



# STERITECH

Protecting what matters

REF-0031 Rev. 01

## **Pollution Incident Response Management Plan (PIRMP)**

An approved Workplace Health & Safety document for use at Steritech's Wetherill Park facility.

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## **1 Steritech Pollution Incident Management Response Plans**

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### **1.1 Pollution licence number: 12902**

- 1.2 Steritech Pty Ltd, located at 5 Widemere Road Wetherill Park employs 19 staff on this site and is engaged in sterilisation of client product; from medical and surgical packs to imported timber, honey and other mainly non-hazardous products.
- 1.3 Steritech operates on a 24-hour, 7 days a week basis and occupies a frontage of 61 metres with a depth of 175 metres.
- 1.4 The company has been in operation on this site since 1982 sterilising client goods, first with gamma radiation and now since 2000 with Ethylene Oxide.
- 1.5 Ethylene Oxide prevents cell reproduction and as such can kill all known viruses, bacteria, and fungi, including bacterial spores.
  - 1.5.1 Ethylene Oxide is compatible with a number of materials.
  - 1.5.2 It is commonly used in the medical field for the sterilisation of medical equipment and Australian Medical Device Manufacturers are among some of Steritech's major customers for this process.
- 1.6 The sterilisation process is designed to kill all bacteria in sterile medical and surgical packs.
  - 1.6.1 It is also used for insect and disease control of imported timber and other products.

### **1.7 Definition of a Pollutant Incident**

- 1.7.1 A pollution incident means, an incident or set of circumstances during or as a consequence of which there is or is likely to be a leak, spill, or other escape of substance that involves actual or potential harm to health and safety of individuals or the surrounding ecosystem.
- 1.8 The incident response plans detailed here; are in regard to pollution licence number 12902 involving Ethylene Oxide, therefore Cobalt 60 is referred to only in summary and not dealt with as part of this plan.
- 1.9 The pollution incident response plan has been written with regard to:
  - 1.9.1 Part 5.7A of the POEO Act, section 153A & C of the protection of the Environment Operations (POEO) Act 1997 and 98B, D & E of the POEO Regulations.

## **2 Activity**

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- 2.1 Ethylene Oxide, the sterilisation agent used by Steritech on this site, is the approved sterilisation agent under the Therapeutic Goods Act (TGA) for therapeutic goods.
- 2.2 For client product not suitable or Ethylene Oxide, sterilisation using Gamma radiation is the approved alternative.
- 2.3 Main Activity: Ethylene Oxide Sterilisation.
- 2.4 Goods arrive from the client by truck in secure boxed, shrink wrapped, palletised form.

## **3 Process**

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- 3.1 Short term storage
- 3.2 Pallets moved into pre-conditioning units
- 3.3 Pallets moved into one of 4 Ethylene Oxide sterilisation chambers
- 3.4 Sterilisation of goods involves the use of steam and nitrogen to flush out oxygen under vacuum.
  - 3.4.1 Ethylene Oxide is then introduced for a specific period of time to ensure the goods are sterilised.
- 3.5 The process is computer controlled and monitored to a stringent set of requirements using data, sensors, pressure, and other probes, to ensure integrity of the system and process
- 3.6 If the parameters are not met through failure of a component, loss of power or loss of steam, the system, dependent on the stage reached will either immediately abort and evacuate Ethylene Oxide or Nitrogen to the high temperature Thermal Oxidiser or hold in sealed under partial vacuum section of the chamber until power is restored and the process can be completed.
- 3.7 Pallets are then moved into the Aeration Chamber for a dwell period to allow for the leaching of residual Ethylene Oxide out of the product.
  - 3.7.1 The residual Ethylene Oxide is then evacuated to the high temperature Thermal Oxidisers for incineration.

## **4 Primary Hazards**

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4.1 Please see full detailed risk matrix attached as part of these plans as Appendix 3.

4.2 The primary pollutant agents are Ethylene Oxide and Nitrogen.

### **4.3 Ethylene Oxide**

4.4 Release of large quantities of Ethylene Oxide could result in a very serious fire and explosion. The resulting fire could produce toxic gases.

4.4.1 This risk is seen as very unlikely.

4.5 A minor leak of Ethylene Oxide through pipe fitting and flange joints is a possible risk however with the use of planned maintenance program, the design of the system and the materials used, i.e. Stainless Steel, the risk is seen as low to rare.

4.6 A leak would be detected by the system, the process would be aborted, and the contents of pipes and the chambers would be evacuated to the high temperature Thermal Oxidisers.

4.6.1 This risk is seen as very unlikely.

### **4.7 Nitrogen**

4.8 Release of large quantities of nitrogen would only occur on vehicle impact with the large storage tank or connecting pipes, located behind the factory on the Western face.

4.8.1 The tank is secured behind a two (2) metre high chain linked fence.

4.9 There is potential health effects due to asphyxiation in the local environment to the tank, otherwise the gas would disperse into the atmosphere.

4.9.1 A large vapour cloud, visible due to the air becoming cold, i.e. the cryogenic effect of nitrogen would be seen.

4.10 The vessel is located and includes separation distances in accordance with AS1894.

4.10.1 That is minimum separation from drains, buildings, property boundaries, flammables, etc. so that in the event of a rupture or the safety valve opening, the nitrogen has a chance to dissipate before entering any potentially dangerous areas.

- 4.10.2 This risk is seen as very unlikely.
- 4.11 Minor leak of Nitrogen through pipe fitting and flange joints.
- 4.12 There is a possible risk, but with the use of planned maintenance program, the design of the system and the materials used i.e. Stainless Steel, the risk is seen as low to rare.
- 4.13 A leak would be detected by the system, the process would be aborted, and the contents of pipes and the chambers would be evacuated to the high temperature Thermal Oxidisers.
- 4.14 The Nitrogen would be mixed with ambient air at normal atmospheric pressure.
- 4.14.1 This risk is seen as very unlikely.

## **5 Impact on Surrounding Properties**

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### **5.1 Ethylene Oxide**

- 5.2 Significant release of Ethylene Oxide would see the development of a serious fire, potentially with explosive release, the resulting fire would be toxic.

5.2.1 North

- 5.2.1.1 7 Widemere Rd has been purchased by Steritech for future expansion.

- 5.2.1.2 9 Widemere Road; Penrite

5.2.2 West

- 5.2.2.1 The direct bus only route between Parramatta and Liverpool runs directly behind the property, the next property that would be impacted by toxic smoke is Freight Logistics at 2 Davis Road and Yusen Logistics at 3 Davis Road.

5.2.3 South

- 5.2.3.1 3 Widemere Rd; Michael Weinig Australia

5.2.4 East

- 5.2.4.1 Open air area Resource Recovery centre.

- 5.3 A major event, depending on wind direction involving Ethylene Oxide may require the alert and evacuation of these businesses.
  - 5.4 Other businesses to the West and South may require alert dependent on wind direction and advice of NSW Fire Brigade Hazmat teams.
  - 5.5 Apart from businesses mentioned, further North impact only on an open quarry.
- 5.6 Nitrogen**
- 5.7 Significant release of Nitrogen would not have a significant impact on surrounding properties.
  - 5.8 The liquid Nitrogen would on contact with the atmosphere turn into a gas and would be quickly dispersed into the atmosphere.

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## 6 Pre-emptive Control Systems

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- 6.1 The Ethylene Oxide (EO) plant has been engineered to fail safe under all circumstances.
  - 6.1.1 All pipe work and the EO chambers have been manufactured out of Stainless Steel.
  - 6.1.2 The process is controlled by computer and continuously monitored 24 hours per day with each process recorded for later analysis.
  - 6.1.3 The system has three (3) alarm levels for monitoring of parameters, first level is a warning alarm, the second, pauses the cycle and the third is abort cycle via the high temperature Thermal Oxidisers.
  - 6.1.4 The alarms are set specifically for different situations rather than an elevation system.
    - 6.1.4.1 For example, a slight drop in temperature of the chamber would create a warning alarm rather than a pause or abort however a further drop would pause the cycle.
  - 6.1.5 A partial loss of vacuum would immediately abort the cycle via the high temperature Thermal Oxidisers.

- 6.1.6 The system has a series of sensors, temperature probes and pressure sensors, which if the process fails to meet any one of the programmed parameters the process is aborted and the Nitrogen and or Ethylene Oxide is evacuated direct to the high temperature burners and is incinerated.
- 6.1.7 Steritech have instituted a planned maintenance program throughout the facility to ensure regular, inspections and maintenance of equipment with all sensors and other probes calibrated every 6 to 12 months.
- 6.1.8 A full induction process for staff and contractors is in place with all staff receiving regular training which is fully documented.
  - 6.1.8.1 Detailed annual safety training of all process related personnel is conducted and assessed.
- 6.1.9 Personnel protective equipment include in-line full face mask independent air systems, rescue equipment includes fully self-contained SCUBA equipment.
- 6.1.10 A full monitoring alarm display panel is used to advise of any issues and warn staff.
- 6.1.11 A detailed EO monitoring system of the immediate equipment areas is in place with alarms for appropriate low-level detection.
- 6.1.12 Fire equipment includes hose reels and handheld fire extinguishers.
- 6.1.13 Steritech have undertaken a series of audits, risk assessments and detailed reviews of all processes, the list is appended as Appendix 1.
- 6.1.14 Development of the Pollution Incident Response Management Plan included a detailed pollution risk matrix, which is appended in Appendix 2.
- 6.1.15 Safety Data Sheets are located in a highly visible red fire box at the front gate for use by the NSW Fire Brigade.

## **7 Maximum Quantities of Pollutants In use or Stored on Site**

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### **7.1 Ethylene Oxide**

7.2	Licence:	5,000kg
	In use:	750kg
	Typical Storage:	1,500kg to 3,000kg

### **7.3 Nitrogen**

7.4	Licence:	15,000 Litres
	Storage:	15,000 Litres

### **7.5 Cobalt 60**

7.6	Licence:	3 million Cu (Curies)
	In use:	approximately 1 million Cu (Curies)

## **8 Safety Equipment and Control Devices**

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- 8.1 The process is controlled by computer and continuously monitored 24 hours per day with each process recorded for later analysis, both by computer and maned control rooms.
  - 8.1.1 The process has a series of sensors, temperature probes and pressure sensors, which if the process fails to meet any one of the programmed parameters set in the system the process is aborted and the Nitrogen and or Ethylene Oxide is evacuated direct to the high temperature burners and is incinerated.
- 8.2 The system is designed under all circumstances to fail safe, see pollution risk matrix for full details.
- 8.3 Personnel protective equipment include in-line full face mask independent air systems, rescue equipment includes fully self-contained SCUBA equipment.
  - 8.3.1 The factory above each control room has a series of lights and siren alarms with full warning signage.
  - 8.3.2 Fire equipment includes hose reels and hand held fire extinguishers
- 8.4 A safety shower is located near the Ethylene Oxide store.

## **9      Pollution Incident Management**

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- 9.1 Pallet damaged during transition from delivery to warehouse storage.
  - 9.1.1 Majority of palletised goods are non-hazardous; the material would be cleaned up and the incident reported to the client.
- 9.2 The small quantity of potentially hazardous goods are controlled with the issue of Safety Data Sheets prior to delivery, the potential hazardous nature is assessed prior to acceptance of the goods for sterilisation.
  - 9.2.1 If goods are damaged in transit prior to delivery, the client is informed, if the goods are damaged at Steritech the material is cleaned up using PPE and disposed of as per client and SDS recommendations.
- 9.3 Liquid material is only a very small percentage of goods sterilised and are non-hazardous.
  - 9.3.1 A storm water shutoff valve has been fitted in the closest storm water drain to ensure no material hazardous or otherwise enters the storm water system.

### **9.4    Small leak of Ethylene Oxide**

- 9.4.1 Full abort of process, Ethylene Oxide evacuated to high temperature incinerators.
- 9.4.2 Maintenance team and operators to identify leak using full PPE.
- 9.4.3 Leak identified under direction of process engineers, repair leak
- 9.4.4 System test to ensure integrity of repair
- 9.4.5 Recomence process

### **9.5    Small leak of Nitrogen**

- 9.5.1 Full abort of process, Nitrogen evacuated to high temperature incinerators, mixed with air at normal atmospheric pressure and incinerated
- 9.5.2 Maintenance team and operators to identify leak using full PPE.
- 9.5.3 Leak identified under direction of process engineers, repair leak
- 9.5.4 System test to ensure integrity of repair
- 9.5.5 Recomence process

**9.6 Failure of Ethylene Oxide storage bottle through major connection leak or other circumstance**

- 9.6.1 Major failure of the system, alarm sounds, and all staff, contractors and visitors are to immediately evacuate the factory and assemble at the first evacuation point.
- 9.6.2 Evacuation of the factory will be as per the Steritech Fire Evacuation Plan, ensure all persons have safely evacuated.
- 9.6.3 If a person or persons are found to be missing, report their absence to the responding NSW Fire Brigade unit.
  - 9.6.3.1 Under no circumstances will staff re-enter the building.
- 9.6.4 Institute emergency communication protocol, a copy of the Pollution Incident Response Management Plan and Communication Protocol to be held in the office and should be available at the emergency assembly point.
  - 9.6.4.1 NSW Fire Brigade to be contacted immediately and other contacts as per the communication plan
- 9.6.5 All staff, contractors and visitors are to be moved further away, up wind of the factory, pending further advice from the NSW Fire Brigade Unit Station Officer.

**9.7 Failure of Nitrogen storage bottle through major connection leak or other circumstance**

- 9.7.1 Major failure of the system, alarm sounds, and all staff, contractors and visitors are to immediately evacuate the factory and assemble at the first evacuation point
- 9.7.2 Evacuation of the factory will be as per the Steritech Fire Evacuation Plan, ensure all persons have safely evacuated.
- 9.7.3 If a person or persons are found to be missing, report their absence to the responding NSW Fire Brigade unit. Under no circumstances will staff re-enter the building.

- 9.7.4 Institute emergency communication protocol, a copy of the Pollution Incident Response Management Plan and Communication Protocol to be held in the office and should be available at the emergency assembly point. NSW Fire Brigade to be contacted immediately and other contacts as per the communication plan
- 9.7.5 All staff, contractors and visitors are to be moved further away, up wind of the factory, pending further advice from the NSW Fire Brigade Unit Station Office.

## **9.8 Fire within the Warehouse**

- 9.8.1 Steritech Emergency Fire Management Plan to be followed.
  - 9.8.1.1 Fire Inspection Panel will be accessible at 5 Widemere Road.

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# **10 Control of Pollutants**

## **10.1 Ethylene Oxide**

- 10.1.1 Small leak of Ethylene Oxide would be identified and controlled via an immediate system abort and evacuation of remaining Ethylene Oxide in process (35kg) to the high temperature incinerators.
- 10.1.2 Major leak of Ethylene Oxide could result in a fire with explosive potential, the resulting fire will be toxic and will require the evacuation of the immediate area surrounding Steritech.

## **10.2 Nitrogen**

- 10.2.1 Small leak of Nitrogen would be identified and controlled via an immediate system abort and evacuation of remaining Nitrogen in the process mixed with air to the high temperature incinerators.
- 10.2.2 Failure of the large bottle storage would see the release of up to 15,000 litres of Nitrogen to atmosphere.

## **11 Steritech Co-ordinating Authority**

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11.1	General Manager NSW	Mr John Irwin
	Telephone:	02 8785 4400
	Mobile:	0418 479 461
	Email:	<a href="mailto:jirwin@steritech.com.au">jirwin@steritech.com.au</a>
11.2	Process Manager NSW:	Mr Kristian Velasquez
	Telephone:	02 8785 4400
	Mobile:	0400 300 831
	Email:	<a href="mailto:kvelasquez@steritech.com.au">kvelasquez@steritech.com.au</a>
11.3	Group Engineering Manager:	Mr Yannick Monzie
	Telephone:	03 8726 5516
	Mobile:	0408 651 483
	Email:	<a href="mailto:ymonzie@steritech.com.au">ymonzie@steritech.com.au</a>

## **12 Communication Protocol**

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### **12.1 Business Hours**

- 12.1.1 Immediate notification following this protocol will be made of an actual or potential pollution incident that may or is having an impact on the health, safety and local environment.
  - 12.1.1.1 The notification will be made by the NSW General Manager.

### **12.2 After Business Hours**

- 12.2.1 Immediate notification to emergency services
- 12.2.2 Contact the NSW General Manager or the Group Engineering Manager.
- 12.2.3 All other notifications following the communication protocol will be made by the General Manager or Group Engineering Manager.

## **12.3 Communication**

12.3.1 The following agencies are to be contacted:

12.3.1.1 Police, Fire and Ambulance (as required)  
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12.3.2 Local stations:

12.3.2.1 Fairfield Police Station  
9728 8399

12.3.2.2 Wetherill Park Police Station  
8288 5799

12.3.3 NSW Fire Brigade, local responding fire station:

12.3.3.1 Smithfield Fire Station  
9609 2343

12.3.3.2 Fairfield Fire Station & St Mary's HAZMAT Station  
9726 1139

12.3.4 EPA Pollution report environment line  
131555

12.3.5 Ministry of Health, Camperdown Hospital environmental health  
9515 9420

12.3.6 WorkCover Hot Line  
13 10 50

12.3.7 Fairfield City Council  
9725 0222

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## **13 Contacts local businesses bordering Steritech**

### **13.1 North**

13.1.1 Penrite  
Wayne Burton  
9 Widemere Road  
02 7200 7160

### **13.2 South**

- 13.2.1 Michael Weinig Australia  
3 Widemere Road  
02 9609 5911

### **13.3 West**

- 13.3.1 Freight Specialists  
Dennis Stewart  
2 Davis Road  
02 9756 3455
- 13.3.2 Yusen Logistics  
Chris Moor/Gary Slater  
3 Davis Road  
02 9612 2100

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## **14 References**

### **14.1 Appendix 1 – List of Audits, Risk Assessments and Reports Commissioned by Steritech**

- 14.1.1 Industry & Environmental Consultants Pty Ltd
- 14.1.1.1 Statement of Environmental Effects & Preliminary Hazard Analysis – April 2001
- 14.1.2 Noel Arnold & Associates
- 14.1.2.1 Dangerous Goods Storage Risk Assessment - March 2007
- 14.1.2.2 Requirements for the Proposed Ethylene Oxide Store
- 14.1.2.3 Hazard Audit report - August 2007
- 14.1.3 Steritech Pty Ltd
- 14.1.3.1 Emission Monitoring Analysis – July 2007
- 14.1.3.2 J & J Ethylene Oxide Steriliser Hazard & Operability Study – September 2007
- 14.1.4 Coffey Environmental Specialists
- 14.1.4.1 OH&S & E Review on ETO Plant Operations – September 2007

14.1.4.2 ETO Sterilisation Facility EH&S Audit – January 2008

14.1.5 C.C. Weston & Associates

14.1.5.1 Statement of Environmental Effects – November 2009

14.1.6 BKB Training & Management Consultants

14.1.6.1 Pollution Incident Response Management Plan – January 2013

## **14.2 Appendix 2 – Safety Data Sheets**

14.2.1 Ethylene Oxide

14.2.2 Liquid Nitrogen

## **14.3 Appendix 3**

14.3.1 Pollution Assessment Risk Matrix & Risk Matrix Tables

## **14.4 Appendix 4**

14.4.1 Stormwater Drain System

# STEREO

Gas For Life

## SAFETY DATA SHEET

### ETHYLENE OXIDE

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Supersedes: 2/11/15

## 1. IDENTIFICATION OF THE SUBSTANCE / PREPARATION AND OF THE COMPANY

Product name	Ethylene Oxide		
Chemical formula	C <sub>2</sub> H <sub>4</sub> O		
Uses	Medical sterilization; chemical intermediate.		
Synonyms	Oxirane; 1,2-Epoxy ethane		
Company	STEREO SDN BHD 37 Lorong Sungai Puloh 1A/KU 6, Taman Teknologi Gemilang, Kaw. Perindustrian Sungai Puloh, 41050 Klang, Selangor, Malaysia T: +60 3 3290 2263 / F: +60 3 3290 2016 E: stereostereocorp.com   www.stereocorp.com		

## 2. HAZARDS IDENTIFICATION

Classified as dangerous according to the criteria of Regulation EC No 1272/2008

Hazards identification	GHS02 - Extremely flammable gas GHS04 - Gas under pressure; may explode if heated. GHS06 - Toxic by inhalation. GHS08 - Irritating to eyes, respiratory system and skin. GHS08 - May cause cancer. GHS08 - May cause heritable genetic defects.	H220 /category 1 H280 / Liquefied gas H331 /category 3 H335 /category 3 H350 / category 1B H340 / category 1B
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GHS classification

Hazard pictograms/symbols



GHS02

GHS04

GHS06

GHS08

## 3. COMPOSITION / INFORMATION ON INGREDIENTS

Substance/Preparation	Substance.
Components/Impurities	Contains no other components or impurities which will influence the classification of the product.
CAS Number	75-21-8
EC Number (from EINECS)	200-849-9

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## **4. FIRST AID MEASURES**

General Information	DO NOT attempt to rescue the victim unless proper respiratory protection is worn. Take appropriate steps to avoid fire, explosion and inhalation hazards. Contaminated leather articles including shoes cannot be decontaminated and should be destroyed to prevent reuse.
Inhalation	Toxic by inhalation. In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation. In low concentrations may cause narcotic effects. Symptoms may include dizziness, headache, nausea and loss of co-ordination. Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.
Skin/eye contact	Remove contaminated clothing. Obtain medical assistance. Immediately flush eyes thoroughly with water for at least 15 minutes. May cause chemical burns to skin and cornea (with temporary disturbance to vision).
Ingestion	Ingestion is not considered a potential route of exposure.

## **5. FIRE FIGHTING MEASURES**

Specific hazards	Exposure to fire may cause containers to rupture/explode.
Hazard combustion products	Incomplete combustion may form carbon monoxide.
Suitable extinguishing media	All known extinguishants can be used
Specific methods	If possible, stop flow of product. Continue water spray from protected position until container stays cool. Move away from the container and cool with water from a protected position. Do not extinguish a leaking gas flame unless absolutely necessary. Spontaneous/explosive re-ignition may occur. Extinguish any other fire.
Protective equipment	Use self-contained breathing apparatus. Use chemically protective clothing.

## **6. ACCIDENTAL RELEASE MEASURES**

Personal precautions	Evacuate area. Use self-contained breathing apparatus and chemically protective clothing. Eliminate ignition sources. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe. Ensure adequate air ventilation.
Environmental precautions	Try to stop release. Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous. Reduce vapour with fog or fine water spray.
Clean up methods	Ventilate area. Keep area evacuated and free from ignition sources until any spilled liquid has evaporated. (Ground free from frost). Hose down area with water. Wash contaminated equipment or sites of leaks with copious quantities of water.

## **7. HANDLING AND STORAGE**

Storage	Segregate from oxidant gases and other oxidants in store Store containers tightly closed and dry: - in a cool, well-ventilated area - away from direct sunlight - away from any source of ignition (including static discharge)
Handling :	Ensure equipment is adequately earthed. Suck back of water into the container must be prevented. Purge air from system before introducing gas. Do not allow backfeed into the container. Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Contact your gas supplier if in doubt.

## **8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

Engineering measures	Provide adequate general and local exhaust ventilation to maintain concentrations below exposure and flammable limits.
Personal protective equipment	Respiratory protection: In case of leakage, use self-contained breathing apparatus. Hand protection : Impervious gloves. Eye protection : Safety glasses. A safety shower and eyewash station should be readily available. Skin and body protection: Coveralls, boots, and/or other resistant protective clothing.

## **9. PHYSICAL AND CHEMICAL PROPERTIES**

Physical state at 20 °C	Liquefied gas.
Colour	Colourless.
Odour	Ethereal. Poor warning properties at low concentrations.
Molecular weight	44
Melting point	-112 °C
Boiling point	10.4 °C
Critical temperature	196 °C
Vapour pressure, 20°C	1.4 bar
Relative density, liquid	0.89 (water=1)
Solubility in water	Completely miscible.
Flammability range	3 to 100 (vol% in air)
Auto-ignition temperature	440 °C
Other data	Gas/vapour heavier than air. May accumulate in confined spaces, particularly at or below ground level.

## 10. STABILITY AND REACTIVITY

Stability	Can form explosive mixture with air. May decompose violently at high temperature and/or pressure or in the presence of a catalyst May polymerize.
Conditions to avoid :	- air or oxygen - water, humidity. - high temperatures
Materials to avoid :	Oxidizing agents, acids, organic bases, amines, ammonia, and certain salts. Reacts explosively with certain alcohols or mercaptans. Reacts with HCl to form highly toxic ethylene chlorohydrins. Avoid copper, silver, magnesium, mercury, and their salts.

## 11. TOXICOLOGICAL INFORMATION

Acute toxicity	LD <sub>50</sub> /oral/rat: 72 mg/kg LC <sub>50</sub> /inhal/rat: 2.92 mg/l / 15min 1.44 mg/l / 4h
Irritating effects	Skin: Very irritating Eye: Very irritating
Is possible	Ethylene oxide caused damage to the blood picture and nervous system in an animal test after sub chronic exposure. The substance exhibits mutagenic properties (modifying the genetic make-up) in various test systems (microorganisms, cell cultures, mammals). The substance exhibits a carcinogenic effect in animal testing under the effect of long-term inhalation. In animals, an increased malformation rate in the maternal toxicity range has been observed.
Further information	Symptoms of contamination may occur after hours. Product can be absorbed over the skin. After inhalation of fairly large quantities: nausea, headache, vomiting, excitation, unconsciousness.

## 12. ECOLOGICAL INFORMATION

Acute Toxicity	Fish : Harmful: 10 < LC/EC/IC50 <= 100 mg/l Aquatic Invertebrates : Low toxicity: LC/EC/IC50 > 100 mg/l Microorganisms : Harmful: 10 < LC/EC/IC50 <= 100 mg/l
Mobility	When released to air, transfers to soil or water by wet and dry deposition.
Persistence/degradability	Dissolves in water. Inherently biodegradable.
Bioaccumulation	Rapidly hydrolyses in water and soil. Does not have the potential to bioaccumulate significantly.

## 13. DISPOSAL CONSIDERATIONS

Product	Must be dumped or incinerated in accordance with local regulations
Contaminated packaging	Uncontaminated packaging can be re-used. Packs that can not be cleaned should be disposed of at a licensed site.

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## 14. TRANSPORT INFORMATION

Proper shipping name	Ethylene Oxide or Ethylene Oxide with Nitrogen
UN Nr	1040
Class	2
ADR/RID Classification code	2TF
ADR/RID Hazard Nr	263
Packing group	None
Labeling ADR	Label 2.3: toxic substance. Label 2.1: flammable gas
IMDG EmS codes	F-D, S-U
IMDG Marine pollutant	No
Passenger aircraft	FORBIDDEN

## 15. REGULATORY INFORMATION

EC Label Name :	ETHYLENE OXIDE
EC Annex I Number :	603-023-00-X
EC symbols	F+ Extremely flammable. T Toxic.
EC Risk Phrases :	R12 Extremely flammable R23 Toxic by inhalation R36/37/38 Irritating to eyes, respiratory system and skin R45 May cause cancer. R46 May cause heritable genetic damage.
EC Safety Phrases :	S53 Avoid exposure. Obtain special instructions before use. S45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

## 16. OTHER INFORMATION

The information contained herein is based on our current knowledge of the underlying data and is intended to describe the product for the purpose of health, safety and environmental requirements only. No warranty or guarantee is expressed or implied regarding the accuracy of these data or the results to be obtained from the use of the product.

Recipients of our product must take responsibility for observing existing laws and regulations

## SAFETY DATA SHEET

# 071

### 1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

#### 1.1 Product identifier

Product name LIQUID NITROGEN

Synonym(s) 071 - SDS NUMBER • 709, 712, 716 • NITROGEN (LIQUEFIED) (FORMERLY) • PRODUCT CODES: 701, 702, 703, 704, 705, 706, 707, 708, 719

#### 1.2 Uses and uses advised against

Use(s) CRYOGEN • FREEZING APPLICATIONS • HEAT TRANSFER MEDIUM • INERT GAS • LOW TEMPERATURE APPLICATIONS • PURGING • SEMICONDUCTORS

#### 1.3 Details of the supplier of the product

Supplier name BOC LIMITED (AUSTRALIA)

Address 10 Julius Avenue, North Ryde, NSW, 2113, AUSTRALIA

Telephone 131 262, (02) 8874 4400

Fax 132 427 (24 hours)

Website <http://www.boc.com.au>

#### 1.4 Emergency telephone number(s)

Emergency 1800 653 572 (24/7) (Australia only)

### 2. HAZARDS IDENTIFICATION

#### 2.1 Classification of the substance or mixture

CLASSIFIED AS HAZARDOUS ACCORDING TO AUSTRALIAN WHS REGULATIONS

GHS classification(s) Gases Under Pressure: Refrigerated liquefied gas

#### 2.2 Label elements

Signal word WARNING

Pictogram(s)



#### Hazard statement(s)

H281 Contains refrigerated gas; may cause cryogenic burns or injury.

#### Prevention statement(s)

P282 Wear cold insulating gloves/face shield/eye protection.

#### Response statement(s)

P315 Get immediate medical advice/attention.

P336 Thaw frostbitten parts with lukewarm water. Do not rub affected area.

#### Storage statement(s)

P403 Store in a well-ventilated place.

#### Disposal statement(s)

None allocated.

**PRODUCT NAME LIQUID NITROGEN**

**2.3 Other hazards**

Asphyxiant. Effects are proportional to oxygen displacement.

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**3. COMPOSITION/ INFORMATION ON INGREDIENTS**

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**3.1 Substances / Mixtures**

Ingredient	CAS Number	EC Number	Content (v/v)
NITROGEN	7727-37-9	231-783-9	>99.9%

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**4. FIRST AID MEASURES**

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**4.1 Description of first aid measures**

Eye	Cold burns: Immediately flush with tepid water or with sterile saline solution. Hold eyelids apart and irrigate for 15 minutes. Seek medical attention.
Inhalation	If inhaled, remove from contaminated area. To protect rescuer, use an Air-line respirator or Self Contained Breathing Apparatus (SCBA). Apply artificial respiration if not breathing. Give oxygen if available. For advice, contact a Poison Information Centre on 13 11 26 (Australia Wide) or a doctor.
Skin	Cold burns: Remove contaminated clothing if not stuck to the skin. Gently flush affected areas with warm water (30°C) for 15 minutes. Apply sterile dressing and treat as for a thermal burn. For large burns, immerse in warm water for 15 minutes. DO NOT apply any form of direct heat. Seek immediate medical attention.
Ingestion	Due to product form and application, ingestion is considered unlikely.
First aid facilities	Eye wash facilities and safety shower should be available.

**4.2 Most important symptoms and effects, both acute and delayed**

In high concentrations may cause asphyxiation. Direct contact with the liquefied material or escaping compressed gas may cause frostbite injury.

**4.3 Immediate medical attention and special treatment needed**

Treat symptomatically.

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**5. FIRE FIGHTING MEASURES**

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**5.1 Extinguishing media**

Use water fog to cool containers from protected area.

**5.2 Special hazards arising from the substance or mixture**

Non flammable.

**5.3 Advice for firefighters**

Temperatures in a fire may cause cylinders to rupture. Cool cylinders or containers exposed to fire by applying water from a protected location. Remove cool cylinders from the path of the fire. Evacuate the area if unable to keep cylinders cool. Do not approach cylinders or containers suspected of being hot.

**5.4 Hazchem code**

- 2T  
2      Fine Water Spray.  
T      Wear full fire kit and breathing apparatus. Dilute spill and run-off.

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**6. ACCIDENTAL RELEASE MEASURES**

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**6.1 Personal precautions, protective equipment and emergency procedures**

If the cylinder is leaking, evacuate area of personnel. Inform manufacturer/supplier of leak. Use Personal Protective Equipment (PPE) as detailed in Section 8 of the SDS. Ventilate area where possible and eliminate ignition sources.

**6.2 Environmental precautions**

Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.

**6.3 Methods of cleaning up**

Stop the flow of material, if this is without risk. If the leak is irreparable, move the cylinder to a safe and well ventilated area, and allow to discharge. Keep area evacuated and free from ignition sources until any leaked or spilled liquid has evaporated.

**PRODUCT NAME LIQUID NITROGEN****6.4 Reference to other sections**

See Sections 8 and 13 for exposure controls and disposal.

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**7. HANDLING AND STORAGE**

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**7.1 Precautions for safe handling**

Before use carefully read the product label. Use of safe work practices are recommended to avoid eye or skin contact and inhalation. Observe good personal hygiene, including washing hands before eating. Prohibit eating, drinking and smoking in contaminated areas.

**7.2 Conditions for safe storage, including any incompatibilities**

Portable liquid container should be stored below 45°C in a secure area and upright to prevent from falling. Portable liquid containers should also be stored in a dry, well ventilated area constructed of non-combustible material with firm level floor (preferably concrete), away from areas of heavy traffic and emergency exits.

**7.3 Specific end use(s)**

No information provided.

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**8. EXPOSURE CONTROLS / PERSONAL PROTECTION**

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**8.1 Control parameters****Exposure standards**

Ingredient	Reference	TWA		STEL	
		ppm	mg/m <sup>3</sup>	ppm	mg/m <sup>3</sup>
Nitrogen	SWA (AUS)			Asphyxiant	

**Biological limits**

No biological limit values have been entered for this product.

**8.2 Exposure controls**

**Engineering controls** Avoid inhalation. Use in well ventilated areas. Where an inhalation risk exists, mechanical explosion proof extraction ventilation is recommended.

**PPE**

- |                    |  |
|--------------------|--|
| <b>Eye / Face</b>  | Wear safety glasses.   |
| <b>Hands</b>       | Wear leather or insulated gloves.  |
| <b>Body</b>        | Wear coveralls.  |
| <b>Respiratory</b> | Where an inhalation risk exists, wear Self Contained Breathing Apparatus (SCBA) or an Air-line respirator. |



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**9. PHYSICAL AND CHEMICAL PROPERTIES**

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**9.1 Information on basic physical and chemical properties**

Appearance	COLOURLESS LIQUID
Odour	ODOURLESS
Flammability	NON FLAMMABLE
Flash point	NOT RELEVANT
Boiling point	-195.8°C
Melting point	NOT AVAILABLE
Evaporation rate	NOT APPLICABLE
pH	NOT APPLICABLE
Vapour density	NOT AVAILABLE
Specific gravity	NOT APPLICABLE
Solubility (water)	0.0149 cm <sup>3</sup> gas/cm <sup>3</sup>
Vapour pressure	NOT AVAILABLE
Upper explosion limit	NOT RELEVANT

**PRODUCT NAME LIQUID NITROGEN**

**9.1 Information on basic physical and chemical properties**

Lower explosion limit	NOT RELEVANT
Partition coefficient	NOT AVAILABLE
Autoignition temperature	NOT AVAILABLE
Decomposition temperature	NOT AVAILABLE
Viscosity	NOT AVAILABLE
Explosive properties	NOT AVAILABLE
Oxidising properties	NOT AVAILABLE
Odour threshold	NOT AVAILABLE

**9.2 Other information**

% Volatiles	100 %
Critical pressure	3400 kPa
Critical temperature	-146.9°C

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## 10. STABILITY AND REACTIVITY

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**10.1 Reactivity**

Carefully review all information provided in sections 10.2 to 10.6.

**10.2 Chemical stability**

Stable under recommended conditions of storage.

**10.3 Possibility of hazardous reactions**

Polymerization will not occur.

**10.4 Conditions to avoid**

Avoid heat, sparks, open flames and other ignition sources.

**10.5 Incompatible materials**

Compatible with most commonly used materials.

**10.6 Hazardous decomposition products**

May evolve toxic gases if heated to decomposition.

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## 11. TOXICOLOGICAL INFORMATION

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**11.1 Information on toxicological effects**

Acute toxicity	<b>Information available for the product:</b> Based on available data, the classification criteria are not met.
Skin	Not classified as a skin irritant. Contact with the liquefied material or escaping compressed gas may cause frostbite injury.
Eye	Not classified as an eye irritant. Contact with the liquefied material or escaping compressed gas may cause frostbite injury.
Sensitization	Not classified as causing skin or respiratory sensitisation.
Mutagenicity	Not classified as a mutagen.
Carcinogenicity	Not classified as a carcinogen.
Reproductive	Not classified as a reproductive toxin.
STOT – single exposure	Asphyxiant. Effects are proportional to oxygen displacement. Over exposure may result in dizziness, drowsiness, weakness, fatigue, breathing difficulties and unconsciousness.
STOT – repeated exposure	Not classified as causing organ effects from repeated exposure.
Aspiration	Not classified as causing aspiration.

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## 12. ECOLOGICAL INFORMATION

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**12.1 Toxicity**

No information provided.

**12.2 Persistence and degradability**

No information provided.

**PRODUCT NAME LIQUID NITROGEN****12.3 Bioaccumulative potential**

No information provided.

**12.4 Mobility in soil**

No information provided.

**12.5 Other adverse effects**

No ecological damage caused by this product. Nitrogen is the major component of the atmosphere (78 % v/v). It is a fairly unreactive gas and will not contribute to ozone depletion or global warming. If released to soil or water, nitrogen will quickly disperse to the atmosphere. Not toxic to plants or animals except at extremely high (asphyxiating) levels.

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**13. DISPOSAL CONSIDERATIONS**

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**13.1 Waste treatment methods**

**Waste disposal** Cylinders should be returned to the manufacturer or supplier for disposal of contents.

**Legislation** Dispose of in accordance with relevant local legislation.

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**14. TRANSPORT INFORMATION**

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**CLASSIFIED AS A DANGEROUS GOOD BY THE CRITERIA OF THE ADG CODE**



	LAND TRANSPORT (ADG)	SEA TRANSPORT (IMDG / IMO)	AIR TRANSPORT (IATA / ICAO)
<b>14.1 UN Number</b>	1977	1977	1977
<b>14.2 Proper Shipping Name</b>	NITROGEN, REFRIGERATED LIQUID	NITROGEN, REFRIGERATED LIQUID	NITROGEN, REFRIGERATED LIQUID
<b>14.3 Transport hazard class</b>	2.2	2.2	2.2
<b>14.4 Packing Group</b>	None Allocated	None Allocated	None Allocated

**14.5 Environmental hazards** No information provided

**14.6 Special precautions for user**

**Hazchem code** 2T

**GTEPG** 2C3

**EMS** F-C, S-V

**Other information** Transport on open top vehicles in accordance with local legislation.

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**15. REGULATORY INFORMATION**

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

**Poison schedule** A poison schedule number has not been allocated to this product using the criteria in the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP).

**Classifications** Safework Australia criteria is based on the Globally Harmonised System (GHS) of Classification and Labelling of Chemicals.

The classifications and phrases listed below are based on the Approved Criteria for Classifying Hazardous Substances [NOHSC: 1008(2004)].

**Hazard codes** None allocated.

**Risk phrases** None allocated.

**Safety phrases** None allocated.

**PRODUCT NAME LIQUID NITROGEN**

**Inventory listing(s)** AUSTRALIA: AICS (Australian Inventory of Chemical Substances)  
All components are listed on AICS, or are exempt.

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**16. OTHER INFORMATION**

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**Additional information** The storage of significant quantities of gas cylinders must comply with AS4332 The storage and handling of gases in cylinders.

APPLICATION METHOD: Specialised liquid distribution system. Vapourised liquid distributed through pressure and flow controlled distribution systems.

**PERSONAL PROTECTIVE EQUIPMENT GUIDELINES:**

The recommendation for protective equipment contained within this report is provided as a guide only. Factors such as method of application, working environment, quantity used, product concentration and the availability of engineering controls should be considered before final selection of personal protective equipment is made.

**HEALTH EFFECTS FROM EXPOSURE:**

It should be noted that the effects from exposure to this product will depend on several factors including: frequency and duration of use; quantity used; effectiveness of control measures; protective equipment used and method of application. Given that it is impractical to prepare a ChemAlert report which would encompass all possible scenarios, it is anticipated that users will assess the risks and apply control methods where appropriate.

**Abbreviations**

ACGIH	American Conference of Governmental Industrial Hygienists
CAS #	Chemical Abstract Service number - used to uniquely identify chemical compounds
CNS	Central Nervous System
EC No.	EC No - European Community Number
EMS	Emergency Schedules (Emergency Procedures for Ships Carrying Dangerous Goods)
GHS	Globally Harmonized System
GTEPG	Group Text Emergency Procedure Guide
IARC	International Agency for Research on Cancer
LC50	Lethal Concentration, 50% / Median Lethal Concentration
LD50	Lethal Dose, 50% / Median Lethal Dose
mg/m <sup>3</sup>	Milligrams per Cubic Metre
OEL	Occupational Exposure Limit
pH	relates to hydrogen ion concentration using a scale of 0 (high acidic) to 14 (highly alkaline).
ppm	Parts Per Million
STEL	Short-Term Exposure Limit
STOT-RE	Specific target organ toxicity (repeated exposure)
STOT-SE	Specific target organ toxicity (single exposure)
SUSMP	Standard for the Uniform Scheduling of Medicines and Poisons
SWA	Safe Work Australia
TLV	Threshold Limit Value
TWA	Time Weighted Average

**Report status**

This document has been compiled by RMT on behalf of the manufacturer, importer or supplier of the product and serves as their Safety Data Sheet ('SDS').

It is based on information concerning the product which has been provided to RMT by the manufacturer, importer or supplier or obtained from third party sources and is believed to represent the current state of knowledge as to the appropriate safety and handling precautions for the product at the time of issue. Further clarification regarding any aspect of the product should be obtained directly from the manufacturer, importer or supplier.

While RMT has taken all due care to include accurate and up-to-date information in this SDS, it does not provide any warranty as to accuracy or completeness. As far as lawfully possible, RMT accepts no liability for any loss, injury or damage (including consequential loss) which may be suffered or incurred by any person as a consequence of their reliance on the information contained in this SDS.

**PRODUCT NAME LIQUID NITROGEN**

**Prepared by**

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**[ End of SDS ]**






Consequence					Likelihood	
Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5		
11	16	20	23	25	5	High, Almost Certain (20-25)
7	12	17	21	24	4	Significant, Likely (16-19)
4	8	13	18	22	3	Medium, Possible (11-15)
2	5	9	14	19	2	Low, Unlikely (1-10)
1	3	6	10	15	1	Rare, Very Unlikely

Risk Level and Associated Action		
Risk Score		Action
20-25	High Risk	Immediate action required
16-19	Significant Risk	Action plan required, executive management attention
11-15	Medium Risk	Specific monitoring or procedures required, management responsibility specified
1-10	Low Risk	Managed through routine procedures, audits and processes
0 - 1	Insignificant	Managed through policy, training and review by management and OH&S Committee

Consequences if Risk Occurs	
Catastrophic	Death or large number of serious injuries. Loss of confidence of Government and general public, very large and serious financial loss and legal action.
Major	Serious injury (LTI), extensive injuries, serious financial loss, Government investigation and media coverage, loss of high calibre staff, serious damage to facilities/property.
Moderate	Medical treatment required, financial loss, environmental impact, potential loss of staff.
Minor	First aid treatment, some environmental and/or financial impact and minor property damage.
Insignificant	Minor first aid no environmental impact and /or financial impact

Likelihood of Risk	
High - Almost Certain	Very likely ( <i>could happen any time</i> )
Significant - Likely	Probably occur in most circumstances
Medium - Possible	Potential to happen sometime
Low - Unlikely	Could happen but very rarely
Rare - Very Unlikely	Could happen but probably never will

## Appendix 3

ET CH 10

### Staff to Verify

### Staff to Verify

### Staff to Complete

Item	Location	Hazard Description	Staff to Verify			Pollution Risk	Further Action	Hierarchy	Mitigated Pollution Risk			Further Action	
			Existing Controls	Consequence	Likelihood				Consequence	Likelihood	Risk		
1	EO Bottle Storage	Damage to ETO bottle on delivery possible release of up to 700kg to atmosphere	Bottle stored near EO Connection point secured on special steel pallet with two straps	Catastrophic	Very Rare	19	Uncontrolled release of Ethylene Oxide with high potential for violent explosion	Relocate EO bottle under awning away from direct sun light & vehicle movement to resupply	Eliminate	Catastrophic	Very Rare	15	
2		Cylinder/valve damage possible release of up to 700kg to atmosphere	Bottle stored near EO Connection point secured on special steel pallet with two straps moved by fork	Catastrophic	Very Rare	19	Uncontrolled release of Ethylene Oxide with high potential for violent explosion	Bottles are moved by fully licensed truck drivers with many years experience	Administrative	Catastrophic	Very Rare	15	
								there are little to no obstructions in the path to the EO storage and decent area					
								A safety audit should be undertaken every 2 years across the factory					
3	Decant EO bottle to System	Failure to connect EO bottle correctly potential for EO escape	Standard operating procedures in place inspection and computer sensor manage system PPE to be worn	Major	Low	14	Potential for leak from fitting of Ethylene Oxide potential health risk potential fire risk	Employees to undertake annual training, connecting & management of EO bottle storage and decanting process	Administrative	Major	Very Rare	10	
4	Decant EO bottle to System	Failure to disconnect EO bottle correctly residual escape of EO	Standard operating procedures in place PPE to be worn	Minor	Low	8	Minor release of residual Ethylene Oxide mixed with Nitrogen, minor risk to health	Employees to undertake annual training, connecting & management of EO bottle storage and decanting process	Administrative	Minor	Rare	3	
5	Decanted EO bottle storage	Empty bottle left in rear yard awaiting pick up, potential for damage by vehicle	Decanted EO bottle purged with nitrogen as part of decanting process little to no Ethylene Oxide would be present in the bottle	Minor	Low	5	Little to no pollution risk	Ensure all vehicle movement is monitored and drivers are aware of bottle location	Administrative	Minor	Rare	3	
6	ETO Chamber 10	Boiler failure, no steam	System sensors detect no steam system aborts sterilisation process	Insignificant	Rare	1	No pollution risk	Computer monitored and controlled specific parameters established specific action designed to ensure safety of staff, integrity of product and mitigate pollution risk to very low level	Administrative	Insignificant	Rare	1	
7		Pump failure	System sensors detect pump failure aborts sterilisation process Process is also designed with redundant equipment re-pumps	Insignificant	Rare	1	No pollution risk	Computer monitored and controlled specific parameters established specific action designed to ensure safety of staff, integrity of product and mitigate pollution risk to very low level	Administrative	Insignificant	Rare	1	
8		Loss of electricity to the plant	Power failure prior to commencement of sterilisation process system aborts	Insignificant	Rare	1	No pollution risk	Computer monitored and controlled specific parameters established specific action designed to ensure safety of staff, integrity of product and mitigate pollution risk to very low level. Main computer system backed up by 3 hour UPS supply	Administrative	Insignificant	Rare	1	
9		Loss of electricity during Nitrogen charge process	Nitrogen within the chamber held until power restored, UPS ensures integrity of each process using integrated data prior to power failure	Insignificant	Rare	1	No pollution risk	Computer monitored and controlled specific parameters established specific action designed to ensure safety of staff, integrity of product and mitigate pollution risk to very low level. Main computer system backed up by 3 hour UPS supply	Administrative	Insignificant	Rare	1	
10		Loss of electricity during charge of Ethylene Oxide (EO)	Ethylene Oxide held in chamber until power restored	Minor	Low	5	Possible very small risk of escape of Ethylene Oxide through flange joints	Computer monitored and controlled specific parameters established specific action designed to ensure safety of staff, integrity of product and mitigate pollution risk to very low level. Main computer system backed up by 3 hour UPS supply	Administrative	Minor	Rare	3	
11		Loss of electricity impact on burners	Burners supplied with natural gas no impact	Insignificant	Rare	1	No pollution risk	Computer monitored and controlled specific parameters established specific action designed to ensure safety of staff, integrity of product and mitigate pollution risk to very low level. Main computer system backed up by 3 hour UPS supply	Engineering	Insignificant	Rare	1	
12		Loss of Nitrogen through pipe failure or flange joint failure	Computer monitored and controlled specific parameters established loss of Nitrogen would drop pressure and would be detected with process immediately aborted until leak identified and repaired	Moderate	Medium	13	Possible very small risk of escape of Nitrogen through flange joints	Computer monitored and controlled specific parameters established specific action designed to ensure safety of staff, integrity of product and mitigate pollution risk to very low level. Main computer system backed up by 3 hour UPS supply	Administrative	Minor	Rare	8	
13		Loss of Ethylene Oxide through pipe or flange joint seal failure	Computer monitored and controlled specific parameters established loss of Ethylene Oxide would drop pressure and would be detected with process immediately aborted until leak identified and repaired PPE includes both in-line independent air supplied system and fully self contained independent air systems EO exhausted to burners	Major	Low	14	Possible very small risk of escape of Ethylene Oxide would be a health risk to staff, potential fire risk	Computer monitored and controlled with data sensors throughout process a very small drop in pressure would be detected and system alarmed and action taken. All pipe work and flange joints are manufactured in Stainless Steel to mitigate against pipe failure. A detailed planned maintenance program mitigates against flange joint failure.	Administrative Engineering	Major	Rare	10	
14		Burner failure	Process is immediately aborted until fault rectified The process of sterilisation will not commence until system verifies that burners are operating. Loss of natural gas due to supply fault, system would abort EO if charged to chamber would be held within chamber 8 until supply restored	Major	Rare	10	Ethylene Oxide process is a sealed system with EO held in pipe and chamber until gas supply fault can be rectified in circumstances of significant delay possible minor leaching of EO is possible	Employees to undertake annual training on EO process and possible consequences of potential failures or loss of critical supply of natural gas or electricity	Administrative Engineering	Major	Rare	10	
15		Aeration Chamber vacuum pump failure to exhaust residual EO to burners	Aeration chamber is monitored on a continual basis, down to 5 ppm vacuum pump failure would be registered by the monitoring computer system and the system would fault in alarm	Moderate	Rare	6	Minor pollution risk the monitoring computer management system would fault in alarm if residual EO was not exhausted to burners.	Staff to receive annual training in system, process and significance of alarms Staff as per operating procedure should be wearing full PPE when the doors are opened. Doors should be interlocked to local alarm	Administrative Engineering	Moderate	Rare	6	
16	Factory	Impact of plant of external agency, meteorite or aircraft potentially cause sufficient damage to rupture EO bottle connections and pipe work, this could lead to destruction of the plant through catastrophic fire and explosion	Non	Catastrophic	Rare	16	plant is not under existing flight paths impact of a meteorite would be considered an extremely rare event.	The potential consequences of aircraft or meteorite impact would be catastrophic with significant release of Ethylene Oxide potentially leading to significant plant damage and staff injuries through fire and explosion releasing toxic gas and smoke into the atmosphere with significant impact on surrounding property	The factory has purchased the property on the Northern border, the rear of the property bordering the Western side of the building is part of the Liverpool direct bus lanes the property to the South is located on the side of the property removed from the Ethylene Oxide storage and sterilisation process operations	Administrative Engineering	Catastrophic	Rare	16
		Toxic smoke, fire fighting water runoff, impacting on local storm water drains and local creeks											
17	Factory	Earthquake impact on factory potentially cause sufficient damage to rupture EO bottle connections and pipe work, this could lead to destruction of the plant through catastrophic fire and explosion	Non	Catastrophic	Rare	16	Earthquakes in Australia and in Sydney are not rare, but earthquakes of sufficient intensity to be noticeable are rare Earthquakes with an intensity to cause significant damage to property of a well engineered plant are here in Australia virtually unknown	The factory has purchased the property on the Northern border, the rear of the property bordering the Western side of the building is part of the Liverpool direct bus lanes the property to the South is located on the side of the property removed from the Ethylene Oxide storage and sterilisation process operations	Administrative Engineering	Catastrophic	Rare	16	
		Toxic smoke, fire fighting water runoff, impacting on local storm water drains and local creeks											
18	Factory	Terrorism	The factory is manned 24 hours per day the gates are not closed after hours and there are after hours security patrols	Catastrophic	Rare	15	Pollution risk would be dependent on objectives of the terrorism event from worst case use of an Ethylene bottle	Security systems and policy should be reviewed, gates should be closed after hours A direct relationship should be developed with	Administrative Engineering	Catastrophic	Rare	15	

19	Fire within office or palleted goods areas	<p>Fire fighting hand held extinguishers are located throughout the premises to control small fires. If a fire can not be easily extinguished or is near Ethylene Oxide pipe or storage areas, the factory will be evacuated and staff directed to assemble at the emergency assembly point. Hazard data sheets are located at the front gate for use by the NSW Fire Brigade.</p>	Major	Low	14	<p>Toxic smoke and fire water run off into local storm water drains, serious fire could threaten the Ethylene Oxide store, though this store is located on the outside of the factory behind fire rated brick wall and is open to the air on the Eastern face of the building. Of more concern would be the potential damage to pipe work that may contain residual Ethylene Oxide within the pipes.</p>	<p>to create a explosive device to publicity without violence</p> <p>with senior police offices within the district to ensure adequate police response</p>	<p>MSDS book at front gate to be up-dated with all relevant hazard material including Ethylene Oxide and Cobalt 60</p> <p>A direct relationship should be developed with local NSW Fire Brigade Station Commander so if a fire were to occur adequate and timely brigade resources could be engaged quickly</p> <p>Note a sign at the front gate or close to factory indicating the hazard of fire and the presence of significant quantities of Ethylene Oxide should be installed</p>	Administrative Engineering	Major	Rare	10	
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## Appendix 3

### Cobalt 60

Consequence					Likelihood
Insignificant	Minor	Moderate	Major	Catastrophic	
1	11	16	20	23	25
					5 High, Almost Certain (20-25)
7	12	17	21	24	4 Significant, Likely (16-19)
4	8	13	18	22	3 Medium, Possible (11-15)
2	5	9	14	19	2 Low, Unlikely (1-10)
1	3	6	10	15	1 Rare, Very Unlikely

Item	Location	Hazard Description	Staff to Verify			Staff to Verify			Staff to Complete			
			Existing Controls	Consequence	Likelihood	Risk	Pollution Risk	Further Action	Hierarchy	Consequence	Likelihood	Risk
1	In transit	Transport of Cobalt 60 damage to containment vessel during traffic accident	The containment vessel has been tested and is designed to withstand substantial impact without damage and release of potential radiation. The container is certified internationally as Best Practice safe movement and containment of Cobalt 60. Detailed security systems are in place for the movement and containment of the material	Catastrophic	Rare	15	Damage to containment vessel could pose a risk of nuclear contamination however the containment vessel has been designed to international Standards to ensure vessel integrity under extreme conditions	No further action measures in place ensure the safety of the material and the possibility of an incident occurring with the accidental release of nuclear material is consisted very unlikely	Administrative	Catastrophic	Rare	15
2	Radiation Plant Cobalt 60	Replacement of Cobalt 60 within the containment vessel. Damage to the containment vessel or radiation exposure to staff risk	A section of the containment vessel roof is removed and the new material is lowered through the roof by crane and lowered into 8 meters of water. All operations transferring the pellets to the rack that will be raised to irradiate product is conducted under 8 meters of water				There is no foreseeable risk of accidental Radiation exposure					
3	Radiation Plant Cobalt 60	Radiation exposure to operators and staff of ration exposure to gammer radiation	Each staff member wears a radiation badge which is checked via ANSTO each month radiation checks are undertaken around the containment vessel. The containment vessel was designed and built with the assistance of the Canadian Nuclear Energy Commission and meet international Standards				There is no foreseeable risk of accidental Radiation exposure					
4	Radiation Plant Cobalt 60	Radiation exposure to operators and staff to gammer radiation	If planned irradiation exposure to product is aborted, or staff require access to the chamber and at all times when not in use, the Cobalt 60 is stored under 8 meters of water. The containment irradiation unit design inhibits gammar radiation escape radiation detectors are positioned at the end of the conveyor process where the product leaves the containment vessel if a pellet is attached to the conveyor belt or product on ext of the first centimetre of the pellet all radiation alarms activate and staff shut down the line and evacuate the area	Major	Rare	10	Minor radiation exposure to staff should be considered very unlikely	Staff should be trained as per SOP	Administrative	Major	Rare	10
5	Mechanical failure of conveyor system	The plate containing the pellets of Cobalt 60 would be lowered back into 8 metres of water and the mechanical fault rectified					There is no foreseeable risk of accidental Radiation exposure					
6	Loss of electricity to the plant	The plate containing the pellets of Cobalt 60 would be lowered back into 8 metres of water and until power restored					There is no foreseeable risk of accidental Radiation exposure					
7	Impact on plant of external agency, meteorite or aircraft potentially cause significal damage to Factory	The impact is unlikely to breach the containment vessel holding the water column; which is underground or exposure Cobalt 60. The containment unit was designed and built under supervision of the Canadian Nuclear Energy Commission and is stressed to hold and withstand significant impact forces					There is no foreseeable risk of accidental Radiation exposure					
8	Fire within office or palleted goods areas	The plate containing the pellets of Cobalt 60 would be lowered back into 8 metres of water					There is no foreseeable risk of accidental Radiation exposure					
9	Terrorism	The factory is manned 24 hours per day the gates are not closed after hours and there are after hours security patrols	Catastrophic	Low	19	A person or persons could penetrate the after hours to cause harm	No warning signage is displayed outside the factory premises security is maintained by keeping a low profile. However some low key security measures should be installed in the unlikely event of a terrorism incident a security review should be undertaken to review security at the factory at present a person after hours can access the factory at any time to cause mischief	Engineering Administrative	Catastrophic	Rare	16	
		Earthquake impact on factory potentially cause sufficient damage to containment vessel to cause release of water	Catastrophic	Rare	15	Earthquakes in Australia and in Sydney are not rare, but earthquakes of sufficient intensity to be noticeable are rare. Earthquakes with an intensity to cause significant damage to property of a well engineered plant are here in Australia virtually unknown	The factory has purchased the property on the Northern border, the rear of the property bordering the Western side of the building is part of the Liverpool direct bus lanes	Administrative Engineering	Catastrophic	Rare	16	

### Appendix 3

**Warehouse**

Item	Location	Hazard Description	Staff to Verify			Unmitigated Pollution Risk	Pollution Risk	Further Action	Mitigated Pollution Risk			Staff to Complete	
			Existing Controls	Consequence	Likelihood				Hierarchy	Consequence	Likelihood		
1	Warehouse	Palleted goods delivery possible hazardous material	Potential hazardous goods client supplied MSDS reviewed prior to acceptance of goods for serialization	Moderate	Medium	15	Potential for damage to product during processing, possible contamination or spill of hazardous material	Existing controls follow standard operating procedure no potential hazard product will be processed until the MSDS is fully reviewed and controls established	Administrative	Minor	Rare	3	
2		Palleted goods damaged on arrival	Palleted goods damaged on arrival reported to client process dependent on advice from client	Minor	Low	5	No pollution risk all goods delivered for processing on pallets and secured with shrink wrapping inhibiting any release or spill of product		Administrative	Minor	Rare	3	
Insignificant		Consequence											
1	Minor	2	3	4	5								
2	16	20	23	25	5 High, Almost Certain (20-25)								
3	12	17	21	24	4 Significant, Likely (16-19)								
4	8	13	18	22	3 Medium, Possible (11-15)								
5	5	9	14	19	2 Low, Unlikely (1-10)								
6	3	6	10	15	1 Rare, Very Unlikely								
		Likelihood											
3	Factory	Impact on plant of external agency, meteorite or aircraft potentially cause sufficient damage to rupture EO bottle connections and pipe work, this could lead to destruction of the plant through catastrophic fire and explosion  Toxic smoke, fire fighting water runoff, impacting on local storm water drains and local creeks	Non	Catastrophic	Rare	15	plant is not under existing flight paths impact of a meteorite would be considered an extremely rare event.  The potential consequences of aircraft or meteorite impact would be catastrophic with significant release of Ethylene Oxide, potentially leading to significant plant damage and staff injuries through fire and explosion releasing toxic gas and smoke into the atmosphere with significant impact on surrounding property	The factory has purchased the property on the Northern border, the rear of the property bordering the Western side of the building is part of the Liverpool direct bus lanes the property to the South is located on the side of the property removed from the Ethylene Oxide storage and sterilisation process operations  The factory and the engineering should be maintained in good operating condition to mitigate any extremely rare occurrences	Administrative Engineering	Catastrophic	Rare	15	
4	Factory	Earthquake impact on factory potentially cause sufficient damage to rupture EO bottle connections and pipe work, this could lead to destruction of the plant through catastrophic fire and explosion  Toxic smoke, fire fighting water runoff, impacting on local storm water drains and local creeks	Non	Catastrophic	Rare	15	Earthquakes in Australia and in Sydney are not rare, but earthquakes of sufficient intensity to be noticeable are rare. Earthquakes with an intensity to cause significant damage to property of a well engineered plant are here in Australia virtually unknown	The factory has purchased the property on the Northern border, the rear of the property bordering the Western side of the building is part of the Liverpool direct bus lanes the property to the South is located on the side of the property removed from the Ethylene Oxide storage and sterilisation process operations  The factory and the engineering should be maintained in good operating condition to mitigate any extremely rare occurrences	Administrative Engineering	Catastrophic	Rare	15	
5	Factory	Terrorism	The factory is manned 24 hours per day the gates are not closed after hours and there are after hours security patrols	Catastrophic	Rare	15	Pollution risk would be dependent on objectives of the terrorism event from worst case use of an Ethylene bottle to create a explosive device to publicly without violence	Security systems and policy should be reviewed, gates should be closed after hours A direct relationship should be developed with senior police offices within the district to ensure adequate police response	Administrative Engineering	Catastrophic	Rare	15	
6	Fire within office or palleted goods areas	Fire fighting hand held extinguishers are located throughout the premises to control small fires. If a fire can not be easily extinguished or is near Ethylene Oxide pipe or storage areas, the factory will be evacuated and staff directed to assemble at the emergency assembly point. Hazard data sheets are located at the front gate for use by the NSW Fire Brigade	Major	Low	10	Toxic smoke and fire water run off into local storm water drains, serious fire could threaten the Ethylene Oxide store, though this store is located on the outside of the factory behind fire rated brick wall and is open to the air on the Eastern face of the building. Of more concern would be the potential damage to pipe work that may contain residual Ethylene Oxide within the pipes.	MSDS book at front gate to be up-dated with all relevant hazard material including Ethylene Oxide and Cobalt 60  A direct relationship should be developed with local NSW Fire Brigade Station Commander so if a fire were to occur adequate and timely brigade resources could be engaged quickly  Note a sign at the front gate or close to factory indicating the hazard of fire and the presence of significant quantities of Ethylene Oxide should be installed	Administrative Engineering	Major	Rare	10		

**Appendix 3**  
Nitrogen Store

Consequence					Likelihood
Insignificant	Minor	Moderate	Major	Catastrophic	High, Almost Certain (20-25)
1	2	3	4	5	5 Significant, Likely (16-19)
11	16	20	23	25	4 Significant, Likely (16-19)
7	12	17	21	24	3 Medium, Possible (11-15)
4	8	13	18	22	2 Low, Unlikely (1-10)
2	5	9	14	19	1 Rare, Very Unlikely
1	3	6	10	15	

Staff to Verify			Staff to Verify			Staff to Complete			Staff to Complete		
Item	Location	Hazard Description	Unmitigated Pollution Risk			Pollution Risk	Further Action	Hierarchy	Consequence	Likelihood	Further Action
			Consequence	Likelihood	Risk						
1	Nitrogen storage	Nitrogen escape during refill process due to incorrect or failed fitting during refill process	Minor	Low	2	A Nitrogen leak would escape into the atmosphere and would quickly disperse A low risk event with little impact		Administrative	Minor	Low	2
2		Vehicle impact on Nitrogen store by backing truck, leading to Nitrogen tank failure and escape of significant quantities of Nitrogen. This could cause a safety risk to near by staff and driver	Moderate	Low	13	potential release of 15,000 Ltres of Nitrogen into the atmosphere	Vehicle bollards should be installed to prevent the unlikely event of a vehicle impact with the Nitrogen store	Engineering	Minor	Low	2
3		Loss of Nitrogen through pipe failure or flange joint failure	Moderate	Medium	13	Possible very small risk of escape of Nitrogen through flange joints	Computer monitored and controlled specific parameters established to ensure safety of staff, integrity of product and mitigate pollution risk to very low level. Main computer system backed up by 3 hour UPS supply	Administrative	Minor	Rare	6

**Appendix 3**  
Maintenance / Engineering

Consequence					Likelihood High, Almost Certain (20-25) 5 Significant, Likely (16-20) 4 Medium, Possible (11-15) 3 Low, Unlikely (1-10) 2 1 Rare, Very Unlikely
Insignificant	Minor	Moderate	Major	Catastrophic	
1	2	3	4	5	
11	16	20	23	25	
7	12	17	21	24	
4	8	13	18	22	
2	5	9	14	19	
1	3	6	10	15	

Item	Location	Hazard Description	Staff to Verify				Pollution Risk	Further Action	Staff to Verify				Mitigated Pollution Risk	Hierarchy	Further Action
			Existing Controls	Unmitigated Pollution Risk	Consequence	Likelihood			Consequence	Likelihood	Risk	Consequence			
1	ETO pipe work & flange joints	Repair and maintenance of existing systems, potential for leak or damage to pipe and flange joints or other equipment	Program maintenance follows standard procedure process	Moderate	Moderate	13	Low risk of work either not correcting fault, failure to observe a fault, damage or leaking flange joint	Standard operating procedures and the use of safe work permit system and safe management practices to be reviewed every 2 years	Moderate	Rare	6	Moderate	Rare	6	
2	Sensors	failure of sensors in system leading to potential failure of ETO or irradiation process	AI data sensors are calibrated multiple sensors recording data with systems monitored 24 hours a day	6 months			No potential pollution risk identified								
3	Installation of new equipment connecting into existing pipe work for the ETO process	Cracking of existing pipe work and installation of new equipment with the installation of new pipe to existing system has potential for leak or damage to pipe and flange joints leading to leak of Ethylene Oxide	Maintained procedures under supervising engineers  If a leak is detected the system process is aborted and the plant inspected to find the leak. PPE is mandatory using in-line self contained breathing mask with sufficient line to negotiate the plant	Moderate	Moderate	13	Low level leak of Ethylene Oxide	Safe work permit system should be used to ensure safety of staff and integrity of process	Moderate	Rare	6	Moderate	Rare	6	

Steritech Stormwater Drain System

Appendix 4

