

## 5. POTENTIAL FOR HUMAN EXPOSURE

### 5.1 OVERVIEW

Di-*n*-octylphthalate is released mainly to the atmosphere and to some extent to surface waters in industrial effluents (TRI92 1994). The compound may be released to soils in the disposal of plastics wastes. Di-*n*-octylphthalate is expected to partition mainly to soils and sediment upon release to the environment (EPA 1979, 1992c). The compound is also bioconcentrated by aquatic organisms, although biomagnification in aquatic food chains is not expected to be significant (EPA 1992d). Aerobic biodegradation is the most important transformation process in soils and surface waters (EPA 1992a, 1992c). Other transformation processes include photooxidation in the atmosphere and photolysis in surface waters (EPA 1992a). As a result of confusion with its branched isomer, di(2-ethylhexyl)phthalate, limited unambiguous monitoring data are available for di-*n*-octylphthalate. The compound has been detected in ambient air, rain, runoff, groundwater, surface water, and sediment.

Human exposure to the compound is expected to occur primarily in workplace settings (HSDB 1995). General population exposure pathways include inhalation of the volatilized plasticizer, ingestion of foods contaminated as a result of leaching of di-*n*-octylphthalate from plastic containers, ingestion of aquatic organisms that have bioconcentrated the compound, and ingestion of contaminated drinking water (EPA 1992c). Populations living near hazardous waste sites contaminated with di-*n*-octylphthalate may also be exposed through dermal contact with and ingestion of contaminated groundwater and sediments (ATSDR 1988, 1989b, 1989c). Populations with potentially high exposures to di-*n*-octylphthalate include workers in the chemical manufacturing and plastics manufacturing and processing industries, individuals requiring routine medical care, such as blood transfusions and kidney dialysis treatments, and individuals living in the vicinity of industrial manufacturing and processing facilities that may manufacture or use di-*n*-octylphthalate or of hazardous waste sites containing di-*n*-octylphthalate or plastics (HSDB 1995).

Di-*n*-octylphthalate has been identified in at least 300 of the 1,416 hazardous waste sites on the EPA National Priorities List (NPL) (HazDat 1995). However, the number of sites evaluated for di-*n*-octylphthalate is not known. The frequency of these sites within the United States can be seen in

Figure 5-1. Of these sites, 298 are located in the United States and 2 are located in the Commonwealth of Puerto Rico (not shown).

## 5.2 RELEASES TO THE ENVIRONMENT

Considerable confusion exists in the literature about the TRI release reporting data and monitoring data available for di-*n*-octylphthalate and its more common branched isomer, di(2-ethylhexyl)phthalate (EPA 1992a; Vista Chemical 1992). The confusion exists because the terms “dioctyl phthalate” and “DOP” are often used as synonyms for di(2-ethylhexyl)phthalate, which is the largest volume plasticizer used in PVC. Consequently, some of the historical release and monitoring data reported in the literature as “dioctyl phthalate” and “DOP” refer to the more common branched isomer rather than di-*n*-octylphthalate. Therefore, releases of di-*n*-octylphthalate and concentrations of the compound in ambient media may actually be lower than historical data suggest. Di-*n*-octylphthalate was withdrawn from the TRI effective in 1993 (EPA 1995h). Thus, the data for TRI92 (1994) is the most recent data that is available from the Toxic Release Inventory for di-*n*-octylphthalate.

### 5.2.1 Air

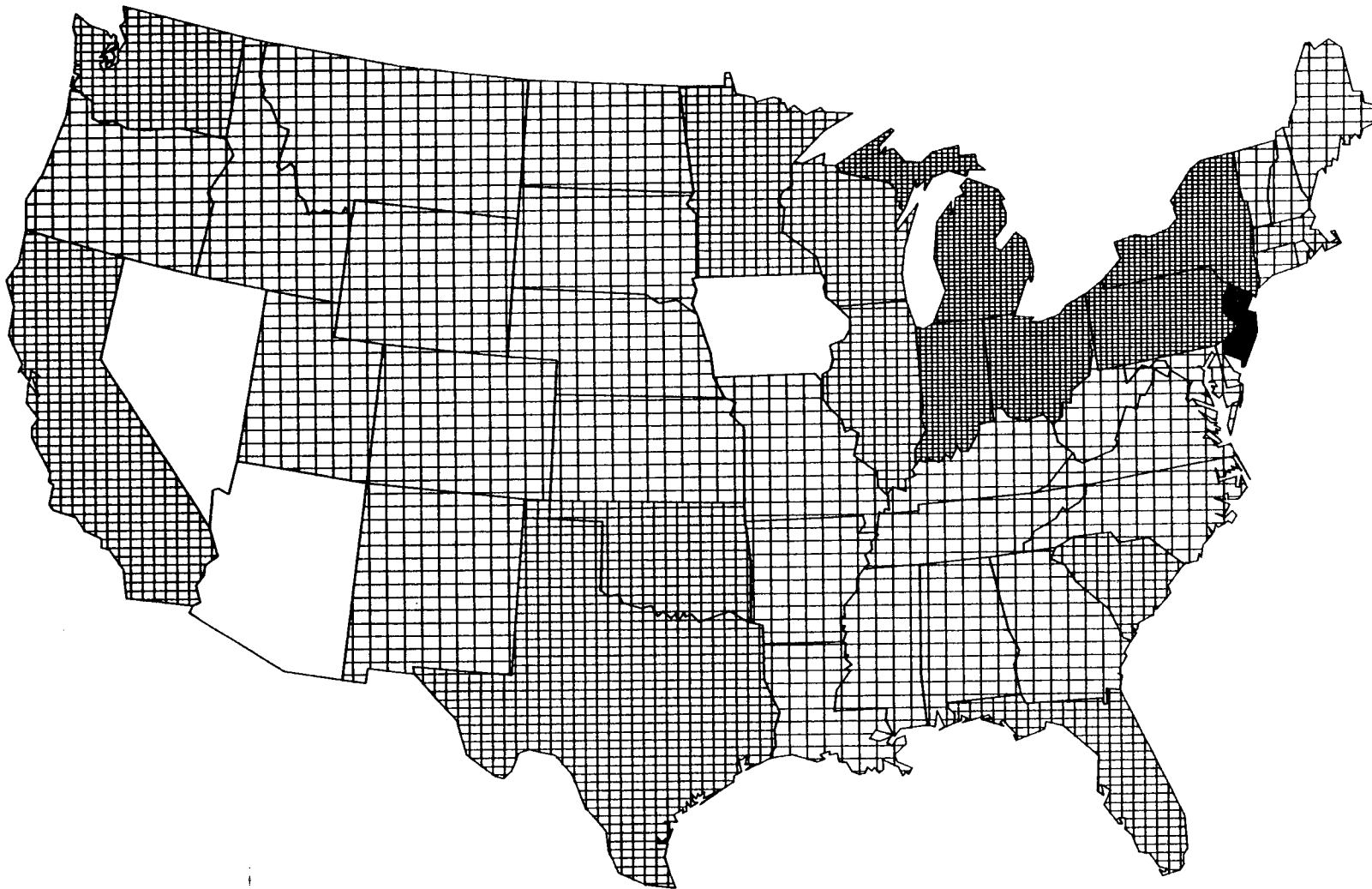
Di-*n*-octylphthalate may be released to the atmosphere through volatilization of the compound from plastics, as a result of manufacturing processes, and through incineration (Vista Chemical 1992).

According to TR192 (1994), an estimated total of 15,011 pounds of di-*n*-octylphthalate, amounting to about 98% of the total environmental release, were discharged to the atmosphere from manufacturing and processing facilities in the United States in 1992 (see Table 5-1). The TRI data listed in Table 5-1 should be used with caution since only certain types of facilities are required to report. This is not an exhaustive list. Furthermore, as noted above, the precise chemical identity of the reported releases is questionable.

### 5.2.2 Water

Di-*n*-octylphthalate is released to surface waters in industrial waste waters from production and use processes and as a result of spills during its transport, storage, and use (Mathur 1974a). For example, di-*n*-octylphthalate was found in one of five industrial process waste waters sampled at an average

FIGURE 5-1. FREQUENCY OF NPL SITES WITH DI-N-OCTYL PHTHALATE CONTAMINATION \*



FREQUENCY



1 TO 5 SITES  
15 TO 30 SITES



6 TO 13 SITES  
34 SITES

\*Derived from HazDat 1995

Table 5-1. Releases to the Environment from Facilities That Manufacture or Process Di-n-octylphthalate

State <sup>a</sup>	City	Facility	Reported amounts released in pounds per year							
			Air	Water	Land	Underground injection	Total environment <sup>b</sup>	POTW transfer	Off-site waste transfer	
AL	NA	NA	250					250		
AR	NA	HALSTEAD IND. INC.								
CA	NA	GILLETTE CO.								195
GA	NA	NA	10		250			260	250	250
IL	NA	NA	1,500					1,500		2
IL	NA	NA								
IL	NA	NEW EXTRUSTIONS & FABRICATING								
IL	NA	EASTERN INDUSTRIES	11					11		
IL	NA	DOW CHEMICAL CO.	206					206		
IN	NA	BRC RUBBER GROUP INC.								
KY	NA	ATOCHEM N.A. INC.	30					30		
MA	NA	VISTA CHEMICAL CO.	3,110	5				3,115		260
MA	NA	LEVITON MFG.								32,844
MA	NA	BRADFORD IND. INC.	23					23		80
MA	NA	NA	635					635		2,731
MA	NA	O'SULLIVAN CORP.	500					500		1
MI	NA	AMERICAN CYANAMID CO.	255					255	250	
MI	NA	GENERAL CABLE IND. INC.								7,307
MO	NA	NA								
MO	NA	GOODYEAR TIRE & RUBBER CO.	500					500	5	
MS	NA	VISTA CHEMICAL CO.		30				30		13,895
NC	NA	HALSTEAD IND. INC.								

**Table 5-1. Releases to the Environment from Facilities That Manufacture or Process Di-n-octylphthalate (continued)**

State <sup>a</sup>	City	Facility	Reported amounts released in pounds per year							
			Air	Water	Land	Underground injection	Total environment <sup>b</sup>	POTW transfer	Off-site waste transfer	
NC	NA	NA								
NC	NA	UNIROYAL CHEMICAL CO. INC.	500				500			250
NC	NA	KONICA CORP.							250	5,500
NC	NA	HBD INDUSTRIES INC.							250	5
NJ	NA	PLASTICS SPECIALTIES & TECHNOL								88
NJ	NA	OCCIDENTAL PETROLEUM CORP.								16
NJ	NA	PLASTIC SPECIALTIES & TECHNOLO								
NJ	NA	NA	140				140			
NJ	NA	NA								
NV	NA	PLASTICS SPECIALTIES & TECHNOL								
NY	NA	HM HOLDINGS INC.	94				94			6,900
NY	NA	NA								9,869
OH	NA	GOODYEAR TIRE & RUBBER CO.								
OH	NA	COOKSON AMERICA	500				500	5		1,741
OH	NA	BORDEN INC.	3,300				3,300			35,260
OH	NA	NA								53
OH	NA	A. SCHULMAN INC.	1,700				1,700	5		10,700
OH	NA	NA	91				91			
PA	NA	ACC MIDDLE CORP.	392				392	460		170
PA	NA	NA	250				250			
TN	NA	NA	5				5			

**Table 5-1. Releases to the Environment from Facilities That Manufacture or Process Di-n-octylphthalate (continued)**

State <sup>a</sup>	City	Facility	Reported amounts released in pounds per year						
			Air	Water	Land	Underground injection	Total environment <sup>b</sup>	POTW transfer	Off-site waste transfer
TN	NA	NA	5	5			10		
TN	NA	GMC							12,699
TN	NA	NA							12,061
TX	NA	TEXAS IND. INC.							2,597
TX	NA	TANDY CORP.							
TX	NA	AMERON INC.	140				140		
UT	NA	NA							
VA	NA	NA	500				500		
VA	NA	NA	255				255		13,659
WI	NA	UNIROYAL TECH. CORP.	103				103		70,001
WI	NA	NA	5				5		
WV	NA	NA	1	1			2		
<b>Totals</b>			<b>15,011</b>	<b>41</b>	<b>250</b>		<b>15,302</b>	<b>1,475</b>	<b>239,134</b>

Source: TRI92 1994

<sup>a</sup> Post office state abbreviations used<sup>b</sup> The sum of all releases of the chemical to air, land, water, and underground injection wells by a given facility

NA = not available; POTW = publicly owned treatment works

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concentration of 3,700 µg/L (EPA 1981). Releases to surface waters are expected to undergo secondary treatment at publicly owned treatment works or at on-site National Pollutant Discharge Elimination System (NPDES) permitted facilities. Such waste-water treatment systems are expected to remove 80-90% of the influent di-*n*-octylphthalate through a combination of adsorption and aerobic biodegradation by acclimated microorganisms (EPA 1992c Petrasek et al. 1983). The compound is also released to surface waters from nonpoint sources, such as surface runoff. For example, di-*n*-octylphthalate was found in runoff samples collected in 1982 from Little Rock, Arkansas, Bellevue, Washington, and Eugene, Oregon, at a 4% frequency of detection in the collected samples and at concentrations of 0.4-1 µg/L. This sampling was conducted as part of the Nationwide Urban Runoff Program (Cole et al. 1984).

According to TR192 (1994), an estimated total of 41 pounds of di-*n*-octylphthalate were discharged to surface waters from manufacturing and processing facilities in the United States in 1992 (see Table 5-1). An estimated total additional 1,475 pounds were transferred to publicly owned treatment works. The TRI data listed in Table 5-1 should be used with caution since only certain types of facilities are required to report. This is not an exhaustive list. Furthermore, as noted above, the precise chemical identity of the reported releases is questionable.

**5.2.3 Soil**

According to TR192 (1994), an estimated total of 250 pounds of di-*n*-octylphthalate, amounting to about 2% of the total environmental release, was discharged to soils from manufacturing and processing facilities in the United States in 1992 (see Table 5-1). An estimated total additional 239,134 pounds were transferred to off-site waste treatment, storage, and disposal facilities. The TRI data listed in Table 5-1 should be used with caution since only certain types of facilities are required to report. This is not an exhaustive list. Furthermore, as noted above, the precise chemical identity of the reported releases is questionable.

## 5.3 ENVIRONMENTAL FATE

### 5.3.1 Transport and Partitioning

Upon release to surface waters, di-*n*-octylphthalate is expected to partition mainly to sediments and to suspended particulates. In a pilot-scale waste-water treatment system, di-*n*-octylphthalate partitioned mainly to primary treatment sludge (Petrasek et al. 1983). The compound strongly adsorbs to organic matter contained in soils and sediments; adsorption is probably the most important transport process for the compound in surface waters (EPA 1979, 1992c). Volatilization from surface waters is expected to be a slow and unimportant process. For example, the estimated volatilization half-life from a model river 1 meter deep with a current of 1 meter/second and a wind speed of 3 meters/second is 13 days (HSDB 1995). In a pilot-scale study of a typical waste-water treatment plant employing both primary and secondary activated sludge treatment processes, no di-*n*-octylphthalate was lost from the system by air stripping (Petrasek et al. 1983). However, in a study simulating the behavior of di-*n*-octylphthalate in different aquatic systems, volatilization was estimated to account for up to 20% of the losses of the compound from certain standing surface water systems characterized by long water detention times (e.g., ponds, lakes), especially in relatively pristine lakes where loss by biodegradation is not likely to be important (Wolfe et al. 1980). This same study suggests that in running surface waters, such as rivers, di-*n*-octylphthalate is most likely to be lost by transport out of the system.

Di-*n*-octylphthalate also strongly adsorbs to soils and does not undergo leaching to groundwater, as indicated by its estimated soil organic carbon/water partition coefficient ( $K_{oc}$ ) of about 19,000. Volatilization from soils is not expected to be significant (HSDB 1994; Vista Chemical 1992).

Di-*n*-octylphthalate released to the atmosphere may partition to soils and surface waters through wet (Ligocki et al. 1985) and dry (Vista Chemical 1992) deposition processes.

Di-*n*-octylphthalate is bioconcentrated by aquatic organisms (EPA 1992d). In a 33-day combined terrestrial-aquatic model ecosystem study, the following di-*n*-octylphthalate bioconcentration factors (BCFs) were reported: (1) algae - 28,500; (2) daphnids - 2,600; (3) fish and mosquitoes - 9,400; and (4) snails - 13,600. However, the half-life for the disappearance of di-*n*-octylphthalate from this model system was estimated to be about 5 days as the result of metabolism of the compound. An EPA (1992d) hazard assessment stated that although di-*n*-octylphthalate does bioconcentrate in aquatic



organisms, the compound is not expected to biomagnify in aquatic food chains; however, this citation did not contain, and does not reference any studies that provide, a basis for this conclusion. In greenhouse studies using radiolabeled di-*n*-octylphthalate added to soils, the compound was not bioconcentrated by crop plants (BCF <1) (EPA 1986e). In a more recent screening study that examined the potential of contaminants contained in sewage sludge to transfer into agricultural products on the basis of their physical/chemical properties, di-*n*-octylphthalate was judged to have a high potential to adsorb to soil, sludge solids, and plant root surfaces, and a low potential for leaching, uptake and translocation by plants, and transfer to animal tissues by foliage ingestion (Wild and Jones 1992).

### **5.3.2 Transformation and Degradation**

#### **5.3.2.1 Air**

The most important transformation process for di-*n*-octylphthalate present in the atmosphere as an aerosol is reaction with photochemically produced hydroxyl radicals. The half-life for this reaction has been estimated to be 4.5-44.8 hours (Howard et al. 1991). Actual atmospheric half-lives may be longer since phthalate esters sorbed to wind-entrained particulates may have long atmospheric residence times (Vista Chemical 1992). Direct photolysis in the atmosphere is not expected to be an important process (EPA 1993a; HSDB 1995).

#### **5.3.2.2 Water**

Phthalate esters undergo a step-wise alkaline hydrolysis to monoesters and then to dicarboxylic acids. As a result of the relatively slow rates of this reaction at pH 6-9 and the low water solubility of di-*n*-octylphthalate, chemical hydrolysis of the compound is not an environmentally important transformation process (EPA 1992a). Hydrolytic half-lives at 25°C and pH 7 and 9 have been estimated to be 107 and 7 years, respectively (Howard et al. 1991).

Biodegradation is the primary process by which phthalate esters are removed from surface waters; rates are strongly dependent on acclimation of microbial communities (EPA 1992a, 1992~). Wolfe et al. (1980) predicted that biodegradation would be the most important mechanism by which di-*n*-octylphthalate would be removed from eutrophic lakes. In static culture flask biodegradation screening

tests, about 93-94% of di-*n*-octylphthalate was metabolized after 3 weeks only after serial subculturing of acclimated microorganisms (Tabak et al. 1981). Enzymatic hydrolysis is the mechanism used by microbes in the aerobic biotransformation of di-*n*-octylphthalate. The ester is hydrolyzed to soluble intermediates, presumably via a pathway producing a phthalic acid monoester (EPA 1993a); however, data on the identity of biodegradation products were not available. Aerobic biodegradation half-lives range from 1 to 4 weeks in surface waters and from 2 weeks to 1 year in groundwater (Howard et al. 1991). Biodegradation under anaerobic conditions occurs at a slower rate (EPA 1993a); it has been predicted that di-*n*-octylphthalate will accumulate in natural sediments because it is persistent under anaerobic conditions (EPA 1992d). For example, in anaerobic digester studies using diluted and undiluted sewage treatment plant sludge, between 40% and 75% of di-*n*-octylphthalate remained undegraded after a 10-week incubation period (Shelton et al. 1984). Anaerobic half-lives for aquatic systems have been predicted to range from 6 months to 1 year (Howard et al. 1991).

Di-*n*-octylphthalate may also undergo photolysis in surface waters as a result of its absorption of electromagnetic radiation at wavelengths less than 290 nm. The estimated photolytic half-life of the compound in surface water is 144 days (EPA 1992a). Photolysis was predicted to be the most important removal mechanism after volatilization for di-*n*-octylphthalate losses from oligotrophic lakes (Wolfe et al. 1980).

### **5.3.2.3 Sediment and Soil**

As discussed above, aerobic biotransformation is expected to be the most important process in the removal of di-*n*-octylphthalate from soils; anaerobic biodegradation occurs in sediments (EPA 1992a). However, because of its persistence under anaerobic conditions, di-*n*-octylphthalate is expected to accumulate in sediments (EPA 1992d). Di-*n*-octylphthalate has been reported to undergo biodegradation by a variety of acclimated soil microorganisms (HSDB 1995; Mathur 1974b); however, data on the identity of biodegradation products were not located.

## **5.4 LEVELS MONITORED OR ESTIMATED IN THE ENVIRONMENT**

As previously discussed, considerable confusion exists in the literature about the monitoring data available for di-*n*-octylphthalate and di(2-ethylhexyl)phthalate. Only monitoring data that clearly

concerned di-*n*-octylphthalate were included in this section of the profile; data from ambiguous studies were not included.

#### 5.4.1 Air

Di-*n*-octylphthalate was detected in five of seven ambient air and six of seven rainwater samples collected during rain events that occurred in February through April 1984 in Portland, Oregon. Di-*n*-octylphthalate concentrations ranged from 2.6 to 20 ng/L in rain samples and from 0.06 to 0.94 ng/m<sup>3</sup> in air samples (Ligocki et al 1985).

#### 5.4.2 Water

Di-*n*-octylphthalate was detected in 4% of the urban runoff samples collected from a total of 15 cities. Di-*n*-octylphthalate was detected at three cities at concentrations of 0.4-1 µg/L (Cole et al. 1984). The compound was found in water samples collected at four locations along the entire length of the Mississippi River at concentrations of 24-310 ng/L (DeLeon et al. 1986). At the Butler Mine Tunnel NPL Site located in Pittston, Pennsylvania, di-*n*-octylphthalate was detected in on-site oil/groundwater samples at concentrations of 110-792,000 ppb (ATSDR 1989b). Di-*n*-octylphthalate was detected at a concentration of 1 ppb in a water sample collected from the discharge pond of a phthalate ester plant located on the Chester River in Maryland (Peterson and Freeman 1984). Di-*n*-octylphthalate was found at 0.001-0.02 ppm in water samples taken from a river that received industrial waste water from a specialty chemical manufacturing plant (Jungclaus et al. 1978).

Estimates of di-*n*-octylphthalate concentrations in receiving waters located downstream from two plants reporting releases of the compound to the TRI have been developed by EPA (1992c). Mean flow concentrations of about 3-9 µg/L and 7-year Q10 low-flow concentrations of about 90-390 µg/L were estimated for the surface waters receiving effluent from the on-site treatment facility used at one plant and the publicly owned treatment facility that handles the effluent from the other plant.

Concentrations of di-*n*-octylphthalate in drinking water utility influents have been estimated to be less than 0.5 ppb (EPA 1992c).

### 5.4.3 Sediment and Soil

In the sediment of a discharge pond of a phthalate ester plant located on the Chester River in Maryland, di-*n*-octylphthalate was detected at a concentration of 12,000 ppb. In sediment samples from the Chester River taken 2 km and 8 km downstream from the plant, the compound was found at concentrations of 62 and <5 ppb, respectively (Peterson and Freeman 1984). In the sediment of a river that received industrial waste water from a specialty chemical manufacturing plant, di-*n*-octylphthalate was detected at concentrations ranging from 1.5 to 25 ppm (Junglaus et al. 1978). At the Dixie Caverns Landfill NPL site located in Salem, Virginia, di-*n*-octylphthalate was detected on-site at a concentration of 80 ppm (ATSDR 1988); however, the media in which this concentration was detected was not specified. Off-site sediment samples collected at the Revere Chemical Company NPL site located in Revere, Pennsylvania, were found to contain 2,300 ppb di-*n*-octylphthalate (ATSDR 1989c).

EPA (1992c) developed estimates of di-*n*-octylphthalate concentrations in the sediments of surface waters located downstream from two plants reporting releases of the compound to the TRI. The surface waters received effluents from an on-site treatment facility and a publicly owned treatment facility. Steady-state sediment concentrations were estimated to exceed 10 mg/kg and possibly >50 mg/kg downstream from the two facilities.

### 5.4.4 Other Environmental Media

Di-*n*-octylphthalate is produced as a decomposition product of the pesticide dinocap (HSDB 1995).

## 5.5 GENERAL POPULATION AND OCCUPATIONAL EXPOSURE

Humans are expected to be exposed to di-*n*-octylphthalate mainly in the workplace (HSDB 1994). The National Occupational Exposure Survey (NOES), conducted between 1981 and 1983; estimated that 10,393 workers (including 1,434 women) in 1,177 facilities were exposed to di-*n*-octylphthalate in the workplace in 1980 (NIOSH 1993).

Exposure of the general population to di-*n*-octylphthalate may occur through ingestion of foods contaminated by leaching of the compound from plastic containers, transfusions of blood or other

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fluids through medical tubing, ingestion of aquatic organisms that have bioconcentrated the compound, and consumption of contaminated drinking water (EPA 1992c; HSDB 1995). An additional potential source of human exposure is contact with contaminated media at hazardous waste sites. For example, di-*n*-octylphthalate has been detected in on-site sediment and groundwater samples and off-site sediment samples collected at NPL hazardous waste sites. The human exposure pathways of concern at these sites include ingestion of contaminated groundwater and sediment (ATSDR 1988, 1989b, 1989c). Since data are not available on the dermal absorption of di-*n*-octylphthalate, it is not known whether dermal contact with di-*n*-octylphthalate at hazardous waste sites would represent an exposure pathway of concern.

In an early report of the 1982 annual results of the National Human Adipose Tissue Survey (NHATS), a compound identified as di-*n*-octylphthalate was reportedly detected in 31% of the composite human adipose tissue samples taken in the various regions of the United States that year. Concentrations in lipid ranged from below the level of detection (9 ng/sample) to a maximum of 850 ng/g (EPA 1986d). However, a later report of the 1982 results stated that the chemical detected was not di-*n*-octylphthalate, but was actually diethylhexyl phthalate (EPA 1989b).

### 5.6 POPULATIONS WITH POTENTIALLY HIGH EXPOSURES

Patients receiving regular dialysis on a kidney machine or receiving blood transfusions may be the populations with the highest potential exposure to di-*n*-octylphthalate. Workers in industries that produce or use plastics, especially materials processed at high temperatures, are also expected to have potentially high exposure to di-*n*-octylphthalate especially via inhalation of the volatilized plasticizer. Members of the general population living in the vicinity of industrial facilities that manufacture or process the compound or plastic materials containing the compound, as well as individuals living near hazardous waste sites known to be contaminated with di-*n*-octylphthalate, are also expected to have potentially high exposures through contact with contaminated environmental media (HSDB 1995).

### 5.7 ADEQUACY OF THE DATABASE

Section 104(i)(5) of CERCLA, as amended, directs the Administrator of ATSDR (in consultation with the Administrator of EPA and agencies and programs of the Public Health Service) to assess whether adequate information on the health effects of di-*n*-octylphthalate is available. Where adequate

information is not available, ATSDR, in conjunction with the NTP, is required to assure the initiation of a program of research designed to determine the health effects (and techniques for developing methods to determine such health effects) of di-*n*-octylphthalate.

The following categories of possible data needs have been identified by a joint team of scientists from ATSDR, NTP, and EPA. They are defined as substance-specific informational needs that if met would reduce the uncertainties of human health assessment. This definition should not be interpreted to mean that all data needs discussed in this section must be filled. In the future, the identified data needs will be evaluated and prioritized, and a substance-specific research agenda will be proposed.

### 5.7.1 Identification of Data Needs

**Physical and Chemical Properties.** The physical and chemical properties of di-*n*-octylphthalate are sufficiently well defined to allow assessments of the environmental fate of the compound to be made. Therefore, no additional information is needed at this time.

**Production, Import/Export, Use, Release, and Disposal.** Because of the general confusion in the literature about the nomenclature for octylphthalate esters, historical information about the production and import/export of di-*n*-octylphthalate is not readily available. These values generally must be estimated as a percentage of di(2-ethylhexyl)phthalate production or import/export. The compound is used principally as a plasticizer additive to plastics and PVC resins. It is also used as a dye carrier in plastics production and as a chemical intermediate (EPA 1993a; HSDB 1995; Mannsville Chemical Products Corporation 1989; Sittig 1991). Limited information is available about releases of di-*n*-octylphthalate to environmental media. Even the TRI data, which comprise the most current information available, contain errors as a result of the nomenclature confusion (EPA 1993a; Vista Chemical 1992). Data are available about the disposal and regulatory status of the compound (see Chapters 4 and 7). More information on the production and releases of di-*n*-octylphthalate is needed to estimate potential exposure to the compound.

According to the Emergency Planning and Community Right-to-Know Act of 1986, 42 U.S.C. Section 11023, industries are required to submit substance release and off-site transfer information to the EPA. The Toxics Release Inventory (TRI), which contains this information for 1993, became available in May of 1995. This database will be updated yearly and should provide a list of industrial production

facilities and emissions. However, di-*n*-octylphthalate was withdrawn from the TRI effective in 1993 (EPA 1995h).

**Environmental Fate.** Di-*n*-octylphthalate partitions primarily to soils and sediment upon release to the environment. The compound is expected to be strongly sorbed to soil and sediment particulates; therefore, it should have limited mobility (EPA 1979, 1992c). Biodegradation half-lives of 1-4 weeks have been estimated for aerobic surface waters and soils. Biodegradation also takes place in sediments; half-lives under anaerobic conditions have been estimated to range from 6 months to 1 year (Howard et al. 1991). The compound may also undergo photolysis in surface waters (estimated half-life of 144 days) and photooxidation in the atmosphere (estimated half-life of about 5-45 hours) (Howard et al. 1991). Di-*n*-octylphthalate may persist in sediments as a result of its limited rate of biotransformation and preferential partitioning to this medium.

However, although degradation is known to occur under both aerobic and anaerobic conditions, data are not available on the identity of degradation products. Because the limited studies on the mechanisms of injury from di-*n*-octylphthalate suggest that mono-*n*-octylphthalate is the proximate toxicant, it is important to know whether the reduction of di-*n*-octylphthalate is coupled with the accumulation of mono-*n*-octylphthalate. The environmental fate of di-*n*-octylphthalate and its metabolites is not sufficiently understood to allow assessments of its exposure potential to be made. Additional data are needed on the identity and fate of degradation products of di-*n*-octylphthalate. No additional information is needed about the transport and partitioning of the compound at this time.

**Bioavailability from Environmental Media.** No information was found regarding the absorption of di-*n*-octylphthalate by humans or laboratory animals following inhalation or dermal exposures. No information is available about absorption following oral exposure in humans. However, indirect evidence from animal studies suggests that the compound is readily absorbed by this route (Albro and Moore 1974; Oishi 1990). Additional information is needed on the absorption of di-*n*-octylphthalate as a result of inhalation of contaminated air, ingestion of contaminated food and water, and dermal contact with contaminated soils and sediments.

**Food Chain Bioaccumulation.** Di-*n*-octylphthalate bioconcentrates in aquatic organisms. However, as a result of metabolism of the compound, biomagnification in aquatic food chains does not occur (EPA 1992d). It appears that the compound is not bioconcentrated by terrestrial plants or animals or biomagnified in terrestrial food chains (EPA 1986e; Wild and Jones 1992). However, the Wild and Jones (1992) study is limited to mathematical modeling results. Thus, only limited data are available regarding the bioaccumulation and biomagnification of di-*n*-octylphthalate, and the potential for human exposure resulting from the bioaccumulation of the compound is not well understood. Therefore, additional data are needed to validate the Wild and Jones (1992) model. Also, an estimation of animal uptake from soil ingestion is needed to support this study.

**Exposure Levels in Environmental Media.** Reliable monitoring data for the levels of di-*n*-octylphthalate in contaminated media at hazardous waste sites are needed so that the information obtained on levels of di-*n*-octylphthalate in the environment can be used in combination with the known body burden of di-*n*-octylphthalate to assess the potential risk of adverse health effects in populations living in the vicinity of hazardous waste sites. Di-*n*-octylphthalate has been detected in ambient air, rain, surface water, groundwater, and sediment. However, as a result of the confusion about the nomenclature for octylphthalate esters, much of the historical monitoring data available actually pertain to the branched isomer, di(2-ethylhexyl)phthalate (Vista Chemical 1992). Therefore, little current information specific to the *n*-octyl isomer is available regarding concentrations of the compound in foods, drinking water, and environmental media, particularly with respect to media at hazardous waste sites. The lack of monitoring data precludes the estimation of human exposure via intake of or contact with contaminated media.

**Exposure Levels in Humans.** This information is necessary for assessing the need to conduct health studies on these populations. Di-*n*-octylphthalate has historically been reported to have been found in human adipose tissue (EPA 1986d). However, more recent information indicates that the compound detected was actually the branched di(Zethylhexyl) isomer (EPA 1989b). Additional information on the concentrations of di-*n*-octylphthalate in human tissues and fluids, particularly for populations living near hazardous waste sites, is needed to assess potential human exposure to the compound.



**Exposure Registries.** No exposure registries for di-*n*-octylphthalate were located. This substance is not currently one of the compounds for which a subregistry has been established in the National Exposure Registry. The substance will be considered in the future when chemical selection is made for subregistries to be established. The information that is amassed in the National Exposure Registry facilitates the epidemiological research needed to assess adverse health outcomes that may be related to exposure to this substance.

### 5.7.2 On-going Studies

No information was found in the available literature concerning on-going studies dealing with the environmental fate or human exposure potential of di-*n*-octylphthalate.

