

1. PUBLIC HEALTH STATEMENT

This public health statement tells you about methoxychlor 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. Methoxychlor has been found in at least 58 of the 1,613 current or former NPL sites. However, the total number of NPL sites evaluated for methoxychlor is not known. As more sites are evaluated, the sites at which methoxychlor is found may increase. This information is important because exposure to methoxychlor 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 methoxychlor, 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 METHOXYCHLOR?

Methoxychlor, also known as DMDT, Marlate[®], or Metox[®], is a manufactured chemical now used in the United States for controlling insects. Methoxychlor is effective against flies, mosquitos, cockroaches, and a wide variety of other insects. This insecticide is used on agricultural crops and livestock, and in animal feed, barns, and grain storage bins. Some pesticide products that contain methoxychlor are used for controlling insects in gardens or on pets.

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Pure methoxychlor is a pale-yellow powder that has a slightly fruity or musty odor. It does not readily evaporate into air or dissolve in water. Pesticide workers usually dissolve methoxychlor in a petroleum-based liquid and apply it as a spray, or they mix it with other chemicals and apply it as a dust. Application of methoxychlor as an insect killer accounts for most of the methoxychlor that enters the environment. Since the use of methoxychlor is highly seasonal, the amount that is released to the environment tends to be greater during periods of insect control (spring and summer). Some methoxychlor is released to the environment from chemical manufacturing plants that make methoxychlor or from manufacturing sites that formulate products containing methoxychlor. A small amount may also be released from hazardous waste sites where it has been disposed of.

More complete information on the sources, properties, and uses of methoxychlor can be found in Chapters 4 and 5 of this profile.

1.2 WHAT HAPPENS TO METHOXYCHLOR WHEN IT ENTERS THE ENVIRONMENT?

Methoxychlor does not occur naturally in the environment. Most methoxychlor enters the environment when it is applied to forests, agricultural crops, and farm animals. Methoxychlor can be applied to forests and crops by aerial spraying. This process can contaminate nearby land and water. Methoxychlor that is released into the air will eventually settle to the ground, although some may travel long distances before settling. Rain and snow cause methoxychlor to settle to the ground more quickly.

Once methoxychlor is deposited on the ground, it becomes bound to the soil. Because of this, methoxychlor does not tend to move rapidly from one place to another. However, soil particles that contain methoxychlor can be blown by the wind or be carried by rainwater or melted snow into rivers or lakes. Most methoxychlor stays in the very top layer of soil, but some of the products that it breaks down into may move deeper into the ground. Smaller amounts of methoxychlor in air may settle directly into rivers, lakes, and other surface waters. Once

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methoxychlor is in water, it usually binds to sediments or organic matter and settles to the bottom.

Methoxychlor is broken down in the environment by several processes. However, these processes are slow and may take months. In soil, some methoxychlor is broken down by bacteria and other microorganisms, and some is broken down by a reaction with water or materials in soil. In air and water, some methoxychlor is broken down by sunlight. Methoxychlor is also broken down by reactive chemicals normally present in the air. Some of the breakdown products are capable of producing harmful effects similar to those caused by exposure to methoxychlor.

Methoxychlor can accumulate in some living organisms, including algae, bacteria, snails, clams, and some fish. However, most fish and animals change methoxychlor into other substances that are rapidly released from their bodies, so methoxychlor does not usually build up in the food chain.

More complete information on the environmental fate of methoxychlor can be found in Chapter 6 of this profile.

1.3 HOW MIGHT I BE EXPOSED TO METHOXYCHLOR?

Most people are not exposed to methoxychlor on a regular basis. Although methoxychlor is not usually detected in air, people can be exposed to low levels of methoxychlor by inhaling dusts and aerosols in air surrounding areas where methoxychlor is used. Since methoxychlor is not usually detected in surface or well water sources, exposure from drinking water is not likely to be significant for the general public. However, surface water that has been treated with methoxychlor for control of insect larvae should be avoided until methoxychlor residue has decreased below the level of concern. Methoxychlor is not usually found in food. However, low levels are sometimes detected in foods obtained from areas where methoxychlor has been used.

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Fish usually do not contain detectable levels of methoxychlor, but people who eat fish caught in water contaminated with methoxychlor may occasionally have above-average intakes of methoxychlor.

People who make or use methoxychlor may be exposed by breathing in the dust or aerosol, or by getting it on their skin. For example:

- C If you work in a factory that makes methoxychlor or products containing methoxychlor, you could be exposed to methoxychlor in air or on your skin during work hours. The government has estimated that approximately 3,400 people may be exposed to methoxychlor in this way.

- C Methoxychlor is present in some pesticides used for home gardening or for spraying pets (such as cats and dogs). If you use these products, you could be exposed to above-average levels of methoxychlor in air and on your skin.

- C If you live or work on or near a farm where methoxychlor is used on crops or livestock, you could be exposed to above-average levels of methoxychlor in air, soil, and possibly in water.

If you live near a hazardous waste site that contains methoxychlor, you could be exposed by breathing in methoxychlor from the air, by swallowing contaminated soil or water, or by getting contaminated soil or water on your skin. The amount of exposure you receive depends on conditions specific to where you live and can only be evaluated on a case-by-case basis.

More information on how you may be exposed to methoxychlor can be found in Chapter 6.

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1.4 HOW CAN METHOXYCHLOR ENTER AND LEAVE MY BODY?

Scientists do not know how much or how quickly methoxychlor is absorbed into your body if you breathe it in or if it contacts your skin. If you get methoxychlor-contaminated soil or water on your skin, some of it may pass through your skin and enter your bloodstream. If you breathe methoxychlor-containing dust into your lungs, some of the dust will deposit in your lungs. Dust that deposits in the upper part of your lungs is likely to be coughed up and swallowed. Dust that deposits deep in your lungs is likely to remain long enough for the methoxychlor to pass through the lining of your lungs and enter your bloodstream. If you swallow food, water, or soil containing methoxychlor, most of it will rapidly pass through the lining of your stomach and intestines and enter your bloodstream.

Once methoxychlor enters your bloodstream, it is distributed to all parts of your body. Animal studies suggest that methoxychlor is changed into other substances called metabolites by your liver. Most of these metabolites leave your body within 24 hours, primarily in your feces, with lesser amounts in your urine. Some methoxychlor can enter the fat in your body, but methoxychlor does not accumulate or build up in fat.

More information on how methoxychlor enters and leaves your body can be found in Chapter 3.

1.5 HOW CAN METHOXYCHLOR 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

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compassion. Laws today protect the welfare of research animals, and scientists must comply with strict animal care guidelines.

Very few reports exist on the health effects of methoxychlor in humans. In animals, exposure to high levels of methoxychlor caused effects on the nervous system. These effects included tremors, convulsions, and seizures. These effects are probably caused by methoxychlor itself and not by its metabolites. Because methoxychlor is quickly transformed into metabolites by the liver, you are not likely to experience nervous system effects unless you are exposed to very high levels.

Some of the breakdown products of methoxychlor cause effects similar to those produced by estrogen. Estrogens are naturally occurring hormones that are important in women for the development and maintenance of their ovaries, uterus, and breasts, and also play a role in the development of the reproductive system in men. Studies in animals show that exposure to methoxychlor adversely affects the ovaries, uterus, and mating cycle in females, and the testes and prostate in males. Fertility is decreased in both female and male animals. These effects can occur both in adult animals and in developing animals exposed prenatally or shortly after birth. Effects of methoxychlor on reproduction have been studied mainly in animals given methoxychlor in food or water, but it is expected that these effects could occur following inhalation and skin exposures as well. Likewise, it is expected that reproductive effects seen in animals could occur in humans exposed to methoxychlor, but this has not been reported.

There is not enough information available to definitely state whether methoxychlor causes cancer. However, most of the information that we have indicates that methoxychlor does not cause cancer. One very small study in humans indicated a possible link with increased incidence of leukemia. However, a definitive connection between a cause of leukemia and exposure to methoxychlor cannot be made with so little information. Most animal studies with methoxychlor have been negative for cancer. Therefore, the International Agency for Research on Cancer (IARC) has determined that methoxychlor is not classifiable as to its carcinogenicity to humans. Similarly, the EPA has determined that methoxychlor is not classifiable as to its human carcinogenicity.

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More information on how methoxychlor can affect your health can be found in Chapters 2 and 3.

1.6 HOW CAN METHOXYCHLOR 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 likely to be exposed to methoxychlor in the same way as adults, primarily from low-level contamination of food. Other possible sources of methoxychlor exposure for children include swallowing soil, crawling on home carpets, breathing in house dust and residues from methoxychlor-containing pesticides used for home gardening or pet care, and touching work clothes or equipment used to apply products that contain methoxychlor.

Little information is available regarding the effects of methoxychlor in children. Exposure to very high doses of methoxychlor may cause nervous system effects such as tremors or convulsions. The reproductive system is likely to be the most sensitive target of methoxychlor in both adults and children. Methoxychlor is metabolized in the liver to substances that act like estrogen in the body. This probably occurs similarly in children and adults. Estrogens are naturally occurring substances that are necessary for the proper development and function of the male and female reproductive system. Elevated levels of estrogen, or substances like methoxychlor that mimic estrogen, have been shown to disrupt reproductive development and function in animals. This has resulted in early puberty in females, delayed puberty in males, disruption of the reproductive cycle in females, decreased fertility in males and females, and altered hormone levels in the blood. These effects can happen when the exposure occurs before birth or between birth and sexual maturity. It is thought that similar effects could occur in humans, but this has not been reported.

There is no evidence in humans that methoxychlor causes birth defects. Methoxychlor does not cause structural birth defects in animals, but exposure to high levels of methoxychlor during pregnancy caused reduced survival of fetuses. It is unclear whether or at what level of exposure this might occur in humans.

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Methoxychlor or its metabolites can probably be transferred from a pregnant mother to a developing fetus in animals, since abnormal reproductive development has been seen in the newborn animals born to mothers exposed during pregnancy. In animals, methoxychlor and metabolites of methoxychlor that are estrogenic can be transferred from a nursing mother to her newborn babies through breast milk. Methoxychlor and its metabolites can probably cross the placenta and have been detected in human breast milk.

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

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

You can purchase products containing methoxychlor as an over-the-counter pesticide product to apply yourself. If you do purchase such a product, be sure that the product is in an unopened pesticide container that is labeled and contains an EPA registration number. If you plan to apply the pesticide indoors, make sure that the pesticide is approved for indoor use. Be sure to carefully follow the instructions on the label and follow any warning statements. Children can be exposed to pesticides by entering a room or playing on a lawn 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. If you or any member of your family feels sick after a pesticide has been applied, consult your doctor or local poison control center. Pesticides and household chemicals should be stored out of reach of young children to prevent unintentional poisonings. Always store pesticides and household chemicals in their original labeled containers. Never store pesticides or household chemicals in containers that children would find attractive to eat or drink from, such as old soda bottles. Your children may be exposed to methoxychlor if an unqualified person applies pesticides containing it around your home. Make sure that any person you hire is licensed. Your state licenses each person who is qualified to apply pesticides according to EPA standards. Ask to see the license. Also ask for the brand name of the pesticide, a Material Safety Data Sheet (MSDS), the name of the product's active

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ingredient, and the EPA registration number. Ask what are the EPA approved uses. This information is important if you or your family react to the product.

Children may be exposed to methoxychlor if they come in contact with family pets or farm animals that have been treated with the pesticide. Exposure may occur through skin contact with the animal or application devices, or by breathing vapor from animal-dipping solutions and baths. Dipping solution that contains methoxychlor should be disposed of according to the directions on the product label. Waste methoxychlor should never be discarded in any area where children might play.

Although methoxychlor has been found in some foods, it occurs at very low levels. To reduce your family's risk of exposure, you should thoroughly wash all fruits and vegetables before preparing them for consumption.

Methoxychlor may be released to soil and water, especially near hazardous waste sites. Hazardous waste sites are often clearly marked, but children have a tendency to ignore signs that are designed to alert us to dangers. Your children should be encouraged not to play at or near hazardous waste sites. Low levels of methoxychlor have also been found in carpet and house dust.

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

Specific and sensitive tests have been developed to detect methoxychlor in blood, fat, semen, and breast milk of exposed individuals. Because methoxychlor is removed from the body relatively quickly, these tests are only useful in detecting recent exposures (within 24 hours) and are not useful for detecting past exposures to methoxychlor. These tests currently cannot be used to estimate how much methoxychlor you have been exposed to or whether adverse health effects will occur. These tests are not usually performed in a doctor's office because special equipment is required and samples must be sent to a laboratory for testing.

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More information on tests that detect methoxychlor and its metabolites can be found in Chapter 7.

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 methoxychlor include the following:

The federal government has taken several actions to help protect humans from excess exposure to methoxychlor. EPA limits the amount of methoxychlor that may be present in drinking water to 0.04 parts of methoxychlor per million parts of water (0.04 ppm). EPA has also set limits of 1–100 ppm on the amount of methoxychlor that may be present in various agricultural products (crops, fruits, vegetables, grains, meats, milk, and food for livestock). FDA limits the amount of methoxychlor in bottled water to 0.04 ppm. EPA restricts the amount of methoxychlor that may

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be released to the environment during burning or by disposal in landfills. OSHA has set a Permissible Exposure Limit (PEL) of 15 milligrams per cubic meter of air (mg/m^3) for the average amount of methoxychlor that may be present in air during an 8-hour workday. A court decision struck down a proposed PEL of $10 \text{ mg}/\text{m}^3$. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends a Threshold Limit Value (TLV) of $10 \text{ mg}/\text{m}^3$.

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
Web site: <http://www.atsdr.cdc.gov>

* Information line and technical assistance

Phone: 1-888-42-ATSDR (1-888-422-8737)
Fax: 1-404-498-0057

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: 1-800-553-6847 or 1-703-605-6000