RN3039

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

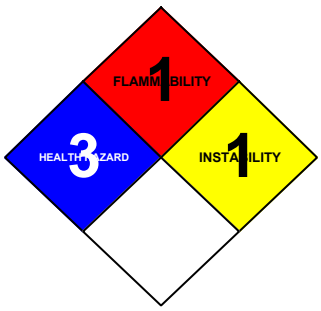
PRODUCT NAME
RN3039

PRODUCT USE
■ Used according to manufacturer's directions.
Polyurethane prepolymer.

SUPPLIER
Company: Era Polymers Pty Ltd
Address:
25- 27 Green Street
Banksmeadow
NSW, 2019
Australia
Telephone: +61 2 9666 3788
Emergency Tel:**1800 039 008 (AUS)**
Emergency Tel: **+61 3 9573 3112 ; +800 2436 2255(INTL)**
Fax: +61 2 9666 4805

Section 2 - HAZARDS IDENTIFICATION

NFPA



GHS Classification
Acute Toxicity Category 2
Carcinogen Category 2
Eye Irritation Category 2A
Respiratory Sensitizer Category 1
Skin Corrosion/Irritation Category 2
Skin Sensitizer Category 1

continued...

STOT - SE Category 3



EMERGENCY OVERVIEW

HAZARD
DANGER

Determined by Chemwatch using GHS criteria

H315	Causes skin irritation.
H317	May cause an allergic skin reaction.
H319	Causes serious eye irritation.
H330	Fatal if inhaled.
H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled.
H335	May cause respiratory irritation.
H351	Suspected of causing cancer.

PRECAUTIONARY STATEMENTS

Prevention

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dust/fume/gas/mist/vapours/spray.
P261	Avoid breathing dust/fume/gas/mist/vapours/spray.
P264	Wash ... thoroughly after handling.
P271	Use only outdoors or in a well- ventilated area.
P272	Contaminated work clothing should not be allowed out of the workplace.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P281	Use personal protective equipment as required.
P284	Wear respiratory protection.
P285	In case of inadequate ventilation wear respiratory protection.

Response

P302+P352	IF ON SKIN: Wash with plenty of soap and water.
P304+P340	IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.
P304+P341	IF INHALED: If breathing is difficult, remove to fresh air and keep at rest in a position comfortable for breathing.
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308+P313	IF exposed or concerned: Get medical advice/ attention.
P310	Immediately call a POISON CENTER or doctor/physician.
P312	Call a POISON CENTER or doctor/physician if you feel unwell.
P320	Specific treatment is urgent (see MSDS).
P333+P313	If skin irritation or rash occurs: Get medical advice/attention.
P337+P313	If eye irritation persists: Get medical advice/attention.
P342+P311	If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician.

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P363	Wash contaminated clothing before reuse.
Storage	
P403+P233	Store in a well- ventilated place. Keep container tightly closed.
P405	Store locked up.
Disposal	
P501	Dispose of contents/container to ...

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
polyurethane prepolymer		>60
toluene diisocyanate	26471-62-5	1-10

Section 4 - FIRST AID MEASURES

SWALLOWED

■ If poisoning occurs, contact a doctor or Poisons Information Centre.
• If swallowed do NOT induce vomiting.
• If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
• Observe the patient carefully.
• Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.
• Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink.
• Seek medical advice.

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 contact occurs:
• Immediately remove all contaminated clothing, including footwear.
• Flush skin and hair with running water (and soap if available).
• Seek medical attention in event of irritation.

INHALED

• If fumes or combustion products are inhaled remove from contaminated area.
• Lay patient down. Keep warm and rested.
• Prostheses 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.

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• Transport to hospital, or doctor, without delay.

NOTES TO PHYSICIAN

■ Toluene diisocyanate is a known pulmonary sensitiser. Annual medical surveillance should be conducted including pulmonary history, examination of the heart and lungs, 14 x 17 inch (35 x 47 cm) x-ray and pulmonary function testing (FCV, FEV1).
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 & Jin, Frontiers of Molecular Toxicology, pp 55-61, 1992].
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 oedema 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 FEV1, may not represent sensitivity.
[Karol & Jin, Frontiers in Molecular Toxicology, pp 56-61, 1992]
Personnel who work with isocyanates, isocyanate prepolymers or polyisocyanates should have a pre-placement medical examination and periodic examinations thereafter, including a pulmonary function test. Anyone with a medical history of chronic respiratory disease, asthmatic or bronchial attacks, indications of allergic responses, recurrent eczema or sensitisation conditions of the skin should not handle or work with isocyanates. Anyone who develops chronic respiratory distress when working with isocyanates should be removed from exposure and examined by a physician. Further exposure must be avoided if a sensitivity to isocyanates or polyisocyanates has developed.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

• Flooding quantities of water only.
• Foam.
• Dry chemical powder.
• BCF (where regulations permit).
• Carbon dioxide.
• Water spray or fog - Large fires only.

FIRE FIGHTING

• Alert Fire Brigade and tell them location and nature of hazard.
• Wear full body protective clothing with breathing apparatus.

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• Prevent, by any means available, spillage from entering drains or water course.
• 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.

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 NOx and carbon monoxide.

Combustion products include: carbon dioxide (CO_2), isocyanates, and minor amounts of, hydrogen cyanide, nitrogen oxides (NOx), other pyrolysis products typical of burning organic material.
When heated at high temperatures many isocyanates decompose rapidly generating a vapour which pressurises containers, possibly to the point of rupture. Release of toxic and/or flammable isocyanate vapours may then occur.
May emit poisonous fumes.

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

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
• Remove all ignition sources.
• 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
• Liquid Isocyanates and high isocyanate vapour concentrations will penetrate seals on self contained breathing apparatus - SCBA should be used inside encapsulating suit where this exposure may occur.

For isocyanate spills of less than 40 litres (2 m2):
• Evacuate area from everybody not dealing with the emergency, keep them upwind and prevent further access, remove ignition sources and, if inside building, ventilate area as well as possible.
• Notify supervision and others as necessary.
• Put on personal protective equipment (suitable respiratory protection, face and eye protection, protective suit, gloves and impermeable boots).
• Control source of leakage (where applicable).
• Dike the spill to prevent spreading and to contain additions of decontaminating solution.
• Prevent the material from entering drains.
• Estimate spill pool volume or area.
• Absorb and decontaminate. - Completely cover the spill with wet sand, wet earth, vermiculite or other similar absorbent. - Add neutraliser (for suitable formulations: see below) to the adsorbent materials

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(equal to that of estimated spill pool volume). Intensify contact between spill, absorbent and neutraliser by carefully mixing with a rake and allow to react for 15 minutes
• Shovel absorbent/decontaminant solution mixture into a steel drum.
• Decontaminate surface. - Pour an equal amount of neutraliser solution over contaminated surface. - Scrub area with a stiff bristle brush, using moderate pressure. - Completely cover decontaminant with vermiculite or other similar absorbent. - After 5 minutes, shovel absorbent/decontamination solution mixture into the same steel drum used above.
• Monitor for residual isocyanate. If surface is decontaminated, proceed to next step. If contamination persists, repeat decontaminate procedure immediately above
• Place loosely covered drum (release of carbon dioxide) outside for at least 72 hours. Label waste-containing drum appropriately. Remove waste materials for incineration.
• Decontaminate and remove personal protective equipment.
• Return to normal operation.
• Conduct accident investigation and consider measures to prevent reoccurrence.

Decontamination:
Treat isocyanate spills with sufficient amounts of isocyanate decontaminant preparation ("neutralising fluid"). Isocyanates and polyisocyanates are generally not miscible with water. Liquid surfactants are necessary to allow better dispersion of isocyanate and neutralising fluids/ preparations. Alkaline neutralisers react faster than water/surfactant mixtures alone.
Typically, such a preparation may consist of:
Sawdust: 20 parts by weight Kieselguhr 40 parts by weight plus a mixture of {ammonia (s.g. 0.880) 8% v/v non-ionic surfactant 2% v/v water 90% v/v}.
Let stand for 24 hours
Three commonly used neutralising fluids each exhibit advantages in different situations.
Formulation A:

liquid surfactant	0.2-2%
sodium carbonate	5-10%
water to	100%

Formulation B

liquid surfactant	0.2-2%
concentrated ammonia	3-8%
water to	100%

Formulation C

ethanol, isopropanol or butanol	50%
concentrated ammonia	5%
water to	100%

After application of any of these formulae, let stand for 24 hours.

Formulation B reacts faster than Formulation A. However, ammonia-based neutralisers should be used only under well-ventilated conditions to avoid overexposure to ammonia or if members of the emergency team wear suitable respiratory protection. Formulation C is especially suitable for cleaning of equipment from unreacted isocyanate and neutralizing under freezing conditions. Regard has to be taken to the flammability of the alcoholic solution.
• Avoid contamination with water, alkalies 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.
Moderate hazard.
• Clear area of personnel and move upwind.
• Alert Fire Brigade and tell them location and nature of hazard.
• Wear breathing apparatus plus protective gloves.
• Prevent, by any means available, spillage from entering drains or water course.

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• No smoking, naked lights or ignition sources.
• Increase ventilation.
• Stop leak if safe to do so.
• Contain spill with sand, earth or vermiculite.
• Collect recoverable product into labelled containers for recycling.
• Absorb remaining product with sand, earth or vermiculite.
• Collect solid residues and seal in labelled drums for disposal.
• Wash area and prevent runoff into drains.
• If contamination of drains or waterways occurs, advise emergency services.

ACUTE EXPOSURE GUIDELINE LEVELS (AEGL) (in ppm)

toluene diisocyanate					
AEGL Type	10 min	30 min	60 min	4 hr	8 hr
1	0.020	0.020	0.020	0.010	CAS_CHECK~
2	0.24	0.17	0.083	0.021	CAS_CHECK~
3	0.65	0.65	0.51	0.32	CAS_CHECK~
1	0.020	0.020	0.020	0.010	CAS_CHECK~
2	0.24	0.17	0.083	0.021	CAS_CHECK~
3	0.65	0.65	0.51	0.32	CAS_CHECK~

AEGL 1: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.
AEGL 2: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.
AEGL 3: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

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:
toluene diisocyanate 0.6ppm

irreversible or other serious effects or symptoms which could impair an individual's ability to take protective action is:
toluene diisocyanate 0.15ppm

other than mild, transient adverse effects without perceiving a clearly defined odour is:
toluene diisocyanate 0.01ppm

American Industrial Hygiene Association (AIHA)

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Ingredients considered according to the following cutoffs

Very Toxic (T+)	>= 0.1%	Toxic (T)	>= 3.0%
R50	>= 0.25%	Corrosive (C)	>= 5.0%
R51	>= 2.5%		
else	>= 10%		

where percentage is percentage of ingredient found in the mixture

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

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

- DO NOT allow clothing wet with material to stay in contact with skin.
- 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.
- 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.

SUITABLE CONTAINER

- Metal can or drum
- Packaging as recommended by manufacturer.
- Check all containers are clearly labelled and free from leaks.

STORAGE INCOMPATIBILITY

- Avoid reaction with water, alcohols and detergent solutions.
- Isocyanates and thioisocyanates are incompatible with many classes of compounds, reacting exothermically to release toxic gases. Reactions with amines, strong bases, aldehydes, alcohols, alkali metals, ketones, mercaptans, strong oxidisers, hydrides, phenols, and peroxides can cause vigorous releases of heat. Acids and bases initiate polymerisation reactions in these materials.
- Isocyanates easily form adducts with carbodiimides, isothiocyanates, ketenes, or with substrates containing activated CC or CN bonds.
- Some isocyanates react with water to form amines and liberate carbon dioxide. This reaction may also generate large volumes of foam and heat. Foaming in confined spaces may produce pressure in confined spaces or containers. Gas generation may pressurise drums to the point of rupture.
- Do NOT reseal container if contamination is expected
- Open all containers with care
- Base-catalysed reactions of isocyanates with alcohols should be carried out in inert solvents. Such reactions in the absence of solvents often occur with explosive violence,
- Isocyanates will attack and embrittle some plastics and rubbers.
- A range of exothermic decomposition energies for isocyanates is given as 20-30 kJ/mol.

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• 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.

BRETHERICK: Handbook of Reactive Chemical Hazards, 4th Edition.

STORAGE REQUIREMENTS

■ for commercial quantities of isocyanates:
• Isocyanates should be stored in adequately bunded areas. Nothing else should be kept within the same bunding. Pre-polymers need not be segregated. Drums of isocyanates should be stored under cover, out of direct sunlight, protected from rain, protected from physical damage and well away from moisture, acids and alkalis.
• Where isocyanates are stored at elevated temperatures to prevent solidifying, adequate controls should be installed to prevent the high temperatures and precautions against fire should be taken.
• Where stored in tanks, the more reactive isocyanates should be blanketed with a non-reactive gas such as nitrogen and equipped with absorptive type breather valve (to prevent vapour emissions)..
• Transfer systems for isocyanates in bulk storage should be fully enclosed and use pump or vacuum systems. Warning signs, in appropriate languages, should be posted where necessary.
• Areas in which polyurethane foam products are stored should be supplied with good general ventilation. Residual amounts of unreacted isocyanate may be present in the finished foam, resulting in hazardous atmospheric concentrations.
• Store in original containers.
• Keep containers securely sealed.
• No smoking, naked lights or ignition sources.
• Store in a cool, dry, well-ventilated area.
• Store away from incompatible materials and foodstuff containers.
• Protect containers against physical damage and check regularly for leaks.
• Observe manufacturer's storing and handling recommendations.

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS



X	X	+	X	X	+

+: May be stored together
O: May be stored together with specific preventions
X: Must not be stored together

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

Source	Material	TWA ppm	TWA mg/m³	STEL ppm	STEL mg/m³	Peak ppm	Peak mg/m³	TWA F/CC	Notes

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Source	Material	TWA ppm	TWA mg/m³	STEL ppm	STEL mg/m³	Peak ppm	Peak mg/m³	TWA F/CC	Notes
Canada - Nova Scotia Occupational Exposure Limits	toluene diisocyanate (Toluene diisocyanate - Mixed isomers)	0.005		0.02					TLV Basis: respiratory sensitization; asthma; eye irritation
Canada - Alberta Occupational Exposure Limits	toluene diisocyanate (Toluene- 2, 4 or 2, 6diisocyanate (or as mixture) (TDI))	0.005	0.04			0.02	0.1		
Canada - British Columbia Occupational Exposure Limits	toluene diisocyanate (Toluene- 2, 4-diisocyanate (2, 4- TDI))	0.005				C 0.01			2B; S
US ACGIH Threshold Limit Values (TLV)	toluene diisocyanate (Toluene- 2, 4- or 2, 6-diisocyanate (or as a mixture))	0.005		0.02					TLV® Basis: (Resp sens) , See Notice of Intended Changes (NIC)
US - Vermont Permissible Exposure Limits Table Z- 1- A Transitional Limits for Air Contaminants	toluene diisocyanate (Toluene- 2, 4-diisocyanate (TDI))	(C)0.02	(C)0.14						
US - Vermont Permissible Exposure Limits Table Z- 1- A Final Rule Limits for Air Contaminants	toluene diisocyanate (Toluene- 2, 4-diisocyanate (TDI))	0.005	0.04	0.02	0.15				

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Source	Material	TWA ppm	TWA mg/m³	STEL ppm	STEL mg/m³	Peak ppm	Peak mg/m³	TWA F/CC	Notes
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	toluene diisocyanate (Toluene- 2, 4-diisocynate (TDI))	0.005	0.04	0.02	0.15				
US - California Permissible Exposure Limits for Chemical Contaminants	toluene diisocyanate (Toluene- 2, 4-diisocyanate; TDI)	0.005	0.04	0.02	0.15	0.02			
US - Idaho - Limits for Air Contaminants	toluene diisocyanate (Toluene- 2, 4-diisocyanate (TDI))					0.02	0.14		
US - Hawaii Air Contaminant Limits	toluene diisocyanate (Toluene di-isocyanate (TDI))	0.005	0.04	0.02	0.15				
US - Alaska Limits for Air Contaminants	toluene diisocyanate (Toluene- 2, 4-diisocyanate (TDI))	0.005	0.04	0.02	0.15				
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	toluene diisocyanate (Toluene- 2, 4- or 2, 6-diisocyanate (TDI))	0.005		0.02					SEN
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	toluene diisocyanate (Toluene- 2, 4-diisocyanate (TDI))	0.02	0.14	-	-				
US - Washington Permissible exposure limits of air contaminants	toluene diisocyanate (TDI (Toluene- 2, 4-diisocyanate))	0.005		0.02					
US - Michigan Exposure Limits for Air Contaminants	toluene diisocyanate (Toluene- 2, 4-diisocyanate(TDI))	0.005	0.04	0.02	0.15				

continued...

Source	Material	TWA ppm	TWA mg/m³	STEL ppm	STEL mg/m³	Peak ppm	Peak mg/m³	TWA F/CC	Notes
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	toluene diisocyanate (Toluene- 2, 4-diisocyanate (TDI))					0.02	0.14		
US OSHA Permissible Exposure Levels (PELs) - Table Z1	toluene diisocyanate (Toluene- 2, 4-diisocyanate (TDI))					0.02	0.14		
Canada - Prince Edward Island Occupational Exposure Limits	toluene diisocyanate (Toluene- 2, 4- or 2, 6-diisocyanate (or as a mixture))	0.005		0.02					TLV® Basis: (Resp sens) , See Notice of Intended Changes (NIC)
Canada - Northwest Territories Occupational Exposure Limits (English)	toluene diisocyanate (Toluene- 2, 4-diisocyanate)					0.02	0.14		
Canada - Alberta Occupational Exposure Limits	toluene diisocyanate (Toluene- 2, 4 or 2, 6diisocyanate (or as mixture) (TDI))	0.005				0.02	0.1		
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	toluene diisocyanate (Toluene diisocyanate (TDI) (isomers mixture))	0.005	0.036	0.02	0.14				
Canada - Ontario Occupational Exposure Limits	toluene diisocyanate (Toluene diisocyanate (TDI) / Diisocyanate de toluène (TDI))	0.005				0.02			

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Source	Material	TWA ppm	TWA mg/m³	STEL ppm	STEL mg/m³	Peak ppm	Peak mg/m³	TWA F/CC	Notes
US - Oregon Permissible Exposure Limits (Z- 2)	toluene diisocyanate (Toluene diisocyanate (TDI))	0.005	0.035			0.140	0.02		

MATERIAL DATA
RN3038:
Not available

TOLUENE DIISOCYANATE:
■ for toluene diisocyanate:
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.
Odour Safety Factor(OSF)
OSF=0.029 ("2,4-TOLUENEDIISOCYANATE").

PERSONAL PROTECTION






EYE
• Safety glasses with side shields.
• Chemical goggles.
• Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers

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have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59], [AS/NZS 1336 or national equivalent].

HANDS/FEET

■ NOTE:
• The material may produce skin sensitisation in predisposed individuals. Care must be taken, when removing gloves and other protective equipment, to avoid all possible skin contact.
• Contaminated leather items, such as shoes, belts and watch-bands should be removed and destroyed.
Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include:
• frequency and duration of contact,
• chemical resistance of glove material,
• glove thickness and
• dexterity
Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739, AS/NZS 2161.1 or national equivalent).
• When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374, AS/NZS 2161.10.1 or national equivalent) is recommended.
• When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374, AS/NZS 2161.10.1 or national equivalent) is recommended.
• Contaminated gloves should be replaced.
Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.
• Isocyanate resistant materials include Teflon, Viton, nitrile rubber and some PVA gloves.
• Protective gloves and overalls should be worn as specified in the appropriate national standard.
• Contaminated garments should be removed promptly and should not be re-used until they have been decontaminated.
• NOTE: Natural rubber, neoprene, PVC can be affected by isocyanates.

OTHER

• Overalls.
• P.V.C. apron.
• Barrier cream.
• Skin cleansing cream.
• Eye wash unit.

RESPIRATOR

•Type A Filter of sufficient capacity. (AS/NZS 1716 & 1715, EN 143:2000 & 149:2001, ANSI Z88 or national equivalent)
■ Cartridge respirators should never be used for emergency ingress or in areas of unknown vapour concentrations or oxygen content. The wearer must be warned to leave the contaminated area immediately on detecting any odours through the respirator. The odour may indicate that the mask is not functioning properly, that the vapour concentration is too high, or that the mask is not properly fitted. Because of these limitations, only restricted use of cartridge respirators is considered appropriate.
• In certain circumstances, personal protection of the individual employee is necessary. Personal protective devices should be regarded as being supplementary to substitution and engineering control and should not be used in preference to them as they do nothing to eliminate the hazard.
• However, in some situations, minimising exposure to isocyanates by enclosure and ventilation is not possible, and occupational exposure standards may be exceeded, particularly during on-site mixing of paints, spray-painting, foaming and maintenance of machine and ventilation systems. In these situations, air-line respirators or self-contained breathing apparatus complying with the appropriate nationals standard must be used.
• Organic vapour respirators with particulate pre- filters and powered, air-purifying respirators are NOT

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suitable.
• Personal protective equipment must be appropriately selected, individually fitted and workers trained in their correct use and maintenance. Personal protective equipment must be regularly checked and maintained to ensure that the worker is being protected.
• Air- line respirators or self-contained breathing apparatus complying with the appropriate national standard should be used during the clean-up of spills and the repair or clean-up of contaminated equipment and similar situations which cause emergency exposures to hazardous atmospheric concentrations of isocyanate.

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required. For further information consult site specific CHEMWATCH data (if available), or your Occupational Health and Safety Advisor.

ENGINEERING CONTROLS

■ Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection.
The basic types of engineering controls are:
Process controls which involve changing the way a job activity or process is done to reduce the risk.
Enclosure and/or isolation of emission source which keeps a selected hazard "physically" away from the worker and ventilation that strategically "adds" and "removes" air in the work environment. Ventilation can remove or dilute an air contaminant if designed properly. The design of a ventilation system must match the particular process and chemical or contaminant in use.
Employers may need to use multiple types of controls to prevent employee overexposure.

• 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 positive-pressure air supplied breathing apparatus (hood or helmet type) is normally required.
• Spraying should be performed in a spray booth fitted with an effective exhaust system which complies with local environmental legislation.
• The spray booth area must be isolated from unprotected personnel whilst spraying is in progress and until all spraying mist has cleared.
NOTE: Isocyanate vapours will not be adequately absorbed by organic vapour respirators.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE

Clear light amber viscous liquid; reacts with water liberating carbon dioxide.

PHYSICAL PROPERTIES

Liquid.
Toxic or noxious vapours/gas.

State	Liquid	Molecular Weight	Not Applicable
Melting Range (°F)	Not Available	Viscosity	Not Available
Boiling Range (°F)	>572	Solubility in water (g/L)	Reacts
Flash Point (°F)	>392	pH (1% solution)	Not Available

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Decomposition Temp (°F)	Not Available	pH (as supplied)	Not Available
Autoignition Temp (°F)	Not Available	Vapour Pressure (mmHG)	Not Available
Upper Explosive Limit (%)	Not Applicable	Specific Gravity (water=1)	1.20 @ 25C
Lower Explosive Limit (%)	Not Applicable	Relative Vapour Density (air=1)	Not Available
Volatile Component (%vol)	Not Available	Evaporation Rate	Not Available

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY
• Presence of incompatible materials.
• Product is considered stable.
• Hazardous polymerisation will not occur.
For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED
■ The material is not thought to produce adverse health effects following ingestion (as classified by EC Directives using animal models). Nevertheless, adverse systemic effects have been produced following exposure of animals by at least one other route and good hygiene practice requires that exposure be kept to a minimum.

EYE
■ This material can cause eye irritation and damage in some persons.

SKIN
■ This material can cause inflammation of the skin oncontact in some persons.
■ The material may accentuate any pre-existing dermatitis condition.
■ Open cuts, abraded or irritated skin should not be exposed to this material.
■ Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.

INHALED
■ If inhaled, this material can irritate the throat andlungs of some persons.
■ Inhalation of aerosols (mists, fumes), generated by the material during the course of normal handling, may produce toxic effects; these may be fatal.
■ Toluene diisocyanate may produce lung irritation and airway narrowing. Severe irritation is produced by inhalation of low vapour concentrations. Symptoms may include a burning sensation, coughing, wheezing, hoarse voice, shortness of breath, headache, nausea and vomiting. Overexposure or repeated exposure may worsen symptoms. Symptoms may persist for several weeks. Most individuals recover completely.

CHRONIC HEALTH EFFECTS
■ There has been concern that this material can cause cancer or mutations, but there is not enough data to make an assessment.
Inhaling this product is more likely to cause a sensitisation reaction in some persons compared to the

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general population.
Skin contact with the material is more likely to cause a sensitisation reaction in some persons compared to the general population.
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].
With most allergens, removal of the offending material results in resolution of symptoms. Asthma caused by toluene diisocyanate (TDI) continues for months or even years after exposure ceases. This may be due to a non-allergenic condition called reactive airway dysfunction syndrome (RADS). Animal testing with mice has shown commercial grade TDI may cause a range of benign and malignant tumours.
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.

TOXICITY AND IRRITATION
RN3039:
■ Not available. Refer to individual constituents.

TOLUENE DIISOCYANATE:
■ unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

■ Contact allergies quickly manifest themselves as contact eczema, more rarely as urticaria or Quincke's oedema. The pathogenesis of contact eczema involves a cell-mediated (T lymphocytes) immune reaction of the delayed type. Other allergic skin reactions, e.g. contact urticaria, involve antibody-mediated immune reactions. The significance of the contact allergen is not simply determined by its sensitisation potential: the distribution of the substance and the opportunities for contact with it are equally important. A weakly sensitising substance which is widely distributed can be a more important allergen than one with stronger sensitising potential with which few individuals come into contact. From a clinical point of view, substances are noteworthy if they produce an allergic test reaction in more than 1% of the persons tested.
Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Key criteria for the diagnosis of RADS include the absence of preceding respiratory disease, in a non-atopic individual, with abrupt onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. A reversible airflow pattern, on spirometry, with the presence of moderate to severe bronchial hyperreactivity on methacholine challenge testing and the lack of minimal lymphocytic inflammation, without eosinophilia, have also been included in the criteria for diagnosis of RADS. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. Industrial bronchitis, on the other hand, is a disorder that occurs as result of exposure due to high concentrations of irritating substance (often particulate in nature) and is completely reversible after exposure ceases. The disorder is characterised by dyspnea, cough and mucus production.
Allergic reactions involving the respiratory tract are usually due to interactions between IgE antibodies and allergens and occur rapidly. Allergic potential of the allergen and period of exposure often determine the severity of symptoms. Some people may be genetically more prone than others, and exposure to other irritants may aggravate symptoms. Allergy causing activity is due to interactions with proteins.
Attention should be paid to atopic diathesis, characterised by increased susceptibility to nasal inflammation, asthma and eczema.
Exogenous allergic alveolitis is induced essentially by allergen specific immune-complexes of the IgG type; cell-mediated reactions (T lymphocytes) may be involved. Such allergy is of the delayed type with onset up to four hours following exposure.
The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged

continued...

exposure to irritants may produce conjunctivitis.
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.
Aromatic and aliphatic diisocyanates may cause airway toxicity and skin sensitization. Monomers and prepolymers exhibit similar respiratory effect. Of the several members of diisocyanates tested on experimental animals by inhalation and oral exposure, some caused cancer while others produced a harmless outcome. This group of compounds has therefore been classified as cancer-causing.
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.

CARCINOGEN

Toluene diisocyanates	International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs	Group	2B
Toluene- 2, 4- or 2, 6- diisocyanate (or as a mixture)	US ACGIH Threshold Limit Values (TLV) - Carcinogens	Carcinogen Category	A4
toluene diisocyanate	US - Rhode Island Hazardous Substance List	IARC	
TOLUENE DIISOCYANATE (MIXED ISOMERS)	US Environmental Defense Scorecard Recognized Carcinogens	Reference(s)	P65
TOLUENE- 2, 4- DIISOCYANATE	US Environmental Defense Scorecard Recognized Carcinogens	Reference(s)	P65- MC
TOLUENE DIISOCYANATE (MIXED ISOMERS)	US Environmental Defense Scorecard Suspected Carcinogens	Reference(s)	P65
TOLUENE- 2, 4- DIISOCYANATE	US Environmental Defense Scorecard Suspected Carcinogens	Reference(s)	P65- MC
2, 4- Toluene diisocyanate	US Air Toxics Hot Spots TSD for Describing Available Cancer Potency Factors	IARC Class	2B
Toluene- 2, 4- diisocyanate [2, 4- TDI]	US NIOSH Recommended Exposure Limits (RELs) - Carcinogens	Carcinogen	Ca
TWA_F_CC~	US - Maine Chemicals of High Concern List	Carcinogen	A4
VPVB_(VERY~	US - Maine Chemicals of High Concern List	Carcinogen	CA Prop 65; NTP 11th ROC

continued...

PBIT_(PERS~	US - Maine Chemicals of High Concern List	Carcinogen	
TWA_F_CC~	Canada - Prince Edward Island Occupational Exposure Limits - Carcinogens	Notes	TLV® Basis: (Resp sens) , See Notice of Intended Changes (NIC)
TWAPPM~	Canada - Prince Edward Island Occupational Exposure Limits - Carcinogens	Notes	TLV Basis: respiratory sensitization; asthma; eye irritation

REPROTOXIN

toluene diisocyanate	US - California Proposition 65 - Reproductive Toxicity	NSRL or MADL (µg/day)

Section 12 - ECOLOGICAL INFORMATION

TOLUENE DIISOCYANATE:
¦ Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Do NOT allow product to come in contact with surface waters or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash-waters.
Wastes resulting from use of the product must be disposed of on site or at approved waste sites.
Hydrolysis would represents the primary fate mechanism for the majority of the commercial isocyanate monomers, but, is tempered somewhat by the lack of water solubility. In the absence of hydrolysis, sorption to solids (e.g., sludge and sediments) will be the primary mechanism of removal. Biodegradation is minimal for most compounds and volatilisation is negligible. Atmospheric degradation is not expected with removal from air occurring by washout or dry deposition. Volatilisation from surface waters (e.g., lakes and rivers) is expected to take years. In wastewater treatment this process is not expected to be significant.
Review of the estimated properties of the isocyanates suggest that sorption is the primary removal mechanism in the ambient environment and in wastewater treatment in the absence of significant hydrolysis. Sorption to solids in wastewater treatment is considered strong to very strong for most compounds. Sorption to sediments and soils in the ambient environment is very strong in most instances. Migration to groundwater and surface waters is not expected due to sorption or hydrolysis.
Hydrolysis of the N=C=O will occur in less than hours in most instances and within minutes for more than 90% of the commercial isocyanates. However, the low to very low solubility of these substances will generally lessen the effectiveness of hydrolysis as a fate pathway. But hydrolysis should be considered one of the two major fate processes for the isocyanates.
Aerobic and/or anaerobic biodegradation of the isocyanates is not expected to occur at significant levels.
Most of the substances take several months to degrade.
Degradation of the hydrolysis products will occur at varying rates depending on the moiety formed.
DO NOT discharge into sewer or waterways.
Water pollution class (WGK): 2 - impairment of water quality

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
toluene diisocyanate	LOW	LOW	LOW	MED

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Section 13 - DISPOSAL CONSIDERATIONS

■ Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.
A Hierarchy of Controls seems to be common - the user should investigate:
• Reduction
• Reuse
• Recycling
• Disposal (if all else fails)
This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. If it has been contaminated, it may be possible to reclaim the product by filtration, distillation or some other means. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate.
• DO NOT allow wash water from cleaning or process equipment to enter drains.
• It may be necessary to collect all wash water for treatment before disposal.
• In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.
• Where in doubt contact the responsible authority.
• DO NOT recycle spilled material.
• Consult State Land Waste Management Authority for disposal.
• Neutralise spill material carefully and decontaminate empty containers and spill residues with 10% ammonia solution plus detergent or a proprietary decontaminant prior to disposal.
• DO NOT seal or stopper drums being decontaminated as CO2 gas is generated and may pressurise containers.
• Puncture containers to prevent re-use.
• Bury or incinerate residues at an approved site.

Section 14 - TRANSPORTATION INFORMATION

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: DOT, IATA, IMDG

Section 15 - REGULATORY INFORMATION

REGULATIONS

RRegulations for ingredients

toluene diisocyanate (CAS: 26471-62-5,584-84-9,91-08-7) is found on the following regulatory lists;
"Canada - Nova Scotia Occupational Exposure Limits","Canada - Saskatchewan Industrial Hazardous Substances", "Canada CEPA Environmental Registry Substance Lists - List of substances on the DSL that meet the human health criteria for categorization (English)","Canada Domestic Substances List (DSL)","Canada Ingredient Disclosure List (SOR/88-64)","Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (English)","International Council of Chemical Associations (ICCA) - High Production Volume List","US - California Proposition 65 - No Significant Risk Levels (NSRLs) for Carcinogens","US - Delaware Pollutant Discharge Requirements - Reportable Quantities","US - Pennsylvania - Hazardous Substance List","US - Vermont Hazardous Constituents","US - Vermont Hazardous wastes which are Discarded Commercial Chemical Products or Off-Specification Batches of Commercial Chemical Products or Spill Residues of Either","US - Washington Dangerous waste constituents list","US - Washington Discarded Chemical Products List - ""U""

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Chemical Products","US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides","US DOE Temporary Emergency Exposure Limits (TEELs)","US EPA High Production Volume Program Chemical List","US List of Lists - Consolidated List of Chemicals Subject to EPCRA, CERCLA and Section 112(r) of the Clean Air Act","US National Toxicology Program (NTP) 11th Report Part B. Reasonably Anticipated to be a Human Carcinogen","US RCRA (Resource Conservation & Recovery Act) - Hazardous Constituents - Appendix VIII to 40 CFR 261","US RCRA (Resource Conservation & Recovery Act) - List of Hazardous Wastes","US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory","US TSCA Section 8 (d) - Health and Safety Data Reporting","USA: Chemical Facility Anti-Terrorism Standards - List Appendix A - 6CFR 27"

No data for RN3039 (CW: 25-9886)

Section 16 - OTHER INFORMATION

INGREDIENTS WITH MULTIPLE CAS NUMBERS

Ingredient Name	CAS
toluene diisocyanate	26471-62-5, 584-84-9, 91-08-7

■ Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

■ For detailed advice on Personal Protective Equipment, refer to the following U.S. Regulations and Standards:
OSHA Standards - 29 CFR:
1910.132 - Personal Protective Equipment - General requirements
1910.133 - Eye and face protection
1910.134 - Respiratory Protection
1910.136 - Occupational foot protection
1910.138 - Hand Protection
Eye and face protection - ANSI Z87.1
Foot protection - ANSI Z41
Respirators must be NIOSH approved.

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Issue Date: Apr-14-2011
Print Date: Nov-21-2011