

1. PUBLIC HEALTH STATEMENT

This Statement was prepared to give you information about chlordane and to emphasize the human health effects that may result from exposure to it. The Environmental Protection Agency (EPA) has identified 1,350 hazardous waste sites as the most serious in the nation. These sites comprise the “National Priorities List” (NPL): Those sites which are targeted for long-term federal cleanup activities. Chlordane has been found in at least 176 of the sites on the NPL. However, the number of NPL sites evaluated for chlordane is not known. As EPA evaluates more sites, the number of sites at which chlordane is found may increase. This information is important because exposure to chlordane may cause harmful health effects and because these sites are potential or actual sources of human exposure to chlordane.

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 can be exposed to a substance only when you come in contact with it. You may be exposed by breathing, eating, or drinking substances containing the substance or by skin contact with it.

If you are exposed to a substance such as chlordane, many factors will determine whether harmful health effects will occur and what the type and severity of those health effects will be. These factors include the dose (how much), the duration (how long), the route or pathway by which you are exposed (breathing, eating, drinking, or skin contact), the other chemicals to which you are exposed, and your individual characteristics such as age, gender, nutritional status, family traits, life-style, and state of health.

1.1 WHAT IS CHLORDANE?

Chlordane is a man-made chemical that was used as a pesticide in the United States from 1948 to 1988. It is sometimes referred to by the trade names Octachlor and Velsicol 1068. It is a thick liquid whose color ranges from colorless to amber, depending on its purity. It may

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have no smell or a mild, irritating smell. We do not know what it tastes like. Chlordane is not a single chemical, but is a mixture of many related chemicals, of which about 10 are major components. Some of the major components are *trans*-chlordane, *cis*-chlordane, β -chlordene, heptachlor, and *trans*-nonachlor. Chlordane does not dissolve in water. Therefore, before it can be used as a spray, it must be placed in water with emulsifiers (soaplike substances), which results in a milky-looking mixture.

From 1983 until 1988, chlordane's only approved use was to control termites in homes. The pesticide was applied underground around the foundation of homes. When chlordane is used in the soil around a house, it kills termites that come into contact with it.

Before 1978, chlordane was also used as a pesticide on agricultural crops, lawns, and gardens and as a fumigating agent. Because of concerns over cancer risk, evidence of human exposure and build up in body fat, persistence in the environment, and danger to wildlife, the EPA canceled the use of chlordane on food crops and phased out other above-ground uses over the next 5 years. In 1988, when the EPA canceled chlordane's use for controlling termites, all approved use of chlordane in the United States stopped. Manufacture for export continues. For more information see Chapters 3 and 4.

1.2 WHAT HAPPENS TO CHLORDANE WHEN IT ENTERS THE ENVIRONMENT?

When used as a pesticide on crops, on lawns and gardens, and to control termites in houses, chlordane enters the environment. Although it is no longer used in the United States, it may be used in other countries. In soil, it attaches strongly to particles in the upper layers of soil and is unlikely to enter into groundwater. It is not known whether chlordane breaks down in most soils. If breakdown occurs, it is very slow. Chlordane is known to remain in some soils for over 20 years. Persistence is greater in heavy, clayey or organic soil than in sandy soil. Most chlordane is lost from soil by evaporation. Evaporation is more rapid from light, sandy soils than from heavy soils. Half of the chlordane applied to the soil surface may evaporate in 2 to 3 days. Evaporation is much slower after chlordane penetrates into the soil. In water, some chlordane attaches strongly to sediment and particles in the water column and

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some is lost by evaporation. It is not known whether much breakdown of chlordane occurs in water or in sediment. Chlordane breaks down in the atmosphere by reacting with light and with some chemicals in the atmosphere. However, it is sufficiently long lived that it may travel long distances and be deposited on land or in water far from its source. Chlordane or the chemicals that chlordane changes into accumulate in fish, birds, and mammals. Chlordane stays in the environment for many years and is still found in food, air, water, and soil. Chlordane is still commonly found in some form in the fat of fish, birds, mammals, and almost all humans. For more information see Chapter 5.

1.3 HOW MIGHT I BE EXPOSED TO CHLORDANE?

Everyone in the United States has been exposed to low levels of chlordane. A more relevant question is whether or not you may have been exposed to high levels of chlordane. Before its ban in 1988, you might have been exposed to high levels of chlordane if you worked in the manufacture, formulation, or application of chlordane. Therefore, farmers and lawn-care workers may have been exposed to chlordane before 1978, and pest control workers may have been exposed to chlordane before 1988 by skin contact and breathing dust and vapor. A national survey conducted from 1980 to 1983 estimated that 3,732 workers were potentially exposed to chlordane in the United States. This number of potentially exposed workers should have decreased after chlordane's use was banned in the United States. However, the ban on chlordane did not eliminate it from your environment, and some of your opportunities for exposure to chlordane continue.

Today, people receive the highest exposure to chlordane from living in homes that were treated with chlordane for termites. Chlordane may be found in the air in these homes for many years after treatment. Houses in the deep south and southwest were most commonly treated. However, chlordane use extended from the lower New England States south and west to California. Houses built since 1988 have not been treated with chlordane for termite control. You can determine if your home was treated with chlordane by examining your records or contacting your termite treatment service.

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Over 50 million persons have lived in chlordane-treated homes. Indoor air in the living spaces of treated homes have been found to contain average levels of between 0.00003 and 0.002 milligram (mg) of chlordane in a cubic meter of air (mg/m^3). However, levels as high as $0.06 \text{ mg}/\text{m}^3$ have been measured in the living areas of these homes. Even higher levels are found in basements and crawl spaces.

The most common source of chlordane exposure is from ingesting chlordane-contaminated food. Chlordane remains in the food supply because much of the farmland was treated with chlordane in the 1960s and 1970s and it remains in some soil for over 20 years. However, since chlordane has been banned, the levels in soils would be expected to decrease with the passage of time. Chlordane may also be found in fish and shellfish caught in chlordane contaminated waters. If you are in doubt about whether a lake or river is contaminated, call your local Game and Fish or Health departments. Chlordane is almost never detected in drinking water. A survey conducted by the Food and Drug Administration (FDA) determined daily intake of chlordane from food to be 0.0013 microgram per kilogram of body weight ($\mu\text{g}/\text{kg}$) for infants and 0.0005-0.0015 $\mu\text{g}/\text{kg}$ for teenagers and adults (a microgram is one thousandth of a milligram). The average adult would, therefore, consume about 0.11 μg of chlordane.

You may come into contact with chlordane while digging in soil around the foundation of homes where it was applied to protect the homes against termites. Soil may also be contaminated with chlordane around certain NPL hazardous waste sites. Chlordane has been found at 176 of 1,350 hazardous waste sites on the NPL in the United States. The highest level of chlordane found in soil near an NPL site was 344 ppm. People may be exposed to chlordane at these sites by breathing low levels of chlordane volatilizing from the soil or from touching the soil. Levels of chlordane found in groundwater near NPL sites containing chlordane ranged from 0.02 to 830 parts of chlordane per billion parts of water (ppb).

Finally, some chlordane may be left over from pre-ban days. Old containers of material thought to contain chlordane should be disposed of carefully and contact with the skin and breathing vapors should be avoided. For more information see Chapter 5.

1.4 HOW CAN CHLORDANE ENTER AND LEAVE MY BODY?

Chlordane can enter the body through the skin if skin contact occurs with contaminated soils, through the lungs if breathed in with contaminated air, and through the digestive tract if swallowed. Uptake through the skin and digestive tract increases if chlordane is in an oily mixture, which might occur at hazardous waste sites. The importance of each of these ways for chlordane to enter the body depends on the kind of exposure. For example, people living in houses that have been treated with chlordane will be exposed mostly by breathing the vapor in the air. Workers who sprayed chlordane as a pesticide were exposed mostly by breathing the compound in the air and by contact with the skin. Other people may be exposed to small quantities by eating food or drinking water that contains chlordane. People at or near waste sites may be exposed by touching chlordane in the soil, by breathing chlordane that evaporates into the air, by drinking water that contains chlordane or by eating contaminated fish or crops. The amount of chlordane that enters the body depends on the amount in air, food, or water, and the length of time a person is exposed to it. Most chlordane that enters the body leaves in a few days, mostly in the feces, and a much smaller amount leaves in the urine. Chlordane and its breakdown products may be stored in body fat, where they cause no bad effects, unless released from body fat in large amounts. It may take months or years before the chlordane and the breakdown products that are stored in fat are able to leave the body. More information on how chlordane moves in the body can be found in Chapter 2.

1.5 HOW CAN CHLORDANE AFFECT MY HEALTH?

Most health effects in humans that may be linked to chlordane exposure are on the nervous system, the digestive system, and the liver. These effects were seen mostly in people who swallowed chlordane mixtures. Large amounts of chlordane taken by mouth can cause convulsions and death. Convulsions occurred in a man who had long-term skin contact with soil containing large amounts of chlordane. Swallowing small amounts or breathing air containing high concentrations of chlordane vapors can cause a variety of nervous system

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effects, including headaches, irritation, confusion, weakness, and vision problems, as well as upset stomach, vomiting, stomach cramps, diarrhea, and jaundice.

No harmful effects on health have been confirmed in studies of workers who made chlordane. One study found minor changes in liver function in workers in Japan who used chlordane as a pesticide. There are indications that chlordane may cause anemia and other changes in the blood cells, but the evidence is not very strong.

Animals given high levels of chlordane by mouth for short periods of time died or had convulsions. Long-term exposure of animals to chlordane in their food caused harmful effects in the liver. It is not known whether chlordane will cause cancer in humans after long-term exposure. Studies of workers who made or used chlordane do not link exposure with cancer, but the information is not sufficient to know for sure. Mice fed low levels of chlordane in their food for most of their lifetimes developed liver cancer. The International Agency for Research on Cancer (IARC) has determined that chlordane is not classifiable as to its carcinogenicity to humans. It is not known whether chlordane will cause reproductive or birth defects in humans. Studies of workers who made or used chlordane do not link exposure to the chemical with birth defects, but there are not enough studies in humans to know for sure. There is some evidence that animals exposed before birth or while nursing develop behavioral effects while growing up. More information on the effects of chlordane on health can be found in Chapter 2.

1.6 IS THERE A MEDICAL TEST TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO CHLORDANE?

Chlordane and its breakdown products (metabolites) can be measured in human blood, urine, feces, and breast milk. Tests have shown that most Americans have low levels of chlordane metabolites in their body fat. The breakdown products can stay in body fat for very long periods, so finding them in body fat or breast milk does not tell how much or how long ago exposure to chlordane occurred. Not all of the breakdown products are specific for chlordane. Finding chlordane and/or breakdown products in your body also cannot predict what health

effects will occur, if any. Levels in blood and fat can be tested, although the tests are not routinely available. More information on medical tests can be found in Chapters 2 and 6.

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

The EPA guidelines for drinking water suggest that no more than 60 ppb chlordane should be present in drinking water that children consume for longer than 10 days. Drinking water should contain no more than 0.5 ppb for children or 2 ppb for adults if they drink the water for longer periods.

EPA stopped all use of chlordane on food crops, effective March 1978. Until 1988, EPA permitted chlordane use for termite control or dipping the roots or tops of nonfood plants. On April 14, 1988, however, EPA stopped all sales and commercial use of chlordane.

The Food and Drug Administration has established that the levels of chlordane and its breakdown products in most fruits and vegetables should not be greater than 300 ppb and in animal fat and fish should not be greater than 100 ppb.

Federal regulations limit the amount of chlordane that factories can release into waste water. The EPA requires industry to report releases or spills of 1 pound or more. A temporary guideline of the National Research Council indicated that 0.005 mg/m^3 should be the maximum amount allowed in the air of military housing.

The Occupational Safety and Health Administration (OSHA) regulates chlordane levels in the workplace. The maximum allowable level in workplace air is 0.5 mg/m^3 for a person who is exposed for 8 hours per workday and 40 hours per workweek. The National Institute for Occupational Health and Safety (NIOSH) also recommends an exposure limit of 0.5 mg/m^3 for a person exposed to chlordane in the workplace for 8 hours per workday and 40 hours per workweek. Chapter 7 provides more information on chlordane regulations.

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1.8 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
1600 Clifton Road NE, E-29
Atlanta, Georgia 30333
(404) 639-6000

This agency can also provide you with information on the location of occupational and environmental health clinics. These clinics specialize in the recognition, evaluation, and treatment of illness resulting from exposure to hazardous substances.