PUBLIC HEALTH STATEMENT
Dichloropropenes
CAS#: 26952-23-8

Division of Toxicology and Environmental Medicine **September 2006**

This Public Health Statement is the summary chapter from the Toxicological Profile for Dichloropropenes. It is one in a series of Public Health Statements about hazardous substances and their health effects. A shorter version, the ToxFAQs™, is also available. This information is important because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present. For more information, call the ATSDR Information Center at 1-800-232-4636.

This public health statement tells you about dichloropropenes and the effects of exposure to it.

The Environmental Protection Agency (EPA) identifies the most serious hazardous waste sites in the nation. These sites are then placed on the National Priorities List (NPL) and are targeted for long-term federal clean-up activities. 1,2-, 1,3-, and 2,3-Dichloropropene have been found in at least 5, 112, and 3 of the 1,678 current or former NPL sites, respectively. 1,1- and 3,3-Dichloropropene were not identified in any of the 1,678 current or former NPL sites. Although the total number of NPL sites evaluated for this substance is not known, the possibility exists that the number of sites at which dichloropropenes are found may increase in the future as more sites are evaluated. This information is important because these sites may be sources of exposure and exposure to dichloropropenes may harm you.

When a substance is released either from a large area, such as an industrial plant, or from a container, such as a drum or bottle, it enters the environment. Such a 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 the substance, or by skin contact.

If you are exposed to dichloropropenes, many factors will determine whether you will be harmed. These factors include the dose (how much), the duration (how long), and how you come in contact with these substances. You must also consider any other chemicals you are exposed to and your age, sex, diet, family traits, lifestyle, and state of health.

1.1 WHAT ARE DICHLOROPROPENES?

Dichloropropene molecules are made of a chain of three carbon atoms with a double bond connecting the first two carbons. Two chlorine atoms are attached at varying positions on this carbon chain. Since there are five possible arrangements of chlorine atoms around this carbon chain, there are five different types (or isomers) of dichloropropene molecules. The names of these dichloropropenes are 1,1-dichloropropene; 1,2-dichloropropene; 1,3-dichloropropene; 2,3-dichloropropene; and 3,3-dichloropropene. The numbers at the beginning of these names specify the carbon atoms (first, second, or third) to which each chlorine atom is attached.

1,3-Dichloropropene is a colorless liquid with a sweet smell. It dissolves in water and evaporates easily. 1,3-Dichloropropene is used mainly in farming to kill tiny pests called nematodes that eat the roots of important crops.

Much less information is available for the other dichloropropenes (1,1-, 1,2-, 2,3-, and 3,3-dichloropropene). It appears that only 2,3-dichloropropene is produced and used in industry; it is used to make other chemicals. Uses for 1,1-, 1,2-, or 3,3-dichloropropene were not found. Based on available data, less than 10,000 pounds (4.5 metric tons) of 1,1-, 1,2-, 2,3-, and 3,3-dichloropropene were produced in 2002 compared to a production amount of between 1 and 10 million pounds (450–4,500 metric tons) of 1,3-dichloropropene during that year.

Because 1,3-dichloropropene is produced and used in much higher amounts than 1,1-, 1,2-, 2,3-, and 3,3-dichloropropene and because 1,3-dichloropropene is released to the environment as a pesticide, the available dichloropropene data are primarily for 1,3-dichloropropene. Therefore, the focus of this ATSDR profile is on the 1,3-dichloropropene isomer. Discussion of 1,1-, 1,2-, 2,3-, and 3,3-dichloropropene are only included where data are available for these substances or when conclusions can be drawn based on similarities in physical and chemical properties between these substances and 1,3-dichloropropene.

1.2 WHAT HAPPENS TO DICHLOROPROPENES WHEN THEY ENTER THE ENVIRONMENT?

When 1,3-dichloropropene is used in farm fields, it is sprayed into the ground. Once in the soil, some of it is likely to be broken down into smaller chemicals by either water or living things. Some of it may be carried deeper into the ground and may reach underground water supplies. However, in high crop-producing states like California where it has been used often, very little 1,3-dichloropropene has actually been found in groundwater. 1,3-Dichloropropene may also be carried into groundwater and soil from landfills and hazardous waste sites.

Some of the 1,3-dichloropropene sprayed onto the ground will evaporate into the air. In the air, 1,3-dichloropropene will be broken down into smaller chemicals. Some of the 1,3-dichloropropene in air may be washed down onto the ground, lakes, or streams by rain. 1,3-Dichloropropene is also expected to be broken down in soil and water. Some of the 1,3-dichloropropene in soil or water will also go back into the air.

Information on what happens to 1,1-, 1,2-, 2,3-, and 3,3-dichloropropene when they enter the environment are not available. Based on their physical and chemical properties, these substances are expected to behave similarly to 1,3-dichloropropene. However, reactions with water are expected to be much slower for 1,1- and 1,2-dichloropropene than for 1,3-, 2,3-, and 3,3-dichloropropene.

1.3 HOW MIGHT I BE EXPOSED TO DICHLOROPROPENES?

You can breathe 1,3-dichloropropene from the air. It can also get on your skin. The people most likely to breathe air containing 1,3-dichloropropene or to get it on their skin are workers who use it for farming or make it in factories.

Food grown in 1,3-dichloropropene treated fields has not been shown to contain 1,3-dichloropropene.

A possible explanation for this is that since 1,3-dichloropropene is applied several months before planting, it may be rapidly broken down or removed from the soil before the crop plants grow and are able to take this chemical up through their roots.

Very small amounts of 1,3-dichloropropene from sewage treatment facilities, electrical power stations, and industrial facilities that use water to cool high-temperature furnaces may go into streams, rivers, and lakes. Some may go into the air.

People who live near garbage dumps or places where chemicals are stored or buried, including hazardous waste sites, may breathe 1,3-dichloropropene if it escapes into the air or may drink well water contaminated with this chemical. They may also be exposed through skin contact with soil containing it. People living in these areas who bathe or shower in contaminated well water may be exposed to 1,3-dichloropropene through breathing or skin contact.

Based on available information, 1,3-dichloropropene is not commonly found in surface water, drinking water, soil, or foods. 1,3-Dichloropropene is also not commonly found in air; however, it has been found in the air in some cities and in some farming areas. The average levels of 1,3-dichloropropene measured in the air at these locations are between 0.088 and 0.33 parts per billion (ppb). 1,3-Dichloropropene has been found in water at many locations across the United States; however, the levels of this pesticide are too low to be measured at most of these locations (scientists cannot accurately determine how much is present). 1,3-Dichloropropene has not been found in many drinking water samples. The average levels of 1,3-dichloropropene are around 0.5 ppb in groundwater at locations where it is measurable.

Based on available information, 1,1-, 1,2-, 2,3-, and 3,3-dichloropropene are not commonly found in measurable quantities in air, surface water, drinking water, groundwater, soil, or food. 1,1-Dichloropropene has been found in water at many locations across the United States; however, the levels of this pesticide are too low to be measured at most of these locations. 1,1-Dichloropropene has not been found in many drinking water samples. The potential for human exposure to 1,1-, 1,2-, and 3,3-dichloropropene is expected to be low because they are not produced or used in high amounts. Higher amounts of 2,3-dichloropropene may be released from facilities where this substance is produced or used. Individuals who work or live near these facilities may be exposed to 2,3-dichloropropene; however, exposure of the general population to this chemical is not expected to be important.

1.4 HOW CAN DICHLOROPROPENES ENTER AND LEAVE MY BODY?

Dichloropropene can enter the body through the lungs if you breathe air that contains it, through the stomach and intestine if you drink water that is contaminated with it, or through the skin if you touch it. Studies with animals exposed to 1,3- or 2,3-dichloropropene have shown that if you breathe air that has dichloropropene in it, most of the chemical will get into the bloodstream. With increasing exposure, there is a greater likelihood that it will enter your body and get into the bloodstream.

Dichloropropenes are not likely to build up in the body because the liver changes (metabolizes) the chemical to a harmless form that can leave the body fairly quickly. Studies with animals have shown that most 1,3- or 2,3-dichloropropene leaves the body within 2 days after exposure. Most dichloropropenes leave the body in urine, and smaller amounts leave in feces and the air you breathe out. If you take in very large amounts of 1,3- or 2,3-dichloropropene, this may overwhelm the ability of the liver to change all of the chemical to a harmless form. When this happens, some may be changed to a harmful form that may bind to tissues and damage them.

1.5 HOW CAN DICHLOROPROPENES AFFECT MY HEALTH?

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

One way to learn whether a chemical will harm people is to determine how the body absorbs, uses, and releases the chemical. For some chemicals, animal testing may be necessary. Animal testing may also help identify health effects such as cancer or birth defects. Without laboratory animals, scientists would lose a basic method for getting information needed to make wise decisions that protect public health. Scientists have the responsibility to treat research animals with care and compassion. Scientists must comply with strict animal care guidelines because laws today protect the welfare of research animals.

Dichloropropenes are reactive chemicals, which means that they may cause irritation at the point of contact. Health effects seen in humans or animals generally occurred at exposure levels that are much higher than the background levels found in air or water. This means that health effects are not likely to be seen in the general population, but may be seen among people who are exposed to relatively high concentrations in their jobs or from being near fields during fumigation.

The main health effects seen in humans who breathed 1,3-dichloropropene are: nausea; vomiting; irritation of the skin, eyes, nose, and throat; breathing difficulties; coughing; headache; and fatigue. Some people who breathed 1,3-dichloropropene could smell it when the amount reached 1 part 1,3-dichloropropene per million parts of air (ppm), but you may be able to smell it at even lower amounts. A few workers who had skin contact with pesticides containing 1,3-dichloropropene developed blisters and an allergic reaction on their skin. A man who accidentally drank some 1,3-dichloropropene died with severe damage to his stomach and surrounding organs. We do not know if 1,3-dichloropropene causes cancer in humans; however, three men who breathed in 1,3-dichloropropene during the cleanup of a tanker spill or during field spraying developed cancers of the blood cells. This small number of cases does not provide proof that 1,3-dichloropropene was the cause of cancer, especially since the liquids may have contained other chemicals besides 1,3-dichloropropene.

At levels more than a thousand times higher than background, dichloropropenes caused irritation at the point of contact in animals. Rats and mice had damage to the lining of the nose, and mice had

damage to the lung after repeatedly breathing 5 ppm of 2,3-dichloropropene vapor several hours a day for less than 2 weeks. Rats and mice had damage to the lining of the nose, and mice had damage to the lining of the urinary bladder after breathing 60 ppm 1,3-dichloropropene for several months or 20 ppm for 2 years. Male mice (but not female mice or female or male rats) developed a benign (nonspreading) lung tumor after breathing 60 ppm 1,3-dichloropropene for 2 years. Rats that ate 1,3-dichloropropene in their feed at a daily dose of 15 mg per kg body weight for several months or longer had damage to the lining of the stomach and dogs had anemia. At a higher dose, rats, but not mice, developed a benign (nonspreading) liver tumor. Direct contact with liquid dichloropropenes caused irritation to eyes and skin in animals and a skin allergic reaction in guinea pigs. Animals tested at high levels, like those seen in accidental exposures in humans, also developed serious injury to the lungs from breathing the chemical vapor or to the stomach from oral exposure. At these unusually high levels, liver and kidney damage was seen, and death occurred because of breathing difficulty and internal bleeding.

The Department of Health and Human Services has determined that 1,3-dichloropropene may reasonably be anticipated to be a carcinogen. The International Agency for Research on Cancer has determined that 1,3-dichloropropene is possibly carcinogenic to humans. The EPA has classified 1,3-dichloropropene as a probable human carcinogen.

1.6 HOW CAN DICHLOROPROPENES AFFECT CHILDREN?

This section discusses potential health effects in humans from exposures during the period from conception to maturity at 18 years of age.

Like adults, children can be exposed to dichloropropenes by breathing air or drinking water that contains the chemicals, but the amounts are usually very low. The most likely exposure occurs near agricultural fields where 1,3-dichloropropene is used to treat the soil before planting. Children are not more likely than adults in the general population to be exposed to dichloropropenes in air, but since they drink more water than adults relative to their body weight, they may have higher exposures from well water.

The effects of dichloropropenes have not been studied in children, but they would likely experience the same health effects seen in adults exposed to the chemical. We do not know whether children differ from adults in their susceptibility to health effects from exposure to dichloropropenes.

We do not know whether dichloropropenes can cause birth defects in humans. Although 1,3-dichloropropene did not cause birth defects in animals, pregnant rats that breathed it gave birth to fewer rat pups or pups with lower body weight. These effects only happened at exposures high enough to be toxic to the mother and reduce her feed intake.

The way that dichloropropenes enter and leave a child's body is likely to be the same as for adults. The liver process that makes the chemicals less

harmful in adults is the same in children by their first year of age.

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

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

Families can reduce their exposure to dichloropropene by staying away from treated fields during pesticide application. Workers who handle dichloropropene should wash their hands before entering their homes and keep contaminated clothing isolated before it is washed. Children should be encouraged to wash their hands after playing near treated soil and discouraged from putting their hands in their mouths.

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

It is possible to measure 1,3- or 2,3-dichloropropene or their breakdown products in blood and urine. In humans, the blood levels of breakdown products from 1,3-dichloropropene could be used to predict how much 1,3-dichloropropene has been breathed. However, tests for 1,3- or 2,3-dichloropropene in the blood and urine would only be useful for recent exposures, because dichloropropenes leave the body within 1–2 days.

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. The EPA, the Occupational Safety and Health Administration (OSHA), and the Food and Drug Administration (FDA) are some federal agencies that develop regulations for toxic substances. Recommendations provide valuable guidelines to protect public health, but cannot be enforced by law. The Agency for Toxic Substances and Disease Registry (ATSDR) and the National Institute for Occupational Safety and Health (NIOSH) are two federal organizations that develop recommendations for toxic substances.

Regulations and recommendations can be expressed as "not-to-exceed" levels, that is, levels of a toxic substance in air, water, soil, or food that do not exceed a critical value that is usually based on levels that affect animals; they are then adjusted to levels that will help protect humans. Sometimes these not-to-exceed levels differ among federal organizations because they used different exposure times (an 8-hour workday or a 24-hour day), different animal studies, or other factors.

Recommendations and regulations are also updated periodically 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 dichloropropenes include the following:

EPA has set 100 pounds per year as the limit of 1,3- or 2,3-dichloropropene that can be released into the environment at any particular site; releases of more than that must be reported. EPA sets limits on the amount of chemicals allowed in drinking water, but has not established an enforceable standard (maximum contaminant level) for 1,3-dichloropropene. As a guideline, EPA established a health advisory level for 1,3-dichloropropene of 0.03 mg per liter of water that should not be exceeded in order to protect children's health.

OSHA has not set a limit for allowable worker exposure to 1,3-dichloropropene in air, but NIOSH sets guidelines (recommended exposure limits or RELs) for chemicals in workplace air. The REL for 1,3-dichloropropene is 1 part per million (4.54 mg per cubic meter) averaged over a 10-hour workday.

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.

ATSDR can also tell you the location of occupational and environmental health clinics. These clinics specialize in recognizing, evaluating, and treating illnesses that result 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 toll-free information and technical assistance number at 1-800-CDCINFO (1-800-232-4636), by e-mailing cdcinfo@cdc.gov, or by writing to

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Environmental Medicine
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Organizations for-profit may request copies of final Toxicological Profiles from

National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22161
Phone: 1-800-553-6847 or 1-703-605-6000
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