

1. PUBLIC HEALTH STATEMENT

This public health statement tells you about endosulfan 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. Endosulfan has been found in at least 164 of the 1,577 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 endosulfan 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 endosulfan 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 endosulfan 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 endosulfan, 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 ENDOSULFAN?

Endosulfan is a manufactured pesticide. It is used to control a number of insects on food crops such as grains, tea, fruits, and vegetables and on nonfood crops such as tobacco and cotton. It is also used as a wood preservative.

Endosulfan is sold as a mixture of two different forms of the same chemical (referred to as α - and β -endosulfan). It is a cream- to brown-colored solid that may appear crystalline or in flakes. It has a distinct odor similar to turpentine. Endosulfan does not burn.

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1.2 WHAT HAPPENS TO ENDOSULFAN WHEN IT ENTERS THE ENVIRONMENT?

Endosulfan enters air, water, and soil when it is manufactured or used as a pesticide. Endosulfan is often applied to crops using sprayers. Some endosulfan in the air may travel long distances before it lands on crops, soil, or water. Endosulfan on crops usually breaks down within a few weeks. Endosulfan released to soil attaches to soil particles. Endosulfan found near hazardous waste sites is usually found in soil. Some endosulfan in soil evaporates into air, and some endosulfan in soil breaks down. However, it may stay in soil for several years before it all breaks down. Rainwater can wash endosulfan that is attached to soil particles into surface water. Endosulfan does not dissolve easily in water. Most endosulfan in surface water is attached to soil particles floating in the water or attached to soil at the bottom. The small amounts of endosulfan that dissolve in water break down over time. Depending on the conditions in the water, endosulfan may break down within 1 day or it may take several months. Some endosulfan in surface water evaporates into air and breaks down. Because it does not dissolve easily in water, only very small amounts of endosulfan are found in groundwater (water below the soil surface; for example, well water). Animals that live in endosulfan-contaminated waters can build up endosulfan in their bodies. The amount of endosulfan in their bodies may be several times greater than in the surrounding water. More information on the chemical and physical properties of endosulfan can be found in Chapter 3. More information on its occurrence and fate in the environment can be found in Chapter 5.

1.3 HOW MIGHT I BE EXPOSED TO ENDOSULFAN?

The most likely way for people to be exposed to endosulfan is by eating food contaminated with it. Endosulfan has been found in some food products such as oils, fats, and fruit and vegetable products. You can also be exposed to low levels of endosulfan by skin contact with contaminated soil or by smoking cigarettes made from tobacco that has endosulfan residues on it. Well water and public water supplies are not likely sources of exposure to endosulfan. Workers can breathe in the chemical when spraying the pesticide on crops. If you are a farmer who works with vegetable or tobacco crops, or if you work in a greenhouse to grow flowers like chrysanthemums, you may use endosulfan to control insects. Exposure can occur by breathing

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the dust or getting the pesticide on your skin if you do not follow all the safety and handling procedures. Accidental spills and releases to the environment at hazardous waste disposal sites are also possible sources of exposure to endosulfan. The most likely exposure to endosulfan for people living near hazardous waste sites is through contact with soils containing it.

Endosulfan is usually not found in the air, and it is not found in soil and water very often. When endosulfan is found in soil and water, levels of less than 1 part of endosulfan in 1 billion parts of surface water (ppb) and less than 1 part of endosulfan in 1 million parts of soil (ppm) have been reported. For more information on human exposure to endosulfan, see Chapter 5.

1.4 HOW CAN ENDOSULFAN ENTER AND LEAVE MY BODY?

If you breathe air containing dust contaminated with endosulfan, it can enter your body through your lungs and pass into the bloodstream. We do not know how much of the endosulfan will pass into your bloodstream or how fast this will happen. If you swallow food, water, or soil contaminated with endosulfan, it will enter your body and some will pass from your stomach into the bloodstream, but we do not know how much or how fast this will occur. However, studies in animals show that endosulfan passes slowly through the stomach into the body tissues after it is taken in by mouth. If you touch soil containing endosulfan (for example, at a hazardous waste site), some endosulfan will pass through the skin into the bloodstream, but we do not know how much or how fast this will occur. Studies in animals also show that when endosulfan is applied to the skin, it passes slowly through the skin into the body tissues. If you have cuts on your skin or if you have covered your skin with oils or oily lotions, endosulfan will pass through the skin faster. Much of the endosulfan that you swallow leaves in the feces without actually entering the body tissues. For people living around waste sites or processing or storage facilities, the most likely way it will enter their bodies is from skin contact or breathing contaminated dusts. Once endosulfan is in the body, it may change in the liver and kidneys into other related chemicals called metabolites. Endosulfan and the metabolites leave your body in the urine and feces within a few days or a few weeks. Chapter 2 has more information on how endosulfan enters and leaves the body.

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1.5 HOW CAN ENDOSULFAN AFFECT MY HEALTH?

Symptoms of endosulfan poisoning have been seen in some people who were exposed to very large amounts of this pesticide during its manufacture. Symptoms of endosulfan poisoning have also been seen in people who intentionally or accidentally ate or drank large amounts of endosulfan. Most of these people experienced convulsions or other nervous system effects. Some people who intentionally ate or drank large amounts of endosulfan died. The health effects in people exposed to smaller amounts of endosulfan for longer periods are not known. We do not know whether endosulfan has ever affected the ability of people to fight disease or has ever caused cancer in people. The Department of Health and Human Services (DHHS) (National Toxicology Program), the International Agency for Research on Cancer (IARC), and EPA have not classified endosulfan as to its ability to cause cancer.

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.

Results from animal studies show that exposure to very large amounts of endosulfan for short periods can cause adverse nervous system effects (such as hyperexcitability, tremors, and convulsions) and death. Because the brain controls the activity of the lungs and heart, lethal or near-lethal exposures in animals have also resulted in failure of these organs. Other effects seen in animals after short-term, high-level exposures include harmful effects on the stomach, blood, liver, and kidneys. One animal study suggested that after somewhat longer exposures, there is a possibility that the body's ability to fight infection may be impaired; however, this was not

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directly demonstrated. The kidneys, testes, and possibly the liver are the only organs in laboratory animals affected by longer term exposure to low levels of endosulfan. The seriousness of these effects is increased when animals are exposed to higher concentrations of endosulfan. Because these effects occurred in animals, they might also occur in humans. Limited studies in animals show no evidence that endosulfan causes cancer in animals. Some studies in animals have shown that endosulfan causes damage to the genetic material within cells.

For more information on how endosulfan can affect your health, see Chapter 2.

1.6 HOW CAN ENDOSULFAN 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 can be exposed to endosulfan by eating food contaminated with the pesticide, by accidentally ingesting the pesticide if it is stored around the house, or by breathing air contaminated with the pesticide if it is sprayed on nearby fields. There are no known unique exposure pathways for children. We do not know if children's intake of endosulfan per kilogram of body weight is different than that of adults.

There have been no studies of health effects in young children exposed to endosulfan. Adults who accidentally or intentionally ingested amounts of endosulfan much greater than those found in the environment suffered convulsions and some died. The same adverse effects would probably occur in young children if they ingested large amounts of endosulfan. We do not know whether children differ from adults in their susceptibility to health effects from endosulfan exposure.

We do not know whether endosulfan affects the ability of people to have children or whether it causes birth defects in children. Studies in animals showed no evidence that endosulfan affects the ability of animals to have babies. Some studies show that large amounts of endosulfan

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damage the testes, but it is unknown whether such large amounts affect the ability of animals to reproduce. Pregnant animals given endosulfan by mouth had some offspring with low birth weight and length, and some with skeletal variations. Often, these effects were seen at doses where the pregnant animals themselves showed signs of poisoning by the endosulfan. Because these effects occurred in animals, they might also occur in humans. We do not know for certain whether endosulfan or its breakdown products can cross the placenta, but it is likely that they can do so. Endosulfan has been found in human breast milk, but results of studies in animals that ate endosulfan while nursing their young suggest that only very small amounts of endosulfan can find their way into breast milk. More information on this topic can be found in Sections 2.7 and 5.6.

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

If your doctor finds that you have been exposed to significant amounts of endosulfan, ask whether your children might also be exposed. Your doctor might need to ask your state health department to investigate.

Endosulfan is a pesticide used in commercial agriculture and home gardening. Endosulfan has been found in some food items but in amounts much lower than those allowed by the EPA and the Food and Drug Administration (FDA). Still, it is a good idea to wash fruits and vegetables before consuming them.

Young children can sometimes be exposed to pesticides by playing in an area too soon after a pesticide has been applied. Carefully read and follow the directions on the pesticide label about how long to wait before re-entering the treated area. Pesticides and household chemicals should be stored out of the reach of young children to prevent accidental poisoning. Always store pesticides and household chemicals in their original labeled containers; never store pesticides or household chemicals in containers which young children would find attractive, such as old soda bottles.

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Your children may be exposed to endosulfan if unqualified people apply pesticides around your home. In some cases, the use of pesticides that have been banned for use in homes has turned homes into hazardous waste sites. Your state licenses each person qualified to apply pesticides using EPA standards and further certifies each person qualified to apply “restricted use” pesticides. Ask to see the license and certification of anyone who applies pesticides for you. Also ask for the brand name of the pesticide, a material safety data sheet (MSDS), the name of the product's active ingredient, and the EPA registration number. Ask whether EPA has designated the pesticide “for restricted use” and what the approved uses are. This information is important if you or your family have a reaction to the product.

If you buy over-the-counter pesticide products to apply yourself, be sure the product is in an unopened pesticide container that is labeled and has an EPA registration number. You should be careful to follow the instructions on the label. If you plan to spray inside a building or your home, check to see if the pesticide is intended for indoor use. If you feel sick after a pesticide has been used in your home, see your doctor or call the local poison control center.

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

Endosulfan and its breakdown products can be measured in your blood, urine, and body tissues if you have been exposed to a large amount. Tests to measure endosulfan in such bodily tissues or fluids are not usually available at a doctor's office because special equipment is needed.

However, a sample taken in the doctor's office can be properly packed and shipped to a special laboratory, if necessary. Because endosulfan leaves the body fairly quickly, these methods are useful only for finding exposures that have occurred within the last few days. At this time, these methods can only be used to prove that a person has been exposed to endosulfan. The test results cannot be used to predict if you will have any adverse health effects. Exposure to other chemicals at the same time at hazardous waste sites could cause some confusion in understanding these results. More information about tests to find endosulfan in the body is presented in Chapters 2 and 6.

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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 endosulfan include the following:

The federal government has set standards and guidelines to protect people from the possible adverse health effects of endosulfan in drinking water and food. EPA recommends that the amount of endosulfan in lakes, rivers, and streams should not be more than 74 micrograms per liter ($\mu\text{g/L}$) or 74 parts per billion (74 ppb). This should prevent any harmful health effects from occurring in people who drink the water or eat fish or seafood that live in the water. FDA allows no more than 24 parts per million (24 ppm) of endosulfan on dried tea, and EPA allows no more than 0.1 to 2 ppm endosulfan on other raw agricultural products.

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NIOSH recommends that workers should not breathe air that contains more than 0.1 milligram (mg) of endosulfan per cubic meter of air (0.1 mg/m^3) during a 10-hour workday, 40-hour workweek. For more information on limits and standards for endosulfan exposure, see Chapter 7.

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: 1-888-42-ATSDR (1-888-422-8737)
Fax: (404) 639-6359

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 22161
Phone: (800) 553-6847 or (703) 605-6000

