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

5.1 PRODUCTION

Acrolein was first produced commercially in the 1930s through the vapor phase condensation of acetaldehyde and formaldehyde (Etzkorn et al. 2002). A second method was developed in the 1940s, which involved the vapor phase oxidation of propylene; however, this method was not used at first due to the poor performance of cuprous oxide catalysts. During the 1960s, propylene oxidation was greatly enhanced by the introduction of bismuth molybdate-based catalysts and has since become the primary method used for the commercial production of acrolein. Acrylic acid and carbon oxides are the major byproducts produced during this reaction. Minor byproducts are acetaldehyde, acetic acid, formaldehyde, and polyacrolein.

Companies located in the United States that currently produce acrolein are: Baker Petrolite Corporation, Taft, California; Degussa Corporation, Theodore, Alabama; and Dow Chemical U.S.A., Taft, Louisiana (SRI 2006). Annual production capacities reported during the year 2000 were 110,000 metric tons/year (242 million pounds/year) for the Degussa Corporation and 72,000 metric tons/year (159 million pounds/year) for Dow Chemical (Etzkorn et al. 2002). Production capacity data were not provided for the Baker Petrolite Corporation. In 1978, domestic manufacturing plants produced approximately 354 million pounds of acrolein (EPA 1983). The production volumes of acrolein reported by manufacturers in 1986, 1990, 1994, 1998, and 2002 were within the ranges of >10–50 million pounds, >50–100 million pounds, >50–100 million pounds, >100–500 million pounds, and >100–500 million pounds, respectively (IUR 2002).

Table 5-1 summarizes information on companies that reported the production, import, or use of acrolein for the Toxics Release Inventory in 2004 (TRI04 2006). The TRI data should be used with caution since only certain types of facilities are required to report. This is not an exhaustive list.

5.2 IMPORT/EXPORT

Current information regarding the import or export of this compound could not be located.

Table 5-1. Facilities that Produce, Process, or Use Acrolein

State[a]	Number of facilities	Minimum amount on site in pounds[b]	Maximum amount on site in pounds[b]	Activities and uses[c]
AL	5	0	999,999	1, 3, 5, 6, 13
AR	2	0	9,999	1, 5, 12
CA	4	0	999,999	1, 2, 4, 5, 9, 12
GA	3	0	9,999	1, 5
IA	2	0	9,999	1, 5, 13
IL	2	0	999	1, 5
IN	1	10,000	99,999	6
KS	2	100	9,999	1, 13
LA	14	0	10,000,000,000	1, 3, 4, 5, 6, 7, 8, 12, 13
ME	1	0	99	1, 5
MI	2	0	9,999	1, 5, 12
MN	4	0	999,999	1, 5, 13, 14
MS	1	0	99	1, 5
NC	4	0	9,999	1, 5
NE	2	100	9,999	1, 5, 13
NY	1	1,000,000	9,999,999	12
OH	1	1,000	9,999	1, 13
OR	1	0	99	1, 5, 13
TN	1	100,000	999,999	8, 9
TX	44	0	9,999,999	1, 3, 4, 5, 6, 7, 9, 10, 12, 13
VA	2	0	99,999	1, 5
WI	3	0	9,999	1, 5, 13, 14
WV	2	0	9,999	1, 5, 6

[a]Post office state abbreviations used
[b]Amounts on site reported by facilities in each state
[c]Activities/Uses:

1. Produce
2. Import
3. Onsite use/processing
4. Sale/Distribution
5. Byproduct
6. Impurity
7. Reactant
8. Formulation Component
9. Article Component
10. Repackaging
11. Chemical Processing Aid
12. Manufacturing Aid
13. Ancillary/Other Uses
14. Process Impurity

Source: TRI04 2006 (Data are from 2004)

5.3 USE

The largest single use for acrolein is as an unisolated intermediate in the manufacture of acrylic acid, most of which is converted to its lower alkyl esters (IARC 1995). Acrolein is also used as a herbicide and algicide in irrigation waters and drainage ditches; as a biocide in the control of algae, weeds, and mollusks in recirculating process water systems; as a slimicide in the paper industry; as a biocide in oil wells and liquid petrochemical fuels; in the cross-linking of protein collagen in leather tanning; as a tissue fixative in histological samples; in the manufacture of colloidal forms of metals; in the production of perfumes; as a warning agent in methyl chloride refrigerant; and as an intermediate in the manufacture of methionine and its hydroxyl analogue, glutaraldehyde, ally1 alcohol, pyridines, and tetrahydrobenz-aldehyde (Arntz et al. 2002; Baker Petrolite 2005; Etzkorn et al. 2002; Hess et al. 1978; HSDB 2007; IARC 1995; Lewis 1997; O'Neil 2001; Windholz et al. 1983). Isolated, refined acrolein is used mainly as a biocide and as an intermediate in the production of methionine, which is a protein supplement used in animal feed (Arntz et al. 2002; IARC 1995). Acrolein has been used to make modified food starch, synthetic glycerine, acrolein polymers, polyurethane, and polyester resins (Arntz et al. 2002; HSDB 2007; Lewis 1997). It has also been used in military poison gas mixtures (IARC 1995).

5.4 DISPOSAL

Prior to implementing land disposal of waste residues (including waste sludge), environmental regulatory agencies should be consulted for guidance on acceptable disposal practices (HSDB 2007). Materials containing concentrated acrolein may be incinerated by: rotary kiln incineration, with a temperature range of 820–1,600 °C and a residence time of seconds; fluidized bed incineration, with a temperature range of 450–980 °C and a residence time of seconds; and liquid injection, with a temperature range of 650–1,600 °C and a residence time of 0.1–2 seconds (HSDB 2007). Materials containing small amounts of acrolein may be disposed of by neutralization (if needed), followed by secondary biological treatment or by submerged combustion (to concentrate the waste) followed by incineration (Hess et al. 1978; OHM-TADS 1988). On-site combustion is an option for disposal if the spill site is in a very remote, inaccessible area, and there is danger of subsequent discharge if other methods of disposal are attempted. Local, state, and federal Resource Conservation and Recovery Act (RCRA) approval must be obtained before burning on site (OHM-TADS 1988).

Acrolein has been identified as a hazardous waste by the EPA, and the disposal of this compound is regulated under RCRA. Specific information regarding federal regulations concerning disposal of

hazardous wastes through land treatment, landfilling, incineration, thermal treatment, chemical/physical/biological treatment, underground injection, and deep sea injection are provided in the Code of Federal Regulations (40 CFR 190–399). Release of acrolein in waste water is regulated under the Clean Water Act by the National Pollutant Discharge Elimination System (NPDES).

Information regarding effluent guidelines and standards for acrolein may be found in 40 CFR 122, 40 CFR 125, 40 CFR 268, 40 CFR 413, 40 CFR 423, and 40 CFR 433.

Pursuant to RCRA Section 3004(g)(5), EPA has proposed to restrict the land disposal of acrolein (EPA 1989b). Acrolein may be land disposed only if prior treatment standards have been met, or if disposal occurs in units that satisfy the statutory no migration standard (EPA 1989b). Proper guidelines and standards are outlined in the Federal Register (EPA 1989b).