1. PUBLIC HEALTH STATEMENT

This public health statement tells you about hexachlorocyclopentadiene (HCCPD) and the effects of exposure.

The Environmental Protection Agency (EPA) identifies the most serious hazardous waste sites in the nation. These sites make up the National Priorities List (NPL) and are the sites targeted for long-term federal cleanup activities. HCCPD has been found in at least 31 of the 1,467 current or former NPL sites. However, the total number of NPL sites evaluated for this substance is not known. As more sites are evaluated, the sites at which HCCPD is found may increase. This information is important because exposure to this substance may harm you and because these sites may be sources of exposure.

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

If you are exposed to HCCPD, many factors determine whether you'll be harmed. These factors include the dose (how much), the duration (how long), and how you come in contact with it. You must also consider the other chemicals you're exposed to and your age, sex, diet, family traits, lifestyle, and state of health.

1.1 WHAT IS HCCPD?

HCCPD is a light, lemon-yellow liquid that has a sharp, musty odor. It easily turns from a liquid to a vapor when exposed to air. The vapor looks like a blue haze. This chemical is also called percyclopentadiene, hexachloropentadiene, and hex. Some of its former trade names, still listed in chemical reference documents, are C-56, Graphlox, and HRS 1655.

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HCCPD is a manufactured chemical and does not occur naturally in the environment. It is made by adding chlorine to cyclopentadiene, or by removing chlorine from octachlorocyclopentane. HCCPD is used to make a group of related pesticides (aldrin, chlordane, dieldrin, endosulfan, endrin, heptachlor, isodrin, mirex, and pentac). Only two of these pesticides, endosulfan and pentac, are currently registered for use in the United States. Thus, your exposure to these compounds is expected to be limited. Endosulfan and pentac are the only two of these pesticides that you can buy in a store. HCCPD is also used to make flame retardants, resins that won't burn, shock-proof plastics, esters, ketones, fluorocarbons, and dyes.

Most of the HCCPD in the environment results from releases during its production and disposal. Releases can also occur as a result of the manufacture, use, and disposal of pesticides made from HCCPD. Most people can smell HCCPD in the air at 30 parts HCCPD per billion (ppb) parts of air. Most people can smell it in water when it is present at 1.4 ppb. The amount of HCCPD that you can taste in water has not been measured and the taste has not been described.

See Chapters 3,4, and 5 for more information on the properties and uses of HCCPD and its presence in the environment.

1.2 WHAT HAPPENS TO HCCPD WHEN IT ENTERS THE ENVIRONMENT?

HCCPD can be released to the air as a vapor during its production and use. However, it does not remain in the air very long since it is usually broken down to other substances by sunlight and by reaction with other chemicals in the air. Half of the HCCPD released to the air is removed in less than one day.

When HCCPD is mixed with water at room temperature, only 2.1 milligrams will dissolve in a liter of water (2 parts per million or 2 ppm). In a stream or small river, the HCCPD near the surface will evaporate to the air. Sunlight on the water will cause HCCPD to change quickly into other chemicals. About half of the HCCPD in the water will be changed to other chemicals by the light in only four minutes.

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The HCCPD that gets into soil binds to decaying plant and animal matter. If the soil is sandy, the HCCPD can move through the soil and reach the water that is under the ground. When soil that contains HCCPD also contains solvents like gasoline, paint thinners, and acetone, these liquids will help carry the HCCPD through the soil to lakes, rivers, or wells. Bacteria can change HCCPD in the soil to other chemicals, but scientists do not know the nature of these compounds. About half of the HCCPD in the soil will be changed to other chemicals by bacteria in 1-2 weeks.

HCCPD has been known to build up in fish, but only in very small amounts. We do not know if HCCPD accumulates in plants, milk, or animals used for food.

See Chapter 5 for more information on how HCCPD behaves in the environment.

1.3 HOW MIGHT I BE EXPOSED TO HCCPD?

If you live near a hazardous waste site where HCCPD or HCCPD-derived pesticides were disposed, you might be exposed to HCCPD in the air. In one survey, levels ranging from 0.032 to 0.053 ppb were measured in air near a hazardous waste site. HCCPD has not been reported in outdoor air in city, suburban, and rural areas. In most areas, the concentration of HCCPD in the air should be low because this chemical is not widely used.

HCCPD is not commonly found in surface water. In one survey, it was found in less than 0.1% of 854 water samples from various sources. The median concentration of HCCPD was less than 10 ppb in water. HCCPD in not often found in drinking water, so exposure by this route is unlikely. However, it may be formed during chlorination of water containing humic acid.

HCCPD may be present in soils that have recently been treated with the pesticides, endosulfan or pentac, because it is sometimes found as an impurity in these pesticides. The soils near a landfill where these pesticides (including those no longer used, such as aldrin, chlordane, dieldrin, endrin, heptachlor, and isodrin) or waste HCCPD were disposed might also contain HCCPD, but, since it binds to organic matter in soils, it is less likely to be free to affect you.

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It is highly unlikely that you will be exposed to HCCPD in the foods you eat, although you could be exposed to very small amounts if you catch and eat fish that lived in HCCPD-contaminated water.

The highest exposures to HCCPD are likely to occur in people who are involved in the production or use of HCCPD, who handle pesticides made from it, or who treat wastes that contain it. These people can be exposed by breathing air contaminated with HCCPD, or by skin and eye contact with the vapors or liquid.

Air concentrations ranging from 270 to 970 ppb were reported at a waste water treatment plant after large amounts of the compound were dumped into a city sewage system. Traces of HCCPD were present in waste water at another treatment plant near an industrial facility that used it as a reactant for making pesticides.

See Chapter 5 for more information on how you can be exposed to HCCPD.

1.4 HOW CAN HCCPD ENTER AND LEAVE MY BODY?

There is no information available to tell us what happens to HCCPD once it enters the human body. Based on studies in animals, if you are exposed to HCCPD through food or drinking water, most of the HCCPD you eat or drink will stay bound to the food or water and only a small amount will enter your bloodstream. Thereafter, most of the HCCPD (64-80%) will leave your body in your feces and the rest will leave in your urine.

Animal studies have shown that up to 95% of the HCCPD that is inhaled stays in your windpipe and lungs, and a small amount reaches your liver and kidneys. Inhaled HCCPD, therefore, causes more health effects in people and animals than HCCPD that is ingested (see Section 1.5).

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If HCCPD touches your skin, it can enter your body. Based on studies in animals, when either pure HCCPD or a solution with 10% HCCPD in mineral oil comes in contact with your skin, a sore can form. The open sore will allow more HCCPD to enter your body.

Most of the HCCPD that enters your body is changed to other chemicals, but those chemicals have not been identified. A small amount of HCCPD remains unchanged. You can find more information on how HCCPD and its breakdown products enter and leave your body in Chapter 2.

1.5 HOW CAN HCCPD AFFECT MY HEALTH?

To protect the public from the harmful effects of toxic chemicals and to find ways to treat people who have been harmed, scientists use many tests.

One way to see if a chemical will hurt people is to learn how the chemical is absorbed, used, and released by the body; for some chemicals, animal testing may be necessary. Animal testing may also be used to identify health effects such as cancer or birth defects. Without laboratory animals, scientists would lose a basic method to get information needed to make wise decisions to protect public health. Scientists have the responsibility to treat research animals with care and compassion. Laws today protect the welfare of research animals, and scientists must comply with strict animal care guidelines.

Information on the health effects of HCCPD on people is limited to one incident involving shortterm exposure to HCCPD vapors (0.04-19.2 ppm). Exposure occurred at a waste water treatment plant as a result of an industrial release of HCCPD into the sewage system. This incident showed that the breathing passageways (nose, throat, lungs) in people are very sensitive to HCCPD. You may get a sore throat or have shortness of breath and chest discomfort if you breathe HCCPD at high levels. Your eyes may burn and turn red, and your skin may be irritated. Some people get headaches when they breathe high levels of HCCPD.

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Your kidneys and liver may show signs that you have been exposed to HCCPD. Some people who were exposed to HCCPD had increased amounts of protein in their urine and increased levels of other compounds in their blood. These are signs that kidney and liver effects may have occurred after exposure to HCCPD. Other people who were exposed did not show these effects.

Bleeding, swelling, and fluid buildup occurred in the lungs of rats, mice, guinea pigs, and rabbits that inhaled small amounts of HCCPD vapors for two weeks under controlled conditions. Severe breathing difficulty was seen in animals exposed to large amounts of HCCPD for a short period of time, and all the animals died during or soon after exposure. In rats, some cells of the lung, windpipe, and nose contained yellow-colored or clear granules after exposure to a very low level (0.01 ppm) of HCCPD in air for a long time. In monkeys, higher levels (0.2 ppm) caused similar changes in those cells.

When rats and rabbits swallowed HCCPD dissolved in corn oil or peanut oil, cells in the lungs, liver, kidney, brain, and heart were harmed and a sore formed in the stomach lining. When the doses were high (261-1,950 milligrams per kilogram of body weight [mg/kg]), most of the animals died after only one dose. There was damage to stomach lining and kidney cells in mice given a low concentration of HCCPD in corn oil by mouth 5 days a week for several months. Because these mice were also exposed to another chemical, hexachlorobutadiene, it is not clear if the cell damage in the kidneys was caused by HCCPD alone.

No information is available on whether HCCPD affects the reproductive organs of people.

No information is available on whether HCCPD causes cancer in people. The Department of Health and Human Services (DHHS) has determined that HCCPD does not cause cancer in rats and mice under the conditions of the study conducted by the National Toxicology Program. The International Agency for Research on Cancer (IARC) has not evaluated HCCPD as a possible cancer-causing chemical. The EPA has determined that HCCPD is not classifiable as to its ability to cause cancer in people.

See Chapter 2 for more information on how HCCPD can affect your health.

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1.6 HOW CAN HCCPD AFFECT CHILDREN?

This section discusses potential health effects from exposures during the period from conception to maturity at 18 years of age in humans.

Children are unlikely to be exposed to HCCPD. There is no information on the effects of exposure to HCCPD in children or in adults who were exposed as children. We do not know whether HCCPD causes birth defects in humans. Studies in animals indicate that exposure to HCCPD does not cause problems during development. HCCPD did not cause birth defects or impair the ability of mice and rabbits to produce offspring. We do not know whether HCCPD can cross the placenta or accumulate in breast milk.

1.7 HOW CAN FAMILIES REDUCE THE RISK OF EXPOSURE TO HCCPD?

If your doctor finds that you have been exposed to significant amounts of HCCPD, he or she can advise you about the potential risk of exposure to the rest of your family. When necessary your doctor may need to ask your state public health department to investigate.

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

If you have been recently exposed to HCCPD, your blood and urine can be tested for its presence. Such tests are not routinely done in a doctor's office because special equipment is needed. Doctors often can collect blood or urine samples and send them to special laboratories to determine if you have been exposed to HCCPD; but these laboratories can't determine how much HCCPD you were exposed to, or whether your health will be affected. Exposure to HCCPD that occurred weeks or months before your test is not likely to be detected in either your blood or urine.

See Chapters 2 and 6 for more information on how HCCPD can be measured in exposed people.

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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. Federal agencies that develop regulations for toxic substances include the Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), and the Food and Drug Administration (FDA). Recommendations provide valuable guidelines to protect public health but cannot be enforced by law. Federal organizations that develop recommendations for toxic substances include the Agency for Toxic Substances and Disease Registry (ATSDR) and the National Institute for Occupational Safety and Health (NIOSH).

Regulations and recommendations can be expressed in not-to-exceed levels in air, water, soil, or food that are usually based on levels that affect animals, then they are adjusted to help protect people. Sometimes these not-to-exceed levels differ among federal organizations because of different exposure times (an 8-hour workday or a 24-hour day), the use of different animal studies, or other factors.

Recommendations and regulations are also periodically updated as more information becomes available. For the most current information, check with the federal agency or organization that provides it. Some regulations and recommendations for HCCPD include the following:

To protect workers who may be exposed to HCCPD on the job, the Occupational Safety and Health Administration (OSHA) limits HCCPD exposure to 0.01 ppm in air for an 8-hour workday over a 40-hour workweek. The National Institute for Occupational Safety and Health (NIOSH) suggests the same limit for workplace air.

EPA has recommended guidelines on how much HCCPD can be present in drinking water. The maximum contaminant levels (MCL) and maximum concentration level goal (MCLG) for drinking water are 50 ppb. EPA recommends that exposures in children should not exceed 2 ppm in water

for l0-day periods or no more than 0.7 ppb for up to 7 years. If adults are exposed for more than 7 years, the EPA recommends that exposure levels should not exceed 50 ppb.

HCCPD has been named a hazardous substance by EPA. If quantities equal to or greater than one pound are released to the environment, the National Response Center for the federal government must be told immediately. HCCPD has not been identified as a carcinogen.

See Chapter 7 for more information on state or federal government regulations and guidelines for HCCPD.

1.10 WHERE CAN I GET MORE INFORMATION?

If you have any more questions or concerns, please contact your community or state health or environmental quality department or

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE, Mailstop E-29
Atlanta, GA 30333

* Information line and technical assistance
Phone: l-888-42-ATSDR (l-888-422-8737)
Fax: (404) 639-63 14 or 6324

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

* To order toxicological profiles, contact
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22 16 1
Phone: (800) 553-6847 or (703) 605-6000