PUBLIC HEALTH STATEMENT
ETHYLENE OXIDE
CAS#: 75-21-8

Division of Toxicology **December 1990**

This Public Health Statement is the summary chapter from the Toxicological Profile for Ethylene oxide. 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 this substance 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 1-888-422-8737.

This Statement was prepared to give you information about ethylene oxide and to emphasize the human health effects that may result from exposure to it. The Environmental Protection Agency (EPA) has identified 1,177 sites on its National Priorities List (NPL). Ethylene oxide has not been definitely identified at any NPL site. However, it has been tentatively identified at three of these sites. As EPA evaluates more sites, the number of sites at which ethylene oxide is found may change. This information is important for you to know because ethylene oxide may cause harmful health effects and because these sites are potential or actual sources of human exposure to ethylene oxide.

When a chemical 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 as a chemical emission. This emission, which is also called a release, does not always lead to exposure. You can be exposed to a chemical only when you come into contact with the chemical. You may be exposed to it in the environment by breathing, eating, or drinking substances containing the chemical or from skin contact with it.

If you are exposed to a hazardous substance such as ethylene oxide, several factors will determine whether harmful health effects will occur and what the type and severity of those health effects will be. These factors include the dose (how much), the duration (how long), the route or pathway by which you are exposed (breathing, eating, drinking, or skin contact the other chemicals to which you are exposed, and your individual characteristics such as age, sex, nutritional status, family traits, life style, and state of health.

1.1 WHAT IS ETHYLENE OXIDE?

Ethylene oxide (also known as ETO or oxirane) is a flammable gas with a somewhat sweet odor. It dissolves easily in water, alcohol, and most organic solvents. Ethylene oxide is produced in large volumes and is used to make other chemicals, especially ethylene glycol, a chemical used to make antifreeze and polyester. Most ethylene oxide is used up in the factories where it is produced. A very small amount (less than 1%) is used to control insects on stored agricultural products such as nuts and spices.

Ethylene oxide is also used in very small amounts in hospitals to sterilize medical equipment and supplies.

When ethylene oxide is produced or used, some of the gas is released to air and water. If it is released into the air, humidity and sunlight cause it to break down within a few days. In water, ethylene oxide will either break down or be destroyed by bacteria within a few days.

1.2 HOW MIGHT I BE EXPOSED TO ETHYLENE OXIDE?

You are not likely to be exposed to ethylene in the general environment. In studies of the air quality in Texas and California, no ethylene oxide was found. There is also no evidence that ethylene oxide is commonly found in water. Because of the limited information about ethylene oxide in air, water, or soil at hazardous waste sites, we do not know how likely it is that you might be exposed to ethylene oxide at or near these sites.

You may be exposed to ethylene oxide if you work where it is produced or used. Health care workers, such as technicians, nurses, and physicians in hospitals and clinics, may have contact with ethylene oxide because it is used to sterilize medical equipment and supplies. Since ethylene oxide is used as a fumigant to spray agricultural products, if you are a farmer or work on a farm where ethylene oxide is used, you may also be exposed to this substance.

It is not known if food crops are a source of exposure to ethylene oxide for the general public. Ethylene oxide has been found at levels up to 3.5 parts of ethylene oxide per one million parts of food (3.5 ppm) in some foods shortly after being sprayed with pesticide that contains it. These levels decrease with time as ethylene oxide evaporates or breaks down into other substances, and thus little or none may remain when the food is eaten.

1.3 HOW CAN ETHYLENE OXIDE ENTER AND LEAVE MY BODY?

Ethylene oxide can enter your body when air containing this substance is breathed into your lungs. Because ethylene oxide evaporates very easily, it is unlikely that it remains in or on food or remains dissolved in water long enough to be eaten or swallowed, although this is not known for certain. It is not known if ethylene oxide can enter the body through the skin.

After a person has been exposed to ethylene oxide, it leaves the body through the urine or feces or by breathing it out through the lungs. This probably occurs very rapidly, perhaps within 2 or 3 days.

1.4 HOW CAN ETHYLENE OXIDE AFFECT MY HEALTH?

Ethylene oxide can cause a wide variety of harmful health effects in exposed persons. In general, with higher levels of exposure to the chemical, more severe effects will occur. The major effects seen in workers exposed to ethylene oxide at low levels for several months or years are irritation of the eyes, skin, and mucous membranes and problems in the functioning of the brain and nerves. At higher levels of exposure to ethylene oxide, which may result from accidents or equipment breakdown, the types of effects are similar, but they are more severe and harmful. There is also some evidence that exposure to ethylene oxide can cause an increased rate of miscarriages in female workers exposed to ethylene oxide. Studies in animals have shown that breathing ethylene oxide at high levels can interfere with their ability to reproduce. Litter sizes have been smaller than usual, and the babies of exposed animals have weighed less than normal and have had delayed bone formation.

Scale studies of workers exposed to ethylene oxide in ethylene oxide factories or hospital sterilizing rooms have shown an increased incidence of

leukemia, stomach cancer, cancer of the pancreas and Hodgkin's disease. Ethylene oxide has also been shown to cause cancer in laboratory animals. Leukemia, brain tumors, lung tumors and tumors of the tear glands of the eye have been found.

1.5 WHAT LEVELS OF EXPOSURE HAVE RESULTED IN HARMFUL HEALTH EFFECTS?

Skin contact with ethylene oxide can result in blisters and burns that may appear to be similar to frostbite. With longer times of contact, there is a more severe reaction. Eye damage can also result from ethylene oxide contact.

It is possible to smell ethylene oxide if it is present in water at or above 140 mg per liter (about one quart) of water. It can also be smelled in air if it is present at or above 430 ppm (430 parts of ethylene oxide per million parts of air).

Exposure to high levels (700 ppm) of ethylene oxide in air has resulted in seizures and cataracts in people. Exposure to lower levels has resulted in problems with hand/eye coordination and eye and nose irritation. In animals, kidney damage has been seen at levels of 100 ppm, while lower levels (50 ppm) have resulted in decreased physical activity.

1.6 IS THERE A MEDICAL TEST TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO ETHYLENE OXIDE?

There are two kinds of tests that can determine if you have been exposed to ethylene oxide within the last couple of days. These tests are not routinely done in a doctor's office, but can be done in a special laboratory. One test measures this substance in blood, the other measures it in air that you breathe out of your lungs. If you were exposed to ethylene oxide more than two or three days ago, there may be no ethylene oxide remaining in your body. In addition, if you have been exposed to very low levels of ethylene oxide, these tests may not detect it. The results of these tests cannot be used to predict the type or severity of health effects resulting from exposure.

1.7 WHAT RECOMMENDATIONS HAS THE FEDERAL GOVERNMENT MADE TO PROTECT HUMAN HEALTH?

The Food and Drug Administration (FDA) has set a tolerance limit of 50 ppm of ethylene oxide in ground spices. Any release to the environment greater than 10 pounds must be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set a limit of 1 ppm over an 8-hour workday, 40-hour workweek with a short-term exposure limit (not to exceed 15 minutes) of 5 ppm.

The National Institute of Occupational Safety and Health (NIOSH) recommends that average workplace air should contain less than 0.1 ppm ethylene oxide averaged over a 10-hour workday, 40-hour workweek.

The federal recommendations have been updated as of July 1999.

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 F-32
Atlanta, GA 30333

Information line and technical assistance:

Phone: 888-422-8737
FAX: (770)-488-4178

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

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 1990. Toxicological profile for ethylene oxide. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.