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

4.1 PRODUCTION

MBOCA is a man-made chemical and has not been found in nature (IARC 1974). It is produced commercially by reacting formaldehyde with o-chloraniline (HSDB 1991; IARC 1974). Pure MBOCA is a colorless crystalline solid (Smith and Woodward 1983). The technical grade of MBOCA that is available in the United States comes mainly from Japan in the form of tan/yellow fused prills or pastilles. The diamine purity is 99.8%, typically with 0.2% free o-chloroaniline (monomer). Isomers are produced as side reactions such as trimers and tetrameres-diamines with three- and four-ring structures joined by methylene groups. Isomers constitute up to 8-10% of MBOCA. The dimer makes up to 90-92% of the MBOCA produced today for coatings and cast polyurethanes. There is no commercial use for pure dimer MBOCA other than for laboratory work.

MBOCA has been produced commercially in the United States for some time. The first reported production was in 1956 (IARC 1974). U.S. production of MBOCA was estimated to be 3.3-5.5 million pounds in 1970 and 7.7 million pounds in 1972 (IARC 1974). In 1982, production of MBOCA in the United States was reported to have ceased (HSDB 1991).

MBOCA has been manufactured in the United States by two companies E.I. Du Pont de nemours and Company (Deepwater, new Jersey) and Anderson Development Company (Adrian, Michigan). However, E.I. Du Pont de nemours and Company ceased MBOCA production in 1978, and Anderson Development Company ceased production in 1979. Presently, all MBOCA used in the United States is imported. As of 1985, there were at least four production sites in the United States that use imported MBOCA: Polyester Corporation (Southampton, new York), American Cyanamid Company (Bound Brook, new Jersey), E.I. Du Pont De nemours and Company (Deepwater, New Jersey), and Anderson Development Company (Adrian, Michigan) (OHM/TADS 1985). However, in 1992, Allchem Industries, Inc. (Gainesville, Florida), Maypro Industries, Inc. (Harrison, New York), and Miki Sangyo (USA), Inc. (New York, New York), were also reported to produce MBOCA for commercial sale (Van et al. 1992).

Eighteen industrial sites (Table 4-l) were listed in the 1990 Toxics Release Inventory (TRI) as producers and/or users of MBOCA (TRI90 1991). However, since not all producers of MBOCA are required to report to TRI, the companies listed on the inventory cannot be considered the exclusive producers of MBOCA in the United States. This is not an exhaustive list.

4.2 IMPORT/EXPORT

In 1978, approximately 0.4 million pounds of MBOCA were imported into the United States (HSDB 1991). The amount of MBOCA imported into the United States increased in 1983 to 1.51 million pounds. In 1991, approximately 2.0 million pounds of MBOCA were imported into the United States. The MBOCA was manufactured by two Japanese producers and a Taiwanese producer.

4.3 USE

The majority of MBOCA consumed in the United States has been used as a curing agent for isocyanate-containing polymers, and only about 1% is used in epoxy/epoxy-urethane resin blends

TABLE 4-1. Facilities That Manufacture or Process 4,4'-Methylenebis(2-Chloroaniline) (MBOCA)[a]

Facility	Location[b]	Range of maximum amounts on site in pounds	Activities AND uses
PERMA-FLEX ROLLERS INC.	NEWARK, DE	1,000-9,999	As a reactant; as an article component
TOWNLEY MFG. CO. INC.	CANDLER, FL	10,000-99,999	As a formulation component
GALLAGHER CORP.	GURNEE, IL	1,000-9,999	As a reactant
MARTIN ENGINEERING CO.	NEPONSET, IL	1,000-9,999	As a reactant
ANDERSON DEVELOPMENT CO.	GARY, IN	100,000-999,999	Import; for on-site use/processing; for sale/distribution; as a formulation component
GATES RUBBER CO. POLYFLEX PLANT	ELIZABETHTOWN, KY	1,000-9,999	As a formulation component
PERMATHANE CUSTOM MOLDED URETHANES	WESTBROOK, ME	1,000-9,999	As an article component
VAIL RUBBER WORKS INC.	SAINT JOSEPH, MI	1,000-9,999	As a reactant; as a formulation component
POLYURETHANE SPECIALTIES CO. INC.	LYNDHURST, NJ	10,000-99,999	For sale/distribution
DICAR INC.	PINE BROOK, NJ	10,000-99,999	As a reactant
CONAP INC.	OLEAN, NY	10,000-99,999	As a formulation component; in re-packaging
MONARCH INDUSTRIAL TIRE CORP.	AKRON, OH	1,000-9,999	As a reactant
D. S. BROWN CO.	NORTH BALTIMORE, OH	1,000-9,999	In re-packaging
GRIFFITH POLYMERS INC.	HILLSBORO, OR	10,000-99,999	As an article component
BELOIT CORP. MANHATTAN DIV.	AIKEN, SC	1,000-9,999	As a reactant
BAILEY-PARKS URETHANE	MEMPHIS, TN	1,000-9,999	As a reactant
TRCW INDUSTRIAL WHEELS INC.	NASHVILLE, TN	1,000-9,999	As a reactant
DICAR INC.	TOMBALL, TX	1,000-9,999	As a reactant
TROSTEL POLYURETHANE	LAKE GENEVA, WI	1,000-9,999	As an article component

[a]Derived from TRI91 (1993); MBOCA used in these facilities is imported from Japan because MBOCA has not been produced in the United States since 1979.
[b]Post office state abbreviations used

(IARC 1974). These cured polymers have many commercial and military uses. MBOCA was reported to be the most widely used agent for curing castable liquid polyurethane elastomers (HSDB 1991; IARC 1974; Sax and Lewis 1987). Commercially, these MBOCA-cured polyurethanes have been used to produce shoe soles, rolls for postage stamp machines, cutting bars in plywood manufacturing, rolls and belt drives in cameras, computers, and reproducing equipment, and wheels and pulleys for escalators and elevators (NRC 1981). MBOCA has also been reported to be formulated with other aromatic diamines and sold under trade names as a curing agent (IARC 1974). MBOCA has also been used in the manufacture of gun mounts, jet engine turbine blades, radar systems, components in home appliances (HSDB 1991), and as a wiring patting and curing agent (Cowles 1978). Military applications of MBOCA-cured polyurethanes include ball seals on nuclear submarines, positioning strips in Poseidon missiles, and encapsulation of electric components (NRC 1981).

4.4 DISPOSAL

Because MBOCA is defined as a "hazardous waste," companies that generate wastes containing 100 kg or more of MBOCA are required to conform with EPA regulations (EPA 1989; HSDB 1991). For more information on the regulations and guidelines that apply to MBOCA, see Chapter 7.

No universal method exists for the disposal of carcinogenic compounds such as MBOCA (HSDB 1991). Product residues and sorbent media containing MBOCA have been packaged in epoxy-lined drums and disposed of at EPA-approved sites (OHM/TADS 1985). Destruction via chemical reaction is another method that has been used to dispose of small amounts of MBOCA (HSDB 1991). This method, in which MBOCA is oxidized with potassium permanganate, is generally used for laboratory wastes containing small amounts of MBOCA.

Incineration technologies have been investigated for the disposal of MBOCA. MBOCA has been considered a good candidate for rotary kiln incineration at a temperature range of 820-1,600°C, with residence times of seconds for liquids and gases and hours for solids (EPA 1981b; HSDB 1991). MBOCA is also listed as a good candidate for fluidized bed incineration at temperatures ranging from 450°C to 980°C and residence times similar to those for rotary kiln incineration (EPA 1981). Disposal of MBOCA contained in waste waters using activated carbon adsorption has been studied (HSDB 1991). Saturated filters used to remove MBOCA from waste water via carbon absorption can subsequently be destroyed by rotary kiln or fluidized bed incineration (EPA 1979). Biodegradation treatment of MBOCA using continuous flow reactors that are designed to remove potential hazardous chemicals from water and waste water may be also useful in clean-up operations. Similarly, activated carbon processes and ozone oxidation provide effective disposal treatment (EPA 1979). There is, however, no information on the availability of MBOCA residues from polyurethanes and other plastics.