ACRYLONITRILE

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
ACRYLONITRILE

OTHER NAMES
C3-H3-N, CH2=CHN, AN, ACN, acrylon, acrylo, carbacryl, cyanoethylene, VCN, "vinyl cyanide", propenenitrile, 2-propenenitrile, 2-propenenitrile,

PROPER SHIPPING NAME
ACRYLONITRILE, STABILIZED

PRODUCT USE
■ DANGEROUS POISON.
Large volume usage in the manufacturer of ABS and SAN plastics. In polymers for surface coatings and adhesives industry. As a chemical intermediate in the synthesis of antioxidants, dyes, pharmaceuticals, surface-active agents etc. As a modifier of natural polymers.
Preferably handled in closed systems; O.S.H.A. (U.S.A.) require this material be used in designated areas only.
Ranks among the top 50 chemicals produced domestically in USA..

SUPPLIER
Company: S D FINE - CHEM LIMITED
Address:
315- 317, T.V.IND.ESTATE,
248 WORLI ROAD,
MUMBAI- 400 030, INDIA
technical@sdfine.com
Telephone: 91- 22 24959898
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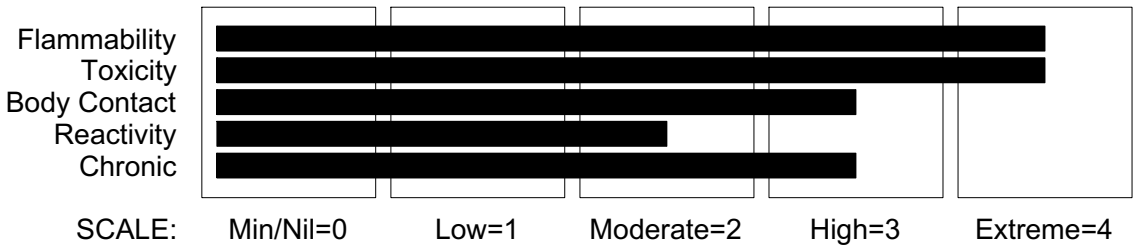
Section 2 - HAZARDS IDENTIFICATION

HAZARD RATINGS



GHS Classification

Acute Aquatic Hazard Category 2

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Acute Toxicity (Dermal) Category 3
Acute Toxicity (Inhalation) Category 2
Acute Toxicity (Oral) Category 3
Carcinogen Category 1B
Chronic Aquatic Hazard Category 2
Flammable Liquid Category 2
Respiratory Irritation Category 3
Respiratory Sensitizer Category 1
Serious Eye Damage Category 1
Skin Corrosion/Irritation Category 2
Skin Sensitizer Category 1

EMERGENCY OVERVIEW

HAZARD
DANGER
Determined by using GHS criteria:
H335 H225 H330 H301 H311 H315 H334 H317 H350 H318 H411 H401
May cause respiratory irritation
Highly flammable liquid and vapour
Fatal if inhaled
Toxic if swallowed
Toxic in contact with skin
Causes skin irritation
May cause allergic or asthmatic symptoms or breathing difficulties if inhaled
May cause allergic skin reaction
May cause CANCER
Causes serious eye damage
Toxic to aquatic life with long lasting effects
Toxic to aquatic life

PRECAUTIONARY STATEMENTS

Prevention
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
Keep container tightly closed.
Ground/bond container and receiving equipment.
Use explosion-proof electrical/ventilating/lighting equipment
Use only non-sparking tools.
Take precautionary measures against static discharge.
Do not breathe dust/fume/gas/mist/vapours/spray.
Avoid breathing dust/fume/gas/mist/vapours/spray.
Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.
Use only outdoors or in a well-ventilated area.
Contaminated work clothing should not be allowed out of the workplace.
Avoid release to the environment.
Wear protective gloves/protective clothing/eye protection/face protection.

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Section 2 - HAZARDS IDENTIFICATION

Use personal protective equipment as required.
Wear respiratory protection.
In case of inadequate ventilation wear respiratory protection.

Response
IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
IF ON SKIN: Wash with plenty of soap and water.
IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.
IF INHALED: If breathing is difficult, remove to fresh air and keep at rest in a position comfortable for breathing.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
IF exposed or concerned: Get medical advice/ attention.
Immediately call a POISON CENTER or doctor/physician.
Call a POISON CENTER or doctor/physician if you feel unwell.
Specific treatment is urgent (see MSDS).
Rinse mouth.
If skin irritation or rash occurs: Get medical advice/attention.
If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician.
Remove/Take off immediately all contaminated clothing.
Wash contaminated clothing before reuse.
Collect spillage.

Storage
Store in a well-ventilated place. Keep container tightly closed.
Store in a well-ventilated place. Keep cool.
Store locked up.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
acrylonitrile	107-13-1	>99
inhibitor *		0.1 max
hydroquinone or phenol as stabilising inhibitor		
phenol	108-95-2	0.001- ^
hydroquinone	123-31-9	0.001- ^

Section 4 - FIRST AID MEASURES

SWALLOWED
■ IMPORTANT: ESTABLISH A FIRST AID PLAN BEFORE WORKING WITH CYANIDES. ANTIDOTES SHOULD BE AV
• Prompt response in an emergency is vital.
• All workers are to be trained and refresher trained in procedures.
• Rescuers might need the protection of breathing apparatus where there is the potential of exposure to airborne cyanide.
• Use the buddy system and avoid becoming a casualty.

In all cases of cyanide exposure get medical help urgently after administering first aid.
For cyanide poisonings by any route:
• Contact Poisons Advisory Centre or a doctor.
• Seek immediate medical attention.
• Place casualty in coma position.
• Give oxygen when available.

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• Consider external cardiac compression, mechanical resuscitation and use of antidote kit.

If breathing stops mouth-to-mouth resuscitation (also called expired air resuscitation - EAR) may be given only as a last resort. Should such resort prove necessary, first wash the casualty's mouth and lips. A first aid attendant giving EAR must not inhale the expired air of the casualty.

US Practice as employed by DuPont:-

FIRST AID Swallowed/ Inhaled /Skin Contact
• If no symptoms, no treatment is necessary; decontaminate patient.
• If conscious but with symptoms present (nausea, shortness of breath, dizziness) give oxygen.
• If consciousness is impaired (slurred speech, drowsiness) give oxygen and amyl nitrite.
• If unconscious but breathing, give oxygen and amyl nitrite by means of a respirator. To give amyl nitrite, break an ampoule in a cloth and insert into lip of mask for 15 seconds, then take away for 15 seconds. Repeat 5-6 times.

First Aid Supplies for cyanide poisoning should be conveniently placed throughout cyanide areas and should be IMMEDIATELY accessible at all times. They should be routinely inspected (typically daily) by people who would use them in an emergency. The total numbers of any item listed below should be adequate to handle the largest number of exposure cases that can reasonably be anticipated, taking into account that some supplies may be wasted, destroyed or inaccessible during an emergency.

Oxygen Resuscitators - The Flynn Series III Model from O-Two Systems has been found satisfactory, being lightweight, rugged and easy to use.

Amyl Nitrite Ampoules - One box of one dozen ampoules per station is usually satisfactory. Stations should be located throughout the cyanide area.
CAUTION: Amyl nitrite is not stable and must be replaced every 1 to 2 years. Store in the original dated box away from heat. (can be stored with the resuscitator).
Avoid storage on vehicles where cabin temperatures can reach 60 deg. C. Storage in high temperature climates may require replacement before the expiry date on the box. Also avoid excessive cold storage which may limit the vapour pressure and reduce its evaporating property. Kits and amyl nitrite should be accessible, but secured against tampering or theft (an increase in the use of nitrite "poppers", as aphrodisiacs, introduces substance abuse concerns).
A set of cyanide first aid instructions should be located at each amyl nitrite storage location. Workers should be fully trained since in real emergency situations there will be insufficient time to "read the book".
Notes on the use of amyl nitrite:-
• AN is highly volatile and flammable - do not smoke or use around a source of ignition.
• If treating patient in a windy or draughty area provide some shelter or protection (shirt, wall, drum, cupped hand etc.) to prevent amyl nitrite vapour from being blown away. Keep ampoule upwind from the nose , the objective is to get amyl nitrite into the patient's lungs.
• Rescuers should avoid AN inhalation to avoid becoming dizzy and losing competence.
• Lay the patient down. Since AN dilates blood vessels and lowers blood pressure, lying down will help keep the patient conscious.
• DO NOT overuse - excessive use might put the patient into shock.
• Vasodilatory effects of amyl nitrate may promote fatal cardiac arrhythmias (particularly if the patient is not really poisoned by cyanide).
• the role of amyl nitrate as a competitive inducer of methaemoglobin in the blood stream is highly variable and, alone, may produce levels of methaemoglobin as a low as 5% only.
Experience at DuPont plants has not shown any serious after-effects from treatment with amyl nitrite.

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 Centre or a doctor, or for at least 15 minutes.

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• 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:
• Quickly but gently, wipe material off skin with a dry, clean cloth.
• Immediately 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 Centre.
• 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 cyanide intoxication (and for certain nitriles which produce cyanide ion)
• Signs symptoms of acute cyanide poisoning reflect cellular hypoxia and are often non-specific.
• Cyanosis may be a late finding.
• A bradycardic, hypertensive and tachypneic patient suggests poisoning especially if CNS and cardiovascular depression subsequently occurs.
• Immediate attention should be directed towards assisted ventilation, administration of 100% oxygen, insertion of intravenous lines and institution of cardiac monitoring.
• Obtain an arterial blood gas immediately and correct any severe metabolic acidosis (pH below 7.15).
• Mildly symptomatic patients generally require supportive care alone. Nitrites should not be given indiscriminately - in all cases of moderate to severe poisoning, they should be given in conjunction with thiosulfate. As a temporizing measure supply amyl nitrite perles (0.2ml inhaled 30 seconds every minute) until intravenous lines for sodium nitrite are established. 10 ml of a 3% solution is administered over 4 minutes to produce 20% methaemoglobin in adults. Follow directly with 50 ml of 25% sodium thiosulfate, at the same rate, IV. If symptoms reappear or persist within 1/2-1 hour, repeat nitrite and thiosulfate at 50% of initial dose. As the mode of action involves the metabolic conversion of the thiosulfate to thiocyanate, renal failure may enhance thiocyanate toxicity.
• Methylene blue is not an antidote. [Ellenhorn and Barceloux: Medical Toxicology]

If amyl nitrite intervention is employed then Medical Treatment Kits should contain the following:
• One box containing one dozen amyl nitrite ampoules
• Two sterile ampoules of sodium nitrite solution (10 mL of a 3% solution in each)
• Two sterile ampoules of sodium thiosulfate solution (50 mL of a 25% solution in each)
• One 10 mL sterile syringe. One 50 mL sterile syringe. Two sterile intravenous needles. One tourniquet.
• One dozen gauze pads.
• Latex gloves
• A "Biohazard" bag for disposal of bloody/contaminated equipment.
• A set of cyanide instructions on first aid and medical treatment.

- Notes on the use of amyl nitrite:-
• AN is highly volatile and flammable - do not smoke or use around a source of ignition.
• If treating patient in a windy or draughty area provide some shelter or protection (shirt, wall, drum, cupped hand etc.) to prevent amyl nitrite vapour from being blown away. Keep ampoule upwind from the nose, the objective is to get amyl nitrite into the patients lungs.
• Rescuers should avoid AN inhalation to avoid becoming dizzy and losing competence.
• Lay the patient down. Since AN dilates blood vessels and lowers blood pressure, lying down will help keep patient conscious.
• DO NOT overuse - excessive use might put the patient into shock. Experience at DuPont plants has not shown any serious after-effects from treatment with amyl nitrite.

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ADDITIONAL NOTES:
• Major medical treatment procedures may vary e.g. US (FDA method as recommended by DuPont) uses amyl nitrite as a methaemoglobin generator, followed by treatment with sodium nitrite and then sodium thiosulfate.

MODES OF ACTION: Amyl nitrite (AN) reacts with haemoglobin (HB) to form about 5% methaemoglobin (MHB). Sodium nitrite ($NaNO_2$) reacts with haemoglobin to form approximately 20-30% methaemoglobin. Methaemoglobin attracts cyanide ions (CN) from tissue and binds with them to become cyanmethaemoglobin (CNMHB). Sodium thiosulfate ($Na_2S_2O_3$) converts cyanmethaemoglobin to thiocyanate (HSCN) which is excreted by the kidneys. i.e. AN + HB = MHB $NaNO_2$ + HB = MHB CN + MHB = CNMHB $Na_2S_2O_3$ + CNMHB + O_2 = HSCN
• The administration of the antidote salts is intravenous in normal saline, Ringers lactate or other available IV fluid.
• European practice may use 4-dimethylaminophenol (DMAP) as a methaemoglobin generator. Also hydroxycobalamin (Vitamin B12a) is used. Hydroxycobalamin works by reacting with cyanide to form cyanocobalamin (Vitamin B12) which is excreted in the urine.
• European and Australian NOHSC (ASCC) propose dicobalt edetate (Kelocyanor) as antidote. This acts by chelating cyanide to form stable cobalticyanide, which is excreted in the urine. In all cases hyperbaric therapy may increase the efficiency of a cyanide antidote kit.
Acrylonitrile is a cellular asphyxiant with actions similar to cyanide. One author concludes that the relative ineffectiveness of anti cyanide drugs indicates that the toxicity cannot be due to cyanide solely.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA
• Foam.
• Dry chemical powder.
• BCF (where regulations permit).
• Carbon dioxide.
• Water spray or fog - Large fires only.

FIRE FIGHTING
• Alert Fire Brigade and tell them location and nature of hazard.
• 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 vapour fire hazard removed.
• Use water delivered as a fine spray to control fire and cool adjacent area.
• Avoid spraying water onto liquid pools.
• DO NOT approach containers suspected to be hot.
• Cool fire exposed containers with water spray from a protected location.
• If safe to do so, remove containers from path of fire.

FIRE/EXPLOSION HAZARD
• Liquid and vapour are highly flammable.
• Severe fire hazard when exposed to heat, flame and/or oxidisers.
• Vapour forms an explosive mixture with air.
• Severe explosion hazard, in the form of vapour, when exposed to flame or spark.
• Vapour 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 (CO_2), nitrogen oxides (NOx), other pyrolysis products typical of burning organic material.

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

Personal Protective Equipment
Gas tight chemical resistant suit.

Section 6 - ACCIDENTAL RELEASE MEASURES

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

MAJOR SPILLS
■ Environmental hazard - contain spillage.
Chemical Class: cyanides and nitriles
For release onto land: recommended sorbents listed in order of priority.

SORBENT TYPE	RANK	APPLICATION	COLLECTION	LIMITATIONS
LAND SPILL - SMALL				
cross- linked polymer - pillow	1	throw	pitchfork	R, DGC, RT
cross- linked polymer - particulate	1	shovel	shovel	R, W, SS
sorbent clay - particulate	2	shovel	shovel	R, I, P
foamed glass - pillow	2	throw	pitchfork	R, P, DGC, RT
wood fiber - pillow	3	throw	pitchfork	R, P, DGC, RT
treated wood fiber - pillow	3	throw	pitchfork	DGC, RT
LAND SPILL - MEDIUM				
sorbent clay - particulate	1	blower	skiploader	R, I, P
cross- linked polymer - particulate	2	blower	skiploader	R, W, SS
polypropylene - particulate	3	blower	skiploader	R, SS, DGC

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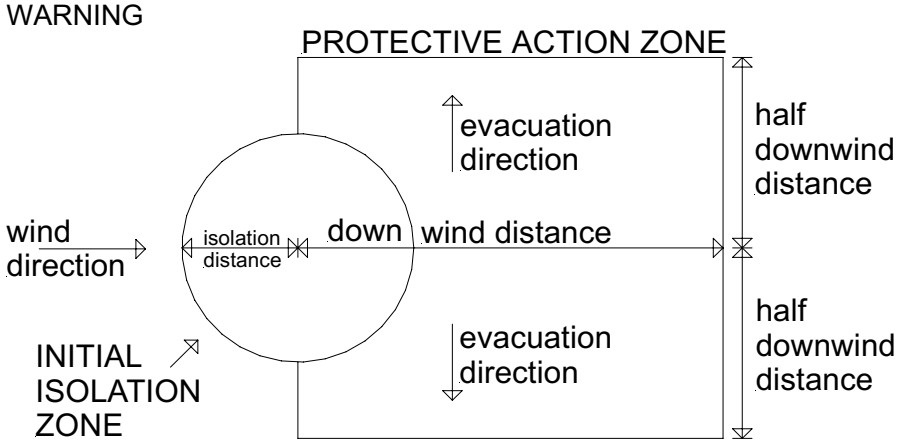
expanded mineral - particulate	4	blower	skiploader	R, I, W, P, DGC
wood fiber - particulate	5	blower	skiploader	R, W, P, DGC
diatomite - particulate	6	blower	skiploader	R, I, W, P

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
Reference: Sorbents for Liquid Hazardous Substance Cleanup and Control;
R.W Melvold et al: Pollution Technology Review No. 150: Noyes Data Corporation 1988.

- Clear area of personnel and move upwind.
- Alert Fire Brigade 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).
- 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 vapour.
- Contain spill with sand, earth or vermiculite.
- Use only spark-free shovels and explosion proof equipment.
- Collect recoverable product into labelled containers for recycling.
- Absorb remaining product with sand, earth or vermiculite.
- Collect solid residues and seal in labelled drums for disposal.
- Wash area and prevent runoff into drains.
- If contamination of drains or waterways occurs, advise emergency services.

PROTECTIVE ACTIONS FOR SPILL

WARNING



From IERG (Canada/Australia)

Isolation Distance	50 metres
Downwind Protection Distance	300 metres
IERG Number	16P

FOOTNOTES

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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 protection 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.
5 Guide 131P is taken from the US DOT emergency response guide book.
6 IERG information is derived from CANUTEC - Transport Canada.

EMERGENCY RESPONSE PLANNING GUIDELINES (ERPG)
The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour WITHOUT experiencing or developing

life-threatening health effects is:
acrylonitrile 75ppm

irreversible or other serious effects or symptoms which could impair an individual's ability to take protective action is:
acrylonitrile 35ppm

other than mild, transient adverse effects without perceiving a clearly defined odour is:
acrylonitrile 10ppm

American Industrial Hygiene Association (AIHA)

Ingredients considered according to the following cutoffs

Very Toxic (T+)	>= 0.1%	Toxic (T)	>= 3.0%
R50	>= 0.25%	Corrosive (C)	>= 5.0%
R51	>= 2.5%		
else	>= 10%		

where percentage is percentage of ingredient found in the mixture

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

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING
• Containers, even those that have been emptied, may contain explosive vapours.
• 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.
The substance is a peroxidisable vinyl monomer that may exothermically polymerise as a result of decomposition of accumulated peroxides; that is, the peroxides initiate very energetic polymerisation of the bulk monomer
Purchases of peroxidisable chemicals should be restricted to ensure that the chemical is used completely before it can become peroxidised.
• A responsible person should maintain an inventory of peroxidisable chemicals or annotate the general chemical inventory to indicate which chemicals are subject to peroxidation. An expiration date should be

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determined. The chemical should either be treated to remove peroxides or disposed of before this date.
- The person or laboratory receiving the chemical should record a receipt date on the bottle. The individual opening the container should add an opening date.
- Unopened containers received from the supplier should be safe to store for 18 months.
- Opened containers of inhibited material should not be stored for more than 12 months; they should NOT be stored under an inert atmosphere. Generally, storage of inhibited vinyl monomers should be under air rather than nitrogen or other inert atmosphere, because customary inhibitors are phenolic compounds, which require oxygen for their action. Most vinyl monomers may be polymerized without removal of inhibitor by proper adjustment of initiator concentration, thus making the isolation of the more hazardous uninhibited material unnecessary.
- Opened containers of uninhibited material (>500 g) should not be stored for more than 24 hours; small samples (less than 10 g) may be stored longer than 24 hours with discretion. Generally storage of uninhibited vinyl monomers should be under nitrogen and below room temperatures. For storage in excess of 24 hours, a suitable inhibitor should be added, and its name and quantity should be placed on the label.
- 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.
- Vapour 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.

SUITABLE CONTAINER
- Packing as supplied by manufacturer.
- Plastic containers may only be used if approved for flammable liquid.
- Check that containers are clearly labelled and free from leaks.
- For low viscosity materials (i) : Drums and jerry cans must be of the non-removable head type. (ii) : Where a can is to be used as an inner 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 (25 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 moulded plastic box and the substances are not incompatible with the plastic.

STORAGE INCOMPATIBILITY
- Nitriles may polymerise in the presence of metals and some metal compounds.
- They are incompatible with acids; mixing nitriles with strong oxidising acids can lead to extremely violent reactions.
- Nitriles are generally incompatible with other oxidising agents such as peroxides and epoxides.

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- The combination of bases and nitriles can produce hydrogen cyanide. Nitriles are hydrolysed exothermally in both aqueous acid and base to give carboxylic acids (or salts of carboxylic acids).
- Nitriles can react vigorously with reducing agents.
- The covalent cyano group is endothermic and many organic nitriles are reactive under certain conditions; N-cyano derivatives are reactive or unstable.
- The majority of endothermic compounds are thermodynamically unstable and may decompose explosively under various circumstances of initiation.
- Many but not all endothermic compounds have been involved in decompositions, reactions and explosions and, in general, compounds with significantly positive values of standard heats of formation, may be considered suspect on stability grounds.

BRETHERICK L.: Handbook of Reactive Chemical Hazards.
Acrylonitrile:

- may polymerise spontaneously unless inhibited (usually with methylhydroquinone)
- may polymerise on contact with oxygen, heat, strong light, peroxides, or concentrated or heated alkalis
- may polymerise explosively at elevated temperatures, under influence of strong light, in presence of alkalis, sliver nitrate, and peroxides (e.g. dibenzoyl peroxide, di-tert-butyl peroxide)
- reacts, possibly violently, with strong acids, oleum, strong oxidisers, amines, 2-aminoethanol, azoisobutyronitrile, bromine, caustics, chlorosulfonic acid, ethylenediamine, tetrahydrocarbazole
- reacts with copper, copper alloys, ammonia, amines, forming poisonous products
- attacks aluminium at high concentrations
- attacks most rubbers and plastics
- flow or agitation may generate electrostatic charges due to low conductivity
- vapours are uninhibited and may form polymers in plug vents, confined spaces, or flame arresters of storage tanks.
- Avoid strong acids, bases.
- Avoid reaction with oxidising agents.

STORAGE REQUIREMENTS

■ Easily peroxidisable.

- Products formed as a result of peroxidation are not only safety hazards but may chemically alter the chemical behavior of the parent compound.
- Should have a warning label affixed bearing the date of receipt in the laboratory and the date on which the container label is first opened, or laboratory synthesised materials are the responsibility of the individual chemist.
- WARNING:This product may form peroxides which themselves are not themselves particularly hazardous but which on decomposition may initiate explosive polymerisation of the bulk monomer (Trommsdorf effect).
- Should be evaluated every 12 months, redated if safe or else discarded.
- Quantities of uninhibited monomers exceeding 500 ml should not be stored for more than 24 hours.
- The oxidation of iodide to iodine or the conversion of colourless ferrothiocyanate to red ferrithiocyanate by peroxides are simple and convenient tests for most peroxides.
- Before distilling or evaporating a suitable polymerisation inhibitor should be added.
- Leave at least 10% bottoms.
- Use a shield when evaporating or distilling mixtures which may contain peroxidisable compounds.
- Store away from heat and light.
- Particular attention should be paid to the adequacy of the closure on storage containers.

Peroxides may be removed by;

- passing the material over a column of ordinary activated alumina (care should be taken in disposal of the activated alumina);
- shaking with a concentrated solution of ferrous salt (provided the carrier solvent is water-insoluble);
- agitation with an approximately equimolar mixture of ferrous sulfate and sodium bisulfate;
- commercial quantities may be treated with a 5% solution of aqueous sodium carbonate.

Jackson et al: Control of Peroxizable Compounds; Safety in the Chemical Laboratory, Journal of Chemical Education; Vol 47, 1970, pp A175-A188

- When solvents have been freed from peroxides by percolation through a column of activated alumina, the adsorbed peroxides must promptly be desorbed by treatment with polar solvents, methanol or water, which must in turn be discarded safely.***.
- Storage requires stabilising inhibitor content and dissolved oxygen content to be monitored. Refer to manufacturer's recommended levels.

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• DO NOT overfill containers so as to maintain free head space above product.
• Blanketing or sparging with nitrogen or oxygen free gas will deactivate stabiliser.
• 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 vapours 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	+

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

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

Source	Material	TWA ppm	TWA mg/m³	Notes
Australia Exposure Standards	acrylonitrile (Acrylonitrile)	2	4.3	Sk
Australia Exposure Standards	phenol (Phenol)	1	4	Sk
Australia Exposure Standards	hydroquinone (Hydroquinone)		2	

EMERGENCY EXPOSURE LIMITS

Material	Revised IDLH Value (mg/m3)	Revised IDLH Value (ppm)
acrylonitrile		85

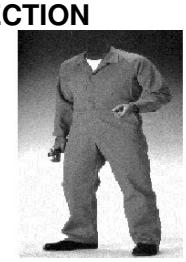
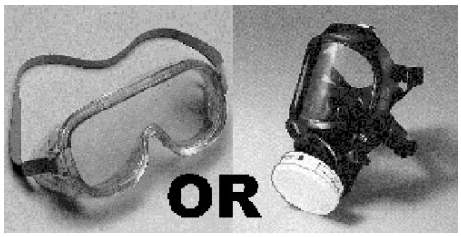
MATERIAL DATA

ACRYLONITRILE:
■ Odour Threshold Value for acrylonitrile: 1.6 ppm (detection), 22 ppm (recognition)
Odour threshold level 22 ppm (recognition) is well above exposure standard, hence odour gives no warning, rather it indicates severe overexposure.
NOTE: Detector tubes, for acrylonitrile, measuring concentrations in excess of 1ppm, are commercially available. Long-term (8 hrs) measurements may be conducted to detect concentrations exceeding 0.25 ppm.
The recommended TLV-TWA takes account of the consistent production of tumours in rats and the suspicion of cancer in humans.
Some jurisdictions require that health surveillance be conducted on occupationally exposed workers. Such surveillance should emphasise:
(i) demography, occupational and medical history and health advice
(ii) physical examination if indicated
(iii) records of personal exposure.
Odour Safety Factor(OSF)
OSF=0.12 (ACRYLONITRILE).
Odour Threshold Value for phenol: 0.060 ppm (detection)

continued...

NOTE: Detector tubes for phenol, measuring in excess of 1 ppm, are commercially available.
Systemic absorption by all routes may induce convulsions with damage to the lungs and central nervous system. Exposure at or below the recommended TLV-TWA is thought to protect the worker from respiratory, cardiovascular, hepatic, renal and neurological toxicity. Workers or volunteers exposed at or below 5.2 ppm phenol have experienced no ill-effects. Because phenol as a vapour, liquid or solid can penetrate the skin causing systemic effects, a skin notation is considered necessary. Although ACGIH has not recommended a STEL it is felt that ACGIH excursion limits (15 ppm limited to a total duration of 30 minutes with brief excursions limited to no more than 25 ppm) and NIOSH Ceiling values are sufficiently similar so as to provide the same margin of safety.
Odour Safety Factor(OSF)
OSF=25 (PHENOL).
The recommended TLV-TWA for hydroquinone takes into account the toxicology of hydroquinone and experience of industrial exposures to benzenediols. Exposure at or below the limit is thought to minimise the risk to workers of eye injury, dermatitis and central nervous system effects. A short-term duration exposure value has not been recommended, because no quantitative data as to the levels of hydroquinone which produce eye irritation or more serious corneal changes has been identified.
Exposure limits with "skin" notation indicate that vapour and liquid may be absorbed through intact skin. Absorption by skin may readily exceed vapour inhalation exposure. Symptoms for skin absorption are the same as for inhalation. Contact with eyes and mucous membranes may also contribute to overall exposure and may also invalidate the exposure standard.

PERSONAL PROTECTION

EYE
- Safety glasses with side shields.
- Chemical goggles.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

HANDS/FEET
- Wear chemical protective gloves, eg. PVC.
- Wear safety footwear or safety gumboots, eg. Rubber.

NOTE:
- The material may produce skin sensitisation in predisposed individuals. Care must be taken, when removing gloves and other protective equipment, to avoid all possible skin contact.
- Contaminated leather items, such as shoes, belts and watch-bands should be removed and destroyed.

Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: 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

continued...

(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.
• Neoprene rubber gloves.
Wear neoprene apron or full body suit.
While neoprene provides best impervious protective clothing it gives limited protection against acrylonitrile. Remove and decontaminate promptly after contact.
Wear neoprene boots.

OTHER
• Employees working with confirmed human carcinogens should be provided with, and be required to wear, clean, full body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), shoe covers and gloves prior to entering the regulated area.
• Employees engaged in handling operations involving carcinogens should be provided with, and required to wear and use half-face filter-type respirators with filters for dusts, mists and fumes, or air purifying canisters or cartridges. A respirator affording higher levels of protection may be substituted.
• Emergency deluge showers and eyewash fountains, supplied with potable water, should be located near, within sight of, and on the same level with locations where direct exposure is likely.
• Prior to each exit from an area containing confirmed human carcinogens, employees should be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers must be identified with suitable labels. 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.
• Overalls.
• 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.
First aiders must be trained for specific treatments.
Ensure there is ready access to antidote kit.

GLOVE SELECTION INDEX
■ Glove selection is based on a modified presentation of the:
" Forsberg Clothing Performance Index" .
The effect(s) of the following substance(s) are taken into account in the computer- generated selection: acrylonitrile

■ Protective Material CPI *.

BUTYL	A
SARANEX- 23	B
TEFLON	B
PE	C
PVA	C
NEOPRENE	C

continued...

A: Best Selection
B: Satisfactory; may degrade after 4 hours continuous immersion
C: Poor to Dangerous Choice for other than short term immersion

NOTE: As a series of factors will influence the actual performance of the glove, a final selection must be based on detailed observation. -

* Where the glove is to be used on a short term, casual or infrequent basis, factors such as "feel" or convenience (e.g. disposability), may dictate a choice of gloves which might otherwise be unsuitable following long-term or frequent use. A qualified practitioner should be consulted.

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.

Breathing Zone Level ppm (volume)	Maximum Protection Factor	Half- face Respirator	Full- Face Respirator
1000	10	A- AUS	-
1000	50	-	A- AUS
5000	50	Airline *	-
5000	100	-	A- 2
10000	100	-	A- 3
	100+		Airline**

* - 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. For further information consult your
Occupational Health and Safety Advisor.

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.

continued...

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE
Colourless highly flammable mobile liquid; floats on water. Solubility in water = 7%. Pungent but faint odour. Mixes with most organic solvents. Polymerizes readily in the absence of oxygen or on exposure to light. Polymerises violently in the presence of concentrated alkali. On standing may develop a yellow colour particularly on exposure to light. Acrylonitrile forms azeotropes with water and a number of organic solvent

PHYSICAL PROPERTIES
Liquid.
Mixes with water.
Toxic or noxious vapours/gas.
Contact with acids liberates very toxic gas.

State	Liquid	Molecular Weight	53.1
Melting Range (°C)	- 83	Viscosity	Not Available
Boiling Range (°C)	77.3	Solubility in water (g/L)	Miscible
Flash Point (°C)	- 1 (TOC)	pH (1% solution)	6- 7.5 @ 5% Soln.
Decomposition Temp (°C)	Not Available	pH (as supplied)	Not applicable
Autoignition Temp (°C)	481	Vapour Pressure (kPa)	11.07 @ 20C
Upper Explosive Limit (%)	17.0	Specific Gravity (water=1)	0.806- 0.82 @ 20
Lower Explosive Limit (%)	3.0	Relative Vapour Density (air=1)	1.83
Volatile Component (%vol)	100 @ 20 C	Evaporation Rate	4.54 BuAc=1
Gas group	IIB		

Material	Value
ACRYLONITRILE:	
log Kow	- 0.92- 0.25

Section 10 - CHEMICAL STABILITY AND REACTIVITY INFORMATION

CONDITIONS CONTRIBUTING TO INSTABILITY
• Polymerisation may occur at elevated temperatures.
• Polymerisation may be accompanied by generation of heat as exotherm.
• Process is self accelerating as heating causes more rapid polymerisation.
• Exotherm may cause boiling with generation of acrid, toxic and flammable vapour.
• Polymerisation and exotherm may be violent if contamination with strong acids, amines or catalysts occurs.
• Polymerisation and exotherm of material in bulk may be uncontrollable and result in rupture of storage tanks.
• Polymerisation may occur if stabilising inhibitor becomes depleted by aging.
• Stabilising inhibitor requires dissolved oxygen to be present in liquid for effective action.
• Specific storage requirements must be met for stability on ageing and transport.
For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

continued...

SWALLOWED
■ Toxic effects may result from the accidental ingestion of the material; animal experiments indicate that ingestion of less than 40 gram may be fatal or may produce serious damage to the health of the individual.
■ Initial effects of over-exposure to acrylonitrile include headache and dizziness, then nausea, vomiting diarrhoea, weakness and tachycardia. Lactic acidosis may result due to an increased rate of glycolysis. Liver dysfunction, characterised by jaundice and liver tenderness, anorexia and leukocytosis has been reported. A low grade anaemia and kidney dysfunction may also occur. Severe poisonings may produce coma, convulsions, respiratory arrest, cardiovascular collapse, and death. Convulsions and cardiac arrest may occur without warning.

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

SKIN
■ Skin contact with the material may produce toxic effects; systemic effects may result following absorption.
■ The material may cause moderate inflammation of the skin either following direct contact or after a delay of some time. Repeated exposure can cause contact dermatitis which is characterised by redness, swelling and blistering.
■ Open cuts, abraded or irritated skin should not be exposed to this material.
■ Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.
■ Minor but prolonged skin contact with acrylonitrile may cause skin damage and blistering. However lethal concentrations can be absorbed through the skin.
Prolonged skin contact produce systemic toxicity and the formation of large dermal vesicles after a latent period of several hours. The affected area may resemble a second degree thermal burn.
Repeated dermal exposure may produce a scaling dermatitis due to its solvent effect.
Acrylonitrile applied to the skin of rats had a general toxic effect producing changes in the blood vessels (congestive plethora and haemorrhage).

INHALED
■ Inhalation of vapours or aerosols (mists, fumes), generated by the material during the course of normal handling, may produce toxic effects.
■ The material can cause respiratory irritation in some persons. The body's response to such irritation can cause further lung damage.
■ Inhalation of low concentrations of acrylonitrile may cause non specific discomfort, nausea, weakness, headache, respiratory irritation even through to anaemia and abnormal liver function with jaundice.
Higher exposures may lead to nausea, vomiting, abdominal pain. Continued exposure may show convulsions, loss of consciousness, irregular pulse, palpitations, cyanosis, severe lung irritation, methaemoglobinaemia profound weakness, asphyxia or fatality from gross overexposure, irritation and anaemia.
■ Inhalation exposure may cause susceptible individuals to show change in heart beat rhythm i.e. cardiac arrhythmia. Exposures must be terminated.

CHRONIC HEALTH EFFECTS
■ Long-term exposure to respiratory irritants may result in disease of the airways involving difficult breathing and related systemic problems.
Skin contact with the material is more likely to cause a sensitisation reaction in some persons compared to the general population.
There is ample evidence that this material can be regarded as being able to cause cancer in humans based on experiments and other information.
Substance accumulation, in the human body, may occur and may cause some concern following repeated or long-term occupational exposure.
There is some evidence that inhaling this product is more likely to cause a sensitisation reaction in some persons compared to the general population.
Acrylonitrile can sensitise the skin and airways. Chronic exposures may produce severe liver inflammation. Chronic exposure at work can cause skin and eye irritation, nausea, vomiting, weakness, fatigue, jaundice, anaemia, raised white blood cells, elevated bilirubin and thiocyanate in the blood, and irritation of the liver and kidneys. When given by mouth, animal studies showed that there was an increased incidence of cancers in the nervous system, stomach, and breast. Long-term studies on textile workers showed that the

continued...

rates of lung and prostate cancer were increased.
Chronic exposure to cyanides and certain nitriles may result in interference to iodine uptake by thyroid gland and its consequent enlargement. This occurs following metabolic conversion of the cyanide moiety to thiocyanate. Thyroid insufficiency may also occur as a result of metabolic conversion of cyanides to the corresponding thiocyanate. Exposure to small amounts of cyanide compounds over long periods are reported to cause loss of appetite, headache, weakness, nausea, dizziness, abdominal pain, changes in taste and smell, muscle cramps, weight loss, flushing of the face, persistent runny nose and irritation of the upper respiratory tract and eyes. These symptoms are not specific to cyanide exposure and therefore the existence of a chronic cyanide toxicity remains speculative. Repeated minor contact with cyanides produce a characteristic rash with itching, papules (small, superficial raised spots on the skin) and possible sensitisation. Concerns have been expressed that low-level, long term exposures may result in damage to the nerves of the eye.

TOXICITY AND IRRITATION
■ unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

■ Contact allergies quickly manifest themselves as contact eczema, more rarely as urticaria or Quincke's oedema. The pathogenesis of contact eczema involves a cell-mediated (T lymphocytes) immune reaction of the delayed type. Other allergic skin reactions, e.g. contact urticaria, involve antibody-mediated immune reactions. The significance of the contact allergen is not simply determined by its sensitisation potential: the distribution of the substance and the opportunities for contact with it are equally important. A weakly sensitising substance which is widely distributed can be a more important allergen than one with stronger sensitising potential with which few individuals come into contact. From a clinical point of view, substances are noteworthy if they produce an allergic test reaction in more than 1% of the persons tested.
Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Key criteria for the diagnosis of RADS include the absence of preceding respiratory disease, in a non-atopic individual, with abrupt onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. A reversible airflow pattern, on spirometry, with the presence of moderate to severe bronchial hyperreactivity on methacholine challenge testing and the lack of minimal lymphocytic inflammation, without eosinophilia, have also been included in the criteria for diagnosis of RADS. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. Industrial bronchitis, on the other hand, is a disorder that occurs as result of exposure due to high concentrations of irritating substance (often particulate in nature) and is completely reversible after exposure ceases. The disorder is characterised by dyspnea, cough and mucus production.
For acrylonitrile:
Acute toxicity: Acrylonitrile is acutely toxic by all routes of administration.
The acute toxicity is roughly similar in most species, including rat, mice, guinea pigs, rabbits, cat dogs.
Irrespective of route or test species, a lethal dose causes central nervous system (CNS) excitation followed by paralysis and respiratory arrest. The target organs are the gastrointestinal tract (bleeding), adrenals (haemorrhagic necrosis), brain (oedema) and lungs (oedema).
Acrylonitrile is irritating to the skin and eyes. Repeated airborne exposure induces inflammatory and hyperplastic changes in the nasal mucosa, indicating a potential for irritation of the respiratory system.
In humans, short-term airborne exposure at >5 ppm (not otherwise specified) has been reported to cause eye, nose, throat and airway irritation, nausea, vomiting, headache, dizziness and limb weakness, whereas human volunteers exposed for 8 h to 2.4-5.0 ppm exhibited no deleterious effects. At higher concentrations, convulsions, unconsciousness and cardio-respiratory arrest have occurred. Skin exposure has resulted in one fatality and cases of irritant and allergic contact dermatitis. Chronic inhalation of concentrations from 0.3-5 ppm has been associated with headache, insomnia, irritability, fatigue and laryngitis, with mild anaemia and jaundice reported at levels >35 ppm.
A guinea pig maximisation test for skin sensitisation was strongly positive. There are no data on respiratory sensitisation.
Repeated-dose toxicity studies involving inhalation, ingestion or subcutaneous or intraperitoneal injection of acrylonitrile for 1-12 months in rats, mice, guinea pigs, rabbits, cats, dogs and monkeys showed a narrow range between lethal and no observed adverse effect levels. The most consistently observed effects were decreased body weight gain, irritation of the respiratory tract, kidney damage and reversible ataxia or paralysis. Retching and vomiting, adrenal hyperplasia, increased liver weight, hyperplasia of the gastric

continued...

mucosa and biochemical effects such as small reductions in haemoglobin, haematocrit and erythrocyte counts and small increases in alkaline phosphatase were observed in some studies.
Reproductive toxicity: In a 3-generation rat study, up to 35 mg/kg/day had no effect on fertility. In subacute studies in rats and mice, there was evidence of defective spermatogenesis at oral doses approaching acutely toxic levels, whereas several long-term studies found no abnormalities in male reproductive organs. In developmental toxicity studies in rats, hamsters, and rat embryos exposed in vitro, acrylonitrile showed some potential to cause foetal toxicity, but developmental effects in vivo occurred only at exposure levels associated with marked maternal toxicity.
Genotoxicity: The genetic toxicity of acrylonitrile has been investigated in numerous in vitro and in vivo test systems. In vitro, it was weakly positive in several bacterial, fungal and mammalian mutagenicity assays and mammalian and fungal cytogenetic tests, particularly in the presence of metabolic activation. Where CNEO was tested in parallel assays, it was mutagenic in the absence of metabolic activation. In vivo, acrylonitrile tested negative in several dominant lethal, micronucleus and chromosome aberration assays. Studies in Drosophila using various genetic markers gave positive results. In vitro and in vivo assays for DNA binding and unscheduled DNA synthesis yielded negative results in tests using the most reliable techniques. On balance, it appears that acrylonitrile has little affinity for DNA, whereas the metabolite CNEO is a direct-acting mutagen in vitro. It is conceivable that the lack of genotoxicity of acrylonitrile in several in vivo tests is due to limited formation and/or rapid degradation of CNEO in intact mammals.
Carcinogenicity: The carcinogenic potential of acrylonitrile has been investigated in three strains of rats exposed to 5-80 ppm in air (2 studies), 1-500 ppm in drinking water (5 studies), or 0.1-10 mg/kg by gavage (2 studies). Exposure-related tumours were found in all studies. The most common forms were astrocytomas of the CNS and carcinomas of the zymbal gland, both of which rarely occur spontaneously in experimental animals. Tumours of the mammary gland, tongue, small intestine and forestomach (oral exposure only) were less consistent across studies.
Epidemiological studies of cancer rates include 21 retrospective mortality and/or incidence cohort studies with an average duration of follow-up of 30 years in 40,887 acrylonitrile workers. Whereas early studies pointed to lung cancer as a potential hazard, recent meta-analyses found no excess of all cancers or lung cancer . In the mortality studies, all specific causes of cancer examined had meta-risk ratios near or below 1.0, except bladder cancer for which the excess was unrelated to exposure and limited to factories with aromatic amines. In the incidence studies, the relative risk of prostate cancer was slightly elevated, but most cases occurred when diagnostic techniques were less reliable and there was no trend with exposure level. The meta-analyses included many small studies with dubious exposure assessments. In the three most recent and well-conducted studies, overall findings indicated no elevation of risk for all cancers combined, cancers of the prostate and brain, or leukaemia. In the highest exposure groups (>=8 ppm-years) the relative risk of respiratory cancer was slightly elevated in two of the studies and there were 81 deaths from this cause against 75.5 expected in all three studies combined
Metabolic fate: Several studies in rats have shown that systemic absorption of acrylonitrile is fast and nearly complete by all routes of administration, with rapid distribution throughout the body and little accumulation in any particular organ. In rodents, acrylonitrile undergoes extensive biotransformation by two pathways: direct reaction with glutathione (GSH) and oxidation by cytochrome P450 to yield the epoxide cyanoethylene oxide (CNEO), which also reacts with GSH. These routes produce distinct GSH conjugates, which are further metabolised to small, water-soluble, sulfur-containing molecules, including thiocyanate. Limited data on the disposition of acrylonitrile in humans indicate that both direct conjugation with GSH and metabolism via CNEO take place. The rate of spontaneous hydrolysis of CNEO is significantly increased by microsomes from human but not from rodent
liver, apparently through catalysis by epoxide hydrolase. This is a detoxifying enzyme in liver, brain, and blood cells that hydrolyses a wide range of epoxides to the corresponding dihydrodiols. The dihydrodiol of CNEO is unstable and transformed to glycolate and thiocyanate.
Acrylonitrile and CNEO have been shown to bind to proteins in the stomach, liver, blood, kidney, lung, skin and other organs. At high exposure levels, more than 25% of the chemical may form protein adducts. Both acrylonitrile and CNEO form DNA adducts in vitro, although acrylonitrile binding is limited in the absence of metabolic activation. The only DNA adduct identified in vivo is a CNEO-guanine reaction product found at very low levels in rat liver, which is not a target organ for acrylonitrile-induced tumours.
In humans, where the epoxide hydrolase pathway is active, proteins and DNA may be less likely to form CNEO adducts than in rodents.
The material may cause severe skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin. Repeated exposures may produce severe ulceration.
WARNING: This substance has been classified by the IARC as Group 2B: Possibly Carcinogenic to Humans.

continued...

Section 11 - TOXICOLOGICAL INFORMATION

Tenth Annual Report on Carcinogens: Substance anticipated to be Carcinogen [National Toxicology Program: U.S. Dep. of Health & Human Services 2002].

CARCINOGEN

Acrylonitrile	International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs	Group	2B
Acrylonitrile	Australia National Model Regulations for the Control of Scheduled Carcinogenic Substances	Schedule	2
	Australia Exposure Standards - Carcinogens	Carcinogen Category	2

REPROTOXIN

acrylonitrile	ILO Chemicals in the electronics industry that have toxic effects on reproduction	Reduced fertility or sterility	

SKIN

acrylonitrile	Australia Exposure Standards - Skin	Notes	Sk

Section 12 - ECOLOGICAL INFORMATION

acrylonitrile 96 hr LC50 (10) mg/L Bluegill Fish Source: Experimental

Refer to data for ingredients, which follows:

ACRYLONITRILE:

■ Hazardous Air Pollutant:	Yes
■ Fish LC50 (96hr.) (mg/l):	1.18
■ log Kow (Prager 1995):	0.25
■ log Kow (Sangster 1997):	0.25
■ log Pow (Verschueren 1983):	- 0.92
■ Half- life Soil - High (hours):	552
■ Half- life Soil - Low (hours):	30
■ Half- life Air - High (hours):	189
■ Half- life Air - Low (hours):	13.4
■ Half- life Surface water - High (hours):	552
■ Half- life Surface water - Low (hours):	30
■ Half- life Ground water - High (hours):	1104
■ Half- life Ground water - Low (hours):	60
■ Aqueous biodegradation - Aerobic - High (hours):	552
■ Aqueous biodegradation - Aerobic - Low (hours):	30
■ Aqueous biodegradation - Anaerobic - High (hours):	2208
■ Aqueous biodegradation - Anaerobic - Low (hours):	120
■ Aqueous biodegradation - Removal secondary treatment - High (hours):	99.90%
■ Aqueous biodegradation - Removal secondary treatment - Low (hours):	75%
■ Photolysis maximum light absorption - High (nano- m):	203
■ Photooxidation half- life air - High (hours):	189
■ Photooxidation half- life air - Low (hours):	13.4
■ First order hydrolysis half- life (hours):	1.06E+07
■ Acid rate constant [M(H+)- HR]- 1:	4.2E- 02M- 1
■ Base rate constant [MOH)- HR]- 1:	6.1E- 01M- 1

continued...

■ On the basis of available evidence concerning either toxicity, persistence, potential to accumulate and or observed environmental fate and behaviour, the material may present a danger, immediate or long-term and /or delayed, to the structure and/ or functioning of natural ecosystems.
■ 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.
■ Soil Guidelines: Dutch Criteria:

free cyanide: 1 mg/kg (target)

20 mg/kg (intervention)

complex cyanide (pH 5): 5 mg/kg (target)

50 mg/kg (intervention)

Air Quality Standards: no safe guidelines recommended due to carcinogenic properties.
■ For acrylonitrile:
log Kow: -0.92- 0.25
Koc: 9
Half-life (hr) air: 96
Half-life (hr) H2O surface water: 24-144
Henry's atm m3 /mol: 1.10E-04
BOD 5: 0.72,nil
COD: 1.39
ThOD: 3.17
BCF: 48
Environmental fate:
Acrylonitrile is fairly degradable in both surface and groundwater. In the atmosphere, acrylonitrile reacts with hydroxyl radicals, which break down the chemical to formaldehyde and other degradation products in a few days.
Acrylonitrile evaporates rapidly so it is mainly transported by air. Due to its solubility in water, it may be washed from the air by rain and leached from the soil to groundwater.
In the atmosphere acrylonitrile degrades principally by reacting with photochemically produced hydroxy radicals. Half-life of 3.5 sunlit days under relatively clean atmospheric conditions; disperses from source.
Reported rate constants for the reaction of acrylonitrile with hydroxyl radicals range from between 2 x 10-12 cm3/molec/s to 4.9 x 10-12 cm3/molec/s, leading to half-lives of approximately 5 days or less. It has been shown that the reaction of acrylonitrile with hydroxyl radicals is independent of temperature, although it is pressure dependent and the reaction constant rises slightly with increased pressure. Half-lives determined from reaction with ozone are significantly longer, with rate constants reported between 0.14 x 10-18 and 1.38 x 10-19 cm3/molec/sec. These constants suggest half-lives between 58 and 84 days.
The major product of the reaction of acrylonitrile with hydroxyl radicals has been identified as formaldehyde. Small amounts of carbon monoxide and hydrogen cyanide, formyl cyanide and formic acid have also been reported as degradation products.
Acrylonitrile is both readily volatile in air (0.13 atm at 23 C) and highly soluble in water (79,000 mg/L) . These characteristics dominate the behavior of acrylonitrile in the environment. While present in air, acrylonitrile has little tendency to adsorb to particulate matter , so air transport of volatilized material is determined mainly by wind speed and direction. Similarly, acrylonitrile dissolved in water has only a low tendency to adsorb to suspended soils or sediments , so surface transport is determined by water flow parameters.
Based on its relatively high water solubility, acrylonitrile is expected to be highly mobile in moist soils. In addition, acrylonitrile may penetrate into groundwater from surface spills or from contaminated surface water. The high vapor pressure indicates that evaporation from dry soil samples is expected to occur rapidly.
The tendency of acrylonitrile to partition between air and water is described by Henry's law constant (H). The value of H for acrylonitrile has not been determined experimentally, but has been calculated to be 8.8 x 10-5 atm-m3/mole . This value indicates that acrylonitrile will occur in both air and water, tending to transfer between air and water phases only slowly. It is estimated that the half-time of acrylonitrile

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clearance from air in wet precipitation to be greater than 10 months.
As there are no readily hydrolysable groups on the acrylonitrile molecule, hydrolysis is not expected to be an environmentally significant process. The hydrolysis of acrylonitrile to form acrylamide requires strong acid and elevated temperatures. Based upon measured acid- and base-catalysed hydrolysis rate constants, a first-order hydrolysis half-life for acrylonitrile at pH 7 of more than 1200 years has been estimated.
Based on the relatively low value of the octanol/water partition coefficient (Kow) for acrylonitrile (log Kow = -0.92) it would not be expected that acrylonitrile will strongly bioaccumulate in the tissues of aquatic organisms. However, data in aquatic organisms exposed to water containing acrylonitrile show that it does accumulate in fat tissue. A steady-state bioconcentration factor (BCF) of 48 in bluegill sunfish has been measured. Based on the relative proportion of fat in sunfish and other aquatic organisms,an average estimated BCF of about 30 for the edible portions of freshwater and marine species has been made.
In waste-water acrylonitrile evaporates slowly (half-life 1-6 days). Biodegradation under appropriate conditions complete in about 1 week. rapidly volatile on soil although some may leach into ground water (fate unknown).
Ecotoxicity:
Acrylonitrile is moderately to slightly toxic to aquatic vertebrates and aquatic invertebrates based on acute exposure results. The available chronic studies for these two trophic levels indicate slight toxicity.
Similarly, for algae and aquatic plants, results for effects on biomass suggest acrylonitrile is moderately toxic, while results for effects on reproduction are indicative of slight toxicity.
Fish LC50 (96 h): 10-33 mg/L
Fish LC50 (96 h): bluegill sunfish 10-11.8 mg/l*; carp 19.64 mg/l*, fathead minnow 14.3-18.1 mg/*l, guppy 33.5 mg/l*, perch 5.16 mg/l*, rainbow trout 24 mg/l, sheepshead minnow 8.6 mg/l (measured, semi-static)
* nominal concentration, static or semi-static assay
Chronic toxicity of acrylonitrile to fish appears limited. A 30-day test to fathead minnow resulted in an LC50 = 2.6 mg/L, with a 100-day test on rainbow trout resulting in an LC50 =2.2 mg/L. A 30-day test in fathead minnow showed a significantly reduced survival rate at mean measured concentrations of >=0.86 mg/L and significantly reduced growth rate at test concentrations of >=0.34 mg/L. It is established from this test that a definite no observed effect concentration (NOEC) could not be measured, because effects were observed at all concentrations. In two further studies. Roach (Leuciscus rutilus) was exposed to 40 and 30 mg/L and survived >6 days and >11 days respectively. Bleak (Alburnus alburnus) similarly were exposed to 40, 25 and 20 mg/L, resulting in survival of 47 h, 16 days and >20 days respectively
Daphnia magna EC (48 h) 8.7-10 mg/l; LC50 (48 h): 7.6 mg/l; NOEC 0.78 mg/l
Two studies carried out at 14 and 21 days on Daphnia magna produced identical results, with a NOEC for survival of 2 mg/L nominal, and a NOEC for reproduction of 0.5 mg/L .The experimental data showed little or no dose response for both survival and reproduction in the concentration range used. A no adverse effect level of 3.6 mg/L in a life cycle study (21 days) in Daphnia was determined.
Algae EbC50 (72 h): Scenedesmus capricornutum 3.1 mg/l (nominal); ErC50 >7.1 mg/l (nominal); NOEC 0.8 mg/l (calculated).
■ DO NOT discharge into sewer or waterways.

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
acrylonitrile	LOW	HIGH	LOW	HIGH

GESAMP/EHS COMPOSITE LIST - GESAMP Hazard Profiles

Name / Cas No / RTECS No	EHS	TRN	A1a	A1b	A1	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3
- CAS:107-13- 1 / AT5250000	25	72	0	2	2	NR	3	0	2	3	3	2	2	CSM	NT	DE	3

Legend:
EHS=EHS Number (EHS=GESAMP Working Group on the Evaluation of the Hazards of Harmful Substances Carried by

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Ships) NRT=Net Register Tonnage, A1a=Bioaccumulation log Pow, A1b=Bioaccumulation BCF, A1=Bioaccumulation, A2=Biodegradation, B1=Acuteaquatic toxicity LC/ECIC50 (mg/l), B2=Chronic aquatic toxicity NOEC (mg/l), C1=Acute mammalian oral toxicity LD50 (mg/kg), C2=Acutemammalian dermal toxicity LD50 (mg/kg), C3=Acute mammalian inhalation toxicity LC50 (mg/kg), D1=Skin irritation & corrosion, D2=Eye irritation& corrosion, D3=Long-term health effects, E1=Tainting, E2=Physical effects on wildlife & benthic habitats, E3=Interference with coastal amenities,
For column A2: R=Readily biodegradable, NR=Not readily biodegradable.
For column D3: C=Carcinogen, M=Mutagenic, R=Reprotoxic, S=Sensitising, A=Aspiration hazard, T=Target organ systemic toxicity, L=Lunginjury, N=Neurotoxic, I=Immunotoxic.
For column E1: NT=Not tainting (tested), T=Tainting test positive.
For column E2: Fp=Persistent floater, F=Floater, S=Sinking substances.
The numerical scales start from 0 (no hazard), while higher numbers reflect increasing hazard.
(GESAMP/EHS Composite List of Hazard Profiles - Hazard evaluation of substances transported by ships)

Section 13 - DISPOSAL CONSIDERATIONS

- Containers may still present a chemical hazard/ danger when empty.
- Return to supplier for reuse/ recycling if possible.

Otherwise:

- If container can not be cleaned sufficiently well to ensure that residuals do not remain or if the container cannot be used to store the same product, then puncture containers, to prevent re-use, and bury at an authorised landfill.
- Where possible retain label warnings and MSDS and observe all notices pertaining to the product.

Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.
A Hierarchy of Controls seems to be common - the user should investigate:

- Reduction,
- Reuse
- Recycling
- Disposal (if all else fails)

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

- DO NOT allow wash water from cleaning or process equipment to enter drains.
- It may be necessary to collect all wash water for treatment before disposal.
- In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.
- Where in doubt contact the responsible authority.
- Recycle wherever possible.
- Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
- Dispose of by: burial in a land-fill specifically licenced to accept chemical and / or pharmaceutical wastes or Incineration in a licenced apparatus (after admixture with suitable combustible material).
- Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

If incinerated under oxygen depletion, hydrogen cyanide can form.

Section 14 - TRANSPORTATION INFORMATION

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Section 14 - TRANSPORTATION INFORMATION

Labels Required: FLAMMABLE LIQUID,TOXIC

HAZCHEM:
□ *3WE Use alcohol resistant foam

Land Transport UNDG:

Class or division:	3	Subsidiary risk:	6.1
UN No.:	1093	UN packing group:	I

Shipping Name:ACRYLONITRILE, STABILIZED

Air Transport IATA:

ICAO/IATA Class:	3 (6.1)	ICAO/IATA Subrisk:	None
UN/ID Number:	1093	Packing Group:	I
Special provisions:	None		
Cargo Only			
Packing Instructions:	303	Maximum Qty/Pack:	30 L
Passenger and Cargo		Passenger and Cargo	
Packing Instructions:	Forbidden	Maximum Qty/Pack:	Forbidden
Passenger and Cargo		Passenger and Cargo	
Limited Quantity		Limited Quantity	
Packing Instructions:	-	Maximum Qty/Pack:	-

Shipping Name: ACRYLONITRILE, STABILIZED

Maritime Transport IMDG:

IMDG Class:	3	IMDG Subrisk:	6.1
UN Number:	1093	Packing Group:	I
EMS Number:	F- E, S- D	Special provisions:	None
Limited Quantities:	None		

Shipping Name: ACRYLONITRILE, STABILIZED

GESAMP hazard profiles for this material can be found in section 12 of the MSDS.

Section 15 - REGULATORY INFORMATION

REGULATIONS

acrylonitrile (CAS: 107-13-1) is found on the following regulatory lists;

"Australia - New South Wales Hazardous Substances Requiring Health Surveillance","Australia - New South Wales Notifiable Carcinogens","Australia - Queensland Hazardous Materials and Prescribed Quantities for Major Hazard Facilities","Australia - Tasmania Hazardous Substances Requiring Health Surveillance","Australia - Western Australia Carcinogenic substances to be used only for purposes approved by the Commissioner","Australia - Western Australia Hazardous Substances Requiring Health Surveillance","Australia Dangerous Goods Code (ADG Code) - Goods Too Dangerous To Be Transported","Australia Exposure Standards","Australia Hazardous Substances","Australia Hazardous Substances Requiring Health Surveillance","Australia Inventory of Chemical Substances (AICS)","Australia National Model Regulations for the Control of Scheduled Carcinogenic Substances","Australia National Pollutant Inventory","Australia Occupational Health and Safety (Commonwealth Employment) (National Standards) Regulations 1994 - Hazardous Substances Requiring Health Surveillance","Australia Occupational Health and Safety (Commonwealth Employment) (National Standards) Regulations 1994 - Scheduled Carcinogenic Substance","GESAMP/EHS Composite List - GESAMP Hazard Profiles","IMO IBC Code Chapter 17: Summary of minimum requirements","IMO MARPOL 73/78 (Annex II) - List of Noxious Liquid Substances Carried in Bulk","International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs","International Air Transport Association (IATA) Dangerous Goods Regulations", "International Air Transport Association (IATA) Dangerous Goods Regulations - Prohibited List","International Chemical Secretariat (ChemSec) REACH SIN* List (*Substitute It Now!) 1.0","OECD Representative List of High Production Volume (HPV) Chemicals"

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Section 16 - OTHER INFORMATION

MSDS SECTION CHANGES

The following table displays the version number of and date on which each section was last changed.

Section Name	Version	Date	Section Name	Version	Date	Section Name	Version	Date
Ingredients	5	7- Jan- 2006	Storage (storage incompatibility)	6	11- Jun- 2007	Instability Condition	5	7- Jan- 2006
Advice to Doctor	5	7- Jan- 2006	Storage (storage requirement)	5	7- Jan- 2006	Acute Health (eye)	5	7- Jan- 2006
First Aid (skin)	5	7- Jan- 2006	Storage (suitable container)	5	7- Jan- 2006	Acute Health (inhaled)	6	11- Jun- 2007
Fire Fighter (extinguishing media)	5	7- Jan- 2006	Engineering Control	6	11- Jun- 2007	Acute Health (skin)	6	11- Jun- 2007
Fire Fighter (fire fighting)	5	7- Jan- 2006	Exposure Standard	6	11- Jun- 2007	Acute Health (swallowed)	5	7- Jan- 2006
Fire Fighter (fire incompatibility)	5	7- Jan- 2006	Personal Protection (eye)	5	7- Jan- 2006	Chronic Health	6	11- Jun- 2007
Fire Fighter (fire/explosion hazard)	5	7- Jan- 2006	Personal Protection (hands/feet)	6	11- Jun- 2007	Toxicity and Irritation (Other)	6	11- Jun- 2007
Spills (major)	5	7- Jan- 2006	Personal Protection (other)	5	7- Jan- 2006	Environmental	6	11- Jun- 2007
Spills (minor)	5	7- Jan- 2006	Appearance	5	7- Jan- 2006	Disposal	6	11- Jun- 2007
Handling Procedure	6	11- Jun- 2007	Physical Properties	5	7- Jan- 2006	Transport	5	7- Jan- 2006

■

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

The above information is believed to be accurate and represent the best information currently available to us, but does not represent any warranty expressed or implied of the properties of the product. User should make their own investigation to determine the suitability of the information for their particular purpose.

Issue Date: 4-Jul-2017