1. PUBLIC HEALTH STATEMENT

This public health statement tells you about dichlorobenzenes (DCBs) and the effects of exposure to them.

The Environmental Protection Agency (EPA) identifies the most serious hazardous waste sites in the nation. EPA then places these sites are on the National Priorities List (NPL) and targets them for federal long-term cleanup activities. 1,2-DCB, 1,3-DCB, and 1,4-DCB have been identified in at least 280, 176, and 331, respectively, of the 1,647 current or former NPL sites. Although the total number of NPL sites evaluated for these substances is not known, the number of sites at which DCBs are found could increase as more sites are evaluated. This information is important because these sites may be sources of exposure, and exposure to these substances might harm you.

When a substance is released either from a large area, such as an industrial plant, or from a container, such as a drum or bottle, it enters the environment. Such a release does not always lead to exposure. You can be exposed to a substance only when you contact it—by breathing, eating, or drinking the substance or by skin contact.

Many factors will determine whether exposure to DCBs will harm you. These factors include the dose (how much), the duration (how long), and the way you contact them. You also must consider any other chemicals to which you are exposed and your age, sex, diet, family traits, lifestyle, and state of health.

1.1 WHAT ARE DICHLOROBENZENES?

Each of the three types of DCBs (i.e., 1,2-DCB, 1,3-DCB, and 1,4-DCB) contains two chlorine atoms connected to one benzene molecule. 1,2-DCB is a colorless to pale yellow liquid used to make herbicides. 1,3-DCB is a colorless liquid used to make herbicides, insecticides, medicine, and dyes. 1,4-DCB, the most important of the three chemicals, is a colorless to white solid. It

smells like mothballs and it is one of two chemicals commonly used to make mothballs. 1,4-DCB also is used to make deodorant blocks used in garbage cans and restrooms, and to help control odors in animal-holding facilities. 1,4-DCB has been used as an insecticide on fruit and as an agent to control mold and mildew growth on tobacco seeds, leather, and some fabrics. Recently, using 1,4-DCB to make resins has become very important.

When a package of 1,4-DCB is opened, it 'sublimates', that is, it slowly changes from a solid into a vapor, and enters the atmosphere. The vapor acts as a deodorizer and insect killer. Most of the 1,2-, 1,3-, and 1,4-DCB released into the environment is present as a vapor. DCBs can burn, but they do not burn easily. Most people begin to smell 1,4-DCB when it is in the air at a concentration of 0.18 parts per million (ppm) and 0.011 ppm in water.

DCBs do not occur naturally; chemical companies produce them to make products for home use and other chemicals such as herbicides and plastics. More information about the properties and uses of 1,2-, 1,3-, and 1,4-DCB is provided in Chapters 4 and 5.

1.2 WHAT HAPPENS TO DICHLOROBENZENES WHEN THEY ENTER THE ENVIRONMENT?

Most of the 1,4-DCB enters the environment when it is used in mothballs and in toilet-deodorizer blocks. Some 1,4-DCB is released to the air by factories that make or use it, and only a little is released to soil and water. Very little 1,4-DCB enters the environment from hazardous waste sites. Some 1,2- and 1,3-DCBs are released into the environment when used to make herbicides and when people use products that contain these chemicals. Companies that make 1,4-DCB also make unwanted amounts of 1,2-DCB during the process. 1,2-DCB is released to the environment when companies dispose of these unwanted supplies.

Because DCBs do not dissolve easily in water, the small amounts that enter water quickly evaporate into the air. If they are released to groundwater, they may be transported through the ground to surface water. Sometimes, DCBs bind to soil and sediment. DCBs in soil usually are

not easily broken down by soil organisms. Evidence suggests that plants and fish absorb DCBs. 1,4-DCB has been detected at concentrations of up to 470 parts per billion (ppb) in fish.

More information about DCBs in the environment is provided in Chapters 5 and 6.

1.3 HOW MIGHT I BE EXPOSED TO DICHLOROBENZENES?

Humans are exposed to 1,4-DCB mainly by breathing vapors from 1,4-DCB products used in the home, such as mothballs and toilet-deodorizer blocks. Reported levels of 1,4-DCB in some homes and public restrooms have ranged from 0.291 to 272 parts of 1,4-DCB per billion parts (ppb) of air. 1,2- and 1,3-DCB are not found frequently in the air of homes and buildings because, unlike 1,4-DCB, these chemicals are not used in household products. Outdoor levels of 1,4-DCB range from 0.01 to 1 ppb and are much lower than levels in homes and buildings. Levels in the air around hazardous waste sites are low and range from 0.01 to 4.2 ppb. Outdoor air levels generally range from 0.01 to 0.1 ppb for 1,2-DCB and from 0.001 to 0.1 ppb for 1,3-DCB.

DCBs have been found in samples of drinking water from surface water sources. 1,4-DCB was found in 13% of surface water samples collected during a national survey. These samples contained about 0.008–154 ppb of 1,4-DCB. DCBs also have been found in drinking water from wells but at low concentrations. DCBs are found only infrequently in soil, but they have been detected in soil around hazardous waste sites in the United States.

DCBs have been detected in beef, pork, chicken, eggs, baked goods, soft drinks, butter, peanut butter, fruits, vegetables, and fish. However, the levels of DCBs in foods are generally low.

The average daily adult exposure of 1,4-DCB is about 35 micrograms (µg), which comes mainly from breathing 1,4-DCB vapors of released from products in homes and businesses. The average daily adult respiratory exposure of the other DCBs is about 1.8 µg for 1,2-DCB and about 0.8 µg for 1,3-DCB.

Individuals can be occupationally exposed to DCBs in workplace air at much higher levels than the general public is exposed. Levels measured in the air of factories that make or process 1,4-DCB products have ranged from 5.6 to 748 ppm of air. In addition, people who live or work near industrial facilities or hazardous waste sites that have high DCBs levels may have greater exposure to these compounds due to emissions from the facilities and waste sites. People who work or live in buildings where air fresheners, toilet block deodorants, or moth balls containing 1,4-DCB are used also are expected to have a higher exposure to this compound, which could occur from skin contact as well as by breathing.

More information on how you could be exposed to DCBs is given in Chapter 6.

1.4 HOW CAN DICHLOROBENZENES ENTER AND LEAVE MY BODY?

The main way DCBs enter your body is through the lungs when you breathe in DCB vapors released in the workplace or in the home from use of products that contain it. When you breathe in these chemicals for a few hours, it is likely that some of the DCBs that have entered your body will get into your bloodstream.

DCBs also can get into your body if you drink water or eat certain foods that contain them, such as meat, chicken, eggs, or fish. Most of the DCBs that enter your body from food and water will get into your bloodstream. It is not likely that DBCs will enter your body through the skin if you touch products that contain them.

1,4-DCB used in the home could be accidentally swallowed, especially by young children. This possibility exists because household products that contain 1,4-DCB, particularly some kinds of mothballs and deodorant blocks, might be freely available in closets or bathrooms.

Most of the DCB that enters your body (perhaps more than 95%) leaves through the urine in less than a week. Small amounts (perhaps 1–2%) leave your body in the feces and in the air you breathe out. Tiny amounts remain in your fat and might stay there for a long time.

Most of the DCBs that enter your body are changed into other chemicals, mainly dichlorophenols. It is not known if these breakdown products are more or less harmful than the DCBs themselves.

More information about how DCBs enter and leave the body is found in Chapter 3.

1.5 HOW CAN DICHLOROBENZENES AFFECT MY HEALTH?

Scientists use many tests to protect the public from harmful effects of toxic chemicals and to find ways for treating persons who have been harmed.

One way to learn whether a chemical will harm people is to determine how the body absorbs, uses, and releases the chemical. For some chemicals, animal testing may be necessary. Animal testing can help identify health problems such as cancer or birth defects. Without laboratory animals, scientists would lose a basic method for getting information needed to make wise decisions that protect public health. Scientists have the responsibility to treat research animals with care and compassion. Scientists must comply with strict animal-care guidelines because laws today protect the welfare of research animals.

Most of the information on health effects of DCBs is from studies of 1,2- and 1,4-DCB. Very little is known about the health effects of 1,3-DCB, especially in humans, but they are likely to be similar to those of the other DCBs.

Inhaling the vapor or dusts of 1,2-DCB and 1,4-DCB at very high concentrations could be very irritating to your eyes and nose and cause burning and tearing of the eyes, coughing, difficult breathing, and an upset stomach. These concentrations could occur in workplaces, but are much higher than you would be exposed to in the home. 1,4-DCB is the only DCB that is commonly used in household products (mainly mothballs and toilet-deodorizer blocks). Scientists have no evidence that the moderate use of common household products containing 1,4-DCB will cause any problems to your health. Some people reported health problems, such as dizziness, headaches, and liver problems, from very high levels of 1,4-DCB in the home. However, these

people used very high amounts of 1,4-DCB products and continued to use the products for months or even years, even though they felt ill. People who ate 1,4-DCB products regularly for long periods (months to years) because of its sweet taste developed skin blotches and problems with red blood cells, such as anemia (iron-poor blood). Little information is available about the effects of skin contact with DCBs. 1,4-DCB might cause a burning feeling in your skin if you hold mothballs or toilet-deodorizer blocks against your skin for a long time.

Breathing or eating any of the DCBs caused harmful effects in the liver of laboratory animals. Animal studies also found that 1,2-DCB and 1,4-DCB caused effects in the kidneys and blood, and that 1,3-DCB caused thyroid and pituitary effects. There is no clear evidence that 1,2-DCB and 1,4-DCB impair reproduction or fetal development in animals at levels below those that also cause serious health effects in the mother, although there is an indication that 1,4-DCB can affect development of the nervous system after birth.

Lifetime exposure to 1,4-DCB by breathing or eating induced liver cancer in mice. 1,2-DCB was not carcinogenic in laboratory animals, and 1,3-DCB has not been tested for its potential to cause cancer. The animal studies suggest that 1,4-DCB could play a role in the development of cancer in humans, but we do not definitely know this. The U.S. Department of Health and Human Services (DHHS) has determined that 1,4-DCB might be a human carcinogen. The International Agency for Research on Cancer (IARC) determined that 1,4-DCB is possibly carcinogenic to humans. Both IARC and the EPA concluded that 1,2-DCB and 1,3-DCB are not classifiable as to human carcinogenicity.

More information about how it can affect your health is given in Chapter 3.

1.6 HOW CAN DICHLOROBENZENES AFFECT CHILDREN?

This section discusses potential health problems in people from exposures during conception to maturity (18 years of age).

Children are exposed to DCBs in many of the same ways adults are. It is possibile that mothballs and toilet bowl deodorant blocks containing 1,4-DCB could be played with or accidentally swallowed, especially by young children. Because children tend to be curious about unknown powders and liquids, and because these products might be easily accessible in cabinets, closets, or bathrooms, children could be at a higher risk of exposure to 1,4-DCB than adults.

Children who are exposed to DCBs are likely to exhibit the same effects as adults, although this is not known for certain. Thus, all health problems of DCBs observed in adults are of potential concern in children.

Children can also be exposed to DCBs prenatally, because all three isomers have been detected in placenta samples, as well as through breast feeding. There is no reliable evidence suggesting that DCBs cause birth defects, although animal data raise concern for effects of 1,4-DCB on postnatal development of the nervous system.

1.7 HOW CAN FAMILIES REDUCE THE RISK OF EXPOSURE TO DICHLORO-BENZENES?

If your doctor finds that you (or a family member) have been exposed to substantial amounts of DCBs, ask whether your children also might have been exposed. Your doctor might need to ask your state health department to investigate.

You and your children could be exposed to 1,4-DCB in your home if you use consumer products that contain 1,4-DCB, such as some toilet bowl cleaners and mothballs. Exposure of children to 1,4-DCB can be minimized by discouraging them from playing with, swallowing, or having skin contact with treated products. These items should be stored out of reach of young children and kept in their original containers to prevent accidental poisonings. Keep your Poison Control Center’s number by the phone.

1.8 IS THERE A MEDICAL TEST TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO DICHLOROBENZENES?

Several tests can be used to show if you have been exposed to DCBs. The most commonly used tests measure their dichlorophenol breakdown products in urine and blood. These tests require special equipment that is not routinely available in a doctor's office, but they can be performed in a special laboratory.

The presence of the dichlorophenol breakdown products in the urine indicates a person has been exposed to DCBs within the previous day or two. For example, detection of 2,5-dichlorophenol in urine is commonly used to determine worker exposure to 1,4-DCB in industrial settings. Another test measures levels of DCBs in your blood, but this is used less often. Neither of these tests can be used to show how high the level of DCB exposure was or to predict whether harmful health effects will follow.

More information about how 1,4-DCB can be measured in exposed people is presented in Chapters 3 and 7.

1.9 WHAT RECOMMENDATIONS HAS THE FEDERAL GOVERNMENT MADE TO PROTECT HUMAN HEALTH?

The federal government develops regulations and recommendations to protect public health. Regulations *can* be enforced by law. EPA, the Occupational Safety and Health Administration (OSHA), and the Food and Drug Administration (FDA) are some federal agencies that develop regulations for toxic substances. Recommendations provide valuable guidelines to protect public health but *cannot* be enforced by law. The Agency for Toxic Substances and Disease Registry (ATSDR) and the National Institute for Occupational Safety and Health (NIOSH) of the Centers for Disease Control and Prevention (CDC) are two federal agencies that develop recommendations for toxic substances.

Regulations and recommendations can be expressed as “not-to-exceed” levels—in other words, levels of a toxic substance in air, water, soil, or food that do not exceed a critical value that is

usually based on levels that affect animals; they are then adjusted to levels that will help protect people. Sometimes these not-to-exceed levels differ among federal agencies because the agencies use different exposure times (for example, an 8-hour workday or a 24-hour day), different animal studies, or other factors.

Recommendations and regulations are periodically updated as more information becomes available. For the most current information, check with the federal agency that provides it.

The federal government has taken a number of steps to protect people from excessive exposure to 1,4-DCB. EPA has listed 1,4-DCB as a hazardous waste and has subjected it to hazardous waste regulations. EPA has set a maximum level of 75 micrograms (μg) of 1,4-DCB per liter of drinking water. In addition, 1,4-DCB is a pesticide registered with EPA, and its manufacturers must provide certain kinds of information to EPA for it to be registered for use as a pesticide. OSHA has set a maximum level of 75 ppm for 1,4-DCB in workplace air for an 8-hour day, 40-hour workweek.

More information about federal and state regulations regarding 1,4-DCB is presented in Chapter 8.

1.10 WHERE CAN I GET MORE INFORMATION?

If you have questions or concerns, please contact your community or state health or environmental quality department, or contact ATSDR at the address and phone number below.

ATSDR can tell you the location of occupational and environmental health clinics. These clinics specialize in recognizing, evaluating, and treating illnesses that result from exposure to hazardous substances.

Toxicological profiles are available on-line at www.atsdr.cdc.gov and on CD-ROM. You may request a copy of the ATSDR ToxProfiles™ CD-ROM by calling the toll-free information and

technical assistance number at 1-888-42ATSDR (1-888-422-8737), by e-mailing atsdric@cdc.gov, or by writing to

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE
Mailstop F-32
Atlanta, GA 30333
Fax: 1-770-488-4178

For-profit organizations may request copies of final Toxicological Profiles from

National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22161
Phone: 1-800-553-6847 or 1-703-605-6000
Web site: http://www.ntis.gov/