



PUBLIC HEALTH STATEMENT

Hexamethylene Diisocyanate (HDI)

CAS#: 822-06-0

Division of Toxicology

August 1998

This Public Health Statement is the summary chapter from the Toxicological Profile for hexamethylene diisocyanate. 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 public health statement tells you about hexamethylene diisocyanate (HDI) 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 activities. Hexamethylene diisocyanate has not been found in any of the 1,445 current or former NPL sites. However, the total number of NPL sites evaluated is not known. As more sites are evaluated, the number of sites at which HDI is found may increase. 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 can be exposed to a substance only when you come in

contact with it by breathing, eating, touching, or drinking.

If you are exposed to hexamethylene diisocyanate, 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 HDI?

HDI is the common name for hexamethylene diisocyanate. It is also known as 1,6-hexamethylene diisocyanate, 1,6-diisocyanatohexane, Mondur HX, and Desmodur H. It is a pale yellow liquid with a strong odor. HDI is found in hardening agents for automobile paints.

1.2 WHAT HAPPENS TO HDI WHEN IT ENTERS THE ENVIRONMENT?

HDI is most often found in air near locations where spray paints that contain it as a hardening agent are used. HDI in the air can enter the soil and water. HDI can also enter the soil if products containing it are dumped directly onto the soil. HDI can enter the water supply by washing out of soil that contains it or if products with HDI are dumped directly into water. Once it is in soil or water, HDI does not easily evaporate, so general air pollution is not expected. HDI breaks down very quickly in water or sunlight, so it probably will not build up in the environment.

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1.3 HOW MIGHT I BE EXPOSED TO HDI?

The most common products that contain HDI are called hardening agents and are used to spray-paint cars. The most common way a person can be exposed to HDI is by breathing air that contains it as a vapor or mist, like that made when spray-painting a car. Most of the people who are exposed to HDI work in the automotive painting industry or in areas where this is done. If you do this kind of work, you can be exposed to more HDI if you do not wear the right protective safety equipment such as a respirator or mask. If your safety equipment does not fit right or does not work properly when you are using products that contain HDI, you may be exposed to larger amounts. You can probably absorb some HDI through your skin. You could also accidentally swallow HDI if it is on your hands and you do not wash them before eating, drinking, or smoking.

Unless you have been employed in the automobile refinishing or other business where painters manually mix two-component polyurethane paint systems, it is unlikely that you will be exposed to large amounts of HDI.

1.4 HOW CAN HDI ENTER AND LEAVE MY BODY?

The most common way HDI enters your body is by breathing air that has it in it. You can probably absorb some HDI through your skin, and you can also accidentally swallow HDI if it is on your hands and you do not wash them before eating, drinking, or smoking. Once inside your body, HDI breaks down very quickly and is quickly excreted in the urine. Some HDI can attach itself to protein in your

blood, but we do not know how long it takes for this form of HDI to break down and be excreted.

1.5 HOW CAN HDI 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.

How HDI affects your health depends on how much is in the air you breathe. Tests using laboratory animals showed that breathing in high concentrations of HDI can irritate the nose, eyes, and throat. High concentrations have also caused pneumonia, difficulty in breathing, and death in some animals. Swallowing high concentrations of HDI also killed laboratory animals. When placed on the skin of these animals, HDI caused redness, irritation, and irreversible skin damage. People would probably be affected in many of the same ways if they were exposed to large amounts of HDI in air.

Many people who breathe in vapors from products with small amounts of HDI for many months or

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many years may develop an allergic, asthma-like reaction. Symptoms usually develop very slowly over a long time (months or years), but they can also develop within a couple of weeks after first breathing in HDI. At low concentrations, sensitized workers develop a burning sensation and a feeling of tightness in the chest, a cough (with and without phlegm), fever, and chills. They have a hard time breathing during their work day when using a product containing HDI. These signs usually are not seen on weekends, during vacations, or any time the person is not using a product that contains HDI. These reactions usually begin again soon after the person returns to work and begins to use the product with HDI.

Some studies in laboratory animals showed that, when breathed in over a long time, HDI did not produce cancer. No studies that show that HDI can cause cancer in people have been found.

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

Before you ask for special medical tests for HDI, you should talk with your doctor and tell him you work in a place that uses products that contain HDI. There are no good medical tests for finding out if you have been exposed to HDI. Some tests are available that measure the antibodies against HDI your body makes after you have been exposed to it. However, these blood tests are not very good because they can react with other substances that look like HDI in your blood. The test can show that you have been exposed to HDI when really you have not been exposed to it (false positives). Also, some people do not develop antibodies to HDI after they have been exposed. Another test looks for the

breakdown products of HDI in the urine. This test is only good if you were exposed to HDI within the last 12–15 hours. It is not a good test to find out if you have been exposed to low amounts of HDI over many months or years.

Unless you have been employed in the automobile refinishing or other business where painters manually mix two-component polyurethane paint systems, it is unlikely that you have been exposed to significant amounts of HDI. Your doctor can give you more information on medical tests that are available for determining if you have been exposed to HDI.

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.

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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 HDI include the following.

The EPA proposes to list HDI as a hazardous substance that will be required to be reported under the Emergency Planning and Community Right-to-Know Act for 1986 and the Pollution Prevention Act of 1990. Currently, some owners and operators using HDI are required to report every year how much HDI they release into the environment.

The NIOSH-recommended limit for occupational exposure is 0.035 milligrams of HDI per cubic meter of air (.035 mg/m³), which is the same as 5 parts per billion (ppb). There is no established OSHA permissible exposure limit (PEL) for HDI at this time; however, a similar substance, toluene diisocyanate (TDI), has a PEL of 5 parts per billion (ppb).

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). 1998. Toxicological profile for hexamethylene diisocyanate (HDI). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

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