



Right to Know Hazardous Substance Fact Sheet

Common Name: **TOLUENE DIISOCYANATE (mixed isomers)**

Synonyms: Diisocyanatotoluene; Methylphenylene Isocyanate; TDI

Chemical Name: Benzene, 1,3-Diisocyanatomethyl-

Date: December 2008

CAS Number: 26471-62-5

RTK Substance Number: 3132

DOT Number: UN 2078

Description and Use

Toluene Diisocyanate is a clear, colorless to pale yellow liquid with a strong odor. It is used, most often as a mixture of 80% *2,4-Diisocyanate* and 20% *2,6-Diisocyanate*, in making polyurethane, plastics, coatings and elastomers used in paints, adhesives, furniture and insulation.

- ▶ **ODOR THRESHOLD = 2.1 ppm**
- ▶ Odor thresholds vary greatly. Do not rely on odor alone to determine potentially hazardous exposures.

Reasons for Citation

- ▶ **Toluene Diisocyanate** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, NTP, DEP, IARC, IRIS and EPA.
- ▶ This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

- ▶ Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while flushing. Seek medical attention.

Skin Contact

- ▶ Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Inhalation

- ▶ Remove the person from exposure.
- ▶ Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- ▶ Transfer promptly to a medical facility.
- ▶ Medical observation is recommended for 24 to 48 hours after overexposure, as pulmonary edema may be delayed.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

EMERGENCY RESPONDERS >>>> SEE BACK PAGE

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	3	-
FLAMMABILITY	1	-
REACTIVITY	3 W	-
CARCINOGEN COMBUSTIBLE REACTIVE POISONOUS GASES ARE PRODUCED IN FIRE CONTAINERS MAY EXPLODE IN FIRE		

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

- ▶ **Toluene Diisocyanate** can affect you when inhaled.
- ▶ **Toluene Diisocyanate** should be handled as a CARCINOGEN--WITH EXTREME CAUTION.
- ▶ Contact can irritate and burn the skin and eyes.
- ▶ Inhaling **Toluene Diisocyanate** can irritate the nose and throat.
- ▶ Inhaling **Toluene Diisocyanate** can irritate the lungs. Higher exposures may cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency.
- ▶ **Toluene Diisocyanate** can cause headache, nausea, and vomiting.
- ▶ **Toluene Diisocyanate** may cause a skin allergy and an asthma-like allergy.
- ▶ Repeated high exposure may cause loss of coordination, and memory and concentration problems.
- ▶ **Toluene Diisocyanate** is REACTIVE and a DANGEROUS EXPLOSION HAZARD.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **0.02 ppm** (as *2,4-Diisocyanate*), not to be exceeded at any time.

NIOSH: Recommends that exposure to occupational carcinogens be limited to the lowest feasible concentration.

ACGIH: The threshold limit value (TLV) is **0.001 ppm** (as the *inhalable fraction* and *vapor*) averaged over an 8-hour workshift and **0.003 ppm** (as the *inhalable fraction* and *vapor*) as a STEL (short-term exposure limit).

- ▶ **Toluene Diisocyanate** may be a CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.

Determining Your Exposure

- ▶ Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- ▶ For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- ▶ You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- ▶ The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Toluene Diisocyanate**:

- ▶ Contact can irritate and burn the skin and eyes.
- ▶ Inhaling **Toluene Diisocyanate** can irritate the nose and throat.
- ▶ Inhaling **Toluene Diisocyanate** can irritate the lungs causing coughing and/or shortness of breath. Higher exposures may cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.
- ▶ **Toluene Diisocyanate** can cause headache, nausea, and vomiting.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Toluene Diisocyanate** and can last for months or years:

Cancer Hazard

- ▶ **Toluene Diisocyanate** may be a CARCINOGEN in humans since it has been shown to cause cancer of the pancreas, liver, and mammary glands in animals.
- ▶ Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard

- ▶ There is limited evidence that **Toluene Diisocyanate** may affect male fertility.

Other Effects

- ▶ **Toluene Diisocyanate** may cause a skin allergy. If allergy develops, very low future exposure can cause itching and a skin rash.
- ▶ **Toluene Diisocyanate** may cause an asthma-like allergy. Future exposure can cause asthma attacks with shortness of breath, wheezing, coughing, and/or chest tightness.
- ▶ **Toluene Diisocyanate** can irritate the lungs. Repeated exposure may cause bronchitis to develop with coughing, phlegm, and/or shortness of breath.
- ▶ Repeated high exposure may cause loss of coordination, and memory and concentration problems.

Medical

Medical Testing

For frequent or potentially high exposure (half the TLV or greater), the following is recommended before beginning work and at regular times after that:

- ▶ Chest x-ray

If symptoms develop or overexposure is suspected, the following are recommended:

- ▶ Exam of the nervous system
- ▶ Evaluation by a qualified allergist can help diagnose skin allergy.
- ▶ Lung function tests. The results may be normal if the person is not having an attack at the time of the test.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures

- ▶ Smoking can cause heart disease, lung cancer, emphysema, and other respiratory problems. It may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- ▶ Label process containers.
- ▶ Provide employees with hazard information and training.
- ▶ Monitor airborne chemical concentrations.
- ▶ Use engineering controls if concentrations exceed recommended exposure levels.
- ▶ Provide eye wash fountains and emergency showers.
- ▶ Wash or shower if skin comes in contact with a hazardous material.
- ▶ Always wash at the end of the workshift.
- ▶ Change into clean clothing if clothing becomes contaminated.
- ▶ Do not take contaminated clothing home.
- ▶ Get special training to wash contaminated clothing.
- ▶ Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- ▶ Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- ▶ Before entering a confined space where **Toluene Diisocyanate** may be present, check to make sure that an explosive concentration does not exist.
- ▶ Where possible, transfer **Toluene Diisocyanate** from drums or other containers to process containers in an enclosed system.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- ▶ Avoid skin contact with **Toluene Diisocyanate**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- ▶ Safety equipment manufacturers recommend Butyl, Silver Shield®/4H®, Viton and Barrier® for gloves, and Tychem® BR, LV, Responder® and TK, or the equivalent, as protective materials for clothing.

- ▶ All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- ▶ Wear indirect-vent, impact and splash resistant goggles when working with liquids.
- ▶ Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.
- ▶ Do not wear contact lenses when working with this substance.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- ▶ Where the potential exists for exposure over **0.001 ppm**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- ▶ Exposure to **2.5 ppm** is immediately dangerous to life and health. If the possibility of exposure above **2.5 ppm** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- ▶ **Toluene Diisocyanate** is a COMBUSTIBLE LIQUID which may explode when exposed to HEAT and FLAMES.
- ▶ Use dry chemical, CO₂, water spray (as fog, not in solid streams) or alcohol-resistant foam as extinguishing agents.
- ▶ **Toluene Diisocyanate** is REACTIVE and a DANGEROUS EXPLOSION HAZARD.
- ▶ POISONOUS GASES ARE PRODUCED IN FIRE, including *Nitrogen Oxides* and *Cyanides*.
- ▶ CONTAINERS MAY EXPLODE IN FIRE.
- ▶ Use water spray to keep fire-exposed containers cool.
- ▶ Use water spray to reduce vapors.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Toluene Diisocyanate** is spilled or leaked, take the following steps:

- ▶ Evacuate personnel and secure and control entrance to the area.
- ▶ Eliminate all ignition sources.
- ▶ Absorb liquids in vermiculite, dry sand, earth, or a similar material and place into sealed containers for disposal.
- ▶ Ventilate area of spill or leak.
- ▶ DO NOT wash into sewer.
- ▶ It may be necessary to contain and dispose of **Toluene Diisocyanate** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Toluene Diisocyanate** you should be trained on its proper handling and storage.

- ▶ **Toluene Diisocyanate** reacts with WATER to form *Polyurea* and *Carbon Dioxide*. This reaction produces HEAT, resulting in container rupture.
- ▶ **Toluene Diisocyanate** can polymerize (self react) uncontrollably when in contact with STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); ACYL CHLORIDES; and AMINES.
- ▶ **Toluene Diisocyanate** is not compatible with ANILINE; ALCOHOLS; STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); and OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).
- ▶ Store in tightly closed containers in a cool, well-ventilated area away from PLASTICS, RUBBER, ALUMINUM, COPPER, ZINC, and HEAT.
- ▶ Sources of ignition, such as smoking and open flames, are prohibited where **Toluene Diisocyanate** is used, handled, or stored in a manner that could create a potential fire or explosion hazard.
- ▶ Use only non-sparking tools and equipment, especially when opening and closing containers of **Toluene Diisocyanate**.
- ▶ DO NOT store in *Polyethylene* containers as there is a potential for explosion due to absorption of water.
- ▶ Containers of *unreacted Toluene Diisocyanate* and WATER should be left with the bung open or the lid slightly ajar to prevent pressure build-up.

Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health
 Right to Know
 PO Box 368
 Trenton, NJ 08625-0368
 Phone: 609-984-2202
 Fax: 609-984-7407
 E-mail: rtk@doh.state.nj.us
 Web address: <http://www.nj.gov/health/eoh/rtkweb>

The Right to Know Hazardous Substance Fact Sheets are not intended to be copied and sold for commercial purposes.

GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Acute Exposure Guideline Levels (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a-lifetime, or rare, exposure to airborne chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

CFR is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database on human health effects that may result from exposure to various chemicals, maintained by federal EPA.

LEL or Lower Explosive Limit, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m³ means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

Protective Action Criteria (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or Upper Explosive Limit is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

Common Name: **TOLUENE DIISOCYANATE (mixed isomers)**

Synonyms: Diisocyanatotoluene; Methylphenylene Isocyanate; TDI

CAS No: 26471-62-5

 Molecular Formula: C₉H₆N₂O₂

RTK Substance No: 3132

Description: Clear, colorless to pale yellow liquid with a strong odor

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
3 - Health 1 - Fire 3-W - Reactivity DOT#: UN 2078 ERG Guide #: 156 Hazard Class: 6.1 (Poison)	<p>Toluene Diisocyanate is a COMBUSTIBLE LIQUID which may explode when exposed to HEAT and FLAMES.</p> <p>Use dry chemical, CO₂, water spray (as fog, not in solid streams) or alcohol-resistant foam as extinguishing agents.</p> <p>Toluene Diisocyanate is REACTIVE and a DANGEROUS EXPLOSION HAZARD.</p> <p>POISONOUS GASES ARE PRODUCED IN FIRE, including <i>Nitrogen Oxides</i> and <i>Cyanides</i>.</p> <p>CONTAINERS MAY EXPLODE IN FIRE.</p> <p>Use water spray to keep fire-exposed containers cool.</p> <p>Use water spray to reduce vapors.</p>	<p>Toluene Diisocyanate reacts with WATER to form <i>Polyurea</i> and <i>Carbon Dioxide</i>. The reaction produces HEAT, resulting in container rupture.</p> <p>Toluene Diisocyanate can polymerize (self react) uncontrollably when in contact with STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); ACYL CHLORIDES; and AMINES.</p> <p>Toluene Diisocyanate is not compatible with ANILINE; ALCOHOLS; STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); and OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).</p>

SPILL/LEAKS

Isolation Distance:

Spills: 50 meters (150 feet)

Fire: 800 meters (1/2 mile)

Absorb liquids in vermiculite, dry sand, earth, or a similar material and place into sealed containers for disposal.

Use only non-sparking tools and equipment, especially when opening and closing containers.

 Containers of *unreacted Toluene Diisocyanate* and WATER should be left with the bung open or the lid slightly ajar to prevent pressure build-up.

DO NOT wash into sewer.

PHYSICAL PROPERTIES

Odor Threshold:	2.1 ppm
Flash Point:	250°F (121°C)
LEL:	0.9%
UEL:	9.5%
Auto Ignition Temp:	>300°F (>149°C)
Vapor Density:	6 (air = 1)
Vapor Pressure:	0.025 mm Hg at 77°F (25°C)
Specific Gravity:	1.2 (water = 1)
Water Solubility:	Reacts
Boiling Point:	484°F (251°C)
Melting Point:	67° to 71°F (19° to 22°C)
Molecular Weight:	174.2

EXPOSURE LIMITS

OSHA: 0.02 ppm, Ceiling

ACGIH: 0.001 ppm, 8-hr TWA; 0.003 ppm, 15-min STEL

IDLH: 2.5 ppm

The Protective Action Criteria values are:

PAC-1 = 0.75 ppm,

PAC-2 = 2 ppm

PAC-3 = 2 ppm

PROTECTIVE EQUIPMENT

Gloves:	Butyl, Silver Shield®/4H®, Viton and Barrier® (>8-hr breakthrough)
Coveralls:	Tychem® BR, LV, Responder® and TK (>8-hr breakthrough)
Respirator:	Supplied air or SCBA

HEALTH EFFECTS

Eyes:	Irritation and burns
Skin:	Irritation and burns
Inhalation:	Nose, throat and lung irritation with coughing and severe shortness of breath (pulmonary edema) Headache, nausea and vomiting
Chronic:	Cancer (pancreas, liver, mammary glands) in animals

FIRST AID AND DECONTAMINATION

Remove	the person from exposure.
Flush	eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn. Seek medical attention
Quickly	remove contaminated clothing and wash contaminated skin with large amounts of soap and water.
Begin	artificial respiration if breathing has stopped and CPR if necessary.
Transfer	promptly to a medical facility
Medical	observation is recommended as symptoms may be delayed.