



## EMC95A

Chemwatch GHS Safety Data Sheet

Mar-9-2011

C614LP

Hazard Alert Code: MODERATE

CHEMWATCH 24-3812

Version No:2.0

Page 1 of 21

### Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

#### PRODUCT NAME

EMC95A

#### 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)**

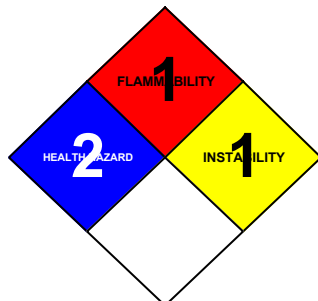
Emergency Tel: **+61 3 9573 3112 ; +800 2436**

**2255(INTL)**

Fax: +61 2 9666 4805

### Section 2 - HAZARDS IDENTIFICATION

#### NFPA



#### GHS Classification

Acute Toxicity Category 4

Carcinogen Category 2

Eye Irritation Category 2A

Respiratory Sensitizer Category 1

Skin Corrosion/Irritation Category 2

Skin Sensitizer Category 1

continued...

# EMC95A

Chemwatch GHS Safety Data Sheet  
Mar-9-2011  
C614LP

Hazard Alert Code: MODERATE

CHEMWATCH 24-3812

Version No:2.0

Page 2 of 21

## Section 2 - HAZARDS IDENTIFICATION

STOT - RE Category 2  
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.
H332	Harmful if inhaled.
H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled.
H335	May cause respiratory irritation.
H351	Suspected of causing cancer.
H373	May cause damage to organs through prolonged or repeated exposure.

## 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.
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.
P312	Call a POISON CENTER or doctor/physician if you feel unwell.
P314	Get medical advice/attention if you feel unwell.
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.

continued...

# EMC95A

Hazard Alert Code: MODERATE

Chemwatch GHS Safety Data Sheet  
Mar-9-2011  
C614LP

CHEMWATCH 24-3812

Version No:2.0

Page 3 of 21

## Section 2 - HAZARDS IDENTIFICATION

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

## Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
polyurethane prepolymer		>60
4, 4' - diphenylmethane diisocyanate (MDI)	101-68-8	30-60

## 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:
- Wash out immediately with fresh 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.
- Seek medical attention without delay; if pain persists or recurs seek medical attention.
- 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.
- Transport to hospital, or doctor.

continued...

# EMC95A

Chemwatch GHS Safety Data Sheet  
Mar-9-2011  
C614LP

Hazard Alert Code: MODERATE

CHEMWATCH 24-3812

Version No:2.0

Page 4 of 21

Section 4 - FIRST AID MEASURES

## 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 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.
- 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

continued...

# EMC95A

Hazard Alert Code: MODERATE

Chemwatch GHS Safety Data Sheet  
Mar-9-2011  
C614LP

CHEMWATCH 24-3812

Version No:2.0

Page 5 of 21

## Section 5 - FIRE FIGHTING MEASURES

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<sub>2</sub>), 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 m<sup>2</sup>):
- 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 (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.

continued...

# EMC95A

Hazard Alert Code: MODERATE

Chemwatch GHS Safety Data Sheet  
Mar-9-2011  
C614LP

CHEMWATCH 24-3812

Version No:2.0

Page 6 of 21

## Section 6 - ACCIDENTAL RELEASE MEASURES

- 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.
- 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.

continued...

# EMC95A

Hazard Alert Code: MODERATE

Chemwatch GHS Safety Data Sheet  
Mar-9-2011  
C614LP

CHEMWATCH 24-3812

Version No:2.0

Page 7 of 21

## Section 6 - ACCIDENTAL RELEASE MEASURES

### 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:

4,4'-diphenylmethane diisocyanate (MDI) 25mg/m<sup>3</sup>

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

4,4'-diphenylmethane diisocyanate (MDI) 2mg/m<sup>3</sup>

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

4,4'-diphenylmethane diisocyanate (MDI) 0.2mg/m<sup>3</sup>

American Industrial Hygiene Association (AIHA)

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.

continued...

Chemwatch GHS Safety Data Sheet  
Mar-9-2011  
C614LP

CHEMWATCH 24-3812  
Version No:2.0  
Page 8 of 21

## Section 7 - HANDLING AND STORAGE

### 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.
- 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



continued...



# EMC95A

Chemwatch GHS Safety Data Sheet  
Mar-9-2011  
C614LP

Hazard Alert Code: MODERATE

CHEMWATCH 24-3812

Version No:2.0

Page 9 of 21

Section 7 - HANDLING AND STORAGE

+ 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/m <sup>3</sup>	STEL ppm	STEL mg/m <sup>3</sup>	Peak ppm	Peak mg/m <sup>3</sup>	TWA F/CC	Notes
Canada - Alberta Occupational Exposure Limits	4, 4' - diphenylmethane diisocyanate (MDI) (Diphenylmethane-4, 4'diisocyanate (Methylene bisphenyl isocyanate, MDI))	0.005	0.05						
Canada - British Columbia Occupational Exposure Limits	4, 4' - diphenylmethane diisocyanate (MDI) (Methylene bisphenyl isocyanate (MDI))	0.005				C 0.01			Skin; S
Canada - Ontario Occupational Exposure Limits	4, 4' - diphenylmethane diisocyanate (MDI) (Methylene bisphenyl isocyanate (MDI) / Diisocyanate- 4, 4' de diphénylméthane (MDI))	0.005				0.02			
US NIOSH Recommended Exposure Limits (RELs)	4, 4' - diphenylmethane diisocyanate (MDI) (Methylene bisphenyl isocyanate)	0.005	0.05			0.020	0.2		(Ceiling [10-minute])

continued...

# EMC95A

Hazard Alert Code: MODERATE

Chemwatch GHS Safety Data Sheet  
Mar-9-2011  
C614LP

CHEMWATCH 24-3812  
Version No:2.0  
Page 10 of 21

## Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Source	Material	TWA ppm	TWA mg/m <sup>3</sup>	STEL ppm	STEL mg/m <sup>3</sup>	Peak ppm	Peak mg/m <sup>3</sup>	TWA F/CC	Notes
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	4, 4' - diphenylmethane diisocyanate (MDI) (Methylene bis (4- phenyl isocyanate) (MDI))	0.005	0.051						
US OSHA Permissible Exposure Levels (PELs) - Table Z1	4, 4' - diphenylmethane diisocyanate (MDI) (Methylene bisphenyl isocyanate (MDI))					0.02	0.2		
US ACGIH Threshold Limit Values (TLV)	4, 4' - diphenylmethane diisocyanate (MDI) (Methylene bisphenyl isocyanate (MDI))	0.005							TLV® Basis: Resp sens
US - Minnesota Permissible Exposure Limits (PELs)	4, 4' - diphenylmethane diisocyanate (MDI) (Methylene bisphenyl isocyanate (MDI))					0.02	0.2		
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	4, 4' - diphenylmethane diisocyanate (MDI) (Methylene bisphenyl isocyanate (MDI))					0.02	0.2		
US - Vermont Permissible Exposure Limits Table Z- 1- A Transitional Limits for Air Contaminants	4, 4' - diphenylmethane diisocyanate (MDI) (Methylene bisphenyl isocyanate (MDI))	(C)0.02	(C)0.2						
US - Vermont Permissible Exposure Limits Table Z- 1- A Final Rule Limits for Air Contaminants	4, 4' - diphenylmethane diisocyanate (MDI) (Methylene bisphenyl isocyanate (MDI))					0.02	0.2		

continued...

# EMC95A

Hazard Alert Code: MODERATE

Chemwatch GHS Safety Data Sheet  
Mar-9-2011  
C614LP

CHEMWATCH 24-3812  
Version No:2.0  
Page 11 of 21

## Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Source	Material	TWA ppm	TWA mg/m <sup>3</sup>	STEL ppm	STEL mg/m <sup>3</sup>	Peak ppm	Peak mg/m <sup>3</sup>	TWA F/CC	Notes
US - Idaho - Limits for Air Contaminants	4, 4' - diphenylmethane diisocyanate (MDI) (Methylene bisphenyl isocyanate (MDI))					0.02	0.2		
US - California Permissible Exposure Limits for Chemical Contaminants	4, 4' - diphenylmethane diisocyanate (MDI) (Methylene bis(phenylisocyanate); MDI; diphenylmethane diisocyanate)	0.005	0.051						
US - Hawaii Air Contaminant Limits	4, 4' - diphenylmethane diisocyanate (MDI) (Methylene bisphenyl isocyanate (MDI))					0.02	0.2		
US - Alaska Limits for Air Contaminants	4, 4' - diphenylmethane diisocyanate (MDI) (Methylene bisphenyl isocyanate (MDI))					0.02	0.2		
US - Michigan Exposure Limits for Air Contaminants	4, 4' - diphenylmethane diisocyanate (MDI) (Methyl bisphenyl isocyanate (MDI))					0.02	0.2		
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	4, 4' - diphenylmethane diisocyanate (MDI) (Methylene bisphenyl isocyanate (MDI))	0.005		0.015					
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	4, 4' - diphenylmethane diisocyanate (MDI) (Diphenylmethane diisocyanate, see Methylene bisphenyl isocyanate (MDI))	0.02	0.2	-	-				

continued...

# EMC95A

Hazard Alert Code: MODERATE

Chemwatch GHS Safety Data Sheet  
Mar-9-2011  
C614LP

CHEMWATCH 24-3812  
Version No:2.0  
Page 12 of 21

## Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Source	Material	TWA ppm	TWA mg/m <sup>3</sup>	STEL ppm	STEL mg/m <sup>3</sup>	Peak ppm	Peak mg/m <sup>3</sup>	TWA F/CC	Notes
US - Washington Permissible exposure limits of air contaminants	4, 4' - diphenylmethane diisocyanate (MDI) (Methylene bisphenyl isocyanate) (Diphenylmethane diisocyanate))					0.02			
Canada - Nova Scotia Occupational Exposure Limits	4, 4' - diphenylmethane diisocyanate (MDI) (Methylene bisphenyl isocyanate [MDI])	0.005							TLV Basis: respiratory sensitization
Canada - Prince Edward Island Occupational Exposure Limits	4, 4' - diphenylmethane diisocyanate (MDI) (Methylene bisphenyl isocyanate (MDI))	0.005							TLV® Basis: Resp sens
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	4, 4' - diphenylmethane diisocyanate (MDI) (Methylene bisphenyl isocyanate (MDI))					0.02	0.2		
US - Oregon Permissible Exposure Limits (Z- 2)	4, 4' - diphenylmethane diisocyanate (MDI) (Diphenylmethane diisocyanate (MDI))	0.005	0.050			0.200	0.02		
Canada - Northwest Territories Occupational Exposure Limits (English)	4, 4' - diphenylmethane diisocyanate (MDI) (Diphenylmethane diisocyanate (Methylene bisphenyl-isocyanate) (MDI))					0.02	0.2		

### EMERGENCY EXPOSURE LIMITS

Material	Revised IDLH Value (mg/m <sup>3</sup> )	Revised IDLH Value (ppm)
4,4'-diphenylmethane diisocyanate (MDI) 2489	75	

continued...

# EMC95A

Hazard Alert Code: MODERATE

Chemwatch GHS Safety Data Sheet  
Mar-9-2011  
C614LP

CHEMWATCH 24-3812  
Version No:2.0  
Page 13 of 21

## Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

### MATERIAL DATA

ERAPOL EME150:

Not available

#### 4,4'-DIPHENYLMETHANE DIISOCYANATE (MDI):

- for diphenylmethane diisocyanate (methylene bisphenyl isocyanate; MDI)

Odour Threshold Value: 0.39 ppm

IDLH Level: 10 mg/m<sup>3</sup>

Mean MDI exposures of less than 0.003 ppm appear to have no acute or chronic effect on pulmonary function.

MDI produces identical toxicological responses to those produced by TDI and the recommended TLV-TWA is identical for the two isocyanates. Exposure at or below the recommended value is thought to protect the worker against pulmonary function decrements as well as to minimise the potential for respiratory tract sensitisation. Individuals who may be hypersusceptible or otherwise unusually responsive to exposure to certain industrial chemicals may not adequately protected from adverse health effects caused by MDI at the recommended TLV-TWA. Ceiling values recommended by NIOSH and OSHA are synonymous with normal excursions allowable for exposures to the TLV-TWA (in excess of 3 x TLV-TWA for no more than a total of 30 minutes during a work day but in any case not exceeding 5 x TLV-TWA).

### 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 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

continued...

# EMC95A

Hazard Alert Code: MODERATE

Chemwatch GHS Safety Data Sheet  
Mar-9-2011  
C614LP

CHEMWATCH 24-3812  
Version No:2.0  
Page 14 of 21

## Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

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)

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.

continued...

# EMC95A

Chemwatch GHS Safety Data Sheet  
Mar-9-2011  
C614LP

Hazard Alert Code: MODERATE

CHEMWATCH 24-3812  
Version No:2.0  
Page 15 of 21

## Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

## Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

### APPEARANCE

Milky liquid; reacts with water.

### PHYSICAL PROPERTIES

Liquid.

State	Liquid	Molecular Weight	Not Applicable
Melting Range (°F)	Not Available	Viscosity	Not Available
Boiling Range (°F)	Not Available	Solubility in water (g/L)	Reacts
Flash Point (°F)	Not Available	pH (1% solution)	Not Available
Decomposition Temp (°F)	Not Available	pH (as supplied)	Not Available
Autoignition Temp (°F)	Not Available	Vapour Pressure (mmHG)	Not Available
Upper Explosive Limit (%)	Not Available	Specific Gravity (water=1)	1.16
Lower Explosive Limit (%)	Not Available	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.
- Presence of elevated temperatures.

*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 may produce eye irritation in some persons and produce eye damage 24 hours or more after instillation. Moderate inflammation may be expected with redness; conjunctivitis may occur with prolonged exposure.

##### SKIN

- This material can cause inflammation of the skin on contact in some persons.
- The material may accentuate any pre-existing dermatitis condition.

continued...

# EMC95A

Chemwatch GHS Safety Data Sheet  
Mar-9-2011  
C614LP

Hazard Alert Code: MODERATE

CHEMWATCH 24-3812  
Version No:2.0  
Page 16 of 21

## Section 11 - TOXICOLOGICAL INFORMATION

- Open cuts, abraded or irritated skin should not be exposed to this material.

### INHALED

- The material can cause respiratory irritation in some persons. The body's response to such irritation can cause further lung damage.
- Inhalation of aerosols (mists, fumes), generated by the material during the course of normal handling, may be harmful.
- 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.

### CHRONIC HEALTH EFFECTS

- Harmful: danger of serious damage to health by prolonged exposure through inhalation. This material can cause serious damage if one is exposed to it for long periods. It can be assumed that it contains a substance which can produce severe defects. This has been demonstrated via both short- and long-term experimentation.
- 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].
- 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.
- Respiratory sensitisation may result in allergic/asthma like responses; from coughing and minor breathing difficulties to bronchitis with wheezing, gasping.

### TOXICITY AND IRRITATION

EMC95A:

- Not available. Refer to individual constituents.

4,4'-DIPHENYLMETHANE DIISOCYANATE (MDI):

- unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

#### TOXICITY

Oral (rat) LDLo: 9200 mg/kg  
Oral (mouse) LD50: 2200 mg/kg Dermal Sensitiser \*  
Dermal (rabbit) LD50: >6200 mg/kg \* Respiratory Sensitiser (g.pig) \*  
Oral (Rat) LD50: 9200 mg/kg [\* = Bayer CCINFO 2133615]  
Inhalation (Rat) LC50: 178 mg/m<sup>3</sup>

- 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

#### IRRITATION

Skin (rabbit): 500 mg /24 hours

continued...



# EMC95A

Hazard Alert Code: MODERATE

Chemwatch GHS Safety Data Sheet  
Mar-9-2011  
C614LP

CHEMWATCH 24-3812  
Version No:2.0  
Page 17 of 21

## Section 11 - TOXICOLOGICAL INFORMATION

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 moderate eye irritation leading to inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

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.

The substance is classified by IARC as Group 3:

NOT classifiable as to its carcinogenicity to humans.

Evidence of carcinogenicity may be inadequate or limited in animal testing.

Inhalation (human) TCLo: 0.13 ppm/30 mins Eye (rabbit): 0.10 mg moderate

### CARCINOGEN

4, 4' - Methylenediphenyl diisocyanate	International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs	Group	3
Methylene Diphenyl Diisocyanate (monomeric MDI) and polymeric MDI (PMDI)	US EPA Carcinogens Listing	Carcinogenicity	D

continued...

# EMC95A

Hazard Alert Code: MODERATE

Chemwatch GHS Safety Data Sheet  
Mar-9-2011  
C614LP

CHEMWATCH 24-3812  
Version No:2.0  
Page 18 of 21

## Section 11 - TOXICOLOGICAL INFORMATION

Methylene Diphenyl Diisocyanate (monomeric MDI) and polymeric MDI (PMDI)	US EPA Carcinogens Listing	Carcinogenicity	CBD
4, 4' - diphenylmethane diisocyanate (MDI)	US ACGIH Threshold Limit Values (TLV) - Carcinogens	Carcinogen Category	D
4, 4' - diphenylmethane diisocyanate (MDI)	US ACGIH Threshold Limit Values (TLV) - Carcinogens	Carcinogen Category	CBD
4, 4' - diphenylmethane diisocyanate (MDI)	US - Rhode Island Hazardous Substance List	IARC	
4, 4' - diphenylmethane diisocyanate (MDI)	US - Maine Chemicals of High Concern List	Carcinogen	D
4, 4' - diphenylmethane diisocyanate (MDI)	US - Maine Chemicals of High Concern List	Carcinogen	CBD
<b>SKIN</b>			
4, 4' - diphenylmethane diisocyanate (MDI)	Canada - British Columbia Occupational Exposure Limits - Skin	Notation	Skin; S

## Section 12 - ECOLOGICAL INFORMATION

### 4,4'-DIPHENYLMETHANE DIISOCYANATE (MDI):

Hydrolysis would represent 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.

Fish LC50 (96 h): 95.24-134.37 mg/L

### Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
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continued...

# EMC95A

Chemwatch GHS Safety Data Sheet  
Mar-9-2011  
C614LP

Hazard Alert Code: MODERATE

CHEMWATCH 24-3812  
Version No:2.0  
Page 19 of 21

## Section 12 - ECOLOGICAL INFORMATION

4, 4' - diphenylmethane diisocyanate (MDI)	LOW	LOW	LOW	LOW
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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 CO<sub>2</sub> 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

**4,4'-diphenylmethane diisocyanate (MDI) (CAS: 101-68-8,26447-40-5) is found on the following regulatory lists;**

"Canada - Alberta Ambient Air Quality Objectives", "Canada - Alberta Occupational Exposure Limits", "Canada - British Columbia Occupational Exposure Limits", "Canada - Northwest Territories Occupational Exposure Limits (English)", "Canada - Nova Scotia Occupational Exposure Limits", "Canada - Ontario Occupational Exposure Limits", "Canada - Prince Edward Island Occupational Exposure Limits", "Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)", "Canada - Saskatchewan Occupational Health and Safety Regulations

continued...

# EMC95A

Hazard Alert Code: MODERATE

Chemwatch GHS Safety Data Sheet

Mar-9-2011

C614LP

CHEMWATCH 24-3812

Version No:2.0

Page 20 of 21

## Section 15 - REGULATORY INFORMATION

- Contamination Limits", "Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances", "Canada CEPA Environmental Registry Substance Lists - List of substances on the DSL that meet the human health criteria for categorization (English)", "Canada Ingredient Disclosure List (SOR/88-64)", "Canada National Pollutant Release Inventory (NPRI)", "Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (English)", "GESAMP/EHS Composite List - GESAMP Hazard Profiles", "IMO IBC Code Chapter 17: Summary of minimum requirements", "IMO MARPOL 73/78 (Annex II) - List of Noxious Liquid Substances Carried in Bulk", "International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs", "International Air Transport Association (IATA) Dangerous Goods Regulations", "US - Alaska Limits for Air Contaminants", "US - California Air Toxics ""Hot Spots"" List (Assembly Bill 2588) Substances for which emissions must be quantified", "US - California Occupational Safety and Health Regulations (CAL/OSHA) - Hazardous Substances List", "US - California OEHHA/ARB - Chronic Reference Exposure Levels and Target Organs (CRELs)", "US - California Permissible Exposure Limits for Chemical Contaminants", "US - California Toxic Air Contaminant List Category II", "US - Connecticut Hazardous Air Pollutants", "US - Delaware Pollutant Discharge Requirements - Reportable Quantities", "US - Hawaii Air Contaminant Limits", "US - Idaho - Limits for Air Contaminants", "US - Louisiana Toxic Air Pollutants Supplemental List", "US - Michigan Exposure Limits for Air Contaminants", "US - Minnesota Hazardous Substance List", "US - Minnesota Permissible Exposure Limits (PELs)", "US - New Jersey Right to Know Hazardous Substances", "US - Oregon Permissible Exposure Limits (Z-1)", "US - Oregon Permissible Exposure Limits (Z-2)", "US - Pennsylvania - Hazardous Substance List", "US - Rhode Island Hazardous Substance List", "US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants", "US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants", "US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants", "US - Washington Permissible exposure limits of air contaminants", "US - Washington Toxic air pollutants and their ASIL, SQER and de minimis emission values", "US - Wisconsin Control of Hazardous Pollutants - Emission Thresholds, Standards and Control Requirements (Hazardous Air Contaminants)", "US - Wisconsin Control of Hazardous Pollutants - Substances of Concern for Sources of Incidental Emissions of Hazardous Air Contaminants", "US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants", "US ACGIH Threshold Limit Values (TLV)", "US CAA (Clean Air Act) - HON Rule - Organic HAPs (Hazardous Air Pollutants)", "US Clean Air Act - Hazardous Air Pollutants", "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 Carcinogens Listing", "US EPA High Production Volume Program Chemical List", "US EPA Master Testing List - Index I Chemicals Listed", "US List of Lists - Consolidated List of Chemicals Subject to EPCRA, CERCLA and Section 112(r) of the Clean Air Act", "US NIOSH Recommended Exposure Limits (RELs)", "US OSHA Permissible Exposure Levels (PELs) - Table Z1", "US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory", "US TSCA Section 8 (a) - Preliminary Assessment Information Rules (PAIR) - Reporting List", "US TSCA Section 8 (d) - Health and Safety Data Reporting"

No data for EMC95A (CW: 24-3812)

## Section 16 - OTHER INFORMATION

### Denmark Advisory list for selfclassification of dangerous substances

Substance	CAS	Suggested codes
4, 4' - diphenylmethane diisocyanate (MDI)	26447- 40- 5	R43

### INGREDIENTS WITH MULTIPLE CAS NUMBERS

Ingredient Name	CAS
4,4'-diphenylmethane diisocyanate (MDI)	101-68-8, 26447-40-5

continued...

# EMC95A

**Hazard Alert Code: MODERATE**

**Chemwatch GHS Safety Data Sheet**  
**Mar-9-2011**  
**C614LP**

**CHEMWATCH 24-3812**

**Version No:2.0**

**Page 21 of 21**

**Section 16 - OTHER INFORMATION**

■ 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](http://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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