



**TEAMSTERS**

# **Safety & Health FACTS**

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## **DIISOCYANATES**

### **What are diisocyanates?**

Diisocyanates are a family of chemicals which includes:

- ♦ TDI – Toluene diisocyanate
- ♦ MDI – Diphenylmethane diisocyanate
- ♦ HDI – Hexamethylene diisocyanate
- ♦ NDI – Naphthalene diisocyanate
- ♦ IPDI – Isophorone diisocyanate

### **What are they used for?**

Diisocyanates are used to make urethane plastics, including rigid and flexible foams, urethane coatings (in paints), and two-part adhesives.

### **What do they look like?**

Diisocyanates are generally found as a liquid combined with other chemicals and have a sharp, pungent, irritating odor. They may also be found as white to light yellow crystalline flakes (NDI).

### **What are possible health hazards?**

Diisocyanates can cause a wide range of health effects.

- ♦ Skin contact may produce an allergic skin rash in some individuals, and can cause reddening and irritation of the skin in others.
- ♦ Eye contact may result in severe irritation, inflammation, and permanent damage to the eye.
- ♦ Inhalation of large amounts can produce nausea, headache, coughing, respiratory irritation, and shortness of breath, leading to coughing spasms, bronchitis, and chemical pneumonitis.

These effects may be delayed by up to 24 hours. There have been several fatalities reported after massive exposures to diisocyanates. Fatalities are due to pulmonary edema (fluid in the lungs). The lethal limit for TDI in animals is reported to be 12 parts per million (ppm).

- ♦ Sensitization is the most common hazard reported for diisocyanates. This is a type of chemical asthma in which the body develops antibodies for the diisocyanate material. Once a person is sensitized, even very low levels of diisocyanates can produce an asthmatic attack with serious respiratory distress. Experience indicates that worker exposure at levels below the OSHA standard does not seem to cause sensitization. Sensitization can develop suddenly after years of handling the material without reaction. Once sensitized, workers may then be unable to tolerate even slight exposure to diisocyanates. There have been cases of sensitized workers who had to transfer or quit to avoid all exposures.

Heavy diisocyanate exposures have also been linked with neurological problems. Prolonged exposure to diisocyanates at low levels has caused reduced breathing capacity and an increase in bronchitis and influenza.

Several animal studies have been conducted to determine if TDI causes cancer. Animals fed TDI developed cancer, but animals exposed via inhalation did not. The National Institute for Occupational Safety and Health (NIOSH) has determined that TDI should be classified as a potential human carcinogen. Therefore, exposure to TDI should be reduced to the lowest possible concentrations.

## **What precautions can be taken?**

Successful control of diisocyanate hazards requires a comprehensive program. Key elements of such a program are as follows:

- ♦ Engineering controls, such as ventilation systems, must be installed to control vapors and mists.
- ♦ Specific procedures must be put into place for safe handling of spills, leaks, and malfunctions.
- ♦ Worker training on diisocyanate hazards and health effects is essential.
- ♦ Local exhaust ventilation must be used where diisocyanate contaminants are generated.
- ♦ Respirators should be used for spills, leaks, and emergencies, but not as a substitute for ventilation controls. This is especially important for spray operations, where high concentrations can be generated.
- ♦ Where contact with liquid diisocyanates is possible, employees must be provided with eye protection, protective clothing, and eyewash stations.

- ♦ Employees must be trained to report all spills and malfunctions. If the smell of diisocyanates can be detected, or if nose or eye irritation occurs, then levels probably exceed the OSHA standard and a hazardous condition might exist.
- ♦ Evacuation procedures should be developed in any facility that uses diisocyanates. These procedures should be followed whenever there is a spill or malfunction.
- ♦ Clean-up crews must be provided with respirators and protective clothing. Care must be taken to avoid fires with diisocyanate and urethane materials. Smoke from burning material contains highly poisonous hydrogen cyanide gas.

### What regulations are there?

	OSHA		NIOSH	
	<u>TWA*</u>	<u>Ceiling**</u>	<u>TWA*</u>	<u>Ceiling**</u>
TDI:		0.02 ppm		Ca***
MDI: -		0.02 ppm	0.005 ppm	0.02 ppm
HDI: -		-	0.005 ppm	0.02 ppm
NDI: -		-	0.005 ppm	0.02 ppm
IPDI: -		-	0.005 ppm	0.02 ppm

\* TWA – Time-Weighted Average over an eight-hour work shift

\*\* STEL – 15-minute Time-Weighted Average Exposure

\*\*\* Ca – Carcinogenic: NIOSH has determined this to be a potential human carcinogen, and as such exposure should be limited to the lowest possible concentration.