

1. PUBLIC HEALTH STATEMENT

This statement was prepared to give you information about endrin and to emphasize the human health effects that may result from exposure to it. 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 clean-up activities. Endrin has been found in at least 120 (8.4%) of the current or former NPL sites. Endrin ketone has been found in at least 37 sites of the current or former sites on the NPL. However, the number of NPL sites evaluated for endrin ketone is not known. As the EPA evaluates more sites, the number of sites at which endrin ketone is found may increase. This information is important because exposure to endrin may cause harmful health effects and because these sites are potential or actual sources of human exposure to endrin.

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 endrin, 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, sex, nutritional status, family traits, lifestyle, and state of health.

1.1 WHAT IS ENDRIN?

This toxicologic profile focuses on endrin, but because of its close association to both endrin aldehyde and endrin ketone, the profile includes studies with data relevant to human exposure to these compounds when available.

Endrin is a solid, white, almost odorless substance that was used as a pesticide to control insects, rodents, and birds. Endrin has not been produced or sold for general use in the United States since 1986. Little is known about the properties of endrin aldehyde, an impurity and breakdown product of endrin, or endrin ketone, which is a product of endrin when it is exposed to light.

Further information on the properties and uses of endrin, endrin aldehyde, and endrin ketone is in Chapters 3 and 4.

1.2 WHAT HAPPENS TO ENDRIN WHEN IT ENTERS THE ENVIRONMENT?

Endrin does not dissolve very well in water. It has been found in ground water and surface water, but only at very low levels. It is more likely to cling to the bottom sediments of rivers, lakes, and other bodies of water. Endrin is generally not found in the air except when it was applied to fields during agricultural applications.

The persistence of endrin in the environment depends highly on local conditions. Some estimates indicate that endrin can stay in soil for over 10 years. Endrin may also be broken down by exposure to high temperatures (230 (C) or light to form primarily endrin ketone and endrin aldehyde.

It is not known what happens to endrin aldehyde or endrin ketone once they are released to the environment; however, the amount of endrin broken down to endrin aldehyde or endrin ketone is very small (less than 5%). Chapter 5 has information on the presence of endrin, endrin aldehyde, or endrin ketone in the environment.

1.3 HOW MIGHT I BE EXPOSED TO ENDRIN?

Since endrin is no longer produced or used in the United States, you can probably be exposed to it only in areas where it is concentrated, such as a hazardous waste site. You may be exposed to endrin in air, water, or soil if you live near a hazardous waste site. Endrin has been detected at 120 (8.4%) such sites. Children living near hazardous waste sites could be exposed to endrin in contaminated soils, if they eat dirt. Detection of endrin in ground water or drinking water is rare. In the U.S. EPA 1989 National Pesticide in Groundwater Study, in which ground water was collected from areas with significant agricultural land uses as well as urban areas, only two wells were found with detectable levels of endrin. In wells drilled to access ground water near hazardous waste sites, 1.3% of 156 Resource Conservation and Recovery Act (RCRA) sites and 0.9% of 178 Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) or Superfund sites had detectable levels of endrin in the early 1980s. No information about the presence of endrin aldehyde or endrin ketone in the environment was found.

You may also be exposed to endrin by eating foods that contain endrin. Before cancellation of endrin use, reported concentrations of endrin in domestic and imported food samples ranged from 0.05 to 0.50 parts per million (ppm; where 1 ppm = 1 microgram per gram ($\mu\text{g/g}$) of food). However, no endrin was detected in food samples from a Texas survey and only 0.084% of over 13,000 food samples were found to contain endrin in 1989 after cancellation of endrin use. Endrin was found in less than 1% of all food sampled by the U.S. Food and Drug Administration (FDA) in 1991. Because endrin is no longer used in the United States, residues on imported foods are the main source of potential human exposure in food. The levels of endrin aldehyde or endrin ketone in foods are not known.

Endrin levels can build up (bioaccumulate) in the tissues of organisms that live in water. In the 1986 EPA National Study of Chemical Residues in Fish, concentrations of endrin were found in fish at 11% of 362 sites surveyed (average 1.69 parts per billion [ppb; where 1 ppb = 1 nanogram per gram (ng/g) of food]; maximum 162 ppb). Endrin was also detected in 21 of 31 samples of 2 commercial shrimp species from a Gulf Coast estuary receiving both

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industrial discharges, and urban and agricultural runoff. The average concentration was 1,070 and the maximum concentration was 9,470 ppb. Levels of endrin have probably declined, even in such polluted areas, since using endrin was banned.

Endrin has been detected in human breast milk (0.02-6.24 milligrams endrin in each kilogram milk fat [mg/kg]); this may be a route of exposure for nursing infants. However, no studies of endrin in breast milk in United States or Canadian populations have been conducted.

Further information on the ways you may be exposed to endrin is in Chapter 5.

1.4 HOW CAN ENDRIN ENTER AND LEAVE MY BODY?

Endrin and endrin aldehyde can enter your body when you eat foods or drink beverages or breathe air that contain this substance, or when it comes in contact with your skin. When endrin enters your body in any of these ways, it is rapidly changed into other substances. Endrin and its metabolic breakdown products are rapidly removed from the body, usually within a few days, through the urine and feces. There is some evidence that small amounts of endrin may remain in the fatty tissue of your body when you are exposed to high levels. No information is known about how endrin aldehyde or endrin ketone leaves the body.

Further information on endrin uptake and excretion is in Chapter 2.

1.5 HOW CAN ENDRIN AFFECT MY HEALTH?

Exposure to endrin can cause various harmful effects including death and severe central nervous system (brain and spinal cord) injury. Swallowing large amounts of endrin (more than 0.2 mg/kg of body weight) may cause convulsions and kill you in a few minutes or hours.

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Symptoms that may result from endrin poisoning are headache, dizziness, nervousness, confusion, nausea, vomiting, and convulsions. Some of these symptoms may continue for weeks after exposure to high doses of endrin.

No long-term health effects have been noted in workers, either in factories or during field applications, who have been exposed to endrin by breathing or touching it.

Studies in animals confirm that endrin's main target is the nervous system, probably because the brain and other parts of the nervous system contain much fatty tissue, and endrin tends to stay in those tissues. Birth defects, especially abnormal bone formation, have been seen in some animal studies. While there are no human data on birth defects, evidence in rodents suggests that exposure to high doses of endrin during pregnancy could be a health risk to developing fetuses.

In studies using rats, mice, and dogs, endrin did not produce cancer. However, most of these studies did not accurately evaluate the ability of endrin to cause cancer. No significant excess of cancer has been found in exposed factory workers, although endrin metabolites have been detected in their urine. The EPA has determined that endrin is not classifiable as to its human carcinogenicity because there is not enough information to allow classification. Endrin has also not been classified for carcinogenic effects by the Department of Health and Human Services (DHHS) or the International Agency for Research on Cancer (IARC).

One study in rodents suggests that exposure to endrin aldehyde or endrin ketone may cause liver disease. No other studies were found on how endrin aldehyde or endrin ketone can affect your health.

Further information on the health effects of endrin is in Chapter 2.

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

If you are exposed to endrin, the chemical can be detected in your blood, breast milk, or fatty tissue. Tests can measure endrin in the blood or fat of people recently exposed. Endrin is cleared from the blood rapidly, so samples should be taken within 1-2 weeks of exposure. Since special analytical equipment is needed (see Chapter 6), these tests are not routinely performed in doctors' offices. Although these tests can be used to confirm that a person has been exposed to endrin, it is not yet possible to use those tests to predict the type or severity of any health effects that might occur. Endrin metabolites have been found in urine (0.001-0.14 micrograms per milliliter [μmL]; where $1 \mu\text{mL} = 1 \text{ ppm}$) and feces of workers exposed to endrin.

Further information on how endrin levels can be measured in exposed persons is in Chapter 6. No information is available on tests for exposure to endrin aldehyde or endrin ketone.

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

In order to protect people from potential health effects, the EPA banned the production and use of endrin in the United States in 1986. The EPA's proposed maximum contaminant level (MCL) in drinking water is 0.0002 milligrams per liter (mg/L; $1 \text{ mg/L} = 1 \text{ ppm}$). The EPA has also set health advisories which are levels of a chemical in water that are safe. The 1-day and 10-day health advisories for endrin are 0.02 mg endrin per liter of water for both children and adults. The longer-term health advisories for children and adults are 0.003 mg/L and 0.01 mg/L, respectively. The lifetime health advisory for children and adults is 0.002 mg/L. The EPA recommends an ambient water quality criteria level of 0.001 mg/L to protect human health.

The National Institute of Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA) have established a limit of 0.1 mg endrin per cubic

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meter of air (0.1 mg/m^3) averaged over an 8-hour day in an occupational setting for a 40-hour work week. In addition, NIOSH considers that a person could escape within 30 minutes from a concentration of $2,000 \text{ mg/m}^3$ without respiratory protection and without experiencing any escape-impairing or irreversible health effects.

More detailed information on federal and state regulations related to endrin is in Chapter 7. No information can be found on government regulations for endrin aldehyde or endrin ketone.

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, Mailstop 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.

