Material Safety Data Sheet

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
2-Methylaziridine

STATEMENT OF HAZARDOUS NATURE

NFPA

SUPPLIER
Company: Santa Cruz Biotechnology, Inc.
Address:
2145 Delaware Ave
Santa Cruz, CA 95060
Telephone: 800.457.3801 or 831.457.3800
Emergency Tel: CHEMWATCH: From within the US and Canada:
877-715-9305
Emergency Tel: From outside the US and Canada: +800 2436 2255
(1-800-CHEMCALL) or call +613 9573 3112

PRODUCT USE
Organic intermediate whose derivatives are used in paper, textile, rubber and pharmaceutical industries. Intermediate

SYNONYMS
C3-H7-N, "aziridine, 2-methyl", "aziridine, 2-methyl", 2-methylazacyclop propane, 2-methylazacyclop propane, 2-methylaziridine, 2-methylaziridine, 2-methylethenimine, 2-methylethenimine, "1, 2-propyleneimine", "1, 2-propyleneimine", propyleneimine, "1, 2-propyleneimine", "1, 2-propyleneimine"

Section 2 - HAZARDS IDENTIFICATION

CANADIAN WHMIS SYMBOLS

EMERGENCY OVERVIEW
RISK
Risk of serious damage to eyes.
May cause CANCER.
Very toxic by inhalation, in contact with skin and if swallowed.
Highly flammable.
2-Methylaziridine

sc-230543

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Hazard Alert Code Key:

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</table>

Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED
- Severely toxic effects may result from the accidental ingestion of the material; animal experiments indicate that ingestion of less than 5 gram may be fatal or may produce serious damage to the health of the individual.

EYE
- If applied to the eyes, this material causes severe eye damage.

SKIN
- Skin contact with the material may produce severely toxic effects; systemic effects may result following absorption and these may be fatal.
- Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.
- This material can cause inflammation of the skin on contact in some persons.

INHALED
- Inhalation of aerosols (mists, fumes), generated by the material during the course of normal handling, may produce severely toxic effects. Relatively small amounts absorbed from the lungs may prove fatal.
- Inhalation of vapours may cause drowsiness and dizziness. This may be accompanied by narcosis, reduced alertness, loss of reflexes, lack of coordination and vertigo.
- Inhalation hazard is increased at higher temperatures.
- Inhalation of high concentrations of gas/vapor causes lung irritation with coughing and nausea, central nervous depression with headache and dizziness, slowing of reflexes, fatigue and inco-ordination.
- The material can cause respiratory irritation in some persons. The body’s response to such irritation can cause further lung damage.

CHRONIC HEALTH EFFECTS
- There is ample evidence that this material can be regarded as being able to cause cancer in humans based on experiments and other information.
- Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems.
- There is limited evidence that, skin contact with this product is more likely to cause a sensitization reaction in some persons compared to the general population.
- Repeated or prolonged exposure to corrosives may result in the erosion of teeth, inflammatory and ulcerative changes in the mouth and necrosis (rarely) of the jaw. Bronchial irritation, with cough, and frequent attacks of bronchial pneumonia may ensue. Gastrointestinal disturbances may also occur. Chronic exposures may result in dermatitis and/or conjunctivitis.
- When given to rats by oral intubation (10 mg/kg, twice weekly for 60 weeks) propylene imine was a potent tumourigen.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

HAZARD RATINGS

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flammability</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Toxicity</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Body Contact</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Reactivity</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Chronic</td>
<td>3</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>NAME</th>
<th>CAS RN</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>propylene imine</td>
<td>75-55-8</td>
<td>&gt;98</td>
</tr>
<tr>
<td>hydrolyses to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-methylaminopropanoic acid</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Lessor is Outono
2-Methylaziridine

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Section 4 - FIRST AID MEASURES

SWALLOWED

- IF SWALLOWED, REFER FOR MEDICAL ATTENTION, WHERE POSSIBLE, WITHOUT DELAY.
- Where Medical attention is not immediately available or where the patient is more than 15 minutes from a hospital or unless instructed otherwise:
  - For advice, contact a Poisons Information Center or a doctor.
  - Urgent hospital treatment is likely to be needed.
  - If conscious, give water to drink.
  - INDUCE vomiting with fingers down the back of the throat, ONLY IF CONSCIOUS. Lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.

NOTE: Wear a protective glove when inducing vomiting by mechanical means.

- In the mean time, qualified first-aid personnel should treat the patient following observation and employing supportive measures as indicated by the patient’s condition.
- If the services of a medical officer or medical doctor are readily available, the patient should be placed in his/her care and a copy of the MSDS should be provided. Further action will be the responsibility of the medical specialist.
- If medical attention is not available on the worksite or surroundings send the patient to a hospital together with a copy of the MSDS.

EYE

- If this product comes in contact with the eyes:
  - Immediately hold eyelids apart and flush the eye continuously with running water.
  - Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
  - Continue flushing until advised to stop by the Poisons Information Center or a doctor, or for at least 15 minutes.
  - Transport to hospital or doctor without delay.
  - Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN

- If skin or hair contact occurs:
  - Immediately flush body and clothes with large amounts of water, using safety shower if available.
  - Quickly remove all contaminated clothing, including footwear.
  - Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Center.
  - Transport to hospital, or doctor.

INHALED

- If fumes or combustion products are inhaled remove from contaminated area.
  - Lay patient down. Keep warm and rested.
  - Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
  - Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
  - Transport to hospital, or doctor, without delay.

NOTES TO PHYSICIAN

- For lung damage, treatment regime is similar to that imposed in the case of nitrogen oxide induced damage. For intoxication due to nitrogen oxides:
  - If patient encountered shortly after exposure, instruct the patient to breathe deeply.
  - Enforce complete rest for 24-48 hours even when the patient is not symptomatic.
  - During the presymptomatic period inhalation of sodium bicarbonate-sodium chloride aerosol has been suggested as a prophylactic measure. Vitamin E (an antioxidant), in the form of mixed tocopherols, can be given by mouth in doses of several hundred milligrams. N-acetylcysteine (Mycormyst) by aerosolization or direct installation may be worthwhile.
  - When patient commences coughing or feels slightly fatigued commence oxygen therapy. Nasal prongs or the use of oxygen with continuous distending airway pressure may be appropriate. (Hyperbaric oxygen increased the risk of pulmonary edema when given together with NO2 in dogs.)
  - Removal of frothy exudate from the respiratory tract may be a major therapeutic problem. Suction, postural draining and other methods may be useful.
  - Bronchospasm is corrected by inhalation of aerosols of albuterol, isoetharine, metaproterenol or terbutaline.
  - Atropine, adrenaline, expectorants, emetics, sedatives (other than small doses of morphine) and, usually, cardiac glycosides are ineffective. In a few instances rapid digitalization with a drug like ouabain may be advisable.
  - The role of venesection and blood replacement by isotonic saline is the subject of debate although venesection should certainly be
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Avoided once circulatory collapse has become established.
- Artificial ventilation is seldom effective.
- In the presence of severe, confirmed methemoglobinemia, a cautious trial of methylene blue may be justified even though the safety and efficacy of the procedure has not been established in nitrogen oxides poisoning.
- Steroid therapy, to minimize inflammatory reaction, remains controversial.
- Patients should be observed closely, for at least 6 weeks, to observe, for example, pulmonary edema.

Gosselin, Smith and Hodge: Clinical Toxicology of Commercial Products: 5th Edition

Patients suspected of excessive exposure should be kept under observation.

For poisons (where specific treatment regime is absent):

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**BASIC TREATMENT**

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- Establish a patent airway with suction where necessary.
- Watch for signs of respiratory insufficiency and assist ventilation as necessary.
- Administer oxygen by non-rebreather mask at 10 to 15 l/min.
- Monitor and treat, where necessary, for pulmonary edema.
- Monitor and treat, where necessary, for shock.
- Anticipate seizures.
- Do NOT use emetics. Where ingestion is suspected rinse mouth and give up to 200 ml water (5 ml/kg recommended) for dilution where patient is able to swallow, has a strong gag reflex and does not drool.

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**ADVANCED TREATMENT**

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- Consider orotracheal or nasotracheal intubation for airway control in unconscious patient or where respiratory arrest has occurred.
- Positive-pressure ventilation using a bag-valve mask might be of use.
- Monitor and treat, where necessary, for arrhythmias.
- Start an IV D5W TKO. If signs of hypovolemia are present use lactated Ringers solution. Fluid overload might create complications.
- Drug therapy should be considered for pulmonary edema.
- Hypotension with signs of hypovolemia requires the cautious administration of fluids. Fluid overload might create complications.
- Treat seizures with diazepam.
- Proparacaine hydrochloride should be used to assist eye irrigation.

BRONSTEIN, A.C. and Currance, P.L.

EMERGENCY CARE FOR HAZARDOUS MATERIALS EXPOSURE: 2nd Ed. 1994.

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**Section 5 - FIRE FIGHTING MEASURES**

<table>
<thead>
<tr>
<th>Vapor Pressure (mmHg):</th>
<th>139.661 @ 20 C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Explosive Limit (%):</td>
<td>15.58</td>
</tr>
<tr>
<td>Specific Gravity (water=1):</td>
<td>0.8039-0.807</td>
</tr>
<tr>
<td>Lower Explosive Limit (%):</td>
<td>1.32</td>
</tr>
</tbody>
</table>

**EXTINGUISHING MEDIA**

- Water
- Foam
- Dry Chemical
- Do NOT use carbon dioxide

**FIRE FIGHTING**

- Alert Emergency Responders and tell them location and nature of hazard.
- May be violently or explosively reactive.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.
- Consider evacuation (or protect in place).
- Fight fire from a safe distance, with adequate cover.
- If safe, switch off electrical equipment until vapor fire hazard removed.
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- Use water delivered as a fine spray to control fire and cool adjacent area.
- Avoid spraying water onto liquid pools.
- DO NOT approach containers suspected to be hot.
- Cool fire exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.

**GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS**

- Liquid and vapor are highly flammable.
- Severe fire hazard when exposed to heat, flame and/or oxidizers.
- Vapor forms an explosive mixture with air.
- Severe explosion hazard, in the form of vapor, when exposed to flame or spark.
- Vapor may travel a considerable distance to source of ignition.
- Heating may cause expansion / decomposition with violent rupture of containers.
- On combustion, may emit toxic fumes of carbon monoxide (CO)

Combustion products include: carbon dioxide (CO2), nitrogen oxides (NOx), other pyrolysis products typical of burning organic material.

**FIRE INCOMPATIBILITY**

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

**PERSONAL PROTECTION**

Glasses:
- Chemical goggles.
- Full face- shield.

Gloves:

Respirator:
- Type AX Filter of sufficient capacity

**Section 6 - ACCIDENTAL RELEASE MEASURES**

**MINOR SPILLS**

- Remove all ignition sources.
- Clean up all spills immediately.
- Avoid breathing vapors and contact with skin and eyes.
- Control personal contact by using protective equipment.
- Contain and absorb small quantities with vermiculite or other absorbent material.
- Wipe up.
- Collect residues in a flammable waste container.

Neutralize and eliminate odors with 10% acetic acid or phosphoric acid. If acetic acid is used, an odor of vinegar should be evident when propylene imine is neutralised.

Remove contaminated trace residues from soil and dispose of in same manner as material.

**MAJOR SPILLS**

- Chemical Class: bases
- Recommended sorbents:

<table>
<thead>
<tr>
<th>SORBENT TYPE</th>
<th>RANK</th>
<th>APPLICATION</th>
<th>COLLECTION</th>
<th>LIMITATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAND SPILL - SMALL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cross-linked polymer - particulate</td>
<td>1</td>
<td>shovel</td>
<td>shovel</td>
<td>R, W, SS</td>
</tr>
<tr>
<td>cross-linked polymer - pillow</td>
<td>1</td>
<td>throw</td>
<td>pitchfork</td>
<td>R, DGC, RT</td>
</tr>
<tr>
<td>sorbent clay - particulate</td>
<td>2</td>
<td>shovel</td>
<td>shovel</td>
<td>R, I, P</td>
</tr>
<tr>
<td>foamed glass - pillow</td>
<td>2</td>
<td>throw</td>
<td>pitchfork</td>
<td>R, P, DGC, RT</td>
</tr>
<tr>
<td>expanded minerals - particulate</td>
<td>3</td>
<td>shovel</td>
<td>shovel</td>
<td>R, I, W, P, DGC</td>
</tr>
<tr>
<td>foamed glass - particulate</td>
<td>4</td>
<td>shovel</td>
<td>shovel</td>
<td>R, W, P, DGC,</td>
</tr>
<tr>
<td>LAND SPILL - MEDIUM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cross-linked polymer - particulate</td>
<td>1</td>
<td>blower</td>
<td>skiploader</td>
<td>R, W, SS</td>
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</table>
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<td></td>
<td>R, I, P</td>
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<tr>
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<td></td>
<td></td>
<td>R, I, W, P, DGC</td>
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<td></td>
<td></td>
<td>R, DGC, RT</td>
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<tr>
<td>foamed glass - particulate</td>
<td>4</td>
<td></td>
<td></td>
<td>R, W, P, DGC</td>
</tr>
<tr>
<td>foamed glass - pillow</td>
<td>4</td>
<td></td>
<td></td>
<td>R, P, DGC, RT</td>
</tr>
</tbody>
</table>

Legend
DGC: Not effective where ground cover is dense
R: Not reusable
I: Not incinerable
P: Effectiveness reduced when rainy
RT: Not effective where terrain is rugged
SS: Not for use within environmentally sensitive sites
W: Effectiveness reduced when windy


- Clear area of personnel and move upwind.
- Alert Emergency Responders and tell them location and nature of hazard.
- May be violently or explosively reactive.
- Wear full-body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.
- Consider evacuation.
- No smoking, naked lights or ignition sources.
- Increase ventilation.
- Stop leak if safe to do so.
- Water spray or fog may be used to disperse / absorb vapor.
- Contain spill with sand, earth or vermiculite.
- Use only spark-free shovels and explosion proof equipment.
- Collect recoverable product into labeled containers for recycling.
- Absorb remaining product with sand, earth or vermiculite.
- Collect solid residues and seal in labeled drums for disposal.
- Wash area and prevent runoff into drains.
- If contamination of drains or waterways occurs, advise emergency services.

PROTECTIVE ACTIONS FOR SPILL

WARNING
MAY POLYMERISE VIOLENTLY UNDER CERTAIN CONDITIONS.

From IERG (Canada/Australia)

Isolation Distance 25 meters
Downwind Protection Distance 250 meters

FOOTNOTES
2-Methylaziridine

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1 PROTECTIVE ACTION ZONE is defined as the area in which people are at risk of harmful exposure. This zone assumes that random changes in wind direction confines the vapour plume to an area within 30 degrees on either side of the predominant wind direction, resulting in a crosswind protective action distance equal to the downwind protective action distance.

2 PROTECTIVE ACTIONS should be initiated to the extent possible, beginning with those closest to the spill and working away from the site in the downwind direction. Within the protective action zone a level of vapour concentration may exist resulting in nearly all unprotected persons becoming incapacitated and unable to take protective action and/or incurring serious or irreversible health effects.

3 INITIAL ISOLATION ZONE is determined as an area, including upwind of the incident, within which a high probability of localised wind reversal may expose nearly all persons without appropriate protective to life-threatening concentrations of the material.

4 SMALL SPILLS involve a leaking package of 200 litres (55 US gallons) or less, such as a drum (jerrican or box with inner containers). Larger packages leaking less than 200 litres and compressed gas leaking from a small cylinder are also considered "small spills". LARGE SPILLS involve many small leaking packages or a leaking package of greater than 200 litres, such as a cargo tank, portable tank or a "one-tonne" compressed gas cylinder.


6 IERG information is derived from CANUTEC - Transport Canada.

ACUTE EXPOSURE GUIDELINE LEVELS (AEGL) (in ppm)

AEGL 1: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

AEGL 2: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

AEGL 3: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

- Containers, even those that have been emptied, may contain explosive vapors.
- Do NOT cut, drill, grind, weld or perform similar operations on or near containers.
- Do NOT allow clothing wet with material to stay in contact with skin.
- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.
- Do NOT enter confined spaces until atmosphere has been checked.
- Avoid smoking, naked lights, heat or ignition sources.
- When handling, Do NOT eat, drink or smoke.
- Vapor may ignite on pumping or pouring due to static electricity.
- Do NOT use plastic buckets.
- Earth and secure metal containers when dispensing or pouring product.
- Use spark-free tools when handling.
- Avoid contact with incompatible materials.
- Keep containers securely sealed.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately.
- Use good occupational work practice.
- Observe manufacturer's storing and handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

RECOMMENDED STORAGE METHODS

- Glass container.
- Packing as supplied by manufacturer. Plastic containers may only be used if approved for flammable liquid. Check that containers are clearly labeled and free from leaks.
- For low viscosity materials (i): Drums and jerricans must be of the non-removable head type. (ii): Where a can is to be used as an inner
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package, the can must have a screwed enclosure.

For materials with a viscosity of at least 2680 cSt. (23 deg. C)

For manufactured product having a viscosity of at least 250 cSt. (23 deg. C)

Manufactured product that requires stirring before use and having a viscosity of at least 20 cSt (23 deg. C) - (i): Removable head packaging; (ii): Cans with friction closures and (iii): low pressure tubes and cartridges may be used.

Where combination packages are used, and the inner packages are of glass, there must be sufficient inert cushioning material in contact with inner and outer packages

In addition, where inner packagings are glass and contain liquids of packing group I there must be sufficient inert absorbent to absorb any spillage, unless the outer packaging is a close fitting molded plastic box and the substances are not incompatible with the plastic.

STORAGE REQUIREMENTS

- Store in original containers in approved flame-proof area.
- No smoking, naked lights, heat or ignition sources.
- DO NOT store in pits, depressions, basements or areas where vapors may be trapped.
- Keep containers securely sealed.
- Store away from incompatible materials in a cool, dry well ventilated area.
- Protect containers against physical damage and check regularly for leaks.
- Observe manufacturer's storing and handling recommendations.

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS

| X | X | X | X | X | + |

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

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

<table>
<thead>
<tr>
<th>Source</th>
<th>Material</th>
<th>TWA ppm</th>
<th>TWA mg/m³</th>
<th>STEL ppm</th>
<th>STEL mg/m³</th>
<th>Peak ppm</th>
<th>Peak mg/m³</th>
<th>TWA F/CC</th>
<th>Notes</th>
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<tbody>
<tr>
<td>US NIOSH Recommended Exposure Limits (RELs)</td>
<td>propylene imine (Propylene imine)</td>
<td>2</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Canada - Alberta Occupational Exposure Limits</td>
<td>propylene imine (Propyleneimine (2-Methylaziridine))</td>
<td>2</td>
<td>4.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Canada - British Columbia Occupational Exposure Limits</td>
<td>propylene imine (Propyleneimine Revised 2009)</td>
<td>0.2</td>
<td>0.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Skin</td>
<td></td>
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<tr>
<td>Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)</td>
<td>propylene imine (Propylene imine)</td>
<td>2</td>
<td>4.7</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>US OSHA Permissible Exposure Levels (PELs) - Table Z1</td>
<td>propylene imine (Propylene imine)</td>
<td>2</td>
<td>5</td>
<td></td>
<td></td>
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<tr>
<td>US ACGIH Threshold Limit Values (TLV)</td>
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<td>0.2</td>
<td>0.4</td>
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<td></td>
<td></td>
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<td>TLV Basis: upper respiratory tract irritation; kidney damage</td>
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<td>propylene imine (Propylenimine)</td>
<td>2</td>
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<td>Skin</td>
</tr>
<tr>
<td>US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants</td>
<td>propylene imine (Propylene imine)</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants</td>
<td>propylene imine (Propylene imine)</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants</td>
<td>propylene imine (Propylene imine)</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>US - Minnesota Permissible Exposure Limits (PELs)</td>
<td>propylene imine (Propylene imine)</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>US - California Permissible Exposure Limits for Chemical Contaminants</td>
<td>propylene imine (Propyleneimine; 2-methylaziridine)</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>US - Idaho - Limits for Air Contaminants</td>
<td>propylene imine (Propylene imine)</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>US - Hawaii Air Contaminant Limits</td>
<td>propylene imine (Propylene imine)</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances</td>
<td>propylene imine (Propylene imine - Skin)</td>
<td>2</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>US - Washington Permissible exposure limits of air contaminants</td>
<td>propylene imine (Propylene imine)</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits</td>
<td>propylene imine (Propylenimine)</td>
<td>2</td>
<td>4</td>
<td>Skin, T20</td>
</tr>
<tr>
<td>US - Alaska Limits for Air Contaminants</td>
<td>propylene imine (Propylene imine)</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Canada - Nova Scotia Occupational Exposure Limits</td>
<td>propylene imine (Propyleneimine)</td>
<td>0.2</td>
<td>0.4</td>
<td>TLV Basis: upper respiratory tract irritation; kidney damage</td>
</tr>
<tr>
<td>Canada - Prince Edward Island Occupational Exposure Limits</td>
<td>propylene imine (Propyleneimine)</td>
<td>0.2</td>
<td>0.4</td>
<td>TLV Basis: upper respiratory tract irritation; kidney damage</td>
</tr>
<tr>
<td>US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants</td>
<td>propylene imine (Propylene imine)</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>US - Michigan Exposure Limits for Air Contaminants</td>
<td>propylene imine (Propylene imine)</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>US - Oregon Permissible Exposure Limits (Z1)</td>
<td>propylene imine (Propylene imine)</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Canada - Northwest Territories Occupational Exposure Limits (English)</td>
<td>propylene imine (Propylene imine - Skin)</td>
<td>2</td>
<td>4.7</td>
<td>4</td>
</tr>
</tbody>
</table>

### EMERGENCY EXPOSURE LIMITS
2-Methylaziridine

Material Safety Data Sheet

Hazard Alert Code Key: EXTREME | HIGH | MODERATE | LOW
---|---|---|---

<table>
<thead>
<tr>
<th>Material</th>
<th>Revised IDLH Value (mg/m³)</th>
<th>Revised IDLH Value (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>propylene imine</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

MATERIAL DATA

PROPYLENE IMINE:
- Sensory irritants are chemicals that produce temporary and undesirable side-effects on the eyes, nose or throat. Historically occupational exposure standards for these irritants have been based on observation of workers’ responses to various airborne concentrations. Present day expectations require that nearly every individual should be protected against even minor sensory irritation and exposure standards are established using uncertainty factors or safety factors of 5 to 10 or more. On occasion animal no-observable-effect-levels (NOEL) are used to determine these limits where human results are unavailable. An additional approach, typically used by the TLV committee (USA) in determining respiratory standards for this group of chemicals, has been to assign ceiling values (TLV C) to rapidly acting irritants and to assign short-term exposure limits (TLV STELs) when the weight of evidence from irritation, bioaccumulation and other endpoints combine to warrant such a limit. In contrast the MAK Commission (Germany) uses a five-category system based on intensive odour, local irritation, and elimination half-life. However this system is being replaced to be consistent with the European Union (EU) Scientific Committee for Occupational Exposure Limits (SCOEL); this is more closely allied to that of the USA.
- OSHA (USA) concluded that exposure to sensory irritants can:
  - cause inflammation
  - cause increased susceptibility to other irritants and infectious agents
  - lead to permanent injury or dysfunction
  - permit greater absorption of hazardous substances and
  - acclimate the worker to the irritant warning properties of these substances thus increasing the risk of overexposure.
- Propyleneimine possesses a lesser toxicity than ethyleneimine and the recommended value for TLV-TWA is much higher.

PERSONAL PROTECTION

Consult your EHS staff for recommendations

EYE
- Chemical goggles.
- Full face shield.
- Contact lenses pose a special hazard; soft contact lenses may absorb irritants and all lenses concentrate them.

HANDS/FEET
- Elbow length PVC gloves.

NOTE: The material may produce skin sensitization in predisposed individuals. Care must be taken, when removing gloves and other protective equipment, to avoid all possible skin contact.
- Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:
  - frequency and duration of contact,
  - chemical resistance of glove material,
  - glove thickness and
dexterity
- Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739).
  - When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374) is recommended.
  - When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374) is recommended.
  - Contaminated gloves should be replaced.
- Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.

OTHER
- Overall.
2-Methylaziridine

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Material Safety Data Sheet

Hazard Alert Code Key:

EXTREME HIGH MODERATE LOW

- PVC Apron.
- PVC protective suit may be required if exposure severe.
- Eyewash unit.
- Ensure there is ready access to a safety shower.
- Some plastic personal protective equipment (PPE) (e.g. gloves, aprons, overshoes) are not recommended as they may produce static electricity.
- For large scale or continuous use wear tight-weave non-static clothing (no metallic fasteners, cuffs or pockets), non sparking safety footwear.

RESPIRATOR

Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

<table>
<thead>
<tr>
<th>Breathing Zone Level ppm (volume)</th>
<th>Maximum Protection Factor</th>
<th>Half-face Respirator</th>
<th>Full-Face Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>10</td>
<td>AX-1</td>
<td>-</td>
</tr>
<tr>
<td>1000</td>
<td>50</td>
<td>-</td>
<td>AX-1</td>
</tr>
<tr>
<td>5000</td>
<td>50</td>
<td>Airline*</td>
<td>-</td>
</tr>
<tr>
<td>5000</td>
<td>100</td>
<td>-</td>
<td>AX-2</td>
</tr>
<tr>
<td>10000</td>
<td>100</td>
<td>-</td>
<td>AX-3</td>
</tr>
<tr>
<td>100+</td>
<td>100+</td>
<td>Airline*</td>
<td>-</td>
</tr>
</tbody>
</table>

* - Continuous Flow ** - Continuous-flow or positive pressure demand.

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required. Use appropriate NIOSH-certified respirator based on informed professional judgement. In conditions where no reasonable estimate of exposure can be made, assume the exposure is in a concentration IDLH and use NIOSH-certified full face pressure demand SCBA with a minimum service life of 30 minutes, or a combination full facepiece pressure demand SAR with auxiliary self-contained air supply. Respirators provided only for escape from IDLH atmospheres shall be NIOSH-certified for escape from the atmosphere in which they will be used.

ENGINEERING CONTROLS

- Employees exposed to confirmed human carcinogens should be authorized to do so by the employer, and work in a regulated area.
- Work should be undertaken in an isolated system such as a “glove-box”. Employees should wash their hands and arms upon completion of the assigned task and before engaging in other activities not associated with the isolated system.
- Within regulated areas, the carcinogen should be stored in sealed containers, or enclosed in a closed system, including piping systems, with any sample ports or openings closed while the carcinogens are contained within.
- Open-vessel systems are prohibited.
- Each operation should be provided with continuous local exhaust ventilation so that air movement is always from ordinary work areas to the operation.
- Exhaust air should not be discharged to regulated areas, non-regulated areas or the external environment unless decontaminated. Clean make-up air should be introduced in sufficient volume to maintain correct operation of the local exhaust system.
- For maintenance and decontamination activities, authorized employees entering the area should be provided with and required to wear clean, impervious garments, including gloves, boots and continuous-air supplied hood. Prior to removing protective garments the employee should undergo decontamination and be required to shower upon removal of the garments and hood.
- Except for outdoor systems, regulated areas should be maintained under negative pressure (with respect to non-regulated areas).
- Local exhaust ventilation requires make-up air be supplied in equal volumes to replaced air.
- Laboratory hoods must be designed and maintained so as to draw air inward at an average linear face velocity of 150 feet/ min. with a minimum of 125 feet/ min. Design and construction of the fume hood requires that insertion of any portion of the employees body, other than hands and arms, be disallowed.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL PROPERTIES

Liquid.
Mixes with water.
Toxic or noxious vapors/ gas.

<table>
<thead>
<tr>
<th>State</th>
<th>Liquid</th>
<th>Molecular Weight</th>
<th>57.11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melting Range (°F)</td>
<td>-65.2 - -62.6</td>
<td>Viscosity</td>
<td>Not Available</td>
</tr>
<tr>
<td>Boiling Range (°F)</td>
<td>150.8- 152.6</td>
<td>Solubility in water (g/L)</td>
<td>Miscible</td>
</tr>
</tbody>
</table>
2-Methylaziridine

**Material Safety Data Sheet**

**sc-230543**

### Hazard Alert Code Key:

<table>
<thead>
<tr>
<th></th>
<th>EXTREME</th>
<th>HIGH</th>
<th>MODERATE</th>
<th>LOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flash Point (°F)</td>
<td>5</td>
<td>pH (1% solution)</td>
<td>Not available</td>
<td></td>
</tr>
<tr>
<td>Decomposition Temp (°F)</td>
<td>Not Available</td>
<td>pH (as supplied)</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td>Autoignition Temp (°F)</td>
<td>498.2</td>
<td>Vapor Pressure (mmHg)</td>
<td>139.661 @ 20 C</td>
<td></td>
</tr>
<tr>
<td>Upper Explosive Limit (%)</td>
<td>15.58</td>
<td>Specific Gravity (water=1)</td>
<td>0.8039-0.807</td>
<td></td>
</tr>
<tr>
<td>Lower Explosive Limit (%)</td>
<td>1.32</td>
<td>Relative Vapor Density (air=1)</td>
<td>&gt;1</td>
<td></td>
</tr>
<tr>
<td>Volatile Component (%vol)</td>
<td>100</td>
<td>Evaporation Rate</td>
<td>Fast</td>
<td></td>
</tr>
</tbody>
</table>

**APPEARANCE**

Water-white oily liquid with strong ammonia smell; mixes with water and most organic solvents. Normally stored and shipped in the presence of anhydrous sodium hydroxide. When inhibited with sodium hydroxide has an indefinite shelf life.

### Section 10 - CHEMICAL STABILITY

**CONDITIONS CONTRIBUTING TO INSTABILITY**

- Presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerization will not occur.

**STORAGE INCOMPATIBILITY**

- Several derivatives of the highly reactive aziridine (a strained ring compound) show explosive instability. In the presence of acids these compounds may be chemically reactive and may be subject to aqueous auto-catalyzed exothermic polymerization, which may be violent if uncontrolled by dilution, slow addition or cooling. Carbon dioxide may produce sufficiently acidic solutions to produce such reactions. Silver and its alloys may produce explosive compounds.

**BRETHERRICK L.:** Handbook of Reactive Chemical Hazards.

- Avoid oxidizing agents, acids, acid chlorides, acid anhydrides.
- Avoid strong acids.
- Avoid contact with copper, aluminium and their alloys.

For incompatible materials - refer to Section 7 - Handling and Storage.

### Section 11 - TOXICOLOGICAL INFORMATION

**propylene imine**

**TOXICITY AND IRRITATION**

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

<table>
<thead>
<tr>
<th></th>
<th>TOXICITY</th>
<th>IRRITATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral (rat) LD50: 19 mg/kg</td>
<td></td>
<td>Eye (rabbit):0.25 mg(open)SEVERE</td>
</tr>
<tr>
<td>Intraperitoneal (mouse) LD50: 355 mg/kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skin (guinea pig): LD50 43 mg/kg</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis. Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Key criteria for the diagnosis of RADS include the absence of preceding respiratory disease, in a non-atopic individual, with abrupt onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. A reversible airflow pattern, on spirometry, with the presence of moderate to severe bronchial hyperreactivity on methacholine challenge testing and the lack of minimal lymphocytic inflammation, without eosinophilia, have also been included in the criteria for diagnosis of RADS. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. Industrial bronchitis, on the other hand, is a disorder that occurs as result of exposure due to high concentrations of irritating substance (often particulate in nature) and is completely reversible after exposure ceases. The disorder is characterised by dyspnea, cough and mucus production.

**WARNING:** This substance has been classified by the IARC as Group 2B: Possibly Carcinogenic to Humans. Propyleneimine is a carcinogen in animals and is considered a potential...
human carcinogen. This chemical has also produced corneal injury when tested in the eyes of rabbits. Exposure of rats to 500 ppm of PI vapor for four hours was fatal, but inhalation for two hours resulted in no deaths. Rats administered 20 mg/kg of PI orally twice per week suffered from advanced flaccid paralysis after 18 weeks along with a high mortality rate. At 10 mg/kg PI, paralysis occurred to a lesser extent after 30 weeks. Granulocytic leukemia, squamous cell carcinoma of the ear duct, brain tumors, and mammary adenocarcinomas (females only) were observed in different animals. A number of the observed mammary adenocarcinomas metastasized to the lungs.

2-Methylaziridine

Propyleneimine

US ACGIH Threshold Limit Values (TLV) - Carcinogens

Carcinogen Category: A3

US Environmental Defense Scorecard Recognized Carcinogens

Reference(s): P65

US Environmental Defense Scorecard Suspected Carcinogens

Reference(s): P65

US NIOSH Recommended Exposure Limits (RELs) - Carcinogens

Carcinogen Category: Ca

Canada - Ontario Occupational Exposure Limits - Skin

Notes: Skin

US AIHA Workplace Environmental Exposure Levels (WEELs) - Skin

Notes: Skin

US NIOSH Recommended Exposure Limits (RELs) - Skin

Skin Designation: Yes

Canada - Quebec Permissible Exposure Values for Airborne Contaminants - Skin (French)

Notes: Skin

US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants - Skin

Skin Designation: X

US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants - Skin

Skin Designation: X

US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants - Skin

Skin Designation: X

US - Washington Permissible exposure limits of air contaminants - Skin

Skin Designation: X

US ACGIH Threshold Limit Values (TLV) - Skin

Skin Designation: Yes

Canada - British Columbia Occupational Exposure Limits - Skin

Notation: Skin

US - Minnesota Permissible Exposure Limits (PELs) - Skin

Skin Designation: X

US - Hawaii Air Contaminant Limits - Skin Designation

Skin Designation: X

ND

Skin Designation: X

US OSHA Permissible Exposure Levels (PELs) - Skin

Skin Designation: X

US - California Permissible Exposure Limits for Chemical Contaminants - Skin

Skin Designation: X

US - California Permissible Exposure Limits for Chemical Contaminants - Skin

Skin Designation: S

Canada - Alberta Occupational Exposure Limits - Skin

Substance Interaction: 1,3
2-Methylaziridine

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Section 12 - ECOLOGICAL INFORMATION

Refer to data for ingredients, which follows:

PROPYLENE IMINE:

- Hazardous Air Pollutant: Yes
- Half-life Soil - High (hours): 870
- Half-life Soil - Low (hours): 87
- Half-life Air - High (hours): 10.6
- Half-life Air - Low (hours): 1.1
- Half-life Surface water - High (hours): 870
- Half-life Surface water - Low (hours): 87
- Half-life Ground water - High (hours): 870
- Half-life Ground water - Low (hours): 87
- Aqueous biodegradation - Aerobic - High (hours): 672
- Aqueous biodegradation - Aerobic - Low (hours): 168
- Aqueous biodegradation - Anaerobic - High (hours): 2688
- Aqueous biodegradation - Anaerobic - Low (hours): 672
- Photooxidation half-life - high air - High (hours): 10.6
- Photooxidation half-life - high air - Low (hours): 1.1
- First order hydrolysis half-life (hours): 87
- Acid rate constant [M(H+)- HR]- 1: 870
- Base rate constant [MOH)- HR]- 1: 4.00E- 03

- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
- Do NOT allow product to come in contact with surface waters or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash-waters.
- Wastes resulting from use of the product must be disposed of on site or at approved waste sites.
- DO NOT discharge into sewer or waterways.
- Half-life (hr) soil: 420
- Nitrf. inhib.: not sig
- processes Abiotic: rapid hydrol

Ecotoxicity

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Persistence: Water/Soil</th>
<th>Persistence: Air</th>
<th>Bioaccumulation</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>propylene imine</td>
<td>LOW</td>
<td>LOW</td>
<td>LOW</td>
<td>HIGH</td>
</tr>
</tbody>
</table>

Section 13 - DISPOSAL CONSIDERATIONS

US EPA Waste Number & Descriptions

A. General Product Information
- Ignitability characteristic: use EPA hazardous waste number D001 (waste code I)

B. Component Waste Numbers
- When propylene imine is present as a solid waste as a discarded commercial chemical product, off-specification species, as a container residue, or a spill residue, use EPA waste number P067 (waste code T).

Disposal Instructions

- All waste must be handled in accordance with local, state and federal regulations.
- Puncture containers to prevent re-use and bury at an authorized landfill.
- Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.
- A Hierarchy of Controls seems to be common - the user should investigate:
  - Reduction
  - Reuse
2-Methylaziridine

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Hazard Alert Code Key:
- Recycling
- Disposal (if all else fails)

This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. If it has been contaminated, it may be possible to reclaim the product by filtration, distillation or some other means. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate.

DO NOT allow wash water from cleaning equipment to enter drains. Collect all wash water for treatment before disposal.

Recycle wherever possible.

Consult manufacturer for recycling options or consult Waste Management Authority for disposal if no suitable treatment or disposal facility can be identified.

Dispose of by: Burial in a licensed land-fill or Incineration in a licensed apparatus (after admixture with suitable combustible material)

Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION

<table>
<thead>
<tr>
<th>DOT:</th>
<th>None</th>
<th>Hazard class or Division:</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbols:</td>
<td>None</td>
<td>PG:</td>
<td>I</td>
</tr>
<tr>
<td>Identification Numbers:</td>
<td>UN1921</td>
<td>Special provisions:</td>
<td>A3, N34, T14, TP2, TP13</td>
</tr>
<tr>
<td>Label Codes:</td>
<td>3, 6.1</td>
<td>Packaging: Non-bulk:</td>
<td>201</td>
</tr>
<tr>
<td>Packaging: Exceptions:</td>
<td>None</td>
<td>Quantity limitations:</td>
<td>1 L</td>
</tr>
<tr>
<td>Packaging: Exceptions:</td>
<td>None</td>
<td>Vessel stowage: Location:</td>
<td>B</td>
</tr>
<tr>
<td>Quantity Limitations: Cargo</td>
<td>30 L</td>
<td>Vessel stowage: Other:</td>
<td>40</td>
</tr>
<tr>
<td>aircraft only:</td>
<td></td>
<td>Hazardous materials descriptions and proper shipping names:</td>
<td></td>
</tr>
</tbody>
</table>

PROPYLENEIMINE, STABILIZED

Air Transport IATA:

| ICAO/IATA Class: | 3 (6.1) | ICAO/IATA Subrisk: | None |
| UN/ID Number: | 1921 | Packing Group: | I |
| Special provisions: | None |

Shipping Name: PROPYLENEIMINE, STABILIZED

Maritime Transport IMDG:

| IMDG Class: | 3 | IMDG Subrisk: | 6.1 |
| UN Number: | 1921 | Packing Group: | I |
| EMS Number: | F-E,S-D | Special provisions: | None |
| Limited Quantities: | None |

Shipping Name: PROPYLENEIMINE, STABILIZED

Section 15 - REGULATORY INFORMATION

propylene imine (CAS: 75-55-8) is found on the following regulatory lists:

“Canada - Alberta Occupational Exposure Limits”,”Canada - British Columbia Occupational Exposure Limits”,”Canada - Northwest Territories
2-Methylaziridine
sc-230543

Material Safety Data Sheet

Hazard Alert Code Key:
- **EXTREME**
- **HIGH**
- **MODERATE**
- **LOW**


**LIMITED EVIDENCE**
- Cumulative effects may result following exposure*.
- May produce discomfort of the respiratory system and skin*.
- Possible skin sensitizer*.
- Vapors potentially cause drowsiness and dizziness*.
* (limited evidence).

Reasonable care has been taken in the preparation of this information, but the author makes no warranty of merchantability or any other warranty, expressed or implied, with respect to this information. The author makes no representations and assumes no liability for any direct, incidental or consequential damages resulting from its use. For additional technical information please call our toxicology department on +800 CHEMCALL.

- Classification of the mixture and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references. A list of reference resources used to assist the committee may be found at: www.chemwatch.net/references.
- The (MSDS) is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

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