

# TOLUENE DIISOCYANATE

ChemWatch Material Safety Data Sheet (REVIEW)

Issue Date: Wed 30-Jun-2004

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## Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

### PRODUCT NAME

TOLUENE DIISOCYANATE

### SYNONYMS

C9- H6- N2- O2  
TDI mixture

4- methyl- m- phenylenediisocyanate / -  
- - 6methylmphenylesocyanate  
2,4- tolylene diisocyanate / , -  
26tolylene diisocyanate  
Hylene T Mondur TD Niax TDI

CH3C6H3(NCO) 2  
tolylene- 2,4- diisocyanate / - , -  
tolylene26diisote  
isocyanic acid, methylphenylene ester  
diisocayantomethylbenzene  
di- iso- cyanatoluene

Rubinate TDI 80/20 Voronate T80

### PROPER SHIPPING NAME

TOLUENE DIISOCYANATE

### PRODUCT USE

In the manufacture of polyurethane foams, elastomers and coatings. CAUTION: isocyanates are strong respiratory sensitisers and skin sensitisers. Sensitised people can react to very low levels of airborne isocyanates and should not be required to work with these materials.

### SUPPLIER

Company: Orica P/L (ICI Australia Operations P/L)

Address:

1 Nicholson Street

Melbourne

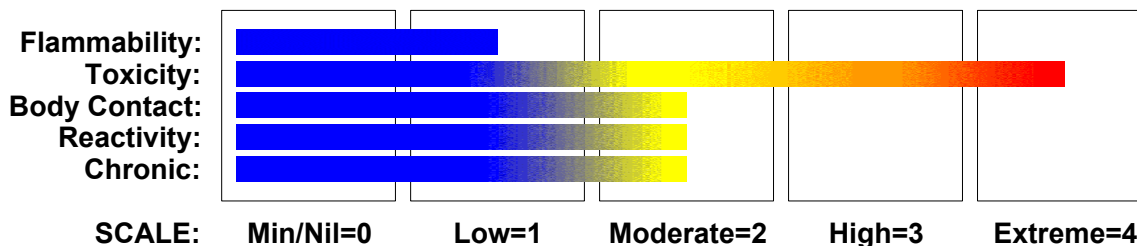
VIC, 3000

AUS

Telephone: 1300 550 036

Fax: 1300 550 081

### HAZARD RATINGS



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## Section 2 - HAZARDS IDENTIFICATION



### EMERGENCY OVERVIEW

#### HAZARD

Determined by Chemwatch using GHS/HSNO criteria:

6.1A 6.3A 6.4A 6.5A 6.5B 6.7B 9.1C

Extremely Toxic by inhalation

Irritating to skin.

Irritating to eyes.

May cause SENSITISATION by inhalation.

May cause SENSITISATION by skin contact.

Limited evidence of a carcinogenic effect.

Harmful in the aquatic environment

### POTENTIAL HEALTH EFFECTS

#### ACUTE HEALTH EFFECTS

##### SWALLOWED

Although ingestion is not thought to produce harmful effects (as classified under EC Directives), the material may still be damaging to the health of the individual, following ingestion, especially where pre-existing organ (e.g liver, kidney) damage is evident. Present definitions of harmful or toxic substances are generally based on doses producing mortality rather than those producing morbidity (disease, ill-health). Gastrointestinal tract discomfort may produce nausea and vomiting. In an occupational setting however, ingestion of insignificant quantities is not thought to be cause for concern.

##### EYE

Evidence exists, or practical experience predicts, that the material may cause eye irritation in a substantial number of individuals and/or may produce significant ocular lesions which are present twenty-four hours or more after instillation into the eye(s) of experimental animals.

Repeated or prolonged eye contact may cause inflammation characterised by temporary redness (similar to windburn) of the conjunctiva (conjunctivitis); temporary impairment of vision and/or other transient eye damage/ulceration may occur.

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## Section 2 - HAZARDS IDENTIFICATION ...

### SKIN

Evidence exists, or practical experience predicts, that the material either produces inflammation of the skin in a substantial number of individuals following direct contact, and/or produces significant inflammation when applied to the healthy intact skin of animals, for up to four hours, such inflammation being present twenty-four hours or more after the end of the exposure period. Skin irritation may also be present after prolonged or repeated exposure; this may result in a form of contact dermatitis (nonallergic). The dermatitis is often characterised by skin redness (erythema) and swelling (oedema) which may progress to blistering (vesiculation), scaling and thickening of the epidermis. At the microscopic level there may be intercellular oedema of the spongy layer of the skin (spongiosis) and intracellular oedema of the epidermis. Skin contact is not thought to have harmful health effects (as classified under EC Directives); the material may still produce health damage following entry through wounds, lesions or abrasions.

### INHALED

Very toxic by inhalation.

Evidence shows, or practical experience predicts, that the material produces irritation of the respiratory system in a substantial number of individuals following inhalation.

### CHRONIC HEALTH EFFECTS

On the basis, primarily, of animal experiments, concern has been expressed that the material may produce carcinogenic or mutagenic effects; in respect of the available information, however, there presently exists inadequate data for making a satisfactory assessment.

Practical evidence shows that inhalation of the material is capable of inducing a sensitisation reaction in a substantial number of individuals at a greater frequency than would be expected from the response of a normal population. Pulmonary sensitisation, resulting in hyperactive airway dysfunction and pulmonary allergy may be accompanied by fatigue, malaise and aching. Significant symptoms of exposure may persist for extended periods, even after exposure ceases. Symptoms can be activated by a variety of nonspecific environmental stimuli such as automobile exhaust, perfumes and passive smoking.

Practical experience shows that skin contact with the material is capable either of inducing a sensitisation reaction in a substantial number of individuals, and/or of producing a positive response in experimental animals.

Principal routes of exposure are usually by inhalation and skin contact. Isocyanate vapours are irritating to the airways and can cause their inflammation, with wheezing, gasping, severe distress, even loss of consciousness and fluid in the lungs. Nervous system symptoms that may occur include headache, sleep disturbance, euphoria, inco-ordination, anxiety, depression and paranoia. Digestive effects include nausea and vomiting. Breathing difficulties may occur unpredictably after a period of tolerance and after skin contact. Allergic inflammation of the skin can occur, with rash, itching, blistering, and swelling of the hands and feet. Sensitive people can react to very low levels and should not be exposed to this material. With most allergens, removal of the offending agent results in the individual becoming asymptomatic. Toluene diisocyanate (TDI)-induced asthma may continue for months or even years after exposure ceases. This may be due to a non-allergenic condition known as reactive airway dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Evidence of carcinogenic potential of commercial grade TDI in female mice included induction of haemangiomas in the spleen and subcutaneous tissues, hepatocellular adenomas, and haemangiosarcomas in the liver, ovary and peritoneum. Ingestion of commercial grade TDI

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## Section 2 - HAZARDS IDENTIFICATION ...

produced subcutaneous fibromas, pancreatic acinar cell adenomas, mammary gland fibroadenomas and subcutaneous fibromas and fibrosarcomas in female rats. No treatment related tumours were induced in male mice.

## Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
toluene diisocyanate (technical grades as the mixed isomers)	26471-62-5	
toluene-2,4-diisocyanate	584-84-9	>65
toluene-2,6-diisocyanate	91-08-7	>20

## Section 4 - FIRST AID MEASURES

### SWALLOWED

If poisoning occurs, contact a doctor or Poisons Information Centre.

- IF SWALLOWED, REFER FOR MEDICAL ATTENTION, WHERE POSSIBLE, WITHOUT DELAY.
- For advice, contact a Poisons Information Centre or a doctor.

Where Medical attention is not immediately available or where the patient is more than 15 minutes from a hospital or unless instructed otherwise:

- Induce vomiting with fingers down the back of the of the throat, ONLY IF CONSCIOUS.
  - Lean patient forward or place on left side (head-down position if possible) to maintain open airway and prevent aspiration.
- NOTE: Wear a protective glove when inducing vomiting by mechanical means.
- In the mean time, qualified first-aid personnel should treat the patient following observation and employing supportive measures as indicated by the patient's condition.
  - If the services of a medical officer or medical doctor are readily available, the patient should be placed in his/her care and a copy of the MSDS should be provided. Further action will be the responsibility of the medical specialist.
  - If medical attention is not available on the worksite or surroundings send the patient to a hospital together with a copy of the MSDS.

### EYE

If this product comes in contact with the eyes:

- Immediately hold eyelids apart and flush the eye continuously with running water.
- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes.
- Transport to hospital or doctor without delay.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

### SKIN

If skin or hair contact occurs:

- Immediately flush body and clothes with large amounts of water, using safety shower if available.
- Quickly remove all contaminated clothing, including footwear.

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## Section 4 - FIRST AID MEASURES ...

- Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Centre.
- Transport to hospital, or doctor.

### INHALED

- If fumes or combustion products are inhaled remove from contaminated area.
- Lay patient down. Keep warm and rested.
- Prosthesis such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
- Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
- Transport to hospital, or doctor, without delay.

### NOTES TO PHYSICIAN

For sub-chronic and chronic exposures to isocyanates:

- This material may be a potent pulmonary sensitiser which causes bronchospasm even in patients without prior airway hyperreactivity.
- Clinical symptoms of exposure involve mucosal irritation of respiratory and gastrointestinal tracts.
- Conjunctival irritation, skin inflammation (erythema, pain vesiculation) and gastrointestinal disturbances occur soon after exposure.
- Pulmonary symptoms include cough, burning, substernal pain and dyspnoea.
- Some cross-sensitivity occurs between different isocyanates.
- Noncardiogenic pulmonary edema and bronchospasm are the most serious consequences of exposure. Markedly symptomatic patients should receive oxygen, ventilatory support and an intravenous line.
- Treatment for asthma includes inhaled sympathomimetics (epinephrine [adrenalin], terbutaline) and steroids.
- Activated charcoal (1 g/kg) and a cathartic (sorbitol, magnesium citrate) may be useful for ingestion.
- Mydriatics, systemic analgesics and topical antibiotics (Sulamyd) may be used for corneal abrasions.
- There is no effective therapy for sensitised workers.

[Ellenhorn and Barceloux; Medical Toxicology]

NOTE: Isocyanates cause airway restriction in naive individuals with the degree of response dependant on the concentration and duration of exposure. They induce smooth muscle contraction which leads to bronchoconstrictive episodes. Acute changes in lung function, such as decreased FEV<sub>1</sub>, may not represent sensitivity.

[Karol & Jin, Frontiers in Molecular Toxicology, pp 56-61, 1992]

In normal commercial preparations of toluene diisocyanate, the 2,4-isomer dominates in the ratio 4:1. However it is also hydrolysed, in air, more rapidly than the 2,6-isomer. Airway sensitivities may result from the appearance of immunoglobulins in the blood. Frequent inability to detect antibodies to TDI in clinical cases may result from the routine use of diagnostic antigens containing predominantly 2,4-TDI, whereas individuals may have been exposed to atmospheres in which 2,6-TDI was the predominant isomer. [Karol Frontiers of Molecular Toxicology, pp 55-61, 1992]

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## Section 5 - FIRE FIGHTING MEASURES

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### EXTINGUISHING MEDIA

- Dry chemical powder.
- BCF (where regulations permit).
- Carbon dioxide.

### FIRE FIGHTING

- Alert Fire Brigade and tell them location and nature of hazard.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.
- Consider evacuation (or protect in place).
- Fight fire from a safe distance, with adequate cover.
- Extinguishers should be used only by trained personnel
- Use water delivered as a fine spray to control fire and cool adjacent area.
- Avoid spraying water onto liquid pools.
- Do not approach containers suspected to be hot.
- Cool fire exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.
- If fire gets out of control withdraw personnel and warn against entry.
- Equipment should be thoroughly decontaminated after use.

### FIRE/EXPLOSION HAZARD

- Combustible.
- Moderate fire hazard when exposed to heat or flame.
- When heated to high temperatures decomposes rapidly generating vapour which pressures and may then rupture containers with release of flammable and highly toxic isocyanate vapour.
- Burns with acrid black smoke and poisonous fumes.
- Combustion yields traces of highly toxic hydrogen cyanide HCN, plus toxic nitrogen oxides NO<sub>x</sub> and carbon monoxide.
- Small quantities of water in contact with hot liquid may react violently with generation of a large volume of rapidly expanding hot sticky semi-solid foam.
- Presents additional hazard when fire fighting in a confined space.
- Cooling with flooding quantities of water reduces this risk.

### FIRE INCOMPATIBILITY

Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result

### Personal Protective Equipment

Glasses:  
Chemical goggles.  
Full face- shield.

Gloves:  
1.BUTYL 2.PE/EVAL/PE 3.TEFLON

Respirator:  
Type AB-P Filter of sufficient capacity

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## Section 6 - ACCIDENTAL RELEASE MEASURES

### EMERGENCY PROCEDURES

#### MINOR SPILLS

Environmental hazard - contain spillage.

- Clean up all spills immediately.
- Avoid breathing vapours and contact with skin and eyes.
- Control personal contact by using protective equipment.
- Contain and absorb spill with sand, earth, inert material or vermiculite.
- Wipe up.
- Place in a suitable labelled container for waste disposal.

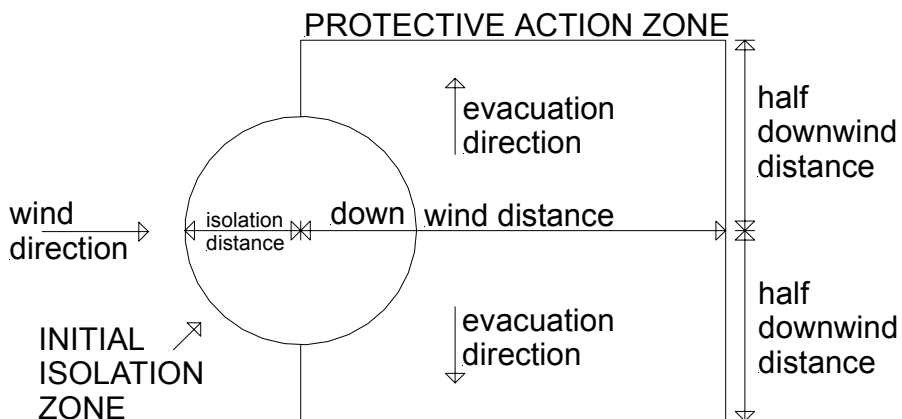
#### MAJOR SPILLS

DO NOT touch the spill material

Environmental hazard - contain spillage.

- Clear area of personnel and move upwind.
  - Alert Fire Brigade and tell them location and nature of hazard.
  - Wear full body protective clothing with breathing apparatus.
  - Prevent, by any means available, spillage from entering drains or water course.
  - Stop leak if safe to do so.
  - Contain spill with sand, earth or vermiculite.
  - Collect recoverable product into labelled containers for recycling.
  - Neutralise/decontaminate residue.
  - Collect solid residues and seal in labelled drums for disposal.
  - Wash area and prevent runoff into drains.
  - After clean up operations, decontaminate and launder all protective clothing and equipment before storing and re-using.
  - If contamination of drains or waterways occurs, advise emergency services.
- Treat the spill with a sufficient amount of isocyanate decontaminant preparation. (see "Disposal")

#### PROTECTIVE ACTIONS FOR SPILL



From IERG (Canada/Australia)

Isolation Distance	25 metres
Downwind Protection Distance	250 metres
IERG Number	39

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## Section 6 - ACCIDENTAL RELEASE MEASURES ...

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### FOOTNOTES

- 1 PROTECTIVE ACTION ZONE is defined as the area in which people are at risk of harmful exposure. This zone assumes that random changes in wind direction confines the vapour plume to an area within 30 degrees on either side of the predominant wind direction, resulting in a crosswind protective action distance equal to the downwind protective action distance.
- 2 PROTECTIVE ACTIONS should be initiated to the extent possible, beginning with those closest to the spill and working away from the site in the downwind direction. Within the protective action zone a level of vapour concentration may exist resulting in nearly all unprotected persons becoming incapacitated and unable to take protective action and/or incurring serious or irreversible health effects.
- 3 INITIAL ISOLATION ZONE is determined as an area, including upwind of the incident, within which a high probability of localised wind reversal may expose nearly all persons without appropriate protection to life-threatening concentrations of the material.
- 4 SMALL SPILLS involve a leaking package of 200 litres (55 US gallons) or less, such as a drum (jerrican or box with inner containers). Larger packages leaking less than 200 litres and compressed gas leaking from a small cylinder are also considered "small spills".  
LARGE SPILLS involve many small leaking packages or a leaking package of greater than 200 litres, such as a cargo tank, portable tank or a "one-tonne" compressed gas cylinder.
- 5 Guide 156 is taken from the US DOT emergency response guide book.
- 6 IERG information is derived from CANUTEC - Transport Canada.

### EMERGENCY RESPONSE PLANNING GUIDELINES (ERPG)

The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour WITHOUT experiencing or developing

life-threatening health effects is:

irreversible or other serious effects or symptoms which could impair an individual's ability to take protective action is:

other than mild, transient adverse effects without perceiving a clearly defined odour is:

American Industrial Hygiene Association (AIHA)

**Personal Protective Equipment advice is contained in Section 8 of the MSDS.**

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## Section 7 - HANDLING AND STORAGE

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### PROCEDURE FOR HANDLING

- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.
- DO NOT enter confined spaces until atmosphere has been checked.

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## Section 7 - HANDLING AND STORAGE ...

- Avoid smoking, naked lights or ignition sources.
  - Avoid contact with incompatible materials.
  - When handling, DO NOT eat, drink or smoke.
  - Keep containers securely sealed when not in use.
  - Avoid physical damage to containers.
  - Always wash hands with soap and water after handling.
  - Work clothes should be laundered separately.
  - Use good occupational work practice.
  - Observe manufacturer's storing and handling recommendations.
  - Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
- Decant in a well-ventilated area or under an exhaust hood.  
Avoid contact with moisture.  
Never add water to this product.  
DO NOT return unused product to containers.

### SUITABLE CONTAINER

Packaging as recommended by manufacturer.

- Check that containers are clearly labelled
- Metal drum

### STORAGE INCOMPATIBILITY

- Avoid contamination with water, alkalis and detergent solutions.
- Material reacts with water and generates gas, pressurises containers with even drum rupture resulting.
- DO NOT reseal container if contamination is suspected.
- Open all containers with care.

Avoid reaction with strong alkalis, strong oxidising agents and compounds containing active hydrogen (such as water, ammonia, amines, alcohols, acids, etc.) - the reaction may be violent, the rate being dependent upon the active hydrogen compound and the presence of catalysts.

A range of exothermic decomposition energies for isocyanates is given as 20-30 kJ/mol. The relationship between energy of decomposition and processing hazards has been the subject of discussion; it is suggested that values of energy released per unit of mass, rather than on a molar basis (J/g) be used in the assessment. For example, in "open vessel processes" (with man-hole size openings, in an industrial setting), substances with exothermic decomposition energies below 500 J/g are unlikely to present a danger, whilst those in "closed vessel processes" (opening is a safety valve or bursting disk) present some danger where the decomposition energy exceeds 150 J/g.

BREITHERICK: Handbook of Reactive Chemical Hazards, 4th Edition

### STORAGE REQUIREMENTS

- Store in original containers.
  - Keep containers securely sealed.
  - Store in a cool, dry, well ventilated area.
  - DO NOT allow to freeze.
  - Store away from incompatible materials.
  - Protect containers against physical damage and check regularly for leaks.
  - Observe manufacturer's storing and handling recommendations.
- DO NOT store in pits, depressions, basements or areas where vapours may be

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## Section 7 - HANDLING AND STORAGE ...

trapped

Bulk storage should be blanketed with nitrogen and equipped with absorptive type breather valve (to prevent vapour emissions).

Avoid temperatures above 60 deg.C and below 15 deg.C.\* \*[Bayer]

## Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

### EXPOSURE CONTROLS

#### ODOUR SAFETY FACTOR (OSF)

OSF=0.029 (toluene diisocyanate)

Exposed individuals are NOT reasonably expected to be warned, by smell, that the Exposure Standard is being exceeded.

Odour Safety Factor (OSF) is determined to fall into either Class C, D or E.

The Odour Safety Factor (OSF) is defined as:

OSF= Exposure Standard (TWA) ppm/ Odour Threshold Value (OTV) ppm

Classification into classes follows:

Class	OSF	Description
A	550	Over 90% of exposed individuals are aware by smell that the Exposure Standard (TLV-TWA for example) is being reached, even when distracted by working activities
B	26-550	As "A" for 50-90% of persons being distracted
C	1-26	As "A" for less than 50% of persons being distracted
D	0.18-1	10-50% of persons aware of being tested perceive by smell that the Exposure Standard is being reached
E	<0.18	As "D" for less than 10% of persons aware of being tested

### INGREDIENT DATA

TOLUENE-2,4-DIISOCYANATE:

TLV TWA: 0.005 ppm A4 [ACGIH]

TLV STEL: 0.02 ppm A4 [ACGIH]

NOTICE OF INTENDED CHANGE

TLV TWA: 0.005 ppm (SEN;A4) [ACGIH]

TLV STEL: NOTICE OF INTENDED CHANGE 0.02 ppm (SEN;A4) [ACGIH]

TLV TWA: 0.005 ppm, 0.036 mg/m<sup>3</sup>; STEL: 0.02ppm, 0.14 mg/m<sup>3</sup> A4

NOTE: This substance has been classified by the ACGIH as A4 NOT classifiable as causing Cancer in humans

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## Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION ...

### NOTICE OF INTENDED CHANGE

Sensitiser (ACGIH 1998)

isocyanates, all as NCO (Mol.Wt: 42.00)

ES TWA: 0.02 mg/m<sup>3</sup>; STEL: 0.07 mg/m<sup>3</sup> sensitiser

MEL TWA: 0.02 mg/m<sup>3</sup>; STEL: 0.07 mg/m<sup>3</sup> sensitiser

Some jurisdictions require that health surveillance be conducted on occupationally exposed workers. This should emphasise:

- demography, occupational and medical history and health advice
- completion of a standardised respiratory questionnaire
- physical examination of the respiratory system and skin
- standardised respiratory function tests such as FEV1, FVC and FEV1/FVC

IDLH Level: 2.5 ppm

NOTE: Detector tubes for toluene diisocyanate, measuring in excess of 0.02 ppm, are commercially available.

The odour recognition threshold, 0.05-0.4 ppm in air, is not reliable and being above exposure standard, gives no warning of exposure.

A substantial proportion of the working population (4.3% to 25%) can be sensitised to TDI at the ES-TWA. Such sensitisation was not limited to highly susceptible individuals and workers often developed symptoms early.

Preplacement exams have been unsuccessful in identifying those who may develop sensitisation. Allergy, bronchial asthma and chronic bronchitis sufferers should be excluded from exposure to TDI. Chronic low level exposures below 0.02 ppm have been reported to cause sensitisation.

Workers complained of cough, phlegm production, breathlessness and wheezing 2 to 17 years after the last exposure and it is reported that several workers developed chronic bronchitis 40 months after removal from exposure. Effects of TDI appear to be dose-related and there is a threshold (0.005 ppm) below which no respiratory effects are produced by at least the isomer 2,4-TDI. It should be noted that some polyurethane production facilities also emit amines which are the most important cause of respiratory symptoms and occupational asthma.

### TOLUENE-2,6-DIISOCYANATE:

#### NOTICE OF INTENDED CHANGE

TLV TWA: 0.005 ppm (SEN;A4) [ACGIH]

TLV STEL: NOTICE OF INTENDED CHANGE 0.02 ppm (SEN;A4) [ACGIH]

isocyanates, all as NCO (Mol.Wt: 42.00)

ES TWA: 0.02 mg/m<sup>3</sup>; STEL: 0.07 mg/m<sup>3</sup> sensitiser

MEL TWA: 0.02 mg/m<sup>3</sup>; STEL: 0.07 mg/m<sup>3</sup> sensitiser

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- demography, occupational and medical history and health advice
- completion of a standardised respiratory questionnaire
- physical examination of the respiratory system and skin
- standardised respiratory function tests such as FEV1, FVC and FEV1/FVC

#### NOTICE OF INTENDED ADDITION

TLV TWA 0.005 ppm, 0.036 mg/m<sup>3</sup>; STEL: 0.02ppm, 0.14 mg/m<sup>3</sup> A4 Sensitiser

NOTE: This substance has been classified by the ACGIH as A4 NOT classifiable as causing Cancer in humans

NOTE: Detector tubes for toluene diisocyanate, measuring in excess of 0.02 ppm, are commercially available.

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## Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION ...

highly susceptible individuals and workers often developed symptoms early. Preplacement exams have been unsuccessful in identifying those who may develop sensitisation. Allergy, bronchial asthma and chronic bronchitis sufferers should be excluded from exposure to TDI. Chronic low level exposures below 0.02 ppm have been reported to cause sensitisation. Workers complained of cough, phlegm production, breathlessness and wheezing 2 to 17 years after the last exposure and it is reported that several workers developed chronic bronchitis 40 months after removal from exposure. Effects of TDI appear to be dose-related and there is a threshold (0.005 ppm) below which no respiratory effects are produced by at least the isomer 2,4-TDI. It should be noted that some polyurethane production facilities also emit amines which are the most important cause of respiratory symptoms and occupational asthma.

### PERSONAL PROTECTION



#### EYE

- Chemical goggles.
- Full face shield.
- Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

#### HANDS/FEET

DO NOT use skin cream unless necessary and then use only minimum amount. Isocyanate vapour may be absorbed into skin cream and this increases hazard.

Butyl rubber gloves

or

Viton gloves

Nitrile rubber gloves

or

PVA gloves

Safety footwear

or

PVC safety gumboots

#### RESPIRATOR

Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

Breathing Zone Level ppm (volume)	Maximum Protection Factor	Half-face Respirator	Full-Face Respirator
1000	10	ab-AUS p	-
1000	50	-	ab-AUS p
5000	50	Airline *	-
5000	100	-	ab-2 p

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## Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION ...

10000	100	-	ab-3 p
	100+		Airline**

\* - Continuous Flow \*\* - Continuous-flow or positive pressure demand

Note: Organic vapour respirators are not protection for sensitised workers.

### OTHER

Overalls

or

- Impervious apron
- Impervious protective clothing
- Eyewash unit.

Ensure there is ready access to a safety shower

### ENGINEERING CONTROLS

Local exhaust ventilation usually required. If risk of overexposure exists, wear approved respirator. Correct fit is essential to obtain adequate protection.

Supplied-air type respirator may be required in special circumstances. Correct fit is essential to ensure adequate protection.

An approved self contained breathing apparatus (SCBA) may be required in some situations.

Provide adequate ventilation in warehouse or closed storage area. Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant.

Type of Contaminant:	Air Speed:
solvent, vapours, degreasing etc., evaporating from tank (in still air).	0.25-0.5 m/s (50-100 f/min.)
aerosols, fumes from pouring operations, intermittent container filling, low speed conveyer transfers, welding, spray drift, plating acid fumes, pickling (released at low velocity into zone of active generation)	0.5-1 m/s (100-200 f/min.)
direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)	1-2.5 m/s (200-500 f/min.)
grinding, abrasive blasting, tumbling, high speed wheel generated dusts (released at high initial velocity into zone of very high rapid air motion).	2.5-10 m/s (500-2000 f/min.)

Within each range the appropriate value depends on:

Lower end of the range

- 1: Room air currents minimal or favourable to capture
- 2: Contaminants of low toxicity or of

Upper end of the range

- 1: Disturbing room air currents
- 2: Contaminants of high toxicity

continued...

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## Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION ...

nuisance value only.

3: Intermittent, low production.

4: Large hood or large air mass in motion

3: High production, heavy use

4: Small hood-local control only

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 1-2 m/s (200-400 f/min) for extraction of solvents generated in a tank 2 meters distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.

Spraying of material or material in admixture with other components must be carried out in conditions conforming to local state regulations. Local exhaust ventilation with full face air supplied breathing apparatus (hood or helmet type) is normally required. Unprotected personnel must vacate spraying area. NOTE: Isocyanate vapours will not be adequately absorbed by organic vapour respirators. Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant.

Type of Contaminant:  
direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)

Air Speed:  
1-2.5 m/s (200-500 f/min.)

Within each range the appropriate value depends on:

Lower end of the range  
1: Room air currents minimal or favourable to capture  
2: Contaminants of low toxicity or of nuisance value only  
3: Intermittent, low production.  
4: Large hood or large air mass in motion

Upper end of the range  
1: Disturbing room air currents  
2: Contaminants of high toxicity  
3: High production, heavy use  
4: Small hood-local control only

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 4-10 m/s (800-2000 f/min.) for extraction of solvents generated by spraying at a point 2 meters distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that

continued...

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## Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION ...

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theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.

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## Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

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### APPEARANCE

Clear, colourless, off-white to pale yellow combustible liquid with an irritating sweetish, sharp odour. Lachrymator; i.e. causes tear formation.

Liquid darkens on exposure to light.

Soluble in acetone, carbon tetrachloride, benzene, kerosene and olive oil.

Mixes with alcohols, glycol ethers with reaction, decomposition.

Reacts with water to produce carbon dioxide.

### PHYSICAL PROPERTIES

Liquid.

Does not mix with water.

Sinks in water.

Toxic or noxious vapours/gas.

Molecular Weight: 174.16

Melting Range (°C): <15

Solubility in water (g/L): Immiscible

pH (1% solution): Not applicable

Volatile Component (%vol): Not applicable.

Relative Vapour Density (air=1): 6.0

Lower Explosive Limit (%): 0.9

Autoignition Temp (°C): Not available.

State: Liquid

Boiling Range (°C): 251

Specific Gravity (water=1): 1.21

pH (as supplied): Not applicable

Vapour Pressure (kPa): 0.013 @ 20C

Evaporation Rate: Not available

Flash Point (°C): 132 (open)

Upper Explosive Limit (%): 9.5

Decomposition Temp (°C):

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## Section 10 - CHEMICAL STABILITY AND REACTIVITY INFORMATION

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### CONDITIONS CONTRIBUTING TO INSTABILITY

May be unstable unless stored under controlled conditions

Avoid any contamination of this material as it is very reactive and any contamination is potentially hazardous

Presence of incompatible materials

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## Section 11 - TOXICOLOGICAL INFORMATION

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### POTENTIAL HEALTH EFFECTS

#### ACUTE HEALTH EFFECTS

##### SWALLOWED

The liquid is corrosive to the gastro-intestinal tract  
highly toxic

continued...

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## Section 11 - TOXICOLOGICAL INFORMATION ...

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and  
may be fatal  
if swallowed  
Considered an unlikely route of entry in commercial/industrial environments

### EYE

The liquid is highly discomforting to the eyes and is capable of causing severe damage with loss of sight. The vapour is discomforting to the eyes and may cause lachrymation (tears). The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

### SKIN

The liquid is highly discomforting to the skin it is slowly absorbed and may cause skin sensitisation. Sensitisation may result in allergic dermatitis responses including rash, itching, hives or swelling of extremities. Toxic effects may result from skin absorption. The material may cause severe skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin. Repeated exposures may produce severe ulceration.

### INHALED

The vapour/mist may be highly irritating to the upper respiratory tract and lungs; the response may be severe enough to produce bronchitis and pulmonary oedema. Possible neurological symptoms arising from isocyanate exposure include headache, insomnia, euphoria, ataxia, anxiety neurosis, depression and paranoia. Gastrointestinal disturbances are characterised by nausea and vomiting. Pulmonary sensitisation may produce asthmatic reactions ranging from minor breathing difficulties to severe allergic attacks; this may occur following a single acute exposure or may develop without warning for several hours after exposure. Sensitized people can react to very low doses, and should not be allowed to work in situations allowing exposure to this material. Continued exposure of sensitised persons may lead to possible long term respiratory impairment. Inhalation hazard is increased at higher temperatures. In addition to producing pulmonary sensitisation, toluene diisocyanate (TDI) is active in contracting smooth muscle such as that found in the airway. So-called bronchoconstriction is often mistaken for sensitisation and lung function tests, including measurement of forced expiratory volume (FEV1) and forced vital capacity (FCV) may distinguish acute reaction. Severe irritation is produced by inhalation of low vapour concentrations. At 0.02 ppm, TDI does not produce

continued...

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## Section 11 - TOXICOLOGICAL INFORMATION ...

immediate irritation but this may become apparent after an extended period of exposure. Symptoms may include a burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea and vomiting. Overexposure or repeated exposure may produce bronchial spasm and asthma which may not appear for several hours. Symptoms may persist for several weeks. Most individuals recover completely. Both allergy-prone and non allergy-prone individuals may become sensitised. Cross-sensitisation to other isocyanates may occur.

### CHRONIC HEALTH EFFECTS

Principal routes of exposure are usually by inhalation and skin contact Isocyanate vapours are irritating to the airways and can cause their inflammation, with wheezing, gasping, severe distress, even loss of consciousness and fluid in the lungs. Nervous system symptoms that may occur include headache, sleep disturbance, euphoria, inco-ordination, anxiety, depression and paranoia. Digestive effects include nausea and vomiting. Breathing difficulties may occur unpredictably after a period of tolerance and after skin contact. Allergic inflammation of the skin can occur, with rash, itching, blistering, and swelling of the hands and feet. Sensitive people can react to very low levels and should not be exposed to this material. With most allergens, removal of the offending agent results in the individual becoming asymptomatic. Toluene diisocyanate (TDI)-induced asthma may continue for months or even years after exposure ceases. This may be due to a non-allergenic condition known as reactive airway dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Evidence of carcinogenic potential of commercial grade TDI in female mice included induction of haemangiomas in the spleen and subcutaneous tissues, hepatocellular adenomas, and haemangiosarcomas in the liver, ovary and peritoneum. Ingestion of commercial grade TDI produced subcutaneous fibromas, pancreatic acinar cell adenomas, mammary gland fibroadenomas and subcutaneous fibromas and fibrosarcomas in female rats. No treatment related tumours were induced in male mice.

### toluene diisocyanate

Not available. Refer to individual constituents.  
unless otherwise specified data extracted from RTECS - Register of Toxic Effects  
of Chemical Substances

#### TOLUENE-2,4-DIISOCYANATE:

##### TOXICITY

Inhalation (woman) TCLo: 300ppt/8hr/5d

Inhalation (human) TCLo: 20 ppb/2 yr

Inhalation (human) TCLo: 80 ppb

Inhalation (human) TCLo: 500 ppb

Oral (rat) LD50: 5800 mg/kg

Inhalation (rat) LC50: 14 ppm/14 hr

Inhalation (rat) LC50: 600 ppm/6 hr

WARNING: This substance has been classified by the IARC as Group 2B: Possibly  
Carcinogenic to Humans.

Tenth Annual Report on Carcinogens: Substance anticipated to be Carcinogen  
[National Toxicology Program: U.S. Dep. of Health & Human Services 2002]

##### IRRITATION

Skin (rabbit): 500 mg(open)-SEVERE

Skin (rabbit):500 mg/24hr-moderate

Eye (rabbit): 100 mg - SEVERE

#### TOLUENE-2,6-DIISOCYANATE:

##### TOXICITY

Inhalation (human) TCLo: 50 ppb

Hamster ovary cell mutagen in vitro.

WARNING: This substance has been classified by the IARC as Group 2B: Possibly  
Carcinogenic to Humans.

##### IRRITATION

Nil reported

continued...

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## Section 11 - TOXICOLOGICAL INFORMATION ...

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Tenth Annual Report on Carcinogens: Substance anticipated to be Carcinogen  
[National Toxicology Program: U.S. Dep. of Health & Human Services 2002]

CAUTION: TDI is a potent respiratory and skin sensitizer. Sensitized people can react to very low levels of airborne isocyanates. Cross sensitization to other isocyanates can occur.

Persons with a history of asthma or other respiratory problems or are known to be sensitised, should not be engaged in any work involving the handling of isocyanates. [CCTRADE-Bayer, APMF]

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## Section 12 - ECOLOGICAL INFORMATION

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Water pollution class (WGK): 2 - impairment of water quality

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## Section 13 - DISPOSAL CONSIDERATIONS

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- Recycle wherever possible. Special hazard may exist - specialist advice may be required.
  - Consult manufacturer for recycling options.
  - Consult State Land Waste Management Authority for disposal.
  - Bury or incinerate residue at an approved site.
  - Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.
  - Puncture containers to prevent re-use and bury at an authorised landfill.
- 

## Section 14 - TRANSPORTATION INFORMATION

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Shipping Name:  
TOLUENE DIISOCYANATE  
Transport Hazard Class: 6.1  
UN/NA Number: 2078  
ADR Number: 60  
Packing Group: II  
Labels Required: toxic  
Additional Shipping Information:  
International Transport Regulations:  
IMO: 6269

HAZCHEM

2XE

continued...

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## Section 15 - REGULATORY INFORMATION

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### REGULATIONS

toluene diisocyanate (CAS: 26471-62-5) is found on the following regulatory lists:

Australian Inventory of Chemical Substances (NICNAS)

Canadian Domestic Substances List (DSL)

Canadian Ingredient Disclosure List (SOR/88-64)

Chinese Inventory of Existing Chemical Substances

European Customs Inventory of Chemical Substances

European Inventory of Existing Chemical Substances (EINECS)

European Union (EU) Carcinogenic Substances

European Union (EU) List of Dangerous Substances (Annex I)

Japan Industrial Safety and Health Law (ISHL) - Specified Chemical Substances

Japanese Existing Chemical Substances - Chemical Substances Control Law

Philippines Inventory of Chemicals and Chemical Substances (PICCS)

South Korean Existing Chemicals List (KECL)

Taiwan List of Announced Toxic Chemical Substances

US Californian Proposition 65 Carcinogens

US EPA High Production Volume Program Chemical List

US EPCRA Section 313 Toxic Chemicals

US National Toxicology Program Carcinogens

US NIOSH Carcinogen List

US Toxic Substances Control Act (TSCA)

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## Section 16 - OTHER INFORMATION

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