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This fact sheet answers the most frequently asked health questions (FAQs) about toluene diisocyanate (TDI) and methylenediphenyl diisocyanate (MDI). For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information 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.

What are TDI and MDI?

TDI and MDI do not occur naturally in the environment. TDI is a clear, colorless to pale yellow liquid. MDI is a light yellow crystalline solid. There are several forms of TDI and MDI, which are called isomers. The two most common TDI isomers are 2,4-TDI and 2,6-TDI. The most common isomer of MDI is 4,4'-MDI.

TDI and MDI are used to make many household products. They combine with other chemicals to produce various polyurethanes. Some of the products made with these polyurethanes include foam for furniture cushions and carpet padding and waterproof sealants.

What happens to TDI and MDI when they enter the environment?

- TDI and MDI can be released into the air, water, and soil at places where they are produced or used.
- TDI and MDI are extremely reactive chemicals and are not likely to stay in the environment.
- In air, TDI and MDI have half-lives (amount of time needed for the amount of TDI or MDI in air to be reduced by one-half) of less than 1 day.
- TDI and MDI rapidly react with water to form other compounds. The half-lives of TDI and MDI in water range from a few minutes to a few hours.
- Small amounts of TDI and MDI may be detected in soil near point sources such as industrial waste streams and hazardous waste sites.
- TDI and MDI will not bioaccumulate in the food chain.

How might I be exposed to TDI and MDI?

- Exposure to diisocyanates from cured polyurethane products is unlikely. You may be exposed by using products such as adhesives, sealants, coatings, paints, craft materials, and insulating foams. In these products, diisocyanates are reactive (uncured).
- Workers involved in the manufacture of polyurethane products or involved in other industries using diisocyanates may be exposed to higher levels.
- Exposure through food and water is unlikely.

How can TDI and MDI affect my health?

Respiratory effects, including a decrease in lung function, have been reported in workers exposed to TDI or MDI. Some workers who become sensitized to TDI and/or MDI are particularly sensitive to the toxicity of TDI and MDI. They may experience adverse effects at much lower concentrations than the concentrations that may affect non-sensitized individuals.

Asthma and symptoms of asthma, such as wheezing and shortness of breath, have been observed in some individuals who are particularly sensitive to the toxicity of TDI and MDI.
How likely is TDI and MDI to cause cancer?

An excess of lung cancer was seen in some workers at a polyurethane foam manufacturing plant. However, it is not known if exposure to TDI was the cause. A study in animals orally exposed to TDI reported increases in tumors in the pancreas, mammary gland, and liver. The National Toxicology Program considers TDI as reasonably anticipated to be a human carcinogen. EPA has not classified the carcinogenicity of MDI. EPA notes that the carcinogenicity of MDI cannot be determined, but there is suggestive evidence that raises concern for carcinogenic effects.

How can TDI and MDI affect children?

There is no information on the effects of TDI or MDI in children. We expect that the effects in children will be similar to those seen in adults; exposure to TDI or MDI in the air could result in lung damage.

How can families reduce the risk of exposure to TDI and MDI?

• TDI and MDI are used to make many products; however, most of these products are cured and should not have unreacted diisocyanates remaining in them.

• Primary users and bystanders should be made aware of the potential risks and appropriate precautions to take when uncured TDI or MDI products (such as spray foam or sealants) are being used because use of these products can result in exposure to TDI or MDI.

Is there a medical test to show whether I’ve been exposed to TDI and MDI?

TDI and MDI can be measured in blood and urine. However, the detection of TDI and MDI or their hydrolysis products cannot predict the kind of health effects that might develop from that exposure.

Because TDI and MDI and their degradation products leave the body fairly rapidly (within days), the tests need to be conducted soon after exposure. These tests are not routinely available in a doctor’s office, but the samples can be sent to special laboratories.

Has the federal government made recommendations to protect human health?

The EPA has not recommended any drinking water guidelines for TDI or MDI.

The Occupational Safety and Health Administration (OSHA) has set a legal limit of 0.02 parts per million (ppm) for TDI and MDI in workplace air; these are “not-to exceed” levels.

The National Institute for Occupational Safety and Health (NIOSH) has set a recommended limit of 0.005 ppm for monomeric 4,4’ MDI in workplace air during a 10-hour workday, 40-hours workweek.

Reference

This ToxFaQs™ information is taken from the 2015 Toxicological Profile for Toluene Diisocyanate and Methylene diphenyl Diisocyanate (Draft for Public Comment) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.