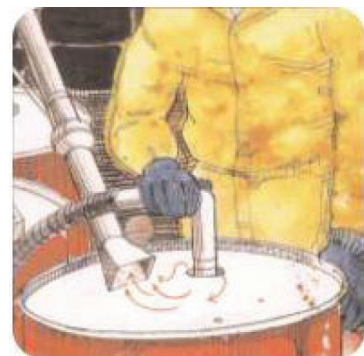
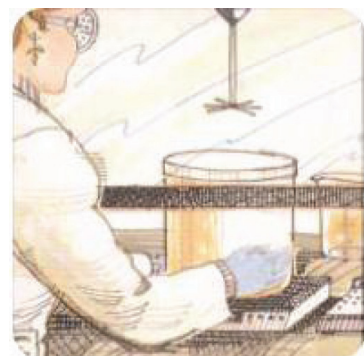


Guidance for Working with TDI: Things You Should Know

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Purpose

The Center for the Polyurethanes Industry (CPI) prepared this guidance documents to help remind professionals about important health and safety considerations when working with TDI. It supplements the more comprehensive information contained in your supplier's Safety Data Sheet (SDS), which is used as the primary document for specific TDI distribution and handling issues.



Identifying TDI

Toluene Diisocyanate, commonly referred to as TDI, is a colorless to pale yellow liquid at room temperature with a sharp, pungent odor. The table below illustrates some key chemical and physical properties of TDI:

| Physical State | Liquid at ambient conditions |
|-------------------------------|---|
| Molecular Weight | 174.2 |
| Boiling Point | 486 - 489°F (252 - 254°C) |
| Freezing Point | 49 - 50°F (9.5 - 10°C) |
| Specific Gravity | 1.22 @ 68°F (20°C) |
| Density | 10.2 lbs/gal |
| Vapor Pressure | 0.0105 mm Hg at 68°F (20°C) |
| Saturated Vapor Concentration | 14 ppm at 68°F (20°C) |
| Viscosity | 3.0 m Pas @ 77°F (25°C) |
| Solubility in Water | not soluble; reacts with the evolution of CO ₂ |
| Flash Point | 270°F (132°C) |
| Auto ignition Temperature | >1103°F (595°C) |
| CAS # | 26471-62-5 |

Source: MDI and TDI: Safety, Health and the Environment. A Source Book and Practical Guide. Dennis C. Allport, David S. Gilbert, Susan M. Outterside, 2003. All values shown are for 80/20 mix of 2,4- and 2,6-TDI.

Recognizing Potential Health Hazards

Overexposure to TDI vapor, liquid or aerosol can be harmful to your health. There are four possible routes of exposure:

- inhalation
- eye contact
- skin contact
- ingestion

Below are the potential effects of overexposure and some first-aid considerations:

Inhalation:

The odor threshold of TDI is above established exposure limits, meaning users cannot tell by their senses alone if they are exposed to airborne concentrations that exceed allowable exposure limits. Therefore, odor should never be used to indicate the presence of TDI.

Exposure limits are set by regulatory organizations like the Occupational Safety and Health Administration (OSHA) and other professional (non-regulatory) organizations such as the American Conference of Governmental Industrial Hygienists (ACGIH). Exposure limits typically define the maximum airborne concentrations of chemical substances and represent conditions to which it is believed that nearly all workers, without use of respiratory protection, may be repeatedly exposed without adverse health effects.

Airborne exposure to TDI may include possible respiratory irritation effects such as:

- nose irritation
- coughing
- chest tightness or discomfort
- shortness of breath

Overexposure to TDI may cause users to become sensitized or “allergic.” If sensitized, you may feel tightness in your chest and have difficulty breathing when exposed to TDI even at low levels. Effects may be either immediate and/or delayed for several hours. If diagnosed by a medical professional with sensitization, avoid exposure to all diisocyanates.

If you suspect someone has become overexposed, move the person to an area free from the potential for further exposure. Seek medical attention immediately. A qualified person may administer oxygen or artificial respiration as needed.

Eye Contact:

Getting liquid TDI in your eyes may be painful and could cause temporary corneal injury. High vapor concentrations or mists may cause pain, tearing and irritation. Low concentrations of TDI vapor may cause mild tearing or a slight burning sensation. If you get TDI in your eyes, flush them immediately with a continuous flow of low pressure water, preferably from an eyewash station, for at least 15 minutes. Seek medical attention at once.

Skin Contact:

Getting TDI on your skin may cause redness, swelling, or itching and may also play a role in the development of skin sensitization, an allergic reaction. In addition, animal tests have indicated that skin contact with TDI may play a role in the development of respiratory sensitization. If direct skin contact with isocyanates occurs, immediately remove contaminated clothing and shoes. Wipe off the isocyanate product from the skin using dry towels or other similar absorbent fabric. If readily available, apply a polyglycol-based cleanser or corn oil. If a polyglycol-based cleanser is not available, wash with soap and warm water for 15 minutes. If available, use a wipe test pad to verify decontamination is complete. Seek medical attention if irritation develops. Discard or wash contaminated clothing before reuse. For larger exposures, use an emergency shower.

Ingestion:

Although unlikely, accidental ingestion of TDI can occur. Swallowing TDI can cause irritation in your mouth, throat, and stomach.

If ingestion occurs, rinse the mouth with water; do NOT induce vomiting. Do not give anything by mouth to an unconscious person. Seek medical attention immediately.

Protecting Yourself from TDI Overexposure

Overexposure to airborne TDI can occur when working with TDI even at room temperature. In addition, overexposure can occur when there is direct skin contact with liquid TDI. Reducing or eliminating your exposure risk will help prevent the potential of adverse health effects.

At normal room temperature (i.e., 70° F), airborne concentrations of TDI can exceed the TLV or PEL. Therefore, respiratory protection should be worn when handling TDI in an open system, in process areas near foam production not covered by a ventilation system, and during tasks such as making or breaking hose connections, initial line breaking and in similar situations where a sudden pressure release could cause an overexposure. Respiratory protection should always be worn during spill or emergency situations.

Where there is a potential risk of exposure to airborne TDI above applicable exposure limits, consider using (at a minimum):

- An approved respirator, either air-supplied or air purifying. The type of respiratory protection will depend upon the maximum exposure concentration. Consult your company safety professional or the product SDS for guidance.
- Elevated airborne concentrations may be irritating to the eyes, therefore eye protection may also be needed if not already provided by the respirator.
- For more details on the use of air purifying respirators under the OSHA Standard, please refer to the CPI document Guidance for Developing a Written Respiratory Program (AX 501).

Where there is a risk of skin and eye exposure to TDI liquid, consider using (at a minimum):

- TDI-resistant chemical gloves (see CPI document Guidance for Selection of Personal Protective Equipment for TDI Users, AX-179)
- In situations where there is splash potential (e.g., when directly handling liquid product), workers should wear chemical splash goggles and, depending upon the extent of potential contact, a faceshield. These situations may include line-breaking (transfer hose disconnect), transfer of material using a drum pump, etc.
- If there is potential for more extensive exposure, the following may also be necessary:
 - o TDI-resistant long-sleeve coveralls or full body suit (see CPI document AX-179)
 - o TDI-resistant fitted boots
 - o Head covering

Respiratory protection, eye protection, and complete skin protection are necessary for spray applications containing TDI.

Understanding Potential Reactivity Hazards

TDI is a reactive chemical and it is important that it is stored and handled properly. Dangerous buildup of heat and/or pressure (see “Caution” noted below) within storage containers or closed process vessels can result from improper mixing or contact with:

- Acids, inorganic bases (such as sodium hydroxide or potassium hydroxide), and ammonia
- Polyetheramines, amine catalysts and other amines
- Magnesium, aluminum and their alloys
- Other metal salts, especially halides (such as tin, iron, aluminum and zinc chlorides)
- All strong oxidizing agents (such as bleach or chlorine)
- Polyols and other alcohols
- Water (typically a relatively slow reaction that releases carbon dioxide gas)

Caution: Resealing TDI containers contaminated with any of the above materials can cause a buildup of pressure in the container and could cause it to forcibly rupture. TDI can react with itself in a fire or at very high temperatures releasing carbon dioxide and causing the buildup of pressure in sealed containers sufficient to cause a forcible rupture.

Handling, Unloading and Storing TDI

To minimize hazards when handling, unloading, storing or disposing of TDI, consider the following:

- Wearing protective clothing
- Following employer’s established procedures for normal operations, emergencies, maintenance, loading/unloading sampling and special operations
- Using appropriate checklists as the steps are being completed
- Inspecting equipment to ensure operating integrity following maintenance procedures
- Maintaining good housekeeping
- Participating in relevant training programs
- Following all safety precautions for handling TDI until empty drums are resealed or ready for reclamation
- Handling and storing drums in a well-ventilated and dry area with spill containment
- Following manufacturer’s instructions for TDI storage temperature
- Checking drum shipments for leakage
- Using plugs/caps on terminal valves or fittings and bleed valves
- Keeping drum overpacks available
- Keeping drums segregated from containers of material that are incompatible with TDI
- Providing secondary containment
- Always review the manufacturer’s SDS (Safety Data Sheet)

When handling TDI, DO NOT:

- use pressure to empty drums
- store TDI in open-head drums
- cut empty TDI drums with a torch
- use empty TDI drums from a worksite for personal use such as a barbecue pit, flower box, trash barrel, etc.

Empty drums should be handled by a qualified drum reconditioner. Contact the Reusable Industrial Packaging Association (RIPA – <https://www.reusablepackaging.org/>) to locate a drum reconditioner near you.

Responding To Emergencies

Fires, spills, bulging drums, and other emergencies involving TDI require immediate responses. If you are not a trained, designated emergency responder, leave the area immediately and notify the appropriate emergency response personnel.

If you need assistance with a spill or other emergency involving TDI, call CHEMTREC at 1-800-424-9300.

CHEMTREC operators are available 24 hours a day, seven days a week.



Legal Notice

This guidance document was prepared by the American Chemistry Council's Center for the Polyurethanes Industry. It is intended to provide general information to professional persons who may work with or handle TDI. It is not intended to serve as a substitute for in-depth training or specific handling or storage requirements, nor is it designed or intended to define or create legal rights or obligations. It is not intended to be a "how-to" manual, nor is it a prescriptive guide. All persons involved in handling TDI have an independent obligation to ascertain that their actions are in compliance with current federal, state and local laws and regulations and should consult with legal counsel concerning such matters. The guidance is necessarily general in nature and individual companies may vary their approach with respect to particular practices based on specific factual circumstance, the practicality and effectiveness of particular actions and economic and technological feasibility. Neither the American Chemistry Council, nor the individual member companies of the Center for the Polyurethanes Industry of the American Chemistry Council, nor any of their respective directors, officers, employees, subcontractors, consultants, or other assigns, makes any warranty or representation, either express or implied, with respect to the accuracy or completeness of the information contained in this guidance document; nor do the American Chemistry Council or any member companies assume any liability or responsibility for any use or misuse, or the results of such use or misuse, of any information, procedure, conclusion, opinion, product, or process disclosed in this guidance document. **NO WARRANTIES ARE GIVEN; ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED.**

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Center for the
Polyurethanes Industry

American Chemistry Council

700 2nd Street, NE
Washington, DC 20002
(202) 249-7000

www.americanchemistry.com