Chemical Storage and Delivery Risk Assessment

December, 2007

WIPS Management

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1. Introduction

1.1 Background

Parsons Brinckerhoff (PB) was engaged by WIPS Management to conduct a risk analysis assessment of the proposed chemical storage and delivery facilities at a foam composite manufacturing plant within the Hunter Economic Zone.

This report details the findings of the risk analysis assessment.

1.2 Scope of work

The risk analysis was required to assess the likelihood of a 'major fire' and spillage of chemicals on the driveway during chemical delivery operations. WIPS Management have engaged MJS Dangerous Goods Solutions and Chris Curran (an independent dangerous goods consultant) to assess the proposed development against the requirements of SEPP 33. These other assessments recommended a further risk assessment because the development is in an Environmentally Sensitive Area.

PB has used a semi-quantitative approach to the risk analysis to assess potential hazards associated with the storage and delivery of chemicals for the manufacture of foam panels. PB's analysis examined the risk to people, plant, property, equipment and the environment.

2. Site information

WIPS Management intends to construct a Foam Composite Panel manufacturing plant in the Hunter Economic Zone (HEZ). The plant will be located on a Green Field Site and in an Environmentally Sensitive Area.

The manufacture of Foam Composite Panels requires five chemicals:

- Pentane
- Supasprec 2085 or equivalent - Polymeric methylene diisocyanate (PMDI)
- Daltofoam 33200 - Polyol
- Catalyst 1 – Daltofoam TO 33203
- Catalyst 2 – Daltofoam TR 33204

Pentane, polyol and PMDI will be delivered in bulk isotainers and stored in bulk tanks. Material and Safety Data Sheets for the bulk chemicals can be found in Appendix A. The two catalysts will be delivered and stored in 1,000 litre intermediate bulk containers (IBCs). The Material Safety and Data Sheets for the two Catalyst can be found in appendix B.

Bulk underground storage tanks will be used to store pentane and polyol.

2.1 Assumptions

Information on the proposed chemical storage and its classification in relation to State Environmental Planning Policy 33 – Hazardous and Offensive Development (SEPP 33) was provided by WIPS Management. This information provided the following assumptions for the risk analysis conducted by PB.

1. WIPS Management's proposed Foam Composite Panels manufacturing plant in the HEZ is not classified as 'High Hazard'. Independent consultants (MJS Dangerous Goods Solutions, 13/4/06) have determined the plant would not be classified as Potentially Offensive or Hazardous. Because the plant has not been classified as such, consequently SEPP 33 is not applicable and a Preliminary Hazard Analysis is not required.
2. Licences or approvals from the Environmental Protection Agency are not required.
3. Proposed chemical storage is detailed in Table 2.1.

Table 2.1 Proposed Chemical Storage Details[1]

Product	Class (per ADG)	Packaging Group (per ADG)	Total Storage (L or kgs)	No. of Tanks/ Packages	Qty per Tank/ Package (L or kgs)	Type of Storage	Distance to Boundary (m)	Under SEPP 33 Threshold
Pentane	3	2	110,000	2	55,000	Underground tanks	20	Yes
Catalyst 1	8	2	5,000	5	1,000	Packaged goods/ 1000 L IBC	20	Yes
Catalyst 2	9	n/a	5,000	5	1,000	Packaged goods/ 1000 L IBC	20	Yes
PMDI	9	n/a	150,000	3	50,000	Above ground tank	20	Yes
Polyol	9	n/a	150,000	3	50,000	Above ground tank	20	Yes

4. The proposed chemical usage/deliveries are detailed in Table 2.2.

Table 2.2 Predicted Chemical Usage/Deliveries [2]

Product	Qty per annum	Qty per week	Isotainer Deliveries per week	IBCs Deliveries per week
Pentane	945t	20t	1.1	
PMDI	1,892t	39t	2.2	
Polyol	202t	4t	0.2	
Catalyst 1	} 270t	} 6t		} 5.6
Catalyst 2				

[1] Extracted from Dangerous Goods Consultant (Chris Curran) Draft Summary Provided
[2] Extracted from Proposed WIPS Management Operations Data

3. Methodology

PB's risk analysis is semi-quantitative and utilises aspects of the Hazard and Operability (HAZOP) study methodology. Hazard events were identified from representative standard HAZOP prompts.

For a particular hazardous event, the identified risks have been assessed based on the probability of the occurrence of the event and the likely consequence of the event. Control measures are proposed for each event to reduce the potential likelihood and consequences and the risk re-assessed. The procedure involves:

- determining the maximum reasonable Consequence of each event based on the definitions and examples provided in Table 3.1
- determining the Probability of each event based on the definitions provided in Table 3.2
- determining the Risk Ranking of the event from Table 3.3.

Significant impacts are those with a residual Risk Ranking of Critical or High.

Table 3.1 Categorisation of maximum reasonable environmental consequence

Consequence	Examples
1. Catastrophic Intense local impacts with short to medium term effects and/or significant potential for widespread impacts in the medium to long term. These impacts are clearly apparent and may be irreversible.	▪ long term or widespread with significant harm to ecological systems ▪ significant impact on any threatened species, population, ecological community, natural ecosystems (eg major fish kills or widespread death of terrestrial flora or fauna) ▪ major impact on environmental quality of region (that is, water quality in catchment, material spillage onto ground causing contamination) ▪ serious or repeated breach of licence or legislation likely to result in prosecutions ▪ significant impact on significant area (that is, unauthorized destruction on an area of high natural heritage value) ▪ extensive community outrage and/or major adverse publicity of operations/ activities/ decisions
2. Major Major local impact with short to medium term impacts and /or moderate potential for widespread impacts in the medium to long term. Impacts are apparent and require large scale outside assistance.	▪ significant unauthorised damage to cultural heritage ▪ major impact on environmental quality of region (that is, water quality in catchment, material spillage onto ground causing contamination) , but rectification is possible in the medium term ▪ breach of license or legislation
3. Moderate Moderate local impacts with medium term effects and/or low potential for widespread impacts in the short to medium term.	▪ significant impact on ecology but able to be remediated (e.g. large sewer spill into creek) ▪ spill or moderate disturbance of an area that has been moderately modified from its natural condition ▪ limited community outrage

Consequence	Examples
	▪ significant nuisance impacts (eg odours)
4. Minor Minor local impacts with short term effects or minor widespread impact.	▪ localised impact easily contained and readily remediated (eg minor sewer spill into creek) ▪ minor damage to cultural heritage ▪ local community outrage
5. Insignificant Minor impact with negligible effects.	▪ very localised, transient impact causing minor ecological harm not requiring remediation ▪ temporary community impacts

Table 3.2 Categorisation of probability

	Probability
A	ALMOST CERTAIN to happen
B	LIKELY to happen at some point
C	MODERATE, possible, it might happen
D	UNLIKELY, not likely to happen
E	RARE, practically impossible

Table 3.3 Risk ranking matrix

PROBABILITY

CONSEQUENCES	A	B	C	D	E
1	1	2	4	7	11
2	3	5	8	12	16
3	6	9	13	17	20
4	10	14	18	21	23
5	15	19	22	24	25

1 – 3	CRITICAL	CR
4 – 10	HIGH RISK	HR
11 – 15	MODERATE RISK	MR
16 – 25	LOW RISK	LR

PBs proposed controls measures have been developed based on a hierarchical approach to risk management. Specifically for each assessed hazard risks, control measures are identified according to the following heirachy:

- eliminate the risk where possible
- redesign to eliminate to reduce the risk or recommend substitutes where available
- provide engineering controls where available
- recommend administrative controls in the absence of engineering controls
- provide training
- recommend the use of Personal Protective Equipment (PPE).

4. Risk assessment

PB has completed a risk assessment for the storage and delivery of chemicals required for WIPS Management's proposed foam composite manufacturing facility using the methodology outlined above. A summary of the hazards and risks is provided below. Details of the complete working risk assessment can be found within Appendix D.

4.1 Summary of risks

The greatest risks associated with the storage and deliveries of polyol are from personnel exposure, release into the environment resulting in surface or groundwater contamination, damage to isotainers, chemical incompatibilities, reactions, equipment failures, temperature, or vehicle accident. These risks are similar for PMDI.

Polyol and PMDI reactions can be easily initiated through contamination from catalyst or moisture (presence of hydrogen ions).

Pentane poses the greatest risk due to its extreme flammability. Additional risks from the storage and delivery of pentane come from the risk of fire, the need for earthing, design of equipment, electrics and instrumentation to be intrinsically safe.

The smaller quantities of catalyst presents a lower level of risk than the bulk chemicals. Awareness and careful management of these risks are still required. PB's risk assessment found puncturing and accidental release posed the highest risk.

4.2 Summary of hazards and impacts

The main hazards associated with the storage of bulk pentane are:

- Chemical incompatibility between materials used in the construction of tanks, pipework and transfer hoses
- Making and breaking of connections during delivery using flexible connections
- Overflowing (from reverse flow, operator or instrumentation error) of the storage tank
- Blockages, valve or pump seal failures
- Contamination of stormwater or sewer discharge
- High temperatures
- Noise from poorly designed or maintained equipment
- Ignition source / spark leading to a fire
- Power or instrumentation failure
- Accidental vehicle collision

Whilst pentane is extremely flammable, PMDI and polyol are only combustible. So whilst the bulk installation, storage and delivery risks are similar, ignition sources do not pose as great a hazard to PMDI and polyol.

The impacts from a hazardous event will lead to similar impacts for all bulk chemical storages and deliveries which include:

- unintended or accidental initiation of a chemical reaction
- release of flammable vapours into the environment resulting in personnel exposure to liquids and vapours (pentane is volatile) and odours
- release of a flammable liquid into the environment leading to ground, surface water, or ground water contamination
- financial loss from the lost chemicals and production, and incurred clean-up and waste disposal costs
- damage to plant and equipment from a fire or as a result of chemical incompatibility
- smoke inhalation from a fire
- noise pollution or damage to hearing from noisy equipment.

5. Findings and recommendations

In addition to the findings and recommendations provided below, a manufacturing activity of this scale and chemical types requires:

- an Emergency Management Plan. As part of the Emergency Management Plan, a map and record of chemicals on the site at any time should be accessible to on-site and off-site emergency response services.
- a specialist fire response system designed in accordance with AS1940 and, if possible in consultation with the local Emergency Services Department (NSW Fire Brigade)

5.1 Risk analysis findings

In general, the risk analysis detailed in Section 4 and Appendix C identified that the chemical storage and delivery activities at the proposed foam composite panel manufacturing plant will present low to moderate risk to people, plant, property, equipment and the environment after the implementation of the proposed control measures and actions.

The analysis identified that the storage and delivery of pentane poses the greatest potential risk. Pentane is classified as a flammable liquid (Class 3) under the Australian Dangerous Goods Code and as such presents a potential fire risk. The risk analysis identified that residual risk to people, plant, property, equipment and the environment after the implementation of control measures presented a medium risk for the following potential hazardous events relating to the storage and delivery of pentane:

- personnel exposure to pentane
- fire risk from the overflow, spillage, leak or release into the environment in conjunction with an ignition source
- contamination of stormwater or water discharged to sewer
- use of incompatible materials for storage transfer activities
- flammability of liquids and vapours.

The residual risk to people, plant, property, equipment and the environment after control measures are implemented from PMDI was also found to be a medium potential because of the quantity and under some conditions (for instance a fire) hydrogen cyanide is released. There are several scenarios (overflowing of tanks, damage to equipment, inclusions and contamination) which are of high risk, but through recommended controls listed in 5.2 reduce the risk.

Bulk polyol storage and delivery has a number of high risk scenarios similar to PMDI which are reduced through the suggested controls.

Exposure to PMDI and polyol also has a high risk to human health in the absence of personal protective equipment and engineered controls such as ventilation.

The two catalysts used in the manufacture of composite foam panels stored and delivered in IBCs do not introduce the same level as risk as the bulk chemical storages. The greatest risk for these items comes from the accidental damage to the storage containers.

5.2 Recommended control measures

The analysis in appendix C identifies the control measures required to minimise potential risks associated with the chemical storage and delivery activities. The key control measures are summarised below:

- A major fire involving pentane poses a high threat. Electrical and instrumentation systems involved in handling pentane should be designed to be intrinsically safe and not provide an ignition source to pentane liquid and vapours. Earthing should also be provided. Pentane bunds should be designed with fire traps.
- Establishment of an inspection and testing program to verify the condition of plant and equipment.
- Bunding of storage and transfer areas in accordance with AS 1940, EPA and Local Government requirements.
- Adequate buffer zones between the surrounding native vegetation and scrub are recommended to reduce the likelihood of bushfire threats on the manufacturing activity and chemical storage area.
- Stormwater should be diverted away from the main chemical storage areas. Chemical storage and transfer should be conducted undercover. Diversion of stormwater will minimise the likelihood of generating contaminated water requiring treatment and/or disposal. Protection of stormwater drains are recommended if there is the potential for contamination to occur.
- Stormwater modelling for rainfall events eg 1:10, 1:50 and 1:100 should be conducted to ensure run-off does not impact bunding capacities and underground storage tanks.
- Bunds and sumps within the chemical storage areas should be designed and constructed to capture leaks and spills from the largest storage container in accordance with the relevant standard. Designs should allow for flexible piping transfers to occur within bunded areas.
- Underground storage tanks (pentane and polyol) should have leak detection systems on the tanks and inventory control systems to assist in the early identification of leaks.
- Specific chemical handling and emergency response training will reduce the likelihood of chemical mishandling and allow rapid response to incidents to reduce the threat to personnel, the environment and equipment. Spill control equipment should be available and staff trained in its use.
- Process monitoring systems could include temperature to allow the early detection and response to potential exothermic reactions. Calibration and maintenance schedules developed to minimise the likelihood of failure.
- The design of drainage systems should allow for the isolation and containment of spillages and contaminated surface waters from the stormwater and sewer. In the event that these sumps are connected to the sewer or stormwater system, they should be isolated (and set in the closed position if not required for stormwater collection). Otherwise, consideration should be given to isolating spillages and leaks from entering the stormwater and sewer systems.
- In the event of a major fire, contaminated fire water required to be collected by appropriate standards must be isolated from the sewer and stormwater system.

Similarly, for a vehicle collision resulting in a spillage on the site, the stormwater system must be able to be isolated to contain the spillage on site.

- Breathing apparatus should be available to assist in managing leaks and spills, in particular, pentane.
- Motors and drives should be designed and maintained to prevent excessive noise and in accordance with relevant standards.
- Vehicle protection barriers should be provided in front of bulk storage areas to prevent accidental collisions.

Appendix A

Material Safety and Data Sheet for Bulk Chemicals (Polyol, Pentane and PMDI)

Material Safety Data Sheet

Hazardous Substance, NON - Dangerous Goods

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product name: DALTOFOAM TR 33200

Recommended use: Component of a Polyurethane System.

Supplier:	Huntsman Polyurethanes (Australia) Pty Limited
ABN:	40 090 446 165
Street address:	Gate 3 Ballarat Road Deer Park 3023 Australia
Telephone:	+61 3 9361 6000
Facsimile:	+61 3 9361 6066

Emergency telephone number: **Australia: 1 800 786 152 (ALL HOURS)**

2. HAZARDS IDENTIFICATION

Australia
Hazard classification
Classified as hazardous according to criteria of NOHSC Australia.

Hazard Category

Xn	Harmful
Xi	Irritant

Risk phrase(s)

R22	Harmful by swallowed.
R36/38	Irritating to eyes and skin.
R41	Risk of serious damage to eyes.

Safety phrase(s)

S24	Avoid contact with eyes.
S36/37/39	Wear suitable protective clothing, gloves and eye/face protection.
S20	When using do not eat or drink.
S45	In case of accident or if you feel unwell, seek advice immediately (show the label where possible).

Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by Road and Rail.

Poisons schedule (Aust): None Allocated.

New Zealand
Classified as hazardous according to the Hazardous Substances (Classifications) Regulations 2001 (NZ).

Hazard Category

Xn	Harmful
Xi	Irritant

Risk phrase(s)

R22	Harmful if swallowed.
R36/38	Irritating to eyes and skin.
R41	Risk of serious damage to eyes.

HSNO Classification Categories
6.1D
6.4A
6.3A
8.3A

Not classified as Dangerous Goods by the criteria of the New Zealand Standard 5433.1999 Transport of Dangerous Goods on Land.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Appearance: Liquid.

CHEMICAL ENTITY	CAS NO.	PROPORTION (%weight/weight)
Triethyl phosphate	78-40-0	10-30
Ethylene glycol	107-21-1	1-9
Propylene carbonate	108-32-7	1-9
Lactic acid	50-21-5	1-9
Non hazardous ingredients	-	to 100%

All the constituents of this material are listed on the Australian Inventory of Chemical Substances (AICS).

4. FIRST AID MEASURES

Ingestion: Do NOT induce vomiting unless directed to do so by medical personnel. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as collar, tie, belt or waistband. Never give anything by mouth to an unconscious person.

Eye contact: Irrigate with copious quantities of water for 15 minutes. Obtain medical attention. Check for and remove contact lenses.

Skin contact: If skin or hair contact occurs, remove contaminated clothing and flush skin and hair with soap and running water. If irritation occurs seek medical attention. Wash contaminated clothing before re-use.

Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult. Give oxygen. Obtain medical attention.

Medical attention and special treatment: Symptomatic treatment and supportive therapy as indicated. Following ingestion admission to hospital should be the first priority. Gastric lavage or emesis should be performed as soon as possible to minimise absorption and is recommended within four hours of ingestion. Adsorbents such as activated charcoal may also be of value. Ethanol may be given intravenously as an antidote to prevent build-up of toxic metabolites and increase excretion of unchanged ethylene glycol by the kidneys. Uraemia, pulmonary oedema and metabolic acidosis can occur and dialysis, preferably haemodialysis, may be employed to treat these complications and to remove ethylene glycol and its metabolites from the blood.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media: Combustible liquid, Water fog (or if unavailable fine water spray), foam, dry agent (carbon dioxide, dry chemical powder).

Hazards from combustion products: On burning will emit toxic fumes including those of carbon monoxide and carbon dioxide. Phosphates and some metallic oxides.

Precautions for fire fighters and special protective equipment: Fire fighters to wear self-contained breathing apparatus if risk of exposure to vapour or products of combustion.

Hazchem code: None assigned.

6. ACCIDENTAL RELEASE MEASURES

Emergency procedures: Slippery when spilt. Avoid accidents, clean up immediately. Wear protective equipment to prevent skin and eye contamination and inhalation of vapours. Do not touch or walk through spilled material.

Methods and materials for containment and clean up procedures: Contain - prevent run off into drains and waterways. Use absorbent (soil, sand or other inert material). Collect and seal in properly labelled drums for disposal. Wash area down with excess water to remove residual material.

7. HANDLING AND STORAGE

Precautions for safe handling: Keep locked up. Do not ingest**.** Avoid skin and eye contact. Avoid inhaling vapours or spray mists. Always wash hands before smoking, eating, drinking or using the toilet. Wash contaminated clothing and other protective equipment before storage or re-use. Do not dispose of material to sewers or waterways.
Conditions for safe storage: Store in a well ventilated area. Store in a cool place and out of direct sunlight. Keep containers tightly sealed.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

National exposure standards
Australia
No value assigned for this specific material by the National Occupational Health and Safety Commission (NOHSC Australia). However, exposure standard for the constituents:

	8-hr TWA		STEL (15 min's)		Peak Limitation		Carcinogen Category	Notices
	ppm	mg/m³	ppm	mg/m³	ppm	mg/m³		
Ethylene Glycol (Vapour)	-	60	-	0.07	-	120	-	'

TWA - the Time-Weighted Average airborne concentration over an eight-hour working day, for a five-day working week over an entire working life.
STEL (Short Term Exposure Limit) - the average airborne concentration over a 15 minute period which should not be exceeded at any time during a normal eight-hour work day. According to current knowledge these concentrations should neither impair the health of, nor cause undue discomfort to, nearly all workers. Keep exposures as low as practicable below the exposure standards.

New Zealand
No value assigned for this specific material by the New Zealand Occupational Safety and Health Service (OSH). However, Workplace Exposure Standard for constituents:

	8-hr TWA		STEL (15 min's)		Ceiling Limitation		Carcinogen Category	Notices
	ppm	mg/m³	ppm	mg/m³	ppm	mg/m³		
Ethylene Glycol (Vapour or mist)			-		50	127	-	-

As published by the New Zealand Occupational Safety and Health Service (OSH)

Workplace Exposure Standard – Ceiling (WES-Ceiling). A concentration that should not be exceeded during any part of the working day.

Biological limit values
Not Relevant.

Engineering controls: Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapours below their respective occupational exposure limit. Ensure that eyewash stations and safety showers are close to the workstation location. Keep containers closed when not in use.

Personal protective equipment: OVERALLS, SAFETY SHOES, FACE SHIELD, GLOVES(Long).

Wear suitable protective clothing, gloves and eye/face protection.
* Respirators : Suitable respiratory equipment with positive air supply should be used in cases of insufficient ventilation or where operational procedures demand it.
* Eye Protection :Chemical safety glasses. Full face shield if splashing is possible.
* Gloves : Chemical gloves should be worn while handling this material.
* Other : Overall (preferably heavy cotton) or Tyvek-Pro Tech 'C', Tyvek-Pro 'F' disposable coverall.

Contaminated clothing should be thoroughly cleaned before re-use.

9. PHYSICAL AND CHEMICAL PROPERTIES

Form / colour / odour: liquid.

Solubility: Miscible with water

Specific Gravity (water=1):	N Av	Melting Point (°C):	N Av
Rel Vapour Density (air=1):	N Av	Boiling Point (°C):	N Av
Vapour Pressure at 20ºC (mmHg):	N Av	Decomp. Point (°C):	N Av
Flash Point (open cup) (°C):	185	Sublimation Point (°C):	N App
Flammability Limits (%):	N AP	pH (neat):	N Av
Autoignition Temp (°C):	N Av	Viscosity (20°C):	N Av
% Volatile by weight:	N Av	Evaporation Rate:	N Av

Solubility in water: N Av (n-Butyl acetate=1)

(Typical values only - consult specification sheet)

N Av = Not available N App = Not applicable

10. STABILITY AND REACTIVITY

Chemical stability: Stable under normal conditions of use.

Conditions to avoid: Slightly reactive to reactive with oxidising agents and acids.

Incompatible materials:
Reacts with strong oxidising agents.

Hazardous decomposition products: On burning will emit toxic fumes including those of carbon monoxide and carbon dioxide. Phosphates and some metallic oxides.
.

Hazardous reactions: Oxidising agents and acids.

11. TOXICOLOGICAL INFORMATION

No adverse health effects expected if the product is handled in accordance with this Safety Data Sheet and the product label. Symptoms that may arise if the product is mishandled are:

Acute Toxicity

Ingredient Name	Test	Result	Route	Species
Triethyl phosphate	LD50	1310 mg/kg	Oral	Rat
Ethylene glycol	LD50	4000 to 6140 mg/kg	Oral	Rat
	LD50	14600 mg/kg	Oral	Mouse
	LD50	>2000 mg/kg	Dermal	Rabbit
Propylene carbonate	LD50	29000 mg/kg	Oral	Rat
	LD50	20700 mg/kg	Oral	Mouse
	LD50	>23780 mg/kg	Dermal	Rabbit
Lactic acid	LD50	3543 to 3730 mg/kg	Oral	Rat
	LD50	4875 mg/kg	Oral	Mouse
	LD50	>2000 mg/kg	Dermal	Rabbit

Acute Effects

Ingestion: No adverse effects expected.

Eye contact: Risk of serious damage to eyes

Skin contact: Irritating.

Inhalation: No adverse effects expected..

Long Term Effects
No data available for the product.

Acute toxicity / Chronic toxicity
Repeated or prolonged exposure is not known to aggravate medical condition
At the present time, there is no direct evidence to suggest that ethylene glycol produces birth defects in humans under normal conditions of use and exposure. Ethylene Glycol has caused teratogenic and foetotoxic effects in rats and mice following the administration of high doses in drinking water or by gavage even in the absence of maternal toxicity. Repeated exposure may produce adverse effects on the central nervous system, liver and kidneys. (Ethylene glycol)

Mutagenic Effects
Nonmutagenic for bacteria and/or yeast. [Ethylene glycol]. Nonmutagenic for bacteria and/or yeast. [Lactic acid]. Nonmutagenic for bacteria and/or yeast. [Propylene carbonate]. Nonmutagenic for bacteria and/or yeast. [Triethyl phosphate].
Reproduction toxicity
Classified Reproductive system/toxin/female, Reproductive system/toxin/male [SUSPECTED] [Ethylene glycol].

12. ECOLOGICAL INFORMATION

Ecotoxicity

Ingredient Name	Species	Period	Result
Triethyl phosphate	Fish (LC50)	96 hours	>1.07 mg/l
Ethylene glycol	Fish (LC50)	96 hours	>18500 mg/l
Propylene carbonate	Fish (LC50)	96 hours	1000 mg/l
	Daphnia (EC50)	48 hours	1000 mg/l
	Algae (IC50)	72 hours	>900 mg/l

Persistence/degradability
No data available for product.

Mobility
No data available for product.
Avoid contaminating waterways.

13. DISPOSAL CONSIDERATIONS

Disposal methods: The generation of waste should be avoided or minimised wherever possible. Untreated material is not suitable for disposal. Waste, even small quantities, should never be poured down drains, sewers or water courses. Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Special precautions for landfill or incineration: Waste must be disposed of in accordance with federal, state and local environmental control regulations.

14. TRANSPORT INFORMATION

Road and Rail Transport
Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by Road and Rail.

Marine Transport
Not classified as Dangerous Goods by the criteria of the International Maritime Dangerous Goods Code (IMDG Code) for transport by sea.

Air Transport
Not classified as Dangerous Goods by the criteria of the International Air Transport Association (IATA) Dangerous Goods Regulations for transport by air.

15. REGULATORY INFORMATION

Country/Region	Inventory	Status
Australia	AICS	Listed

Poisons schedule (Aust): None Allocated

16. OTHER INFORMATION

Reason(s) For Issue: Change to emergency telephone number
Literary reference: Supplier Material Safety Data Sheets

Material Safety Data Sheets are updated frequently. Please ensure that you have a current copy.
This MSDS summarises at the date of issue our best knowledge of the health and safety hazard information of the product, and in particular how to safely handle and use the product in the workplace. Since Huntsman Corporation Australia Pty Limited cannot anticipate or control the conditions under which the product may be used, each user must, prior to usage, review this MSDS in the context of how the user intends to handle and use the product in the workplace.

If clarification or further information is needed to ensure that an appropriate assessment can be made, the user should contact this company.

Our responsibility for product as sold is subject to our standard terms and conditions, a copy of which is sent to our customers and is also available upon request.

MATERIAL SAFETY DATA SHEET

Ref. No. : LS3514	Issue date : October 2003	Issued by LABSCAN ASIA

PRODUCT NAME : n-PENTANE 99%

COMPANY DETAILS

Company Name	LABSCAN ASIA CO., LTD.
Address	24 Rama 1 Road, Pathumwan, Bangkok 10330 Thailand
Tel. / Fax	Tel : 662-613-7911-4 Fax : 662-613-7915
Emergency Tel.	Tel : 662-613-7911-4
Other Information	**Ireland** : Labscan Limited T26 Stillorgan Industrial Park, Stillorgan Co. Dublin, Ireland Tel. : 353-1-295-2684 Fax : 353-1-295-2685 Labscan Asia Co., Ltd. does not warrant that this product is suitable for any use or purpose. The user must ascertain the suitability of the product for any intended purpose. Preliminary testing of the product before use or application is recommended. Any reliance or purported reliance upon Labscan Asia Co., ltd. with respect to any kill or judgment or advice in relation to the extent prohibited at law, any condition implied by any statute as to the merchantable quality of this product or fitness for any purpose is hereby excluded. This product is not sold by description. Where the provisions of Part V, Division 2 of the Trade Practices Act apply, the liability of Labscan Asia Co., Ltd. is limited to the replacement or supply of equivalent goods or payment of the cost of replacing the goods or acquiring equivalent goods.

HAZARDS IDENTIFICATION

Product Name	n-PENTANE 99%
Proper Shipping Name	PENTANES
Other Names	**Name** / **Grade** / **Labscan Code** n-PENTANE 99% / AR / A3540 n-PENTANE 99% / HPLC / C2540 n-PENTANE 99% / PESTI / P5539 n-PENTANE 99% / SPECTRO / S7540 normal-Pentane, Pentane Amyl hydride
UN No.	1265
D.G. Class	3.1
Packing Group	I
Hazchem Code	3[Y]E
Poisons schedule	S5
EEC-No	601-006-00-1
Class	F R12; Xn R65 R66 R67; N R51/53
CAS-No	109-66-0
Weight	99%+
Most Important hazards	Extremely flammable.
Specific hazards	The vapor has narcotic effect and in high concentrations induces unconsciousness which can be fatal. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. May be harmful if swallowed – damages lungs. Repeated or prolonged exposure may cause skin irritation and dermatitis, due to degreasing properties of the product.

Continued on next page

MATERIAL SAFETY DATA SHEET

Ref. No. : LS3514	Issue date : October 2003	Issued by LABSCAN ASIA

PRODUCT NAME : n-PENTANE 99%

FIRST AID

General advice: Show this safety data sheet to the doctor in attendance.

Inhalation: Move to fresh air in case of accidental inhalation of vapors. Keep patient warm. In case of shortness of breath, give oxygen. Apply artificial respiration only if patient is not breathing or under medical supervision. No artificial aspiration mouth-to-mouth or mouth to nose. Use suitable instruments / apparatus. Obtain medical attention.

Skin contact: Remove contaminated clothing and wash affected skin with soap and water. Wash contaminated clothing before re-use.

Eye contact: If the substance has got into the eyes, wash out with water or saline solution for at least 15 minutes. Obtain medical attention.

Ingestion: Rinse mouth. Do not induce vomiting. Keep patient warm. Apply artificial respiration only if patient is not breathing or under medical supervision. No artificial aspiration mouth-to-mouth or mouth to nose. Use suitable instruments / apparatus. Obtain medical attention. Never give anything by mouth to an unconscious person.

FIRE-FIGHTING MEASURES

Suitable extinguishing media:
Extinguish with carbon dioxide (CO_2), dry chemical, foam and water spray.
Extinguishing media which must not be used for safety reasons:
Do not use a solid water stream as it may scatter and spread fire.
Specific hazards:
Decomposes in a fire giving off toxic fumes and dense clouds of smoke (carbon oxides). Vapors are heavier than air and may spread along floor / flash back possible over considerable distance.
Special protective equipment for firefighters:
Wear a positive-pressure supplied-air respirator / full protective flameproof clothing.
Specific methods:
Standard procedure for chemical fires. Water mist may be used to cool closed containers.
Hazchem Code:
3[Y]E

ACCIDENTAL RELEASE MEASURES

Personal precautions: Evacuate personnel to safe areas. Remove all sources of ignition. Wear self-contained breathing apparatus and protective suit. Shut off leaks if without risk. Keep people away from and upwind of spill/leak.

Environmental precautions: Contain or absorb leaking liquid with sand or earth. Prevent liquid entering sewers, basements and work pits vapor may create explosive atmosphere. If substance has entered a water course or sewer or contaminated soil or vegetation, advise police.

Methods for cleaning up: Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, universal binder, sawdust). Transfer to covered steel drums. Contact waste disposal services. Dispose of promptly

Continued on next page

MATERIAL SAFETY DATA SHEET

Ref. No. : LS3514	Issue date : October 2003	Issued by LABSCAN ASIA

PRODUCT NAME : n-PENTANE 99%

SAFE HANDLING AND STORAGE INFORMATION

Handling: Use only in area provided with appropriate exhaust ventilation. Do not breathe vapors or spray mist. Take necessary action to avoid static electricity discharge (which might cause ignition of organic vapors.) Keep away from open flames, hot surfaces and sources of ignition.

Storage: Keep tightly closed in a dry, cool and well-ventilated place. Keep away from heat and sources of ignition. Store in original container. Electrical equipment should be protected to the appropriate standard.

EXPOSURE CONTROLS / PERSONAL PROTECTION

Chemical Name:
n-PENTANE

National occupational exposure limits:
EH40: OES 600 ppm (1800 mg/cum) 8h TWA.

Engineering measures to reduce exposure:
The product should only be used in areas from which all naked lights and other sources of ignition have been excluded. Ventilation hoods and fans required when working with organic solvents or in hot melt applications.

Personal protection equipment:

- **Respiratory protection:** Incase of insufficient ventilation wear suitable respiratory equipment.
- **Hand protection:** Neoprene gloves, PVC disposable glove.
- **Eye protection:** Goggles giving complete protection to eyes.
- **Skin and body protection:** Rubber or plastic boots. Chemical resistant apron / complete suit protecting against chemicals.

Hygiene measures:
Keep away from food, drink and animal feeding stuffs. Keep working clothes separately.

PHYSICAL DATA AND OTHER PROPERTIES

Formula			$CH_3(CH_2)_3CH_3$
Form			Liquid,
Color			Clear, colorless,
Odor			Characteristic
Boiling point/range			36^oC
Melting point/range			-129.7^oC
Flash point			-35^oC
Autoignition temperature			285^oC
Flammability (solid, gas)			Extremely flammable
Explosion limits		**lower**	1.4 vol. %
		Upper	7.8 vol. %
Vapor pressure		**(20^oC)**	650 hpa
Relative density		**(20^oC)**	>= 0.626
Bulk density			630 kg/m^3
Solubility	**Water solubility**	**(20^oC)**	0.01 g/l
	Solubility in other solvents		Soluble in hydrocarbons
Viscosity		**(20^oC)**	0.25 mPa.s

Continued on next page

MATERIAL SAFETY DATA SHEET

Ref. No. : LS3514	Issue date : October 2003	Issued by LABSCAN ASIA

PRODUCT NAME : n-PENTANE 99%

STABILITY AND REACTIVITY

Stability:	Stable at normal conditions.
Conditions to avoid:	Heating of containers may cause pressure rise, with risk of bursting. Take precautionary measures against static discharges.
Materials to avoid:	Strong oxidizing agents.
Hazardous decomposition products:	Decomposes in a fire giving off toxic fumes and dense clouds of smoke (carbon Oxides).

TOXICOLOGICAL INFORMATION

Acute toxicity:

Inhalation:
High concentration of vapors may include, unconsciousness, nausea, headache, dizziness, vomiting, cyanosis.

Skin contact:
Repeated or prolonged exposure may cause skin irritation and dermatitis, due to degreasing properties of the product.

Eye contact:
Irritant to eyes, but not inquiry.

Ingestion:
Ingestion of larger amounts may cause defects to the central nervous system (e.g. dizziness, headache).

Sensitization:
Slightly irritating to eyes.
Slightly irritating to skin.

Long term toxicity:
Repeated and prolonged exposure to solvents may cause brain and nervous system damage.

Chronic toxicity:
No data is available on the product itself.

ECOLOGICAL INFORMATION

Mobility:	Immiscible with water, heavier than water.
Persistence / degradability:	Readily biodegradable, according to appropriate OECD test.
Bio accumulation:	Slight bio accumulation.
Ecotoxicity:	Slightly water contaminating. TLM96 1-10 mg/l.

DISPOSAL CONSIDERATIONS

Waste from residues / unused products:
If recycling is not practicable, dispose of in compliance with local regulations.
Can be incinerated, when in compliance with local regulations.

Contaminated packaging:
Empty containers should be taken for local recycling, recovery or waste disposal.
Empty containers can be land filled after cleaning, when in compliance with local regulations.

Continued on next page

MATERIAL SAFETY DATA SHEET

Ref. No. : LS3514	Issue date : October 2003	Issued by LABSCAN ASIA

PRODUCT NAME : n-PENTANE 99%

TRANSPORT INFORMATION

ADR/RID

Class……3.1
TREM-CARD……LAB30TRM30
Proper shipping name……n-PENTANE
Item……1(a)
HI/UN No……1265
Marine pollutant……not applicable

IMO

Class……3.1
MFAG……310
Proper shipping name ……n-PENTANE
EmS……3-07
IMDG Page……3140

ICAO

Class……3.0
Proper shipping name……n-PENTANE
UN/ID No……1265

REGULATORY INFORMATION

Classification according to European directive on classification of hazardous preparations 90/492/EEC

Contains n-PETANE

Symbol(s) F – Highly flammable

R – phrase(s)	R12	- Extremely flammable.
	R51/53	- Toxic aquatic organisms, may cause long-term adverse effects in the aquatic environment.
	R65	- Harmful : may cause lung damage if swallowed.
	R66	- Repeated exposure may cause skin dryness or cracking.
	R67	- Vapours may cause drowsiness and dizziness.
S – phrase(s)	S9	- Keep container in a well-ventilated place.
	S16	- Keep away from sources of ignition – No smoking.
	S29	- Do not empty into drains.
	S33	- Take precautionary measures against static discharges.
	S61	- Avoid release to the environment. Refer to special instruction/MSDS.
	S62	- If swallowed, do not induce vomiting : seek medical advice immediately and show this container or label.

Recommended restrictions: Take notice of labels and material safety data sheets for the working chemicals. Take necessary action to avoid static electricity discharge (which might cause ignition of organic vapors.

Recommended use: General purpose solvent.

CONTACT POINT

Contact

Australia : Lomb Scientific (Aust) Pty, Ltd.
20 Mangrove Lane, Taren Point, N.S.W. Australia 2229
Tel : 612-853-66200, 612-8536-6218
Fax : 612-853-66250

End of MSDS


LAB-SCAN
ANALYTICAL SCIENCES

Material Safety Data Sheet

Hazardous according to criteria of NOHSC Australia.

1. MATERIAL AND SUPPLY COMPANY IDENTIFICATION

Product name: Suprasec 2085

Supplier: Huntsman Polyurethanes (Australia) Pty Limited
ABN: 40 090 446 165
Street address: Gate 3 Ballarat Road
Deer Park 3023
Australia
Telephone: +61 3 9361 6000
Facsimile: +61 3 9361 6066

Emergency telephone number: **Australia: 1 800 786 152** **NZ: 0800 767 376**

2. COMPOSITION / INFORMATION ON INGREDIENTS

Recommended use: As the hardener in the manufacture of polyurethane products

Appearance: Brown liquid with earthy odour.

CHEMICAL	ENTITY CAS NO.	PROPORTION
Diphenylmethane-4,4'di-isocyanate (MDI)	9016-87-9	
Isomers and homologues, blend of	101-68-8	

		100%

PROPORTION (% weight per weight): VHIGH >60, HIGH 30-60, MED 10-29, LOW 1-9, VLOW <1

3. HAZARDS IDENTIFICATION

Australia
This material is hazardous according to health criteria of NOHSC Australia

Hazard Category:
Xn Harmful
Xi Irritant

Risk Phrase(s):
R20: Harmful by inhalation.
R36/37/38 Irritating to eyes, respiratory system and skin.
R42: May cause sensitization by inhalation.

Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by Road and Rail

Classified as a C2 (COMBUSTIBLE LIQUID) for the purpose of storage and handling, in accordance with the requirements of AS 1940. Refer to State Regulations for storage and transport requirements.

Poisons Schedule (Aust): None allocated

New Zealand
Classified as hazardous according to criteria in the HS (Minimum Degrees of Hazard) Regulations 2001.

Hazard Category:
Xn Harmful
Xi Irritant

R-phrase(s)

R20	Harmful by inhalation.
R36/37/38	Irritating to eyes, respiratory system and skin
R42	May cause sensitisation by inhalation

HSNO Classification Categories
6.1D
6.3A
6.4A
6.5A

Not classified as a Dangerous Good under NZS 5433:1999 Transport of Dangerous Goods on Land.

4. FIRST AID MEASURES

If poisoning occurs, contact a doctor or Poisons Information Centre (Phone Australia 131 126; New Zealand 03 474 7000).

Ingestion: Rinse mouth with water. Give water to drink. Do NOT induce vomiting. Seek immediate medical assistance

Eye contact: Immediately irrigate with copious quantities of water for 15 minutes. Eyelids to be held open. Remove clothing if contaminated and wash skin. Seek immediate medical assistance.

Skin contact: If skin or hair contact occurs, immediately remove contaminated clothing and wash skin thoroughly with plenty of soap and water. Wash contaminated clothing before re-use. If swelling, redness, blistering or irritation occurs seek medical assistance.

Inhalation: Remove victim from exposure – avoid becoming a casualty. Remove contaminated clothing and loosen remaining clothing. Allow patient to assume most comfortable position and keep warm. Keep at rest until fully recovered. If breathing laboured and patient cyanotic (blue), ensure airways are clear and have qualified person give oxygen through a face mask. If breathing has stopped apply artificial respiration at once. In event of cardiac arrest, apply external cardiac massage. Seek medical advice.

Notes to physician: Treat symptomatically. Effects may be delayed. Following severe exposures the patient should be kept under medical supervision for at least 48 hours. (1)

5. FIRE-FIGHTING MEASURES

Specific hazards: Combustible liquid.

Fire fighting further advice: Combustible liquid. On burning may emit toxic fumes including those of carbon oxides, nitrogen oxides, isocyanate vapours and hydrogen cyanide.. Fire fighters to wear self-contained breathing apparatus if risk of exposure to vapour or products of combustion. Containers may burst if overheated. Due to reaction with water producing C02-gas, a hazardous build-up of pressure could result if contaminated containers are re-sealed.

Suitable extinguishing media: If material is involved in a fire use foam, dry agent (carbon dioxide, dry chemical powder). Water fog (or if unavailable fine water spray) may be used if no other extinguishing medium is available, and then in copious quantities. Reaction between water and hot isocyanate may be vigorous.

6. ACCIDENTAL RELEASE MEASURES

FOR A MAJOR SPILLAGE:
1. Clear area of all unprotected personnel.
2. Wear full protective equipment to prevent skin and eye contamination and the inhalation of vapours, including air supplied mask, PVC boots and splash suit.
3. Contain – prevent run off into drains and waterways. Cover with wet soil, wet sand or solid decontaminant.
4. Let the material react for 10 minutes.
5. Shovel into open-top drums for further decontamination, if necessary.
6. Wash area down with excess water and inspect.
7. Test the atmosphere for MDI Vapour to ensure safe-working conditions prevail prior to re-entry into contaminated area.

FOR A MINOR SPILLAGE:
1. Wear protective equipment to prevent skin and eye contamination.
2. Treat spillage with solid or liquid decontaminant, leave to react for 10 minutes.
3. Remove and dispose of residues.

The composition of Liquid and Solid Decontaminants are given in Section 16.

Huntsman MDI-Based Compositions: Hazards and Safe-Handling Procedures, PU 193-1E (4ed)/2001.

7. HANDLING AND STORAGE

Handling: Avoid skin and eye contact and inhalation of vapour.

Storage: Store in well ventilated area. Store away from sources of heat or ignition and foodstuffs. Keep dry – reacts with water; may lead to drum rupture. Recommended storage temperature 20-25ºC. Keep containers closed at all times – check regularly for leaks.

Classified as C2(COMBUSTIBLE LIQUID) for the purpose of storage and handling, in accordance with the requirements of AS 1940. Refer to State Regulations for storage and transport requirements

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

National occupational exposure limits:
Australia

No value assigned for this specific material by the National Occupational Health and Safety Commission (NOHSC Australia).

However for the constituent:

	TWA		STEL		NOTICES
	ppm	mg/m3	ppm	mg/m3	
Icocyanates all (as NCO)	-	0.02	-	0.07	'Sen'

As published by the National Occupational Health and Safety Commission (NOHSC Australia).

New Zealand
No value assigned for this specific material by the New Zealand Occupational Safety and Health Service (OSH).

However, Workplace Exposure Standard for constituents:

TWA	STEL		NOTICES	
	ppm	mg/m3	ppm	mg/m3	
Icocyanates all (as NCO)	-	0.02	-	0.07	'Sen'

As published by the New Zealand Occupational Safety and Health Service (OSH)

TWA – the Time-Weighted Average airborne concentration over an eight-hour working day, for a five-day working week over an entire working life.

STEL (Short Term Exposure Limit) – the average airborne concentration over a 15 minute period which should not be exceeded at any time during a normal eight – hour work day. According to current knowledge these concentrations should neither impair the health of, nor cause undue discomfort to , nearly all workers.
'Sen' notice – sensitiser. The substance can cause a specific immune response in some people. An affected individual may subsequently react to exposure to minute levels of that substance.

Medical supervision of all employees who handle or come in contact with respiratory sensitisers is recommended. Personnel with a history of asthma-type conditions, bronchitis or skin sensitisation conditions should not work with MDI based products

The Occupation Exposure Standards do not apply to previously sensitised individuals. Sensitised individuals should be removed from any further exposure.

Engineering measures: Ensure ventilation is adequate and that air concentrations of components are controlled below quoted Exposure Standards. Use with local exhaust ventilation or while wearing air supplied mask. Vapour heavier than air - prevent concentration in hollows or sumps. DO NOT enter confined spaces where vapour may have collected. MDI can only be smelled if the occupational exposure limit has been exceeded considerably.

Personal protection equipment: OVERALLS, SAFETY SHOES, FACE SHIELD OR AIR MASK, GLOVES (Long)

Avoid skin and eye contact and inhalation of vapour and aerosols/mists. Wear overalls, chemical goggles or full face shield (if splashing is possible) and elbow-length impervious gloves. Use with adequate ventilation. If inhalation risk exists wear air supplied mask meeting the requirements of AS/NZS 1715 and AS/NZS 1716. Available information suggests that gloves made from neoprene or butyl rubber should be suitable for intermittent contact. However, due to variations in glove construction and local conditions, a final assessment should be made by the user. (1)

Always wash hands before smoking, eating, drinking or using the toilet. Wash contaminated clothing and other protective equipment before storing or re-using. Contaminated overalls should be decontaminated in 8% (dilute) ammonia solution for one hour and laundered before re-use.

9. PHYSICAL AND CHEMICAL PROPERTIES

Form / Colour / Odour: Brown liquid with earthy odour.

Solubility:	Insoluble in water. Soluble in most organic solvents
Specific Gravity (20° C):	1.23
Relative Vapour Density (air =1):	>1
Vapour Pressure (20° C):	<0.013k Pa
Flash Point (C) (CC):	>200
Flammability Limits (%):	N Av
Autoignition Temperature (° C):	N Av
Melting Point/Range (° C):	N App
% Volatile by volume:	N Av
Solubility in water (g/L):	Negligible
Decomp. Point (C):	N Av
Boiling Point / Range (° C):	N App
pH:	N App
Viscosity:	N Av
Evaporation Rate (n-Butyl acetate=1)	N Av

(Typical values only - consult specification sheet)
N Av = Not available N App = Not applicable

10. STABILITY AND REACTIVITY

Stability: Will react exothermically with water and all organic compounds containing active hydrogen groups.

11. TOXICOLOGICAL INFORMATION

No adverse health effects expected if the product is handled in accordance with this Safety Data Sheet and the product label. Symptoms that may arise if the product is mishandled are:

Acute Effects

Ingestion: Swallowing may result in irritation of the gastrointestinal tract

Eye contact: Both vapour and liquid are eye irritants

Skin contact: Contact with skin will result in severe moderate irritation. Repeated or prolonged contact may cause skin sensitisation. Animal studies have shown that respiratory sensitisation can be induced by skin contact with known respiratory sensitisers including diisocyanates. These results emphasise the need for protective clothing including gloves to be worn when handling these chemicals or in maintenance work (1)

Inhalation: A respiratory irritant and potential respiratory sensitiser; repeated inhalation of vapour or aerosol at levels above the occupational exposure standard could cause respiratory sensitisation. Symptoms may include irritation of the eyes, nose, throat and lungs, possibly with dryness of the throat, tightness of the chest and difficulty in breathing. Onset of respiratory symptoms may be delayed for several hours after exposure. A hyper-reactive response may develop to even minimal concentrations of MDI in sensitised individuals (1)

Long Term Effects: There are reports that chronic exposure by inhalation may result in a permanent decrease in lung function. (1)

Acute toxicity / Chronic toxicity
Based on information available on similar products; (1)

Oral LD50 (rat):	>5000 mg/kg (1)
Dermal LD50 (rabbit):	>5000 mg/kg
Inhalation LC50 (rat):	490 mg/kg (respirable aerosol).
EYES (rabbit):	100ug (Mild irritant). (2)

Rats have been exposed for two years to a respirable aerosol of polymeric MDI which resulted in chronic pulmonary irritation at high concentrations. Only at the top level (6mg/m3) was there a significant incidence of a benign tumour of the lung (adenoma) and one malignant tumour (adenocarcinoma). There were no lung tumours at 1 mg/m3 and no effects at 0.2 mg/m3. The tumour incidence, both benign and malignant and the number of animals with the tumours were not different from the controls. The increased incidence of lung tumours is associated with prolonged respiratory irritation and the concurrent accumulation of yellow material in the lung, which occurred through out the study.

In the absence of prolonged high exposure leading to chronic irritation lung damage, it is highly unlikely that tumour formation could occur.
Industrial experience in humans has not shown any links between MDI exposure and cancer development.
No birth defects were seen in two independent animal (rat) studies.
Fetotoxicity was observed at doses that were highly toxic (including lethal) to the mother. Fertotoxicity was not observed at doses that were not maternally toxic. The doses used in these studies were maximal, respirable concentrations, which were well in excess of defined occupational exposure limits.
There is no substantial evidence of mutagenic potential.
Respiratory hypersensitivity in guinea pigs has resulted from dermal exposure to MDI (3)

12. ECOLOGICAL INFORMATION

Avoid contaminating waterways.
Based on information on similar products: (1)

AQUATIC TOXICITY
Based on information available on similar products (1)
LC0 (zebra fish): >1000 mg/L

EC50 (Daphnia magna): >1000mg/L
EC50 (E.coli): >100 mg/L

ENVIRONMENTAL FATE, DEGRADATION AND PERSISTENCE
No information available.

TERRESTRIAL TOXICITY
No information available

13. DISPOSAL CONSIDERATIONS

Australia
Refer to State Land Waste Management Authority. Empty containers MUST BE decontaminated and destroyed

New Zealand
Refer to Local City, District or Regional Council Waste Management Authority. Empty containers must be decontaminated and destroyed.

14. TRANSPORT INFORMATION

Road and Rail Transport
Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by Road and Rail.

Marine Transport
Not classified as Dangerous Goods by the criteria of the International Maritime Dangerous Goods Code (IMDG Code) for transport by sea.

Air Transport
Not classified as Dangerous Goods by the criteria of the International Air Transport Association (IATA) Dangerous Goods Regulations for transport by air.

15. REGULATORY INFORMATION

This material is hazardous according to health criteria of NOHSC Australia.

Hazard Category:
Xn Harmful
Xi Irritant

R-phrase(s):
R20: Harmful by inhalation.
R36/37/38: Irritating to eyes, respiratory system and skin
R42 May cause sensitization by inhalation

S-phrase(s):
S26: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S28: After contact with skin, wash immediately with plenty of soap-suds.

S38: In case of insufficient ventilation, wear suitable respiratory equipment.
S45: In case of accident or if you feel unwell, seek medical advice immediately (show label where possible)

Poisons Schedule (Aust): Not applicable.

All the constituents of this material are listed on the Australian Inventory of Chemical Substances (AICS).

New Zealand
Classified as hazardous according to criteria in the HS (Minimum Degrees of Hazard) Regulations 2001.

16. OTHER INFORMATION

Literary reference:

(1) Huntsman MDI-Based Compositions: Hazards and Safe-Handling Procedures, PU 193-1E (4ed)/2001.
(2) In Registry of Toxic Effects of Chemical Substances 1998' (Ed.D.Sweet)(U.S.Dept. of Health & Human Services: Cincinatti) 1998
(3) International Isocyanate Institute Inc. Scientific Office, Compendium of Technical Information, Volume 2 1990-(Ed.III) p 1.4, 1992

For further information about this product:

Contact: Huntsman Polyurethanes Australia Pty Ltd
EHS and Quality Systems Manager

Within Australia:	Telephone	03 9361 6062
	Facsimile	03 9361 6066
Outside Australia	Telephone	+ 61 3 9361 6062
	Facsimile	+ 61 3 9361 6066

Reason(s) For Issue: Change to emergency telephone numbers

Material Safety Data Sheets are updated frequently. Please ensure that you have a current copy.

LIQUID MDI DECONTAMINANTS
Decontaminant 1:
-Water 90%
-Concentrated sodium hydroxide solution 8%
-Liquid detergent 2%

Decontaminant 2:
-Water 90-95%
-Sodium carbonate 5-10%
-Liquid detergent 0.2-0.5%

*Note Decontaminant 2 reacts slower with MDI but is more environmentally friendly than Decontaminant 1.

SOLID MDI DECONTMINANTS
May use sand, sawdust, Newsorb.

This MSDS summarises at the date of issue our best knowledge of the health and safety hazard information of the product, and in particular how to safely handle and use the product in the workplace. Since Huntsman Corporation Australia Pty Limited cannot anticipate or control the conditions under which the product may be used, each user must, prior to usage, review this MSDS in the context of how the user intends to handle and use the product in the workplace.

If clarification or further information is needed to ensure that an appropriate assessment can be made, the user should contact this company.

Our responsibility for product as sold is subject to our standard terms and conditions, a copy of which is sent to our customers and is also available upon request.

Appendix B

Material Safety and Data Sheet for Daltofoam TO 33203 and Daltofoam TR 33204

Material Safety Data Sheet

Hazardous Substance, Dangerous Goods

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product name: DALTOFOAM TO 33203

Recommended use: Component of a Polyurethane System.

Supplier:	Huntsman Polyurethanes (Australia) Pty Limited
ABN:	40 090 446 165
Street address:	Gate 3 Ballarat Road Deer Park 3023 Australia
Telephone:	+61 3 9361 6000
Facsimile:	+61 3 9361 6066

Emergency telephone number: **Australia: 1 800 767 376 (ALL HOURS)**

2. HAZARDS IDENTIFICATION

Australia
Hazard classification
Classified as hazardous according to criteria of NOHSC Australia.

Hazard Category

Xn	Harmful
C	Corrosive

Risk phrase(s)

R22	Harmful by swallowed.
R34	Causes burns.

Safety phrase(s)

S26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S36/37/39	Wear suitable protective clothing, gloves and eye/face protection.
S20	When using do not eat or drink.
S45	In case of accident or if you feel unwell, contact a doctor poison Information Centre immediately and show the label. Phone 13 11 26 (Aust) 0800 764 766 (NZ)

Classified as Dangerous Goods by the criteria of the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code).

Poisons schedule (Aust): None Allocated.

New Zealand
Classified as hazardous according to the Hazardous Substances (Classifications) Regulations 2001 (NZ).

Hazard Category

Xn	Harmful
C	Corrosive

Risk phrase(s)

S26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S36/37/39	Wear suitable protective clothing, gloves and eye/face protection.
S20	When using do not eat or drink.
S45	In case of accident or if you feel unwell, contact a doctor poison Information Centre immediately and show the label. Phone 13 11 26 (Aust) 0800 764 766 (NZ)

HSNO Classification Categories
6.1D
8.2B

Classified as Dangerous Goods by the criteria of the New Zealand Standard 5433.1999 Transport of Dangerous Goods on Land.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Appearance: Liquid.

CHEMICAL ENTITY	CAS NO.	PROPORTION (%weight/weight)
Triethyl phosphate	78-40-0	30-60
N,N,N' dimethylaminopropyl hexa hydro triazine	15875-13-5	10-30
Non hazardous ingredients	-	to 100%

All the constituents of this material are listed on the Australian Inventory of Chemical Substances (AICS).

4. FIRST AID MEASURES

Ingestion: Do NOT induce vomiting unless directed to do so by medical personnel. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as collar, tie, belt or waistband. Never give anything by mouth to an unconscious person.

Eye contact: In case of contact, immediately flush eyes with copious quantities of water for at least 15 minutes. Obtain medical attention immediately. Check for and remove contact lenses.

Skin contact: If skin or hair contact occurs, immediately flush skin and hair with copious quantities of water or at least 15 minutes while removing contaminated clothing and shoes. Obtain medical attention immediately.

Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult. Give oxygen. Obtain medical attention immediately.

Medical attention and special treatment: Symptomatic treatment and supportive therapy as indicated. Following severe exposure the patent should be kept under medical review for at least 48 hours.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media: Combustible liquid, Water fog (or if unavailable fine water spray), foam, dry agent (carbon dioxide, dry chemical powder). Do not use water jet.

Hazards from combustion products: On burning will emit toxic fumes including those of carbon monoxide, carbon dioxide, nitrogen oxides and phosphates.

Precautions for fire fighters and special protective equipment: Fire fighters to wear self-contained breathing apparatus if risk of exposure to vapour or products of combustion.

Hazchem code: 3X

6. ACCIDENTAL RELEASE MEASURES

Emergency procedures: Slippery when spilt. Avoid accidents, clean up immediately. Wear protective equipment to prevent skin and eye contamination and inhalation of vapours. Use water spray curtain to divert vapour drift. Neutralise the residue with dilute solution of acidic acid. Do not touch or walk through spilled material.

Methods and materials for containment and clean up procedures: Contain - prevent run off into drains and waterways and confines areas. Use absorbent (soil, sand or other inert material). Collect and seal in properly labelled drums for disposal.

7. HANDLING AND STORAGE

Precautions for safe handling: Corrosive liquid. Do not ingest**.** Avoid skin and eye contact. Do not breathe gas/fumes/vapour/spray. Wash contaminated clothing and other protective equipment before storage or re-use. Do not dispose of material to sewers or waterways. Keep away from incompatible materials such as oxidising agents.

Conditions for safe storage: Store in a well ventilated area. Store in a cool place and out of direct sunlight. Keep containers tightly sealed.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

National exposure standards
Australia
No value assigned for this specific material by the National Occupational Health and Safety Commission (NOHSC Australia).
Keep exposures as low as practicable below the exposure standards.
New Zealand
No value assigned for this specific material by the New Zealand Occupational Safety and Health Service (OSH). Keep exposures as low as practicable below the exposure standards.

Biological limit values

Not Relevant.

Engineering controls: Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapours below their respective occupational exposure limit. Ensure that eyewash stations and safety showers are close to the workstation location. Keep containers closed when not in use.

Personal protective equipment: OVERALLS, SAFETY SHOES, FACE SHIELD, GLOVES (Long).

Wear suitable protective clothing, gloves and eye/face protection.
* Respirators: Suitable respiratory equipment with positive air supply should be used in cases of insufficient ventilation or where operational procedures demand it.
* Eye Protection: Chemical splash goggles. Full face shield if splashing is possible.
* Gloves: Chemical gloves should be worn while handling this material.
* Other: Overall (preferably heavy cotton) or Tyvek-Pro Tech 'C', Tyvek-Pro 'F' disposable coverall and boots.

Contaminated clothing should be thoroughly cleaned before re-use.

9. PHYSICAL AND CHEMICAL PROPERTIES

Form / colour / odour: liquid.

Specific Gravity (water=1):	N Av	Melting Point (°C):	N Av
Rel Vapour Density (air=1):	N Av	Boiling Point (°C):	N Av
Vapour Pressure at 20ºC (mmHg):	N Av	Decomp. Point (°C):	N Av
Flash Point (open cup) (°C):	130	Sublimation Point (°C):	N App
Flammability Limits (%):	N AP	pH (neat):	N Av
Autoignition Temp (°C):	N Av	Viscosity (20°C):	N Av
% Volatile by weight:	N Av	Evaporation Rate:	N Av

Solubility in water: N Av (n-Butyl acetate=1)

(Typical values only - consult specification sheet)

N Av = Not available N App = Not applicable

10. STABILITY AND REACTIVITY

Chemical stability: Stable under normal conditions of use.

Conditions to avoid: Reactive to oxidising agents. Slightly reactive to reactive with acids.

Incompatible materials:
Reacts with oxidising agents.

Hazardous decomposition products: On burning will emit toxic fumes including those of carbon monoxide, carbon dioxide, nitrogen oxides and phosphates

Hazardous reactions: Oxidising agents.

11. TOXICOLOGICAL INFORMATION

No adverse health effects expected if the product is handled in accordance with this Safety Data Sheet and the product label. Symptoms that may arise if the product is mishandled are:

Acute Toxicity

Ingredient Name	Test	Result	Route	Species
Triethyl phosphate	LD50	1310 mg/kg	Oral	Rat
N,N,N' dimethylaminopropyl hexa hydro triazine	LD50	2800to 3088 mg/kg	Oral	Rat
	LD50	1919 mg/kg	Dermal	Rabbit

Acute Effects

Ingestion: May be fatal if swallowed. May cause burns to mouth, throat and stomach.

Eye contact: Corrosive to eyes

Skin contact: Skin contact may cause burns.

Inhalation: Inhalation of the spray mist may produce severe irritation of respiratory tract, characterised by coughing, choking or shortness of breath. Overexposure by inhalation may cause respiratory irritation.

Long Term Effects
Eyes: Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe irritation.
Skin: Repeated or prolonged contact with spray mist may produce chronic skin irritation and severe irritation.
Inhalation: Repeated or prolonged contact with spray mist may produce respiratory tract irritation, leading to frequent attacks of bronchial infection.

Mutagenic Effects
Nonmutagenic for bacteria and/or yeast. [Triethyl phosphate].

12. ECOLOGICAL INFORMATION

Ecotoxicity

Ingredient Name	Species	Period	Result
Triethyl phosphate	Fish (LC50)	96 hours	>1.07 mg/l

Persistence/degradability
No data available for product.

Mobility
No data available for product.
Avoid contaminating waterways.

13. DISPOSAL CONSIDERATIONS

Disposal methods: The generation of waste should be avoided or minimised wherever possible. Untreated material is not suitable for disposal. Waste, even small quantities, should never be poured down drains, sewers or water courses. Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Special precautions for landfill or incineration: Waste must be disposed of in accordance with federal, state and local environmental control regulations.

14. TRANSPORT INFORMATION

Road and Rail Transport (ADG Code)

UN Number	2735
Proper Shipping Name:	AMINES, LIQUID, CORROSIVE, N.O.S. (CONTAINS N,N,N' DIMETHYLAMINOPROPYL HEXA HYDRO TRIAZINE)
Dangerous Goods Class:	8
Subsidiary Risk:	-
Packing Group:	III
Hazchem Code:	3X
Emergency Information:	IERG 36

Road and Rail Transport

Classified as Dangerous Goods by the criteria of the New Zealand Standard 5433:1999 Transport of Dangerous Goods on Land.

UN-No:	2735
Class:	8
Hazchem code:	3X
Packing group:	III
Proper Shipping Name:	AMINES, LIQUID, CORROSIVE, N.O.S. (CONTAINS N,N,N' DIMETHYLAMINOPROPYL HEXA HYDRO TRIAZINE)

Segregation Dangerous Goods:

Not to be loaded with explosives (Class 1), Dangerous when wet (Class4), oxidising agents (Class 5.1), organic peroxides (Class 5.2), radio active material (Class 7) and strong acids, however exemptions may apply.

Marine Transport (IMDG Code)

UN Number	2735
Proper Shipping Name:	AMINES, LIQUID, CORROSIVE, N.O.S. (CONTAINS N,N,N' DIMETHYLAMINOPROPYL HEXA HYDRO TRIAZINE)
Dangerous Goods Class:	8
Subsidiary Risk:	-
Packing Group:	III
Marine pollutant:	Not pollutant

Air Transport (IATA Regulations)

UN Number	2735
Proper Shipping Name:	AMINES, LIQUID, CORROSIVE, N.O.S. (CONTAINS N,N,N' DIMETHYLAMINOPROPYL HEXA HYDRO TRIAZINE)
Dangerous Goods Class:	8
Subsidiary Risk:	-
Packing Group:	III

15. REGULATORY INFORMATION

Country/Region	Inventory	Status
Australia	AICS	Listed

Poisons schedule (Aust): None Allocated

16. OTHER INFORMATION

Reason(s) For Issue: Change of emergency telephone number
Literary reference: Supplier Material Safety Data Sheets

Material Safety Data Sheets are updated frequently. Please ensure that you have a current copy.
This MSDS summarises at the date of issue our best knowledge of the health and safety hazard information of the product, and in particular how to safely handle and use the product in the workplace. Since Huntsman Corporation Australia Pty Limited cannot anticipate or control the conditions under which the product may be used, each user must, prior to usage, review this MSDS in the context of how the user intends to handle and use the product in the workplace.

If clarification or further information is needed to ensure that an appropriate assessment can be made, the user should contact this company.

Our responsibility for product as sold is subject to our standard terms and conditions, a copy of which is sent to our customers and is also available upon request.

Material Safety Data Sheet

Hazardous Substance, Dangerous Goods

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product name: DALTOFOAM TR 33204

Recommended use: Component of a Polyurethane System.

Supplier:	Huntsman Polyurethanes (Australia) Pty Limited
ABN:	40 090 446 165
Street address:	Gate 3 Ballarat Road Deer Park 3023 Australia
Telephone:	+61 3 9361 6000
Facsimile:	+61 3 9361 6066

Emergency telephone number: **Australia: 1800 786 152**

2. HAZARDS IDENTIFICATION

Australia
Hazard classification
Classified as hazardous according to criteria of NOHSC Australia.

Hazard Category

Xn	Harmful
Xi	Irritant

Risk phrase(s)

R22	Harmful by swallowed.
R38	Irritating to skin.
R41	Risk of serious damage to eyes.
R51/53	Harmful to aquatic organisms. May cause long-term adverse effects in the aquatic environment.

Safety phrase(s)

S26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S39	Wear eye/face protection.
S20	When using do not eat or drink.
S46	If swallowed, contact a doctor or poison Information Centre immediately and show the label. Phone 13 11 26, 0800 764 766 (NZ)
S57	Use appropriate containment to avoid environmental contamination.
S61	Avoid release to the environment. Refer to special instructions/ safety data sheet.

Classified as Dangerous Goods by the criteria of the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code).

Poisons schedule (Aust): None Allocated.

New Zealand
Classified as hazardous according to the Hazardous Substances (Classifications) Regulations 2001 (NZ).

Hazard Category

Xn	Harmful
Xi	Irritant

Risk phrase(s)

R22	Harmful by swallowed.
R38	Irritating to skin.
R41	Risk of serious damage to eyes.
R51/53	Harmful to aquatic organisms. May cause long-term adverse effects in the aquatic environment.

HSNO Classification Categories
6.1D
6.3A
8.3A
9.1B
9.1D
Classified as Dangerous Goods by the criteria of the New Zealand Standard 5433.1999 Transport of Dangerous Goods on Land.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Appearance: Liquid.

CHEMICAL ENTITY	CAS NO.	PROPORTION (%weight/weight)
Diethylethylphosphonate	78-38-6	10-30
Non hazardous ingredients	-	to 100%

All the constituents of this material are listed on the Australian Inventory of Chemical Substances (AICS).

4. FIRST AID MEASURES

Ingestion: Do NOT induce vomiting unless directed to do so by medical personnel. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as collar, tie, belt or waistband. Never give anything by mouth to an unconscious person.

Eye contact: Irrigate with copious quantities of water for 15 minutes. Obtain medical attention immediately. Check for and remove contact lenses.

Skin contact: If skin or hair contact occurs, remove contaminated clothing and flush skin and hair with plenty of running water. If irritation occurs seek medical attention. Wash contaminated clothing before re-use.

Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult. Give oxygen. Obtain medical attention.

Medical attention and special treatment: Symptomatic treatment and supportive therapy as indicated. Following severe exposure the patent should be kept under medical review for at least 48 hours.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media: Combustible liquid, Water fog (or if unavailable fine water spray), foam, dry agent (carbon dioxide, dry chemical powder). Do not use water jet.

Hazards from combustion products: On burning will emit toxic fumes including those of carbon monoxide and carbon dioxide and phosphates.

Precautions for fire fighters and special protective equipment: Fire fighters to wear self-contained breathing apparatus if risk of exposure to vapour or products of combustion.

Hazchem code: 2X

6. ACCIDENTAL RELEASE MEASURES

Emergency procedures: Slippery when spilt. Avoid accidents, clean up immediately. Wear protective equipment to prevent skin and eye contamination and inhalation of vapours. Do not touch or walk through spilled material.

Methods and materials for containment and clean up procedures: Contain - prevent run off into drains and waterways. Use absorbent (soil, sand or other inert material). Collect and seal in properly labelled drums for disposal. If polluted water reaches drainage system or water courses, immediately inform the appropriate authorities. .

7. HANDLING AND STORAGE

Precautions for safe handling: Do not ingest**.** Avoid skin and eye contact. Do not breathe gas/fumes/vapour/spray. Always wash hands before smoking, eating, drinking or using the toilet. Wash contaminated clothing and other protective equipment before storage or re-use. Do not dispose of material to sewers or waterways.
Conditions for safe storage: Store in a well ventilated area. Store in a cool place and out of direct sunlight. Keep containers tightly sealed.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

National exposure standards
Australia
No value assigned for this specific material by the National Occupational Health and Safety Commission (NOHSC Australia).
Keep exposures as low as practicable below the exposure standards.

New Zealand
No value assigned for this specific material by the New Zealand Occupational Safety and Health Service (OSH). Keep exposures as low as practicable below the exposure standards.

Biological limit values
Not Relevant.

Engineering controls: Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapours below their respective occupational exposure limit. Ensure that eyewash stations and safety showers are close to the workstation location. Keep containers closed when not in use.

Personal protective equipment: OVERALLS, SAFETY SHOES, FACE SHIELD, GLOVES (Long).

Wear suitable protective clothing, gloves and eye/face protection.
* Respirators: Suitable respiratory equipment with positive air supply should be used in cases of insufficient ventilation or where operational procedures demand it.
* Eye Protection: Chemical splash goggles. Full face shield if splashing is possible.
* Gloves: Chemical gloves should be worn while handling this material.
* Other: Overall (preferably heavy cotton) or Tyvek-Pro Tech 'C', Tyvek-Pro 'F' disposable coverall.

Contaminated clothing should be thoroughly cleaned before re-use.

9. PHYSICAL AND CHEMICAL PROPERTIES

Form / colour / odour: liquid.

Solubility: Miscible with water

Specific Gravity (water=1):	N Av	Melting Point (°C):	N Av
Rel Vapour Density (air=1):	N Av	Boiling Point (°C):	N Av
Vapour Pressure at 20ºC (mmHg):	N Av	Decomp. Point (°C):	N Av
Flash Point (open cup) (°C):	150	Sublimation Point (°C):	N App
Flammability Limits (%):	N AP	pH (neat):	N Av
Autoignition Temp (°C):	N Av	Viscosity (20°C):	N Av
% Volatile by weight:	N Av	Evaporation Rate:	N Av

Solubility in water: N Av (n-Butyl acetate=1)

(Typical values only - consult specification sheet)
N Av = Not available N App = Not applicable

10. STABILITY AND REACTIVITY

Chemical stability: Stable under normal conditions of use.

Conditions to avoid: Slightly reactive to reactive with oxidising agents.

Incompatible materials:
Reacts with strong oxidising agents.

Hazardous decomposition products: On burning will emit toxic fumes including those of carbon monoxide, carbon dioxide and. phosphates.
Hazardous reactions: Oxidising agents.

11. TOXICOLOGICAL INFORMATION

No adverse health effects expected if the product is handled in accordance with this Safety Data Sheet and the product label. Symptoms that may arise if the product is mishandled are:

Acute Toxicity

Ingredient Name	Test	Result	Route	Species
Diethylethylphosphonate	LD50	732to 2330 mg/kg	Oral	Rat
	LD50	2500 mg/kg	Oral	Mouse
	LD50	>2000 mg/kg	Dermal	Rat

Acute Effects

Ingestion: No adverse effects expected.

Eye contact: Irritating

Skin contact: Irritating.

Inhalation: No adverse effects expected.

Long Term Effects
Repeated or prolonged exposure is not known to aggravate medical condition.

Mutagenic Effects
Nonmutagenic for bacteria and/or yeast. [Diethylethylphosphonate].

12. ECOLOGICAL INFORMATION

Ecotoxicity

Ingredient Name	Species	Period	Result
Diethylethylphosphonate	Fish (LC50)	96 hours	>100 mg/l
	Daphnia (EC50)	48 hours	3 mg/l
	Algae (IC50)	72 hours	>100 mg/

Persistence/degradability
No data available for product.

Mobility
No data available for product.
Avoid contaminating waterways.

13. DISPOSAL CONSIDERATIONS

Disposal methods: The generation of waste should be avoided or minimised wherever possible. Untreated material is not suitable for disposal. Waste, even small quantities, should never be poured down drains, sewers or water courses. Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Special precautions for landfill or incineration: Waste must be disposed of in accordance with federal, state and local environmental control regulations.

14. TRANSPORT INFORMATION

Road and Rail Transport (ADG Code)

UN Number	3082
Proper Shipping Name:	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S (CONTAINS DIETHYLETHYLPHOSPHONATE)
Dangerous Goods Class:	9
Subsidiary Risk:	-
Packing Group:	III
Hazchem Code:	2X
Emergency Information:	IERG 37

Road and Rail Transport

Classified as Dangerous Goods by the criteria of the New Zealand Standard 5433:1999 Transport of Dangerous Goods on Land.

UN-No:	3082
Class:	9
Hazchem code:	2X
Packing group:	III
Proper Shipping Name:	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S (CONTAINS DIETHYLETHYLPHOSPHONATE)

Segregation Dangerous Goods:

Not to be loaded with explosives (Class 1), oxidising agents (Class 5.1), organic peroxides (Class 5.2), however exemptions may apply.

Marine Transport (IMDG Code)

UN Number	3082
Proper Shipping Name:	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S (CONTAINS DIETHYLETHYLPHOSPHONATE
Dangerous Goods Class:	9
Subsidiary Risk:	-
Packing Group:	III

Air Transport (IATA Regulations)

UN Number	3082
Proper Shipping Name:	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S (CONTAINS DIETHYLETHYLPHOSPHONATE
Dangerous Goods Class:	9
Subsidiary Risk:	-
Packing Group:	III

Dangerous Goods Segregation (ADG Code):

Not to be loaded with explosives (Class 1), oxidising agents (Class 5.1), organic peroxides (Class 5.2), however exemptions may apply.

15. REGULATORY INFORMATION

Country/Region	Inventory	Status
Australia	AICS	Listed

Poisons schedule (Aust): None Allocated

16. OTHER INFORMATION

Reason(s) For Issue: Change of emergency number
Literary reference: Supplier Material Safety Data Sheets

Material Safety Data Sheets are updated frequently. Please ensure that you have a current copy.
This MSDS summarises at the date of issue our best knowledge of the health and safety hazard information of the product, and in particular how to safely handle and use the product in the workplace. Since Huntsman Corporation Australia Pty Limited cannot anticipate or control the conditions under which the product may be used, each user must, prior to usage, review this MSDS in the context of how the user intends to handle and use the product in the workplace.

If clarification or further information is needed to ensure that an appropriate assessment can be made, the user should contact this company.

Our responsibility for product as sold is subject to our standard terms and conditions, a copy of which is sent to our customers and is also available upon request.

Appendix C

Detailed Risk Assessment

Risk Assessment

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
POLYOL									
Transferring polyol from isotainer to UST	Chemically incompatible hoses and connectors. Making and breaking transfer connections could result in spills and leaks.	Occupational exposure causing skin contact, eye irritation and vapour inhalation.	B	3	HR	Specify hoses and connectors to be compatible with chemicals at design. Establish an inspection and testing program to confirm suitability for duty. Forced ventilation or good natural ventilation, eye protection, industrial clothing and gloves. Consider occupational ambient air monitoring to assess exposure of personnel to determine if additional controls are required.	D	3	LR
		Release into the environment resulting in water and/or ground contamination. Damage to hoses and tanks. Lost product. Clean-up and waste disposal.	C	2	HR	Take all precautions when making and breaking connections, bund transfer area. Select hoses and fittings based on chemical compatibility.	D	2	MR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Transferring polyol from isotainer to UST	Overflow / high flow due to operator error, delivery vessel over pressure or loss of automatic control system could result in a major spill or leak.	Damage to isotainer. Release into the environment resulting in water and/or ground contamination. Clean-up and waste disposal.	B	3	HR	Maintain pumps and automatic control equipment. Check supplier maintenance schedules for isotainers. Design bunding in storage area to capture and contain spillages from overfilling. Train operators to detect problems quickly and shutdown pumps. Clearly identify isolation valves and locate within easy access to operators. Provide spill control equipment and ensure staff are trained in the use of this equipment.	D	3	LR
Transferring polyol from isotainer to UST	Low flow due to pump failure, blockage by foreign body or sediment, poor suction condition or valve jam could result in a spill or leak.	Damage to pump and pipework. Release into the environment resulting in water and/or ground contamination. Lost product.	C	2	HR	Maintain pumps, valves and delivery mains. Check maintenance schedules for isotainers. Train operators to detect problems quickly and shutdown pumps. Clearly identify isolation valves and locate within easy access to operators. Design bunding in isotainer transfer area to capture and contain spillages and leaks.	D	4	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Transferring polyol from isotainer to UST	No flow due to pump failure, delivery vessel/main pressurised, blockage by foreign body or sediment, could result in a spill or leak.	Damage to pump, pipework and/or tank. Release into the environment resulting in water and/or ground contamination.	D	2	MR	Maintain pumps, valves and delivery mains. Check maintenance schedules for isotainers. Design bunding to capture and contain spillages and leaks. Train operators to detect problems quickly and shutdown pumps. Clearly identify isolation valves and locate within easy access to operators. Provide spill control equipment and ensure staff are trained in the use of this equipment.	E	2	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Transferring polyol from isotainer to UST	Reverse flow due to pump reversal, operator error, delivery vessel/main over pressure, loss of automatic control system could result in a major spill or leak.	Release into the environment resulting in water and/or ground contamination. Clean-up and waste disposal. Lost product and production.	D	2	MR	Maintain pumps and automatic control equipment. Check maintenance schedules for isotainers. Scheduled calibration and testing of instrumentation and control system. Design bunding in isotainer transfer area to capture and contain contents (isotainer plus 50kL). Train operators to detect problems quickly and shutdown pumps. Clearly identify isolation valves and locate within easy access to operators. Provide spill control equipment and ensure staff are trained in the use of this equipment.	E	2	LR
Transferring polyol from isotainer to UST	Contamination of stormwater or wash down water/sewer.	Release into the environment resulting in water and/or ground contamination. Clean up and waste disposal.	C	2	HR	Conduct loading and transfer activities undercover. Ensure no stormwater runs into the bunded area. Protect stormwater drains if there is the potential for contamination to occur. Segregate and capture contaminated run-off or water for classification to sewer or disposal off-site.	D	2	MR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Transferring polyol from isotainer to UST	High vapour pressure due to chemical reaction or fire could result in a major spill or leak	Release into the atmosphere, water and/or ground contamination. Clean-up and waste disposal. Lost product and production.	C	2	HR	Design bunding to capture and contain spillages and leaks. Including contaminated fire water. Provide spill control equipment and ensure staff are trained in the use of this equipment.	D	2	MR
Transferring polyol from isotainer to UST	Low pressure due to break could result in a major spill or leak	Release into the environment resulting in water and/or ground contamination. Clean-up and waste disposal.	D	2	HR	Maintain pumps, valves, storage tanks and delivery mains. Check maintenance schedules for isotainers. Process monitoring to detect low pressure or flow. Provide spill control equipment and ensure staff are trained in the use of this equipment.	E	2	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Transferring polyol from isotainer to UST	High temperature or exothermic reaction due to cross contamination or other conditions could result in a major spill or leak or cause a fire.	Occupational exposure causing eye irritation and vapour inhalation, smoke inhalation, burns or risk to human health due to fire/explosion. Release to the environment resulting in water, ground contamination and/or fire. Damage to plant equipment and adjacent land uses, lost product and production time.	C	2	HR	Maintain pumps, valves, storage tanks and delivery mains. Check maintenance schedules for isotainers. Prevent contamination from catalyst or other iniators of reaction with polyols in storage tanks and isotainers. Bund transfer area, create and maintain adequate fire breaks between plant and surrounding bushland. Emergency response training for staff, direction in correct use of fire suppressants. Provide spill control equipment and ensure staff are trained in the use of this equipment.	D	2	MR
Transferring polyol from isotainer to UST	Impurities such as dust, air and water entering the delivery main or storage tank could cause initiate a reaction.	Occupational exposure causing skin contact, eye irritation and vapour inhalation. Damage to tank and lost production. Release into the environment resulting in water and/or ground contamination.	C	3	MR	Consider installing filters and/or non-return valves on discharges to atmosphere. Maintain pumps, valves, storage tanks and delivery mains. Check maintenance schedules for isotainers.	E	3	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Transferring polyol from isotainer to UST	Chemical incompatibility with delivery main construction material could result in a major spill or leak	Occupational exposure causing skin contact, eye irritation and vapour inhalation. Damage to tank and lost product and production. Release into the environment resulting in water and/or ground contamination. Clean-up and waste disposal.	C	2	HR	Check delivery main and isotainer construction materials. Check cleaning and maintenance schedules for isotainers.	D	2	MR
Transferring polyol from isotainer to UST	Pumps could generate excessive noise	Excessive noise to nearby residents or adjacent activities. Damage to hearing, distraction from other potential problems	C	3	MR	Purchase motors and drives on transfer pumps to meet local noise standards. Consider sound proofing. Provide employees hearing protection.	D	2	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Transferring polyol from isotainer to UST	Vehicle / isotainer collision causing injury and spillage due to high number of vehicle movements	Release into the environment resulting in water and/or ground contamination. Equipment damage and lost product and production.	C	2	HR	Design stormwater system so that it can be isolated to contain spillages within the site. Implement an appropriate vehicle management plan which considers the possibility of one way traffic flow and dedicated access and unloading areas to reduce probability of a collision. Provide vehicle protection barriers in front of bulk storage areas to prevent accidental collision.	D	2	MR
Storage of polyol in UST	Chemical incompatibility with storage vessel construction material could cause major spill or leak.	Occupational exposure causing eye irritation and vapour inhalation. Release into the environment, resulting in water and/or ground contamination.	C	3	MR	Check storage tank construction material. Bund storage tank area. Use stormwater modelling to determine effectiveness of underground bund.	D	3	LR
Storage of polyol in UST	Electrical failure could cause major spill, leak if pumps and valves stay in the open position.	Release into the environment, resulting in water and/or ground contamination.	B	4	MR	Consider back-up power supply to enable safe shutdown. Classify areas / equipment to assist with isolation of processes and storage containers.	D	4	LR
Storage of polyol in UST	Failure of control instruments could cause a major spill or leak	Release into the environment, resulting in water and/or ground contamination.	B	4	MR	Conduct schedule calibrations and checks for shutdown, loss of power, loss of signal scenarios.	D	4	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Storage of polyol in UST	Failure to sufficiently isolate the storage tank during shutdown could cause a major spill or leak	Release into the environment, resulting in water and/or ground contamination.	D	2	MR	Develop and document isolation procedures. Provide training to employees in isolation procedures.	E	2	LR
Storage of polyol in UST	Power failure causing a major spill or leak	Occupational exposure causing eye irritation and vapour inhalation. Release into the environment, resulting in water and/or ground contamination. Lost production time.	B	4	MR	Consider Installing backup power supply. Test and maintain back-up systems.	D	4	LR
PENTANE									
Transferring pentane from isotainer to UST	Making and breaking transfer connections could result in small spills.	Occupational exposure dermatitis, eye irritation, dizziness, odours and risk to human health.	C	1	HR	Specify hoses and connectors to be compatible with chemicals at design. Establish an inspection and testing program to confirm suitability for duty. Forced ventilation or good natural ventilation, supplied air respirator, eye protection, industrial clothing and gloves. Ventilation design should be intrinsically safe to ensure no significant flammable vapour mix.	E	1	MR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
		Release of flammables into the environment could cause long-term effects to the aquatic environment. Vapour could cause odours. Ignition possibly leading to bushfire.	C	2	HR	Take all precautions when making and breaking connections, bund transfer area. Select hosing and fittings based on chemical compatibility. Provide spill control equipment and ensure staff are trained in the use of this equipment.	D	2	MR
Transferring pentane from isotainer to UST	Overflow / high flow due to operator error, delivery vessel over pressure or loss of automatic control system could result in a major spill or leak.	Damage to isotainer. Release of flammables into the environment resulting in water and/or ground contamination. Clean-up and waste disposal. Lost product. Fire – plant and equipment damage.	C	2	HR	Maintain pumps and automatic control equipment. Check maintenance schedules for isotainers. Design bunding in storage area to capture and contain spillages from overfilling. Bunds designed with fire traps. Train operators to detect problems quickly and shutdown pumps. Clearly identify isolation valves and locate within easy access to operators. Provide spill control equipment and ensure staff are trained in the use of this equipment.	D	2	MR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Transferring pentane from isotainer to UST	Low flow due to pump failure, blockage by foreign body or sediment, poor suction condition or valve jam could result in a major spill or leak.	Damage to pump and pipework. Release of flammables into the environment resulting in soil and/or ground contamination. Fire – plant and equipment damage.	C	2	HR	Maintain pumps, valves and delivery mains. Check maintenance schedules for isotainers. Design bunding to capture and contain spillages and leaks. Train operators to detect problems quickly and shutdown pumps. Clearly identify isolation valves and locate within easy access to operators. Provide spill control equipment and ensure staff are trained in the use of this equipment.	D	2	MR
Transferring pentane from isotainer to UST	Zero flow due to pump failure, delivery vessel/main pressurised, blockage by foreign body or sediment, could result in a spill or leak.	Damage to pump, pipework and/or tank. Release of flammables into the environment resulting in water and/or ground contamination. Fire – plant and equipment damage.	C	2	HR	Maintain pumps, valves and delivery mains. Check maintenance schedules for isotainers. Design bunding to capture and contain spillages and leaks. Train operators to detect problems quickly and shutdown pumps. Clearly identify isolation valves and locate within easy access to operators.	D	2	MR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Transferring pentane from isotainer to UST	Reverse flow due to pump reversal, operator error, delivery vessel/main over pressure, loss of automatic control could result in a spill or leak.	Release of flammables into the environment resulting in soil and/or ground contamination. Clean-up and waste disposal. Fire – plant and equipment damage.	C	2	HR	Maintain pumps, valves and delivery mains. Check maintenance schedules for isotainers. Scheduled calibration and testing of instrumentation and control system. Design bunding to capture and contain spillages and leaks (isotainer plus 55kL). Train operators to detect problems quickly and shutdown pumps. Clearly identify isolation valves and locate within easy access to operators.	D	2	MR
Transferring pentane from isotainer to UST	Contamination of stormwater or wash down water.	Release of flammables into the environment resulting in water and/or ground contamination. Clean up and waste disposal.	C	2	HR	Conduct loading and transfer activities undercover. Segregate and capture contaminated run-off or water for classification for classification to sewer or disposal offsite. Ensure no stormwater runs into the bunded area. Protect stormwater drains if there is the potential for contamination to occur.	D	2	MR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Transferring pentane from isotainer to UST	High pressure due to chemical breakdown or fire could result in a major spill or leak	Release of flammables the environment. Clean-up and waste disposal.	C	2	HR	Design for detection of over-pressure. Design bunding to capture and contain spillages and leaks. Include contaminated fire water. Process monitoring to detect high pressure. Provide spill control equipment and ensure staff are trained in the use of this equipment.	D	2	MR
Transferring pentane from isotainer to UST	Low pressure could result in a spill or leak	Release of flammables into the environment.	D	2	HR	Design for detection of low pressure. Design for transfers to occur within bunded area and to be air tight. Maintain pumps, valves, storage tanks and delivery mains. Check maintenance schedules for isotainers. Process monitoring to detect low pressure or flow.	E	2	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Transferring pentane from isotainer to UST	High temperature or exothermic reaction due to cross contamination or weather conditions could result in a major spill or leak or cause a fire	Smoke inhalation, burns or death due to fire/explosion. Release of flammables into the environment could cause long-term effects to the aquatic environment and bush fire. Damage to plant equipment and adjacent land uses, lost production time.	C	2	HR	Design with temperature alarms and monitoring of tanks. Maintain pumps, valves, storage tanks and delivery mains. Check maintenance schedules for isotainers. Prevent contamination of storage tanks and isotainers. Bund transfer area, create and maintain adequate fire breaks between plant and surrounding bushland. Bunds designed with fire traps. Emergency response training for staff, direction in correct use of fire suppressants.	D	2	MR
Transferring pentane from isotainer to UST	Impurities such as dust, air and water entering the delivery main or storage tank could cause could initiate a reaction.	Occupational exposure causing skin contact, eye irritation and vapour inhalation. Damage to tank and lost production. Release of flammables into the environment could cause long-term effects to the aquatic environment.	C	2	HR	Consider installing filters and/or non-return values on discharges to the atmosphere. Maintain pumps, valves, storage tanks and delivery mains. Check maintenance schedules for isotainers.	D	2	MR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Transferring pentane from isotainer to UST	Chemical incompatibility with delivery main construction material could result in a major spill or leak	Occupational exposure causing skin contact, eye irritation and vapour inhalation. Damage to tank and lost production. Release of flammables into the environment. Clean-up and waste disposal.	C	2	HR	Check delivery main and isotainer construction materials. Check maintenance schedules for isotainers.	E	2	LR
Transferring pentane from isotainer to UST	Pumps could generate excessive noise	Excessive noise to nearby residents or adjacent activities. Damage to hearing, distraction from other potential problems.	C	3	MR	Purchase motors and drives on transfer pumps to meet local noise standards. Consider sound proofing. Provide employees hearing protection.	D	4	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Transferring pentane from isotainer to UST	Vehicle / isotainer collision causing human injury and spillage due to high number of vehicle movements	Release of flammables into the environment resulting in water and/or ground contamination.	B	2	HR	Design stormwater systems so it can be isolated to contain spillages within the site. Implement an appropriate vehicle management plan which considers the possibility of one way traffic flow and dedicated access and unloading areas. Provide vehicle protection barriers in front of bulk storage areas to prevent accidental collision.	D	2	MR
Storage of pentane in UST	Chemical incompatibility with storage vessel construction material could cause major spill or leak.	Occupational exposure causing eye irritation and vapour inhalation. Release of flammables to the environment.	C	2	HR	Check storage tank construction material. Bund storage tank area. Use stormwater modelling to determine effectiveness of underground bund.	E	2	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Storage of pentane in UST	Electrical failure could cause major spill, leak if pumps and valves stay in the open position.	Release of flammables into the environment. Fire – damage to plant and equipment.	C	1	HR	Electrical equipment and connections designed not to create an ignition source. Electrical motors / drives should be designed for hazardous area. Provide earthing. Consider back-up power supply to enable safe shutdown. Classify areas / equipment to assist with isolation processes and storage containers.	E	1	MR
Storage of pentane in UST	Failure of control instruments could cause a major spill or leak	Release of flammables into the environment. Fire – damage to plant and equipment.	C	1	HR	Instrumentation designed not to create an ignition source. Conduct scheduled calibrations and checks for shutdown, loss of power and loss of signal scenarios.	E	1	MR
Storage of pentane in UST	Failure to sufficiently isolate the storage tank during shutdown could cause a major spill or leak	Release of flammables into the environment.	D	2	HR	Develop and document isolation procedures. Provide training to employees in isolation training procedures.	E	2	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Storage of pentane in UST	Power failure causing a major spill or leak	Release of flammables into the environment. Lost production time. Fire – damage to plant and equipment.	C	1	HR	Design pentane transfer systems to shut close and stop release of flammable liquid or vapour. Consider installing backup power supply. Test and Maintain backup systems. .	E	1	MR
PMDI									
Transferring PMDI from isotainer to above ground storage tank.	Chemically incompatible hoses and connectors. Making and breaking transfer connections could result in spills and leaks.	Occupational exposure could cause respiratory irritation, skin irritation and slight eye irritation.	B	3	HR	Specify hoses and connectors to be compatible with chemicals at design. Establish an inspection and testing program to confirm suitability for duty. Forced ventilation or good natural ventilation, eye protection, industrial clothing and gloves. Consider occupational ambient air monitoring to assess exposure of personnel to determine if additional controls are required.	D	3	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
		Release into the environment resulting in water and/or ground contamination.	C	4	HR	Take all precautions when making and breaking connections, bund transfer area. Select hoses and fittings based on chemical compatibility.	D	4	LR
Transferring PMDI from isotainer to above ground storage tank.	Overflow / high flow due to operator error, delivery vessel over pressure or loss of automatic control system could result in a major spill or leak.	Damage to isotainer. Release into the environment resulting in water and/or ground contamination. Clean-up and waste disposal.	C	4	HR	Maintain pumps and automatic control equipment. Train operators to detect problems quickly and shutdown pumps. Clearly identify isolation valves and locate within easy access to operators. Design bunding in storage area to capture and contain spillages from overfilling. Provide spill control equipment and ensure staff are trained in the use of this equipment.	D	4	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Transferring PMDI from isotainer to above ground storage tank.	Low flow due to pump failure, blockage by foreign body or sediment, poor suction condition or valve jam could result in a spill or leak.	Damage to pump and pipework. Release into the environment resulting in water and/or ground contamination.	C	3	HR	Maintain pumps, valves and delivery mains. Check maintenance schedules for isotainers. Train operators to detect problems quickly and shutdown pumps. Clearly identify isolation valves and locate within easy access to operators. Design bunding in isotainer transfer area to capture and contain spillages and leaks. Provide spill control equipment and ensure staff are trained in the use of this equipment..	D	3	LR
Transferring PMDI from isotainer to above ground storage tank.	Zero flow due to pump failure, delivery vessel/main pressurised, blockage by foreign body or sediment, could result in a spill or leak.	Damage to pump, pipework and/or tank. Release into the environment resulting in water and/or ground contamination.	C	3	HR	Maintain pumps, valves and delivery mains. Check maintenance schedules for isotainers. Train operators to detect problems quickly and shutdown pumps. Clearly identify isolation valves and locate within easy access to operators. Design bunding to capture and contain spillages and leaks.	D	3	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Transferring PMDI from isotainer to above ground storage tank.	Reverse flow due to pump reversal, operator error, delivery vessel/main over pressure, loss of automatic control system could result in a major spill or leak	Release into the environment resulting in water and/or ground contamination. Clean-up and waste disposal.	C	3	HR	Maintain pumps and automatic control equipment. Check maintenance schedules for isotainers. Scheduled calibration and testing of instrumentation and control system. Train operators to detect problems quickly and shutdown pumps. Clearly identify isolation valves and locate within easy access to operators. Design bunding in isotainer transfer area to capture and contain contents (isotainer plus 50kL).	D	3	LR
Transferring PMDI from isotainer to above ground storage tank.	Contaminated stormwater or wash down water.	Release into the environment resulting in water and/or ground contamination. Clean up and waste disposal.	C	4	HR	Conduct loading and transfer activities undercover. Segregate and capture contaminated run-off or water for classification to sewer or disposal off-site. Ensure no stormwater runs into the bunded area. Protect stormwater drains if there is the potential for contamination to occur.	D	4	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Transferring PMDI from isotainer to above ground storage tank.	High vapour pressure due to chemical reaction or fire could result in a major spill or leak	Release into the atmosphere, water and/or ground contamination. Clean-up and waste disposal.	C	3	HR	Design bunding to capture and contain spillages and leaks. Include contaminated fire water.	D	3	LR
Transferring PMDI from isotainer to above ground storage tank.	Low pressure could result in a major spill or leak	Release into the environment resulting in water and/or ground contamination. Clean-up and waste disposal.	D	3	HR	Maintain pumps, valves, storage tanks and delivery mains. Check maintenance schedules for isotainers. Process monitoring to detect low pressure or flow.	E	3	LR
Transferring PMDI from isotainer to above ground storage tank.	High temperature or exothermic reaction due to cross contamination or weather conditions could result in a major spill or leak or cause a fire.	Occupational exposure causing eye irritation and vapour inhalation, smoke inhalation, burns or risk to human health due to fire/explosion. Release into the environment resulting in water and/or ground contamination, bush fire. Damage to plant equipment and adjacent land uses, lost production time.	C	3	HR	Maintain pumps, valves, storage tanks and delivery mains. Check maintenance schedules for isotainers. Prevent contamination of storage tanks and isotainers. Bund transfer area, create and maintain adequate fire breaks between plant and surrounding bushland. Emergency response training for staff, direction in correct use of fire suppressants.	D	3	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Transferring PMDI from isotainer to above ground storage tank.	Impurities such as dust, air and water entering the delivery main or storage tank could cause initiate a reaction.	Occupational exposure causing skin contact, eye irritation and vapour inhalation. Damage to tank and lost production. Release into the environment resulting in water and/or ground contamination.	C	3	HR	Consider installing filters and/or non-return valves on discharges to atmosphere. Maintain pumps, valves, storage tanks and delivery mains. Check maintenance schedules for isotainers.	D	3	LR
Transferring PMDI from isotainer to above ground storage tank.	Chemical incompatibility with delivery main construction material could result in a major spill or leak	Occupational exposure could cause irritation to the respiratory tract and lungs, skin irritation and slight eye irritation. Damage to tank and lost production. Release into the environment resulting in water and/or ground contamination.	C	3	HR	Check delivery main and isotainer construction materials. Check maintenance schedules for isotainers.	D	3	LR
Transferring PMDI from isotainer to above ground storage tank.	Pumps could generate excessive noise	Excessive noise to nearby residents or adjacent activities. Damage to hearing, distraction from other potential problems	C	3	MR	Purchase motors and drives on transfer pumps to meet local noise standards. Consider sound proofing. Provide employees hearing protection.	D	4	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Transferring PMDI from isotainer to above ground storage tank.	Vehicle / isotainer collision causing human injury and spillage due to high number of vehicle movements	Release into the environment resulting in water and/or ground contamination. Equipment damage and lost production.	C	2	HR	Implement an appropriate vehicle management plan which considers the possibility of one way traffic flow and dedicated access and unloading areas. Ensure vehicle protection barriers are provided in front of all bulk storage areas to prevent accidental collision.	D	2	MR
Storage of PMDI in above ground tanks.	Chemical incompatibility with storage vessel construction material could cause major spill or leak.	Occupational exposure causing eye irritation and vapour inhalation. Release into the environment, resulting in water and/or ground contamination.	C	4	LR	Check storage tank construction material. Bund storage tank area.	D	4	LR
Storage of PMDI in above ground tanks.	Electrical failure could cause major spill, leak	Release into the environment, resulting in water and/or ground contamination.	B	4	CR	Consider back-up power supply to enable safe shutdown. Classify areas / equipment to assist with isolation of processes and storage containers.	D	4	LR
Storage of PMDI in above ground tanks.	Failure of control instruments could cause a major spill or leak	Release into the environment, resulting in water and/or ground contamination.	B	4	MR	Conduct schedule calibrations and checks for shutdown, loss of power, loss of signal scenarios.	D	4	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Storage of PMDI in above ground tanks.	Failure to sufficiently isolate the storage tank during shutdown could cause a major spill or leak	Release into the environment, resulting in water and/or ground contamination.	C	4	HR	Conduct schedule calibrations and checks for shutdown, loss of power, loss of signal scenarios.	D	4	LR
Storage of PMDI in above ground tanks.	Electrical failure could cause major spill, leak if pumps and valves stay in the open position.	Occupational exposure causing eye irritation and vapour inhalation. Release into the environment, resulting in water and/or ground contamination. Lost production time.	B	3	HR	Consider Installing backup power supply. Test and maintain back-up systems.	D	3	LR
CATALYST 1 DALTOFOAM TO 33203									
Transferring IBC from delivery vehicle to storage area	Puncturing of container by operator error could result in major spill or leak.	Occupational exposure causing skin contact, eye irritation and vapour inhalation.	B	4	MR	Forced ventilation or good natural ventilation, eye protection, industrial clothing and gloves.	C	4	LR
		Release into the environment resulting in water and/or ground contamination.	C	3	MR	Conduct transfer in roofed, bunded area. Train operators effectively in the use of transfer equipment and dangerous goods and chemical handling Provide spill control equipment and ensure staff are trained in the use of this equipment.	E	3	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
		Equipment damage involving lost production Cost of replacing lost material	C	2	HR	Ensure correct clean up materials are on hand to prevent lost time. Consider having replacement parts on hand for high risk parts.	E	2	LR
Transferring IBC from delivery vehicle to storage area	Container falls as a result of operator error from forklift while transferring from delivery vehicle to storage area could result in a major spill or leak.	Release into the environment resulting in water and/or ground contamination. Equipment damage involving lost production Cost of replacing lost material	C	2	HR	Use steel cages around IBCs. Conduct transfer in roofed, bunded area. Train operators effectively in the use of transfer equipment and dangerous goods and chemical handling Provide spill control equipment and ensure staff are trained in the use of this equipment. Consider having replacement parts on hand for high risk parts.	E	2	LR
Transferring IBC from delivery vehicle to storage area	Contaminated stormwater or wash down water.	Release into the environment resulting in water and/or ground contamination. Clean up and waste disposal.	C	4	LR	Conduct loading and transfer activities undercover and inside bunded area. Segregate and capture contaminated run-off or water for classification to sewer or disposal off-site.	D	4	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Transferring IBC from delivery vehicle to storage area	High vapour pressure due to chemical reaction or fire could result in a major spill or leak	Release into the atmosphere, water and/or ground contamination. Equipment damage involving lost production Cost of replacing lost material	C	2	HR	Design bunding to capture and contain spillages and leaks. Include contaminated fire water. Ensure transfer occurs in well ventilated area. Ensure correct clean up materials are on hand to prevent lost time. Consider having replacement parts on hand for high risk parts.	E	2	LR
Transferring IBC from delivery vehicle to storage area	High temperature or exothermic reaction from cross contamination could result in a major spill or leak or cause a fire	Occupational exposure causing eye irritation and vapour exposure, smoke inhalation, burns or death due to fire/explosion. Release to the environment, bush fire. Equipment damage involving lost production Cost of replacing lost material	C	3	MR	Prevent contamination of IBCs. Bund transfer area, create and maintain adequate fire breaks between plant and surrounding bushland. Ensure fire sprinkler system adequate to fight fires. Ensure correct	E	3	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Storage of IBC's	Failure to correctly shut off IBC bottom valves resulting in leakage/spillage	Occupational exposure causing eye irritation and vapour exposure. Release into the environment.	B	4	MR	End caps on IBC valves. Routine checking for leakage from IBC. Provide suitable clean up equipment for immediate clean up Bund storage area and isolate from stormwater system. Provide drip trays.	D	4	LR
Storage of IBC's	Rupture due to deterioration of IBC due to age or chemical incompatibility	Occupational exposure causing eye irritation and vapour exposure. Release into the environment. Damage to equipment.	D	4	LR	Routine checking for leakage from IBC. Provide suitable clean up equipment for immediate clean up Bund transfer area and isolate from stormwater system. Ensure replacement of IBC as per manufacturers instructions	E	4	LR
Storage of IBC's	Rupture of IBC due to impact from vehicles/heavy equipment if not stored in correct location.	Occupational exposure causing eye irritation and vapour exposure. Release into the environment. Damage to equipment.	C	3	MR	Ensure IBC stored in area not likely to have high vehicle usage. Use IBC with protective metal caging.	D	3	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
CATALYST 2 DALTOFOAM TR 33204									
Transferring IBC from delivery vehicle to storage area	Puncturing of container by operator error could result in major spill or leak.	Occupational exposure causing skin contact, eye irritation and vapour exposure. Release into the environment resulting in water and/or ground contamination.	C	2	HR	Forced ventilation or good natural ventilation, eye protection, industrial clothing and gloves. Conduct transfer in roofed, bunded area. Train operators effectively in the use of transfer equipment and dangerous goods and chemical handling Ensure correct clean up materials are on hand to prevent lost time. Consider having replacement parts on hand for high risk parts.	E	2	LR
		Equipment damage involving lost production Cost of replacing lost material	C	2	HR		E	2	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Transferring IBC from delivery vehicle to storage area	Container falls as a result of operator error from forklift while transferring from delivery vehicle to storage area could result in a major spill or leak.	Release into the environment resulting in water and/or ground contamination. Equipment damage involving lost production Cost of replacing lost material	C	2	HR	Conduct transfer in roofed, bunded area. Use steel cages around IBCs. Train operators effectively in the use of transfer equipment and dangerous goods and chemical handling. Provide spill control equipment and ensure staff are trained in the use of this equipment. Ensure correct clean up materials are on hand to prevent lost time. Consider having replacement parts on hand for high risk parts.	E	2	LR
Transferring IBC from delivery vehicle to storage area	Contaminated stormwater or wash down water.	Release into the environment resulting in water and/or ground contamination. Clean up and water disposal.	C	4	LR	Conduct loading and transfer activities undercover and inside bunded area. Segregate and capture contaminated run-off or water for classification to sewer or disposal off-site.	D	4	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Transferring IBC from delivery vehicle to storage area	High vapour pressure due to chemical reaction or fire could result in a major spill or leak	Release into the atmosphere, water and/or ground contamination. Equipment damage involving lost production Cost of replacing lost material	C	2	HR	Design bunding to capture and contain spillages and leaks. Include contaminated fire water. Ensure transfer occurs in well ventilated area. Ensure correct clean up materials are on hand to prevent lost time. Consider having replacement parts on hand for high risk parts.	E	2	LR
Transferring IBC from delivery vehicle to storage area	High temperature or exothermic reaction from cross contamination could result in a major spill or leak or cause a fire	Occupational exposure causing eye irritation and vapour exposure, smoke inhalation, burns or death due to fire/explosion. Release to the environment, bush fire. Equipment damage involving lost production Cost of replacing lost material	C	3	MR	Prevent contamination of IBCs. Bund transfer area, create and maintain adequate fire breaks between plant and surrounding bushland. Ensure fire sprinkler system adequate to fight fires. Ensure correct	D	3	LR
Transferring IBC from delivery vehicle to storage area	High temperature due to an exothermic reaction or weather conditions could result in a major spill or leak or cause a fire	Occupational exposure causing eye irritation and vapour exposure, smoke inhalation, burns or death due to fire/explosion. Release to the environment, bush fire.	C	3	HR	Prevent contamination of IBCs. Bund transfer area, create and maintain adequate fire breaks between plant and surrounding bushland. Ensure fire sprinkler system adequate to fight fires	E	2	LR

Activity	Hazard (what can happen and why)	Consequence	Initial Risk			Current Control Measures and Actions Required	Risk after Intended Controls and Actions		
			P	C	Risk		P	C	Risk
Storage of IBC's	Failure to correctly shut off IBC bottom valves resulting in leakage/spillage	Occupational exposure causing eye irritation and vapour exposure. Release into the environment.	B	4	MR	End caps on IBC valves. Routine checking for leakage from IBC. Provide suitable clean up equipment for immediate clean up Bund storage area and isolate from stormwater system. Provide drip trays.	D	4	LR
Storage of IBC's	Rupture due to deterioration of IBC due to age or chemical incompatibility	Occupational exposure causing eye irritation and vapour exposure. Release into the environment. Damage to equipment.	D	4	LR	Routine checking for leakage from IBC. Provide suitable clean up equipment for immediate clean up Bund transfer area and isolate from stormwater system. Ensure replacement of IBC as per manufacturers instructions	E	4	LR
Storage of IBC's	Rupture of IBC due to impact from vehicles/heavy equipment if not stored in correct location.	Occupational exposure causing eye irritation and vapour exposure. Release into the environment. Damage to equipment.	C	3	MR	Ensure IBC stored in area not likely to have high vehicle usage. Use IBC with protective metal caging.	D	3	LR