

TFC 300

MATERIAL SAFETY

The information contained within this Technical Data Sheet, details product description, health and safety hazard information of the product and how to safely handle and use the product in the workplace. Also refer to the MSDS for more information. Each user of this product should read the MSDS and consider the information in the context of how the product will be handled and used in the workplace including in conjunction with other products. If clarification or further information is needed to ensure that an appropriate risk assessment can be made, the user should contact Demtech Australia Pty Ltd. Demtech Australia Pty Ltd makes no representation as to the completeness and accuracy of the data contained within this data sheet. It is the user's obligation to evaluate and use this product safely, and to comply with all relevant Federal, State and Local Government laws and regulations. Demtech Australia Pty Ltd shall not be responsible for loss, damage or injury resulting from reliance upon or failure to adhere to any recommendation or information contained herein, from abnormal use of the material, or any hazard inherent in the nature of the material.

1. PRODUCT IDENTIFICATION

Product identifier

Product name	Cureflex® TFC 300 (Part A)
Synonyms	Not available
Other means of identification	Not available

Relevant identified uses of the substance or mixture

Relevant identified uses	Component of a polyurea system
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Details of the supplier of the safety data sheet

Registered company name	Demtech Australia Pty Ltd
Address	16 Logis Blvd, Dandenong South VIC 3175 Australia
Telephone	1300 300 090
Fax	Not available
Website	www.demtech.com.au
Email	reception@demtech.com.au

Emergency telephone number

Association/organisation	Not available
Emergency telephone number	Not available
Other emergency telephone	Not available

2. HAZARD IDENTIFICATION

Classification of the substance or mixture

HAZARDOUS CHEMICAL. NON-DANGEROUS GOODS. According to the WHS Regulations and the ADG Code.

Poisons schedule	S6
Classification	Specific target organ toxicity - single exposure (respiratory tract irritation); Category 3. Acute toxicity (oral); Category 4. Skin sensitizer; Category 1.
Legend	1. Classified by Chemwatch; 2. Classification drawn from HCIS; 3. Classification drawn from Regulation (EU) No 1272/2008 Annex VI.

Label elements



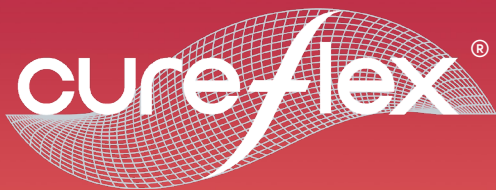
Signal word: WARNING

Hazard and general precautionary statement(s)

H335	May cause respiratory irritation.
H302	Harmful if swallowed.
H317	May cause an allergic skin reaction.
P101	If medical advice is needed, have product container or label at hand.
P102	Keep out of reach of children.
P103	Read carefully and follow all instructions.

Prevention and response precautionary statement(s)

P271	Use only outdoors or in a well-ventilated area.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P261	Avoid breathing mist/vapours/spray.
P270	Do not eat, drink or smoke when using this product.
P272	Contaminated work clothing should not be allowed out of the workplace.
P362+P364	Take off contaminated clothing and wash it before reuse.
P302+P352	IF ON SKIN: Wash with plenty of soap and water.
P333+P313	If skin irritation or rash occurs: Get medical advice/attention.
P301+P312	IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell.
P304+P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P330	Rinse mouth.



TFC 300

MATERIAL SAFETY

2. HAZARD IDENTIFICATION Cont.

Storage precautionary statement(s)

P405	Store locked up.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.

Disposal precautionary statement(s)

P501	Dispose of contents/container in accordance with local regulations.
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3. PRODUCT COMPOSITION

Composition of mixtures

CAS No	% (weight)	Name
28182-81-2	>60	Hexamethylene diisocyanate polymer
78-40-0	10-30	Triethyl phosphate
Not available	to 100	All other substances - non-hazardous

4. FIRST AID MEASURES

Description of first aid measures

Eye contact

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 contact

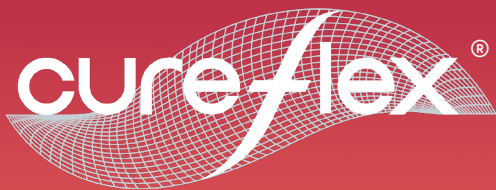
If skin contact occurs:

- 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.

Inhalation

- 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, without delay.

Following uptake by inhalation, move person to an area free from risk of further exposure. Oxygen or artificial respiration should be administered as needed. Asthmatic-type symptoms may develop and may be immediate or delayed up to several hours. Treatment is essentially symptomatic. A physician should be consulted.



TFC 300

MATERIAL SAFETY

4. FIRST AID MEASURES Cont.

Description of first aid measures

Ingestion

- IF SWALLOWED, REFER FOR MEDICAL ATTENTION, WHERE POSSIBLE, WITHOUT DELAY.
- For advice, contact a Poisons Information Centre or a doctor.
- Urgent hospital treatment is likely to be needed.
- In the mean time, qualified first-aid personnel should treat the patient following observation and employing supportive measures as indicated by the patient's condition.
- If the services of a medical officer or medical doctor are readily available, the patient should be placed in his/her care and a copy of the MSDS should be provided. Further action will be the responsibility of the medical specialist.
- If medical attention is not available on the worksite or surroundings send the patient to a hospital together with a copy of the MSDS.

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

- INDUCE vomiting with fingers down the back of the throat, ONLY IF CONSCIOUS. Lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. NOTE: Wear a protective glove when inducing vomiting by mechanical means.

Indication of any immediate medical attention and special treatment needed

All persons handling organic phosphorus-ester materials regularly should undergo regular medical examination with special stress on the central nervous systems. Whilst atropine or pyridine-2-aldoxime methiodide (PAM) are beneficial antidotes for acute phosphate ester poisonings, they are of little value in reversing acute or chronic neurological damage due to phosphites and some types of aryl phosphate.

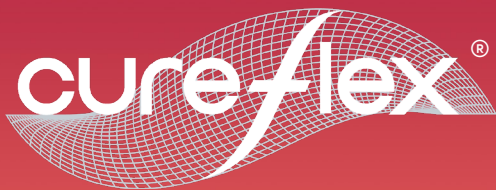
For sub-chronic and chronic exposures to isocyanates:

- 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 & 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.



TFC 300

MATERIAL SAFETY

5. FIREFIGHTING MEASURES

Extinguishing media

- Small quantities of water in contact with hot liquid may react violently with generation of a large volume of rapidly expanding hot semi-solid foam.
- Presents additional hazard when fire fighting in a confined space.
- Cooling with flooding quantities of water reduces this risk.
- Water spray or fog may cause frothing and should be used in large quantities.
- Foam.
- Dry chemical powder.
- BCF (where regulations permit).
- Carbon dioxide.
- Water spray or fog (large fires only).

Special hazards arising from the substrate or mixture

Fire incompatibility

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

Advice for firefighters

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 pressurises and may then rupture containers with release of flammable and highly toxic isocyanate vapour.
- Burns with acrid black smoke and poisonous fumes.
- Due to reaction with water producing CO₂-gas, a hazardous build-up of pressure could result if contaminated containers are re-sealed.
- Combustion yields traces of highly toxic hydrogen cyanide HCN, plus toxic nitrogen oxides NO_x and carbon monoxide.

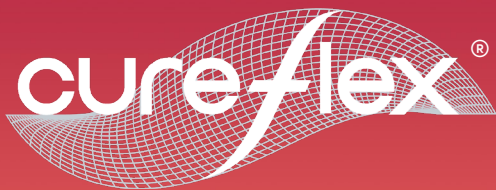
Combustion products include:

- Carbon dioxide (CO₂).
- Isocyanates.
- Hydrogen cyanide.
- Nitrogen oxides (NO_x).
- Phosphorus oxides (PO_x).
- Other pyrolysis products typical of burning organic material.

May emit corrosive fumes. 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.

HAZCHEM

Not applicable.



TFC 300

MATERIAL SAFETY

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

See Section 8.

Environmental precautions

See Section 12.

Methods and materials for containment and cleaning up

Minor spills

- Remove all ignition sources.
- Clean up all spills immediately.
- Avoid breathing vapours and contact with skin and eyes.
- Control personal contact with the substance, 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

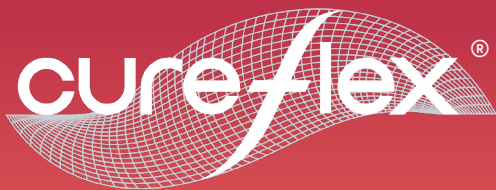
Liquid isocyanates and high isocyanate vapour concentrations will penetrate seals on self contained breathing apparatus (SCBA) should be used inside encapsulating suit where this exposure may occur.

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 (see below for suitable formulations) 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.
- 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.



TFC 300

MATERIAL SAFETY

6. ACCIDENTAL RELEASE MEASURES Cont.

Methods and materials for containment and cleaning up

Major spills

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 over-exposure 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.
- 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.

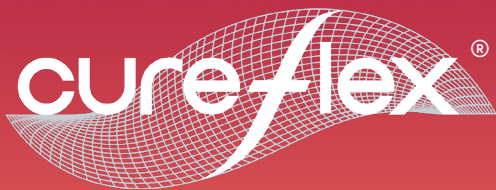
Personal Protective Equipment advice is contained in Section 8 of the MSDS.

7. HANDLING & STORAGE

Precautions for safe handling

Safe handling

- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.
- DO NOT enter confined spaces until atmosphere has been checked.
- 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 storage and handling recommendations contained within this MSDS.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
- DO NOT allow clothing wet with material to stay in contact with skin.



TFC 300

MATERIAL SAFETY

7. HANDLING & STORAGE Cont.

Precautions for safe handling

Other information

For commercial quantities of isocyanates:

- Isocyanates should be stored in adequately banded areas. Nothing else should be kept within the same banding. 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 storage and handling recommendations contained within this MSDS.

Conditions for safe storage, including any incompatibilities

Suitable container

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

Storage incompatibility

For monoalkyl phosphates:

- The rate of hydrolysis of most simple monoalkyl phosphates passes through a maximum lying in the pH range of 3 to 5.
- At alkaline pH values, the hydrolysis rate drops sharply. At acid pH values, a minimum is observed (at pH 1), then the hydrolysis rate increases again with acidity of the medium. Since the pKa values for the first and second steps of dissociation of methyl phosphate are 1.54 and 6.31, respectively, it can be assumed that the hydrolysis rate maximum at pH 4 corresponds to the highest monoanion concentration in the solution. The decreasing hydrolysis rate in an alkaline medium suggests that the dianion is not active (apparently because the electrostatic repulsion hinders the attack of the dianion by the hydroxyl ion). A non-dissociated acid is less active than its monoanion. At pH < 1, one can observe acid-catalyzed hydrolysis with formation of a conjugate acid.

For dialkyl phosphates:

- Dialkyl phosphates are among the least reactive esters. Exceptions include acid phosphates of 1,2-diols, containing a phosphate group at the adjacent carbon atoms, as well as cyclic diphosphates-so-called cyclic phosphates.
- Hydrolysis of the diester in its neutral form proceeds predominantly (70-80%) with cleavage of the C-O bond, while the P-O is broken only in 20 to 30 per cent of the cases.
- As the medium becomes more acidic, the dialkyl phosphate hydrolysis rate increases with acid concentration. The protonated form of the diester is hydrolysed, primarily, at the C-O bond (up to 90%), just as the neutral form, the P-O bond being affected insignificantly (10 %).
- Thus, the widest difference in the hydrolysis rate of di- and monophosphates is observed in the case of the monoanionic form. The differences in the rates of hydrolysis of other ionic forms are not as pronounced.

For trialkyl phosphates:

- Trialkylphosphates undergo hydrolysis in both acid and alkaline media. At alkaline pH values, the mechanism of the reaction is bimolecular and includes a nucleophilic attack of the tetrahedral phosphorus atom by a hydroxyl ion (experiments show the P-O bond is usually broken in this case).

7. HANDLING & STORAGE Cont.

Conditions for safe storage, including any incompatibilities

Storage incompatibility

Cyclic phosphates:

- Unlike simple dialkyl phosphates, five-membered cyclic diphosphates are extremely reactive. The high reactivity of cyclic phosphates, as compared to non-cyclic ones, can be explained by the ring being strained. The straining seems to occur only in five-membered cyclic phosphates, in view of the fact that the reactivity of compounds with a larger (six and seven membered) ring equals that of dimethyl phosphate or is even lower.
- A number of phosphate and thiophosphate esters are of limited thermal stability and undergo highly exothermic self-accelerating decomposition reactions which may be catalysed by impurities.
- The potential hazards can be reduced by appropriate thermal control measures.
(Bretherick L: Handbook of Reactive Chemical Hazards).

Thermal decomposition of organophosphate esters, in the presence of trimethylolpropane or its homologues (common components of synthetic lubricants), may produce bicyclic phosphates and phosphites. These may occur be produced in as little as 5 minutes at 650 deg C. These bicyclic compounds are a class of materials with neurotoxic properties which produce convulsive seizures in test animals. The formation of these compounds does not occur, for example, in the presence of a pentaerythritol base (another common component of synthetic lubricants).

- Avoid cross contamination between the two liquid parts of product (kit).
- If two part products are mixed or allowed to mix in proportions other than manufacturer's recommendation, polymerisation with gelation and evolution of heat (exotherm) may occur.
- This excess heat may generate toxic vapour.
- Segregate from alcohol, water.
- Avoid strong bases.

Avoid reaction with water, alcohols and detergent solutions. Isocyanates are electrophiles, and as such they are reactive toward a variety of nucleophiles including alcohols, amines, and even water. Upon treatment with an alcohol, an isocyanate forms a urethane linkage. If a di-isocyanate is treated with a compound containing two or more hydroxyl groups, such as a diol or a polyol, polymer chains are formed, which are known as polyurethanes. Reaction between a di-isocyanate and a compound containing two or more amine groups, produces long polymer chains known as polyureas.

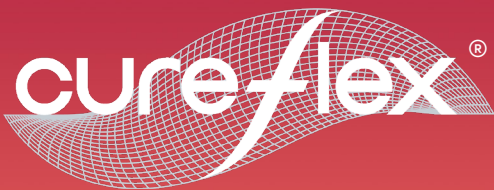
Isocyanates and thioisocyanates are incompatible with many classes of compounds, reacting exothermically to release toxic gases. Reactions with amines, strong bases, aldehydes, alcohols, alkali metals, ketones, mercaptans, strong oxidisers, hydrides, phenols, and peroxides can cause vigorous releases of heat. Acids and bases initiate polymerisation reactions in these materials.

Isocyanates also can react with themselves. Aliphatic di-isocyanates can form trimers, which are structurally related to cyanuric acid. Isocyanates participate in Diels-Alder reactions, functioning as dienophiles. 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 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. The isocyanate anion is a pseudohalide (syn pseudohalogen) whose chemistry, resembling that of the true halogens, allows it to substitute for halogens in several classes of chemical compounds. The behavior and chemical properties of the several pseudohalides are identical to that of the true halide ions.

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.



TFC 300

MATERIAL SAFETY

7. HANDLING & STORAGE Cont.

Conditions for safe storage, including any incompatibilities

Storage incompatibility

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 L: Handbook of Reactive Chemical Hazards, 4th Edition).

8. EXPOSURE CONTROLS

Control parameters

Occupational exposure limits

Source	Ingredient	Material name	TWA	STEL	Peak	Notes
Australia Exposure Standards	Hexamethylene diisocyanate polymer	Isocyanates (as NCO)	0.02 mg/m ³	0.07 mg/m ³	Not available	Not available

Ingredient	Material name	TEEL-1	TEEL-2	TEEL-3
Hexamethylene diisocyanate polymer	Hexamethylene diisocyanate polymer	7.8 mg/m ³	86 mg/m ³	510 mg/m ³
Triethyl phosphate	Triethyl phosphate (TEP)	23 mg/m ³	250 mg/m ³	320 mg/m ³

Ingredient	Original IDLH	Revised IDLH
Hexamethylene diisocyanate polymer	Not available	Not available
Triethyl phosphate	Not available	Not available
All other substances non-hazardous	Not available	Not available

Exposure controls

Appropriate engineering controls

- All processes in which isocyanates are used should be enclosed wherever possible.
- Total enclosure, accompanied by good general ventilation, should be used to keep atmospheric concentrations below the relevant exposure standards.
- If total enclosure of the process is not feasible, local exhaust ventilation may be necessary. Local exhaust ventilation is essential where lower molecular weight isocyanates (such as TDI or HDI) is used or where isocyanate or polyurethane is sprayed.
- Where other isocyanates or pre-polymers are used and aerosol formation cannot occur, local exhaust ventilation may not be necessary if the atmospheric concentration can be kept below the relevant exposure standards.
- Where local exhaust ventilation is installed, exhaust vapours should not be vented to the exterior in such a manner as to create a hazard.

8. EXPOSURE CONTROLS Cont.

Exposure controls

Appropriate 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 (AS/NZS 4114, UNI EN 12215:2010, ANSI/AIHA Z9.3-2007 or national equivalent).
- Local exhaust ventilation with full face positive-pressure air supplied breathing apparatus (hood or helmet type) is 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. Air contaminants generated in the workplace possess varying 'escape' velocities which, in turn, determine the 'capture velocities' of fresh circulating air required to effectively remove the contaminant.

Type of contaminant	Air speed
Direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation in zone of rapid air).	1-2.5 m/s (200-500f/min.)

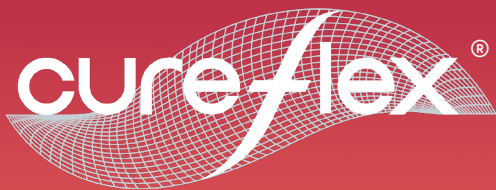
Within each range the appropriate value depends on:

Lower end of the range	Upper end of the range
Room air currents minimal or favourable	Disturbing room air currents
Contaminants of low toxicity or nuisance	Contaminants of high toxicity
Intermittent, low production	High production, heavy use
Large hood or large air mass in motion	Small hood-local control only

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

Personal protection





TFC 300

MATERIAL SAFETY

8. EXPOSURE CONTROLS Cont.

Exposure controls

Eye and face protection

- 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 lenses 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).

Skin protection

See hand protection below.

Hand/feet protection

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.

The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.

The exact break through time for substances has to be obtained from the manufacturer of the protective gloves and has to be observed when making a final choice. Personal hygiene is a key element of effective hand care. 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.

Important factors in the selection of gloves include:

- Frequency and duration of contact.
- Chemical resistance of glove material.
- Glove thickness.
- Dexterity.

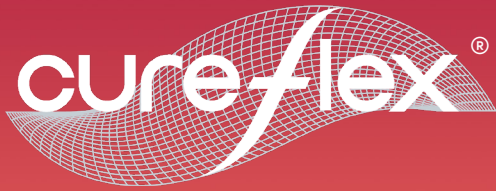
Select gloves tested to a relevant standard:

- 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.
- Some glove polymer types are less affected by movement and this should be taken into account when considering gloves for long-term use.
- Contaminated gloves should be replaced.

As defined in ASTM F-739-96 in any application, gloves are rated as:

- Excellent when breakthrough time > 480 min.
- Good when breakthrough time > 20 min.
- Fair when breakthrough time < 20 min.
- Poor when glove material degrades.

For general applications, gloves with a thickness typically greater than 0.35 mm, are recommended. It should be emphasised that glove thickness is not necessarily a good predictor of glove resistance to a specific chemical, as the permeation efficiency of the glove will be dependent on the exact composition of the glove material. Therefore, glove selection should also be based on consideration of the task requirements and knowledge of breakthrough times.



TFC 300

MATERIAL SAFETY

8. EXPOSURE CONTROLS Cont.

Exposure controls

Hand/feet protection

Glove thickness may also vary depending on the glove manufacturer, the glove type and the glove model. Therefore, the manufacturers' technical data should always be taken into account to ensure selection of the most appropriate glove for the task. NOTE: Depending on the activity being conducted, gloves of varying thickness may be required for specific tasks. For example:

- Thinner gloves (down to 0.1 mm or less) may be required where a high degree of manual dexterity is needed. However, these gloves are only likely to give short duration protection and would normally be just for single use applications, then disposed of.
- Thicker gloves (up to 3 mm or more) may be required where there is a mechanical (as well as a chemical) risk i.e. where there is abrasion or puncture potential.

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.

- Do NOT wear natural rubber (latex gloves).
- 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.
- DO NOT use skin cream unless necessary and then use only minimum amount.
- Isocyanate vapour may be absorbed into skin cream and this increases hazard.

Body protection

See other protection below

Other protection

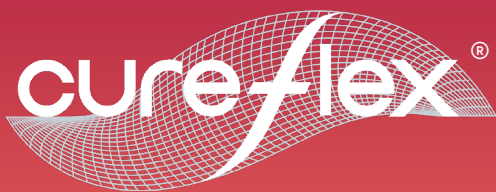
All employees working with isocyanates must be informed of the hazards from exposure to the contaminant and the precautions necessary to prevent damage to their health. They should be made aware of the need to carry out their work so that as little contamination as possible is produced, and of the importance of the proper use of all safeguards against exposure to themselves and their fellow workers. Adequate training, both in the proper execution of the task and in the use of all associated engineering controls, as well as of any personal protective equipment, is essential.

Employees exposed to contamination hazards should be educated in the need for, and proper use of, facilities, clothing and equipment and thereby maintain a high standard of personal cleanliness. Special attention should be given to ensuring that all personnel understand instructions, especially newly recruited employees and those with local-language difficulties, where they are known.

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

Respiratory protection

- 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.
- Cartridge performance is affected by humidity. Cartridges should be changed after 2 hr of continuous use unless it is determined that the humidity is less than 75%, in which case, cartridges can be used for 4 hr. Used cartridges should be discarded daily, regardless of the length of time used.



TFC 300

MATERIAL SAFETY

8. EXPOSURE CONTROLS Cont.

Respiratory protection

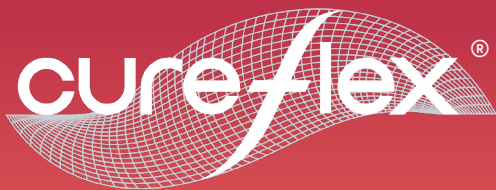
For spraying or operations which might generate aerosols:

- 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 national standard must be used.
- Organic vapour respirators with particulate pre- filters and powered, air-purifying respirators are NOT 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.

9. PHYSICAL & CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Moisture sensitive clear liquid	Relative density (water = 1)	1.13
Physical state	Liquid	Partition coefficient	Not available
Odour	Not available	Auto-ignition temperature (°C)	Not available
Odour threshold	Not available	Decomposition temperature	Not available
pH (as supplied)	Not available	Viscosity (cSt)	Not available
Melting/freezing point (°C)	Not available	Molecular weight (g/mol)	Not available
Boiling point/range (°C)	Not available	Taste	Not available
Flash point (°C)	Not available	Explosive properties	Not available
Evaporation rate	BuAC = 1	Oxidising properties	Not available
Flammability	Not available	Surface tension (dyn/cm or mN/m)	Not available
Upper explosive limit (%)	Not available	Volatile component (%vol)	Not available
Lower explosive limit (%)	Not available	Gas group	Not available
Vapour pressure (kpa)	Not available	pH as a solution (1%)	Not available
Solubility in water	Not available	VOC g/l	Not available
Vapour density (air = 1)	Not available		



TFC 300

MATERIAL SAFETY

10. STABILITY & REACTIVITY

Reactivity	See Section 7.
Chemical stability	<ul style="list-style-type: none">• Unstable in the presence of incompatible materials.• Product is considered stable.• Hazardous polymerisation will not occur.
Possibility of hazardous reactions	See Section 7.
Conditions to avoid	See Section 7.
Incompatible materials	See Section 7.
Hazardous decomposition products	See Section 5.

11. TOXICOLOGICAL INFORMATION

Information on toxicological effects

Inhaled

Inhalation of vapours or aerosols (mists, fumes), generated by the material during the course of normal handling, may be harmful. The material can cause respiratory irritation in some persons. The body's response to such irritation can cause further lung damage. Inhalation of vapours may cause drowsiness and dizziness. This may be accompanied by sleepiness, reduced alertness, loss of reflexes, lack of co-ordination and vertigo.

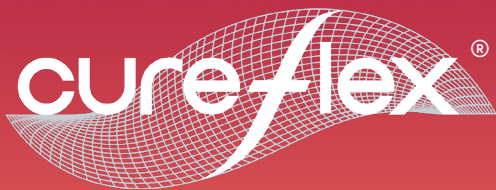
The vapour/mist may be highly irritating to the upper respiratory tract and lungs; the response may be severe enough to produce bronchitis and pulmonary oedema. Possible neurological symptoms arising from isocyanate exposure include headache, insomnia, euphoria, ataxia, anxiety neurosis, depression and 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. Organic phosphates are very stable and highly hazardous. There are a number of effects they can have on the body, including excitement of the central nervous system, and irritation of the skin and respiratory tract.

Ingestion

Accidental ingestion of the material may be harmful; animal experiments indicate that ingestion of less than 150 gram may be fatal or may produce serious damage to the health of the individual.

Central nervous system (CNS) depression may include general discomfort, symptoms of giddiness, headache, dizziness, nausea, anaesthetic effects, slowed reaction time, slurred speech and may progress to unconsciousness. Serious poisonings may result in respiratory depression and may be fatal.



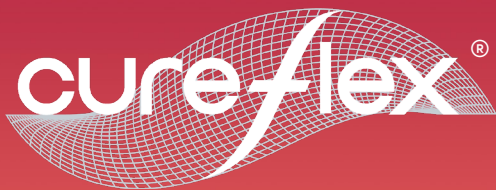
TFC 300

MATERIAL SAFETY

11. TOXICOLOGICAL INFORMATION Cont.

Information on toxicological effects

Skin contact	<p>Skin contact is not thought to produce harmful health effects (as classified under EC Directives using animal models). Systemic harm, however, has been identified following exposure of animals by at least one other route and the material may still produce health damage following entry through wounds, lesions or abrasions.</p> <p>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.</p>	
Eye	<p>Although the liquid is not thought to be an irritant (as classified by EC Directives), direct contact with the eye may produce transient discomfort characterised by tearing or conjunctival redness (as with windburn).</p>	
Chronic	<p>Long-term exposure to respiratory irritants may result in airways disease, involving difficulty breathing and related whole-body problems. Skin contact with the material is more likely to cause a sensitisation reaction in some persons compared to the general population. Substance accumulation, in the human body, may occur and may cause some concern following repeated or long-term occupational exposure.</p> <p>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) Animal testing shows that polymeric MDI can damage the nasal cavities and lungs, causing inflammation and increased cell growth. This product contains a polymer with a functional group considered to be of high concern. Isothiocyanates may cause hypersensitivity of the skin and airways.</p>	
Hexamethylene diisocyanate polymer	<p>Toxicity</p> <p>Dermal (rat) LD50: >2000 mg/kg[1]</p> <p>Inhalation (rat) LC50: 0.052-0.5 mg/L4h[1]</p> <p>Oral (rat) LD50: >2000 mg/kg[1]</p>	<p>Irritation</p> <p>Skin (rabbit): 500 mg moderate</p>
Triethyl phosphate	<p>Toxicity</p> <p>Dermal (rabbit) LD50: >20000 mg/kg[1]</p> <p>Inhalation(Rat) LC50: >8.817 mg/L4h[1]</p> <p>Oral (Rat) LD50: 1165 mg/kg[2]</p>	<p>Irritation</p> <p>Eye: Severe*</p> <p>Adverse effect observed (irritating)[1]</p> <p>Skin: Severe*</p> <p>No adverse effect observed (not irritating)[1]</p>
Legend	<p>[1] Value obtained from Europe ECHA Registered Substances - acute toxicity.</p> <p>[2] Value obtained from manufacturer's MSDS.</p> <p>Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of Chemical Substances.</p>	
Cureflex® TFC 300 (Part A)	<p>Asthma-like symptoms may continue for months or even years after exposure to the material ends. This may be due to a non-allergic condition known as reactive airways dysfunction syndrome (RADS) which can occur after exposure to high levels of highly irritating compound. Main criteria for diagnosing RADS include the absence of previous airways disease in a non-atopic individual, with sudden onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant.</p> <p>Other criteria for diagnosis of RADS include a reversible airflow pattern on lung function tests, moderate to severe bronchial hyperreactivity on methacholine challenge testing, and the lack of minimal lymphocytic inflammation, without eosinophilia. 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.</p> <p>On the other hand, industrial bronchitis is a disorder that occurs as a result of exposure due to high concentrations of irritating substance (often particles) and is completely reversible after exposure ceases. The disorder is characterized by difficulty breathing, cough and mucus production.</p>	



TFC 300

MATERIAL SAFETY

11. TOXICOLOGICAL INFORMATION Cont.

Information on toxicological effects

Hexamethylene diisocyanate polymer

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 cause 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.

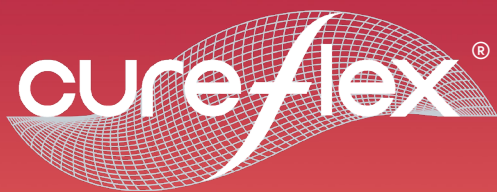
Triethyl phosphate

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis. NOTE: Substance has been shown to be mutagenic in at least one assay, or belongs to a family of chemicals producing damage or change to cellular DNA.

For toxicological endpoints, the NOAEL is 1000 mg/kg bw for subacute toxicity, a NOEL of 625 mg/kg bw/day for teratogenicity and about 335 mg/kg bw for fertility effects. On the basis of all data on genotoxicity, a mutagenic effect of TEP is not assumed. The substance is harmful with a narcotic effect and, at high doses, shows certain neurotoxic properties (inhibition of cholinesterase) without indicating delayed neurotoxicity. The substance is not irritant to the skin. Studies on experimental animals showed no irritation properties. The most comprehensive documented, actual study (OECD Guideline 405, GLP) showed moderate irritation in 1 of 3 animals. According to the classification guideline this does not lead to a classification as irritant. Triethylphosphate administered orally or i.p. to rodents is eliminated rapidly and comprehensively (90% within 16 hours). The very low acute dermal toxicity indicates a markedly lower adsorption than with oral administration. In a subchronic study (rat; oral, up to 6700 mg/kg bw) retarded weight gain, elevated liver and adrenals weight were observed (a validated NOEL or NOAEL cannot be given, the approx. NOEL based on the available data is about 670 mg/kg bw). A subacute 28-day study performed according actual guidelines after oral administration to rats determined a NOEL of 100 mg/kg bw (increased liver metabolism). An increase of liver metabolism is of no toxicological relevance, therefore a NOAEL of 1000 mg/kg bw was derived. After high doses to rats a depressive effect on the central nervous system and slight inhibition of cholinesterases are described. In mice, a NOAEL of 274 mg/kg bw was determined in an oral study (1/5 LD 50 = 274 mg/kg bw for 4 weeks). In rats a NOEL following inhalatory exposure (5h/d for 12 d) of 366 mg/m³ was determined.

Conclusion: Low toxicity, no serious damage in oral doses up to 6700 mg/kg bw. The NOAEL in the most relevant tests was 1000 mg/kg bw/day.

Reproductive toxicity in an early study using a small number of animals the litter size was reduced after repeated feeding to both sexes (rat) beginning at 670 mg/kg bw, although no symptoms of poisoning in the parent animals were described for the 670 mg/kg bw dose. The NOEL for effects on the litter size was 335 mg/kg bw/day. Neither testicular weights nor the histological investigation of the testes revealed remarkable findings in this study (max. dose 6700 mg/kg bw/day). A more recent 28-day study with doses up to 1000 mg/kg bw also showed no effect on the testicular weight (Bayer 1992). A teratogenicity study in rats showed no evidence of a teratogenic potential up to the highest dose of 625 mg/kg bw/day (NOEL developmental toxicity). In the highest dose there was reduction of body weight gain, food intake and feces excretion as a sign of maternal toxicity (NOEL 125 mg/kg bw/day). Genetic toxicity aside from several ames tests with negative results, triethylphosphate induces gene mutations without metabolic activation in *S. Typhimurium* his C117, some bacteria, viruses and a yeast strain. For clarification of the endpoint gene mutation a HPRT test in V79 cell cultures was done. This test revealed a negative result with and without metabolic activation. In an in vitro UDS test on rat hepatocytes triethylphosphate showed no DNA-damaging effect. The results for *diosiphilia melanogaster* in the limited documented recessive-lethal tests are contradictory, while in vivo studies on the mouse (cytogenetics in the bone marrow, dominant lethal test) were negative.



TFC 300

MATERIAL SAFETY

11. TOXICOLOGICAL INFORMATION Cont.

Information on toxicological effects

Cureflex® TFC 300 (Part A) and Hexamethylene diisocyanate polymer

The following information refers to contact allergens as a group and may not be specific to this product. 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. 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.

Cureflex® TFC 300 (Part A) and Triethyl phosphate

Alkyl-esters of phosphoric acid exhibit a low to moderate acute toxicity and metabolised. From studies done on mice, they are not likely to cause gene damage or affect reproduction. However, 2-ethylhexanoic acid produced an effect on newborn rats at high doses to the pregnant female.

Hexamethylene diisocyanate polymer and Triethyl phosphate

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

Acute toxicity	✓	Carcinogenicity	✗
Skin irritation/corrosion	✗	Reproductivity	✗
Serious eye damage/irritation	✗	STOT: Single exposure	✓
Respiratory or skin sensitisation	✓	STOT: Repeated exposure	✗
Mutagenicity	✗	Aspiration hazard	✗

Legend: ✓ Data available to make classification.

✗ Data either not available or does not fill the criteria for classification.

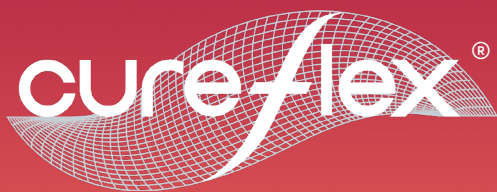
12. ECOLOGICAL INFORMATION

Toxicity: Cureflex® TFC 300 (Part A)

Endpoint	Test duration (hr)	Species	Value	Source
Not available	Not available	Not available	Not available	Not available

Toxicity: Hexamethylene diisocyanate polymer

Endpoint	Test duration (hr)	Species	Value	Source
EC50	72	Algae or aquatic plants	>1000mg/L	Not available
EC50(ECx)	48	Crustacea	>100mg/L	Not available
EC50	48	Crustacea	>100mg/L	Not available
LC50	96	Fish	>100mg/L	Not available



TFC 300

MATERIAL SAFETY

12. ECOLOGICAL INFORMATION

Toxicity: Triethyl phosphate

Endpoint	Test duration (hr)	Species	Value	Source
BCF	1008	Fish	>1-mg/L	7
NOEC(ECx)	Not available	Crustacea	8.471mg/L	Not available
EC50	72	Algae or aquatic plants	1-mg/L	Not available
LC50	96	Fish	1-mg/L	Not available

Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 3. EPIWIN Suite V3.12 (QSAR) - Aquatic Toxicity Data (Estimated) 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data.

For polyisocyanates:

- Polyisocyanates are not readily biodegradable. However, due to other elimination mechanisms (hydrolysis, adsorption), long retention times in water are not to be expected. The resulting polyurea is more or less inert and, due to its molecular size, not bioavailable. Within the limits of water solubility, polyisocyanates have a low to moderate toxicity for aquatic organisms.

For isocyanate-monomers:

- Environmental fate: Isocyanates, (di- and polyfunctional isocyanates), are commonly used to make various polymers, such as polyurethanes. Polyurethanes find significant application in the manufacture of rigid and flexible foams. They are also used in the production of adhesives, elastomers, and coatings.
- Atmospheric fate: These substances are not expected to be removed from the air via precipitation washout or dry deposition.
- Terrestrial fate: These substances are expected to absorb strongly into soil. Migration to groundwater and surface waters is not expected to occur.
- Aquatic fate: Breakdown by water, (hydrolysis), is the primary fate mechanism for the majority of commercial isocyanate monomers, however; the 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. These substances strongly sorb to suspended particulates in water. In the absence of hydrolysis, adsorption to solids, (e.g., sludge and sediments), will be the primary mechanism of removal. Biological breakdown is minimal for most compounds and evaporation is negligible. Evaporation from surface water is expected to take years. In wastewater treatment this process is not expected to be significant. Isocyanates will react with water producing carbon dioxide and forming a solid mass, which is insoluble.
- Biodegradation: Breakdown of these substances in oxygenated and low oxygen environments is not expected to occur. Most of the substances take several months to degrade. Degradation of the hydrolysis products will occur at varying rates.
- Ecotoxicity: These substances are not expected to accumulate/biomagnify in the environment. These substances are toxic if inhaled. These substances are harmful to aquatic organisms and may cause long-term adverse effects in the aquatic environment.

For alky-esters of phosphoric acid:

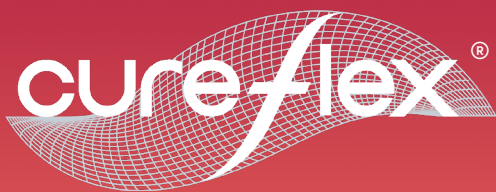
- Environmental fate: The chemicals in this category have low melting, high boiling points or decomposition temperatures and low vapor pressures.
- Terrestrial fate: If released into the environment, these chemicals will exist predominantly in the soil or the aquatic environment depending on the environmental compartment that they first contact. In tests, tris (2-ethylhexyl) phosphate exhibited 0% biodegradation after 28 days.
- Aquatic fate: The tri-esters are slightly soluble and the others are moderately soluble to soluble in water and are hydrolytically stable.
- Ecotoxicity: Alky esters of phosphoric acid are not expected to bioconcentrate and are moderately degradable if soluble and will not persist in the environment. None of the members are highly toxic to aquatic species. Alky esters of phosphoric acid are not acutely toxic to killifish, Daphnia magna water fleas or algae. DO NOT discharge into sewer or waterways.

Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air
Hexamethylene diisocyanate polymer	HIGH	HIGH
Triethyl phosphate	HIGH	HIGH

Bioaccumulative potential

Ingredient	Bioaccumulation
Hexamethylene diisocyanate polymer	LOW (LogKOW = 7.5795)
Triethyl phosphate	LOW (BCF = 1.3)



TFC 300

MATERIAL SAFETY

12. ECOLOGICAL INFORMATION Cont.

Mobility in soil

Ingredient	Mobility
Hexamethylene diisocyanate polymer	LOW (KOC = 18560000)
Triethyl phosphate	LOW (KOC = 47.96)

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Product/packaging disposal:

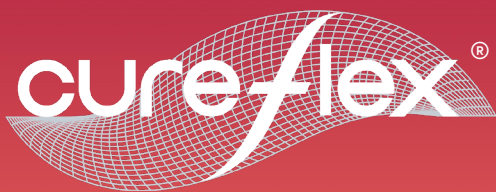
- Containers may still present a chemical hazard/danger when empty. Return to supplier for reuse/recycling if possible.
- If container can not be cleaned sufficiently well to ensure that residuals do not remain or if the container cannot be used to store the same product, then puncture containers, to prevent re-use, and bury at an authorised landfill. Where possible retain label warnings and MSDS and observe all notices pertaining to the product.
- 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 and 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.

14. TRANSPORT INFORMATION

Labels required

Marine pollutant	No
HAZCHEM	Not applicable

- Land transport (ADG): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS.
- Air transport (ICAO-IATA/DGR): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS.
- Sea transport (IMDG-Code/GGVSee): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS.
- Transport in bulk according to Annex II of MARPOL and the IBC Code: Not applicable.



TFC 300

MATERIAL SAFETY

15. REGULATORY INFORMATION

Safety, health and environmental regulations/legislation specific for the substance or mixture

Hexamethylene diisocyanate polymer (28182-81-2) is found on the following regulatory lists:

- Australia Exposure Standards
- Australia Inventory of Chemical Substances (AICS)
- Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Appendix E (Part 2)
- Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Appendix F (Part 3)
- Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Index
- Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Schedule 6
- Australia Work Health and Safety Regulations 2016 - Hazardous chemicals (other than lead) requiring health monitoring

Triethyl phosphate (78-40-0) is found on the following regulatory lists:

- Australia Hazardous Chemical Information System (HCIS) - Hazardous Chemicals
- Australia Inventory of Chemical Substances (AICS)
- Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Appendix E (Part 2)
- Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Appendix F (Part 3)
- Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Index
- Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Schedule 6
- GESAMP/EHS Composite List - GESAMP Hazard Profiles
- IMO IBC Code Chapter 17: Summary of minimum requirements
- IMO MARPOL (Annex II) - List of Noxious Liquid Substances Carried in Bulk

National inventory status

National Inventory	Status
Australia - AICS	Yes
Canada - DSL	Yes
China - IECSC	Yes
Europe - EINEC/ELINCS/NLP	Yes
Korea - KECI	Yes
New Zealand - NZIoC	Yes
Philippines - PICCS	Yes
USA - TSCA	Yes
Taiwan - TCSI	Yes
Vietnam - NCI	Yes
Russia - ARIPS	Yes

Legend: Yes = All CAS declared ingredients are on the inventory.

Definitions and abbreviations

PC - TWA: Permissible Concentration - Time Weighted Average
PC - STEL: Permissible Concentration - Short Term Exposure Limit
IARC: International Agency for Research on Cancer
ACGIH: American Conference of Governmental Industrial Hygienists
STEL: Short Term Exposure Limit
TEEL: Temporary Emergency Exposure Limit
IDLH: Immediately Dangerous to Life or Health Concentrations
OSF: Odour Safety Factor
NOAEL: No Observed Adverse Effect Level
LOAEL: Lowest Observed Adverse Effect Level
TLV: Threshold Limit Value
LOD: Limit of Detection
OTV: Odour Threshold Value
BCF: Bio-concentration Factors
BEI: Biological Exposure Index