5. PRODUCTION, IMPORT/EXPORT, USE, AND DISPOSAL

5.1 PRODUCTION

1-Bromopropane is primarily produced by reacting propanol with an excess of hydrogen bromide gas. Small amounts of 2-bromopropane are produced as a byproduct. There are various modifications to the production method that increase the purity of the 1-bromopropane product, as well as distillation procedures to remove byproducts (NTP 2011).

Another production method is dehydration of propanol with bromine or hydrogen bromide in the presence of a sulfur catalyst (NTP 2003).

In 2012, 1-bromopropane was reported to be manufactured by at least 21 companies globally, including at least 1 in the United States (NTP 2013).

Worldwide annual production capacity of 1-bromopropane was estimated to be >20,000 metric tons (mt) in 2006. The same year, U.S. production was estimated to be about 5,000 mt and growing by 15–20% per year (NTP 2011). The non-confidential 2012 Chemical Data Reporting (CDR) database listed the U.S. national production volume as 15,348,727 lb/year (6,962 mt/year) (HSDB 2013).

It was estimated that in 2000, 2001, and 2002, the global sales and emissions of 1-bromopropane for solvent and adhesive applications were 4,839, 3,152, and 3,736 mt, respectively. In 2003, the estimation of use and emissions was 5,000–10,000 mt (NTP 2003).

As of November 23, 2015, the EPA published a final rule adding 1-bromopropane to the TRI list of reportable chemicals (EPA 2015). Under this rule, facilities that manufacture or process 1-bromopropane are required to report release and waste management data under Section 313 of the Emergency Planning and Community Right-to-Know Act (Title III of the Superfund Amendments and Reauthorization Act of 1986) (EPA 2005). This rule applies to the reporting year beginning January 1, 2016, and facility reports are due on July 1, 2017 (EPA 2015). It is estimated that 140 facilities will be required to report release and waste management data (EPA 2015).

Available data on the release and environmental fate of 1-bromopropane can be found in Sections 6.2 and 6.3.

5.2 IMPORT/EXPORT

It was reported that the U.S. imported 2.8 million pounds (1,270 mt) of 1-bromopropane in 2000 (NTP 2003). In 2007 and 2011, U.S. imports were reported as 10.9 and 10.3 million pounds (4,944 and 4,672 mt), respectively; however, this amount was for brominated derivatives of acyclic hydrocarbons and included other chemicals in addition to 1-bromopropane.

In 2007 and 2011, U.S. exports were reported as 8.8 and 15.1 million pounds (3,992 and 6,849 mt), respectively; however, this amount was for brominated derivatives of acyclic hydrocarbons and included other chemicals in addition to 1-bromopropane (NTP 2013).

5.3 USE

1-Bromopropane was originally used as an intermediate in the early to mid-1990s, primarily in the production of pesticides, flavors and fragrances, pharmaceuticals, and other chemicals. In the mid to late-1990s, methylene chloride, used in emissive applications such as degreasing operations and cleaning of electronics and metals, was determined to be toxic to workers, so 1-bromopropane was introduced as a less toxic replacement for these applications. 1-Bromopropane is often used as a vapor due to its relatively high vapor pressure. Aerosol-applied adhesives containing 1-bromopropane have been used extensively in the foam fabricating industry (NTP 2011).

In the last decade, the use of 1-bromopropane in industry has increased due to new applications as an alternative to ozone-depleting substances (ODS) and possible carcinogens. For example, the dry cleaning industry started using 1-bromopropane as a substitute for tetrachloroethylene, in response to states pursuing to ban the suspected carcinogen (NTP 2013). Also, 1-bromopropane was reviewed through the U.S. EPA's Significant New Alternatives Policy (SNAP) program that identifies substitutes for ODSs, such as hydrochlorofluorocarbons (EPA 2007c). Due to increased application of 1-bromopropane, exposure to workers has been increasing, which has caused some human health concern, such as neurological alterations and reproductive toxicity. Therefore, its use in certain industries is being reevaluated (NTP 2013). In 2007, the U.S. EPA proposed to allow the use of 1-bromopropane as an alternative to CFC-113, HCFC-141b, and methyl chloroform in some, but not all, end uses. The decision found 1-bromopropane to be an acceptable substitute in metals, electronics, and precision cleaning and acceptable subject to use conditions as a coating, but not as an aerosol solvent or adhesive carrier solvent due to the exposure potential and health risks to workers (EPA 2007c). It has also been reported that at least three manufacturers are limiting or eliminating use of 1-bromopropane for solvent applications (NTP

2003). In 2013, OSHA issued a hazard alert for 1-bromopropane suggesting that the most effective way to reduce worker exposure is by eliminating or substituting 1-bromopropane (OSHA 2014). In addition, in 2014, ACGIH significantly lowered the TLV-TWA for 1-bromopropane, from 10 to 0.1 ppm and also reclassified it as a confirmed animal carcinogen (USAPHC 2014). In 2016, EPA developed a Toxic Substances Control Act (TSCA) Work Plan Chemical risk assessment for 1-bromopropane in order to assess the uses with significant potential for exposure, and based on the findings, may bring about risk reduction actions (EPA 2016). Due to these new threshold values and hazard alerts, 1-bromopropane may no longer be a viable option for use in some industry applications, such as vapor degreasing, and therefore, the occupational use of 1-bromopropane may decrease in the future.

The EPA (2014e) indicated that some consumer products may contain 1-bromopropane, including aerosol cleaning products, spot cleaners, and arts and craft spray glues. However, no consumer products were identified as containing 1-bromopropane in the U.S. Department of Health and Human Services (DHHS) household database (DHHS 2016).

5.4 DISPOSAL

Disposal of the chemical must take into consideration the material's impact on air quality, its potential migration to groundwater, its effect on biological species, and must follow disposal regulations (HSDB 2013). Because of its propensity to volatilize, most disposal is by release to the atmosphere. Disposal of liquid or solid wastes that contain 1-bromopropane is regulated by federal restrictions that apply to hazardous substances (see Chapter 8).