1. PUBLIC HEALTH STATEMENT

This public health statement tells you about methylene chloride 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. Methylene chloride has been found in at least 882 of the 1,569 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 methylene chloride 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 methylene chloride, 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 METHYLENE CHLORIDE?

Methylene chloride, also known as dichloromethane, is a colorless liquid that has a mild sweet odor, evaporates easily, and does not burn easily. It is widely used as an industrial solvent and as a paint stripper. It can be found in certain aerosol and pesticide products and is used in the manufacture of photographic film. The chemical may be found in some spray paints, automotive cleaners, and other household products. Methylene chloride does not appear to occur naturally in the environment. It is made from methane gas or wood alcohol. Most of the methylene

chloride released to the environment results from its use as an end product by various industries and the use of aerosol products and paint removers in the home.

More information on the properties and uses of methylene chloride may be found in Chapters 3 and 4.

1.2 WHAT HAPPENS TO METHYLENE CHLORIDE WHEN IT ENTERS THE ENVIRONMENT?

Methylene chloride is mainly released to the environment in air, and to a lesser extent in water and soil, due to industrial and consumer uses. Many chemical waste sites, including NPL sites, contain methylene chloride and these might act as additional sources of environmental contamination through spills, leaks, or evaporation. Because methylene chloride evaporates readily, most of it is released into the air. In the air, it is broken down by sunlight and by reaction with other chemicals present in the air. About half of the methylene chloride disappears from air in 53 to 127 days. Although methylene chloride does not dissolve easily in water, small amounts may be found in some drinking water. Methylene chloride that is present in water is broken down slowly by reactions with other chemicals or by bacteria. Over 90% of the methylene chloride in the environment changes to carbon dioxide (CO_2), which is already present in air. It takes about 1 to 6 days for half the methylene chloride to break down in water. When methylene chloride is spilled on land, it attaches loosely to nearby surface soil particles. It moves from the soil into the air. Some may also move into groundwater. We do not know how long it remains in soil. We do not expect methylene chloride to build up in plants or animals.

More information on what happens to methylene chloride in the environment may be found in Chapters 4 and 5.

1.3 HOW MIGHT I BE EXPOSED TO METHYLENE CHLORIDE?

You may be exposed to methylene chloride in air, water, food, or from consumer products. Because methylene chloride evaporates easily, the greatest potential for exposure is when you breathe vapors of contaminated air. Background levels in air are usually at less than one part methylene chloride per billion parts (ppb) of air. Methylene chloride has been found in some urban air and at some hazardous waste sites at average concentrations of 11 ppb of air. The average daily intake of methylene chloride from outdoor air in three U.S. cities ranges from 33 to 309 micrograms per day (1 milligram is equivalent to 1,000 micrograms, 1 mg = 1,000 μg.) Contact with consumer products such as paint strippers or aerosol cans that contain methylene chloride is another frequent source of exposure. Exposure occurs as a result of breathing the vapors given off by the product or from direct contact of the liquid material with the skin. The highest and most frequent exposures to methylene chloride usually occur in workplaces where the chemical is used; exposure can be dangerously high if methylene chloride is used in an enclosed space without adequate ventilation. People who work with it can breathe in the chemical or it may come in contact with their skin. In the past, concentrations ranging from 1 to 1,000 parts of methylene chloride per million parts of air (ppm; 1 ppm is 1,000 times more than 1 ppb) have been detected in general work areas, while higher concentrations (1,400 ppm) have been detected in samples in the breathing zone of some workers. These exposure levels exceed the current recommended federal limits. The National Institute for Occupational Safety and Health (NIOSH) estimated that 1 million workers may be exposed to methylene chloride. Averages of 68 ppb of methylene chloride in surface water and 98 ppb methylene chloride in groundwater have been found at some hazardous waste sites. Less than 1 ppb has been found in most drinking water analyzed. We expect exposure from water and food to be low because very little methylene chloride has been detected in these sources.

More information on how you might be exposed to methylene chloride is given in Chapter 5.

1.4 HOW CAN METHYLENE CHLORIDE ENTER AND LEAVE MY BODY?

Methylene chloride may enter your body when you breathe vapors of contaminated air. It may also enter your body if you drink water from contaminated wells, or it may enter if your skin comes in contact with it. Since methylene chloride evaporates into air rapidly, exposure by breathing is the most likely source of exposure at hazardous waste sites, in the home, and in the workplace. When you breathe in methylene chloride, over 70% of it enters your bloodstream and quickly spreads throughout your body, with most of it going to the liver, kidney, brain, lungs, and fatty tissue. Increased physical activity or an increased amount of body fat tends to increase the amount of methylene chloride that remains or accumulates in your body tissue. About half of the methylene chloride in the blood leaves within 40 minutes. Some of the methylene chloride is broken down into other chemicals, including carbon monoxide (CO), a natural substance in the body occurring from the breakdown of hemoglobin. Unchanged methylene chloride and its breakdown products are removed from your body mainly in the air you breathe out. Small amounts leave in your urine. This usually occurs within 48 hours after exposure. Although the rate of uptake through the stomach has not been measured, uptake is likely to be fast. Skin absorption is usually small. Trapping the chemical against the skin with clothing or gloves can lead to greater absorption and possible chemical burns.

More information on how methylene chloride enters and leaves the body is given in Chapter 2.

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

If you breathe large amounts (800 ppm) of methylene chloride you may not be able to react fast, remain steady, or perform tasks requiring precise hand movements. You may experience dizziness, nausea, tingling or numbness of the fingers and toes, and drunkenness if you breathe methylene chloride for a sufficiently long period of time. In most cases, effects disappear shortly after the exposure ends. Studies in animals suggest that exposure to higher concentrations (8,000–20,000 ppm) can lead to unconsciousness and death. There have been reports of some people becoming unconscious and some people dying after breathing high concentrations of methylene chloride; accidents of this kind happen more often when methylene chloride is used without adequate ventilation.

Breathing methylene chloride may cause changes in the liver and kidney in animals, but similar effects have not been observed in humans. Animal studies indicate that should you be exposed to high levels of vapors of methylene chloride in air, the vapors may irritate your eyes and affect your cornea. One study reported these effects at concentrations of 490 ppm; however, the effects usually disappeared within a few days.

In humans, direct skin contact with large amounts of methylene chloride causes intense burning and mild redness of the skin. In a workplace accident in which a person was found to have lost consciousness and partly fallen into an open vat of methylene chloride, extended direct contact with the liquid caused severe burns of the skin and eyes (cornea); these conditions were treatable. In rabbits, effects were observed on the eyes (e.g., cornea), but they were reversible within a few days.

People can smell methylene chloride at about 200 ppm in air. After about 3 hours of exposure at this level, a person will become less attentive and less accurate in tasks that require hand-eye

coordination. Because people differ in their ability to smell various chemicals, odors may not be helpful in avoiding over-exposure to methylene chloride.

There is not clear evidence that methylene chloride causes cancer in humans exposed to vapors in the workplace. However, breathing high concentrations of methylene chloride for long periods of time did increase the incidence of cancer in mice. No information was found regarding the cancer-causing effects of methylene chloride in humans after oral exposure. The Department of Health and Human Services (DHHS) has determined that methylene chloride may reasonably be anticipated to be a cancer-causing chemical. The International Agency for Research on Cancer (IARC) has classified methylene chloride in Group 2B, possibly causing cancer in humans. The EPA has determined that methylene chloride is a probable cancer-causing agent in humans.

More information on how methylene chloride can affect your health is given in Chapter 2.

1.6 HOW CAN METHYLENE CHLORIDE 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 and adults may be exposed to low levels of methylene chloride in drinking water. Small children who live near factories that produce or use methylene chloride could accidently eat some of the chemical by putting dirty hands in their mouths, but the amount of methylene chloride in the soil is thought to be too low to be harmful. Children could breathe in methylene chloride that is used in a number of household products, since it evaporates easily. Also, since the vapor of methylene chloride is heavier than air, it will tend to stay close to the ground; as a result, children, being shorter, would breathe in larger amounts than adults during accidental exposure.

The effects of methylene chloride have not been studied in children, but they would likely experience the same health effects seen in adults exposed to the chemical. It is also not known if

the way in which methylene chloride is absorbed, metabolized, and eliminated from the body is different in children than it is in adults. Therefore, adverse effects noted in animals and adult humans (as discussed in Section 1.5) might also occur in children.

There have not been any reports of a connection between methylene chloride exposure during pregnancy and birth defects in humans. If a pregnant woman is exposed to methylene chloride, a small amount may cross the placenta, but not enough to harm the fetus. Studies in animals show that breathing methylene chloride at relatively high levels during pregnancy may lead to bone variations, none of which are serious and some of which may be outgrown, in newborn pups. Methylene chloride has been shown to cross the placenta in rats. Methylene chloride has not been accurately measured in human milk and there are no animal studies testing to what extent it can pass into milk.

Sections 2.7 and 5.6 contain specific information about the effects of methylene chloride in children.

1.7 HOW CAN FAMILIES REDUCE THE RISK OF EXPOSURE TO METHYLENE CHLORIDE?

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

Children may be exposed to methylene chloride in consumer household products, such as paint removers, which contain a large percentage of methylene chloride. In general, the amounts of methylene chloride in consumer products are low and children are not likely to be harmed unless large amounts contact the skin or are accidentally swallowed. Using paint removers, especially in unventilated or poorly ventilated areas, may cause the amount of methylene chloride in the air to reach potentially dangerous levels. Caution should be used when using paint removers inside your house; you should follow instructions on the package label for the proper ventilation

conditions when using these products. It is also advisable to make certain that children do not remain near indoor paint removal activities.

Household chemicals should be stored out of reach of young children to prevent accidental poisonings or skin irritation. Always store household chemicals in their original labeled containers. Never store household chemicals in containers that children would find attractive to eat or drink from, such as old soda bottles. Keep your Poison Control Center's number next to the phone.

Sometimes older children sniff household chemicals in an attempt to get high. Your children may be exposed to methylene chloride by inhaling products containing it. Talk with your children about the dangers of sniffing chemicals.

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

Several tests exist for determining whether you have had measurable exposure to methylene chloride. The most direct method measures methylene chloride in the air you breathe out. Your blood can also be analyzed to determine if methylene chloride is present. However, these tests are only useful for detecting exposures which have occurred within a few days because methylene chloride remains in the blood for a very short time. Some absorbed methylene chloride is stored in fat and slowly returns to the bloodstream. A test to measure carboxyhemoglobin (COHb), a chemical formed in blood as methylene chloride breaks down in the body, can also be used as an indicator of exposure. However, this test is not specific, since smoking and exposure to other chemicals may also increase COHb levels. Your urine can also be tested for methylene chloride itself or for other chemicals (such as formic acid) that are produced as methylene chloride breaks down in the body. These tests are not routinely available in a doctor's office, and they require special equipment. Also, the test for formic acid is not specific for methylene chloride, since other chemicals, such as formaldehyde, are broken down

to formic acid. The tests may be useful to determine exposure to methylene chloride but do not by themselves measure or predict health effects.

More information on how methylene chloride can be measured in exposed humans is presented in Chapters 2 and 6.

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 methylene chloride include the following:

The EPA requires that releases of methylene chloride of 1,000 pounds or more be reported to the federal government. The EPA has provided guidelines on how much methylene chloride you may be exposed to for certain amounts of time without causing risk to human health. It recommends that exposure of children to methylene chloride in drinking water should not exceed 10 milligrams/liter (mg/L) for 1 day or 2 mg/L for 10 days.

Because methylene chloride is used in processing spices, hops extract, and decaffeinated coffee, the FDA has established limits on the amounts of methylene chloride that can remain in these food products.

The OSHA currently has a "permissible exposure limit" (PEL) of 25 ppm for an 8-hour workday with 125 ppm as a "short-term exposure limit" (STEL) for 15 minute durations for persons who work with methylene chloride.

NIOSH no longer has a "recommended exposure limit" (REL) for methylene chloride. Because methylene chloride causes tumors in some animals, NIOSH currently considers it a possible cancer-causing substance in the workplace and recommends that exposure be lowered to the lowest feasible limit.

More information on government recommendations regarding methylene chloride can be found in 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