

1. PUBLIC HEALTH STATEMENT

This public health statement tells you about diisopropyl methylphosphonate 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 clean-up. Diisopropyl methylphosphonate has been found in at least 2 of the 1,416 current or former NPL sites. However, it's unknown how many NPL sites have been evaluated for this substance. This 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 diisopropyl methylphosphonate, 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 DIISOPROPYL METHYLPHOSPHONATE?

Diisopropyl methylphosphonate is a colorless liquid at normal temperatures. It is also known as methyl-,bis-(1-methyl-ethyl)ester, phosphonic acid, and methyl-diisopropyl ester.

Diisopropyl methylphosphonate, or DIMP, is a chemical by-product resulting from the manufacture and detoxification of GB (also called Sarin), a nerve gas that the Army produced

from 1953 to 1957. A chemical by-product is a chemical that is formed while making another substance. You might find diisopropyl methylphosphonate in places where GB has been produced, stored, or used, for example, the Rocky Mountain Arsenal (RMA) outside of Denver, Colorado. The RMA is where GB was produced for loading into chemical warfare munitions. Production of GB was discontinued in 1957, and it is not likely that GB, or diisopropyl methylphosphonate, will be produced in the United States in the future because of signing of a chemical treaty that bans not only the use but also the production and stockpiling of poison gases. Diisopropyl methylphosphonate is a colorless liquid. A small amount (0.1%, or 1g of DIMP in 1,000 mL of water) of it dissolves in water, but some scientists have found it to be more soluble (8%). Once it is dissolved, little, if any, evaporates into the air. More information on the chemical and physical properties of diisopropyl methylphosphonate is found in Chapter 3. More information on the production and use of diisopropyl methylphosphonate is found in Chapter 4.

1.2 WHAT HAPPENS TO DIISOPROPYL METHYLPHOSPHONATE WHEN IT ENTERS THE ENVIRONMENT?

Diisopropyl methylphosphonate was released into the environment at the RMA between 1953 and 1957. While most discharged diisopropyl methylphosphonate entered the groundwater at the RMA, some also entered the surface water and soils. It is unlikely that diisopropyl methylphosphonate escaped to the air because it does not evaporate easily. Diisopropyl methylphosphonate does not break down in the environment very quickly and can remain in water and soil for years. The flow of water during irrigation can carry diisopropyl methylphosphonate through the soil. Plants can take up diisopropyl methylphosphonate and store or accumulate it in leaves and DIMP may enter the food chain when animals eat these plants. However, because DIMP is rapidly changed to isopropyl methylphosphonic acid (IMPA) by animals that eat it, it is unlikely that DIMP will be present further up the food chain. Muman exposure may also occur by consumption of home-grown fruits and vegetables irrigated by DIMP-contaminated water. For more information on what happens to diisopropyl methylphosphonate in the environment, see Chapters 4 and 5.

1.3 HOW MIGHT I BE EXPOSED TO DIISOPROPYL METHYLPHOSPHONATE?

Exposure of the general population to diisopropyl methylphosphonate is expected to be rare and even then in small amounts. Only people living near a site where DIMP is found (such as RMA) may be exposed to this substance.

Drinking or showering with water containing diisopropyl methylphosphonate, or eating vegetables irrigated with it are the most likely ways that a person can be exposed to it. Water contaminated with DIMP has been found only at or near the RMA. In 1974 diisopropyl methylphosphonate was first measured in the groundwater at RMA. The reported amounts ranged from 0.5 parts per billion (ppb) to 44,000 ppb (1 ppb is equivalent to one part by weight of diisopropyl methylphosphonate in a billion parts by volume of water or soil). In 1989, soil samples from some areas in the RMA were reported to contain approximately 50 ppb to 240 ppb of diisopropyl methylphosphonate. During the most recent comprehensive groundwater sampling at RMA in 1995, diisopropyl methylphosphonate concentrations in groundwater were reported to range from less than 0.110 ppb to 965 ppb. It is possible that exposure to diisopropyl methylphosphonate might occur by eating plants that absorbed it from water or soil.

Please refer to Chapter 5 for more information on how you might be exposed to diisopropyl methylphosphonate.

1.4 HOW CAN DIISOPROPYL METHYLPHOSPHONATE ENTER AND LEAVE MY BODY?

Diisopropyl methylphosphonate may enter your body after drinking water contaminated with it or it may enter through your skin. You could be exposed to diisopropyl methylphosphonate if you drink water that contains the chemical near the RMA. Exposure of the general population to diisopropyl methylphosphonate is not likely to occur. Studies in animals show that diisopropyl methylphosphonate enters the bloodstream relatively quickly following oral exposure. Animal

studies also show that once diisopropyl methylphosphonate is inside the body, it is changed almost completely into isopropyl methylphosphonic acid (IMPA) and leaves the body in the urine. Chapter 2 has more information on how diisopropyl methylphosphonate can enter and leave the body.

1.5 HOW CAN DIISOPROPYL METHYLPHOSPHONATE AFFECT MY HEALTH?

Scientists use many tests to protect the public from the harmful effects of toxic chemicals and to find ways to treat people who have been harmed.

One way to see if a chemical will hurt people is to learn how the chemical is absorbed, changed, 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.

Little is known about the human health effects of diisopropyl methylphosphonate. Skin rashes and other signs of irritation have been reported in some people who handled dead animals near a pond containing diisopropyl methylphosphonate and other chemicals, but it is not known which substances caused these effects.

Drinking large amounts of diisopropyl methylphosphonate kills animals. The amount needed to cause death in humans is not known for sure. Animal studies have shown no evidence that drinking or eating diisopropyl methylphosphonate causes fertility problems or birth defects. Animal studies have shown that eating diisopropyl methylphosphonate can affect some liver enzymes (indicating a response by the liver). However, test animals showed no liver disease. While most animal studies have shown only minimal toxic effects below a certain level of

exposure, there is some evidence that diisopropyl methylphosphonate can cause effects on the blood and nervous systems at high levels. Overall, however, it is not a very toxic chemical.

See Chapter 2 for more information about the health effects of diisopropyl methylphosphonate.

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

Once inside the body, diisopropyl methylphosphonate is rapidly converted to isopropyl methylphosphonic acid (IMPA), which is rapidly cleared from the blood. Laboratory tests can determine the amount of IMPA in the blood or urine. However, because IMPA leaves the body rapidly, these tests are useful only for recent exposure. It is helpful for your doctor to know whether there are other chemicals to which you have been exposed. See Chapters 2 and 6 for more information.

1.7 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 diisopropyl methylphosphonate include the following:

The EPA has issued guidelines concerning recommendations for levels of diisopropyl methylphosphonate that may be in drinking water, including Health Advisories. It has concluded that a lifetime of exposure to drinking water containing 0.6 mg/L (1 mg/L = 1 milligram of diisopropyl methylphosphonate in 1 liter of water) of diisopropyl methylphosphonate would not result in any noncancer harmful health effects. This amount, 0.6 mg/L, is the same as 600 parts per billion parts of water. The EPA has determined that diisopropyl methylphosphonate is unclassifiable as to its ability to cause cancer in humans, that is, there are not enough data to classify the ability of diisopropyl methylphosphonate to cause cancer in humans. For more information, 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, Mailstop E-29
Atlanta, Georgia 30333

*Information line and technical assistance

Phone: 1-800-447-1544

Fax: (404) 639-6315 or 6324

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) 487-4650