHWAY 1 S PLAQUEMINE, LA 70765	10,000,000 - 49,999,999	Produce Used Processed Sale Distribution Byproduct Reactant Chem Processing Aid Ancillary	325199 All Other Basic Organic Chemical Manufacturing
HONEYWELL INTERNATIONAL INC-BATON ROUGE PLANT CORNER OF LUPINE & ONTARIO STR EETS BATON ROUGE, LA 70805	10,000,000 - 49,999,999	Reactant	325199 All Other Basic Organic Chemical Manufacturing
OXY VINYL LP DEER PARK- VCM PLANT 5900 HWY 225 GATE 8A DEER PARK, TX 77536	10,000 - 99,999	Produce Byproduct Ancillary	325199 All Other Basic Organic Chemical Manufacturing

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use	NAICS Industry Code
DOW CHEMICAL CO FREEPORT FACILITY 2301 N BRAZOSPORT BLVD FREEPORT, TX 775413257	10,000,000 - 49,999,999	Produce Imported Byproduct Manufacture Impurity Reactant Repackaging Process Impurity Chem Processing Aid Manufacture Aid Ancillary	325199 All Other Basic Organic Chemical Manufacturing
OLIN BLUE CUBE FREEPORT TX 2301 N. BRAZOSPORT BLVD. FREEPORT, TX 77541	10,000,000 - 49,999,999	Produce Imported Byproduct Manufacture Impurity Reactant Repackaging Process Impurity Chem Processing Aid Manufacture Aid Ancillary	325199 All Other Basic Organic Chemical Manufacturing
OXY VINYLs LP LA PORTE VCM PLANT 2400 MILLER CUTOFF RD LA PORTE, TX 77571	100,000 - 999,999	Produce Byproduct Reactant	325199 All Other Basic Organic Chemical Manufacturing
OCCIDENTAL CHEMICAL CORP 4133 HWY 361 GREGORY, TX 78359	10,000 - 99,999	Produce Byproduct Ancillary	325199 All Other Basic Organic Chemical Manufacturing
DOW CHEMICAL CO 901 LOVERIDGE RD PITTSBURG, CA 94565	100,000 - 999,999	Formulation Component Repackaging Chem Processing Aid Manufacture Aid	325199 All Other Basic Organic Chemical Manufacturing
WESTLAKE VINYLs CO 36045 HWY 30 GEISMAR, LA 70734	1,000 - 9,999	Produce Sale Distribution Byproduct Manufacture Impurity	325211 Plastics Material and Resin Manufacturing
SHINTECH PLAQUEMINE PLANT 26270 HWY 405 PLAQUEMINE, LA 70764	100,000 - 999,999	Produce Byproduct	325211 Plastics Material and Resin Manufacturing

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use	NAICS Industry Code
AXIALL LLC 26100 HWY 405 S PLAQUEMINE, LA 70764	100,000 - 999,999	Produce Byproduct Repackaging	325211 Plastics Material and Resin Manufacturing
FORMOSA PLASTICS CORP LOUISIANA GULF STATES RD BATON ROUGE, LA 70805	1,000,000 - 9,999,999	Produce Manufacture Impurity	325211 Plastics Material and Resin Manufacturing
FORMOSA PLASTICS CORP TEXAS 201 FORMOSA DR POINT COMFORT, TX 77978	100,000 - 999,999	Produce Used Processed Sale Distribution Manufacture Impurity Reactant Process Impurity Ancillary	325211 Plastics Material and Resin Manufacturing
COFFEYVILLE RESOURCES NITROGEN FERTILIZERS LLC 701 E MARTIN ST COFFEYVILLE, KS 67337	0 - 99	Produce Used Processed Article Component Chem Processing Aid	325311 Nitrogenous Fertilizer Manufacturing
SHERWIN-WILLIAMS CO 26300 FARGO AVE BEDFORD HEIGHTS, OH 44146	10,000 - 99,999	Formulation Component	325510 Paint and Coating Manufacturing
TRINKOTE INDUSTRIAL FINISHES INC 800 HUGHIE LONG RD CRESSON, TX 76035	10,000 - 99,999	Formulation Component	325510 Paint and Coating Manufacturing
LORD CORP 601 SOUTH ST SAEGERTOWN, PA 16433	100,000 - 999,999	Formulation Component Chem Processing Aid	325520 Adhesive Manufacturing
ROHM & HAAS CHEMICALS LLC 10 S ELECTRIC ST WEST ALEXANDRIA, OH 45381	100,000 - 999,999	Formulation Component Chem Processing Aid Ancillary	325520 Adhesive Manufacturing
SHERWIN-WILLIAMS CO 2504 MARINA DR ELKHART, IN 46514	100,000 - 999,999	Formulation Component	325520 Adhesive Manufacturing
ROYAL ADHESIVES & SEALANTS 2001 W WASHINGTON ST SOUTH BEND, IN 46628	10,000 - 99,999	Formulation Component	325520 Adhesive Manufacturing

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use	NAICS Industry Code
ECLECTIC PRODUCTS INC 4507 WILLAMETTE BLVD PINEVILLE, LA 71360	100,000 - 999,999	Imported Used Processed Formulation Component Ancillary	325520 Adhesive Manufacturing
COMSTAR INTERNATIONAL INC 20-45 128 ST COLLEGE POINT, NY 11356	0 - 99	Imported Sale Distribution	325611 Soap and Other Detergent Manufacturing
WAUSAU CHEMICAL CORP 2001 N RIVER DR WAUSAU, WI 54403	10,000 - 99,999	Repackaging	325611 Soap and Other Detergent Manufacturing
QUESTSPECIALTY CORP 2001 E TOM GREEN ST BRENHAM, TX 77833	10,000 - 99,999	Formulation Component Ancillary	325611 Soap and Other Detergent Manufacturing
SHIELD PACKAGING CO INC 50 OXFORD AVE DUDLEY, MA 1571	100,000 - 999,999	Formulation Component Ancillary	325612 Polish and Other Sanitation Good Manufacturing
RR STREET & CO INC 2353 S BLUE ISLAND AVE CHICAGO, IL 60608	10,000 - 99,999	Formulation Component	325612 Polish and Other Sanitation Good Manufacturing
NCH CORP MOHAWK LABS DIV 2730 CARL RD IRVING, TX 75062			325612 Polish and Other Sanitation Good Manufacturing
CRC INDUSTRIES INC 885 LOUIS DR WARMINSTER, PA 18974	1,000,000 - 9,999,999	Formulation Component Repackaging	325998 All Other Miscellaneous Chemical Product and Preparation Manufacturing
RADIATOR SPECIALTY CO 600 RADIATOR RD INDIAN TRAIL, NC 28079	100,000 - 999,999	Formulation Component Repackaging	325998 All Other Miscellaneous Chemical Product and Preparation Manufacturing
ANIMAL HEALTH & SCIENCES 100 CHRIS CALLIS PARKWAY THOMASTON, GA 30286	*	*	325998 All Other Miscellaneous Chemical Product and Preparation Manufacturing
AMC INTERNATIONAL 310 BROOKHOLLOW IND BLVD DALTON, GA 30721	*	*	325998 All Other Miscellaneous Chemical Product and Preparation Manufacturing
MOBILE SOLVENT & SUPPLY 5750 K US HLA MCLEOD RD EIGHT MILE, AL 36613	10,000 - 99,999	Ancillary	325998 All Other Miscellaneous Chemical Product and Preparation Manufacturing
NITEO PRODUCTS LLC 720 VAIDEN DR HERNANDO, MS 38632	10,000 - 99,999	Formulation Component	325998 All Other Miscellaneous Chemical Product and Preparation Manufacturing

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use	NAICS Industry Code
AMERICAN JETWAY CORP 34136 MYRTLE WAYNE, MI 48184	100,000 - 999,999	Formulation Component	325998 All Other Miscellaneous Chemical Product and Preparation Manufacturing
3M COTTAGE GROVE CENTER 10746 INNOVATION RD COTTAGE GROVE, MN 55016	10,000 - 99,999	Ancillary	325998 All Other Miscellaneous Chemical Product and Preparation Manufacturing
PENRAY COS INC 440 DENNISTON CT WHEELING, IL 60090	10,000 - 99,999	Formulation Component Repackaging	325998 All Other Miscellaneous Chemical Product and Preparation Manufacturing
PLAZE INC 1,000 INTEGRAM DR PACIFIC, MO 63069	100 - 999	Formulation Component	325998 All Other Miscellaneous Chemical Product and Preparation Manufacturing
BERRYMAN PRODUCTS INC 3800 E RANDOL MILL RD ARLINGTON, TX 76011	10,000 - 99,999	Formulation Component	325998 All Other Miscellaneous Chemical Product and Preparation Manufacturing
TECHNICAL CHEMICAL CO 3327 PIPELINE RD CLEBURNE, TX 76033	1,000,000 - 9,999,999	Formulation Component	325998 All Other Miscellaneous Chemical Product and Preparation Manufacturing
BIO-RAD LABORATORIES INC 3110 REGATTA BLVD RICHMOND, CA 94804	100 - 999	Chem Processing Aid	325998 All Other Miscellaneous Chemical Product and Preparation Manufacturing
GACO WESTERN 1245 CHAPMAN DRIVE WAUKESHA, WI 53186	*	*	326150 Urethane and Other Foam Product (except Polystyrene) Manufacturing
KEYSTONE CEMENT CO RT 329 BATH, PA 18014	1,000 - 9,999	Ancillary	327310 Cement Manufacturing
HOLCIM (US) INC HOLLY HILL PLANT 2173 GARDNER BLVD HOLLY HILL, SC 29059	100 - 999	Ancillary	327310 Cement Manufacturing
GIANT CEMENT CO HWY 453 & I-26 (654 JUDGE ST) HARLEYVILLE, SC 29448	1,000 - 9,999	Ancillary	327310 Cement Manufacturing
LAFARGE NA (INCLUDING SYSTECH ENV CORP) 11435 COUNTY RD 176 PAULDING, OH 45879	10,000 - 99,999	Process Impurity Ancillary	327310 Cement Manufacturing

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use	NAICS Industry Code
BUZZI UNICEM USA- GREENCASTLE PLANT 3301 S COUNTY RD 150 W GREENCASTLE, IN 46135	1,000 - 9,999	Repackaging Process Impurity Ancillary	327310 Cement Manufacturing
ESSROC CEMENT CORP STATE RD 25 SOUTH 3084 W CR. 225 S LOGANSFORT, IN 46947	1,000 - 9,999	Ancillary	327310 Cement Manufacturing
CONTINENTAL CEMENT CO LLC 10107 HWY 79 HANNIBAL, MO 63401	10,000 - 99,999	Ancillary	327310 Cement Manufacturing
BUZZI UNICEM USA-CAPE GIRARDEAU 2524 S SPRIGG ST CAPE GIRARDEAU, MO 63703	1,000 - 9,999	Ancillary	327310 Cement Manufacturing
ASH GROVE CEMENT CO 1801 N SANTA FE CHANUTE, KS 66720	1,000 - 9,999	Ancillary	327310 Cement Manufacturing
ASH GROVE CEMENT CO 4343 HWY 108 FOREMAN, AR 71836	1,000 - 9,999	Ancillary	327310 Cement Manufacturing
CENTRAL PLAINS CEMENT CO 2609 N 145TH E AVE TULSA, OK 74116	*	*	327310 Cement Manufacturing
NORLITE LLC 628 S SARATOGA ST COHOES, NY 12047	1,000 - 9,999	Ancillary	327992 Ground or Treated Mineral and Earth Manufacturing
HINES PRECISION INC 5680 OLD KY 54 PHILPOT, KY 42366	10,000 - 99,999	Ancillary	332119 Metal Crown, Closure, and Other Metal Stamping (except Automotive)
VITA CRAFT CORP 11100 W 58TH ST SHAWNEE, KS 66203	10,000 - 99,999	Manufacture Aid	332215 Metal kitchen cookware, utensil, cutlery, and flatware (except precious) manufacturing
FRAEN MACHINING CORP 324 NEW BOSTON ST WOBURN, MA 1801	1,000 - 9,999	Manufacture Aid	332721 Precision Turned Product Manufacturing
TECH MET INC 15 ALLEGHENY SQUARE GLASSPORT, PA 15045	10,000 - 99,999	Chem Processing Aid	332812 Metal Coating, Engraving (except Jewelry and Silverware), and Allied Services to Manufactur..
FOUNTAIN PLATING CO INC 492 PROSPECT AVE WEST SPRINGFIELD, MA 1089	1,000 - 9,999	Ancillary	332813 Electroplating, Plating, Polishing, Anodizing, and Coloring

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use	NAICS Industry Code
MAGELLAN AEROSPACE PROCESSING, LONG ISLAND INC. 165 FIELD ST WEST BABYLON, NY 11704	1,000 - 9,999	Ancillary	332813 Electroplating, Plating, Polishing, Anodizing, and Coloring
SIERRA BULLETS LLC 1400 W HENRY ST SEDALIA, MO 65301	1,000 - 9,999	Manufacture Aid	332992 Small Arms Ammunition Manufacturing
METAL IMPACT LLC 1501 OAKTON ST ELK GROVE VILLAGE, IL 60007	10,000 - 99,999	Chem Processing Aid	332999 All Other Miscellaneous Fabricated Metal Product Manufacturing
ARCOS INDUSTRIES LLC 394 ARCOS DR MOUNT CARMEL, PA 17851	1,000 - 9,999	Manufacture Aid	333992 Welding and Soldering Equipment Manufacturing
METALLICS SYSTEMS A DIV OF PYROTEK-INC 2040 CORY RD SANBORN, NY 14132	10,000 - 99,999	Manufacture Aid	335991 Carbon and Graphite Product Manufacturing
JAYCO INC 903 S MAIN ST MIDDLEBURY, IN 46540	1,000 - 9,999	Manufacture Aid	336214 Travel Trailer and Camper Manufacturing
SPIRIT AEROSYSTEMS INC 3801 S OLIVER WICHITA, KS 67210	100,000 - 999,999	Formulation Component Chem Processing Aid Manufacture Aid Ancillary	336411 Aircraft Manufacturing
NORDAM I&S DIV 6910 N WHIRLPOOL DR TULSA, OK 74117	10,000 - 99,999	Chem Processing Aid	336411 Aircraft Manufacturing
BELL HELICOPTER PLANT 5 1700 N HWY 360 GRAND PRAIRIE, TX 75050	10,000 - 99,999	Ancillary	336411 Aircraft Manufacturing
ROLLS-ROYCE CORP-PLANTS 5 & 8 2355 & 2001 S TIBBS AVE INDIANAPOLIS, IN 46241	1,000 - 9,999	Ancillary	336412 Aircraft Engine and Engine Parts Manufacturing
TRIUMPH FABRICATIONS HOT SPRINGS 1923 CENTRAL AVE HOT SPRINGS, AR 71901	100,000 - 999,999	Manufacture Aid	336413 Other Aircraft Parts and Auxiliary Equipment Manufacturing
WEATHERFORD AEROSPACE LLC 1020 E COLUMBIA ST WEATHERFORD, TX 76086	100,000 - 999,999	Formulation Component	336413 Other Aircraft Parts and Auxiliary Equipment Manufacturing

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use	NAICS Industry Code
WEATHERFORD AEROSPACE LLC 610 W THIRD ST WEATHERFORD, TX 76086	100,000 - 999,999	Chem Processing Aid Manufacture Aid	336413 Other Aircraft Parts and Auxiliary Equipment Manufacturing
PRECISION AEROSPACE CORP 11155 JERSEY BLVD SUITE A RANCHO CUCAMONGA, CA 91730	10,000 - 99,999	Manufacture Aid	336413 Other Aircraft Parts and Auxiliary Equipment Manufacturing
DUCOMMUN AEROSTRUCTURES 4001 EL MIRAGE RD EL MIRAGE, CA 92301	10,000 - 99,999	Formulation Component	336413 Other Aircraft Parts and Auxiliary Equipment Manufacturing
DUCOMMUN AEROSTRUCTURES INC ORANGE FACILITY 1885 N BATAVIA ST ORANGE, CA 92865	100,000 - 999,999	Chem Processing Aid Manufacture Aid	336413 Other Aircraft Parts and Auxiliary Equipment Manufacturing
BOEING CO OF PORTLAND 19000 NE SANDY BLVD GRESHAM, OR 97230	1,000 - 9,999	Manufacture Aid	336413 Other Aircraft Parts and Auxiliary Equipment Manufacturing
TEXAS BARGE & BOAT INC 4115 E FLOODGATE FREEPORT, TX 77541	10,000 - 99,999	Repackaging	336611 Ship Building and Repairing
GETZEN CO INC 530 S HWY H ELKHORN, WI 53121	10,000 - 99,999	Manufacture Aid	339992 Musical Instrument Manufacturing
HUBBARD-HALL INC 589 S LEONARD ST WATERBURY, CT 6708	*	*	424690 Other Chemical and Allied Products Merchant Wholesalers
PRIDE SOLVENT & CHEMICAL CO OF NY INC 6 LONG ISLAND AVE HOLTSVILLE, NY 11742	*	*	424690 Other Chemical and Allied Products Merchant Wholesalers
INTERSTATE CHEMICAL CO INC 2797 FREEDLAND RD HERMITAGE, PA 16148	1,000 - 9,999	Formulation Component Repackaging	424690 Other Chemical and Allied Products Merchant Wholesalers
BRENNTAG NORTHEAST INC 81 W HULLER LN READING, PA 19605	*	*	424690 Other Chemical and Allied Products Merchant Wholesalers
NEXEO SOLUTIONS LLC- DORAVILLE 4550 NE EXPRESSWAY DORAVILLE, GA 30340	*	*	424690 Other Chemical and Allied Products Merchant Wholesalers
INDUSTRIAL CHEMICALS INC 1125 ROBERTS IND US TRIAL DR BIRMINGHAM, AL 35208	*	*	424690 Other Chemical and Allied Products Merchant Wholesalers

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use	NAICS Industry Code
SUPERIOR OIL CO INC 400 W REGENT ST INDIANAPOLIS, IN 46225	*	*	424690 Other Chemical and Allied Products Merchant Wholesalers
SUPERIOR FIBERGLASS & RESINS 1030 ALL PRO DR ELKHART, IN 46514	*	*	424690 Other Chemical and Allied Products Merchant Wholesalers
BRENNTAG GREAT LAKES LLC 14765 W BOBOLINK AVE MENOMONEE FALLS, WI 53051	*	*	424690 Other Chemical and Allied Products Merchant Wholesalers
INTERSTATE CHEMICAL CO INC 23247 W EAMES ST CHANNAHON, IL 60410	10,000 - 99,999	Formulation Component Repackaging	424690 Other Chemical and Allied Products Merchant Wholesalers
UNIVAR USA INC 7050 W 71ST ST BEDFORD PARK, IL 60638	1,000,000 - 9,999,999	Repackaging	424690 Other Chemical and Allied Products Merchant Wholesalers
SUPERIOR SOLVENTS & CHEMICALS 2055 E BLAINE ST SPRINGFIELD, MO 65803	*	*	424690 Other Chemical and Allied Products Merchant Wholesalers
UNIVAR USA INC GEISMAR 34200 DISTRIBUTION LN GEISMAR, LA 70734	*	*	424690 Other Chemical and Allied Products Merchant Wholesalers
BRENNTAG SOUTHWEST INC ST GABRIEL 7200 HWY 74 SAINT GABRIEL, LA 70776	10,000 - 99,999	Repackaging	424690 Other Chemical and Allied Products Merchant Wholesalers
UNIVAR USA INC OKLAHOMA CITY 3320 S COUNCIL RD OKLAHOMA CITY, OK 73179	100,000 - 999,999	Repackaging	424690 Other Chemical and Allied Products Merchant Wholesalers
NEXEO SOLUTIONS LLC 9733 MEADOR RD CONROE, TX 77303	*	*	424690 Other Chemical and Allied Products Merchant Wholesalers
VALLEY SOLVENTS & CHEMICALS 8215 UP RIVER RD CORPUS CHRISTI, TX 78409	*	*	424690 Other Chemical and Allied Products Merchant Wholesalers
UNIVAR USA INC BORGER 601 S LOCUST ST BORGER, TX 79007	*	*	424690 Other Chemical and Allied Products Merchant Wholesalers
UNIVAR USA INC HOUSTON 7777 BRISBANE ST HOUSTON, TX 77061	100,000 - 999,999	Repackaging	424690 Other Chemical and Allied Products Merchant Wholesalers
UNIVAR USA INC 2600 S GARFIELD AVE COMMERCE, CA 90040	10,000 - 99,999	Ancillary	424690 Other Chemical and Allied Products Merchant Wholesalers

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use	NAICS Industry Code
BRENNTAG PACIFIC INC 10747 PATTERSON PL SANTA FE SPRINGS, CA 90670	*	*	424690 Other Chemical and Allied Products Merchant Wholesalers
AMBER CHEMICAL INC 5201 BOYLAN ST BAKERSFIELD, CA 93308	*	*	424690 Other Chemical and Allied Products Merchant Wholesalers
UNIVAR USA INC - SAN JOSE 2256 JUNCTION AVE SAN JOSE, CA 95131	1,000,000 - 9,999,999	Formulation Component Repackaging Ancillary	424690 Other Chemical and Allied Products Merchant Wholesalers
UNIVAR USA INC 8201 S 212 TH KENT, WA 98032	*	*	424690 Other Chemical and Allied Products Merchant Wholesalers
K-SOLV LP 1007 LAKESIDE DR CHANNELVIEW, TX 77530	*	*	424710 Petroleum Bulk Stations and Terminals
CHEVRON RICHMOND TECHNOLOGY CENTER 100 CHEVRON WAY RICHMOND, CA 94801	0 - 99	Ancillary	541712 Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnol..
SAFETY-KLEEN SYSTEMS INC 167 MILL ST CRANSTON, RI 2905	10,000 - 99,999	Formulation Component Repackaging	562211 Hazardous Waste Treatment and Disposal
EVOQUA WATER TECHNOLOGIES DARLINGTON FACILITY 118 PARK RD DARLINGTON, PA 16115	1,000 - 9,999	Ancillary	562211 Hazardous Waste Treatment and Disposal
SAFETY-KLEEN SYSTEMS INC 3700 LAGRANGE RD SMITHFIELD, KY 40068	10,000 - 99,999	Ancillary	562211 Hazardous Waste Treatment and Disposal
CHEMTRON CORP 35850 SCHNEIDER CT AVON, OH 44011	1,000 - 9,999	Ancillary	562211 Hazardous Waste Treatment and Disposal
ROSS INCINERATION SERVICES INC 36790 GILES RD GRAFTON, OH 44044	10,000 - 99,999	Ancillary	562211 Hazardous Waste Treatment and Disposal
CHEMICAL SOLVENTS INC-- DENISON FACILITY 1010 OLD DENISON AVE CLEVELAND, OH 44109	10,000 - 99,999	Ancillary	562211 Hazardous Waste Treatment and Disposal
TIER ENVIRONMENTAL LLC 7013 KRICK RD BEDFORD, OH 44146	100,000 - 999,999	Repackaging	562211 Hazardous Waste Treatment and Disposal

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use	NAICS Industry Code
VEOLIA ES TECHNICAL SOLUTIONS LLC 7 MOBILE AVE SAUGET, IL 62201	1,000 - 9,999	Ancillary	562211 Hazardous Waste Treatment and Disposal
SYSTECH ENVIRONMENTAL CORP 1420 S CEMENT PLANT RD FREDONIA, KS 66736	1,000 - 9,999	Process Impurity Ancillary	562211 Hazardous Waste Treatment and Disposal
CLEAN HARBORS EL DORADO LLC 309 AMERICAN CIR UNION EL DORADO, AR 71730	100,000 - 999,999	Repackaging Ancillary	562211 Hazardous Waste Treatment and Disposal
CLEAN HARBORS DEER PARK LLC 2027 INDEPENDENCE PARKWAY SOUTH LA PORTE, TX 77571	100,000 - 999,999	Repackaging	562211 Hazardous Waste Treatment and Disposal
VEOLIA ES TECHNICAL SOLUTIONS LLC PORT ARTHUR FACILITY HWY 73, 3.5 MILES W OF TAYLOR BAYOU PORT ARTHUR, TX 77640	10,000 - 99,999	Ancillary	562211 Hazardous Waste Treatment and Disposal
BERG LACQUER CO 3150 E PICO BLVD LOS ANGELES, CA 900233632	0 - 99	Formulation Component Repackaging Chem Processing Aid Ancillary	562211 Hazardous Waste Treatment and Disposal
VEOLIA ES TECHNICAL SOLUTIONS LLC 1704 W 1ST ST AZUSA, CA 91702	10,000 - 99,999	Repackaging	562211 Hazardous Waste Treatment and Disposal
CHEMICAL WASTE MANAGEMENT OF THE NORTHWEST INC 17629 CEDAR SPRINGS LN ARLINGTON, OR 97812	10,000 - 99,999	Ancillary	562211 Hazardous Waste Treatment and Disposal
EMERALD SERVICES INC 1825 E ALEXANDER AVE TACOMA, WA 98421	100 - 999	Process Impurity	562211 Hazardous Waste Treatment and Disposal
HERITAGE THERMAL SERVICES 1250 ST GEORGE ST EAST LIVERPOOL, OH 43920	10,000 - 99,999	Ancillary	562213 Solid Waste Combustors and Incinerators

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use	NAICS Industry Code
CLEAN HARBORS PPM LLC 2474 HWY 169 N INDUSTRIAL PARK COFFEYVILLE, KS 67337	10,000 - 99,999	Repackaging	562219 Other Nonhazardous Waste Treatment and Disposal
SAFETY-KLEEN SYSTEMS INC 130 A FRONTAGE RD LEXINGTON, SC 29073	10,000 - 99,999	Repackaging	562920 Materials Recovery Facilities
CLEAN HARBORS RECYCLING SERVICES OF OHIO LLC 581 MILLIKEN DR SE HEBRON, OH 43025	10,000 - 99,999	Formulation Component Ancillary	562920 Materials Recovery Facilities
US DOD USAF ROBINS AFB 775 MACON ST BUILDING 1555 ROBINS AFB, GA 31098	10,000 - 99,999	Ancillary	928110 National Security
Source: U.S. EPA, 2015 Notes: *No quantity or use data reported			

Facility	Maximum Amount of Chemical (lbs.)	Activity or Use	NAICS Industry Code
<p>“<i>Ancillary</i>” indicates that the chemical is used at the facility for purposes other than aiding chemical processing or manufacturing</p> <p>“<i>Article Component</i>” indicates the toxic chemical becomes an integral part of an article distributed into commerce, such as copper in wire or resins in a plastic pen, or the pigment components of paint applied to a chair that is sold</p> <p>“<i>Byproduct</i>” indicates the toxic chemical is produced coincidentally during the manufacture, process, or otherwise use of another chemical substance or mixture and, following its production, is separated from that other chemical substance or mixture. This, Includes toxic chemicals that may be created as the result of waste management</p> <p>“<i>Chemical Processing Aid</i>” indicates the toxic chemical is used to aid in the manufacture or synthesis of another chemical substance such that it comes into contact with the product during manufacture, but is not intended to remain with or become part of the final product or mixture. Some examples of chemical processing aids are process solvents, catalysts, solution buffers, inhibitors, and reaction terminators</p> <p>“<i>Formulation Component</i>” indicates the toxic chemical is used as an ingredient in a product mixture to enhance performance of the product during its use, such as dyes in ink, solvents in paint, additions, reaction diluents, initiators, inhibitors, emulsifiers, surfactants, lubricants, flame retardants, and rheological modifiers</p> <p>“<i>Imported</i>” indicates that the chemical is imported by the facility into the Customs Territory of the United States</p> <p>“<i>Manufacture Aid</i>” indicates the toxic chemical is used to aid in the manufacturing process but does not come into contact with the product during manufacture. Some examples, Include valve lubricants, refrigerants, metalworking fluids, coolants, and hydraulic fluids</p> <p>“<i>Manufacture Impurity</i>” indicates whether the facility produces the reported chemical as a result of the manufacture, processing, or otherwise use of another chemical, but does not separate the chemical and it remains primarily in the mixture or product with that other chemical</p> <p>“<i>Process Impurity</i>” indicates whether the facility processed the reported chemical but did not separate it and it remains as an impurity in the primary mixture or trade name product</p> <p>“<i>Produce</i>” indicates the toxic chemical was created by the facility. A toxic chemical is considered manufactured even if the toxic chemical is created unintentionally or exists only for a short period of time</p> <p>“<i>Reactant</i>” indicates the toxic chemical is used in chemical reactions to create another chemical substance or product that is then sold or otherwise distributed to other facilities. Some examples of reactants, Include feedstocks, raw materials, intermediates, and initiators</p> <p>“<i>Repackaging</i>” indicates the toxic chemical has been received by the facility and subsequently prepared for distribution into commerce in a different form, state, or quantity than it was received, such as petroleum being transferred from a storage tank to tanker trucks</p> <p>“<i>Sale Distribution</i>” indicates that the chemical is produced or imported specifically for sale or distribution outside the manufacturing facility</p> <p>“<i>Used Processed</i>” indicates that the chemical is produced or imported and then further processed or otherwise used at the same facility</p>			

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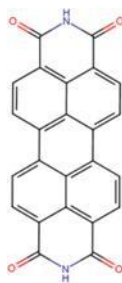
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Use and Market Profile for Pigment Violet 29

CAS RN: 81-33-4



May 5, 2017

Table of Contents

1. Introduction 1

 1.1 Overview of Pigment Violet 29 1

 1.2 U.S. and International Regulations Affecting Pigment Violet 29 2

2. Producers, Production and Import Volume..... 3

 2.1 U.S. Producers and Importers 3

 2.2 U.S. Production Volume by Producer..... 3

 2.3 U.S. Historic Production Volume 4

3. Use Information and Market Trends..... 4

 3.1 Uses of Pigment Violet 29 Reported in the IUR and CDR 4

 3.2 Uses of Pigment Violet 29 Reported by the European Chemicals Agency 5

 3.3 Uses of Pigment Violet 29 on Alibaba.com..... 5

 3.4 Uses of Pigment Violet 29 Reported in Scientific Literature..... 6

 3.5 Use Percentages of Pigment Violet 29 by Sector..... 6

 3.6 Products Containing Pigment Violet 29..... 6

 3.7 End Uses of Plastics Containing Pigment Violet 29 12

 3.8 Market Trends 13

4. Other Resources Considered 14

5. References 15

6. Appendix 18

List of Tables

Table 1: Chemical Name, Synonyms, and CAS RN.....	2
Table 2: Federal Regulations and Guidelines Concerning Pigment Violet 29	2
Table 3: 2012 CDR Manufacturers and Importers of Pigment Violet 29	3
Table 4: 2012 CDR Production Volume Data for Pigment Violet 29 (Pounds)	3
Table 5: National Production Volume Data for Pigment Violet 29 from 1986-2012 (Pounds)	4
Table 6: 2012 CDR Industrial Use and Production Data for Pigment Violet 29	5
Table 7: 2012 CDR Consumer and Commercial Use and Production Data for Pigment Violet 29	5
Table 8: Pigment Violet 29 Use Percentages by Sector in the U.S.....	6
Table 9: Products That Contain Pigment Violet 29	8
Table 10: Products That Contain Pigment Violet 29 According to the Society of Dyers and Colourists (2016).....	12
Table 11: End Uses of Plastics That May Contain Pigment Violet 29	12

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1. Introduction

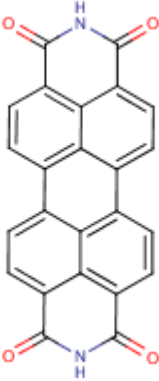
A pigment is an insoluble black, white, or colored crystal or particulate solid that improves the appearance of or gives color to media through selective absorption and/or by scattering of light (BASF, 2013). Pigments are physically and chemically unaffected by the vehicle or substrate in which they are incorporated, while dyes are soluble and/or go through an application process which, at least temporarily, alters their physical or chemical structure (Society of Dyers and Colourists, n.d.-a). The same compound can be used as a pigment or dye, depending on the type of media in which it is added. Each pigment is designated by a generic name and chemical constitution as assigned by the Colour Index (CI), published by The Society of Dyers and Colourists (of the United Kingdom) and The American Association of Textile Chemists and Colorists (Society of Dyers and Colourists, n.d.-b).

Commercial organic pigments can be classified into the following major categories: Azo, Phthalocyanine, Condensation acid, Quinacridone, and Perylene (Herbst and Hunger, 2004). Pigment Violet 29 (PV29), the subject of this report, is a perylene pigment. This group of high-performance pigments is characterized by high color strength, weather fastness, and heat stability (Greene, 2001).

This report provides an overview (Section 1), U.S. producers, production, and import volume (Section 2), and market and use information (Section 3) of PV29.

1.1 Overview of Pigment Violet 29

PV29, perylene pigment, is a maroon-colored shade. Perylenes were used exclusively as vat dyes until the 1950s when investigations by Harmon Colors led to the conversion of vat dyes to pigments (Herbst and Hunger, 2004). PV29 is now used in metallic finishes and textile printing and as a colorant for plastics processed at high temperatures (Herbst and Hunger, 2004; LANSCO COLORS, 2011). It also has applications in polyester spin dyeing (Herbst and Hunger, 2004). However, commercial use of PV29 is limited due to it tending to be a dull color with full shades being brown to almost black (Herbst and Hunger, 2004). Identification characteristics of PV29 are summarized in Table 1.

Table 1: Chemical Name, Synonyms, and CAS RN	
Chemical Name	Antra(2,1,9-def:6,5,10-d'e'f)diisoquinoline-1,3,8,10(2H,9H)-tetrone
CAS RN	81-33-4
Synonyms	C.I. Pigment Violet 29; C.I. 71129; Perylimid; 3,4,9,10-Perylenetetracarboxylic diimide; 3,4,9,10-Perylenetetracarboxylic acid diimide; NSC 16842; UNII-63NLI8842L; EINECS 201-344-6; 3,4,9,10-Perylenetetracarboxylic 3,4:9,10-diimide (8CI); Perylene-3,4,9,10-tetracarboxydiimide
Trade Names¹	Perrindo® Violet 29 (Sun Chemical Company); PALIOGEN® REDVIOLET K 5011 (BASF-old product), Paliogen® Red Violet K 5411 (BASF), Perylene Violet B (Hangzhou Epsilon Chemical Co., Ltd); 1029 Perylene Violet 29 (LANSCO COLORS)
Molecular Formula	C24-H10-N2-O4
Structure	
<p>Note: ¹Not a complete list Sources: NLM (n.d.); Sun Chemical Company (n.d.); BASF (1998); BASF (2015); LANSCO COLORS (2017)</p>	

1.2 U.S. and International Regulations Affecting Pigment Violet 29

In the U.S., only one Federal agency appears to have a regulation specific to PV29, described in Table 2. This regulation was found by searching the regulations.gov website for the Chemical Abstracts Service (CAS) number assigned to PV29, 81-33-4.

Table 2: Federal Regulations and Guidelines Concerning Pigment Violet 29	
Agency	Description of Regulation
Food and Drug Administration (FDA)	May be safely used as a colorant in the manufacture of articles or components of articles intended for use in producing, manufacturing, packing, processing, preparing, treating, packaging, transporting, or holding food, but level of use is not to exceed 1% by weight of polymers.
Source: FDA (2016)	

Laws concerning PV29 were not found in other countries. Broad internet searches for “pigment violet 29,” “perylene pigments,” or “81-33-4” and “regulations” or “laws” did not yield relevant results, and nor did conducting site-specific searches of the websites for environmental agencies in Australia, Canada, or Japan. In the European Union, the European Chemicals Agency (ECHA) reports that no hazards have been classified for PV29 (2016).

2. Producers, Production and Import Volume

2.1 U.S. Producers and Importers

Table 3 contains the sole U.S. manufacturer for PV29 as listed in the public 2012 Chemical Data Reporting (CDR) data (U.S. EPA, 2014). For the 2012 CDR cycle, manufacturers of certain chemicals were required to report information about those chemicals manufactured in amounts of 25,000 pounds or more at each of their sites during calendar year 2011. It is possible that other sites manufacture or import PV29 but are not listed in the public CDR database because they claimed their production as CBI or had production volumes below the 25,000 pound reporting threshold.

Table 3: 2012 CDR Manufacturers and Importers of Pigment Violet 29				
Company	City	State	Manufacture	Import
DIC Americas, Inc. (Sun Chemical)	Goose Creek	SC	Yes	No
Source: U.S. EPA (2014)				

In a meeting between U.S. EPA and the Color Pigments Manufacturers Association (CPMA), Sun Chemical was confirmed as the only U.S. producer of PV29. Sun Chemical sells PV29 to between eighteen and twenty companies. Lanco Color has been identified as an importer of PV29 (U.S. EPA, 2017).

In addition, Greene (2001) reports that Bayer, Ciba, and Clariant produce perylene pigments. However, Bayer sold its organic pigments business in the U.S. to Sun Chemical in 2002, and BASF bought Ciba in 2008 (Bayer Corporation, 2002; DEALBOOK, 2008). Clariant continues to manufacture perylene pigments in its Hostaperm series of automotive coatings, but PV29 or products containing PV29 were not found on the company's website (Clariant, 2016).

2.2 U.S. Production Volume by Producer

Table 4 presents the 2012 CDR production data available for the company that reported manufacturing of PV29. The facility did not recycle PV29, and it was manufactured as a dry powder and wet solid (U.S. EPA, 2014).

Table 4: 2012 CDR Production Volume Data for Pigment Violet 29 (Pounds)				
Company	Site	2011 Manufactured Volume	2011 Imported Volume	2010 Production Volume
DIC Americas, Inc.	Sun Chemical Bushy Park Facility 1506 Bushy Park Rd Goose Creek, SC 29454	520,916	0	395,108
Source: U.S. EPA (2014)				

2.3 U.S. Historic Production Volume

Table 5 presents the historic U.S. production volume data for PV29 submitted by companies under the non-confidential 1986, 1990, 1994, 1998, 2002, and 2006 Inventory Update Reporting (IUR) rule and the 2012 CDR. While the reporting threshold for manufacturing information was 25,000 pounds for the 2006 IUR and 2012 CDR, the reporting threshold for manufacturing information was 10,000 pounds from 1986 to 2002.

Table 5: National Production Volume Data for Pigment Violet 29 from 1986-2012 (Pounds)

1986	1990	1994	1998	2002	2006	2012
>500K - 1M	>500K - 1M	10K - 500K	>1M - 10M	10K - 500K	<500K	520,916

Source: U.S. EPA (n.d.); U.S. EPA (2010); U.S. EPA (2014)

3. Use Information and Market Trends

Pigments are primarily used as colorants and extenders with functional applications, such as providing reinforcement, corrosion, stain, or heat resistance (The Rohm and Haas Paint Quality Institute, n.d.). Printing inks are a major end-use for organic color pigments, as well as paints and coatings, plastics, pigmented fibers and rubber, and other uses, including for paper and textiles (Heucotech Ltd., 2015; Organic Dyes and Pigments, 2015).

Perylene pigments are frequently used in conjunction with other pigments in end-products. In automotive coatings, quinacridone pigments are often added to a perylene base to improve coloristic properties. Coatings, resins, synthetic fibers, and textile printing are common applications of perylene pigments (Greene, 2001).

PV29 in particular is used as a colorant in polyester spin dyeing (Herbst and Hunger, 2004). PV29 can also be used in plastics, such as polyolefins, polyvinyl chloride (PVC), polyurethane (PUR), polystyrene (PS), styrene butadiene (SB), styrene acrylonitrile (SAN) and other polymers, as well as for automotive and industrial coatings, including metallic finishes (BASF, 1998; LANSCO COLORS, 2011).

3.1 Uses of Pigment Violet 29 Reported in the IUR and CDR

As shown in Table 6 and Table 7, the 2012 CDR reported use of PV29 in the industrial sectors of paint and coating and plastic products manufacturing, as well as commercial use in paints and coatings and plastic and rubber products (U.S. EPA, 2014). In the 2006 IUR, PV29 was reported to be used in synthetic dye and pigment manufacturing with commercial or consumer use in paints and coatings, rubber and plastic products, and other (U.S. EPA, 2010). The 2012 CDR did not indicate use of PV29 in products intended for children.

Table 6: 2012 CDR Industrial Use and Production Data for Pigment Violet 29

Manufacturing Site	Industrial Function Category	Type of Processing or Use	Industrial Sectors	Percent of Production Volume
DIC Americas, Inc. (Sun Chemical Corporation)	Pigments	Processing-incorporation into formulation, mixture, or reaction product	Paint and Coating Manufacturing	50
			Plastics Product Manufacturing	50

Source: U.S. EPA (2014a)

Table 7: 2012 CDR Consumer and Commercial Use and Production Data for Pigment Violet 29

Manufacturing Site	Product Category	Consumer Use	Commercial Use	Used in Product(s) Intended for Children	Percent of Production Volume
DIC Americas, Inc. (Sun Chemical Corporation)	Paints and Coatings	No	Yes	No	50
	Plastic and Rubber Products Not Covered Elsewhere	No	Yes	No	50

Source: U.S. EPA (2014a)

3.2 Uses of Pigment Violet 29 Reported by the European Chemicals Agency

According to the ECHA, PV29 is used in printing and recorded media reproduction, formulation of mixtures and/or repackaging, and construction work. It may be a component of products with material based on metal (e.g., cutlery, pots, toys, jewelry), wood (e.g., floors, furniture, toys), paper (e.g., tissues, feminine hygiene products, nappies, books, magazines, wallpaper), and plastic (e.g., toys, mobile phones, food packaging and storage). On the industrial side, PV29 may be released into the environment in the production of articles, formulation in materials, and formulation of mixtures. Indoor and outdoor release of PV29 is likely to occur from coatings or adhesives used on vehicles, buildings, ships, and wooden products and treated textiles and fabrics (ECHA, 2016).

3.3 Uses of Pigment Violet 29 on Alibaba.com

A search for “Pigment Violet 29” on Alibaba.com, a website representing a Chinese e-commerce company, resulted in 90 hits. One company from Zhejiang, China (Alibaba, 2016a), sells PV29 for use in offset printing inks, solvent inks, water-based inks, plastics, rubbers, stationery, textile printing, pigment printing, coatings, paints, and leather. The price is not displayed. Another seller (Alibaba, 2016b), based in Guangdong, China, advertises that PVB (polyvinylbutyral) pigment chip-C.I. Pigment Violet 29, Mauve is suitable for use in printing ink on food, tea, and cigarette packaging, as well as offset print ink, gravure ink, silk-screen ink, flexographic printing ink, embossing ink, thermal transfer ink, white board marker ink, marking pen ink, and stationery ink. It additionally may be used in metal decoration paint and as a colorant in plastic and polyester fiber. The cost of this product is \$8 to \$18 per kilogram. Pigment violet 29 (Fast Bordeaux B) from Shandong, China, is sold for \$1 to \$50 per kilogram for use mainly in

metallic varnish and terylene stock dyeing (Alibaba, 2016c). The CAS number displayed online with each of these product descriptions matches that of PV29. The other products displayed on Alibaba.com appear to be sold for similar uses, particularly in coatings, paints, plastics, rubber, and solvent-based inks.

3.4 Uses of Pigment Violet 29 Reported in Scientific Literature

Using Google Scholar and excluding citations and patents, two searches for PV29 were conducted for the years 2000 through 2017. The first search, “pigment violet 29,” uncovered only 21 results, none of which had titles related to potential uses of PV29. The second search, “perylene pigments,” resulted in 567 articles. The first two pages of search results suggested the potential use of perylene pigments in solar cells. Kozma and Catellani report that perylenes make up “one of the most promising” classes of electron accepting materials, making them attractive options for photovoltaic applications (2013). However, PV29 is not specifically mentioned in this article.

3.5 Use Percentages of Pigment Violet 29 by Sector

In a recent meeting between the U.S. EPA and the CPMA, Sun Chemical representatives stated that about 80 percent of the PV29 the company produces is consumed on-site and never leaves the facility, 13 percent is sold in the U.S., and 7 percent leaves North America. Of the 13 percent that is sold in the U.S., 50 percent goes into automobile paint and refinish, 41 percent goes into high-performance plastics, such as automobile carpeting and upholstery, and 1 percent goes into merchant ink for banners or branding. The use of the remaining 8 percent was not described (Sun Chemical, recorded in U.S. EPA, 2017).

Table 8: Pigment Violet 29 Use Percentages by Sector in the U.S.	
Sector	Percentage
Automobile paint and refinish	50%
High-performance plastics (e.g., automobile carpeting and upholstery)	41%
Other	8%
Merchant ink	1%
Source: Sun Chemical, recorded in U.S. EPA (2017)	

3.6 Products Containing Pigment Violet 29

The Chemical Product Categories (CPCat) database (Dionisio et al., 2015) and Household Products Database (HPD) (NLM, 2016a) do not list products containing PV29, but broad internet searches for PV29 safety data sheets (SDS) revealed products or formulations containing PV29. Specifically, searches were conducted for “pigment violet 29” or “81-33-4” and “SDS” with all pages of results reviewed. Table 9 describes these products or formulations. Note that this list includes international manufacturers.

Some of the SDS for products containing PV29 represent laboratory chemicals. Although the SDS states that they are intended for use in laboratories, specific applications are not detailed. Kozma and Catellani (2013) describe that perylene pigments have been investigated for use in biochemical applications for

living cell staining, in fingerprint detection, and in electronic devices, including sensors and light-emitting diodes. Again, the authors do not mention PV29 but discuss perylenes in general. See the Appendix for additional companies selling PV29 in laboratory quantities, as reported by ChemicalBook (2016).

Table 9: Products That Contain Pigment Violet 29					
Company	Trade Name	Use	% by Weight of Chemical	Price	Notes and Link to SDS and Other Information
AK Scientific, Inc.	L419, 3,4,9,10-Perylenetetra-carboxylic diimide, 99% (HPLC)	For laboratory research use; not for drug or household use	99%	\$22.95/5 g	Company Website: https://aksci.com/index.php Price: https://aksci.com/item_list.php?search=81-33-4 SDS: http://aksci.com/sds/L419_SDS.pdf
Alfa Aeser	44098, 3,4,9,10-Perylenetetra-carboxylic diimide	Scientific research and development	Not available	\$25/5 g	Company Website: https://www.alfa.com/en/ Price: https://www.alfa.com/en/catalog/044098/ SDS: https://www.alfa.com/en/content/msds/USA/44098.pdf
Axalta Coating Systems, LLC.	Various coatings	Coating for professional use; transportation industry – light and commercial vehicles Industrial use-potentially including uses such as motors, generators, vehicle components, sporting goods, appliances, architectural uses, agricultural equipment, oil and gas pipelines.	Not available	Not available	Company Website: http://www.axaltacs.com/corporate/en_US.html SDS: http://www.color.tc/US_SDS/SDS/US_EN_1250007862_CRMX.pdf Note: This SDS is listed as an example and may not contain PV29; all of the SDS for coatings in this series seem to cite PV29 in Section 12. Ecological Information for completeness (View a full list of results by completing the following Google search: site: http://www.color.tc/ "81-33-4").
BASF	Luprofil® Violet 50-1105 C4	Pigment preparation for mass-dyeing of polypropylene yarns and fibers	40%	Not available	Company Website: https://www.basf.com/us/en.html SDS: http://www.col9.com/portal/streamer?fid=422243 Note: May be old product; not found on company website.

Table 9: Products That Contain Pigment Violet 29					
Company	Trade Name	Use	% by Weight of Chemical	Price	Notes and Link to SDS and Other Information
BASF	Palamid™ Violet 50-1105	Pigment preparation for spin-dyeing of polyamide yarns and fibers	25%	Not available	Company Website: https://www.basf.com/us/en.html Technical Data Sheet (TDS): http://www.xymara.com/portal/streamer?fid=422244 Note: May be old product; not found on company website.
BASF	Paliogen® Red Violet K 5011	Colorant; plastics processing industry – suitable for PVC-p, PVC-u, PUR, LD-PE, HD-PE, PP, PS, SB, SAN, PMMA, CA/CAB, and UP and under certain conditions for ABS/ASA, PC, PA, and PETP	Not available	Not available	Company Website: https://www.basf.com/us/en.html TDS: http://www2.basf.us/additives/pdfs/Paliogen_Redviolet_K5011.pdf Notes: May be old product; not found on company website. It appears to have been replaced by Paliogen® Red Violet K 5411. See Table 11 for end uses of the types of plastic in which this product may be used.
BASF	Paliogen® Red Violet K 5411	Colorant; plastics processing industry	75-80%	Not available	Company Website: http://worldaccount.basf.com/wa/NAFTA~en_US/Catalog/Pigments/pi/BASF/Brand/paliogen SDS: http://worldaccount.basf.com/wa/NAFTA~en_US/Catalog/Pigments/doc4/BASF/PRD/30048503/.pdf?asset_type=msds/pdf&language=EN&validArea=US&urn=urn:documentum:ProductBase_EU:09007af880393a3e.pdf
ColArt International SA	Winsor & Newton Professional Acrylic Perylene Violet	Fine art painting- acrylic	Not available	\$21.99/60 mL	Company Website: http://www.winsornewton.com/na/ Price: http://www.winsornewton.com/na/shop/acrylic-colour/professional-acrylic?colourid=094376990669 SDS: http://d4of2brjuv1jo.cloudfront.net/assetfiles/95d92f4a-b5be-4366-8320-21be2477ce65SAFETY%20DATA%20SHEET-12532-1-1.pdf

Table 9: Products That Contain Pigment Violet 29					
Company	Trade Name	Use	% by Weight of Chemical	Price	Notes and Link to SDS and Other Information
Daniel Smith, Inc.	Perylene Violet (PV29) Daniel Smith Extra Fine Watercolors	Watercolor	Not available	\$15.68/15 mL	Company Website: http://www.danielsmith.com Price: http://www.danielsmith.com/Item--i-284-600-201 SDS: http://www.danielsmith.com/ItemFiles/MSDS/MSDS_US00144_284-600-201_03192014.PDF
Guerra Paint and Pigment Corp.	Anthraquinone Violet	Pigment dispersion for making paints: see http://www.guerrapaint.com/PDF/HowTos/Simple_Paintmaking_Instructions.pdf	Not available	\$29.25/4 oz.	Company Website: https://www.guerrapaint.com/ Price: http://www.guerrapaint.com/index.php?main_page=product_info&cPath=145_101_105&products_id=218 d Notes: SDS not found and product contents verified by name only, not CAS number. Aqueous pigment concentrate ground from dry pigment into water and surfactant.
Guerra Paint and Pigment Corp.	Perrindo Violet	Pigment dispersion for making paints: see http://www.guerrapaint.com/PDF/HowTos/Simple_Paintmaking_Instructions.pdf	Not available	\$29/4 oz.	Company Website: https://www.guerrapaint.com/ Price: http://www.guerrapaint.com/index.php?main_page=product_info&cPath=145_101_105&products_id=215 Notes: SDS not found and product contents verified by name only, not CAS number. Aqueous pigment concentrate ground from dry pigment into water and surfactant.
Hangzhou Epsilon Chemical Co., Ltd. (China)	Perylene Violet B	Metal decorative paints, plastics, polyester spinning, rubbers, solvent based inks, offset inks, industrial paints, and automotive and original equipment manufacturer (OEM) paints	Not available	Not available	Company Website: http://epsilonpigments.com/organic-pigments/Pigment-Violet-29-ECV02901.html SDS: http://www.epsilonpigments.com/pdf/SDS%20-%20ECV02901.pdf

Table 9: Products That Contain Pigment Violet 29					
Company	Trade Name	Use	% by Weight of Chemical	Price	Notes and Link to SDS and Other Information
Jetcolour Industries Co.,Ltd. (China)	Nano pigments	Car coating	Not available	Not available	Company Website: http://www.jetcolour.com/carcoatings/ Note: SDS not found and product contents verified by name only, not CAS number.
MP Biomedicals, LLC.	Perylene-3,4,9,10-tetracarboxylic diimide	For research use only	Not available	\$43.65/5 g	Company Website: http://www.mpbio.com/?country=223 Price: http://www.mpbio.com/search.php?q=81-33-4&s=Search SDS: http://www.mpbio.com/includes/msds/05216511/MP_MSDS_216511_US_EN.pdf
Sun Chemical	229-4050 Perrindo® Violet 29	Automotive coating	Not available	Not available	Company Website: http://www.sunchemical.com/ Brochure: http://melrob.com/wp-content/uploads/coatings_brochure_0520111.pdf Note: SDS not found and product contents verified by name only, not CAS number.
TCI America	P0984, 3,4,9,10-Perylenetetracarboxylic diimide	For laboratory research use; not for drug or household use	≥95%	\$62/25 g	Company Website: http://www.tcichemicals.com/en/us/index.html Price: http://www.tcichemicals.com/eshop/en/us/commodity/P0984/ SDS: http://www.chemblink.com/MSDS/MSDSFiles/81-33-4_TCI.pdf
Utrecht Manufacturing, LLC.	Permanent Violet	Watercolor	Not available	\$10.99/14 mL	Company Website: http://www.utrechtart.com/ Price: http://www.utrechtart.com/Utrecht-Artists--Watercolor-Paint--Permanent-Violet-MP-01766-033-i1001249.utrecht?utm_source=google&utm_medium=cse&utm_term=01766-6922&country=US&currency=USD&gclid=CjwKEAiA-rfDBRDeyOybg8jd2U4SJAaE5XqwFYezI2IG2SihLZMdLczwQ9xOm5p4Xnp_cshoeO5PhBoCzjjw_wcB SDS: http://cdn.dick-blick.com/msds/DBH_SDS_01766XXXX.pdf

Products reported to contain PV29 by the Society of Dyers and Colourists that were not found in the online search are listed in Table 10 (2016).

Table 10: Products That Contain Pigment Violet 29 According to the Society of Dyers and Colourists (2016)		
Company	Trade Name	Use
Liaoning LianGang Pigment and Dyestuff Chemicals Co., Ltd. (China)	Perylene Violet S-0855	Metallic varnish, terylene stock solution dyeing
Color Pigments Manufacturers Association, Inc. (CPMA)	Pigment Violet 29	Provided by one or more CPMA member companies
Sun Chemical	Sunfast Violet 29 (229-9029)	Perylene violet with ultra-transparency for automotive metallic and pearlescent coatings

3.7 End Uses of Plastics Containing Pigment Violet 29

Based on the TDS found for Paliogen® Red Violet K 5011, PV29 could be used in sixteen types of plastics (BASF, 1998). Potential end uses of these plastics are summarized in Table 11.

Table 11: End Uses of Plastics That May Contain Pigment Violet 29	
Plastic	Uses
Cellulose acetate/cellulose acetate butyrate (CA/CAB)	Printing inks; heat seal adhesives; coatings for leather, cloth, wood, and automobiles; lacquers for paper, wood, and automobiles; nail polish and other nail care products (Eastman Chemical Company, 2017a; Eastman Chemical Company, 2017b)
High-density polyethylene (HD-PE)	Containers for milk, motor oil, shampoos, conditioners, soaps, detergents, bleaches, and toys (Tooley, 2017)
Low-density polyethylene (LD-PE)	Cling wrap; sandwich bags; squeezable bottles; plastic grocery bags (Tooley, 2017)
Plasticized PVC (PVC-p)	Cable and wire insulation; plugs; cable jackets; sockets; sable heads; distributors; swimming bath linings; floor and wall coverings; roofing; doorstops; seals for windows and doors; inhalation masks; surgical and examination gloves; blood storage bags and drainage tubes; car body seals, dashboard skins, artificial leather, and sun visors (SpecialChem, 2017a)
Poly(acrylonitrile butadiene acrylate)/poly(acrylonitrile butadiene styrene) (ABS/ASA)	Car instrument panels, pillar trim, dashboard components, door liners and handles, seat backs, and seatbelt components; electronics control panels and housings; refrigerator liners (SpecialChem, 2017b)
Polymethyl methacrylate (PMMA)	Sunglasses, watch glasses, and diffuser panels; windows, port-holes, and domes; blood sample tubes and diagnostic dishes; toothbrushes; car rear light indicators and dashboard covers; plates; pens; salad bowls (SpecialChem, 2017c)
Polyacrylate (PA)	Coatings and paints; textiles; leather finishing; printing inks; automotive products; tape adhesives; oil-resistant and high-temperature-resistant elastomers (Polymer Properties Database, 2015)
Polycarbonate (PC)	Baby bottles; large water bottles; compact discs; medical storage containers (Tooley, 2017)
Polyethylene terephthalate (PETP)	Beverage bottles; peanut butter jars; rope; combs; clothing; bean bags (Tooley, 2017)
Polypropylene (PP)	Plastic diapers; Tupperware; margarine containers; yogurt boxes; syrup bottles; prescription bottles; bottle caps (Tooley, 2017)
Polystyrene (PS)	Disposable coffee cups; plastic food boxes and cutlery; packing foam (Tooley, 2017)

Table 11: End Uses of Plastics That May Contain Pigment Violet 29

Plastic	Uses
Polyurethane (PUR)	Building, refrigerator, and freezer insulation; coatings and adhesives; elastomers and sealants; car seats, armrests, and headrests; footwear; furniture; bedding (ISOPA, 2017)
Rigid PVC (PVC-u)	Drainage, pressure, brewery, and water service pipes; pipe fittings and connections; grating covers; fencing; decking; siding; roofing sheets; sanitary installations; window profiles; insulation pipes; jacketing; electricity distribution boxes; switches; plug housings; battery terminals; disposable pots, spice and cream containers; ball point pen casings; trifolds; bottles for vegetable, oil and juices; cosmetic containers (SpecialChem, 2017d)
Styrene butadiene (SB)	Car and light truck tires and truck tire retread compounds; brake and clutch pads; V-belts; flooring; military tank pads; hard rubber battery box cases; extruded gaskets; cable insulation and jacketing; pharmaceutical, surgical, and sanitary products; houseware mats; drain board trays; shoe soles and heels; chewing gum; food container sealants; conveyor belts; sponge articles; adhesives and caulks; automobile mats; rubber toys (AZoM, 2003)
Styrene-acrylonitrile resin (SAN)	Kitchen mixing bowls and basins; fittings for refrigerators; thermally insulated jugs; tableware and cutlery; coffee filters; jars and beakers; storage containers for foods; toothbrushes; bathroom fittings; cosmetic packaging; outer covers of printers, calculators, instruments, and lamps; scales; battery housings; winding cores; writing and drawing equipment; cylindrical impellers for air-conditioners (British Plastics Federation, 2017a)
Unsaturated polyester (UP)	Coatings; buttons; structural parts in building and sanitary wares; cladding panels; sheeting for pre-fabricated buildings; roofing tiles; pipes, baths and shower trays in bathrooms; bumper beams, body panels, sunroof frames, catalytic converter heat shields, dashboard carriers, seat structures, battery supports, and spring systems in airplanes, trucks, and buses; railroad cars and shipping containers; boat hulls (British Plastics Federation, 2017b)

3.8 Market Trends

The U.S. and European organic pigment markets are expected to grow by around 1-2% per year on average between 2014 and 2019. Much of the pigments business is migrating to Asia, particularly to India and China, the world's largest organic pigment producer. Recently, pigment supplies from China have been disrupted due to the Chinese government removing many subsidies on exports and putting smaller producers out of business by penalizing polluters (IHS Markit, 2015).

Competition from the internet is decreasing the demand for printing inks used for newspapers and publications, although the demand for colored inks for advertising leaflets and catalogs and packaging is expected to expand somewhat. The demand for organic pigments used in automotive coatings is also increasing with vehicle production on the rise (IHS Markit, 2015).

Other key market trends include the increasing demand for high performance, special effect, and heat management pigment solutions. These organic and inorganic specialty pigments are used in the automotive, architecture, fiber, nylon, specialties and niche markets, which are expected to grow. Their use in the packaging market is also expected to grow as consumers continue to purchase more products globally. The demand for heat management pigments is expected to increase due to the need for solar management solutions within architectural and construction applications (Pianoforte, 2012).

With respect to perylene pigments in particular, the largest global suppliers of high-performance perylene pigments were Sun Chemical and BASF in 2001. The median price of perylene pigments was \$40 per pound (Greene, 2001).

4. Other Resources Considered

In addition to the resources previously described, several other data sources were reviewed.

The Toxics Release Inventory (TRI) tracks the annual release of 595 toxic chemicals into the environment by U.S. industries. Facilities manufacturing, processing, or otherwise using PV29 are not required to report releases to TRI, so no information is available on this pigment (U.S. EPA, 2016a).

The National Emissions Inventory (NEI) provides estimates of air emissions of criteria pollutants, criteria precursors, and hazardous air pollutants from air emissions sources. As PV29 is not one of these precursors or pollutants, it is not included in the dataset (U.S. EPA, 2016b).

PubChem, an open chemistry database, offers information about PV29 under “Perylimid,” as confirmed by matching the CAS number. Names and identifiers, 2D structure, 3D conformer, chemical and physical properties, related records, chemical vendors, use and manufacturing, literature, patents, classification, and information sources are included in the database. The use and manufacturing details are taken from the 2012 CDR, and though there are 468 patents related to PV29, it is difficult to determine how PV29 is involved in the processes or compositions without looking up the patents individually. Therefore, this resource was not further investigated (NLM, 2016b).

Another database, Substances in Preparation in Nordic Countries (SPIN), lists use categories of PV29 from product registries of Norway, Sweden, Denmark, and Finland. These applications reinforce those mentioned earlier, such as the use of PV29 in automotive paints (SPIN, 2017).

5. References

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6. Appendix

The Chinese-based ChemicalBook provides basic information about chemicals as well as companies that supply chemicals in laboratory quantities. For PV29, looked up by CAS number, the website lists 48 Chinese suppliers, 15 American suppliers, and 9 suppliers from other countries (ChemicalBook, 2016). However, some of the Chinese suppliers were listed twice, bringing the total number of suppliers from China to 41. Table A- 1 provides an overview of these suppliers.

Table A- 1: Suppliers of Pigment Violet 29 Listed in ChemicalBook (2016)			
Company	Location	Website	Notes
360 Reagent	China	www.360reagent.com	
3600Chem	China	www.3600chem.com	
3B Pharmachem (Wuhan) International Co., Ltd.	China	No website provided	
3B Scientific Corporation	United States	www.3bsc.com	
ABCR GmbH & Co. KG	Germany	www.abcr.de	
Aceto Corporation	United States	www.aceto.com	
Adamas Reagent, Ltd.	China	www.tansoole.com	
Aikon International Limited	China	www.aikonchem.com	
AK Scientific, Inc.	United States	www.aksci.com	Product with SDS found for this supplier
Alfa Aesar	China	www.alfachina.cn	
Alfa Aesar, Avocado, Lancaster	United States	www.alfa.com	Product with SDS found for this supplier
Alfa Chemistry	United States	www.alfa-chemistry.com	
AlliChem, LLC	United States	www.allichemllc.com	
Anshan Hifi Chemicals Co., Ltd.	China	www.hifichem.com	
Anshan Huifeng Chemicals Co., Ltd.	China	www.huifengchem.com	
APAC Pharmaceutical, LLC	United States	www.apacpharma.com	
ASDI Incorporated	United States	www.asdi.net	
Beijing Isomersyn Technology Co., Ltd.	China	www.isomersyn.com	Listed twice in ChemicalBook
Beijing three Shing TOUCH DOWN Technology Ltd.	China	www.zs-ht.com	
Beijing Yunbang Biological Technology Co., Ltd.	China	www.yunbangchem.com	
Carbone Scientific Co., Ltd.	United Kingdom	www.carbonesci.com	

Table A- 1: Suppliers of Pigment Violet 29 Listed in ChemicalBook (2016)

Company	Location	Website	Notes
Changchun Banhe Technology Co., Ltd.	China	www.banhetec.com	
ChemPacific Corporation	United States	www.chempacific.com	
ChemService Inc.	United States	www.chemservice.com	
Cheng Du Micxy Chemical Co., Ltd.	China	www.micxy.com	
Chengdu HuaXia Chemical Reagent Co. Ltd	China	www.hx-r.com	
China Langchem Inc.	China	www.langchem.com	
City Chemicals Corporation	United States	www.citychemical.com	
Codow Chemical Co., Ltd.	China	www.codow.com.cn	
Colorant Pigment Chemicals Co., Ltd.	China	www.colorantpigment.com	
Dongguan Albiya Energy Science and Technology Co., Ltd.	China	www.albiya.com	
Energy Chemical	China	www.energy-chemical.com	Listed twice in ChemicalBook
Eurolabs Limited	United Kingdom	www.eurolabs.co.uk	
Hangzhou J&H Chemical Co., Ltd.	China	www.jhechem.com	
Hangzhou Xcolor Imp. & Exp. Co., Ltd.	China	www.xcolorpigment.com	
Hanshang Chemical Scientific Limited	China	www.hanshangchem.com	Listed twice in ChemicalBook
Hubei Jusheng Technology Co., Ltd.	China	www.hubeijusheng.com	
J & K Scientific Ltd.	China	www.jkchemical.com	
JadeChem International Co., Ltd.	China	www.jadechem-colours.com	
Jilin OLED Material Tech Co., Ltd.	China	www.jl-oled.com	Listed twice in ChemicalBook
Leancare Ltd.	United Kingdom	www.leancare.co.uk	
Liaoyang Liangang Dyes Chemical Co., Ltd.	China	www.lyliangangdyes.com	
Meryer (Shanghai) Chemical Technology Co., Ltd.	China	www.meryer.com	
MP Biomedicals, Inc.	United States	www.mpbio.com	Product with SDS found for this supplier
Ningbo BlueHill Chemicals Co., Ltd.	China	www.bluehillchem.com	
Pfaltz & Bauer, Inc.	United States	www.pfaltzandbauer.com	

Table A- 1: Suppliers of Pigment Violet 29 Listed in ChemicalBook (2016)

Company	Location	Website	Notes
Quzhou Mingfeng Chemical Co., Ltd.	China	www.mfchem.net	
Service Chemical, Inc.	Germany	www.chemos-group.com	Affiliated with ABCR GmbH & Co. KG
Shandong XiYa Chemical Industry Co., Ltd.	China	www.xiyashiji.com	
Shanghai Aladdin Bio-Chem Technology Co., Ltd.	China	www.aladdin-e.com	
Shanghai JONLN Reagent Co., Ltd.	China	www.jonln.com	
Shanghai Macklin Biochemical Co., Ltd.	China	www.macklin.cn	
Shanghai Orgchem Co., Ltd.	China	www.chemofchina.com	
Shanghai YuanYe Biotechnology Co., Ltd.	China	www.shyuanye.com	
TCI America	United States	www.tcichemicals.com/en/us/index.html	Product with SDS found for this supplier
TCI (Shanghai) Development Co., Ltd.	China	www.tcichemicals.com	
TCI Europe	Europe	www.tcichemicals.com/de/de/index.html	
TCI Japan	Japan	www.tcichemicals.com/ja/jp/index.html	
Tokyo Chemical Industry UK Ltd.	United Kingdom	www.tci-uk.co.uk	
VWR International	United Kingdom	www.vwr.com	
Waterstone Technology, LLC	United States	www.waterstonetech.com	
Winchem Industrial Co., Ltd.	China	www.win-chemical.com	Listed twice in ChemicalBook
Wuxi Zhongkun Biochemical Technology Co., Ltd.	China	www.zhk-bio.com	
XiaoGan ShenYuan ChemPharm Co., Ltd.	China	www.farchem.com	Listed twice in ChemicalBook
Zeya Chemicals (Haimen) Co., Ltd.	China	www.zeyachem.com	

Trichloroethylene Market and Use Report

May 12, 2017

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Trichloroethylene Market and Use Report

Table of Contents

1. Introduction.....	1-1
2. TCE Market Profile.....	2-1
2.1 Chemical Data Reporting	2-1
2.2 Toxics Release Inventory	2-5
2.3 National Emissions Inventory	2-15
3. Uses of Trichloroethylene.....	3-1
4. References.....	4-1

1. Introduction

TCE is a volatile organic compound (VOC) that is classified as a human carcinogen. EPA recently proposed to prohibit its use in vapor degreasing, dry cleaning spot removers, and aerosol degreasers under Section 6 of the Toxic Substances Control Act (TSCA). U.S. EPA is also proposing a significant new use rule (SNUR) for non-aerosol spray degreasers. Additionally, under section 5(a)(2) of the Toxic Substances Control Act (TSCA), EPA is finalizing a significant new use rule (SNUR) for TCE at 40 CFR §721.10851 by designating manufacturing (including import) or processing of TCE for use in a consumer product, with an exception for use in cleaners and solvent degreasers, film cleaners, hoof polishes, lubricants, mirror edge sealants, and pepper spray. This report details all of the uses of TCE, including those that have been discontinued.

In 2014, the U.S. accounted for 24 percent of global demand, second only to China which accounted for 52 percent of global demand (IHS 2014). Currently, EPA (2014) reports that 83.6 percent of TCE is used as an intermediate in the production of the refrigerant HFC-134a, an alternative to the banned refrigerant CFC-12. Another 14.7 percent of TCE is used as a degreaser for metal parts (EPA2014). The remaining 1.7 percent is attributable to other uses, including as a spot-removal solvent in dry cleaning, as a modifier in PVC polymerization, and in consumer household aerosol products (EPA 2014). The uses of TCE by percentage presented in EPA (2014) are summarized in Table 1-1.

Table 1-1. Uses of Trichloroethylene by Percentage	
Use	Percentage
Chemical intermediate in the production of refrigerant HFC-134a	83.6
Degreaser for metal parts	14.7
Other uses, including solvent for spot-removal in dry cleaning, modifier in PVC polymerization, and degreaser in consumer aerosols	1.7
Total	100
Source(s): EPA (2014)	

The remainder of this report is organized as follows: Section 2 presents summaries of data taken from the Chemical Data Reporting (CDR) database, the Toxic Release Inventory (TRI), and the National Emissions Inventory (NEI); Section 3 presents a table describing uses of TCE and a complementary table that identifies products currently being sold with TCE that correspond to the uses; and Section 4 presents references used in this report.

2. TCE Market Profile

This section presents a summary of the market information available on TCE. The section is divided into three subsections based on the three critical data sources. Sections 2.1, 2.2, and 2.3 summarize the available industry data on TCE from the Chemical Data Reporting (CDR) database, the Toxics Release Inventory (TRI) database, and the National Emissions Inventory (NEI) database, respectively.

2.1 Chemical Data Reporting

The Chemical Data Reporting Rule under TSCA requires manufactures (including importers) to provide information to EPA on the chemicals they manufacture or import into the United States. Data collected per chemical include the company name, volume of each chemical manufactured/imported, the number of workers at each site, and information on whether the chemical is used in the industrial, commercial, and/or consumer sector. According to the 2012 Chemical Data Reporting (CDR) results, the U.S. produced (including imports) 225 million pounds of TCE in 2011 (EPA 2012a). Title 40 CFR 711.8 (a) states that

any person who manufactured (including imported) for commercial purposes 25,000 lb (11,340 kilogram (kg)) or more of a chemical substance described in §711.5 at any single site owned or controlled by that person during the principal reporting year (i.e., calendar year 2011) is subject to reporting.

A person is not subject to CDR reporting requirements if that person qualifies as a small manufacturer as that term is defined in Title 40 CFR 704.3 unless that person manufactures a chemical substance that is the subject of a rule proposed or promulgated under TSCA section 4, 5(b)(4), or 6, or is the subject of an order in effect under TSCA section 5(e), or is the subject of relief that has been granted under a civil action under TSCA section 5 or 7.

The 2012 CDR non-confidential database includes nine manufacturers and/or importers of TCE (see Table 2-1; EPA 2012b). Both Dow Chemical Co. and PPG Industries, Inc. have recently undergone mergers with or have sold off their TCE capacity to Olin Corporation and Axiall Corporation, respectively (U.S. Securities and Exchange Commission 2012; The DOW Chemical Company 2015).

2.1.1 CDR Information - Major Manufacturers and/or Importers

The CDR lists nine major manufacturers and/or importers of TCE, with two of them anonymized as confidential business information (CBI; see Table 2-1).

Table 2-1. Manufacturers and Importers

Company	NAICS code	State	Manufacture (lb/yr)	Import (lb/yr)	Volume (used in site; lb/yr)	Concentration	Number of workers
Dow Chemical Co	325211	MI	CBI	0	0	90% +	25 - 49
Greenchem Industries LLC	424690	FL	0	CBI	N/A	90% +	< 10
PPG Industries Inc	325510	PA	CBI	0	CBI	90% +	50 - 99
Shin Etsu	325199	LA	140,810	0	106,446	< 1%	500 - 999
Solvchem Inc	424690	TX	109,116	0	109,116	90% +	100 - 499
TRInternational Inc	424690	WA	0	209,780	N/A	90% +	< 10
Vinmar Overseas Ltd	424690	TX	0	91,359	91,359	90% +	< 10
CBI	CBI	CBI	CBI	CBI	CBI	90% +	< 10
CBI	CBI	CBI	CBI	CBI	CBI	CBI	CBI
Source(s): EPA (2012b)							

2.1.2 CDR Use Information

Table 2-2 and Table 2-3 present use information reported in the 2012 CDR for the industrial and commercial/consumer sectors, respectively. Industrial uses of TCE, as reported in the 2012 CDR, are primarily repackaging and processing TCE for use in another industrial process such as repackaging TCE as a solvent for parts cleaning/degreasing or processing TCE to be used as an intermediate in the production of another chemical (see Table 2-2). Only one commercial/consumer product category is identified in the 2012 CDR, Adhesives and Sealants (see Table 2-3). According to the 2012 CDR, the Adhesive and Sealant products produced by Dow Chemical Co. are not included in products used by children. Note that Table 2-2 and Table 2-3 present the information returned from the database query. Thus, blank cells in those tables signify blank cells returned from the database query.

Table 2-2. Industrial Use Information

Manufacturing/ Importing Site	Type of Process	NAICS code	Industrial Sector	Industrial Function Category	Percent of Production Volume	Number of Sites	Number of Workers
Dow Chemical Co	Processing-incorporation into formulation, mixture, or reaction product	325211	Primary Metal Manufacturing	Solvents (for cleaning or degreasing)	2	< 10	N/A
	Processing as a reactant	325211	All Other Basic Organic Chemical Manufacturing	Intermediates	90	< 10	N/A
	Processing-repackaging	325211	All Other Basic Organic Chemical Manufacturing	N/A	2	N/A	N/A
Greenchem Industries LLC		424690					
PPG Industries Inc	Processing-repackaging	325510	All Other Basic Organic Chemical Manufacturing	Solvents (for cleaning or degreasing)	CBI	< 10	N/A
	Processing as a reactant	325510	Agriculture, Forestry, Fishing and Hunting	Agricultural chemicals (non-pesticidal)	CBI	< 10	N/A
	Processing as a reactant	325510	Wholesale and Retail Trade	Solvents (for cleaning or degreasing)	CBI	10 - 24	N/A
	Processing as a reactant	325510	Industrial Gas Manufacturing	Functional fluids (closed systems)	CBI	< 10	N/A
Shin Etsu	Use-non-incorporative activities	325199	All Other Chemical Product and Preparation Manufacturing	N/A	100	< 10	500 - 999
Solvchem Inc	Processing-incorporation into formulation, mixture, or reaction product	424690	All Other Chemical Product and Preparation Manufacturing	Solvents (which become part of product formulation or mixture)	100	< 10	100 - 499
TRInternational Inc	N/A	424690	N/A	N/A	100	N/A	N/A
Vinmar Overseas Ltd		424690					
CBI	N/A	CBI	N/A	N/A	100	N/A	N/A
CBI	Processing as a reactant	CBI	All Other Basic Organic Chemical Manufacturing	Intermediates	100	< 10	100 - 499
Source(s): EPA (2012b)							

Table 2-3. Consumer and Commercial Use Information

Manufacturing /Importing Site	Commercial/ Consumer Use	Used in Children Products	Product Category	Percent of Production Volume	Concentration	Number of Workers
Dow Chemical Co	Both	No	Adhesives and Sealants	1	N/A	N/A
Greenchem Industries LLC						
PPG Industries Inc						
Shin Etsu						
Solvchem Inc						
TRInternational Inc	N/A	N/A	N/A	100	N/A	N/A
Vinmar Overseas Ltd						
CBI	N/A	N/A	N/A	100	N/A	N/A
CBI						
Source(s): EPA (2012b)						

2.2 Toxics Release Inventory

The TRI Program tracks the management of toxic chemicals that may pose a threat to human health and the environment. Facilities in certain industry sectors report annually the volume of toxic chemicals managed as waste (recycled, treated or burned for energy recovery), as well as disposed of or otherwise released into the environment. This section presents information derived from the 2015 TRI database.

2.2.1 Total Number of Facilities

TRI provides data on 172 facilities. The sectors with the highest frequency of TCE facilities are chemicals, fabricated metals, chemical wholesale, and hazardous waste (see Table 2-4).

Table 2-4. TRI Facilities	
Industry type	Number of Facilities
Chemical Wholesalers	20
Chemicals	45
Computers and Electronic Products	1
Electrical Equipment	4
Fabricated Metals	35
Hazardous Waste	17
Machinery	5
Miscellaneous Manufacturing	1
Nonmetallic Mineral Product	10
Petroleum	2
Plastics and Rubber	9
Primary Metals	10
Textile Product	1
Transportation Equipment	10
Petroleum Bulk Terminals	2
Total	172
Source(s): EPA (2015)	

2.2.2 Manufacturing Facilities

Table 2-5 highlights the manufacturing of TCE across different industries. As illustrated in the table, the greatest number of facilities that manufactured or imported TCE is associated with the chemicals industry.

Table 2-5. TRI Manufacturing Facilities			
Industry type	Manufacturing – Number of Facilities		
	Produced	Imported	Total
Chemical Wholesalers	0	0	0
Chemicals	16	2	18
Computers and Electronic Products	0	0	0
Electrical Equipment	0	0	0
Fabricated Metals	0	0	0
Hazardous Waste	0	0	0
Machinery	0	0	0
Miscellaneous Manufacturing	0	0	0
Nonmetallic Mineral Product	0	0	0
Petroleum	1	0	1
Plastics and Rubber	0	0	0
Primary Metals	0	1	1
Textile Product	0	0	0
Transportation Equipment	0	0	0
Petroleum Bulk Terminals	0	0	0
Total	17	3	20
Source(s): EPA (2015)			

Table 2-6 presents the number of facilities in each industrial sector by four manufacturing subcategories:

- For on-site use/processing
- For sale/distribution
- As a byproduct
- As an impurity.

Table 2-6. TRI Sub-Categories of Manufacturing Facilities

Industry type	Sub-Categories of Manufacturing – Number of Facilities				
	For on-site use/processing	For sale/distribution	As a byproduct	As an impurity	Total
Chemical Wholesalers	0	0	0	0	0
Chemicals	5	4	13	8	30
Computers and Electronic Products	0	0	0	0	0
Electrical Equipment	0	0	0	0	0
Fabricated Metals	0	0	0	0	0
Hazardous Waste	0	0	0	0	0
Machinery	0	0	0	0	0
Miscellaneous Manufacturing	0	0	0	0	0
Nonmetallic Mineral Product	0	0	0	0	0
Petroleum	0	0	1	0	1
Plastics and Rubber	0	0	0	0	0
Primary Metals	1	0	0	0	1
Textile Product	0	0	0	0	0
Transportation Equipment	0	0	0	0	0
Petroleum Bulk Terminals	0	0	0	0	0
Total	6	4	14	8	32
Source(s): EPA (2015)					

2.2.3 Processing Facilities

Table 2-7 presents the number of facilities in each industrial sector by five processing subcategories:

- As a reactant
- As a formulation component
- As an article component
- Repacking
- As an impurity.

Table 2-7. TRI Sub-Categories of Processing Facilities

Industry type	Categories of Processing – Number of Facilities					
	As a reactant	As a formulation component	As an article component	Repacking	As an impurity	Total
Chemical Wholesalers	0	4	0	6	0	10
Chemicals	11	13	0	6	1	31
Computers and Electronic Products	0	0	0	0	0	0
Electrical Equipment	0	0	0	0	0	0
Fabricated Metals	0	0	0	0	0	0
Hazardous Waste	0	2	1	3	2	8
Machinery	1	0	0	0	0	1
Miscellaneous Manufacturing	0	0	0	0	0	0
Nonmetallic Mineral Product	0	0	0	1	1	2
Petroleum	0	0	0	0	0	0
Plastics and Rubber	0	0	1	1	0	2
Primary Metals	1	2	0	0	0	3
Textile Product	0	0	0	0	0	0
Transportation Equipment	0	1	0	0	0	1
Petroleum Bulk Terminals	0	0	0	0	0	0
Total	13	22	2	17	4	58
Source(s): EPA (2015)						

2.2.4 Other Uses

TCE is also used as a chemical processing aid, as a manufacturing aid, in an ancillary manner, or for some other use. Table 2-8 presents the number of facilities in each industrial sector by other uses.

Table 2-8. TRI Sub-Categories for Otherwise Use				
Industry type	Categories of Otherwise use – Number of Facilities			
	As a chemical processing aid	As a manufacturing aid	Ancillary or other use	Total
Chemical Wholesalers	0	0	0	0
Chemicals	1	1	15	17
Computers and Electronic Products	0	0	1	1
Electrical Equipment	1	1	2	4
Fabricated Metals	1	8	27	36
Hazardous Waste	0	0	13	13
Machinery	1	2	2	5
Miscellaneous Manufacturing	0	0	1	1
Nonmetallic Mineral Product	0	0	9	9
Petroleum	0	0	2	2
Plastics and Rubber	1	3	2	6
Primary Metals	1	2	8	11
Textile Product	0	0	1	1
Transportation Equipment	1	4	7	12
Petroleum Bulk Terminals	0	0	0	0
Total	7	21	90	118
Source(s): EPA (2015)				

2.2.5 Trends

Table 2-9 details the waste management of TCE related to production from 2013 to 2015. In each of the years, the majority of waste-managed TCE was associated with the chemicals industry. Table 2-10 details onsite and offsite recycling of TCE from 2013 to 2015.

Table 2-9. TRI Reporting Trends

Industry type	Production-Related Waste Managed											
	2013				2014				2015			
	Produced		Imported		Produced		Imported		Produced		Imported	
	# of facilities	Pounds	# of facilities	Pounds	# of facilities	Pounds	# of facilities	Pounds	# of facilities	Pounds	# of facilities	Pounds
Chemical Wholesalers	1	255	0	0	0	0	0	0	0	0	0	0
Chemicals	14	2,059,789	1	766,513	14	2,687,001	1	1,220,308	16	4,107,067	2	2,538,673
Computers and Electronic Products	0	0	0	0	0	0	0	0	0	0	0	0
Electrical Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Fabricated Metals	0	0	0	0	0	0	0	0	0	0	0	0
Hazardous Waste	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
Nonmetallic Mineral Product	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum	1	13,191	0	0	1	7,471	0	0	1	23,181	0	0
Plastics and Rubber	0	0	0	0	0	0	0	0	0	0	0	0
Primary Metals	0	0	3	168,835	0	0	2	93,977	0	0	1	99,311
Textile Product	0	0	0	0	0	0	0	0	0	0	0	0
Textiles	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum Bulk Terminals	0	0	0	0	0	0	0	0	0	0	0	0
Total	16	2,073,235	4	935,348	15	2,694,472	3	1,314,285	17	4,130,248	3	2,637,984
Source(s): EPA (2015)												

Table 2-10. Onsite and Offsite Chemical Recycling

2013				
Industry type	Onsite		Offsite	
	Number of facilities	Pounds	Number of facilities	Pounds
Chemical Wholesalers	0	0	1	210
Chemicals	7	3,800,804	6	15,094
Computers and Electronic Products	0	0	2	28,003
Electrical Equipment	1	471,750	3	43,788
Fabricated Metals	11	21,350,566	23	157,880
Hazardous Waste	6	359,990	2	23,150
Machinery	0	0	4	31,160
Miscellaneous Manufacturing	0	0	2	7,611
Nonmetallic Mineral Product	0	0	1	4
Petroleum	0	0	0	0
Plastics and Rubber	0	0	0	0
Primary Metals	3	12,095,671	2	15,000
Textile Product	4	41,630,661	5	87,891
Textiles	0	0	0	0
Transportation Equipment	0	0	1	23,285
Petroleum Bulk Terminals	1	13,870	4	24,990
Total	33	79,723,312	56	458,066
2014				
Industry type	Onsite		Offsite	
	Number of facilities	Pounds	Number of facilities	Pounds
Chemical Wholesalers	0	0	0	0
Chemicals	8	4,746,610	4	13,599
Computers and Electronic Products	0	0	2	40,553
Electrical Equipment	0	0	2	52,903
Fabricated Metals	9	20,568,639	22	132,801
Hazardous Waste	4	200,165	3	41
Machinery	0	0	4	34,160
Miscellaneous Manufacturing	0	0	1	3,219
Nonmetallic Mineral Product	0	0	1	14
Petroleum	0	0	0	0
Plastics and Rubber	0	0	1	9,528
Primary Metals	3	17,820,606	4	37,829
Textile Product	4	58,336,030	5	42,471
Transportation Equipment	0	0	0	0
Petroleum Bulk Terminals	0	0	4	73,733
Total	28	101,672,050	53	440,851

Table 2-10. Onsite and Offsite Chemical Recycling

2015				
Industry type	Onsite		Offsite	
	Number of facilities	Pounds	Number of facilities	Pounds
Chemical Wholesalers	0	0	0	0
Chemicals	9	4,188,585	3	3,716
Computers and Electronic Products	0	0	1	10,311
Electrical Equipment	0	0	1	32,870
Fabricated Metals	10	22,546,455	15	110,680
Hazardous Waste	6	250,055	3	477
Machinery	0	0	3	30,748
Miscellaneous Manufacturing	0	0	1	2,122
Nonmetallic Mineral Product	0	0	1	4
Petroleum	0	0	0	0
Plastics and Rubber	0	0	0	0
Primary Metals	1	18,850,666	2	2,714
Textile Product	4	29,900,987	5	88,656
Transportation Equipment	0	0	0	0
Petroleum Bulk Terminals	0	0	4	71,374
Total	30	75,736,748	39	353,673
Source(s): EPA (2015)				

2.3 National Emissions Inventory

The National Emissions Inventory (NEI) is a comprehensive and detailed estimate of air emissions of criteria pollutants, criteria precursors, and hazardous air pollutants from air emissions sources. Table 2-11 details the number of facilities across different industries that release TCE into the atmosphere, according to the 2014 NEI database.

Table 2-11. NEI Facilities Count and Emissions		
SCC Level Two type	2014	
	Facility Count	Emissions (lb/yr)
Chemical Manufacturing	208	90,489
Commercial/Institutional	248	3,262
Cooling Tower	4	174
Electric Generation	323	4,936
Electrical Equipment	3	332
Fabricated Metal Products	8	12,400
Food and Agriculture	8	224
Industrial	619	11,196
In-process Fuel Use	16	1,005
Machinery, Miscellaneous	1	0
Mineral Products	135	1,368
Miscellaneous Manufacturing Industries	194	257,483
Oil and Gas Production	1	0
Organic Chemical Storage	73	13,901
Organic Chemical Transportation	7	125
Organic Solvent Evaporation	240	1,152,320
Petroleum Industry	141	9,810
Petroleum Liquids Storage (non-Refinery)	1	30
Petroleum Product Storage at Refineries	15	101
Photo Equip/Health Care/Labs/Air Condit/SwimPools	175	119
Photographic Film Manufacturing	1	36
Primary Metal Production	10	87
Printing/Publishing	10	19,873
Pulp and Paper and Wood Products	666	58,583
Rubber and Miscellaneous Plastics Products	73	519,653
Secondary Metal Production	25	117,013
Site Remediation	55	23,359
Solid Waste Disposal - Commercial/Institutional	165	19,308
Solid Waste Disposal - Government	1239	142,700
Solid Waste Disposal - Industrial	114	4,521
Space Heaters	2	14
Surface Coating Operations	89	83,446
Textile Products	2	11
Transportation and Marketing of Petroleum Products	13	157
Transportation Equipment	3	2,746
Vinyl-based Resins	2	27
Total	4,889	2,550,809
Source(s): EPA (2012b)		

3. Uses of Trichloroethylene

To develop a list of historic and ongoing uses of TCE, EPA reviewed published papers and a chapter in a book focused on the history and use of TCE (Doherty 2000; Bakke et al. 2007; Doherty 2014). EPA also considered uses reported in the *Economic Analysis of the Proposed Significant New Use Rule for Trichloroethylene (TCE) in Non-Aerosol Spray Degreasers*.

To supplement uses found in this initial review, EPA searched the Chemical Product Categories (CPCat) database for TCE. CPCat compiles information from publically available sources to provide a list of uses for more than 43,000 chemicals, as well as a database of products. The CPCat includes three hundred and ninety-eight products containing TCE (Dionisio et al. 2015).

EPA also accessed the Household Products Database (HPD) to find products containing TCE and the European Chemicals Agency (ECHA) to research additional uses that are or may become authorized. The HPD lists thirteen arts and crafts, automotive, home maintenance, home office, and commercial/institutional products that contain TCE (2016).

After compiling the initial list of uses, EPA conducted internet searches to find products containing TCE that fit the use categories. The associated MSDS/SDS was used to confirm whether or not the products found contained TCE. Product names and manufacturer information in the CPCat and HPD provided starting points for these searches. EPA also conducted general internet searches for each use, such as “adhesive” + “Trichloroethylene” + MSDS. Each use was classified as “Historic,” “Ongoing,” or “Unknown.” If a use had an end date, as reported in the literature reviewed, EPA considered its status “Historic.” This marked the passage of legislation requiring the phase out of TCE or a decline in the use so as to be considered negligible. Ongoing use was determined if the study team found a product containing TCE with an SDS published in 2015 or more recently. If the use did not have an end date or an available product that contained TCE, its status was classified as “Unknown.”

Each use was classified by expected use sectors: consumer, commercial, and/or industrial. If the use was clearly a process (i.e., a raw form of TCE was expected to be incorporated into the production process), such as the decaffeination of coffee beans, the use sector was classified as industrial. EPA determined consumer and/or commercial use by reviewing the product manufacturer’s website, distributor’s website, and/or other websites. If the information on the manufacturer’s website indicated a specific commercial use or sector and indicated the product was only available through a distributor, EPA considered the product commercial. Use in homes or by homeowners and availability for purchase at retail locations, such as Amazon, led to classification as consumer use. Some products were both (e.g., pepper spray intended for use by law enforcement agencies and consumers). Some uses were general enough that expected users were reasonably ascertained (e.g., degreasing solvent is assumed to be primarily used in the industrial sector, with some use in the commercial sector). It should be noted that many industrial processes were classified as “Unknown” because no products could be found. Manufacturers could be purchasing a raw form of TCE and incorporating it into processes onsite, but this cannot be determined without more information.

The overall list of known uses of TCE produced using the methods described is given in Table 3-1. Products representative of different use categories are presented in Table 3-2. Blank rows in Table 3-2 indicate that no product containing TCE could be found to support that the use was ongoing. This

list of products is not exhaustive. EPA attempted to find at least one product for each use category. Of the 398 products listed in the CPCat, EPA was able to research approximately 170 products, or 42 percent of the total list. Approximately 94 percent of the products reviewed in the CPCat were either reformulated without TCE or a duplicate of a product already represented in Table 3-2. Thus, it is unlikely that reviewing the remaining products would result in a significant number of additional products not already included in Table 3-2.

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users ¹	Description of Use or Process
Dry Cleaning and Dyeing and Other Fabric Cleaning (Rugs and Fur)			
Dry cleaning: batch process cleaning	Historic TCE's use as a dry cleaning solvent lasted from the 1930s to the 1950s, when it was found to attack cellulose acetate dyes (Doherty 2014).	Commercial	Bakke et al. (2007) There are two different batch process cleaning methods. One method is to use one piece of equipment for all of the cleaning: agitating, extracting and drying. Another method requires a manual trans of the textile between the washer –extractor and the dryer. Beyond textiles, TCE has also been used for cleaning fur, rugs and wool (Bakke et al. 2007).
Textile spot remover ²	Ongoing Product found see Table 3-2	Consumer, Commercial	Bakke et al. (2007) Spot cleaning involve selectively applying a variety of chemicals to areas of the textile requiring specific treatment. The treatment is left to soak before it is removed with a steam gun (Bakke et al. 2007). In the 1950s and 1960s, reported average personal and area air levels combined from dry cleaning spot remover were (95 ppm, n = 99; 35 ppm, n = 6, respectively). The study team found levels were lower in the 1970s and 1980s (Bakke et al. 2007). Textile plants may use (unspecified) solvents for textile spot removal. TCE has also been used in the apparel industry for cleaning. In the 1990s, personal and area air levels from spot removal in the apparel industry in ranged from 0-22 ppm (n=18) (Bakke et al. 2007).
Textile spot remover for combined oil and water stains ²	Ongoing Product found see Table 3-2	Consumer, Commercial	TCE is used in dry cleaning products to remove combination water and oil-based stains (see product MSDS)
Textile spot remover for dry-side spotting ²	Ongoing Product found see Table 3-2	Consumer, Commercial	Doherty (2014); Product MSDS

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users ¹	Description of Use or Process
Ink and ribbons for dry cleaning and laundry use	Ongoing Product found see Table 3-2	Commercial, Industrial	Thermopatch (2017) Ink cassettes and ribbons are designed to withstand the laundromat and dry cleaner processes (Thermopatch 2017)
Textile Mill Products and Apparel			
Textile scouring (e.g., wool and cotton scouring)	Unknown TCE was the main solvent identified for wool cleaning in a 1979 (Bakke et al. 2007). About 70% of textile plants use (unspecified) solvents for textile spot removal (Bakke et al. 2007).	Industrial	Bakke et al. (2007) Solvent scouring involves the removal of dirt, waxes, pectins, and lubricants generated during the coning and knitting processes. Scouring maybe done in a batch or continuous process. In batch operations, textiles are washed in drums and dried with hot air. Continuous process scouring involves feeding fabric into the scouring equipment on rollers and then dipping in or spraying with cold solvent or immersing in hot vaporous solvent. (Bakke et al. 2007).
Textile sizing	Unknown	Industrial	Bakke et al. (2007) TCE used for textile sizing is less than 4% of the total amount of TCE in production (Bakke et al. 2007).
Soap solution ingredient	Unknown	Consumer, Commercial, Industrial	Bakke et al. (2007); EPA (2012b)
Swelling agent in the disperse dyeing of polyesters	Unknown	Industrial	Bakke et al. (2007); EPA (2012b)
Solvent in waterless dyeing and finishing operations	Unknown	Industrial	Bakke et al. (2007); EPA (2012b)
Dye fixative and mordant	Unknown The use in dye manufacturing was probably rare in the 1970s (Bakke et al. 2007).	Industrial	Bakke et al. (2007)

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users ¹	Description of Use or Process
Impregnating artificial fabrics	Unknown	Industrial	Bakke et al. (2007) TCE has been used in the impregnating and dressing of artificial fabrics (rayon, silk, glass fibers, and cotton-polyester materials) (Bakke et al. 2007).
Degreasing fibers (organic fibers, asbestos, glass, carbon, or silicon carbide fibers prior to bonding or lamination)	Unknown	Commercial, Industrial	Bakke et al. (2007); EPA (2012b)
Resin extractor and purifier in the dyeing process	Unknown	Industrial	European Chemicals Agency (ECHA) (n.d.); EUR-Lex (n.d.) TCE has been reportedly used in Europe as a solvent in industrial batik cloth-dyeing to remove and recover the resin from water used to rinse the cloth. Resin, which acts as a resist during the initial dyeing is removed initially through a combination of mechanical force and water. TCE has been used to remove and recover the resin from this rinse water, dissolving the resin, but not the impurities (European Chemicals Agency (ECHA) n.d.). In 2015 The European Commission approved the application of TCE for this use. The review period expires in April 2028 (decision reference: C(2015) 8093) (EUR-Lex n.d.).
Dyed cloth resin remover	Unknown	Industrial	European Chemicals Agency (ECHA) (n.d.); EUR-Lex (n.d.) TCE has been reportedly in Europe used as a solvent in industrial batik cloth-dyeing technique to remove and recover the resin used to create the design. TCE is used to remove the resin from the cloth in a closed system at sub-atmospheric pressure. After distillation, the resin is reusable (European Chemicals Agency (ECHA) n.d.). In 2015 The European Commission approved the application of TCE for this use. The review period expires in April 2028 (decision reference: C(2015) 8093) (EUR-Lex n.d.).
Leather and Leather Products			
Remove fat from hides in the processing of leather	Unknown Until the 1960s, TCE was used in leather processing to remove fat from hides (Bakke et al. 2007).	Industrial	Bakke et al. (2007); EPA (2012b)

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users ¹	Description of Use or Process
Animal hide and skin disinfectant	Unknown Until the 1960s, TCE was used in leather processing to disinfect hides and skins (Bakke et al. 2007).	Industrial	Bakke et al. (2007)
Leather glue ⁴	Unknown Chlorinated solvents may have been used in the leather glue as early as the 1930s (Bakke et al. 2007).	Commercial, Industrial	Bakke et al. (2007); EPA (2012b) Chlorinated solvents have been used as leather glue (Bakke et al. 2007).
Crepe sole rubber cement additive	Unknown	Industrial	Bakke et al. (2007); EPA (2012b)
Recover fat-free glue in tanneries	Unknown	Industrial	Bakke et al. (2007); EPA (2012b) TCE was used in tanneries to recover fat-free glue from residues of glue boilers (Bakke et al. 2007).
Impregnation of leather	Unknown	Industrial, Commercial	Bakke et al. (2007); EPA (2012b) In the 1990s, a study in Portugal reported average exposure levels of 18-33 ppm (n=330) during waxing, coloring, and cleaning/polishing of leather shoes (Bakke et al. 2007).
Rubber and Miscellaneous Plastics Products			
Adhesives for industrial products	Ongoing Product found see Table 3-2 Since the early 1930s, TCE has been used as a rubber solvent although in a limited capacity in the 1930s. TCE use continued in this industry in the 1970s, but was likely rare (Bakke et al. 2007).	Industrial	Bakke et al. (2007); EPA (2012b)

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users¹	Description of Use or Process
Antioxidant for tire manufacturing	Unknown Use of TCE as an antioxidant has decreased (Bakke et al., 2007)	Industrial	Bakke et al. (2007) TCE had applications as processing solvent in the production of an antioxidant for tire manufacturing. This use has decreased (Bakke et al., 2007)
Tire repair	Ongoing Product found see Table 3-2 TCE is used in the tire repair industry (Bakke et al. 2007).	Commercial	Bakke et al. (2007)
Tire Buffer and Cleaner	Ongoing Product found see Table 3-2 TCE is used in the tire repair industry (Bakke et al. 2007).	Commercial	Bakke et al. (2007); EPA (2012b)
Foam blowing agent	Unknown TCE was one of the most commonly used chlorinated solvents used as blowing agents in the foam industry (Bakke et al. 2007).	Industrial	Bakke et al. (2007) Foam blowing agents are used to create a porous or cellular structure (Bakke et al. 2007).
Solvent in the manufacture of large, rigid plastic products	Unknown TCE was used as a solvent in the manufacture of large, rigid plastic products (Bakke et al. 2007).	Industrial	Bakke et al. (2007); EPA (2012b) TCE was used as a solvent to bond foam and polystyrene in the manufacture of large, rigid plastic products (Bakke et al. 2007). In the rubber and plastics industry, area and personal concentrations from adhesive operations were generally below 1 ppm (n=18) (Bakke et al. 2007).

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users ¹	Description of Use or Process
Plastic cements (to bond foam and polystyrene)	Unknown TCE was used to bond foam and polystyrene in the manufacturing of plastic cements (Bakke et al. 2007).	Industrial	Bakke et al. (2007); EPA (2012b) In the rubber and plastics industry, area and personal concentrations from adhesive operations were generally below 1 ppm (n=18) (Bakke et al. 2007).
Cement mixing	Unknown	Commercial	Bakke et al. (2007) In the rubber and plastics industry, area and personal concentrations from adhesive operations were generally below 1 ppm (n=18) (Bakke et al. 2007).
Bonding and vulcanizing agent in conveyor belts in underground hard coal mining	Unknown	Industrial	European Chemicals Agency (ECHA) (n.d.); EUR-Lex (n.d.); EPA (2012b) Hard coal mines in Germany use vulcanizing and bonding agents containing Trichloroethylene (TCE) for underground splicing and repairing of endless transportation belts (European Chemicals Agency (ECHA) n.d.). The European Commission authorized this application of TCE in November of 2016 (decision reference: C(2016) 7607) (EUR-Lex n.d.).
Agricultural Production and Agricultural Chemicals			
Insecticides	Historic TCE was used as a solvent in aerosolized insecticides in the early 1930s until at least the 1970s (Bakke et al. 2007).	Industrial, Commercial, Consumer	Bakke et al. (2007); National Pesticide Information Retrieval System (2016) Limited information was found on its use in insecticides, but it is not used as an inert compound. In the 1990s in Italy, 1% or less of insecticides contained TCE (Bakke et al. 2007). TCE is currently not an active ingredient in any federally registered pesticide. As a result, it is also unlikely to be used as an active ingredient in any state registered pesticides (National Pesticide Information Retrieval System 2016).
Herbicides (chlorophenols and phenoxy)	Historic Chlorinated solvents were used in Finland in herbicide (chlorophenols and phenoxy) formulation (Bakke et al. 2007). ⁶	Industrial, Commercial, Consumer	Bakke et al. (2007)

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users ¹	Description of Use or Process
Fungicides	<p>Historic</p> <p>In the 1960s and 1970s, TCE was used in fungicides (Bakke et al. 2007).</p>	Industrial, Commercial Consumer	<p>Bakke et al. (2007)</p> <p>TCE was used in fungicides such as difolatan (Bakke et al. 2007).</p>
Grain fumigant in agriculture	<p>Historic</p> <p>TCE was used as a grain fumigant (Bakke et al. 2007).</p>	Industrial, Commercial	Bakke et al. (2007)
Food and Kindred Products			
Decaffeination of coffee (as an extractant)	<p>Unknown³</p> <p>TCE was used in the decaffeination of coffee since as early as 1900 (Bakke et al. 2007).</p> <p>In 1975, the FDA limited TCE concentrations to 10 ppm in decaffeinated instant coffee and 25 ppm in decaffeinated ground coffee. A ban on using TCE in direct or indirect food processing was proposed in 1977, but it was not enacted. The 1975 residual concentration limits remained in effect as of 2012, with the current allowable TCE residual in modified hop extract used in beers set at 150 ppm (Doherty 2014).</p>	Industrial	Bakke et al. (2007); Doherty (2014)

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users ¹	Description of Use or Process
Spice oleoresins (as an extractant)	<p>Unknown³</p> <p>In 1975, the FDA limited TCE concentrations to 30 ppm in spice oleoresins. A ban on using TCE in direct or indirect food processing was proposed in 1977, but it was not enacted. The 1975 residual concentration limits remained in effect as of 2012, with the current allowable TCE residual in modified hop extract used in beers set at 150 ppm (Doherty 2014).</p>	Industrial, Consumer	Bakke et al. (2007); Doherty (2014)
Extraction solvent for natural fats and oils (e.g., palm and coconut oil)	<p>Unknown</p> <p>Most U.S. manufacturers voluntarily withdrew soybean oil meals defatted with TCE in 1952 (Doherty 2000).</p>	Industrial	<p>Bakke et al. (2007); Doherty (2000);</p> <p>TCE was used as a solvent for extraction of natural fats and oils such as palm, coconut, soybean; olive, corn, grape seed and other foods. TCE has been widely used in minor amounts to extract fact and alkaloid from fish meal and other natural products. (Bakke et al. 2007).</p>
Egg preservative (in a wax solution applied to the shell)	<p>Unknown</p>	Commercial, Consumer	<p>Bakke et al. (2007)</p> <p>Because of TCE's bactericidal properties, it was applied in a wax solution to eggs as a preservative (Bakke et al. 2007).</p>
Health Service			
Anesthetic (for animals)	<p>Unknown</p>	Commercial, Consumer	<p>Bakke et al. (2007)</p> <p>TCE has been used in veterinary medicine as an inhalation anesthetic for pigs, dogs, and cats (Bakke et al. 2007).</p>

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users ¹	Description of Use or Process
Anesthetic (for humans)	<p>Unknown</p> <p>TCE was first introduced as an anesthetic in 1934. In 1936, the American Medical Association recommended against using it as a general anesthetic, but it remained popular in the 1940s and continued to be used commonly in the 1950s and 1960s. By 1958 it was considered widely used in analgesic and anesthetics with 35,000 liters of TCE used for those purposes. Its use declined in the 1970s until it ended in 1976 (Bakke et al. 2007).</p>	Commercial	<p>Bakke et al. (2007)</p> <p>TCE has historically been recommended for dental extractions, cystoscopy, orthopedic manipulations, burn dressing and similar short surgical procedures (Bakke et al. 2007).</p>
Analgesic	<p>Unknown</p> <p>By 1958 it was considered widely used in analgesic and anesthetics with 35,000 liters of TCE used for those purposes. Its use declined in the 1970s until it ended in 1976 (Bakke et al. 2007).</p>	Commercial	<p>Bakke et al. (2007)</p> <p>TCE was used in the United States as an analgesic for medical events such as childbearing and dentistry (Bakke et al. 2007).</p>
Anthelmintic (treats parasitic intestinal worms)	<p>Unknown</p> <p>TCE was used to destroy parasitic intestinal worms (Bakke et al. 2007).</p>	Consumer	<p>Bakke et al. (2007)</p> <p>TCE was used to destroy parasitic intestinal worms (Bakke et al. 2007).</p>

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users ¹	Description of Use or Process
Abreaction reagent (drug that releases repressed emotions)	Unknown In the U.K. TCE was used to release repressed emotions in psychoanalysis (Bakke et al. 2007).	Commercial	Bakke et al. (2007) In the U.K. TCE was used to release repressed emotions in psychoanalysis (Bakke et al. 2007).
Disinfectant (e.g., hand sterilizer prior to surgery)	Unknown Use as a disinfectant prior to surgery was limited in the 1950s (Bakke, 2007).	Commercial	Bakke et al. (2007) TCE was used as a disinfectant prior to surgery. Additionally it had applications in sterilization of surgical instruments (Bakke et al. 2007).
Animal hair wash	Unknown	Consumer, Commercial	Bakke et al. (2007) TCE has had known applications as a hair wash for animals, particularly in the removal of grease and tar from wounds and fur (Bakke et al. 2007).
Chemicals and Allied Products			
Wood resin extractant	Unknown	Industrial	Bakke et al. (2007)
Pulverized sulphur production	Unknown	Industrial	Bakke et al. (2007)
Chlorinated aliphatics (as a chemical intermediate)	Unknown TCE had minor applications as a raw material in the manufacture of chlorinated aliphatics (Bakke et al. 2007).	Industrial	Bakke et al. (2007); EPA (2012b)
Glycolic and dichloroacetic acids (as a chemical intermediate)	Unknown TCE had minor applications as a raw material in the manufacture of glycolic and dichloroacetic acids (Bakke et al. 2007).	Industrial	Bakke et al. (2007); EPA (2012b)

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users ¹	Description of Use or Process
Chlorofluoromethane refrigerants (as a chemical intermediate) ⁵	Historic TCE had minor applications as a raw material in the manufacture of chlorofluoromethane refrigerants (Bakke et al. 2007).	Industrial	Bakke et al. (2007)
Refrigerant in air-conditioning installations ⁵	Unknown	Industrial	Bakke et al. (2007); EPA (2012b) TCE has been used a refrigerant in air-conditioning installations (Bakke et al. 2007).
Spirit soap	Unknown TCE had applications in cleansing soap solutions used in the production of spirit soap (Bakke et al. 2007).	Industrial	Bakke et al. (2007); EPA (2012b) TCE had applications in cleansing soap solutions used in the production of spirit soap (25% TCE and 75% potassium oleate) (Bakke et al. 2007).
Solvent for sulfur chloride and cellulose esters and ethers	Unknown TCE had applications in the production of sulfur chloride and cellulose eaters and ethers (Bakke et al. 2007).	Industrial	Bakke et al. (2007); EPA (2012b)
Chain terminator (in the production of polyvinyl chloride)	Unknown TCE was used in the production of polyvinyl chloride (Bakke et al. 2007).	Industrial	Bakke et al. (2007)
Dewaxing lubrication oils	Unknown TCE had applications as dewaxing lubrication oils (Bakke et al. 2007).	Industrial	Bakke et al. (2007); EPA (2012b) TCE was used in the process of dewaxing lubrication oils by crystalizing the wax in the oil (Bakke et al. 2007).

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users ¹	Description of Use or Process
To recover wax and paraffin from refuse	Unknown TCE had applications in the process of recovering wax and paraffin from refuse (Bakke et al. 2007).	Industrial	Bakke et al. (2007)
Hobby and model glues (particularly for balsa wood)	Unknown TCE had applications as a component of hobby and model glues (Bakke et al. 2007).	Industrial	Bakke et al. (2007); EPA (2012b)
Paints, Varnishes, Lacquers, Enamels, and Allied Products			
Paint thinner	Unknown TCE had applications as a paint and varnish thinner (Bakke et al. 2007).	Consumer, Commercial, Industrial	Bakke et al. (2007); EPA (2012b) TCE had limited applications as a paint and varnish thinner (Bakke et al. 2007).
Paints	Unknown TCE was reportedly a component of quick-drying paint in a foundry in the 1950s. Only 6% of plant formulators reported using TCE in paints. By 1984, use in this industry was essentially non-existent, with the exception of possible use in the manufacture of machinery and equipment (Bakke et al. 2007).	Consumer, Commercial, Industrial	Bakke et al. (2007); EPA (2012b) TCE had limited applications in paints such as colored paints, furniture stains, house painting, the painting of casks and vats, etc. It was also reportedly a component of qui-drying paints in a U.K. foundry in the 1950s. It was used as a solvent in paints containing tar or pitch but less frequently for paint containing acetyl and nitro-cellulose (Bakke et al. 2007).
Paint stripper	Unknown TCE had known applications as a paint stripper (Bakke et al. 2007).	Consumer, Commercial, Industrial	Bakke et al. (2007) TCE had known applications as a paint stripper. Reportedly, TCE has been used to clean paint spraying booths (Bakke et al. 2007).

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users ¹	Description of Use or Process
Used to flush liquid oxygen	Unknown TCE had known applications to flush liquid oxygen (Bakke et al. 2007).	Industrial	Bakke et al. (2007)
Impregnating cardboard and paper boxes	Unknown TCE had known applications in the pulp and papermaking industry (Bakke et al. 2007).	Industrial	Bakke et al. (2007); EPA (2012b) TCE has been used in the process of impregnating cardboard and paper board boxes (Bakke et al. 2007).
Solvent for paraffin-synthetic resin mixture (used in paper processing)	Unknown TCE had applications in the paper processing industry (Bakke et al. 2007).	Industrial	Bakke et al. (2007); EPA (2012b) TCE had applications as a solvent for paraffin-synthetic resin mixture used for processing paper (Bakke et al. 2007).
Printing inks	Unknown Starting in the 1920s, TCE was used in printing inks (Doherty 2000). In the 1970s, the use of TCE in the printing industry was rare (Bakke et al. 2007).	Industrial	Bakke et al. (2007); Doherty (2000); EPA (2012b)
Cleaning solvent for printing machines	Unknown In the 1970s, the use of TCE in the printing industry was rare (Bakke et al. 2007).	Industrial	Bakke et al. (2007); EPA (2012b) TCE has applications in the cleaning of cylinders and type (Bakke et al. 2007). In the U.K. TCE, in a mixture with other solvents, was sprayed onto a film running over the rollers of a printing machine (Bakke et al. 2007).

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users ¹	Description of Use or Process
Research, Development, and Testing Services			
Cleaning optical lenses	Unknown In the 1960s and early 1970s TCE was used for daily cleaning in laboratories including the cleaning of optical lenses (Bakke et al. 2007).	Commercial, Consumers	Bakke et al. (2007); EPA (2012b) TCE was used to in laboratories to clean optical lenses and in other daily laboratory cleanings. TCE was also reportedly used to clean the optical lenses of binoculars (Bakke et al. 2007).
Extraction solvent for bitumen in asphalt analysis	Unknown	Industrial	European Chemicals Agency (ECHA) (n.d.); EUR-Lex (n.d.) TCE has been used in laboratories in Europe to extract bitumen from filling/binder materials in asphalt samples. The extraction process takes place in a closed loop system (European Chemicals Agency (ECHA) n.d.) The status of the Dow Deutschland application for approval for this use of TCE is “opinions adopted” (EUR-Lex n.d.).
Laboratory chemical: Spectrophotography	Ongoing Product found see Table 3-2	Commercial, Industrial	
Laboratory chemical: Chromatography	Ongoing Product found see Table 3-2	Commercial, Industrial	
Perfumes, Cosmetics, and Other Toiletry Preparations			
Shampoo and dry Shampoo	Historic By 1985, most personal aerosol products contained no chlorinated solvents (Bakke et al. 2007).	Consumer	Bakke et al. (2007) TCE was rarely used in human hair products, however was reportedly a component in dry shampoo (Bakke et al. 2007).
False eyelash cleaner	Historic By 1985, most personal aerosol products contained no chlorinated solvents (Bakke et al. 2007).	Consumer	Bakke et al. (2007)

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users ¹	Description of Use or Process
Perfume ingredient	Historic By 1985, most personal aerosol products contained no chlorinated solvents (Bakke et al. 2007).	Consumer	Bakke et al. (2007)
Glue for hair extensions and lace wigs	Unknown	Consumer, Commercial	NH Asthma Collaborative (2015); EPA (2012b)
Degreasing			
Solvent degreasing: cold cleaning ²	Ongoing Product found see Table 3-2	Commercial	Bakke et al. (2007); EPA (2012b) TCE is used in cold cleaning degreasing operations (Bakke et al. 2007).
Solvent degreasing: vapor degreasing ²	Ongoing TCE became the primary vapor degreasing solvent in the 1930s. In the 1940s vapor degreasing became TCE's largest use.	Commercial	Bakke et al. (2007); EPA (2012b)
Closed system vapor degreasing parts cleaning through	Unknown	Commercial, Industrial	European Chemicals Agency (ECHA) (n.d.); EUR-Lex (n.d.); EPA (2012b) TCE has been used in Europe as a solvent for parts cleaning in closed system vapor degreasing methods. This use has applications in several industries including aerospace, electronics, medical, and automotive sectors (European Chemicals Agency (ECHA) n.d.). The status of two applications to the European Commission for approval of this use of TCE is "opinions adopted" (EUR-Lex n.d.).
Miscellaneous Uses of TCE			
Cutting Fluid (tap and die cutters)	Ongoing Product found; see Table 3-2	Commercial, Industrial	
Film and photographic plate cleaner	Unknown	Commercial	Bakke et al. (2007); EPA (2012b) TCE has been reportedly used for cleaning films and photographic plates (Bakke et al. 2007).
Furniture cleaner	Unknown	Commercial	Bakke et al. (2007); EPA (2012b)

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users¹	Description of Use or Process
To clean trailer tanks	Unknown	Commercial	Bakke et al. (2007); EPA (2012b) TCE has been reportedly used for cleaning the interior of a trailer tank (Bakke et al. 2007).
To clean brewery tanks	Unknown	Commercial	Bakke et al. (2007); EPA (2012b)
To clean atmospheric chambers (for NASA)	Unknown	Commercial	Bakke et al. (2007); EPA (2012b)
To clean computer ribbons	Unknown	Commercial	Bakke et al. (2007); EPA (2012b) TCE has been reportedly used to clean computer ribbons in a South African ribbon manufacturing plant (Bakke et al. 2007).
To clean watch parts (in ultrasonic cleaning machines)	Unknown	Commercial	Bakke et al. (2007); EPA (2012b) Watch makers have reportedly used TCE with a petroleum distillate for cleaning parts in ultrasonic cleaning machines (Bakke et al. 2007).
Toner Aide	Ongoing Product found see Table 3-2	Consumer, Commercial, Industrial	
Typewriter correction fluid	Unknown In 1989, Gillette Co. agreed to remove TCE from its Liquid Paper Correction Fluid to be in compliance with California's Proposition 65 (Paddock 1989).	Consumer, Commercial, Industrial	Bakke et al. (2007); Paddock (1989); EPA (2012b)
Silicone parting agent in shell molding for foundries	Unknown TCE was used in shell molding for foundries (Bakke et al. 2007).	Industrial	Bakke et al. (2007) In shell molding for foundries, TCE had prior applications as a vehicle in a silicone parting agent (Bakke et al. 2007).

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users ¹	Description of Use or Process
Gas and tar purification	Unknown TCE had applications in the gas and tar purification processes (Bakke et al. 2007).	Industrial	Bakke et al. (2007)
Tree wound healers	Historic TCE was used in wound healers for trees (Bakke et al. 2007).	Industrial	Bakke et al. (2007)
Aerosol spray chimney cleaners	Unknown TCE was used in aerosol spray chimney cleaners (Bakke et al. 2007).	Consumer, Commercial	Bakke et al. (2007); EPA (2012b)
Air fresheners	Historic TCE was used in air fresheners (Bakke et al. 2007).	Industrial	Bakke et al. (2007)
Surface disinfectants	Unknown TCE was used in surface disinfectants (Bakke et al. 2007).	Industrial	Bakke et al. (2007)
Preservation and deodorizers	Unknown	Consumer, Industrial	Bakke et al. (2007) TCE was used in preservation and deodorizers (Bakke et al. 2007). TCE has been used in consumer deodorizer products (Doherty 2000).
Mildew sprays	Unknown TCE was used in mildew sprays (Bakke et al. 2007).	Commercial, Consumer, Industrial	Bakke et al. (2007) TCE was used in mildew sprays (Bakke et al. 2007).
Mildew preventative	Unknown	Commercial, Consumer, Industrial	Doherty (2000) TCE has been used in consumer mildew preventatives (Doherty 2000).

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users ¹	Description of Use or Process
Smoke bombs (used to evaluate ventilation)	Unknown TCE was used in smoke bombs to evaluate ventilation (Bakke et al. 2007).	Commercial, Industrial	Bakke et al. (2007) Reported exposure to TCE from smoke bombs in 1987 (Bakke et al. 2007).
Rust prevention products	Unknown TCE had minor applications as a component of various rust preventative formulations (Bakke et al. 2007).	Commercial, Consumer, Industrial	Bakke et al. (2007) TCE had minor applications as a component of various rust preventative formulations (Bakke et al. 2007).
Polishes	Historic TCE was used in polishes; in the 1970s this use was likely rare (Bakke et al. 2007).	Commercial, Consumer, Industrial	Bakke et al. (2007)
Caulking substance (for shipbuilding)	Unknown	Industrial	Bakke et al. (2007)
Waterproof material for brickwork	Unknown	Commercial	Bakke et al. (2007)
Degreasing skins (taxidermy industry)	Unknown	Commercial	Bakke et al. (2007); EPA (2012b)
Fire extinguishers	Unknown	Consumer, Commercial, Industrial	Bakke et al. (2007); Doherty (2000); Doherty (2014) TCE has applications as a depressant in Carbon tetrachloride (CTC) (Doherty 2000). CTC fire extinguishers were used from the early to mid-twentieth century (Doherty 2014).
Extracting sulfur from iron oxide pellets used in the purification of coke oven and similar gases	Unknown	Industrial	Bakke et al. (2007)

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users¹	Description of Use or Process
Gas purification as a solvent of sulfur and phosphorus	Unknown	Industrial	Bakke et al. (2007); EPA (2012b)
Low-temperature heat-transfer agent	Unknown	Industrial	Bakke et al. (2007)
Heated TCE used in banks to correct error on checks	Unknown	Industrial	Bakke et al. (2007)
Pottery glaze ingredient	Unknown	Consumer, Industrial	Bakke et al. (2007); EPA (2012b) In school arts and craft classes, TCE has been reportedly found in pottery glazes (Bakke et al. 2007).
Tin recovery (from scrap metal)	Unknown	Industrial	Bakke et al. (2007)
In centrifuge processes at uranium enrichment plants	Unknown	Industrial	Bakke et al. (2007) TCE has had applications in a gaseous centrifuge process at a uranium enrichment plant (Bakke et al. 2007).
To extract phenol from wastewater	Unknown	Industrial	Bakke et al. (2007) TCE has had applications in the process of extracting phenol from wastewater (Bakke et al. 2007).
Brake parts cleaner	Ongoing Product found; see Table 3-2	Commercial, Industrial	EPA (2012b)
As an aerosol in spray cans	Unknown	Industrial	Bakke et al. (2007) TCE has had rare applications as an aerosol in spray cans (Bakke et al. 2007).

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users ¹	Description of Use or Process
Shoe polish	Ongoing Product found; see Table 3-2 TCE's use in polishes was rare by the 1970s (Bakke et al. 2007).	Consumer, Commercial, Industrial	Bakke et al. (2007); Doherty (2000)
Carpet Cleaner	Ongoing Product found; see Table 3-2	Consumer, Commercial, Industrial	Product MSDS (see Table 3-2 for more information); EPA (2012b)
Drain and pipe cleaners	Unknown	Consumer, Commercial, Industrial	Doherty (2000); EPA (2012b)
Household cleaner	Unknown	Consumer, Industrial	Doherty (2000); EPA (2012b)
Wig cleaner	Unknown	Consumer, Commercial, Industrial	Doherty (2000); EPA (2012b)
Upholstery cleaner	Unknown	Consumer, Commercial, Industrial	Doherty (2000); EPA (2012b)
Septic tank cleaner	Unknown	Consumer, Commercial, Industrial	Doherty (2000); EPA (2012b)
Water repellent	Unknown	Consumer, Commercial, Industrial	Doherty (2000)
Metal cleaner and polish	Unknown	Consumer, Commercial, Industrial	Doherty (2000); EPA (2012b)
Used in the production of hydrofluorocarbons	Ongoing Use of TCE as a feedstock for chlorofluorocarbon replacements, such as HFC-134a, increased in the 1990s. By 1995, 41% of TCE produced was being used as a chemical intermediate (Doherty 2000).	Consumer, Commercial, Industrial	Doherty (2000); The DOW Chemical Company (2014)

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users¹	Description of Use or Process
Fire-retardant chemicals	Unknown TCE was used in fire-retardant chemicals (Doherty 2000).	Industrial	Doherty (2000)
Flame-retardant chemicals	Unknown	Consumer, Commercial, Industrial	The DOW Chemical Company (2014)
Fertilizer	Unknown TCE was used in fertilizers (Doherty 2000).	Consumer, Commercial, Industrial	Doherty (2000)
Heat exchange fluid	Ongoing TCE started to be used as a heat exchange fluid in the 1940s to 1960s (Doherty 2000).	Commercial, Industrial	Doherty (2000); The DOW Chemical Company (2014) TCE is used as a low-temperature heat-transfer medium (The DOW Chemical Company 2014).
Gun scrubber	Ongoing Product found see Table 3-2	Consumer, Commercial, Industrial	Dionisio et al. (2015); EPA (2012b)
Lead-acid batteries	Unknown	Industrial	European Chemicals Agency (ECHA) (n.d.); EUR-Lex (n.d.) TCE has been used to the manufacture of polyethylene separator foils in lead-acid batteries. The chemical has had applications as a solvent to remove process oil during the manufacture of polyethylene separator foils. TCE evaporates to increase the porosity of the separator. TCE processing is performed in closed equipment under reduced pressure (European Chemicals Agency (ECHA) n.d.). The status of two companies applications to the European Commission for approval of TCE for this use is “opinions adopted” (EUR-Lex n.d.).

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users ¹	Description of Use or Process
Lithium batteries	Unknown	Consumer, Commercial, Industrial	<p>The DOW Chemical Company (2014); Pekala (2007)</p> <p>According to a 2007 U.S. Patent on battery separators, TCE is one of several preferred solvents for separating the solvent from the plasticizer through distillation. The patent lists many alternative solvents for this process. Additionally TCE is reportedly used as a bath to dunk a sample of the plasticized sheet in the production of battery separators containing reactive functional groups (Pekala 2007).</p> <p>These uses may not represent the only applications of TCE in the production of lithium batteries.</p>
Battery coat	Ongoing Product found see Table 3-2	Consumer, Commercial	<p>Product website</p> <p>Battery coat products form a durable coating that protects against corrosion on battery terminals, cables, clamps, and hold-downs. It seals out acid fume, moisture, dirt, grease and oil, prolonging battery life.</p>
Pepper spray	Ongoing Product found; see Table 3-2	Consumer, Commercial	
Hoof polish	Ongoing Product found; see Table 3-2	Consumer, Commercial	
Stain removal agent (solvent)	Ongoing	Commercial, Consumer, Industrial	EPA (2012b)
Electrical cleaner/degreaser (aerosol) ²	Ongoing Product found; see Table 3-2	Commercial, Industrial	EPA (2012b)
Electrical cleaner/degreaser (non-spray)	Ongoing Product found; see Table 3-2	Commercial, Industrial	EPA (2012b)

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users ¹	Description of Use or Process
Sealant for mirrors/glassware	Ongoing Product found; see Table 3-2	Consumer, Commercial, Industrial	EPA (2012b)
Adhesives for industrial products	Ongoing Product found; see Table 3-2 By the 1970s, TCE's use in adhesives was small (<4% of total production) (Bakke et al. 2007).	Commercial, Industrial	Bakke et al. (2007); EPA (2012b)
Spray fixatives	Historic Several spray fixatives used in arts and crafts projects contained TCE, but these products have recently been reformulated to no longer contain TCE (EPA, 2016).	Consumer, Commercial, Industrial	EPA (2016); EPA (2012b)
Processing aid in production of betacyclodextrin	Unknown	Industrial	European Chemicals Agency (ECHA) (n.d.); EUR-Lex (n.d.) In Europe, TCE has applications as a processing aid for the biotransformation of starch to product betacyclodextrin (BCD). TCE is used to precipitate cyclodextrins as a compound allowing for the subsequent separation of the cyclodextrin from the hydrolysed starch. BCD is used in the production of hydroxypropyl betacyclodextrin (HPBCD); however TCE is not itself involved in the manufacture of HPBCD. HPBCD is the most frequently used cyclodextrin in pharmaceuticals and is the leading excipient in pharmaceutical applications (European Chemicals Agency (ECHA) n.d.). In November 2016, the European Commission approved this application of TCE (decision reference: C(2016) 7581) (EUR-Lex n.d.).

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users ¹	Description of Use or Process
Processing solvent for the manufacture of hollow fiber membranes in continuous fiber spinning process	Unknown	Industrial	European Chemicals Agency (ECHA) (n.d.); EUR-Lex (n.d.); EPA (2012b) TCE is used in Europe as a solvent for the polymer poly[2,6-dimethyl-p-phenyleneoxide] (PPO) in a continuous fiber spinning process in the production of hollow fiber membranes (European Chemicals Agency (ECHA) n.d.). In January of 2017, the European Commission authorized this application of TCE (decision reference: C(2016) 8596) (EUR-Lex n.d.).
Extraction solvent in the manufacture of caprolactam	Unknown	Industrial	European Chemicals Agency (ECHA) (n.d.); EUR-Lex (n.d.); EPA (2012b) In Europe, TCE is used as an extraction solvent in the industrial manufacture of caprolactam from cyclohexanone. Caprolactam has applications as a precursor in the manufacture of polymers (European Chemicals Agency (ECHA) n.d.). Three companies have recently applied for approval from the European Commission for use of TCE in this application; one application was authorized in January 2017 (decision reference: C(2017) 69), another is pending, and options have been adopted for the third (EUR-Lex n.d.).
Solvent in the synthesis of vulcanization accelerating agents for fluoroelastomers	Unknown	Industrial	European Chemicals Agency (ECHA) (n.d.); EUR-Lex (n.d.); EPA (2012b) In Europe, TCE has applications as a solvent in the synthesis of accelerating agents for fluoroelastomers. After use in the first synthesis step, TCE is recovered and re-used; in the second step, it is removed by distillation. Synthesis is automated and takes place in a closed system (European Chemicals Agency (ECHA) n.d.). The European commission approved an application for this use in November, 2016 (C(2016) 7609) (EUR-Lex n.d.).
Process chemical to remove polystyrene from an intermediate	Unknown	Industrial	European Chemicals Agency (ECHA) (n.d.); EUR-Lex (n.d.) TCE has had applications in Europe as a solvent in the production process of Alacantara, a material of 70% polyester and 30% polyurethane material. TCE is used in an enclosed system to remove polystyrene from an intermediate product of the material (European Chemicals Agency (ECHA) n.d.). The status of DOW Deutschland's application for the European Commission's approval of this use of TCE is "opinions adopted" (EUR-Lex n.d.).

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users ¹	Description of Use or Process
Packaging of recycled TCE	Unknown	Industrial	European Chemicals Agency (ECHA) (n.d.); EUR-Lex (n.d.); Richard Geiss GmbH (n.d.-b); DOW Deutschland Anlagengesellschaft mbH (n.d.) In Europe, TCE waste is reportedly distilled to a purity of 99.95% and stored until requested by a client at which point it is pumped into barrels ranging in size from 1L-425 L. Different grades of TCE are combined with stabilizers during packaging. The filling activity is closely related to formulation since stabilizing agents are added to different grades of TCE during packaging (Richard Geiss GmbH n.d.-b). One packager reports packaging TCE in closed-loop state of the art systems called SAFE-TAINER™ Systems (DOW Deutschland Anlagengesellschaft mbH n.d.). The status of two applications for the European Commission's approval of this use of TCE is "opinions adopted" (EUR-Lex n.d.).
Formulation of recycled TCE	Unknown	Industrial	European Chemicals Agency (ECHA) (n.d.); EUR-Lex (n.d.); Richard Geiss GmbH (n.d.-a) In Europe, TCE waste is reported distilled to a purity of 99.95%. Formulation facilities add stability agents according the clients specifications before re-sale (Richard Geiss GmbH n.d.-a). The status of two applications for the European Commission's approval of this use of TCE is "opinions adopted" (EUR-Lex n.d.).
Non-flammable gas mixture	Ongoing Product found; see Table 3-2	Commercial, Industrial	
Multipurpose lubricant	Ongoing Product found; see Table 3-2	Commercial, Industrial	
Mold cleaner/release agent	Ongoing Product found; see Table 3-2	Industrial	Bakke et al. (2007); EPA (2012b) Bakke et al. (2007) reports exposure to TCE through the use of mold cleaner.
Elastomers	Unknown	Consumer, Commercial, Industrial	Doherty (2000)
Fillers	Unknown	Consumer, Commercial, Industrial	Bakke et al. (2007)

Table 3-1. Known Applications of TCE

Use or Process	Use or Process Status	Expected Users ¹	Description of Use or Process
Sealers	Unknown	Consumer, Commercial, Industrial	EPA (2012b)
<p>Note(s):</p> <p>¹ Determination of the <i>Expected Users</i> associated with a use or process is based on the study team’s best judgement if the users are not explicitly defined in the resource(s) cited.</p> <p>² Denotes uses currently being considered for Section 6 actions under the Toxic Substances Control Act (TSCA).</p> <p>³ Doherty (2014) and Bakke et al. (2007) report contradicting information on the status of a 1977 proposed ban on TCE in food additives. Bakke reports FDA banned TCE in foods in 1977 and Doherty reports a 1977 FDA ban on TCE in food additives was proposed, but not enacted. Further research is required on this subject.</p> <p>⁴ Bakke et al. (2007) only mentions chlorinated solvents use in leather glue. Further research is required to determine if this use specifically includes TCE.</p> <p>⁵ These uses may refer to the same refrigerant.</p> <p>⁶ TCE has confirmed historic applications in herbicides in other countries; further research is necessary to ascertain use in the United States.</p> <p>⁷ CDR use categories are very broad, and any reference to CDR is due to the use or process inclusion in a broader CDR category.</p> <p>Source(s): Bakke et al. (2007); Dionisio et al. (2015); Doherty (2000); Doherty (2014) The DOW Chemical Company (2014); NH Asthma Collaborative (2015); EPA 2016</p>			

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
Dry Cleaning and Dyeing (SIC 7216) and Other Fabric Cleaning (e.g. Rugs and Fur)					
Dry cleaning: batch process cleaning ²					
Textile spot remover ²	Commercial	Puro	TCE>75 % ³	<p>Manufacturer: Adco Professional Products LLC http://adco-inc.com/spotting/dry-side/176-puro</p> <p>Example Distributor: FabriClean Supply https://www.fabricleansupply.com</p>	<p>Product Description: Puro is a volatile dry solvent that is excellent for “touch-ups” and removal of greasy, oily soil. It is safe for all fabrics.³</p> <p>Precautions: Wear safety goggles, Neoprene or Barrier gloves, and a NIOSH/MSHA-approved respirator in circumstances with high-concentration exposure. Have an eye wash station available and do not use contacts. Avoid inhalation, ingestion, and contact with eyes or skin.³</p>
Textile spot remover for combined oil and water stains ²	Commercial	Semi Wet	TCE<75 % ³	<p>Manufacturer:² Adco Professional Products LLC http://adco-inc.com/adco/company</p> <p>Example Distributor: FabriClean Supply https://www.fabricleansupply.com</p>	<p>Product Description: Semi-Wet is used with perchloroethylene or hydrocarbon solvent to remove combined water and oil-based stains.³</p> <p>Precautions: Avoid inhalation, ingestion, and contact with eyes or skin. Use PPE, including safety glasses, Neoprene or Barrier Gloves, NIOSH/MSHA-approved respirator, and protective clothing. Have an eye-wash station available. Do not wear contacts without eye protection. Good ventilation should be used, and if possible use local ventilation and process enclosures.³</p>

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
Textile spot remover for dry-side spotting ²	Commercial	Picrin	TCE>75 % ³	<p>Manufacturer: RR Street & Co. Inc. http://www.4streets.com/</p> <p>Example Distributor: Garland Supply Company http://www.garlandsupply.com/dry-cleaning-chemicals/street-s-chemicals/picrin.html Cleaners Outlet http://www.garlandsupply.com/dry-cleaning-chemicals/street-s-chemicals/picrin.html</p> <p>List of distributors: http://www.4streets.com/index.php/find-a-distributor/</p>	<p>Product Description: Used for dry-side spotting—along with other dry-side agents—to remove difficult dry-side stains.³</p> <p>Precautions: Use PPE, including safety glasses, Neoprene or Barrier Gloves, NIOSH/MSHA-approved respirator, and protective clothing. Have an eye-wash station available. Do not wear contacts without eye protection. Avoid inhalation, ingestion, and contact with eyes and skin. Good ventilation should be used, and if possible use local ventilation and process enclosures.³</p>
Ink and ribbons in laundromats and dry cleaners	Commercial, Industrial	Dot Matrix Printer Ink Ribbons (-15 ink), black, red, green and blue	Trace Amounts ³	<p>Manufacturer: Thermopatch http://www.thermopatch.com/en/home</p> <p>Example Distributor: Cleaner’s Supply https://www.cleanersupply.com/</p>	<p>Product Description: Ink and ribbons for printing and labelling at a laundromat or dry cleaner. Products stand up to the cleaning process of a modern launderer or dry cleaner.³</p> <p>Precautions: Use with adequate ventilation, wash hands after use, and wash clothes thoroughly after use. Wear eye protection. Avoid contact with material when it’s heated. Ventilate well when using heated material; overexposure to vapors may cause irritation of the respiratory tract, dizziness, headache, nausea or chronic pulmonary congestions. May cause moderate irritation to eyes and skin upon contact. Ingestion may cause irritation or gastric disturbances. This product is not considered to be a hazardous substance as defined under OSHA’s Hazard Communication Standard (29 CFR 1910.1200) ³</p>

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
Textile Mill Products and Apparel					
Textile scouring (e.g., wool and cotton scouring)					
Textile sizing					
Soap solution ingredient					Have not found an example product that contains TCE.
Swelling agent in the disperse dyeing of polyesters					
Solvent in waterless dyeing and finishing operations					
Dye fixative and mordant					
Impregnating artificial fabrics					
Degreasing fibers (organic fibers, asbestos, glass, carbon, or silicon carbide fibers prior to bonding or lamination)					
Resin extractor and purifier in the dyeing process					
Dyed cloth resin remover					
Leather and Leather Products					
Remove fat from hides in the processing of leather					
Animal hide and skin disinfectant					
Leather glue					
Crepe sole rubber cement additive					
Recover fat-free glue in tanneries					
Impregnation of leather					

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
Rubber and Miscellaneous Plastics Products					
Adhesives for industrial products	Industrial	SC2000 Black Cement	75-90% ³	<p>Manufacturer: Rema Tip Top http://www.rematiptop.com/</p> <p>Example Distributor: Motion Industries https://www.motionindustries.com/</p>	<p>Product Description: SC2000 is a two component, room temperature curing chloroprene liquid rubber adhesive ideal use in lining installations, when bonding rubber to rubber, rubber to fabric, rubber to steel, rubber to concrete, fiberglass, and urethane, as well as the splicing and repair of fabric conveyor belting.³</p> <p>Precautions: Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not breathe vapors. Avoid contact during pregnancy/while nursing. Wash skin and exposed areas thoroughly after handling. Do not eat, drink or smoke when using this product. Contaminated work clothing should not be allowed out of the workplace. Avoid release to the environment. Wear protective gloves/protective clothing/eye protection/face protection. Use personal protective equipment as required.³</p>
Antioxidant for tire manufacturing					

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
Tire repair	Commercial	Special Cement BL G	80-95% ³	<p>Manufacturer: Rema Tip Top http://www.rematiptop.com/</p> <p>Example Distributor: Tire Shop Supplies http://tireshopsupplies.com/</p>	<p>Product Description: Special Cement BL creates a nearly indestructible bond between tire and repair unit. Specifically designed for the application of REMA TIP TOP Radial, Bias-Ply and Universal, Minicombi & RemaStem repair units. Use for chemical installation of REMA TIP TOP blue bonding layer repair units, Blue Floater Gum and chemical vulcanizing compounds.³</p> <p>Precautions: Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not breathe vapors. Avoid contact during pregnancy/while nursing. Wash skin and exposed areas thoroughly after handling. Do not eat, drink or smoke when using this product. Contaminated work clothing should not be allowed out of the workplace. Avoid release to the environment. Wear protective gloves/protective clothing/eye protection/face protection. Use personal protective equipment as required.³</p>
Tire buffer and cleaner	Commercial	TRU FLATE Liquid Tire Buffer and Cleaner	70-90% ³	<p>Manufacturer: Plews, Inc. http://www.plews-edelmann.com/</p> <p>Example Distributor: Grainger https://www.grainger.com/</p>	<p>Product Description: None listed.</p> <p>Precautions: Avoid breathing dust/fume/gas/mist/vapors/spray. Use only outdoors or in a well-ventilated area. Wear protective gloves/protective clothing/eye protection/face protection. Use personal protective equipment as required. Avoid release to the environment. Wash thoroughly after handling. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood.³</p>
Foam blowing agent					
Solvent in the manufacture of large, rigid plastic products					
Plastic cements (to bond foam and polystyrene)					

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
Cement mixing					
Bonding and vulcanizing agent in conveyor belts in underground hard coal mining					
Agricultural Production and Agricultural Chemicals					
Insecticides					
Herbicides (chlorophenols and phenoxy)					
Fungicides					
Grain fumigant in agriculture					
Food and Kindred Products					
Decaffeination of coffee (as an extractant)					
Spice oleoresins (as an extractant)					
Extraction solvent for natural fats and oils (e.g., palm and coconut oil)					
Egg preservative (in a wax solution applied to the shell)					
Health Service					
Anesthetic (for animals)					
Anesthetic (for humans)					
Analgesic					
Anthelmintic (treats parasitic intestinal worms)					
Abreaction reagent (drug that releases repressed emotions)					
Disinfectant (e.g., hand sterilizer prior to surgery)					
Animal hair wash					
Chemicals and Allied Products					
Wood resin extractant					

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
Pulverized sulphur production					
Chlorinated aliphatics (as a chemical intermediate)					
Glycolic and dichloroacetic acids (as a chemical intermediate)					
Chlorofluoromethane refrigerants (as a chemical intermediate)					
Refrigerant in air-conditioning installations					
Spirit soap					
Solvent for sulfur chloride and cellulose esters and ethers					
Chain terminator (in the production of polyvinyl chloride)					
Dewaxing lubrication oils					
To recover wax and paraffin from refuse					
Hobby and model glues (particularly for balsa wood)					
Paints, Varnishes, Lacquers, Enamels, and Allied Products					
Paint thinner					
Paints					
Paint stripper					
Used to flush liquid oxygen					
Impregnating cardboard and paper boxes					
Solvent for paraffin-synthetic resin mixture (used in paper processing)					
Printing inks					

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
Cleaning solvent for printing machines					
Research, Development, Testing Services					
Cleaning optical lenses					
Extraction solvent for bitumen in asphalt analysis					
Laboratory chemical: spectrophotography	Commercial, Industrial	Trichloroethylene, Spectrophotometric Grade	99.5% ³	Manufacturer: Alfa Aesar https://www.alfa.com/en/	Product Description: Used in chemistry labs, specifically for spectrophotometry and environmental testing. ³ Precautions: Keep in tightly sealed container. Store in cool, dry places in tightly constrained containers. Ensure good ventilation. Avoid inhalation, ingestion, and contact with eyes or skin. ³
Laboratory chemical: chromatography	Commercial, Industrial	VOA Matrix Spike Mix (30005)	.25% ³	Manufacturer/Distributor: Restek Corp www.restek.com	Product Description: Certified reference materials (CRMs) manufactured and QC-tested in Restek's ISO-accredited labs satisfy your ISO requirements. ³ Precautions: Keep away from heat/sparks/open flames/hot surfaces. Ground/bond container and receiving equipment. Do not breathe dust/fume/gas/mist/vapors/spray. Wash hands and skin thoroughly after handling. Do not eat, drink or smoke when using this product. Use only outdoors or in a well-ventilated area. Wear protective gloves/protective clothing/eye protection/face protection. ³
Perfumes, Cosmetics, and Other Toiletry Preparations					
Shampoo and dry shampoo					
False eyelash cleaner					
Perfume ingredient					
Glue for hair extensions and lace wigs					
Degreasing					

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
Solvent degreasing: cold cleaning ²	Commercial, Industrial	Safety Solvent Aerosol	90-100% ³	<p>Manufacturer: Share Corporation http://www.sharecorp.com/products/safety-solvent-aerosol</p> <p>Example Distributor: Share Corporation (Request a quote) http://www.sharecorp.com/products/safety-solvent-aerosol</p>	<p>Product Description: Safety Solvent is an aerosol product used for cold cleaning in vehicle service shops, maintenance shops and industry. It cuts through heavy grease and grime build-up. The non-flammable, non-corrosive, and non-conductive formulation provides an extra margin of safety when cleaning. It can be used on delicate surfaces such as carpets, upholstery and fabric.³</p> <p>Precautions: Use outdoors or in well-ventilated area; avoid breathing mist and vapors. Wear protective gloves, protective clothing, eye protection, face protection. Wash thoroughly after handling.³</p>
Solvent degreasing: vapor degreasing ²					
Closed system vapor degreasing parts cleaning through					

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
Miscellaneous Uses of TCE					
Cutting Fluids (tap and die cutting)	Commercial, Industrial	TrueTap® EV Fast Evaporation Cutting Fluid	>=80%	<p>Manufacturer: CRC Industries, Inc. http://www.crcindustries.com/</p> <p>Example Distributor: Applied Industrial Technologies https://www.applied.com/c-crc-industries-inc--03450/p/101851101</p>	<p>Product Description: Tap and die fluids are used to ease the process of creating screw threads by cooling tools and removing grease and debris.</p> <p>Precautions: Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Keep out of low areas. Wear appropriate protective equipment and clothing during clean-up. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Avoid inhalation of vapors or mists. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained.³</p>
Film and photographic plate cleaner					
Furniture cleaner					
Penetrating Fluids	Commercial, Industrial	Penetrating Oil Aerosol	30-40%	<p>Manufacturer/Distributor: Share Corporation http://sharecorp.com/products/penetrating-oil-aerosol</p>	<p>Product Description: Ideal for use at auto repair shops, maintenance departments, machines shops, etc. Residual film helps protect metal from further corrosion. Penetrates and cleans hard-to reach places.³</p> <p>Precautions: Use with adequate ventilation. Local ventilation Recommended. Do not breathe vapors or spray mists. Ventilate area and remove sources of ignition. Soak up on inert material and place in a properly marked, closed container for disposal. Consult local environmental authorities. Store in a cool, dry, well-ventilated place away from Heat and open flame. Keep container tightly closed when not in use. Wash thoroughly after handling. Keep out of the reach of children.³</p>
To clean trailer tanks					
To clean brewery tanks					

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
To clean atmospheric chambers (for NASA)					
To clean computer ribbons					
To clean watch parts (in ultrasonic cleaning machines)					
Toner aide	Consumer, Commercial, Industrial	Toner Aide (208-003)	15-20% ³	<p>Manufacturer: Sprayway http://www.spraywayinc.com</p> <p>Example Distributor: Dynamic Screen Printing Supply http://www.dynamicscreenprinting.com/Sprayway-SW208-Toner-Aide_p_15622.html</p>	<p>Product Description: Improves toner image opacity, develops higher resolution, enhances detail clarity. Use this product on paper, vellum, transparency film and any dry toner generated media. Product dries in minutes and is 100% transparent. ³</p> <p>Precautions: Wear chemical goggles. Wear appropriate chemical resistant gloves and clothing. If workers are exposed to concentrations above the exposure limit, they must use NIOSH mechanical filter/organic vapor cartridge or an air-supplied respirator..³</p>
Typewriter correction fluid					
Silicone parting agent in shell molding for foundries					
Gas and tar purification					
Tree wound healers					
Aerosol spray chimney cleaners					
Air fresheners					
Surface disinfectants					
Preservation and deodorizers					
Mildew sprays					
Mildew preventative					
Smoke bombs (used to evaluate ventilation)					
Rust prevention products					
Polishes					

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
Caulking substance (for shipbuilding)					
Waterproof material for brickwork					
Degreasing skins (taxidermy industry)					
Fire extinguishers					
Extracting sulfur from iron oxide pellets used in the purification of coke oven and similar gases					
Gas purification as a solvent of sulfur and phosphorus					
Low-temperature heat-transfer agent					
Heated TCE used in banks to correct error on checks					
Pottery glaze ingredient					
Tin recovery (from scrap metal)					
In centrifuge processes at uranium enrichment plants					
To extract phenol from wastewater					

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
Brake parts cleaner	Consumer, Commercial, Industrial	Brake Parts Cleaner706	45-55% ³	<p>Manufacturer: Sprayway Inc. http://www.spraywayinc.com/industry-segments/automotive-all-products?page=4</p> <p>Example Distributor: Sparkle Auto, LLC via Amazon https://www.amazon.com/dp/B0005JNU2Q/ref=olp_product_details?encoding=UTF8&me=</p>	<p>Product Description: Brake Parts Cleaner 706 is a non-flammable automotive maintenance product designed to remove brake fluid, grease, oil, and other contaminants from brake linings and drums. Additionally prevents disc brakes from squealing. Recommended for use on valve covers, clutch housings, clutch pressure plates and transmission. ³</p> <p>Precautions: Use precaution to avoid breathing vapor. Use with sufficient ventilation. Do not puncture or burn containers. Keep away from heat and flame; do not expose to direct sunlight. Do not store at temperatures above 130F(54C).</p>
As an aerosol in spray cans					
Shoe polish	Commercial	Master Quick Shine	10-30% ³	<p>Manufacturer: Petronio Shoe Products http://www.petronioshoeproducts.com/</p>	<p>Product Description: Master Quick Shine is a fast-drying, instant high-glass shoe shine.³</p> <p>Precautions: Use chemical-resistant gloves and safety glasses. Use respirator if using indoors on a consistent basis. If eye contact, flush immediately with water. If skin contact, remove thoroughly with soap and water. If swallowed, seek medical attention.³</p>
Drain and pipe cleaners					
Household cleaner					
Wig cleaner					
Upholstery cleaner					
Septic tank cleaner					
Water repellent					
Metal cleaner and polish					
Used in the production of hydrofluorocarbons					
Fire-retardant chemicals					

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
Flame-retardant chemicals					
Fertilizer					
Heat exchange fluid					
Gun scrubber	Consumer, Commercial	EEZOX® Premium Gun Care	50% ³	<p>Manufacturer: Eezox® Manufacturing http://www.eezox.com/index.html</p> <p>List of Distributors: http://www.eezox.com/dealers.html</p>	<p>Product Description: Eezox® is a cleaning system for the hunting, boating, fishing, biking, camping, sport/competitive shooting and black powder enthusiast. Synthetic EEZOX® Premium Gun Care is a total gun-care system with one-product for all guns. This includes black powder guns.³</p> <p>Precautions: Avoid prolonged breathing of vapors, use with adequate ventilation, avoid contact with skin or eyes. If spilled or released, dike area and absorb spilled material with sawdust or vermiculite. Avoid inhalation and indigestion.³</p>
Lead-acid batteries					
Lithium batteries					
Battery coat	Consumer, Commercial	Zep Battery Coat	>= 30 - < 50% ³	<p>Manufacturer: Zep http://www.zep.com/</p> <p>Example Distributor: Axela medical supplies http://www.axelamedicalsupplies.com/foundations/store/sopdetail.asp?params=AX282%5EZep_Battery_Coat_Terminal_Sealer_and_Protector_Case_of_12</p>	<p>Product Description: Zep Battery Coat is an aerosol that forms a durable coating which protects against corrosion on battery terminals, cables, clamps, and hold-downs. It seals out acid fume, moisture, dirt, grease and oil, prolonging battery life.</p> <p>Precautions: Unless exposure assessment demonstrates exposure is within recommended guidelines, use adequate exhaust ventilation. If ventilation is not adequate, use respiratory protection. Use tightly fitting safety goggles. For abnormal processing problems, wear face-shield and protective suit. Impervious clothing: make body protection determinations based on the amount and concentration of the dangerous substance at the work place. Discuss glove suitability for a specific workplace with the producers of the protective gloves.</p>

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
Pepper spray (fog delivery)	Consumer, Commercial	2, 3, 4, 9 & 16 oz. Pepper Spray (Fog Delivery) PE14 or PE 17	Not Specified on SDS	Manufacturer/Distributor: Personal Safety Corporation http://pepperenforcement.com/stream.htm	Product Description: The 2, 3, 4, oz. Pepper Spray (Fog delivery) is a personal protection irritant spray. ³ Precautions: Use splash goggles, protective clothing, and adequate natural or forced ventilation. Avoid inhalation, ingestion, and contact with skin or eyes. ³
Pepper spray (splatter stream delivery)	Consumer, Commercial	LIVE Shotgun Stream® Aerosol Defense Device OC/CS Combination	91.5% ³	Manufacturer: Enforcement Technology Group Inc. http://etgi.us/	Product Description: LIVE Shotgun Stream® is an aerosol defense device firing pattern with a chemical carrier. ³ Precautions: Avoid inhalation, ingestion, contact with eyes and skin. Wear splash goggles and protective clothing. Utilize adequate natural or forced ventilation. ³
Pepper spray (splatter stream delivery)	Consumer, Commercial	2, 3, 4, OZ. Pepper Spray (STREAM Delivery)	Not Specified on MSDS	Manufacturer: Personal Safety Corporation http://pepperenforcement.com/stream.htm Example Distributor: Amazon https://www.amazon.com/	Product Description: The 2, 3, 4, OZ. Pepper Spray (STREAM Delivery) is a personal protection irritant spray. ³ Precautions: Use splash goggles, protective clothing, and adequate natural or forced ventilation. Avoid inhalation, ingestion, and contact with skin or eyes. ³

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
Hoof polish	Consumer, Commercial	Ultra® Hoof Polish Enhancer	Unknown	<p>Manufacturer: Schneider Saddlery http://horse-supplies.sstack.com/horses/SHine%20On</p> <p>Example Distributor: Schneider Saddlery http://horse-supplies.sstack.com/horses/SHine%20On Horse Health USA http://www.horsehealthusa.com/details/Ultra-Clear-Highlighter/386-5065.html</p>	<p>Product Description: Ultra® Hoof Polish Enhancer is used as a top coat over hoof polish to seal out and repel dust. According to Horse Health USA, it is not for sale in AK, HI, MP, PR, VI.³</p> <p>Precautions: Unknown</p>
Stain removal agent (solvent)					
Electrical cleaner/degreaser (aerosol) ²	Commercial, Industrial	POWER-SOLV Energized Electrical Cleaner Product No.: 891.7070	30-60% ³	<p>Manufacturer: Winzer Corporation https://www.winzer.com/</p>	<p>Product Description: POWER-SOLV Energized Electrical Cleaner is a solvent degreaser and moisture displacer for use on electric motors, electronic equipment, metal parts, ignition systems, refrigeration equipment, generators, power tools, etc. Not for use on computers. Removes dirt, grease, oil and grime.³</p> <p>Precautions: Local exhaust ventilation is preferred. Wear NIOSH/MSHA approved organic vapor respiratory protection if using in confined or poorly ventilated areas. Use safety glasses, gloves, synthetic apron. Avoid contact with eyes and skin. Avoid ingestion and inhalation.³</p>

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
Electrical cleaner/degreaser (aerosol) ²	Consumer, Commercial, Industrial	EL™2001 Electronic Contact Cleaner & 1661 Protectant Aerosol	97% ³	<p>Manufacturer: Sprayon Products http://www.sprayon.com/</p> <p>Example Distributors: Amazon https://www.amazon.com/SO2001000-Electronic-Cleaners-Protectant-Extension/dp/B004H31DBQ Grainger Industrial Supply https://www.grainger.com/product/SPRAYON-16-oz-Electronic-Contact-Cleaner-6KDT5</p> <p>List of distributors: http://www.sprayon.com/where-to-buy/</p>	<p>Product Description: clean/degrease electrical equipment when electrical current exists or when there is a residual electrical potential from a component. Used to clean switches, relays, timers, signals, transmitters, condensers, transistors, microphone, panel boards, circuit breakers, contacts, meters, receivers, speakers, coils.³</p> <p>Precautions: Use only with adequate ventilation, avoid contact with skin and eyes, avoid breathing vapor or spray mist. Wash hands after using. Wear NIOSH/MSHA respiratory protection if poor ventilation and safety spectacles.³</p>
Electrical cleaner/degreaser (aerosol) ²	Commercial	Blast-a-Coil Cleaner	60-100% ³	<p>Manufacturer: Parker Hannifin Corporation www.Parker.com</p> <p>Distributor: Johnstone Supply www.johnstonesupply.com</p>	<p>Product Description: Allows the user to “blast a coil” and walk away. Cleans grease, dirt, lint and other debris without mess or fuss.³</p> <p>Precautions: Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Avoid breathing mist, vapors or spray. Wash thoroughly after handling. Use only outdoors or in a well-ventilated area. Wear protective gloves/clothing and eye/face protection.³</p>

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
Electrical cleaner/degreaser (non-spray)	Commercial, Industrial	Lectra Sol TC	100% ³	Manufacturer: Tri-Chem http://www.tri-chem.com/	<p>Product Description: Lectra Sol TC was designed to clean electrical circuits, contacts, motors, generators and alternators, instrument panels, electric clutches, insulation, coin-operated machines, telephone equipment, contact points, traffic signal equipment, printing equipment, printing plates, but can be used for heavy duty degreasing and parts cleaning. Removes grease, oil, tar, and lubricating compounds.³</p> <p>Precautions: Should only be used in specially designed equipment (i.e. vapor degreaser) and with a respirator with organic vapor cartridge. Use “Viton” gloves, safety glasses, and impermeable clothes. Avoid contact with eyes and skin. Avoid ingestion and inhalation.³</p>
Electrical cleaner/degreaser (non-spray)	Commercial	Trichloroethylene Degreaser	Unknown	Example Distributor: Worldwide Janitor https://worldwidejanitor.com	<p>Product Description: Cleans electrical or mechanical equipment. Ideal for cleaning electric motors, armatures, bearings, switch gears, contacts, controllers, recorders, thermostats, instruments, computers, radios, electronics, generators, alternators, distributors, spark coils, engines, blades, hydraulic pistons, gears, chains, machine surfaces.³</p> <p>Precautions: Personal Protective Equipment is recommended.</p>

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
Sealant for mirrors/glassware	Consumer, Commercial, Industrial	Mirror Edge Sealant	20-40% ³	<p>Manufacturer: Sprayway Inc. http://www.spraywayinc.com/</p> <p>Example Distributors: Amazon https://www.amazon.com/Sprayway-Mirror-Edge-Sealant/dp/B0005JNRNI Fastenal https://www.fastenal.com/products/details/0602395</p>	<p>Product Description: Mirror Edge Sealant is intended for use by glass/mirror professionals, artists, and picture framers that protects edges from blackening and reduces silver deterioration on mirrors.³</p> <p>Precautions: Avoid breathing in mist or vapor. Avoid ingestion, prolonged exposure, and contact with skin, eyes, and clothing. All equipment used while handling this product must be grounded. Avoid operations that promote the accumulation of static charges. Should only use in closed systems and should wear appropriate personal protective equipment.³</p>
Adhesives for acrylics	Industrial	Scigrip 3 Low VOC Solvent Cement for Bonding Acrylics	5-15% ³	<p>Manufacturer: IPS Corporation http://ipscorporation.com/</p> <p>Example Distributor: BMB Solutions Composites info@bmb.com, Composites One LLC www.compositesone.com, North American Composites www.nacomposites.com, Rudolph Brothers & Company www.rudbro.com</p>	<p>Product Description: Scigrip 3 is a water thin, non-flammable, very fast-setting solvent cement for bonding acrylic. It will also bond with other thermoplastics such as polystyrene, CAB (cellulose acetate butyrate), PETG (polyethylene terephthalate glycol) and polycarbonate to themselves. It will not bond to cross linked acrylics.³</p> <p>Precautions: Use chemical goggles. If exposure causes eye discomfort, use a full-face respirator. Prevent contact with the skin as much as possible. Use protective clothing chemically resistant to this material. Remove contaminated clothing immediately, wash skin area with soap and water and launder clothing before reuse or dispose of properly. Prevent inhalation of the solvents. Use in a well-ventilated room.³</p>
Spray fixatives					
Processing aid in production of betacyclodextrin					

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
Processing solvent for the manufacture of hollow fiber membranes in continuous fiber spinning process					
Extraction solvent in the manufacture of caprolactam					
Solvent in the synthesis of vulcanization accelerating agents for fluoroelastomers					
Process chemical to remove polystyrene from an intermediate					
Packaging of recycled TCE					
Formulation of recycled TCE					
Non-flammable gas mixture	Commercial, Industrial	Nonflammable Gas Mixture: 1,1,1 – Trichlorofluoroethane/ Nitrogen / Trichloroethylene / Vinyl Chloride	0.1 – 0.999% ³	Manufacturer: Airgas https://www.airgas.com/home-c?utm_expId=87060952-2.-ZJb5evrTWu-9YzJTAraIA.2	Product Description: Nonflammable Gas Mixture is used in synthetic and analytical chemistry applications. ³ Precautions: Eye contact, skin contact may lead to burn or frostbite. Use engineering and environmental controls if user operations generate dust, fumes, or vapor. Use PPE, including chemical-resistant gloves and air-purifying respirator. This material is considered hazardous by the OSHA Hazardous Communication Standard (29 CFR 1910.1200). ³

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
Multipurpose lubricant	Commercial, Industrial	LU TM 916 Multi-Purpose Silicone Lubricant Aerosol	49% ³	<p>Manufacturer: Sprayon Products http://www.sprayon.com/</p> <p>Example Distributor: Fastenal https://www.fastenal.com/products/details/0616302</p> <p>List of Distributors: http://www.sprayon.com/where-to-buy/</p>	<p>Product Description: Sprayon® LU916 Multi-Purpose Silicone Lubricant Aerosol is a lubricant which can be used on many surfaces to provide a slippery non-drying, long-lasting film with low build-up. It protects against rust and water damage taking the place of petroleum products. Use outdoors or in refrigerated areas to prevent from freezing. For use on slides, guides, knives, food and drug processing equipment, rubber items, conveyor systems, brushings, air tables, locks, guides, slides, hinges, latches, and fabric assembly.³</p> <p>Precautions: Use only with adequate ventilation. Avoid contact with skin and eyes. Avoid vapor and spray mist. Local Exhaust is preferable. If ventilation is insufficient, wear NIOSH/MSHA-approved respirator. Wear safety spectacles, and if long or repeated contact is expected, wear chemical-resistant gloves.³</p>
Mold cleaner/release agent	Industrial	White 2000 (aerosol)	85-98% ³	<p>Manufacturer: IMS Company https://www.imscompany.com/</p>	<p>Product Description: Non-flammable mold cleaner for industrial use only. Fast evaporation; cleans without wiping.³</p> <p>Precautions: Use synthetic gloves, do not wear contacts, and use ANSI approved safety glasses or splash shield. Local Ventilation preferred, but general ventilation is usually sufficient. Use NIOSH-approved respiration if ventilation is insufficient. Eye-wash, shower stations, and spill equipment should be available.³</p>

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
Mold cleaner/release agent	Industrial	White 2000 (bulk)	100%	Manufacturer: IMS Company https://www.imscompany.com/	Product Description: Heavy duty solvent, non-flammable mold cleaner for industrial use only. ³ Precautions: Use synthetic gloves, do not wear contacts, and use ANSI approved safety glasses or splash shield. Local Ventilation preferred, but general ventilation is usually sufficient. Use NIOSH-approved respiration if ventilation is insufficient. Eye-wash, shower stations, and spill equipment should be available. ³
Mold cleaner/release agent	Consumer	Zinc Stearate Dry Powder Spray Mold Release	45-50% ³	Manufacturer: Plastics Process Equipment, Inc. http://www.ppe.com/	Product Description: PPE ZINC STEARATE Z-122 Dry Powder Spray Mold Release is ideal for use on acrylics, polycarbonates, PPO and ABS. Our formula includes only the finest paintable zinc stearate powder for safe use in mold spraying. Our concentration is blended to give you more releases per application. ³ Precautions: Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use personal protective equipment as required. Wear protective gloves. Wear eye or face protection. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Pressurized container: Do not pierce or burn, even after use. Do not spray on an open flame or other ignition source. Use only outdoors or in a well-ventilated area. Do not breathe dust or mist. Wash hands thoroughly after handling. ³
Elastomers	Consumer, Commercial, Industrial				
Fillers	Consumer, Commercial, Industrial				

Table 3-2: Sample of Products that Contain TCE

Use	Expected Users	Product	Percent Conc.	Manufacturer and Distributor Information	Details
Sealers	Consumer, Commercial, Industrial				
Carpet cleaner	Commercial, Consumer	Nutri Carpet Cleaner	Unknown	Example Distributor: Worldwide Janitor https://worldwidejanitor.com/carpet-cleaning-chemicals-c-110_67/	Product Description: Removes grease, chewing-gum, oils, gummy residues, tar, and adhesives from carpets, rugs, matting, and upholstery. ³ Precautions: Personal Protective Equipment is recommended
Note(s): ¹ Determination of the <i>Expected Users</i> associated with a use or process is based on EPA's best judgement if the users are not explicitly defined in the resource(s) cited. ² Denotes uses currently being considered for Section 6 actions under the Toxic Substances Control Act (TSCA). ³ Information from product MSDS and webpage of distributor or manufacturer.					

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