

1. PUBLIC HEALTH STATEMENT

This public health statement tells you about malathion 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. Malathion has been found in at least 21 of the 1,623 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 malathion 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 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 malathion, 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/them. 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 MALATHION?

Malathion is a pesticide that is used to kill insects on agricultural crops, on stored products, on golf courses, in home gardens, and in outdoor sites where trees and shrubs are grown at home; it is also used to kill mosquitoes and Mediterranean fruit flies (medflies) in large outdoor areas. Additionally, malathion is used to kill fleas on pets and to treat head lice on humans. It is usually sprayed on crops or sprayed from an airplane over wide land areas, especially in the states of California and Florida. Malathion comes in two forms: a pure form of a colorless liquid and a technical-grade solution (brownish-yellow liquid), which contains malathion (greater than

1. PUBLIC HEALTH STATEMENT

90%) and impurities in a solvent. The technical-grade malathion smells like garlic. Malathion is a manufactured chemical, so it is only found in the environment as a result of its manufacture or use. Malathion has been manufactured in the United States since 1950 and has been used to kill insects on many types of crops since this time. The Food and Drug Administration (FDA) and the EPA allow a maximum amount of 8 parts per million (ppm) of malathion to be present as a residue on specific crops used as foods. Because malathion can be dangerous to humans, the EPA requires that a certain amount of time must pass between the time of application of the insecticide and entry by a worker into a field where the chemical has been applied. Usually, at least 12 hours must pass between application and entry, but in some cases, such as when workers are entering a field to hand harvest or hand prune the crops, time periods as long as 6 days must pass between application and entry into the field. In this way, exposure to malathion can be controlled and accidental exposures can be prevented.

1.2 WHAT HAPPENS TO MALATHION WHEN IT ENTERS THE ENVIRONMENT?

Once malathion is introduced into the environment, usually from spraying on crops or in wide urban/residential areas, droplets of malathion in the air fall on soil, plants, water, or man-made surfaces. While most of the malathion will stay in the areas where it is applied, some can move to areas away from where it was applied by rain, fog, and wind. Malathion stays in the environment from a few days to several months, but is usually broken down within a few weeks. It is broken down to other chemical compounds by water, sunlight, and bacteria found in soil and water. Malathion does not tend to stick to the soil and is rapidly broken down by bacteria; thus, it is unlikely that malathion will reach groundwater in significant amounts. In water, malathion breaks down quickly by the action of the water and the bacteria in the water. In air, malathion is broken down by reacting with other chemicals formed naturally in the air by sunlight, to form a more toxic product called malaaxon. If malathion is present on dry soil or on man-made surfaces such as sidewalks, pavements, or playground equipment, it usually does not break down as fast as it would in moist soil. For more information, see Chapters 4, 5, and 6.

1. PUBLIC HEALTH STATEMENT

1.3 HOW MIGHT I BE EXPOSED TO MALATHION?

Most people are not exposed to malathion in the air that they breathe or on things that they touch, unless they live near areas being sprayed. The people who are at the greatest risk of being exposed to malathion are those who work with this chemical. These include farm workers, chemical sprayers, and people who work in factories that make malathion or other products that contain the chemical. They are exposed to malathion on things they touch where it can pass through their skin, or by breathing it after it has been sprayed. Other people who are at risk of being exposed to malathion are those who use it near their homes and in their gardens, and people living in areas where malathion is sprayed to control medflies or mosquitos.

Overexposure to malathion may cause severe poisoning or death. Persons may be exposed to dangerous amounts if they go into fields too soon after spraying. The people most likely to be exposed to malathion can be protected by wearing special clothing and breathing equipment and by staying out of sprayed fields for the appropriate amount of time for the job that they are going to do in the field; this amount of time can be up to 6 days.

Individuals can also be exposed to malathion if they live near landfills where malathion has been dumped or near water containing malathion that washes off nearby land or that is accidentally spilled. The greatest amounts of malathion are expected to be present near or on the farms where malathion is used. After spraying, some malathion can be transported by the wind or fog to areas away from where it is used, but the amounts present at these locations are not expected to be at dangerous levels. In a collection of data gathered by the EPA for the years 1971–1991, it was reported that malathion was only found in a total of 12 groundwater monitoring wells in three states. The most that was found in any of the wells was 6.17 parts of malathion per billion parts of water (ppb); this was found in a county in Virginia that is made up mainly of agricultural and forested land. More recent studies of water samples taken near where malathion was sprayed indicate that malathion is not usually found in groundwater. The risk of exposure to malathion from drinking groundwater appears to be low. For more information, see Chapter 6.

Malathion is approved for use on crops, in homes and gardens, in urban/residential areas where mosquitos or medflies pose a problem, and at agricultural sites. The maximum amount of malathion residue allowed by the FDA and EPA on crops used as food is 8 ppm of malathion.

1. PUBLIC HEALTH STATEMENT

The FDA has monitored the food supply for pesticides for a number of years. FDA purchases many kinds of foods through Total Diet Studies (also called Market Basket Surveys) and analyzes them for residue levels of pesticides. These FDA studies allow scientists to estimate the daily intake of pesticides. Generally, the FDA monitoring studies conclude that the U.S. food supply contains only very small amounts of pesticides that are not a concern. For more information, see Section 1.7 and Chapter 6.

1.4 HOW CAN MALATHION ENTER AND LEAVE MY BODY?

For the general population, the most likely way that malathion can enter the body is by eating or drinking contaminated food or water or through dermal contact with contaminated plants, soils, or surfaces such as playground equipment or pavements. It can also enter your body if you breathe air containing malathion during or after it has been sprayed for public health uses. By any means of exposure, malathion enters your body quickly and passes into the bloodstream.

Once in your bloodstream, malathion can go to many organs and tissues. Most of the malathion is broken down in your liver into other substances, called metabolites. One of these metabolites is more harmful than malathion. Malathion and its metabolites do not tend to accumulate in the body, and leave mostly in your urine within a few days.

See Chapter 3 for more information on how malathion enters and leaves the body.

1.5 HOW CAN MALATHION AFFECT MY HEALTH?

Malathion interferes with the normal function of the nervous system. Because the nervous system controls many other organs, malathion indirectly can affect many additional organs and functions. Exposure to high amounts of malathion in the air, water, or food may cause difficulty breathing, chest tightness, vomiting, cramps, diarrhea, watery eyes, blurred vision, salivation, sweating, headaches, dizziness, loss of consciousness, and death. If persons who are exposed accidentally or intentionally to high amounts of malathion are rapidly given appropriate treatment, there may be no long-term harmful effects. If people are exposed to levels of

1. PUBLIC HEALTH STATEMENT

malathion below those that affect the function of the nervous system, few or no health problems seem to occur. This has been shown in studies with volunteers who inhaled or swallowed small known amounts of malathion. There is no evidence that malathion affects the ability of humans to reproduce. There is also no conclusive proof that malathion causes cancer in humans, although some studies have found increased incidence of some cancers in people who are regularly exposed to pesticides, such as farmers and pesticide applicators. The International Agency for Research on Cancer (IARC) has determined that malathion is unclassifiable as to carcinogenicity to humans.

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.

Studies in animals have observed the same effects that occur in humans after exposure to malathion. This is because malathion also affects the nervous system of animals. Some studies in animals suggest that malathion may produce subtle changes in the immune system, but there was no evidence indicating that those animals were more susceptible to infections than animals that were not given malathion. Some studies in male rats observed temporary alterations in the testes following short-term exposure to malathion, but there is no evidence that exposure to malathion affected the reproductive ability of these animals. A longer-term study that evaluated the ability of rats to reproduce did not detect any harmful effects. Most studies of cancer in animals have not shown evidence of carcinogenicity for malathion, or have shown evidence of cancer at doses considered excessive. Still, there is some disagreement among scientists on how to interpret the results. The EPA has determined that there is suggestive evidence of

1. PUBLIC HEALTH STATEMENT

carcinogenicity for malathion in animals but it is not sufficient to assess potential carcinogenicity in humans. See Chapter 3 for more information on how malathion can affect your health.

1.6 HOW CAN MALATHION 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 malathion from food and drinking water, but these risks are low and not of concern. Because malathion is a widely used pesticide, greater concern exists from exposure following application to recreational areas, parks, and playgrounds and from home and garden uses of malathion. Children can also be exposed when malathion is sprayed, for example, to control mosquitos. Because children spend more time outdoors than adults, they may be at a greater risk of exposure to malathion than adults. Because of their smaller weight, children's intake of malathion per kilogram of body weight may be greater than that of adults. The EPA permits residues of pesticides to be present in crops used as food, and these amounts are considered to be safe. Children may be exposed also by dermal contact with contaminated surfaces or by placing contaminated objects in their mouths.

The main target of malathion toxicity in children is the nervous system, the same as in adults. Children who have accidentally swallowed high amounts of malathion or who had skin contact with high amounts of malathion experienced difficulty breathing, chest tightness, vomiting, cramps, diarrhea, watery eyes, salivation, sweating, headaches, dizziness, and loss of consciousness, and some died. We do not know whether or not children are more susceptible than adults to malathion toxicity. However, studies in animals have shown that very young animals are more susceptible than older ones when exposed to high amounts of malathion.

There is no evidence that exposure to malathion at levels found in the environment causes birth defects or other developmental effects in people. Malathion has caused adverse developmental effects in animals, but only when administered to the pregnant mothers in amounts high enough to affect the health of the mothers. A study of people in California found that the use of

1. PUBLIC HEALTH STATEMENT

pesticides, malathion among them, at home during pregnancy did not increase the risk of brain tumors in children.

Animal studies have shown that malathion and/or its breakdown products can be transferred from a pregnant mother to the developing fetus and that it can also be passed to newborn animals in the maternal milk. There is no information in humans regarding transfer of malathion to the fetus or to nursing infants.

More information regarding children's health and malathion can be found in Section 3.7.

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

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

The general population is not likely to be exposed to large amounts of malathion. The populations living in the areas where malathion is used on crops or those who use the insecticide extensively in their gardens or near their homes, however, may be exposed to greater amounts of malathion. Malathion is often detected in foods and air samples collected where malathion is used. People who live close to areas of malathion use, such as where it is sprayed over urban/residential areas to control medflies or mosquitos, may also be exposed to larger amounts of malathion, because small amounts of the pesticide will move from the place where it is used to nearby areas. These exposures may take place during activities such as touching contaminated plants, soils, or man-made surfaces such as playground equipment, sidewalks, or pavements; breathing the mist formed from the sprayed chemical; drinking contaminated water; or eating recently sprayed fruits and vegetables. People who are most likely to receive the highest exposures are those who work in the factories that make malathion or make products that contain the insecticide, workers who spray it on crops, and farmers. Entry of malathion into the body after contact with the skin is expected to be the major exposure pathway for those working in these operations. Breathing the mist containing malathion may also occur.

1. PUBLIC HEALTH STATEMENT

Families can reduce the risk of exposure to malathion in the soil, on plants, or in the air by staying away from fields that have been recently sprayed. If families wait at least a week before entering sprayed fields, then the amount of malathion present in the air or on plants is expected to be small. In areas where malathion is sprayed to control medflies or mosquitos, families may reduce the risk of exposure to the chemical by remaining inside during the spraying periods, and by washing their hands and clothes if they come into contact with sprayed surfaces within a few days of the spraying. For children who play in dry sand boxes, on sidewalks, or on playground equipment that is located in or near the treated areas, the amount of time that caution should be used (that is, the time during which they should make sure to wash thoroughly after contact with sprayed surfaces) may need to be longer. Families may also reduce the risk of exposure to malathion by wearing protective equipment, such as gloves, when applying the insecticide in their homes and gardens, and washing their hands and clothes after they have been in a backyard garden or yard that has been treated with the insecticide. Foods grown in a garden treated with malathion may contain some of the residues on their surface. To reduce the risk of exposure to malathion that may occur when contaminated vegetables or other produce grown in a backyard garden is eaten, it is important to wash the foods prior to eating them.

Families should also be aware that sometimes malathion could be illegally sprayed inside the home to kill insects. Your children may be exposed to malathion if either you or another person applies pesticides containing it in your home. In some cases, the improper use of pesticides not intended for indoor use in homes has turned homes into hazardous waste sites. Make sure that any person you hire is licensed and, if appropriate, certified to apply pesticides. Your state licenses each person who is qualified to apply pesticides according to EPA standards and further certifies each person who is qualified to apply "restricted use" pesticides. Ask to see the license and certification. 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 react to the product. If you buy over-the-counter pesticides products to apply yourself, be sure the products are in unopened pesticide containers that are labeled and contain an EPA registration number. Carefully follow the instructions on the label. If you plan to spray inside, make sure the products are intended for indoor use and are in unopened pesticide containers that are labeled and contain an EPA

1. PUBLIC HEALTH STATEMENT

registration number. Carefully follow the instructions on the label. If you feel sick after a pesticide has been used in your home, consult your doctor or local poison control center.

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

There are tests available to determine whether you have been exposed to malathion. Breakdown products of malathion can be measured in the urine, but the tests need to be conducted within days of the exposure since these products are eliminated fairly rapidly. These tests, however, do not predict whether or not the exposure to malathion will produce harmful health effects. Another type of test measures the levels of a substance called cholinesterase in your blood. This test is not specific for malathion, but can be used to determine exposure to many other substances that act in a way similar to malathion. If the levels of cholinesterase in your blood are less than half of what they should be, then you may get symptoms of poisoning. Smaller decreases in cholinesterase may only indicate that you have been exposed to malathion or similar substances, but you will not necessarily experience harmful effects. Cholinesterase levels in the blood can stay low for months after you have been exposed to malathion or similar chemicals. For more information, see Chapters 3 and 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).

1. PUBLIC HEALTH STATEMENT

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 malathion include the following:

OSHA has established an exposure limit for malathion in the workplace of 15 milligrams per cubic meter (mg/m^3), for an 8-hour workday, 40 hours per week. NIOSH recommends that workers not be exposed to more than $10 \text{ mg}/\text{m}^3$ of malathion for a 10-hour workday, 40 hours per workweek. NIOSH also recommends that a level of $250 \text{ mg}/\text{m}^3$ of malathion in the air be considered as immediately dangerous to life and health.

According to EPA, the following levels of malathion in drinking water are not expected to cause effects that are harmful to health: 0.2 milligrams per liter (mg/L) for 1 day, 10 days, or longer-term exposure for children, and 0.1 mg/L for lifetime exposure of adults.

EPA also has set maximum levels of malathion residues in meat and dairy products, vegetables, fruits, tree nuts, cereal grains, and grass forage, fodder, and hay. Individual values are listed in Table 8-1.

EPA requires notification to the Agency of spills or accidental releases of 100 pounds or more of malathion to the environment. For more information on regulations and guidelines applicable to malathion, see Chapter 8.

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 contact ATSDR at the address and phone number below.

1. PUBLIC HEALTH STATEMENT

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.

Toxicological profiles are also available on-line at www.atsdr.cdc.gov and on CD-ROM. You may request a copy of the ATSDR ToxProfiles CD-ROM by calling the information and technical assistance toll-free number at 1-888-42ATSDR (1-888-422-8737), by email at atsdric@cdc.gov, or by writing at:

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE
Mailstop E-29
Atlanta, GA 30333
Fax: 1-404-498-0093

For-profit organizations may request a copy of final profiles from the following:

National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22161
Phone: 1-800-553-6847 or 1-703-605-6000
Web site: <http://www.ntis.gov/>

