

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

### 5.1 PRODUCTION

Di-*n*-butyl phthalate is a member of a class of compounds called phthalate esters. During the 1980s, there was an increase in the production of phthalate esters with a world-wide production volume of 2 million tons per year (Thuren and Larsson 1990).

Di-*n*-butyl phthalate can be manufactured via the esterification of phthalic acid with *n*-butyl alcohol in the presence of a catalyst such as sulfuric acid or *p*-toluene sulfonic acid (Bisesi 1994; Cadogan and Howick 1996; EPA 1981). This reaction is generally performed at a temperature of 150 EC along with agitation (EPA 1981). Water from this process is either recovered for other operations or treated and discharged as waste water. Di-*n*-butyl phthalate is finally purified by vacuum distillation and/or with activated charcoal. The majority of phthalate esters are produced in Europe with the United States and Asia and Pacific rim countries producing similar amounts each (Cadogan and Howick 1996).

Production volume records for di-*n*-butyl phthalate could only be located combined with the production volume for di-*iso*-butyl phthalate. The production volume of di-*n*-butyl phthalate with di-*iso*-butyl phthalate in the United States from 1979 to 1994 can be found on Table 5-1 (USITC 1980, 1981, 1982, 1983, 1984, 1985, 1986a, 1986b, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995).

Di-*n*-butyl phthalate is produced at two locations in the United States (SRI 2000). These locations include: Eastman Chemical Company (Kingsport, Tennessee) and Unitex Chemical Corporation (Greensboro, North Carolina).

### 5.2 IMPORT/EXPORT

Di-*n*-butyl phthalate is imported to the United States from various countries including Japan, Canada, Mexico, Belgium, and Germany (Deyrup 1999). The total amount of di-*n*-butyl phthalate imported in 1997 was 358,600 pounds (162,700 kg), while for 1998, it was 567,600 pounds (257,500 kg). No quantitative data were located on exports of di-*n*-butyl phthalate. Total phthalate ester exports from the United States in 1977, however, was 42,500 kg (93,700 pounds), and di-*n*-butyl phthalate were estimated

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**Table 5-1. U.S. Production Volumes of Di-*n*-butyl Phthalate<sup>a</sup>**

Year	Production volume (x1,000 kg)
1980	8,226
1981	9,029
1982	7,790
1983	9,187
1984	10,964
1985	9,878
1986	10,858
1987	11,440
1988	11,573
1989	9,725
1990	7,917
1991	8,506
1992	6,555
1993	6,662
1994	7,752

Source: USITC 1980, 1981, 1982, 1983, 1984, 1985, 1986a, 1986b, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995

<sup>a</sup>with di-*iso*-butyl phthalate

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to be about 1% of total phthalate production (EPA 1981). On that basis, about 425 kg (937 pounds) of di-*n*-butyl phthalate was probably exported in 1977. More current data could not be located.

### 5.3 USE

The most important use of di-*n*-butyl phthalate is as a plasticizer (Cadogan and Howick 1992, 1996). Plasticizers are compounds that are added to other substances in order to make them softer and more flexible (Cadogan and Howick 1996). Di-*n*-butyl phthalate appears to be primarily used as a plasticizer in polyvinyl acetate emulsion adhesives (white glues and carpenter's glues, see Pocius 1991); as a solvent for oil-soluble dyes, insecticides, peroxides, and other organics; as an antifoam agent; as a fiber lubricant in the textile industry; as a solvent/plasticizer for nitrocellulose lacquers (Eastman Chemical Company 1999a); and as epoxy resins (EPA 1981, see also Cadogan and Howick 1992, 1996; Towae et al. 1992). Although there was limited use of di-*n*-butyl phthalate in polyvinyl chloride (PVC) plastics during the 1970s and 1980s, it is not currently used as a plasticizer in PVC (NTP 2000). Di-*n*-butyl phthalate is also used as a fragrance fixative (Eastman Chemical Company 1999b; EPA 1981), and as a plasticizer in polysulfides and polyurethanes, and as an alcohol denaturant (EPA 1981). Due to the higher volatility of di-*n*-butyl phthalate compared to other phthalate esters, it is unsuitable as a plasticizer in products that will be exposed to high temperature conditions on a continual basis. It is, however, very suitable in imparting high flexibility, especially at lower temperatures (Cadogan and Howick 1996). Di-*n*-butyl phthalate is often used in conjunction with higher molecular weight esters to improve the flexibility of plasticizer combinations (Cadogan and Howick 1992).

Di-*n*-butyl phthalate has also been used in a number of other applications throughout the world. It has been used in cosmetics, lubricants, floor carpets, tapestry, nail polish (Fishbein 1992), clothing treatments for chiggers (Metcalf 1994), and rubber settings in dentistry (Tesk et al. 1993), for measurement of pore space in carbon black (Dannenberg et al. 1992), and dehydration of maleic acid (Felthouse et al. 1995), as a fuel stabilizer/plasticizer in propellents (Lindner 1993b), in nitroglycerin explosives as a desensitizer (Lindner 1993a), as a solvent for chlorinated rubber, in leather varnishes and lacquers (Bisesi 1994), as an adjusting agent for lead chromate pigments, as a concrete additive to impart work ability, and in polyvinyl acetate emulsions (EPA 1981). Di-*n*-butyl phthalate is listed by EPA as an inert ingredient in some pesticides (EPA 1999a) and an active ingredient in others (EPA 1999b).

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A more current break down of usage data for di-*n*-butyl phthalate could not be located. Table 5-2 presents facilities that manufacture or use di-*n*-butyl phthalate according to Toxics Release Inventory (TRI) data.

**5.4 DISPOSAL**

Currently, a number of different disposal operations may occur for di-*n*-butyl phthalate. During the manufacturing of plasticizers, aerosols containing di-*n*-butyl phthalate can reach concentrations of 500 mg/m<sup>3</sup> (Cadogan and Howick 1996). Many facilities have begun using incineration equipment to reduce aerosol concentrations to practically zero. Also, after transportation or storage operations have ceased, di-*n*-butyl phthalate is generally washed out from its storage containers. This wash water is passed through a series of separators to remove residuals, which are then incinerated.

Some products containing phthalate ester plasticizers (e.g., flooring) may lose plasticizer through extraction by soapy water during cleaning operations (Cadogan and Howick 1996). This waste water could then flow into municipal sewage systems, where it will be later treated and discharged into the environment.

Finally, since di-*n*-butyl phthalate is found in many household products, it may ultimately be disposed of into municipal landfills (Cadogan and Howick 1996).

**Table 5-2. Facilities that Produce, Process, or Use Di-n-butyl Phthalate**

State <sup>a</sup>	Number of facilities	Range of maximum amounts on site in pounds <sup>b</sup>	Activities and uses <sup>c</sup>
AR	3	100–99,999	9, 10, 13
AZ	1	1,000–9,999	10
CA	7	0–99,999	8, 10, 12, 13
CO	1	10,000–99,999	8
FL	3	100,000–999,999	8, 11
GA	2	1,000–99,999	8, 9
IA	2	10,000–99,999	9, 10
IL	6	0–99,999	8, 9, 10
IN	4	100–99,999	2, 3, 8, 13
KS	2	10,000–999,999	8, 10
KY	2	100–99,999	8, 12
LA	1	10,000–99,999	13
MA	4	1,000–999,999	8, 9, 10
MD	1	10,000–99,999	8
MI	3	100–99,999	10, 12, 13
MO	2	1,000–9,999	8, 9
NC	7	100–999,999	1, 4, 8, 10, 11, 12
NE	1	1,000–9,999	8, 9
NJ	7	1,000–99,999	2,3,4,8,10,11, 13
NY	8	1,000–99,999	2,3,8,10,11, 13
OH	3	1,000–99,999	8, 13
OK	1	100,000–999,999	7
PA	3	1,000–99,999	8, 13
RI	1	1,000–9,999	2, 3, 8
TN	3	1,000–999,999	1, 3, 4, 8, 12
TX	4	1,000–999,999	8, 10, 13
UT	1	10,000–99,999	13
VA	2	1,000–999,999	8
WA	2	1,000–99,999	10, 11, 13
WI	2	1,000–9,999	8, 10

Source: TRI99 2001

<sup>a</sup>Post office state abbreviations used

<sup>b</sup>Range represents maximum amounts on site reported by facilities in each state

<sup>c</sup>Activities/Uses:

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