

1. PUBLIC HEALTH STATEMENT

This statement was prepared to give you information about mirex and chlordane and to emphasize the human health effects that may result from exposure to them. The Environmental Protection Agency (EPA) has identified 1,408 hazardous waste sites as the most serious in the nation. These sites make up the National Priorities List (NPL) and are the sites targeted for long-term federal clean-up activities. Mirex has been found in at least 7 of the sites on the NPL. Chlordane has been found at 2 of the sites on the NPL. However, neither mirex or chlordane are on EPA's list of target chemicals and the number of NPL sites evaluated for mirex and chlordane is not known. As EPA evaluates more sites, the number of sites at which mirex and chlordane are found may increase. This information is important because exposure to mirex and chlordane may cause harmful health effects and because these sites are potential or actual sources of human exposure to mirex and 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 substances such as mirex and 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 (breathing, eating, drinking, or skin contact) by which you are exposed, the other chemicals to which you are exposed, and your individual characteristics such as age, sex, nutritional status, family traits, lifestyle, and state of health.

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1.1 WHAT ARE MIREX AND CHLORDECONE?

Mirex and chlordane are two separate synthetic insecticides that have similar chemical structures. They do not occur naturally in the environment. Mirex is a snow-white crystalline solid and chlordane is a tan-white crystalline solid. Both compounds are odorless and neither burns easily.

Mirex and chlordane are no longer made or used in the United States. Mirex and chlordane were most commonly used in the 1960s and 1970s. Mirex was used as a pesticide to control fire ants mostly in the southeastern part of the United States. It was also used extensively as a flame retardant additive under the trade name Dechlorane® in plastics, rubber, paint, paper, and electrical goods from 1959 to 1972 because it does not burn easily. Chlordane was used to control insects that attacked bananas, citrus trees with no fruits, tobacco, and ornamental shrubs. It was also used in household products such as ant and roach traps. Chlordane is also known by its trade name Kepone®. All registered products containing mirex and chlordane were canceled in the United States between 1977 and 1978.

Chapter 3 has more information on the physical and chemical properties of mirex and chlordane. Chapter 4 has more information on the production and use of mirex and chlordane.

1.2 WHAT HAPPENS TO MIREX AND CHLORDECONE WHEN THEY ENTER THE ENVIRONMENT?

Mirex and chlordane contaminated water and soil while they were being manufactured and used in the 1960s and 1970s. These substances can still enter surface water through runoff of contaminated soil at facilities that once manufactured these chemicals or by seeping from waste disposal sites. Mirex and chlordane do not evaporate to any great extent into the air. They also do not dissolve easily in water. Most of the mirex and chlordane in water attaches to soil particles suspended in the water or to sediment. When they bind to soil particles in water, they can travel long distances. Both compounds bind strongly to soil.

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Because they are not likely to move through the soil, very little will get into underground water. Mirex and chlordecone can stay in soil, water, and sediment for years. Both compounds are slowly broken down in soil, water, and sediment. Mirex is broken down more quickly than chlordecone. Mirex is broken down to photomirex, which can also cause harmful health effects. Photomirex is even more poisonous than mirex. It is produced when sunlight reacts with mirex in water or in the air. Fish or animals that live in waters that contain mirex or chlordecone, or that eat other animals contaminated with mirex or chlordecone, can build up these substances in their bodies. The amounts of mirex and chlordecone in their bodies may be several times greater than the amount in their prey or in the surrounding water. See Chapter 3 for more information on the chemical and physical properties of mirex and chlordecone. See Chapter 5 for more information on their occurrence and what happens to them in the environment.

1.3 HOW MIGHT I BE EXPOSED TO MIREX AND CHLORDECONE?

Most people are exposed to very low levels of mirex and chlordecone. The most likely way for people in the general population to be exposed to mirex or chlordecone is by eating food, particularly fish, taken from contaminated areas. Currently, three states (Ohio, New York, and Pennsylvania) have issued a warning to the public that fish may contain mirex. This warning applies mostly to fish caught in Lake Ontario. The state of Virginia has also issued a warning to the public about possible chlordecone contamination in fish and shellfish caught in the lower 113 miles of the James River. This contamination was caused when chlordecone was manufactured in one factory in Hopewell, Virginia, polluting the James River. People who live in areas where these compounds were used or made have higher levels in their tissues. Mirex was found in the milk of women who live in these areas, so nursing infants could be exposed. People who live near hazardous waste sites may be exposed to mirex or chlordecone by touching or eating contaminated soil that is on unwashed hands, food containers, or food itself, since these compounds bind to soil particles. Because mirex and chlordecone do not dissolve easily in water or evaporate easily in air, people are not likely to be exposed to them by drinking water or by inhaling air. Since mirex and chlordecone are no

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longer produced, the only people likely to be exposed through their work are those involved in the clean-up and removal of contaminated soils and sediments.

Mirex and chlordecone do not occur naturally in the environment. Although mirex is not usually found in the air, it was detected at very low levels of up to 10 parts of mirex per quadrillion (1,000,000,000,000,000) parts of air in air samples from southern Ontario, Canada. Surface water concentrations of mirex ranged from 0.06 to 2.6 parts mirex per one trillion (1,000,000,000,000) parts of water in the Niagara River between 1981 and 1983. More recent monitoring data from 1987 show that mirex concentrations are decreasing in the surface waters of the Great Lakes to about 0.022 parts per trillion (ppt). In the mid-1980s mirex was found in sediments of Lake Ontario at levels ranging from 6.4 parts per billion (ppb) to 38 ppb. Nationwide, the average level of mirex in fish was less than 4 ppb in 1986. However, fish from Lake Ontario had levels as high as 225 ppb. Chlordecone was found in surface water samples from the James River estuary at levels less than 10 ppt in 1977. More recent data were not available. In 1978, chlordecone was detected in sediments from the James River below its production site at concentrations of less than one part chlordecone in one million parts of sediment. In 1981, chlordecone was found in clams from the James River at levels ranging from 60 to 140 ppb.

Chapter 5 has more information on how you may be exposed to mirex and chlordecone.

1.4 HOW CAN MIREX AND CHLORDECONE ENTER AND LEAVE MY BODY?

Studies in animals show that mirex can be taken into your bloodstream when you breathe in cigarette smoke containing mirex or eat food contaminated with mirex. We do not know if mirex can pass through your skin and enter your body after you touch it. Mirex passes from the stomach and intestines of animals into their blood. We do not know how much passes from the stomach and intestines of people into the bloodstream. Once in the bloodstream, mirex is carried to many parts of the body where it is stored, mainly in fat. Mirex is not broken down in the body. Mirex that is not stored leaves the body unchanged mainly in the feces. Very little leaves the body in the urine. Most of the mirex that is swallowed leaves

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the body in feces within two days. However, the mirex that enters the bloodstream and is stored in fat leaves the body very slowly. This process can take from several weeks to months. Mirex can also enter breast milk from the bloodstream of nursing mothers who have been exposed. Refer to Chapter 2 for more information on this subject.

Animal studies show that chlordecone can pass into your blood when you eat food contaminated with it. Animal data show that only a small amount of chlordecone can pass through the skin into the bloodstream. We do not know if or how much chlordecone can pass from your lungs into your blood when you breathe it in. Like mirex, once chlordecone is taken up by your body, it is carried by the blood throughout the body and is stored for a long time. Unlike mirex, chlordecone is found mainly in the liver. Chlordecone is broken down to chlordecone alcohol, which is a less harmful product. Chlordecone and its breakdown product slowly leave the body through the feces. This process can take from several weeks to months. Very little chlordecone leaves the body in the urine. Chlordecone has also been found in saliva and human milk. Refer to Chapter 2 for more information on this subject.

1.5 HOW CAN MIREX AND CHLORDECONE AFFECT MY HEALTH?

We do not know how mirex directly affects the health of people. However, animal studies have shown that eating mirex can cause harmful effects on the stomach, intestines, liver, and kidneys. Eating mirex can also cause harmful effects on the eyes, thyroid, nervous system, and reproductive system. Since these effects occur in animals, they may also occur in people. Animals that eat large amounts of mirex for a relatively short time can develop diarrhea. In animals, short-term exposure (14 days or less) to low and high levels of mirex and intermediate exposure (15-364 days) to low levels can harm the liver. Trembling, tiredness, and weakness can also occur after short-term exposure to large amounts of mirex. Younger animals are more sensitive to these effects on the nervous system. Intermediate exposures to low levels of mirex caused tiredness, and exposure to higher levels caused extreme excitability. Long-term (365 days or more) exposure to low levels of mirex caused harm to

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the kidneys. Short-term and intermediate exposures to moderately low levels of mirex did not harm kidneys. Exposure to sufficient amounts of mirex may cause cataracts in animals if they are exposed before or soon after birth. We do not know whether human infants may also develop cataracts; it is not likely that mirex will cause cataracts in adults. Short-term, low-level exposure to mirex may harm reproduction and development in rodents. High-level exposures may result in miscarriage.

Studies in workers exposed (intermediate- or long-term) to chlordecone have shown harmful effects on the liver, the nervous system, and reproductive systems. Workers exposed to high levels of chlordecone during its manufacture experienced trembling, irritability, blurry vision, and headaches. Studies in rats have shown that pretreatment with some anticonvulsants or antidepressants increases the seriousness of the tremors associated with chlordecone exposure. Therefore, people being treated with these drugs for epilepsy or depression may also experience more serious tremors if they are exposed to chlordecone. Male workers experienced some harmful reproductive effects. However, there was no evidence that the ability to father children was affected. Some workers exposed to high levels of chlordecone developed skin rashes and enlarged livers. Animal studies show effects similar to those seen in humans. In addition, long-term exposure to small amounts of chlordecone caused kidney effects in animals. It is possible exposure to high concentrations of chlordecone for a long time may also hurt people's kidneys. Animal studies show harmful effects on the ability of female animals to reproduce. We do not know if similar effects occur in exposed women. Animal studies show that chlordecone harms the offspring of exposed animals. We do not know if similar harmful developmental effects will occur in people. However, it is possible that if parents are exposed to enough chlordecone, their children's development may be harmed. Very young and very old people may be especially sensitive to chlordecone.

We do not know for sure whether either mirex or chlordecone causes cancer in humans. The Department of Health and Human Services (DHHS) has determined that mirex and chlordecone may reasonably be expected to be carcinogens. The International Agency for Research on Cancer (IARC) has determined that mirex and chlordecone are possibly carcinogenic to humans. The EPA has not classified mirex or chlordecone as to

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carcinogenicity. In rodents, mirex causes liver, adrenal, and blood cancer. Chlordecone also causes liver cancer in rodents, but because of problems with these animal studies, more information is necessary to be sure.

Chapter 2 has information on the health effects of mirex and chlordecone.

1.6 ARE THERE MEDICAL TESTS TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO MIREX OR CHLORDECONE?

There are medical tests to determine whether you have been exposed to mirex. Levels of mirex can be measured in blood, feces, fat, or milk. The tests are not done in routine medical examinations. However, doctors can collect tissue and body fluid samples and send them to university medical centers or medical laboratories where the tests can be performed. The tests are specific for mirex exposure. Since mirex is stored in your body for a long time and slowly excreted, the tests can detect mirex for a long time after exposure has stopped. However, the tests are unsatisfactory indicators of the amount of mirex to which you have been exposed. This is because a long time may have passed since you were exposed and you cannot be sure how much mirex may have left your body by the time the test is performed. The tests also cannot be used to predict whether you will experience any potential health effects or harmful changes following exposure.

There are medical tests to determine whether you have been exposed to chlordecone and/or its breakdown product, chlordecone alcohol. Levels of chlordecone and/or chlordecone alcohol can be measured in blood, saliva, feces, or bile. Chlordecone levels in blood are the best indicator of exposure to chlordecone. Since chlordecone remains in the blood for a long time, the test is useful for a long time after exposure has stopped. Chlordecone can be detected in saliva only within the first 24 hours after exposure; therefore, this test has limited use. Blood levels of chlordecone are a good reflection of total body content of chlordecone. However, the test is an unsatisfactory indicator of the amount of chlordecone to which you have been exposed because you cannot be sure how much chlordecone left your body between the time you were exposed and the time the test is performed. These tests cannot predict how your

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health may be affected after exposure. The tests are not done in routine medical examinations, but doctors can collect body fluid samples and send them to a university medical center or a medical laboratory for analysis. Refer to Chapters 2 and 6 for more information.

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

The federal government has made regulations to protect individuals from the possible health effects of mirex and chlordane. The National Institute for Occupational Safety and Health (NIOSH) recommends that the average workroom air levels of chlordane should not exceed 50 parts per trillion (ppt) over an 8-hour period. EPA suggests that taking into your body each day an amount equal to 200 picograms (pg) of mirex per kilogram (kg) of your body weight is not likely to cause any significant (noncancer) harmful health effects. The Food and Drug Administration (FDA) has determined that concentrations of mirex below 100 ppt in fish and other foods are not likely to harm people who eat these foods. EPA has set a limit of 1 ppt in surface waters to protect aquatic life from the harmful effects of mirex. FDA has determined that concentrations of chlordane below 400 ppt in fish, crabs, and shellfish are not likely to harm people who eat these foods.

For more information on rules and standards for mirex and chlordane, see Chapter 7.

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

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This agency can also tell you where to find occupational and environmental health clinics. These clinics specialize in the recognition, evaluation, and treatment of illness resulting from exposure to hazardous substances.

