PARS LIAN
Chemical Company Ltd.

PRODUCT BULLETIN

PL 385
Corrosion Inhibitor

General Information

PL 385 is an oil-soluble, highly water dispersible film-forming type organic inhibitor. It is an outstanding inhibitor for use in continuous treating applications, and exhibits good filming characteristics in batch treating application.

Typical Physical Properties

Specific Gravity @ 25ºC:……...0.84-0.89
Viscosity, cps @ 40ºC:…….3-6
Appearance:……Amber Colour
Pour Point, ASTM ºC:……...<-5
Flash Point ºC:…….>50

Features and Benefits

Contains special emulsion prevention chemical.
Specifically formulates for use in hot, wet or dry systems.
High thermal stability (400ºF)
Soluble in Hydrocarbons and alcohols.

Recommended Uses

PL 385 is used to control corrosion in gas wells, gas pipelines, gas plants, and gas-lift producing systems. It is also used to treat producing oil wells, pipelines, and any other application where a good oil soluble corrosion inhibitor is required.

Material Compatibility

PL 385 is compatible with Carbon Steel, Viton and High Density Polyethylene. Contact with natural and synthetic rubbers and polypropylene should be avoided.

Product Application

Recommendations for any corrosion inhibition program will depend upon the specific conditions of the system. The following are intended to serve as general application guidelines.

Gas Wells

Treat at a rate of 0.5 to 1 pint of chemical per MMSCF of gas by continuous injection through a down-hole injection valve. Where appreciable amounts of liquids are flowing with the gas, consider the use of additional inhibitor. Gas wells can also be treated with **PL 385** by the tubing displacement or batch treating method.

Gas Pipelines

PL 385 may be applied by batching between pigs or by continuous injection. For batch treating, one part of **PL 385** should be diluted or dispersed in 10 to 20 parts of a suitable carrier. The amount of chemical required will depend upon the length and diameter of the line. There should be sufficient volume to ensure a complete coating of the line. For continuous treating inject **PL 385** into the system at a rate of 0.5 to 1 pint per MMSCF of gas, or 10-25 ppm based on total fluids.

Gas Plants

PL 385 may be used in most hydrocarbon processes where corrosion is a problem. Treatment rates will vary depending on the severity of the corrosion problem.

Cont. –2-

Gas Lift Producing Systems

Inject **PL 385** continuously into the surface gas lines of a gas lift system to provide control in down hole equipment. The normal treatment rate is approximately 25 ppm of **PL 385** based on total produced fluids.

Producing Oil wells

Inject **PL 385** continuously at a rate of 5-25 ppm based on total fluids. In batch treating or tubing displacement, this product should be diluted with diesel, kerosene, or field fluids. The ratios used will depend upon the specific applications.

For Pipe Line

Inject **PL 385** continously at arate of 8-10 ppm depending upon the severty of corrosion problem.

Oil Pipelines

Inject **PL 385** continuously at a rate of 5-10 ppm based on total fluids. In batch treating or tubing displacement, this product should be diluted with diesel, kerosene, or field fluids. The ratios used will depend upon the specific applications.

Material Compatibility

See Chemical Hazard Data Sheet or consult with Pars Lian.

Health Information

Avoid breathing vapors and contact with skin, eyes and clothing. Wash thoroughly after handling. In case of eye contact, immediately flush with plenty of water for at least 15 minutes. Call a physician. Flush skin with water. Please refer to the Chemical Handling Data Sheet.

Storage/Handling

Keep away from heat, sparks, and open flames. Keep containers closed. Use with adequate ventilation. Observe any warning labels on product container. Other normal precautions for process chemicals apply.

Availability

PL 385 is available in bulk loads or 220-liter non-returnable drums from Nalco/Pars Lian. For further information on this product, please contact Pars Lian.

SAFETY DATA SHEET

DIESEL FUEL

000003000395

Version 5.0 | Revision Date 2018/12/19 | Print Date 2018/12/19

SECTION 1. IDENTIFICATION

Product name	:	DIESEL FUEL
Synonyms	:	Seasonal Diesel, #1 Diesel, #2 Heating Oil, #1 Heating Oil, D50, Arctic Diesel, Farm Diesel, Marine Diesel, Low Sulphur Diesel, LSD, Ultra Low Sulphur Diesel, ULSD, Mining Diesel, Naval Distillate, Dyed Diesel, Marked Diesel, Coloured Diesel, Furnace special, Biodiesel blend, B1, B2, B5, Diesel Low Cloud (LC), Marine Gas Oil, Marine Gas Oil Dyed.
Product code	:	102907, 102762, 102763, 102755, 102302, 102744, 101801, 100678, 100677, 101802, 100107, 100668, 100658, 100911, 100663, 100652, 100460, 100065, 101796, 101793, 101795, 101792, 101794, 101791, 100768, 100643, 100642, 100103, 101798, 101800, 101797, 101788, 101789, 101787, 102531, 100734, 100733, 100640, 100997, 100995, 100732, 100731, 100994
Manufacturer or supplier's details		Petro-Canada P.O. Box 2844, 150 - 6th Avenue South-West Calgary Alberta T2P 3E3 Canada
Emergency telephone number		Suncor Energy: +1 403-296-3000; Canutec Transportation: 1-888-226-8832 (toll-free) or 613-996-6666; Poison Control Centre: Consult local telephone directory for emergency number(s).

Recommended use of the chemical and restrictions on use

Recommended use	:	Diesel fuels are distillate fuels suitable for use in high and medium speed internal combustion engines of the compression ignition type. Mining diesels, marine diesels, MDO and naval distillates may have a higher flash point requirement.
Prepared by	:	Product Safety: +1 905-804-4752

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Appearance	Bright oily liquid.
Colour	Clear to yellow (This product may be dyed red for taxation purposes)
Odour	Mild petroleum oil like.

GHS Classification

Flammable liquids	:	Category 3
Acute toxicity (Inhalation)	:	Category 4
Skin irritation	:	Category 2
Carcinogenicity	:	Category 2
Specific target organ toxicity - single exposure	:	Category 3 (Central nervous system)
Specific target organ toxicity - repeated exposure	:	Category 2 (Liver, thymus, Bone)
Aspiration hazard	:	Category 1

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Flammable liquid and vapour.
May be fatal if swallowed and enters airways.
Causes skin irritation.
Harmful if inhaled.
May cause drowsiness or dizziness.
Suspected of causing cancer.
May cause damage to organs (Liver, thymus, Bone) through prolonged or repeated exposure.

Precautionary statements : **Prevention:**
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
Keep container tightly closed.
Ground and bond container and receiving equipment.
Use explosion-proof electrical/ ventilating/ lighting equipment.
Use non-sparking tools.
Take action to prevent static discharges.
Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
Wash skin thoroughly after handling.
Use only outdoors or in a well-ventilated area.
Wear protective gloves/ protective clothing/ eye protection/ face protection.
Response:
IF SWALLOWED: Immediately call a POISON CENTER/doctor.
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water.
IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/doctor if you feel unwell.

IF exposed or concerned: Get medical advice/ attention.
Do NOT induce vomiting.
If skin irritation occurs: Get medical advice/ attention.
Take off contaminated clothing and wash it before reuse.
In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
Storage:
Store in a well-ventilated place. Keep container tightly closed.
Store in a well-ventilated place. Keep cool.
Store locked up.
Disposal:
Dispose of contents/ container to an approved waste disposal plant.

Potential Health Effects

Primary Routes of Entry : Eye contact
Ingestion
Inhalation
Skin contact

Aggravated Medical Condition : None known.

Other hazards

None known.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

Hazardous components

Chemical name	CAS-No.	Concentration
Kerosine (petroleum), hydrodesulfurized; Kerosine -unspecified	64742-81-0	70 - 100 %
Kerosine (petroleum); Straight run kerosine	8008-20-6	
Fuels, diesel; Gasoil -unspecified	68334-30-5	
Alkanes, C10-20-branched and linear	928771-01-1	0 - 30 %
Fatty acids, C16-18 and C18-unsatd., Me esters	67762-38-3	0 - 20 %

All concentrations are in percent by weight.

SECTION 4. FIRST AID MEASURES

If inhaled : Move to fresh air.
Artificial respiration and/or oxygen may be necessary.
Seek medical advice.

In case of skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Wash skin thoroughly with soap and water or use recognized skin cleanser.

Wash clothing before reuse.
Seek medical advice.

In case of eye contact	:	Remove contact lenses. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.
If swallowed	:	Rinse mouth with water. DO NOT induce vomiting unless directed to do so by a physician or poison control center. Never give anything by mouth to an unconscious person. Seek medical advice.
Most important symptoms and effects, both acute and delayed	:	Harmful if inhaled. Respiratory, skin and eye irritation; nausea; cancer.
Notes to physician	:	Treat symptomatically. For specialist advice physicians should contact the Poisons Information Service.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Dry chemical Carbon dioxide (CO2) Water fog. Foam
Unsuitable extinguishing media	:	Do NOT use water jet.
Specific hazards during firefighting	:	Cool closed containers exposed to fire with water spray.
Hazardous combustion products	:	Carbon oxides (CO, CO2), nitrogen oxides (NOx), sulphur oxides (SOx), smoke and irritating vapours as products of incomplete combustion.
Further information	:	Prevent fire extinguishing water from contaminating surface water or the ground water system.
Special protective equipment for firefighters	:	Wear self-contained breathing apparatus for firefighting if necessary.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	For personal protection see section 8. Ensure adequate ventilation. Evacuate personnel to safe areas. Material can create slippery conditions.
Environmental precautions	:	If the product contaminates rivers and lakes or drains inform

respective authorities.

Methods and materials for containment and cleaning up : Prevent further leakage or spillage if safe to do so.
Remove all sources of ignition.
Soak up with inert absorbent material.
Non-sparking tools should be used.
Ensure adequate ventilation.
Contact the proper local authorities.

SECTION 7. HANDLING AND STORAGE

Advice on safe handling : For personal protection see section 8.
Smoking, eating and drinking should be prohibited in the application area.
Use only with adequate ventilation.
In case of insufficient ventilation, wear suitable respiratory equipment.
Avoid spark promoters. Ground/bond container and equipment. These alone may be insufficient to remove static electricity.
Avoid contact with skin, eyes and clothing.
Do not ingest.
Keep away from heat and sources of ignition.
Keep container closed when not in use.

Conditions for safe storage : Store in original container.
Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Keep in a dry, cool and well-ventilated place.
Keep in properly labelled containers.
To maintain product quality, do not store in heat or direct sunlight.
Ensure the storage containers are grounded/bonded.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
Kerosine (petroleum), hydrodesulfurized; Kerosine - unspecified	64742-81-0	TWA	200 mg/m3 (As total hydrocarbon vapour)	ACGIH
		TWA	200 mg/m3 (total hydrocarbon vapor)	CA AB OEL
		TWA	525 mg/m3	CA ON OEL
		TWA	200 mg/m3 (As total hydrocarbon vapour)	ACGIH
		TWA	200 mg/m3 (total hydrocarbon	ACGIH

			vapor)	
Kerosine (petroleum); Straight run kerosine	8008-20-6	TWA	200 mg/m3 (total hydrocarbon vapor)	CA BC OEL
		TWA	200 mg/m3 (total hydrocarbon vapor)	CA AB OEL
		TWA	200 mg/m3 (total hydrocarbon vapor)	ACGIH
Fuels, diesel; Gasoil - unspecified	68334-30-5	TWA	100 mg/m3 (total hydrocarbons)	CA AB OEL
		TWA (Vapour and inhalable aerosols)	100 mg/m3 (total hydrocarbons)	CA BC OEL
		TWA (Inhalable fraction and vapor)	100 mg/m3 (total hydrocarbons)	ACGIH

Engineering measures : Adequate ventilation to ensure that Occupational Exposure Limits are not exceeded.
Use only in well-ventilated areas.
Ensure that eyewash station and safety shower are proximal to the work-station location.

Personal protective equipment

Respiratory protection : Concentration in air determines protection needed.
Use respiratory protection unless adequate local exhaust ventilation is provided or exposure assessment demonstrates that exposures are within recommended exposure guidelines. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Filter type : organic vapour cartridge or canister may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits. Protection provided by air-purifying respirators is limited. Use a positive-pressure, air-supplied respirator if there is any potential for uncontrolled release, exposure levels are unknown, or any other circumstances where air-purifying respirators may not provide adequate protection.

Hand protection

Material : neoprene, nitrile, polyvinyl alcohol (PVA), Viton(R). Consult your PPE provider for breakthrough times and the specific glove that is best for you based on your use patterns. It should be realized that eventually any material regardless of their imperviousness, will get permeated by chemicals. Therefore, protective gloves should be regularly checked for wear and tear. At the first signs of hardening and cracks, they should be changed.

Remarks	:	Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Eye protection	:	Wear face-shield and protective suit for abnormal processing problems.
Skin and body protection	:	Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place.
Protective measures	:	Wash contaminated clothing before re-use.
Hygiene measures	:	Remove and wash contaminated clothing and gloves, including the inside, before re-use. Wash face, hands and any exposed skin thoroughly after handling.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Bright oily liquid.
Colour	:	Clear to yellow (This product may be dyed red for taxation purposes)
Odour	:	Mild petroleum oil like.
Odour Threshold	:	No data available
pH	:	No data available
Melting point	:	No data available
Boiling point/boiling range	:	150 - 371 °C (302 - 700 °F)
decomposition temperature		No data available
Flash point	:	> 40 °C (104 °F) Method: closed cup
Auto-Ignition Temperature	:	225 °C (437 °F)
Evaporation rate	:	No data available
Flammability	:	Flammable in presence of open flames, sparks and heat. Vapours are heavier than air and may travel considerable distance to sources of ignition and flash back. This product can accumulate static charge and ignite.
Upper explosion limit	:	6 %(V)
Lower explosion limit	:	0.7 %(V)
Vapour pressure	:	7.5 mmHg (20 °C / 68 °F)

Relative vapour density	:	4.5
Relative density	:	0.8 - 0.88
Solubility(ies)		
Water solubility	:	insoluble
Partition coefficient: n-octanol/water	:	No data available
Viscosity		
Viscosity, kinematic	:	1.3 - 4.1 cSt (40 °C / 104 °F)

SECTION 10. STABILITY AND REACTIVITY

Reactivity	:	Stable at normal ambient temperature and pressure.
Chemical stability	:	Stable under normal conditions.
Possibility of hazardous reactions	:	Hazardous polymerisation does not occur.
Conditions to avoid	:	Extremes of temperature and direct sunlight.
Incompatible materials	:	Reactive with oxidising agents and acids.
Hazardous decomposition products	:	May release COx, NOx, SOx, smoke and irritating vapours when heated to decomposition.

SECTION 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure
Eye contact
Ingestion
Inhalation
Skin contact

Acute toxicity

Product:

Acute oral toxicity	:	Remarks: No data available
Acute inhalation toxicity	:	Acute toxicity estimate: 1.2 mg/l Exposure time: 4 h Test atmosphere: dust/mist Method: Calculation method
Acute dermal toxicity	:	Remarks: No data available

Components:

Kerosine (petroleum), hydrodesulfurized; Kerosine -unspecified:

Acute oral toxicity	:	LD50 (Rat): > 5,000 mg/kg,
Acute inhalation toxicity	:	LC50 (Rat): > 5.2 mg/l Exposure time: 4 hrs Test atmosphere: dust/mist
Acute dermal toxicity	:	LD50 (Rabbit): > 2,000 mg/kg,

Kerosine (petroleum); Straight run kerosine:

Acute oral toxicity	:	LD50 (Rat): > 5,000 mg/kg,
Acute inhalation toxicity	:	LC50 (Rat): > 5 mg/l Exposure time: 4 h Test atmosphere: dust/mist
Acute dermal toxicity	:	LD50 (Rabbit): > 2,000 mg/kg,

Fuels, diesel; Gasoil -unspecified:

Acute oral toxicity	:	LD50 (Rat): 7,500 mg/kg,
Acute dermal toxicity	:	LD50 (Mouse): 24,500 mg/kg,

Skin corrosion/irritation

Product:

Remarks: Causes skin irritation.

Serious eye damage/eye irritation

Product:

Remarks: No data available

Respiratory or skin sensitisation

Product:

Remarks: Based on available data, the classification criteria are not met.

Germ cell mutagenicity

Product:

Genotoxicity in vitro	Remarks: No data available
Genotoxicity in vivo	Remarks: No data available

Carcinogenicity

Product:

Carcinogenicity - Assessment	Suspected of causing cancer.

Reproductive toxicity

Product:

Effects on fertility	Remarks: Based on available data, the classification criteria are not met.

STOT - single exposure

Product:

Remarks: May cause drowsiness or dizziness.

STOT - repeated exposure

Product:

Remarks: May cause damage to organs through prolonged or repeated exposure.

No data available

Aspiration toxicity

Product:

May be fatal if swallowed and enters airways.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish	:	Remarks: No data available
Toxicity to daphnia and other aquatic invertebrates	:	Remarks: No data available
Toxicity to algae	:	Remarks: No data available
Toxicity to bacteria	:	Remarks: No data available

Persistence and degradability

Product:

Biodegradability	:	Remarks: No data available

Bioaccumulative potential

No data available

Mobility in soil

No data available

Other adverse effects

No data available

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues : The product should not be allowed to enter drains, water courses or the soil.
Offer surplus and non-recyclable solutions to a licensed disposal company.
Waste must be classified and labelled prior to recycling or disposal.
Send to a licensed waste management company.
Dispose of as hazardous waste in compliance with local and national regulations.
Dispose of product residue in accordance with the instructions of the person responsible for waste disposal.

SECTION 14. TRANSPORT INFORMATION

International Regulations

IATA-DGR

UN/ID No.	:	UN 1202
Proper shipping name	:	Diesel fuel
Class	:	3
Packing group	:	III
Labels	:	Class 3 - Flammable Liquid
Packing instruction (cargo aircraft)	:	366

IMDG-Code

UN number	:	UN 1202
Proper shipping name	:	DIESEL FUEL
Class	:	3
Packing group	:	III
Labels	:	3
EmS Code	:	F-E, S-E
Marine pollutant	:	no

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

National Regulations

TDG

UN number	:	UN 1202
Proper shipping name	:	DIESEL FUEL
Class	:	3
Packing group	:	III

Labels	:	3
ERG Code	:	128
Marine pollutant	:	no

SECTION 15. REGULATORY INFORMATION

This product has been classified according to the hazard criteria of the Hazardous Products Regulations (HPR) and the SDS contains all of the information required by the HPR.

The components of this product are reported in the following inventories:

DSL	On the inventory, or in compliance with the inventory

SECTION 16. OTHER INFORMATION

For Copy of SDS	:	Internet: www.petro-canada.ca/msds Canada-wide: telephone: 1-800-668-0220; fax: 1-800-837-1228 For Product Safety Information: 1 905-804-4752
Prepared by	:	Product Safety: +1 905-804-4752
Revision Date	:	2018/12/19

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

AFROX
A Member of The Linde Group

MATERIAL SAFETY DATA SHEET (MSDS)
BUTANE
Please ensure that this MSDS is received by an appropriate person

DATE: May 2015 Version 3

Ref. No.: MS088

1 PRODUCT AND COMPANY IDENTIFICATION

Product Name	n-Butane iso-Butane
Chemical Formula	C_4H_{10}r
Trade Names	Butane, Pure
Colour coding	Dulux Light Weatherwork, Grey body with Red (A11) circle, 250 mm diameter, below the valve.
Valve	OMECA: Brass 5/8 inch BSP left hand female (vapour outlet) Liquid outlet ¼ inch flare fitting
Company Identification	African Oxygen Limited 23 Webber Street Johannesburg, 2001 Tel No: (011) 490-0400 Fax No: (011) 490-0506
EMERGENCY NUMBER	**0860 020202 or (011) 873 4382 (24 hours)**

2 COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	n-Butane Iso-Butane
Chemical Family	Aliphatic hydrocarbons
CAS No.	106-97-8
UN No.	1969
ERG No.	115
Hazard Warning	2 A Flammable Gas

3 HAZARDS IDENTIFICATION

Main Hazards

All cylinders are portable gas containers, and must be regarded as pressure vessels at all times. Vaporised Butane liquid is highly flammable and can form explosive mixtures with air. The flammability limits in air are 1,8 -8,4% by volume. Vaporised Butane does not support life. It can act as a simple asphyxiant by diluting the concentration of oxygen in air to below levels necessary to support life. Exposure to the liquid phase could result in serious cold burns.

Adverse Health Effects

Butane is non-toxic. Prolonged inhalation of high concentrations has an anaesthetic effect, but could also act as a simple asphyxiant by displacing oxygen in the air to below levels necessary to support life.

Chemical Hazards

On complete combustion no hazardous compounds are formed.

Biological Hazards

Contact with the liquid phase could result in frostbite.

Vapour Inhalation

Since vaporised Butane acts as a simple asphyxiant, death may result from errors in judgement, confusion, or loss of consciousness which prevents self-rescue. At low oxygen concentrations, unconsciousness and death may occur in seconds without warning.

Eye Contact

Vapour Phase	None
Liquid Phase	Serious cold burns could result

Skin Contact

Vapour Phase	None
Liquid Phase	Frostbite

Ingestion

Liquid Phase	Serious cold burns could result

Label Elements

Hazard Pictograms

Precautionary Statements:

P210:	Keep away from heat/sparks/open flames/hot surfaces
P377:	Leaking gas fire: Do not extinguish unless leak can be stop safely
P381:	Eliminate all sources of ignition
P403:	Store in well ventilated place

4 FIRST AID MEASURES

Prompt medical attention is mandatory in all cases of overexposure to vaporised Butane. Rescue personnel should be equipped with self-contained breathing apparatus. In case of frostbite from contact with the liquid phase, place the frost-bitten part in warm water, about 40-42◦C. If warm water is not available, wrap the affected part gently in blankets. Encourage the patient to exercise the affected part whilst it is being warmed. Do not remove clothing while frosted. Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be removed to an uncontaminated area, and given mouth-to-mouth resuscitation and supplemental oxygen.

Eye Contact

Liquid Phase - Immediately flush with large quantities of tepid water, or with sterile saline solution. Seek medical attention.

Skin Contact

Liquid Phase – See above for handling of frostbite.

Ingestion

No known effect.

5 FIRE FIGHTING MEASURES

Extinguishing Media

Do not extinguish fire unless the leakage can be stopped. Do not use water jet. Use dry chemical, CO_2 or foam.

Specific Hazards

The rupturing cylinders or bulk containers due to excessive exposure to a fire could result in a BLEVE (Boiling Liquid Expanding Vapour Explosion), with disastrous effects. As the flammability limits in air for Butane are 1,8 - 8,4% by volume, extreme care must be taken when handling leaks.

Emergency Actions

If possible, shut off the source of the spillage. Evacuate area. Post notices “NO NAKED LIGHTS - NO SMOKING”. Prevent liquid or vapour from entering sewers, basements and work-pits. Keep cylinders or bulk vessels cool by spraying with water if exposed to a fire. If tanker has overturned, do not attempt to right or move it. CONTACT THE NEAREST AFROX BRANCH.

Protective Clothing

Ref. No.: MS088
Self-contained breathing apparatus, safety gloves, goggles and shoes or boots should be worn when handling containers.

Environmental Precautions
Vaporised Butane is heavier than air and could form pockets of oxygen-deficient atmosphere in low-lying areas.

6 ACCIDENTAL RELEASE MEASURES

Personal Precautions
Do not enter any area where Butane has been spilled unless tests have shown that it is safe to do so.

Environmental Precautions
The danger of widespread formation of explosive Butane/Air mixtures should be taken into account. Accidental ignition could result in a massive explosion.

Small Spills
DO NOT extinguish the fire unless the leakage can be stopped immediately. Once the fire has been extinguished and all spills have been stopped, ventilate the area.

Large Spills
Stop the source if it can be done without risk. Contain the leaking liquid with sand or earth, or disperse with special water/fog spray nozzle. Allow to evaporate. Take the precautions as listed above under "Emergency Actions". Restrict access to the area until completion of the clean-up procedure. Ventilate the area using forced draught if necessary. All electrical equipment should be flameproof.

7 HANDLING AND STORAGE

Cylinders containing Butane should only be handled and stored in the vertical position. Cylinders should never be rolled. Do not allow cylinders to slide or come into contact with sharp edges, and they should be handled carefully. Ensure that cylinders are stored away from other oxidants. Comply with all local legislation. Keep out of reach of children.

8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Hazards
As vapourised Butane is a simple asphyxiant, avoid any areas where spillage has taken place. Only enter once testing has proved the atmosphere to be.

Engineering Control Measures
Engineering control measures are preferred to reduce exposure to oxygen depleted atmospheres. General methods include forced-draught ventilation, separate from other exhaust ventilation systems. Ensure that sufficient fresh air enters at, or near, floor level. Ensure that all electrical equipment is flameproof.

Personal Protection
Self-contained breathing apparatus should always be worn when entering area where oxygen depletion may have occurred. Safety goggles, gloves and shoes, or boots, should be worn when handling containers.

Skin Wear loose-fitting overalls, preferably without pockets.

9 PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL DATA

Chemical Symbol	C_4H_{10}
Molecular Weight	58,124
Specific volume @ 20°C & 101,325 kPa	398 ml/g
Boiling point @ 101,32 kPa	- 0,5°C
Density, gas @ 20°C & 101,35 kPa	2,544 kg/m^3
Relative density (Air = 1)	2,11
Auto-ignition temperature	430°C
Flammability limits in air	1,8 - 8,4% (by volume)
Colour	None
Taste	None
Odour	Slight

10 STABILITY AND REACTIVITY

Conditions to avoid
The dilution of the oxygen concentration in the atmosphere to levels which cannot support life. The formation of explosive gas/air mixtures.

Incompatible Materials
Any common, commercially available metals may be used with Butane as it is non-corrosive, though installations must be designed to withstand the pressures involved and must comply with all state and local regulations.

Hazardous Decomposition Products
The formation of carbon monoxide may occur when incomplete combustion occurs.

11 TOXICOLOGICAL INFORMATION

Acute Toxicity	TLV 600 vpm
Skin & Eye contact	No known effect
Chronic Toxicity	No known effect
Carcinogenicity	Severe cold burns can result in carcinoma
Mutagenicity	No known effect
Reproductive Hazards	No known effect

(For further information see Section 3. Adverse Health effects)

12 ECOLOGICAL INFORMATION

Vaporised Butane is heavier than air, and can cause pockets of oxygen-depleted atmosphere in low-lying areas. It does not pose a hazard to the ecology, unless the gas/air mixture is ignited.

13 DISPOSAL CONSIDERATIONS

Disposal Methods
Personnel familiar with the gas and the procedures for disposal, as with other gases, should only undertake disposal of Butane. Contact supplier for instructions. In general, should it become necessary to dispose of Butane, the best procedure, as for other flammable gases, is to burn it in any suitable burning unit available in the plant. This should be done in accordance with the appropriate regulations.

Disposal of Packaging
The gas supplier must only handle the disposal of containers.

14 TRANSPORT INFORMATION

ROAD TRANSPORTATION

UN No	1969
ERG No	115
Hazchem warning	2 A Flammable Gas

SEA TRANSPORTATION

IMDG	1969
Class	2.1
Label	Flammable Gas

AIR TRANSPORTATION

ICAO/IATA Code	1969
Class	2.1
Packaging instructions	
- Cargo	200
- Passenger	Forbidden
Maximum quantity allowed	
- Cargo	150 kg
- Passenger	Forbidden

MATERIAL SAFETY DATA SHEET (MSDS)
BUTANE
Please ensure that this MSDS is received by an appropriate person

Ref. No.: MS088

15 REGULATORY INFORMATION

Hazard Statement	Description
H220	Extremely flammable gas

National legislation: OHSAct & Regulations 85 of 1993
Refer to SABS 10234 Globally Harmonized System of classification and labelling of Chemicals (GHS) for explanation of the above.

16 OTHER INFORMATION

Bibliography

Compressed Gas Association, Arlington, Virginia
Handbook of Compressed Gases – 3rd Edition
Matheson. Matheson Gas Data Book – 6th Edition

17 EXCLUSION OF LIABILITY

Information contained in this publication is accurate at the date of publication. The company does not accept liability arising from the use of this information, or the use, application, adaptation or process of any products described herein.

MATERIAL SAFETY DATA SHEET (MSDS)
CARBON DIOXIDE
(Please ensure that this MSDS is received by an appropriate person)

1 PRODUCT AND COMPANY IDENTIFICATION

Product Name	CARBON DIOXIDE
Chemical Formula	CO_2
Trade Names	Technical Carbon Dioxide Industrial Carbon Dioxide Food Carbon Dioxide Instrument Grade Carbon Dioxide Laser Grade Carbon Dioxide Pharmaceutical Grade Carbon Dioxide Carbon Dioxide (N4.5) Medical Carbon Dioxide
Colour coding	With the exception of Medical CO_2, all other grades have Green (H.07) bodies, with relevant grades stencilled or denoted by decals, on the bodies of the cylinders. Medical CO_2 has a Green (H.07) body with a French Grey (H.30) shoulder.
Valve	All above grades are fitted with 3S-Brass 0,860-inch by 14 tpi right-hand male valve
Company Identification	African Oxygen Limited 23 Webber Street Johannesburg, 2001 Tel No: (011) 490-0400 Fax No: (011) 490-0506
EMERGENCY NUMBER	**0860 020202 (24 hours)**

2 COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	Carbon Dioxide
Chemical Family	Carbon Anhydride
Synonyms	Carbonic Acid Gas
CAS No.	124-38-9
UN No.	1013
ERG No.	120
Hazard Warning	2 C Non flammable Gas

3 HAZARDS IDENTIFICATION

Main Hazards

Carbon dioxide does not support life. It can act as a simple asphyxiant by diluting the concentration of oxygen in air below the levels necessary to support life. As it is heavier than air it will tend to concentrate at lower levels.

Adverse Health Effects

Carbon dioxide acts as a stimulant and depressant on the central nervous system. Increases in heart rate and blood pressure have been noted at a concentration of 7.6 percent, and dyspnea (laboured breathing), headache, dizziness and sweating occur if exposure at that level is prolonged.

Chemical Hazards

Carbon dioxide is relatively non-reactive and non-toxic. In the presence of moisture it can aggressively bring about corrosion in a variety of steel materials.

Biological Hazards

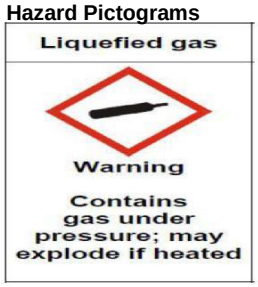
The greatest physiological effect of carbon dioxide is to stimulate the respiratory centre, thereby controlling the volume and rate of respiration. It is able to cause dilation and constriction of blood vessels and is a vital constituent of the acid-base mechanism that controls the pH of the blood.

Vapour Inhalation

At concentrations of 10% and above, unconsciousness can result in one minute or less. Impairment in performance has been noted during prolonged exposure to concentrations of 3% carbon dioxide even when the oxygen concentration was 21%.

Label Elements

Hazard Pictograms



4 FIRST AID MEASURES

Eye/Skin Contact No known effect.

Ingestion (See Section 3 above)

Prompt medical attention is mandatory in all cases of overexposure to carbon dioxide. Rescue personnel should be equipped with self-contained breathing apparatus. Gaseous carbon dioxide is an asphyxiant. Concentrations of 10% or more can produce death or unconsciousness. Lower concentrations may cause sweating, headache, rapid breathing, increase heartbeat, shortness of breath, dizziness, mental depression, visual disturbance, shaking. Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from contaminated area is most important. Unconscious persons should be removed to an uncontaminated area, given mouth-to-mouth resuscitation and supplemental oxygen.

5 FIRE FIGHTING MEA

Extinguishing Media

Carbon dioxide is an extinguishing medium.

Specific Hazards

Carbon dioxide does not support life. It can act as a simple asphyxiant by diluting the concentration of oxygen in the air below the levels to support life.

Emergency Actions

If possible, shut off the source of excess carbon dioxide. Evacuate area. All cylinders should be removed from the vicinity of the fire. Cylinders that cannot be removed should be cooled with water from a safe distance. Cylinders that have been exposed to excessive heat should be clearly identified and returned to the supplier. CONTACT THE NEAREST AFROX BRANCH.

Protective Clothing

Self-contained breathing apparatus. Safety gloves and shoes, or boots, should be worn when handling cylinders.

Environmental Precautions

Carbon dioxide is heavier than air and could accumulate in low-lying areas. Care should be taken when entering a potentially oxygen-deficient environment. If possible, ventilate the affected area.

6 ACCIDENTAL RELEASE MEASURES

Personal Precautions

Do not enter any area where carbon dioxide has been spilled unless tests have shown that it is safe to do so.

Environmental Precautions

As carbon dioxide is classified as a “greenhouse” gas, any spillage should be avoided at all times.

Small Spills

Shut off the source of escaping carbon dioxide. Ventilate the area.

Large Spills

Evacuate the area. Shut off the source of the spill if this can be done without risk. Restrict access to the area until completion of the clean-up procedure. Ventilate the area using forced-draught if necessary.

7 HANDLING AND STORAGE

Do not allow cylinders to slide or come into contact with sharp edges. Carbon dioxide cylinders should be stacked vertically at all times, should be firmly secured in order to prevent them from being knocked over. Use a “first-in first-out” inventory system to prevent full cylinders from being stored for excessive periods of time. Keep out of reach of children.

8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Hazards

As carbon dioxide is a simple asphyxiant, avoid any areas where spillage has taken place. Only enter once testing has proved the atmosphere to be safe, and remember that gas is heavier than air.

Engineering Control Measures

Engineering control measures are preferred to reduce exposure to oxygen-depleted atmospheres. General methods include forced-draught ventilation, separate from other exhaust ventilation systems. Ensure that sufficient fresh air enters at, or near, floor level.

Personal Protection

Self-contained breathing apparatus should always be worn when entering area where oxygen depletion may have occurred. Safety goggles, gloves and shoes, or boots, should be worn when handling cylinders.

No known effect. **Skin**

9 PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL DATA

Chemical Symbol	CO_2
Molecular Weight	44.01
Specific volume @ 20°C & 101,325 kPa	547 ml/g
Density gas @ 101,325 kPa & 20°C	1.839 kg/m^3
Relative density (Air=1) @ 101,325 kPa	1,522
Colour	None
Taste	Acidic
Odour	None

10 STABILITY AND REACTIVITY

Conditions to avoid

The dilution of oxygen in the atmosphere to levels which cannot support life. Never use cylinders as rollers or supports, or for any other purpose than the storing of carbon dioxide. Never expose the cylinders to excessive heat, as this may cause sufficient build-up of pressure to rupture the cylinders.

Incompatible Materials

As dry carbon dioxide is inert it may be contained in systems constructed of any of the common metals that have been designed to safely withstand the pressures involved.

Hazardous Decomposition Products None

11 TOXICOLOGICAL INFORMATION

Acute Toxicity	TLV 5000 VPM
Skin & eye contact	No known effect
Chronic Toxicity	No known effect
Carcinogenicity	No known effect
Mutagenicity	No known effect
Reproductive Hazards	No known effect

(For further information see Section 3. Adverse Health effects)

12 ECOLOGICAL INFORMATION

Carbon dioxide is heavier than air and can cause pockets of oxygen-depleted atmosphere in low-lying areas. It does not pose a hazard to the ecology.

13 DISPOSAL CONSIDERATIONS

Disposal Methods

Small amounts may be blown to the atmosphere under controlled conditions. The gas supplier should only handle large amounts.

Disposal of Packaging

The gas supplier must only handle the disposal of cylinders.

14 TRANSPORT INFORMATION

ROAD TRANSPORTATION

UN No	1013
ERG No	120
Hazchem warning	2C Non-flammable Gas

SEA TRANSPORTATION

IMDG	101
Class	
Packaging group	
Label	Non-flammable Gas

AIR TRANSPORTATION

ICAO/IATA Code	1013
Class	2.2
Packaging group	
Packaging instructions	
- Cargo	200
- Passenger	200
Maximum quantity allowed	
- Cargo	150kg
- Passenger	75kg

15 REGULATORY INFORMATION

EEC Hazard class Non-flammable

Risk Phrase	Description	Safety Phrase	Description
R44	Risk of explosion if heated under confinement	S2	Keep out of reach of Children
R58	May cause long-term adverse effects in the environment	S3	Keep in a cool place
		S9	Keep container in a well-Ventilated place
		S36	Wear suitable protective clothing
		S38	In case of insufficient ventilation, wear suitable respiratory equipment

National legislation OHSAct and Regulations 85 of 1993
Refer to SANS 10234 for explanation of the above.

16 OTHER INFORMATION

Bibliography

Compressed Gas Association, Arlington, Virginia
Handbook of Compressed Gases – 3rd Edition
Matheson. Matheson Gas Data Book – 6th Edition
SABS 10234 – Globally Harmonized System of classification and labelling of chemicals (GHS)

17 EXCLUSION OF LIABILITY

MATERIAL SAFETY DATA SHEET (MSDS)

ETHANE

(Please ensure that this MSDS is received by the appropriate person)

Ref. n.: MS057 DATE: December 2015
Version no.1

1 PRODUCT AND COMPANY IDENTIFICATION

PRODUCT IDENTIFICATION

Product Name	ETHANE
Chemical Formula	C_2H_6
Trade Name	Ethane
Colour coding	Signal Red (A.11) body with the relevant stencilling on the body.
Valve female	Neriki – Brass 5/8-inch BSP left hand
Company Identification	African Oxygen Limited 23 Webber Street Johannesburg, 2001 Tel. No: (011) 490-0400 Fax No: (011) 490-0506
EMERGENCY No	**0860020202 (24 hr)**

2 COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	Ethane
Chemical Family	Saturated hydrocarbon
CAS No.	74-84-0
UN No.	1035
ERG No	115
Hazchem Warning	2 A Flammable gas

3 HAZARDS IDENTIFICATION

Main Hazards All cylinders are portable gas containers, and must be regarded as pressure vessels at all times. Ethane is highly flammable and is slightly heavier than air. This could cause pockets of gas to collect in low-lying areas.

Adverse Health Effects The gas is a simple asphyxiant, and at high concentrations could cause narcosis. No definite symptoms have been observed in concentrations up to 5%. Direct contact with the liquid form can cause frostbite and freeze-burns in exposed tissues.

Chemical hazards None.

Biological Hazards

Eye contact	(gas)	No known effect
	(Liquid)	Serious burns
Skin contact	(gas)	No known effect
	(Liquid)	Serious burns
Ingestion	(liquid)	Serious burns

4 FIRST AID MEASURES

Prompt medical attention is mandatory in all cases of overexposure to vaporized Ethane. Rescue personnel should be equipped with self-contained breathing apparatus. In case of frostbite from contact with the liquid phase, place the frostbitten part in warm water, about 40 - 42°C. If warm water is not available, or is impractical to use, wrap the affected part gently in blankets. Encourage the patient to exercise the affected part whilst it is being warmed. Do not remove clothing while frosted. Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be removed to an uncontaminated area, and given mouth-to-mouth resuscitation and supplemental oxygen.

Eye contact
(With liquid phase) Immediately flush with large quantities of tepid water, or with sterile saline solution. Seek medical attention.

Skin contact
(With liquid phase) See above for handling frostbite.

Ingestion Ingestion is unlikely. Liquid could cause severe burns.

5 FIRE FIGHTING MEASURES

Extinguishing media Do not extinguish fire unless the leakage can be stopped. Do not use water jet, use dry chemical, CO_2 or foam.

Specific hazards The rupturing of cylinders or bulk containers due to excessive exposure to a fire could result in a BLEVE (Boiling Liquid Expanding Vapour Explosion), with disastrous effects. As the flammability limits in air for Ethane are between 3 and 12,5%, extreme care must be taken when handling leaks.

Emergency actions If possible, shut off the source of the spillage. Evacuate area. Post notices, "No naked lights - no smoking". Prevent liquid or vapour from entering sewers, basements and workpits. Keep cylinders or bulk vessels cool by spraying with water if exposed to a fire. CONTACT THE NEAREST AFROX BRANCH

Protective clothing Self-contained breathing apparatus. Safety gloves and shoes, or boots, should be worn when handling cylinders.

Environmental Precautions Vaporized Ethane gas is heavier than air and could form pockets of oxygen-deficient atmosphere in low-lying areas.

6 ACCIDENTAL RELEASE MEASURES

Personal Precautions Do not enter any area where Ethane has been spilled unless tests have shown that it is safe to do so.

Environmental Precautions the danger of widespread formation of explosive Ethane/air mixtures should be taken into account. Accidental ignition could result in a massive explosion.

Small spills Do not extinguish the fire unless the leakage can be stopped immediately. Once the fire has been extinguished and all spills have been stopped, ventilate the area.

Large spills Stop the source if it can be done without risk. Contain the leaking liquid, with sand or earth, or disperse with special water/fog spray nozzle. Allow evaporating. Take the precautions as listed above under "Emergency Actions". Restrict access to the area until completion of the clean-up procedure. Ventilate the area using forced draught if necessary. All electrical equipment should be flameproof.

7 HANDLING AND STORAGE

Cylinders containing Ethane should only be handled and stored in the vertical position. Cylinders should never be rolled. Do not allow cylinders to slide or come into contact with sharp edges and they should be handled carefully. Ensure that cylinders are stored away from other oxidants. Comply with all local legislation. Keep out of reach of children.

8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure hazards as vaporized Ethane is a simple asphyxiant, avoid any areas where spillage has taken place. Only enter once testing has proved the atmosphere to be safe.

Engineering Control measures Engineering control measures are preferred to reduce exposures. General methods include forced-draught ventilation, separate from other exhaust ventilation systems. Ensure that sufficient fresh air enters at, or near, floor level. Ensure that all electrical equipment is flameproof.

Personal protection Self-contained breathing apparatus should always be worn when entering an area where oxygen depletion may have occurred. Safety goggles, gloves and shoes or boots should be worn when handling cylinders.

Skin Wear loose-fitting overalls, preferably without pockets.

AFROX
A Member of The Linde Group

MATERIAL SAFETY DATA SHEET (MSDS)
ETHANE
(Please ensure that this MSDS is received by the appropriate person)

9 PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL DATA

Chemical Symbol	C_2H_6
Molecular Weight	30,07
Specific volume @ 20°C & 101,325 kPa	796 ml/g
Relative density of gas @ 101,325 kPa (Air=1)	1,048
Auto ignition temperature	472,2°C
Flammability limits in air	3,0 - 12,5% (by volume)
Colour	None
Taste	None
Odour	None

10 STABILITY AND REACTIVITY

Conditions to avoid The dilution of the oxygen concentration in the atmosphere to levels that cannot support life. The formation of explosive gas/air mixtures.

Incompatible Materials Any common, commercially available metals may be used with Ethane because it is non-corrosive, though installation must be designed to withstand the pressures involved and must comply with all state and local regulations.

Hazardous Decomposition Products Ethane is relatively stable. However, on combustion, toxic compositions, typically carbon monoxide may be formed, depending on conditions.

11 TOXICOLOGICAL INFORMATION

Acute Toxicity	No known effect
Skin & eye contact	No known effect
Chronic Toxicity	No known effect
Carcinogenicity	Severe cold burns can result in carcinoma
Mutagenicity	No known effect
Reproductive Hazards	No known effect

For further information see Section 3. Adverse Health Effects

12 ECOLOGICAL INFORMATION

Vaporized Ethane is heavier than air, and can cause pockets of oxygen-depleted atmosphere in low-lying areas. It does not pose a hazard to the ecology, unless the gas/air mixture is ignited.

13 DISPOSAL CONSIDERATIONS

Disposal Methods Disposal of Ethane, as with other gases, should be undertaken only by personnel familiar with the gas and the procedures for disposal. Contact the supplier for instructions. In general, should it become necessary to dispose of Ethane, the best procedure, as for other flammable gases, is to burn them in suitable burning units available in the plant. This should be done in accordance with appropriate regulations.

Disposal of Packaging The disposal of containers must only be handled by the gas supplier.

14 TRANSPORT INFORMATION

ROAD TRANSPORTATION

UN No.	1035
ERG No	115
Hazchem warning	2 A Flammable gas

SEA TRANSPORTATION

IMDG	1035
Label	Flammable gas

AIR TRANSPORTATION

ICAO/IATA Code	1035
Class	2.1
Packaging group	none
Packaging instructions	
- Cargo	200
- Passenger	Forbidden
Maximum quantity allowed	
- Cargo	150 kg
- Passenger	Forbidden

15 REGULATORY INFORMATION

EEC Hazard class Flammable gas
National legislation OHSact and Regulations 85 of 1993
SABS 10234 and its supplement for explanation of the above.

16 OTHER INFORMATION

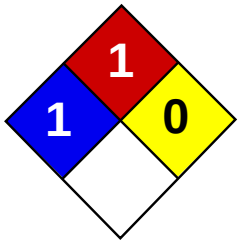
Bibliography
Compressed Gas Association, Arlington, Virginia
Handbook of Compressed Gases - 3rd Edition
Matheson. Matheson Gas Data Book - 6th Edition
SANS 10265 - Labelling of Dangerous Substances

17 EXCLUSION OF LIABILITY

Information contained in this publication is accurate at the date of publication. The company does not accept liability arising from the use of this information, or the use, application, adaptation or process of any product described herein.

For product and safety enquiries please phone

EMERGENCY N°:
0860020202 (24 hr)



Health	1
Fire	1
Reactivity	0
Personal Protection	C

Material Safety Data Sheet
Ethylene glycol MSDS

Section 1: Chemical Product and Company Identification

Product Name: Ethylene glycol

Catalog Codes: SLE1072

CAS#: 107-21-1

RTECS: KW2975000

TSCA: TSCA 8(b) inventory: Ethylene glycol

CI#: Not available.

Synonym: 1,2-Dihydroxyethane; 1,2-Ethanediol; 1,2-Ethandiol; Ethylene dihydrate; Glycol alcohol; Monoethylene glycol; Tescol

Chemical Name: Ethylene Glycol

Chemical Formula: HOCH2CH2OH

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Ethylene glycol	107-21-1	100

Toxicological Data on Ingredients: Ethylene glycol: ORAL (LD50): Acute: 4700 mg/kg [Rat]. 5500 mg/kg [Mouse]. 6610 mg/kg [Guinea pig]. VAPOR (LC50): Acute: >200 mg/m 4 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of ingestion. Slightly hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of inhalation. Severe over-exposure can result in death.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Non-mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention if irritation occurs.

Skin Contact:
Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops. Cold water may be used.

Serious Skin Contact: Not available.

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

Serious Inhalation: Not available.

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

Serious Ingestion:
Medical Conditions Aggravated by Exposure: Persons with pre-existiing kidney, respiratory, eye, or neurological problems might be more sensitive to Ethylene Glycol. Notes to Physician: 1. Support vital functions, correct for dehydration and shock, and manage fluid balance. 2. The currently recommended medical management of Ethylene Glycol poisoning includes elimination of Ethylene Glycol and metabolites. Elimination of Ethylene Glycol may be achieved by the following methods: a. Emptying the stomach by gastric lavage. It is useful if initiated within < 1 of ingestion. b. Correct metabolic acidosis with intravenous administration of sodium bicarbonate, adjusting the administration rate accoridng to repeated and frequent measurement of acid/base status. c. Administer ethanol (orally or by IV (intravenously)) or fomepizole (4-methylpyrazole or Antizol)) therapy by IV as an antidote to inhibit the ormation of toxic metabolites. d. If patients are diagnosed and treated early in the course with the above methods, hemodialysis may be avoided if fomepizole or ethanol therapy is effective and has corrected the metabolic acidosis, and no renal failure is present. However, once severe acidosis and renal failure occured, however, hemodialysis is necessary. It is effective in removing Ethylene Glycol and toxic metabolites, and correcting metabolic acidosis.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 398°C (748.4°F)

Flash Points: CLOSED CUP: 111°C (231.8°F). (Tagliabue.)

Flammable Limits: LOWER: 3.2%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Slightly flammable to flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards:
Explosive decomposition may occur if combined with strong acids or strong bases and subjected to elevated temperatures.

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, acids, alkalis.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Hygroscopic

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Safety glasses. Synthetic apron. Gloves (impervious). For most conditions, no respiratory protection should be needed. However, if material is heated or sprayed and if atmospheric levels exceed exposure guidelines, use an approved vapor (air purifying) respirator.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
STEL: 120 (mg/m3) [Australia] TWA: 100 (mg/m3) from ACGIH (TLV) [United States] CEIL: 125 (mg/m3) from OSHA (PEL) [United States] CEIL: 50 (ppm) from OSHA (PEL) [United States] TWA: 52 STEL: 104 (mg/m3) [United Kingdom (UK)] Inhalation TWA: 10 (mg/m3) [United Kingdom (UK)] SKIN3 Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (syrupy)

Odor: Odorless.

Taste: Mild sweet

Molecular Weight: 62.07 g/mole

Color: Clear Colorless.

pH (1% soln/water): Not available.

Boiling Point: 197.6°C (387.7°F)

Melting Point: -13°C (8.6°F)

Critical Temperature: Not available.

Specific Gravity: 1.1088 (Water = 1)

Vapor Pressure: .06 mmHg @ 20 C; .092 mmHg at 25 C

Vapor Density: 2.14 (Air = 1)

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: The product is more soluble in water; log(oil/water) = -1.4

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, acetone.

Solubility:
Soluble in cold water, hot water, acetone. Slightly soluble in diethyl ether. Miscible with lower aliphatic alcohols, glycerol, acetic acid, acetone and similar ketones, aldehydes, pyridine, similar coal tar bases. Practically insoluble in benzene and its homologs, chlorinated hydrocarbons, petroleum ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, incompatible materials.

Incompatibility with various substances: Reactive with oxidizing agents, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Hygroscopic. Absorbs moisture from the air. Avoid contamination with materials with hydroxyl compounds. Also incompatible with aliphatic amines, isocyanates, chlorosulfonic acid, and oleum

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Ingestion.

Toxicity to Animals:
Acute oral toxicity (LD50): 4700 mg/kg [Rat]. Acute toxicity of the vapor (LC50): >200 mg/m3 4 hours [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Non-mutagenic for bacteria and/or yeast. May cause damage to the following organs: kidneys, liver, central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of ingestion. Slightly hazardous in case of skin contact (irritant, permeator), of inhalation.

Special Remarks on Toxicity to Animals:
Lowest Published Toxic Dose/Conc: TDL [Man] - Route: oral; Dose: 15gm/kg Lethal Dose/Conc 50% Kill LD50 [Rabbit] - Route: dermal; Dose: 9530 ul/kg

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects and birth defects (teratogenic) based on animal test data. No human data has been reported at this time. May affect genetic material (mutagenic)

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: May cause skin irritation. May cause more severe response if skin is abraded. A single prolonged exposure is not likely to result in material being absorbed through skin in harmful amounts. Massive contact with damaged skin may result in absorption of potentially harmful amounts Eyes: Vapors or mist may cause temporary eye irritation (mild temporary conjunctival inflammation) and lacrimation. Corneal injury is unlikely or insignificant.. Ingestion: It is rapidly absorbed from the gastrointestinal tract. Oral toxicity is expected to be moderate in humans due to Ethylene Glycol even though tests with animals show a lower degree of toxicity. Excessive exposure (swallowing large amounts) may cause gastrointestinal tract irritation with nausea, vomiting, abdominal discomfort, diarrhea. It can affect behavior/central nervous system within 0.5 to 12 hours after ingestion. A transient inebriation with excitement, stupor, headache, slurred speech, ataxia, somnolence, and euphoria, similar to ethanol intoxication, can occur within the first several hours. As sthe Ethylene Glycol is metabolized, metabolic acidosis and further central nervous system depression (convulsions, muscle weakness) develop. Serious intoxication may develop to coma associated with hypotonia, hyporeflexia, and less commonly seizures, and meningismus. 12 to 24 hours

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 41000 mg/l 96 hours [Fish (Trout)]. 46300 mg/l 48 hours [water flea]. 34250 mg/l 96 hours [Fish (bluegill fish)]. 34250 mg/l 72 hours [Fish (Goldfish)].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:
Illinois toxic substances disclosure to employee act: Ethylene glycol Illinois chemical safety act: Ethylene glycol New York release reporting list: Ethylene glycol Rhode Island RTK hazardous substances: Ethylene glycol Pennsylvania RTK: Ethylene glycol Minnesota: Ethylene glycol Massachusetts RTK: Ethylene glycol Massachusetts spill list: Ethylene glycol New Jersey: Ethylene glycol Louisiana spill reporting: Ethylene glycol TSCA 8(b) inventory: Ethylene glycol TSCA 4(a) proposed test rules: Ethylene glycol SARA 313 toxic chemical notification and release reporting: Ethylene glycol CERCLA: Hazardous substances.: Ethylene glycol: 5000 lbs. (2268 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R22- Harmful if swallowed. S46- If swallowed, seek medical advice immediately and show this container or label.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 1

Reactivity: 0

Personal Protection: C

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Not applicable. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:18 PM

Last Updated: 11/01/2010 12:00 PM

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MATERIAL SAFETY DATA SHEET (MSDS)
HYDROGEN SULPHIDE (H2S)
Please ensure that this MSDS is received by the appropriate person

DATE: April 2011 Version 2

Ref. No.: MS033

1 PRODUCT AND COMPANY IDENTIFICATION

Product Name HYDROGEN SULPHIDE

Chemical Formula H2S
Trade Name Hydrogen Sulphide

Company Identification African Oxygen Limited
23 Webber Street
Johannesburg, 2001
Tel. No: (011) 490-0400
Fax No: (011) 490-0506

EMERGENCY NUMBER **0860111185 or (0860 02 02 02)**
(24 hours)

2 COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name: Hydrogen Sulphide
Chemical Abstract Service Number (CAS No.): 07783-06-04
UN No.: 1053
ERG No.: 117

3. HAZARDS IDENTIFICATION

Main Hazards in concentrations of 20 to 50ppm , hydrogen sulphide irritates the eyes. Slightly higher concentrations irritate The upper respiratory tract and, may result in pulmonary edema.
Inhalation of 500ppm for 30 minutes produces headache, dizziness, excitement, staggergering, and gastroenteric disorder, followed in some cases by bronchitis and bronchial pneumonia.
Concentrations above 600pm can be fatal within 30 minutes through respiratory paralysis.
Although the foul odor of hydrogen sulphide is readily detectable in low concentrations, it becomes unreliable as a warning of dangerous concentrations of gas since continuous inhalation leads rapidly to olfactory fatigue.

Vapour Inhalation Hydrogen sulfide reacts with enzymes in the bloodstream and inhibits cellular respiration resulting in pulmonary paralysis, sudden collapse and death. Continuous exposure to low (15-50 ppm) concentrations will generally cause irritation to mucous membranes, and may also cause headache, dizziness or nausea. Higher concentrations (200-300 ppm) may result in respiratory arrest leading to coma or unconsciousness. Exposures for more than 30minutes at concentrations greater than 700 ppm have been fatal.
Continuous inhalation of low concentrations may cause olfactory fatigue or paralysis of the sense of smell.Thus, detection of hydrogen sulfide by its odor is not effective.

Eye Contact Low concentrations will generally cause irritation to the conjunctiva. Repeated exposure to low concentrations is reported to cause conjunctivitis, photo phobia, corneal bullae, tearing, pain and blurred vision.

Skin Contact May irritate the skin upon contact

Ingestion Ingestion is unlikely. Hydrogen sulfide will irritate the mucous membranes causing a burning feeling with excess salivation likely. Irritation of the gastrointestinal tract may also occur.

4 FIRST AID MEASURES

Inhalation: Very toxic by inhalation.
May cause damaging effects to central nervous system, metabolism and gastrointestinal tract.
Prolonged exposure to small concentrations may result in pulmonary oedema.
Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor.
Apply artificial respiration if breathing stopped. Delayed adverse effects possible.

Skin/Eye: Remove contaminated clothing.
In case of frostbite spray with water for at least 15minutes. Apply a sterile dressing.
Immediately flush eyes thoroughly with water for at least minutes. Obtain medical assistance.

Ingestion: It is not considered a potential route of exposure

5 FIRE FIGHTING MEASURES

Extinguishing media Suitable extinguishing media: all known extinguishants can be used.

Specific Hazards Exposure to fire may cause containers to rupture/explode.
Hazardous combustion products: If involved in a fire, the following toxic and/or corrosive fumes may be produced by thermal decomposition: Sulfur dioxide,
Suitable extinguishing media: all known extinguishants can be used.

Emergency Actions stop flow of product if possible. Move away from the container and cool with water from a protected position. Do not extinguish a leaking gas flame unless absolutely necessary.
Spontaneous/explosive re-ignition may occur.

Protective Clothing Use a self contained breathing apparatus and chemically protective clothing.

6 ACCIDENTAL RELEASE MEASURES

Personal Precautions Evacuate area.
Eliminate ignition sources. Ensure adequate air ventilation.
Wear self- contained breathing apparatus when entering area unless atmosphere is proved to be safe.

Environmental Precautions Do not allow the product from entering sewers and storm water drains.

Methods for cleaning up Ventilate area. Keep area evacuated and free from ignition sources until any spilled liquid has evaporated, that is ground free from frost

MATERIAL SAFETY DATA SHEET (MSDS)
HYDROGEN SULPHIDE (H2S)
Please ensure that this MSDS is received by the appropriate person

7 HANDLING AND STORAGE

Ensure equipment is adequately earthed.
Purge air from system before introducing gas.
Do not allow backfeed into the container.
Cylinders should be stored upright and prevented from falling.
Suck back of water into the container must be prevented.
Use only properly specified equipment, which is suitable for this product, its supply pressure and temperature.
Contact your gas supplier if in doubt.
Keep away from ignition sources (including static discharges).
Secure them away from flammable or combustible materials; in a dry, well ventilated constructed of non -combustible material with firm level floor.
Keep container below 50 deg. Celsius in a well ventilated place.
Use the "first in – first out" inventory system to prevent full cylinders from being stored for excessive period of time. Compliance of all relevant legislation is essential. Keep away from children

8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational exposure hazards Hydrogen sulfide – TLV: 10ppm; STEL: 15ppm

Engineering control measures Filling or withdrawal from a Hydrogen Sulfide cylinder must be performed in a well ventilated area and if possible should be in a forced ventilation system or using a hood over the valve.

9 PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL DATA

Chemical Symbol	H2S
Molecular Weight	34.08 g/mol
Melting point @ 224 kPa	-86°C
Appearance/Colour:	Colourless gas
Odour:	Rotten eggs
Relative density, Gas @ 101.325kPa @ 25°C	1.188
Specific Volume @ 21.1°C, 101.325 kPa	70.11dm^3/kg
Dielectric constant; Gas @ 0°C, @ 101.325kPa	1.004

10 STABILITY AND REACTIVITY

Conditions to avoid avoid heat, flames, sparks and other source of ignition.
Minimise contact with material
Avoid inhalation of material or combustion by products.
Keep out of water suppliers and sewers.

Incompatible Materials Do not store reserve stocks of hydrogen sulphide cylinder with cylinders containing oxygen or other highly oxidising or combustible materials.

11 TOXICOLOGICAL INFORMATION

Acute Toxicity	unknown
Skin & eye contact	unknown
Chronic Toxicity	unknown
Carcinogenicity	unknown
Mutagenicity	unknown
Reproductive Hazards	unknown

12 ECOLOGICAL INFORMATION

General: Toxic to water organisms.

13 DISPOSAL CONSIDERATIONS

Disposal methods Avoid discharge to atmosphere.
Do not discharge into any place where its accumulation could be dangerous.
Toxic and corrosive gases formed during combustion should be scrubbed before discharge to atmosphere.
Do not discharge into areas where there is a risk of forming an explosive mixture with air. Waste gas should be flared through a suitable burner with flash back arrestor.
Contact supplier if further guidance is required

14 TRANSPORT INFORMATION

UN No.	1053
Class	2.3
ADR/RID Item Nr.	2,2 deg. TIF
ADR/RID Hazard Nr.	263
Labelling ADR	Label 6.1 Toxic Substance Label 3 Flammable substance
Other transport information	Avoid transport on vehicles where load space is not separated from the driver's compartment. Ensure vehicle driver is aware of potential hazards of the load and knows what to do in the event of an accident or an emergency. Before transporting product containers ensure that they are firmly secured and valve outlet cap, nut or plug (where provided) is correctly fitted. Valve protection device (where provided) is correctly fitted. Ensure that there is adequate ventilation. Comply with applicable transport regulation.

15 REGULATORY INFORMATION

Risk phrases R26 Very toxic by inhalation

Safety phrases S (1/2) Keep locked up and out of reach of children
S9 Keep container in a well ventilated place
S16 Keep away from ignition sources – No smoking
S28 After contact with skin, immediately wash with plenty of ... (to be specified by manufacturer)
S36/37 Wear suitable protective clothing and gloves
S45 In case of accident or if you feel unwell, seek medical advice immediately
S61Avoid release into environment; refer to special instructions/material safety data sheet

Reference: SANS 10265

16 OTHER INFORMATION

Ensure all national/local regulations are observed. Ensure operators understand the asphyxiation hazard.

Bibliography
Compressed Gas Association, Arlington, Virginia
Handbook of Compressed Gases – 3rd Edition
Matheson Gas Data Book – 6th Edition

EXCLUSION OF LIABILITY
Whilst AFROX made best endeavour to ensure that the information contained in this publication is accurate at the date of publication, AFROX does not accept liability for an inaccuracy or liability arising from the use of this information, or the use, application, adaptation or process of any products described herein.

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MATERIAL SAFETY DATA SHEET (MSDS)
SHIELDING GASES (Ar/H2)

DATE: April 2017 **Version 2** **Ref.No.: MS135**

1 PRODUCT AND COMPANY IDENTIFICATION

Product Name	Shielding Gases
Chemical Formula	H_2 plus Ar
Trade Names	Stainshield TIG Plasmashield
Colour codings	All of the above have silver bodies and valve guards with red shoulders, with relevant decals or stencilling to identify the product.
Valves	All of the above have Brass 5/8 inch BSP left hand female valves fitted.
Company Identification	African Oxygen Limited 23 Webber Street Johannesburg, 2001 Tel No: (011) 490-0400 Fax No: (011) 490-0506
EMERGENCY NUMBER	**0860 020202 or 0860 111 185 (24Hrs)**

2 HAZARDS IDENTIFICATION

Main Hazards
All cylinders are portable gas containers, and must be regarded as pressure vessels at all times. The above listed Shielding gas mixtures do not support life. They can act as simple asphyxiants by diluting the concentration of oxygen in the air to below levels necessary to support life.

Adverse Health effects
Inhalation of Shielding gases in excessive concentrations can result in dizziness, nausea, vomiting, loss of consciousness and death.

Chemical hazards
The Argon component is inert, but the Hydrogen becomes highly reactive under excessive conditions of temperature and pressure.

Biological Hazards
No known effect.

Vapour inhalation
As these listed Shielding gases act as simple asphyxiants death may result from errors in judgement, confusion, or loss of consciousness which prevents self-rescue. At low oxygen concentrations, unconsciousness and death may occur in seconds without warning.

3 COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Names	Hydrogen plus Argon
UN No	1954
ERG No	115
Hazchem Warning	2 A Flammable gas

4 FIRST AID MEASURES

Eye contact No known effect.
Skin contact No known effect.
Ingestion (See Section 3 above)
Prompt medical attention is mandatory in all cases of overexposure to Shielding gases. Rescue personnel should be equipped with self-contained breathing apparatus. Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be removed to an uncontaminated area, and given mouth-to-mouth resuscitation and supplemental oxygen.

5 FIRE FIGHTING MEASURES

Extinguishing Media
Although the Argon component of these Shielding gases is inert, the Hydrogen component could separate and form pockets of highly flammable or explosive Hydrogen/air mixtures. These could be found entrapped in high-lying enclosed areas.

Specific Hazards
Do not extinguish the fire unless the leakage can be stopped immediately. It may form explosive gas mixtures with air. This is a simple asphyxiant.

Emergency Actions
If possible, shut off the ignition at source. Evacuate area. Post warnings to prevent persons from approaching with lit cigarettes or open flames. Using water, keep all cylinders in the vicinity of the fire cool. Remove cylinders from the vicinity of the fire if possible. Remove all cylinders with signs of overheating to a safe area. Keep cool. CONTACT THE NEAREST AFROX BRANCH.

Protective Clothing
Exposed fire-fighters should wear approved self-contained breathing apparatus with full face mask.

Environmental Precautions
As the Hydrogen component is lighter than air, ensure that it is not entrapped in confined spaces otherwise this could lead to the formation of highly explosive gas-air mixture. Ventilate all confined spaces using forced-draught if necessary. Ensure that all electrically powered equipment is flameproof.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions
As Shielding gases are simple asphyxiants, care should be taken when entering confined spaces where leaks have occurred. Do NOT enter any potentially hazardous area with any source of ignition such as a lit cigarette or match.

Environmental Precautions
Shielding gases do not pose a hazard to the environment. An explosive gas-air mixture could be formed when leaks occur, so eliminate all forms of ignition.

Small Spills
Small leaks should be stopped by shutting off the source of supply, e.g. closing the valve on the cylinder, or tightening the gland nut. If unable to stop small leaks the cylinder should be moved into the open well away from any source of ignition.

Large Spills
Stop the source it if can be done without risk. Eliminate all sources of ignition and static discharges. Restrict access to the area until completion of the clean-up procedure. Post relevant warning signs. Wear adequate protective clothing when working near the source of the leak. Ventilate the area using forced draught if necessary. Ensure that all equipment is flameproof.

7 HANDLING AND STORAGE

Do not allow cylinders to slide or come into contact with sharp edges. Shielding gas cylinders may be stacked horizontally provided that they are firmly secured at each end to prevent rolling. Ensure equipment is adequately earthed. Conspicuous signs should be posted in storage area forbidding smoking or the use of naked lights. Use the “first in - first out” inventory system to prevent full cylinders from being stored for excessive periods of time. Compliance with all relevant legislation is essential. Keep away from children.

8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Hazards
No known effect.

Engineering Control Measures
Engineering control measures are preferred reduce exposures. General methods include mechanical ventilation, process or personal enclosure, and control of process conditions. Administrative controls

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MATERIAL SAFETY DATA SHEET (MSDS)
SHIELDING GASES (Ar/H2)

and personal protective equipment may also be required. Use a suitable flameproof ventilation system separate from other exhaust ventilation systems. Exhausts directly to the outside. Supply sufficient replacement air to make up for air removed by exhaust system.

Personal Protection
Use self-contained breathing apparatus when fighting large fires.

Eyes
Use safety glasses when working with cylinders.

Hands
Use suitable protective gloves when working with cylinders.

Skin
No known effect.

9 PHYSICAL AND CHEMICAL PROPERTIES

Argon

Chemical Symbol	Ar
Molecular Weight	39,948
Specific volume @ 20°C & 101,325 kPa	603,7 ml/g
Relative density of gas @ 101,325 kPa (Air=1)	1,380
Flammable limits in air (by volume)	---
Colour	None
Taste	None
Odour	None

Hydrogen

Chemical Symbol	H_2
Molecular Weight	2,016
Specific volume @ 20°C & 101,325 kPa	11 976 ml/g
Relative density of gas @ 101,325 kPa (Air=1)	0,08989
Flammable limits in air (by volume)	4,0 – 75%
Colour	None
Taste	None
Odour	None

10 STABILITY AND REACTIVITY

Conditions to avoid
Overheating of cylinders! Keep sparks/flames away from cylinder, and under no circumstances allow a torch flame to come into contact with any part of the cylinder. Never test for leaks with a flame. Use soapy water when testing for leaks. Never use cylinders as rollers or supports, or for any other purpose than storing of Shielding gases.

Incompatible Materials
The Shielding gases are non-corrosive and may be contained at ambient temperatures by most common metals used in installations designed to have sufficient strength for working pressures involved.

Hazardous Decomposition Products
No hazardous compounds are formed when Hydrogen/air mixtures burn

11 TOXICOLOGICAL INFORMATION

Acute Toxicity	No known effect
Skin & eye contact	No known effect
Chronic Toxicity	No known effect
Carcinogenicity	No known effect
Mutagenicity	No known effect
Reproductive Hazards	No known effect

(For further information see Section 3. Adverse Health Effects)

12 ECOLOGICAL INFORMATION

As these Shielding gases are heavier than air they can cause pockets of oxygen-depleted atmosphere in low-lying areas. They do not pose a hazard to the ecology.

13 DISPOSAL CONSIDERATIONS

Disposal Methods
Small amounts may be blown to the atmosphere under controlled conditions. No sources of ignition should be in the vicinity. Large amounts should only be handled by the gas supplier.

Disposal of Packaging
The disposal of containers must only be handled by the gas supplier.

14 TRANSPORT INFORMATION

ROAD TRANSPORTATION

UN No.	1954
ERG No	115
Hazchem warning	2A Flammable gas

SEA TRANSPORTATION

IMDG	1954
Class	2.1
Label	Flammable gas

AIR TRANSPORTATION

ICAO/IATA Code	1954
Class	2.1
Packaging instructions	
- Cargo	200
- Passenger	Forbidden
Maximum quantity allowed	
- Cargo	150 kg
- Passenger	Forbidden

15 REGULATORY INFORMATION

EEC Hazard class Flammable Gas
National legislation OHSact and Regulations 85 of 1993.
Reference SANS 10234 and its supplement.

16 OTHER INFORMATION

Bibliography
Compressed Gas Association, Arlington, Virginia
Handbook of Compressed Gases - 3rd Edition
Matheson. Matheson Gas Data Book - 6th Edition
SABS 0625 - Labelling of Dangerous Substances

EXCLUSION OF LIABILITY

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MATERIAL SAFETY DATA SHEET (MSDS)

METHANE – CH_4

(Please ensure that this MSDS is received by an appropriate person)

Date: January 2017 Version2
Ref. no.: MS042

1 PRODUCT AND COMPANY IDENTIFICATION

PRODUCT IDENTIFICATION

Product Name	METHANE
Chemical Formula	CH_4
Trade Names	Methane (N2.5) Methane (N3.5)
Colour Coding	Signal Red (A.11) body with a Black band round the centre of the cylinder
Valve	Neriki – Brass 5/8inch left hand female
Company Identification	African Oxygen Limited 23 Webber Street Johannesburg, 2001 Tel. No: (011) 490-0400 Fax No: (011) 490-0506

EMERGENCY No. 0860 020202 or (011) 873 4382
(24 hours)

2 COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	Methane
Chemical Family	Paraffins
CAS No.	74-82-8
UN No.	1971
ERG No.	115
Hazchem Warning	2A flammable gas

3 HAZARDS IDENTIFICATION

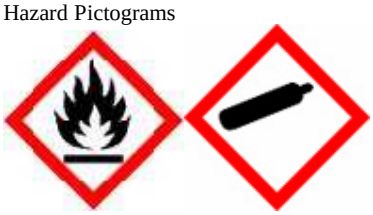
Main Hazards All cylinders are portable gas containers, and must be regarded as pressure vessels at all times. Methane poses hazards to personnel through its flammability. All the precautions necessary for the safe handling of any flammable compressed gas must be observed in working with Methane.

Adverse Health Effects Methane is classified as a simple asphyxiant. It is practically physiologically inert, except when it lowers the partial pressure of oxygen in the air enough to cause systemic effects due to oxygen-deficiency.

Chemical hazards	No known hazards
Biological Hazards	No known effect
Vapour Inhalation	No known effect
Eye contact	No known effect
Skin contact	No known effect
Ingestion	No known effect

Label Elements

Hazard Pictograms



Signal Word: Danger

Precautionary Statements:

P210: Keep away from heat/ sparks/open flames/ hot surface. No Smoking
P377: leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381: Eliminate all ignition sources if safe to do so.
P403: Store in well ventilated place.

Hazard Statements:

H220: Extremely flammable gas.

4 FIRST AID MEASURES

The conscious person who becomes aware of nausea and pressure on the forehead and eyes should go promptly to an uncontaminated area and inhale fresh air or oxygen. However, in the event of a massive exposure the victim may become unconscious or symptoms of asphyxiation may persist. In that case the person should be removed to an uncontaminated area, and given artificial respiration and then oxygen, after breathing has been restored. Treat symptomatically thereafter.

5 FIRE FIGHTING MEASURES

Extinguishing media Dry powder. Carbon dioxide. Fog-water spray. (In the absence of fog equipment a fine spray of water may be used).

Specific hazards Highly flammable. May form explosive gas mixtures with air. Is a simple asphyxiant.

Emergency actions If possible, shut off gas flow at source. Evacuate area. Post warning to prevent persons from approaching with lit cigarettes or open flames. Using water, keep all cylinders in the vicinity of the fire cool. Remove cylinders from the vicinity of the fire if possible. Allow small fires on cylinders to remain burning if they are not posing a hazard. CONTACT THE NEAREST AFROX BRANCH.

Protective clothing Exposed fire fighters should wear approved self-contained breathing apparatus with full mask.

Environmental precautions. As the gas is lighter than air, ensure that is not trapped in confined spaces. This could lead to the formation of a highly explosive gas-air mixture. Ventilate all confined spaces using forced-draught if necessary. Ensure that all electrically powered equipment is flameproof.

6 ACCIDENTAL RELEASE MEASURES

Personal precautions. As Methane is a simple asphyxiant care should be taken when entering confined spaces where leaks have occurred. Do not enter any potentially hazardous area with any source of ignition such as a lit cigarette or match.

Environmental precautions. Methane does not pose a hazard to the environment. An explosive gas-air mixture could be formed when leaks occur, so eliminate all forms of ignition.

Small spills Small leaks should be extinguished by shutting off the source of supply, e.g. closing the valve on the cylinder, or tightening the gland nut. If unable to stop small leaks the cylinder should be moved into the open, well away from any source of ignition. Should a small leak have ignited, use a multi-purpose dry powder or carbon dioxide extinguisher. Should there be no extinguisher available, a welders glove or heavy cloth, soaked in water may be used to extinguish the flame.

Large spills Stop the source if it can be done without risk. Eliminate all sources of ignition and static discharges. Restrict access to the area until completion of the clean-up procedure. Post relevant warning signs. Wear adequate protective clothing when working near the source of the leak. Ventilate the area using forced-draught if necessary. Ensure that all equipment is flameproof.

7 HANDLING AND STORAGE

Do not allow cylinders to slide or come into contact with sharp edges. Methane cylinders may be stacked horizontally provided that they are firmly secured in order to prevent rolling. Ensure that equipment is adequately earthed. Conspicuous signs should be posted in the storage area forbidding smoking or the use of naked lights. Use a "first-in - first-out" inventory system to prevent full cylinders from being stored for excessive periods of time. Compliance with all relevant legislation is essential. Keep out of reach of children.

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MATERIAL SAFETY DATA SHEET (MSDS)

METHANE – CH_4

(Please ensure that this MSDS is received by an appropriate person)

Date: January 2017 Version2
Ref. no.: MS042

8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational exposure hazards No known effect.
Engineering control measures. Engineering control measures are preferred to reduce exposures. General methods include mechanical ventilation, process or personal enclosure, and control of process conditions. Administrative controls and personal protective equipment may also be required. Use a suitable flameproof ventilation system separate from other exhaust ventilation systems. Exhaust direct to outside. Supply sufficient replacement air to make up for air removed by exhaust system.
Personal protection Use self-contained breathing apparatus when fighting large fires.
Eyes. Use safety glasses when working with cylinders.
Hands. Use suitable protective gloves when working with cylinders.
Feet. Wear protective footwear when working with cylinders.

10 STABILITY AND REACTIVITY

Conditions to avoid Overheating of cylinders. Keep sparks and flames away from cylinder, and under no circumstances allow a torch flame to come into contact with any part of the cylinder. Never test for leaks with a flame. Use soapy water when testing for leaks. Never use cylinders as rollers or supports, or for any other purposes other than the storing of Methane.
Incompatible materials. Methane is non-corrosive and may be contained at ambient temperatures by most common metals used in installations designed to have sufficient strength for the working pressures involved.
Hazardous Decomposition Products. No hazardous compounds are formed when Methane / air mixtures burn.

11 TOXICOLOGICAL INFORMATION

Acute Toxicity	No known effect
Skin & eye contact	No known effect
Chronic Toxicity	No known effect
Carcinogenicity	No known effect
Mutagenicity	No known effect
Reproductive Hazards	No known effect

For further information see Section 3. Adverse Health Effects

12 ECOLOGICAL INFORMATION

As Methane is lighter than air it will disperse rapidly in open areas. It does not pose a hazard to the ecology.

13 DISPOSAL CONSIDERATIONS

Disposal Methods Small amounts may be blown to the atmosphere under controlled conditions. No sources of ignition should be in the vicinity. Large amounts should only be handled by the gas supplier.
Disposal of packaging. The disposal of containers must only be handled by the gas supplier.

14 TRANSPORT INFORMATION

ROAD TRANSPORTATION

UN No.	1971
Class	2.1
Subsidiary risk	Asphyxiant
ERG No	115
Hazchem warning	2 A Flammable gas

SEA TRANSPORTATION

IMDG	1971
Class	2.1
Label	Flammable gas

AIR TRANSPORTATION

ICAO/IATA Code	1971
Class	2.1
Subsidiary risk	Flammable gas
Packaging instructions	
- Cargo	200
- Passenger	Forbidden Maximum quantity allowed
- Cargo	150 kg
- Passenger	Forbidden

Skin. No known effect.

9 PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL DATA

Chemical Symbol	CH_4
Molecular Weight	16.04
Specific volume @ 20°C & 101,325 kPa	1474, 0 ml/g
Relative density of gas @ 101,325 kPa (Air=1)	0,555
Flammability limits in air	5.0 – 15.4% (by vol)
Auto ignition temperature	537°C
Colour	None
Taste	None
Odour	Sweet, oil-type

15 REGULATORY INFORMATION

EEC Hazard class Flammable gas
Refer to SANS 10234 Supplement.

16 OTHER INFORMATION

Bibliography
Compressed Gas Association, Arlington, Virginia
Handbook of Compressed Gases - 3rd Edition
Matheson. Matheson Gas Data Book - 6th Edition
SABS 0265 - Labelling of Dangerous Substances

17 EXCLUSION OF LIABILITY

Information contained in this publication is accurate at the date of publication. The company does not accept liability arising from the use of this information, or the use, application, adaptation or process of any product described herein.

safety data sheet

according to Regulation (EC) No. 1907/2006 (REACH), amended by 453/2010/EU

n-Decane ROTICHROM® GC

article number: **3474**
Version: **1.0 en**

date of compilation: 11.05.2015

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Identification of the substance	**n-Decane**
Article number	3474
Registration number (REACH)	01-2119474199-26-xxxx
EC number	204-686-4
CAS number	124-18-5

1.2 Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses	laboratory chemical

1.3 Details of the supplier of the safety data sheet

Carl Roth GmbH + Co KG
Schoemperlenstr. 3-5
D-76185 Karlsruhe
Germany

Telephone: +49 (0) 721 - 56 06 0
Telefax: +49 (0) 721 - 56 06 149
e-mail: sicherheit@carlroth.de
Website: www.carlroth.de

Competent person responsible for the safety data sheet	: Abteilung Arbeitssicherheit
e-mail (competent person)	**: sicherheit@carlroth.de**

1.4 Emergency telephone number

Emergency information service	**Poison Centre Munich: +49/(0)89 19240**

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 (CLP)

Classification acc. to GHS

Section	Hazard class	Hazard class and category	Hazard statement
2.6	flammable liquids	(Flam. Liq. 3)	H226
3.10	aspiration hazard	(Asp. Tox. 1)	H304

Supplemental hazard information

Code	Supplemental hazard information
EUH066	repeated exposure may cause skin dryness or cracking

Classification acc. to 67/548/EEC

Category/ies of danger	Abbreviations
flammable	R10
harmful	Xn; R65
	R66

Remarks

For full text of R-phrases and Hazard- and EU Hazard-statements: see SECTION 16.

2.2 Label elements

Labelling according to Regulation (EC) No 1272/2008 (CLP)

Signal word **Danger**

Pictograms

Hazard statements

H226 Flammable liquid and vapour.
H304 May be fatal if swallowed and enters airways.

Precautionary statements

Precautionary statements - prevention

P280 Wear protective gloves/protective clothing/eye protection/face protection.

Precautionary statements - response

P301+P310 IF SWALLOWED: immediately call a POISON CENTER or doctor/physician.
P331 Do NOT induce vomiting.

Supplemental hazard information

EUH066 Repeated exposure may cause skin dryness or cracking.

Labelling of packages where the contents do not exceed 125 ml

Signal word: **Danger**

Symbol(s).

H304 May be fatal if swallowed and enters airways.

P301+P310 IF SWALLOWED: immediately call a POISON CENTER or doctor/physician.
P331 Do NOT induce vomiting.

EUH066 Repeated exposure may cause skin dryness or cracking.

2.3 Other hazards

There is no additional information.

SECTION 3: Composition/information on ingredients

3.1 Substances

Name of substance	n-Decane
Registration number (REACH)	01-2119474199-26-xxxx
EC number	204-686-4
CAS number	124-18-5
Molecular formula	$C_{10}H_{22}$
Molar mass	142,3 $^{g}/_{mol}$

SECTION 4: First aid measures

4.1 Description of first aid measures

General notes

Take off contaminated clothing.

Following inhalation

Provide fresh air. In all cases of doubt, or when symptoms persist, seek medical advice.

Following skin contact

Rinse skin with water/shower. In all cases of doubt, or when symptoms persist, seek medical advice.

Following eye contact

Rinse cautiously with water for several minutes. In all cases of doubt, or when symptoms persist, seek medical advice.

Following ingestion

Rinse mouth. Do not induce vomiting. Call a physician immediately.

4.2 Most important symptoms and effects, both acute and delayed

Aspiration hazard.

4.3 Indication of any immediate medical attention and special treatment needed

none

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media

Co-ordinate fire-fighting measures to the fire surroundings
foam, dry extinguishing powder, carbon dioxide (CO2)

Unsuitable extinguishing media

water jet

5.2 Special hazards arising from the substance or mixture

Solvent vapours are heavier than air and may spread along floors. Vapours may form explosive mixtures with air. Combustible.

Hazardous combustion products

In case of fire may be liberated: carbon monoxide (CO), carbon dioxide (CO2)

5.3 Advice for firefighters

Fight fire with normal precautions from a reasonable distance. Wear self-contained breathing apparatus.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

For non-emergency personnel

Wearing of suitable protective equipment (including personal protective equipment referred to under Section 8 of the safety data sheet) to prevent any contamination of skin, eyes and personal clothing.

6.2 Environmental precautions

Keep away from drains, surface and ground water.

6.3 Methods and material for containment and cleaning up

Advices on how to contain a spill

Covering of drains.

Advices on how to clean up a spill

Absorb with liquid-binding material (e.g. sand, diatomaceous earth, acid- or universal binding agents).

Other information relating to spills and releases

Place in appropriate containers for disposal. Ventilate affected area.

Reference to other sections

Hazardous combustion products: see section 5. Personal protective equipment: see section 8. Incompatible materials: see section 10. Disposal considerations: see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Provision of sufficient ventilation.

• Measures to prevent fire as well as aerosol and dust generation


Keep away from sources of ignition - No smoking.

Advice on general occupational hygiene

Wash hands after use. Do not to eat, drink and smoke in work areas.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a cool place.

Incompatible substances or mixtures

Observe hints for combined storage.

Consideration of other advice

Ground/bond container and receiving equipment.

• Ventilation requirements

Use local and general ventilation.

• Specific designs for storage rooms or vessels

Recommended storage temperature: 4 °C.

• Packaging compatibilities

Only packagings which are approved (e.g. acc. to ADR) may be used.

7.3 Specific end use(s)

No information available.

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

National limit values

Occupational exposure limit values (Workplace Exposure Limits)

not relevant

Relevant DNELs/DMELs/PNECs and other threshold levels

• environmental values

Endpoint	Threshold level	Environmental compartment	Exposure time
PNEC	1,2 µg/l	freshwater	short-term (single instance)
PNEC	1,2 µg/l	marine water	short-term (single instance)
PNEC	18 µg/l	sewage treatment plant (STP)	short-term (single instance)
PNEC	0,33 mg/kg	freshwater sediment	short-term (single instance)
PNEC	0,33 mg/kg	marine sediment	short-term (single instance)
PNEC	0,13 mg/kg	soil	short-term (single instance)
PNEC	4,5 µg/l	water	continuous

8.2 Exposure controls

Individual protection measures (personal protective equipment)

Eye/face protection

Use safety goggle with side protection.

Skin protection

• hand protection

Wear suitable gloves. Chemical protection gloves are suitable, which are tested according to EN 374. For special purposes, it is recommended to check the resistance to chemicals of the protective gloves mentioned above together with the supplier of these gloves.

• type of material

NBR (Nitrile rubber)

• material thickness

0,4 mm.

• breakthrough times of the glove material

>480 minutes (permeation: level 6)

• other protection measures

Take recovery periods for skin regeneration. Preventive skin protection (barrier creams/ointments) is recommended.

Respiratory protection

Type: A (against organic gases and vapours with a boiling point of > 65 °C , colour code: Brown).

Environmental exposure controls

Keep away from drains, surface and ground water.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance

Physical state	liquid (fluid)
Colour	colourless
Odour	characteristic
Odour threshold	No data available

Other physical and chemical parameters

pH (value)	This information is not available.
Melting point/freezing point	-27 °C at 1 atm
Initial boiling point and boiling range	174 - 180 °C at 1 atm
Flash point	49 °C
Evaporation rate	no data available
Flammability (solid, gas)	not relevant (fluid)

Explosive limits	
• lower explosion limit (LEL)	0,7 vol% (41 g/m³)
• upper explosion limit (UEL)	5,4 vol% (320 g/m³)
Explosion limits of dust clouds	not relevant
Vapour pressure	135 Pa at 20 °C
Density	0,7321 $^{g}/_{cm^3}$ at 20 °C
Vapour density	This information is not available.
Bulk density	Not applicable
Relative density	4,91 air = 1
Solubility(ies)	
Water solubility	no data available
Partition coefficient	
n-octanol/water (log KOW)	5,01
Soil organic carbon/water (log KOC)	4,16 (ECHA)
Auto-ignition temperature	206 °C - ECHA
Viscosity	
• kinematic viscosity	<7 $^{mm^2}/_{s}$ at 40 °C
Explosive properties	none
Oxidising properties	none

9.2 Other information

Refractive index	1,412

SECTION 10: Stability and reactivity

10.1 Reactivity

risk of ignition, In case of warming: Vapours can form explosive mixtures with air

10.2 Chemical stability

The material is stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.

10.3 Possibility of hazardous reactions

Violent reaction with: Strong oxidiser

10.4 Conditions to avoid

Keep away from heat.

10.5 Incompatible materials

There is no additional information.

10.6 Hazardous decomposition products

Hazardous combustion products: see section 5.

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Exposure route	Endpoint	Value	Species	Source
oral	LD50	>5000 $^{mg}/_{kg}$	rat	ECHA

Skin corrosion/irritation

Shall not be classified as corrosive/irritant to skin.

Serious eye damage/eye irritation

Causes slight to moderate irritation.

Respiratory or skin sensitisation

Shall not be classified as a respiratory or skin sensitiser.

Summary of evaluation of the CMR properties

Shall not be classified as germ cell mutagenic, carcinogenic nor as a reproductive toxicant.

• Specific target organ toxicity - single exposure

Shall not be classified as a specific target organ toxicant (single exposure).

• Specific target organ toxicity - repeated exposure

Shall not be classified as a specific target organ toxicant (repeated exposure).

Aspiration hazard

May be fatal if swallowed and enters airways.

Symptoms related to the physical, chemical and toxicological characteristics

• If swallowed

data are not available

• If inhaled

narcosis

• If on skin

data are not available

SECTION 12: Ecological information

12.1 Toxicity

acc. to 1272/2008/EC: Shall not be classified as hazardous to the aquatic environment.

Aquatic toxicity (acute)

Endpoint	Value	Species	Source	Exposure time
EC50	18 $^{mg}/_{l}$	daphnia magna	IUCLID	48 hours

12.2 Process of degradability

The substance is readily biodegradable.
Theoretical Oxygen Demand: 3,486 $^{mg}/_{mg}$
Theoretical Carbon Dioxide: 3,093 $^{mg}/_{mg}$

Process	Degradation rate	Time
biotic/abiotic	100 %	21 d
oxygen depletion	83,1 %	28 d

12.3 Bioaccumulative potential

The substance fulfils the very bioaccumulative criterion.
n-octanol/water (log KOW) 5,01

12.4 Mobility in soil

The Organic Carbon normalised adsorption coefficient 4,16

12.5 Results of PBT and vPvB assessment

Data are not available.

12.6 Other adverse effects

Slightly hazardous to water.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

This material and its container must be disposed of as hazardous waste. Dispose of contents/container in accordance with local/regional/national/international regulation.

Sewage disposal-relevant information

Do not empty into drains.

Waste treatment of containers/packagings

It is a dangerous waste; only packagings which are approved (e.g. acc. to ADR) may be used.

13.2 Relevant provisions relating to waste

The allocation of waste identity numbers/waste descriptions must be carried out according to the EEC, specific to the industry and process.

13.3 Remarks

Waste shall be separated into the categories that can be handled separately by the local or national waste management facilities. Please consider the relevant national or regional provisions.

SECTION 14: Transport information

14.1	UN number	**2247**
14.2	UN proper shipping name	**n-DECANE**
	Hazardous ingredients	Decane
14.3	Transport hazard class(es)	
	Class	3 (flammable liquids)
14.4	Packing group	III (substance presenting low danger)
14.5	Environmental hazards	none (non-environmentally hazardous acc. to the dangerous goods regulations)

14.6 Special precautions for user

Provisions for dangerous goods (ADR) should be complied within the premises.

14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

The cargo is not intended to be carried in bulk.

14.8 Information for each of the UN Model Regulations

• Transport of dangerous goods by road, rail and inland waterway (ADR/RID/ADN)

UN number	2247
Proper shipping name	N-DECANE
Class	3
Classification code	F1
Packing group	III
Danger label(s)	3

Excepted quantities (EQ)	E1
Limited quantities (LQ)	5 L
Transport category (TC)	3
Tunnel restriction code (TRC)	D/E
Hazard identification No	30

• International Maritime Dangerous Goods Code (IMDG)

UN number	2247
Proper shipping name	N-DECANE
Class	3
Packing group	III
Danger label(s)	3

Special provisions (SP)	-
Excepted quantities (EQ)	E1
Limited quantities (LQ)	5 L
EmS	F-E, S-E
Stowage category	A

SECTION 15: Regulatory information

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

Relevant provisions of the European Union (EU)

• Restrictions according to REACH, Annex XVII

None of the ingredients are listed.

• List of substances subject to authorisation (REACH, Annex XIV)

None of the ingredients are listed.

• Seveso Directive

No	Dangerous substance/hazard categories	Qualifying quantity (tonnes) for the application of lower and upper-tier requirements		Notes
P5c	flammable liquids (cat. 2, 3)	5.000	50.000	51)

Notation

51) Flammable liquids, categories 2 or 3 not covered by P5a and P5b

• Limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products (2004/42/EC, Deco-Paint Directive)

VOC content 100 %

• Directive on industrial emissions (VOCs, 2010/75/EU)

VOC content 100 %

National inventories

Substance is listed in the following national inventories:

- EINECS/ELINCS/NLP (Europe)
- REACH (Europe)

15.2 Chemical Safety Assessment

No Chemical Safety Assessment has been carried out for this substance.

SECTION 16: Other information

Abbreviations and acronyms

Abbr.	Descriptions of used abbreviations
ADN	Accord européen relatif au transport international des marchandises dangereuses par voies de navigation intérieures (European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways)
ADR	Accord européen relatif au transport international des marchandises dangereuses par route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
CAS	Chemical Abstracts Service (service that maintains the most comprehensive list of chemical substances)
CLP	Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures
CMR	Carcinogenic, Mutagenic or toxic for Reproduction
DMEL	Derived Minimal Effect Level
DNEL	Derived No-Effect Level
EINECS	European Inventory of Existing Commercial Chemical Substances
ELINCS	European List of Notified Chemical Substances
EmS	Emergency Schedule
GHS	"Globally Harmonized System of Classification and Labelling of Chemicals" developed by the United Nations
IMDG	International Maritime Dangerous Goods Code
MARPOL	International Convention for the Prevention of Pollution from Ships (abbr. of "Marine Pollutant)
NLP	No-Longer Polymer
PBT	Persistent, Bioaccumulative and Toxic
PNEC	Predicted No-Effect Concentration
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RID	Règlement concernant le transport International ferroviaire des marchandises Dangereuses (Regulations concerning the International carriage of Dangerous goods by Rail)
VOC	Volatile Organic Compounds
vPvB	very Persistent and very Bioaccumulative

Key literature references and sources for data

- Regulation (EC) No. 1907/2006 (REACH), amended by 453/2010/EU
- Regulation (EC) No. 1272/2008 (CLP, EU GHS)

List of relevant phrases (code and full text as stated in chapter 2 and 3)

Code	Text
H226	flammable liquid and vapour
H304	may be fatal if swallowed and enters airways
R65	harmful: may cause lung damage if swallowed

Disclaimer

The above information describes exclusively the safety requirements of the product and is based on our present-day knowledge. The information is intended to give you advice about the safe handling of the product named in this safety data sheet, for storage, processing, transport and disposal. The information cannot be transferred to other products. In the case of mixing the product with other products or in the case of processing, the information on this safety data sheet is not necessarily valid for the new made-up material.

Safety data sheet
n-Heptane

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier
Product name
n-Heptane
EC No (from EINECS): 205-563-8
CAS No: 142-82-5
Index-Nr. 601-008-00-2
Chemical formula C7H16
REACH Registration number:
01-2119457603-38

1.2. Relevant identified uses of the substance or mixture and uses advised against
Relevant identified uses
Industrial and professional. Perform risk assessment prior to use.
Uses advised against
Consumer use.

1.3. Details of the supplier of the safety data sheet
Company identification
BOC, Priestley Road, Worsley, Manchester M28 2UT
E-Mail Address ReachSDS@boc.com

1.4. Emergency telephone number
Emergency phone numbers (24h): 0800 111 333

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification acc. to Regulation (EC) No 1272/2008/EC (CLP/GHS)
Flammable liquid: Flam. Liq. 2 – Highly flammable liquid and vapour.
Asp. Tox. 1 - May be fatal if swallowed and enters airways.
Skin Irrit. 2 - Causes skin irritation.
STOT SE 3 - May cause drowsiness or dizziness.
Aquatic Acute 1 - Very toxic to aquatic life.
Aquatic Chronic 1 - Very toxic to aquatic life with long lasting effects.

Classification acc. to Directive 67/548/EEC & 1999/45/EC:
F; R11 **|** Xn; R65 **|** Xi; R38 **|** R67 **|** N; R50/53
Highly flammable.
Irritating to skin.
Very toxic to aquatic organisms, may cause long term adverse effects in the aquatic environment.
Harmful: may cause lung damage if swallowed.
Vapours may cause drowsiness and dizziness.

2.2. Label elements
- Labelling Pictograms

- Signal word

Danger

- **Hazard Statements**

H225	Highly flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H315	Causes skin irritation
H336	May cause drowsiness or dizziness.
H410	Very toxic to aquatic life with long lasting effects.

- **Precautionary Statements**

Precautionary Statement Prevention

P210	Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P233	Keep container tightly closed.
P240	Ground / bond container and receiving equipment.
P241	Use explosion-proof electrical, ventilating, and lighting equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P261	Avoid breathing mist / vapours.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves and eye / face protection.

Precautionary Statement Response

P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P312	Call a POISON CENTER or doctor/physician if you feel unwell.
P331	Do NOT induce vomiting.
P370 + P378	In case of fire: Use water fog, foam, dry chemical or carbon dioxide (CO2) for extinction.
P391	Collect spillage.

Precautionary Statement Storage

P403 + P233+ P235	Store in a well-ventilated place. Keep container tightly closed. Keep cool.
P405	Store locked up.

Precautionary Statement Disposal

P501	Dispose of contents and container in accordance with local regulations.

2.3. Other hazards

SECTION 3: Composition/information on ingredients

Substance / Mixture: Substance.

3.1. Substances
n-Heptane
EC No (from EINECS): 205-563-8
CAS No: 142-82-5
Index-Nr. 601-008-00-2
Chemical formula C7H16
REACH Registration number:
01-2119457603-38

Contains no other components or impurities which will influence the classification of the product.

3.2. Mixtures
Not applicable.

SECTION 4: First aid measures

4.1. Description of first aid measures
First Aid General Information:
Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.
First Aid Inhalation:
Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.
First Aid Skin / Eye:
For liquid spillage - flush with water for at least 15 minutes. Remove contaminated clothing. Drench affected area with water for at least 15 minutes. Immediately flush eyes thoroughly with water for at least 15 minutes. Obtain medical assistance.
First Aid Ingestion:
If victim is conscious: Rinse mouth out with plenty of water.
Let victim drink water as much as possible in small sips
Do NOT induce vomiting.
Get immediate medical advice/attention.
4.2. Most important symptoms and effects, both acute and delayed
Causes skin and eye irritation . Possible symptoms are irritation of the mucous membranes, dry cough and respiratory difficulty. Symptoms may include dizziness, headache, nausea and loss of co-ordination Suitable first-aid treatment should be immediately available. Seek medical advice before using product. May result in pulmonary oedema.

4.3. Indication of any immediate medical attention and special treatment needed
Obtain medical assistance.
Recommendations to physicians: Provide oxygen.

SECTION 5: Fire fighting measures

5.1. Extinguishing media
Suitable extinguishing media
Dry powder.. Carbon dioxide. Alcohol-resistant foam. Use water spray or fog to control fire fumes.
Unsuitable extinguishing media
Do not use a solid water stream.

5.2. Special hazards arising from the substance or mixture
Specific hazards
Exposure to fire may cause containers to rupture/explode.
Hazardous combustion products
If involved in a fire the following toxic and/or corrosive fumes may be produced by thermal decomposition: Carbon dioxide and Carbon monoxide

5.3. Advice for fire-fighters
Specific methods
If possible, stop flow of product. If leaking do not extinguish a flame unless absolutely necessary. Spontaneous/explosive re-ignition may occur. Extinguish any other fire. Move container away or cool with water from a protected position. Prevent water used in emergency cases from entering sewers and drainage systems.
Special protective equipment for fire-fighters
Normal firefighters' equipment consists of an appropriate SCBA (open-circuit positive pressure compressed air type) in combination with fire kit. Equipment and clothing to the following standards will provide a suitable level of protection for firefighters.
Guideline:
EN 469:2005: Protective clothing for firefighters. Performance requirements for protective clothing for firefighting., EN 137 Respiratory protective devices — Self-contained open-circuit compressed air breathing apparatus with full face mask — Requirements, testing, marking., EN 15090 Footwear for firefighters., EN 443 Helmets for fire fighting in buildings and other structures., EN 659 Protective gloves for firefighters.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures
Evacuate area. Use self-contained breathing apparatus and chemically protective clothing. Ensure adequate air ventilation. Eliminate ignition sources. Consider the risk of potentially explosive atmospheres. Monitor concentration of released product. Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.

6.2. Environmental precautions
Try to stop release. Reduce vapour with fog or fine water spray.

6.3. Methods and material for containment and cleaning up
Ventilate area. Keep away from ignition sources (including static discharges). Evacuate area. Prevent evaporation by covering with foam. Absorb excess liquid spillage on inorganic adsorbent material such as fine sand, brick dust etc. Place spent adsorbent in sealed packages and contact specialist waste disposal contractor.

6.4. Reference to other sections
See also sections 8 and 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling
Only experienced and properly instructed persons should use this product. The substance must be handled in accordance with good industrial hygiene and safety procedures. Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Contact your supplier if in doubt. Avoid exposure, obtain special instructions before use. Take precautionary measures against static discharges. Ensure equipment is adequately earthed. Purge air from system before introducing product. Keep away from ignition sources (including static discharges). Do not smoke while handling product. Assess the risk of a potentially explosive atmosphere and use explosion-proof equipment. Use only non-sparking tools. Ensure the complete system has been (or is regularly) checked for leaks before use. Installation of a cross purge assembly between the container and the regulator is recommended. Purge system with dry inert gas (e.g. helium or nitrogen) before product is introduced and when system is placed out of service. Avoid suckback of water, acid and alkalis. Refer to supplier's handling instructions. Do not allow backfeed into the container. Protect containers from physical damage; do not drag, roll, slide or drop. When moving containers, even for short distances, use appropriate equipment e.g. trolley, hand truck, fork truck etc. Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use. If user experiences any difficulty operating container valve discontinue use and contact supplier. Never attempt to repair or modify container valves or safety relief devices. Damaged valves should be reported immediately to the supplier. Keep container valve outlets clean and free from contaminates particularly oil and water. Replace valve outlet caps or

plugs and container caps where supplied as soon as container is disconnected from equipment. Close container valve after each use and when empty, even if still connected to equipment. Never attempt to transfer product from one container to another. Never use direct flame or electrical heating devices to raise the pressure of a container. Do not remove or deface labels provided by the supplier for the identification of the container contents.

7.2. Conditions for safe storage, including any incompatibilities
Segregate from oxidant gases and other oxidants in store. Keep container below 50°C in a well ventilated place. Secure cylinders to prevent them from falling. Observe all regulations and local requirements regarding storage of containers. Cylinders should be stored in the vertical position and properly secured to prevent falling over. Stored containers should be periodically checked for general conditions and leakage. Container valve guards or caps should be in place. Store containers in location free from fire risk and away from sources of heat and ignition. Keep away from combustible materials. All electrical equipment in the storage areas should be compatible with the risk of potentially explosive atmosphere. Containers should not be stored in conditions likely to encourage corrosion.

7.3. Specific end use(s)
None.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters
Exposure limit value

Value type	Value	Note
Great Britain - LTEL	500 ppm	EH 40/07

Derived No Effect Levels

Type	Exposure	Value	Population	Effects
DNEL	Long term Dermal	300 mg/kg bw/day	Workers	Systemic
DNEL	Long term Inhalation	2085 mg/m³	Workers	Systemic

Predicted No Effect Concentrations

Type	Compartment Detail	Value
PNEC	Fresh water	0,03 mg/L
PNEC	Marine water	0,03 mg/L
PNEC	Fresh water sediment	4,4 mg/kg
PNEC	Marine sediment	4,4 mg/kg
PNEC	Soil	1,8 mg/kg

8.2. Exposure controls
Appropriate engineering controls
A risk assessment should be conducted and documented in each work area to assess the risks related to the use of the product and to select the PPE that matches the relevant risk. The following recommendations should be considered. Gas detectors should be used when toxic quantities may be released. Gas detectors should be used when quantities of flammable gases/vapours may be released. Consider work permit system e.g. for maintenance activities. Systems under pressure should be regularly checked for leakages. Provide adequate general or local ventilation.
Personal protective equipment
Eye and face protection
Protect eyes, face and skin from contact with product. Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Wear a face-shield when transfilling and breaking transfer connections. Safety eyewear, goggles or face-shield to EN166 should be used to avoid exposure to liquid splashes. Wear eye protection to EN 166 when using the product. Full-face mask recommended
Guideline:
EN 136 Respiratory protective devices. Full face masks. Requirements, testing, marking
Skin protection
Hand protection
Advice: Wear working gloves and safety shoes while handling containers., Chemically resistant gloves complying with EN 374 should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Guideline: EN 388 Protective gloves. EN 374-1/2/3 Protective gloves against chemicals and micro-organisms.

Body protection
Protect eyes, face and skin from contact with product. Keep suitable chemically resistant protective clothing readily available for emergency use. Personal protective equipment for the body should be selected based on the task being performed and the risks involved.
Guideline:
EN 943: Protective clothing against liquid and gaseous chemicals, including liquid aerosols and solid particles.
Other protection
Wear flame resistant/retardant clothing. Take precautionary measures against static discharges. Wear working gloves and safety shoes while handling containers. EN ISO 20345 Personal protective equipment - Safety footwear. ISO/TR 2801:2007 Clothing for protection against heat and flame -- General recommendations for selection, care and use of protective clothing.
Respiratory protection
Keep self contained breathing apparatus readily available for emergency use., Use SCBA in the event of high concentrations, The selection of the Respiratory Protective Device (RPD) must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected RPD., When a risk assessment shows that air-purifying respirators are appropriate then they may be used as a back-up to engineering controls. If the respirator is the sole means of protection use a full face supplied air respirator.
Guideline:
EN 136 Respiratory protective devices. Full face masks. Requirements, testing, marking

Material:
Filter ABEK

Guideline:
EN 14387: Respiratory protective devices. Gas filter(s) and combined filter(s). Requirements, testing, marking.

Self-contained breathing apparatus (SCBA)

Guideline:
EN 137 Respiratory protective devices — Self-contained open circuit compressed air breathing apparatus with full face mask — Requirements, testing, marking.
Thermal hazards
Not applicable
Environmental Exposure Controls
Specific risk management measures are not required beyond good industrial hygiene and safety procedures. Refer to local regulations for restriction of emissions to the atmosphere. See section 13 for specific methods for waste gas treatment.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties
General information
Appearance/Colour:
Odour: Petroleum-like odour, almost odourless.
Odour threshold:
Odour threshold is subjective and inadequate to warn for over exposure.
Melting point: -91°C
Boiling point: 98,4°C
Flash point: -4°C
Evaporation rate: No data available.
Flammability range: 1,1 %(V) – 7 %(V)
Vapour Pressure 20 °C: 53,3 hPa
Relative density, gas (Air=1): 3,5
Solubility in water: Negligible
Partition coefficient: n-octanol/water: 4,66
Autoignition temperature: 203,85°C
Molecular weight: 100,23 g/mol
Critical temperature: No data available.
Relative density, liquid (Water=1): 0,7

9.2. Other information
Gas/vapour heavier than air. May accumulate in confined spaces, particularly at or below ground level.

SECTION 10: Stability and reactivity

10.1. Reactivity
No reactivity hazard other than the effects described in sub-sections below.

10.2. Chemical stability
Stable under normal conditions.

10.3. Possibility of hazardous reactions
Can form potentially explosive atmosphere in air. May react violently with oxidants.

10.4. Conditions to avoid
Keep away from heat/sparks/open flames/hot surfaces. - No smoking.

10.5. Incompatible materials
Air, Oxidiser

10.6. Hazardous decomposition products
Under normal conditions of storage and use, hazardous decomposition products should not be produced. If involved in a fire the following toxic and/or corrosive fumes may be produced by thermal decomposition:
Carbon dioxide and Carbon monoxide

SECTION 11: Toxicological information

11.1. Information on toxicological effects
Acute inhalation toxicity
Value: LC50
Species: Rat
Method: OECD Test Guideline 403
Exposure time: 4 h
Value in non-standard unit: 29,29 mg/l
May result in pulmonary oedema
Acute oral toxicity
Value: LD50
Species: Rat
Method: OECD Test Guideline 401
Value in non-standard unit: >5000 mg/kg
Read across.
Acute dermal toxicity
Value: LD50
Species: Rabbit
Method: OECD Test Guideline 402
Value in non-standard unit: >2000 mg/kg
Read across.
Skin irritation
Irritating to skin.
Eye irritation
Irritating to eyes.
Sensitization
Not sensitising.
Read across.
Repeated dose toxicity
Species: Rat
Route of application: Inhalation
Exposure time: 16 weeks
Value type: NOAEC
Value: 12470 mg/m³ air
Genetic toxicity in vitro
Negative
Genetic toxicity in vivo
No data available.
Assessment carcinogenicity
No data available.
Toxicity to reproduction/fertility
Species: Rat
Route of application: Inhalation
Value type: NOAEL
Value: 9000 ppm

Value type: NOAEL F1
Value: 3000 ppm

Value type: NOAEL F2
Value: 3000 ppm

Method: OECD Test Guideline 416
Test substance: Read across
Developmental toxicity/teratogenicity
Species: Mouse
Route of application: Inhalation
Value type: NOAEL (maternal)
Value: 900 ppm

Value type: NOAEL (developmental)
Value: 3000 ppm

Value type: LOAEL
Value: 9000 ppm

Method: OECD Test Guideline 414
Test substance: Read across
Specific Target Organ Toxicity (STOT) - Single Exposure
May cause drowsiness or dizziness.
Specific Target Organ Toxicity (STOT) - Repeated Exposure
No data available.
Aspiration hazard
Aspirated material may produce fatal lung injury.

SECTION 12: Ecological information

12.1. Toxicity
Acute and prolonged toxicity fish
Species: Rainbow trout (Oncorhynchus mykiss)
Exposure time: 28d

Method: QSAR
Value type: NOELR
Value in standard unit mg/l: 1,284

Species: Rainbow trout (Oncorhynchus mykiss)
Exposure time: 96h
Method: QSAR
Value type: LL50
Value in standard unit mg/l: 5,738
Toxicity aquatic invertebrates
Species: Water flea (Daphnia magna)
Exposure time: 48h
Value type: EC50
Value in standard unit mg/l: 1,5

Species: Water flea (Daphnia magna)
Exposure time: 21d
Method: OECD Test Guideline 211
Value type: NOELR
Value in standard unit mg/l: 1
Read across

Toxicity aquatic plants
Species: Algae
Exposure time: 72h
Value type: EL50
Value in standard unit mg/l: 4,338
Method: QSAR

12.2. Persistence and degradability
Compartment: Water
Test duration: 10d
Degradation: 70%
The overall results suggest that it would meet the criteria for ready biodegradation.

12.3. Bioaccumulative potential
Log Pow: 4,66
Has potential to bioaccumulate.

12.4. Mobility in soil
n-Heptane is calculated by the Level I fugacity-based Equilibrium Partitioning model to partition 100% into the air phase.

12.5. Results of PBT and vPvB assessment
Not classified as PBT or vPvB.

12.6. Other adverse effects
Very toxic to aquatic life with long lasting effects. Avoid release to the environment.

SECTION 13: Disposal considerations

13.1. Waste treatment methods
Avoid release to the environment. Do not discharge into any place where its accumulation could be dangerous. Contact supplier if guidance is required. Toxic and corrosive gases formed during combustion should be scrubbed before discharge to atmosphere. Do not discharge into areas where there is a risk of forming an explosive mixture with air. Waste gas should be flared through a suitable burner with flash back arrestor.

SECTION 14: Transport information

ADR/RID

14.1. UN number
1206

14.2. UN proper shipping name
Heptanes

14.3. Transport hazard class(es)
Class: 3
Classification Code: F1
Labels: 3
Hazard number: 33
Tunnel restriction code: (D/E)
Emergency Action Code: 3YE

14.4. Packing group (Packing Instruction)
II

14.5. Environmental hazards
Environmentally hazardous.

14.6. Special precautions for user
None.

IMDG

14.1. UN number
1206

14.2. UN proper shipping name
Heptanes

14.3. Transport hazard class(es)
Class: 3
Labels: 3
EmS: F-E, S-D

14.4. Packing group (Packing Instruction)
II

14.5. Environmental hazards
Environmentally hazardous.

14.6. Special precautions for user
Immiscible with water. Irritating to skin, eyes and mucous membranes.

14.7. Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code
Substance name: HEPTANE (ALL ISOMERS)
Ship type required: 2
Pollution category: X

IATA

14.1. UN number
1206

14.2. UN proper shipping name
Heptanes

14.3. Transport hazard class(es)
Class: 3

14.4. Packing group (Packing Instruction)
Passenger Aircraft: Permitted for transport
Cargo Aircraft: Permitted for transport

14.5. Environmental hazards
None.

14.6. Special precautions for user

None.

Other transport information
Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. Before transporting product containers ensure that they are firmly secured. Ensure that the container valve is closed and not leaking. Ensure that the valve outlet cap nut or plug (where provided) is correctly fitted. Ensure that the valve protection device (where provided) is correctly fitted. Ensure adequate ventilation. Ensure compliance with applicable regulations.

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture
Seveso Directive 96/82/EC: Covered

Other regulations
Dangerous Substances and Explosive Atmospheres Regulations (DSEAR 2002 No. 2776)
Management of Health and Safety at Work Regulations (1999 No. 3242)
The Regulatory Reform (Fire Safety) Order 2005 (2005 No. 1541)
Control of Substances Hazardous to Health Regulations (COSHH, 2002 No. 2677)
Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations (EPS, 1996 No. 192)
Provision and Use of Work Equipment Regulations (PUWER, 1998 No. 2306)
Personal Protective Equipment Regulations (1992 No. 2966)
Control of Major Accident Hazards Regulations (COMAH, 1999 No. 743)
Chemical Hazards Information and Packaging for Supply (CHIP, 1994 No. 3247)
Pressure Systems Safety Regulations (PER, 2000 No. 128)
This Safety Data Sheet has been produced to comply with Regulation (EU) 453/2010.

15.2. Chemical safety assessment
A CSA has been carried out.

SECTION 16: Other information

Ensure operators understand the flammability hazard. Ensure operators understand the toxicity hazard. Users of breathing apparatus must be trained. Before using this product in any new process or experiment, a thorough material compatibility and safety study should be carried out.

Advice
Whilst proper care has been taken in the preparation of this document, no liability for injury or damage resulting from its use can be accepted. Details given in this document are believed to be correct at the time of going to press.

Further information
Note:
When using this document care should be taken, as the decimal sign and its position complies with rules for the structure and drafting of international standards, and is a comma on the line.
As an example 2,000 is two (to three decimal places) and not two thousand, whilst 1.000 is one thousand and not one (to three decimal places).

References
Various sources of data have been used in the compilation of this SDS; they include but are not exclusive to:

European Chemical Agency: Guidance on the Compilation of Safety Data Sheets.
European Chemical Agency: Information on Registered Substances http://apps.echa.europa.eu/registered/registered-sub.aspx#search
European Industrial Gases Association (EIGA) Doc. 169/11 Classification and Labelling guide.
ISO 10156:2010 Gases and gas mixtures -- Determination of fire potential and oxidizing ability for the selection of cylinder valve outlets.
International Programme on Chemical Safety (http://www.inchem.org/)
Matheson Gas Data Book, 7th Edition.
National Institute for Standards and Technology (NIST) Standard Reference Database Number 69
The ESIS (European chemical Substances 5 Information System) platform of the former European Chemicals Bureau (ECB) ESIS (http://ecb.jrc.ec.europa.eu/esis/).
The European Chemical Industry Council (CEFIC) ERICards.
United States of America's National Library of Medicine's toxicology data network TOXNET (http://toxnet.nlm.nih.gov/index.html)
Agency for Toxic Substances and Diseases Registry (ATSDR) (http://www.atsdr.cdc.gov/)
Threshold Limit Values (TLV) from the American Conference of Governmental Industrial Hygienists (ACGIH).
Substance specific information from suppliers.
EH40 (as amended) Workplace exposure limits.

End of document

MATERIAL SAFETY DATA SHEET (MSDS)
LIQUID NITROGEN
Please ensure that this MSDS is received by the appropriate person

DATE: September 2019 **Version 4**

Ref. No.: MS006

1 PRODUCT AND COMPANY IDENTIFICATION

Product Name LIQUID NITROGEN

Chemical Formula N_2

Company Identification
African Oxygen Limited
23 Webber Street
Johannesburg, 2001
Tel. No: (011) 490-0400
Fax No: (011) 490-0506

EMERGENCY NUMBER **0860 111 185 or 0860 020202**

2 HAZARDS IDENTIFICATION

Main Hazards: Extremely cold liquid (-196°C) can cause severe frostbite and cold burns. Nitrogen gas can act as an asphyxiant as it dilutes the concentration of oxygen in air below the levels necessary to support life. Rescue workers may require self-contained breathing apparatus and protective clothing.

Adverse Health Effects: Inhalation of nitrogen in excessive concentrations can result in dizziness, nausea, vomiting, loss of consciousness, rapid breathing, asphyxiation without warning and death.

Skin and Eye Contact: May cause severe cold burns and frostbite.

Biological Hazards: Contact between the skin and liquid Nitrogen or uninsulated piping or vessel containing it, can cause severe cold burn injuries.

Environmental Hazard: No known effects to the environment, but in confined space ensure adequate ventilation.

Chemical Hazards. Nitrogen is relatively inert to most materials under ordinary conditions. It becomes more reactive at elevated temperatures when it combines with hydrogen, oxygen and some metals.

3 COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	Nitrogen
Chemical Family	Inert gas
Chemical Abstract Service Number (CAS No.)	7727-37-9
United Nations Number (UN No.)	1977
Emergency Response Guide Number (ERG No.)	120
Hazchem Warning	2.2 Non- flammable gases

4 FIRST AID MEASURES

Skin/Eye Contact: Immediately flush with large quantities of tepid water for at least 15 minutes.
In case of frostbite, spray with tepid water for at least 15 minutes. Apply a sterile dressing, and obtain medical assistance.
If water is not available or impractical to use, wrap the affected part gently with blankets. Keep victim warm and qui**et,** and obtain medical assistance

Ingestion or Swallowing: Ingestion is not considered a potential route of exposure

Inhalation: In high concentration may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Remove victim to fresh air wearing self-contained breathing apparatus. Apply artificial respiration if victim is not breathing. Obtain medical assistance.

5 FIRE FIGHTING MEASURES

Special hazards: Exposure to fire may cause containers or vessels to rupture/explode. Nitrogen is non-flammable.

Extinguishing media As Nitrogen is an inert gas; it does not contribute to a fire, but could help with the extinguishing by reducing the oxygen content of the air by dilution to below the level to support combustion. Keep the PCC, bulk tank or tanker cool by spraying with water if exposed to fire.

Special protective equipment for fire fighters: In confined space use self-contained breathing apparatus.

6 ACCIDENTAL RELEASE MEASURES

Personal Precautions Do not enter any area where nitrogen has been spilled or a serious leak has occurred unless tests have shown that it is safe to do so. If the area must be entered by the emergency personnel, self-contained breathing apparatus, leather gloves, and appropriate foot and leg protection should be worn.

Environmental Protection Liquid nitrogen poses no harm to the environment.
Small spills Shut off the source of escaping nitrogen. Ventilate the area.

Large spills Evacuate the area. Shut off the source of the spill/leak if this can be done without risk. Prevent liquid nitrogen from entering sewers, basements and work pits. If tanker has overturned, do not attempt to right or move it. CONTACT THE NEAREST AFROX BRANCH. Restrict access to the area until is fully ventilated. Ventilate the area using forced-draught if necessary. Monitor the surrounding area for Oxygen level. Oxygen must be at least 19.5% before personnel may be allowed into the area without self-contained breathing apparatus. Large spills can also be dispersed using a water fog spray.

7 HANDLING AND STORAGE

Safe handling When Liquid nitrogen is held in any closed vessel or space, there must be an appropriate pressure relief device because of the large pressure increases that can occur as the liquid nitrogen is vaporised. Use only containers designed for cryogenic liquids. Do not use any stopper or other device that will interfere with venting of gas. Unauthorised modification to these liquid containers is forbidden.

Storage Store in a cool and well ventilated area. If containers are stored outside, provide shelter to protect against extreme weather conditions. Excessive exposure to any heat could cause the internal pressure to increase significantly with the consequent loss of liquid product that has vaporised. Keep out of reach of children.

Personal Protective Equipment Wear face shield; leather gloves and leather apron when using or decanting liquid nitrogen. Do not put hands (even in the best gloves) in the cryogenic liquid. Wear safety boots and overalls.

8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Hazards As nitrogen is a simple asphyxiant, avoid any areas where spillage has taken place unless entering with self-contained breathing apparatus. Only enter once testing has proved the atmosphere to be safe.

Engineering Control Measures Engineering control measures are preferred to reduce exposure to oxygen-depleted atmospheres. General methods include forced-draught or exhaust ventilation systems. Ensure that sufficient fresh air enters at, or near, floor level.

Personal Protection Face shield, leather gloves, leather apron and Safety shoes, or boots, should be worn when handling containers.

9 PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL DATA

Chemical Symbol	N_2
Molecular Weight	28,01
Boiling point @ 101,325 kPa	-195,8°C
Density, liquid @ boiling point	803,6 kg/m^3
Relative density (Air = 1) @ 101,325 kPa	0,967
Latent heat of vaporisation @ boiling point	199,1 kJ/kg
Colour	None
Taste	None
Odour	None

10 STABILITY AND REACTIVITY

Conditions to avoid The dilution of the oxygen concentration in the atmosphere to levels which cannot support life.

Incompatible At the temperature of liquid nitrogen ordinary carbon steels, and most alloy steels lose their ductility, and are therefore considered to be unsatisfactory.

Materials Metals and alloys that have satisfactory ductility include austinitic stainless steel (i.e. types, 304 and 316), and nickel-chromium alloys, nickel, Monel 400, copper, brasses, bronze and aluminium.

Hazardous Decomposition Products None

11 TOXICOLOGICAL INFORMATION

Acute Toxicity	None
Skin & eye contact	none
Carcinogenicity	Severe cold burns could result in cancerous growth.
Reproductive Hazards	No known effect

For further information, see Section 3. **(Adverse Health Effects).**

12 ECOLOGICAL INFORMATION

It does not pose a hazard to the ecology but it can cause frost damage to vegetation

13 DISPOSAL CONSIDERATIONS

Disposal Methods Small amounts may be allowed to evaporate to atmosphere under controlled conditions. Large amounts should only be handled by the gas supplier.

Disposal of packaging The disposal of containers must only be handled by the gas supplier.

14 TRANSPORT INFORMATION

ROAD TRANSPORTATION

United Nations Number (UN No.)	1977
Emergency Response Guide (ERG No.)	120
Hazchem warning	2.2 Non-flammable gases

SEA TRANSPORTATION

IMDG	1977
Class	2.2
Packaging group	
Label	Non-flammable gas

AIR TRANSPORTATION

ICAO/IATA Code	1977
Class	2.2
Packaging group	
Packaging instructions	
- Cargo	202
- Passenger	202
Maximum quantity allowed	
- Cargo	500 kg
- Passenger	50 kg

15 REGULATORY INFORMATION

EEC Hazard class Non-flammable
National legislation OHSact and Regulations 85 of 1993.
Reference SANS 10234 and its supplement.

16 OTHER INFORMATION

This MSDS has been compiled using the following sources of information;
Compressed Gas Association, Arlington, Virginia
Handbook of Compressed Gases - 3rd Edition
Matheson. Matheson Gas Data Book - 6th Edition SANS

EXCLUSION OF LIABILITY

Whilst AFROX made best endeavour to ensure that the information contained in this publication is accurate at the date of publication, AFROX does not accept liability for an inaccuracy or liability arising from the use of this information, or the use, application, adaptation or process of any products described herein.

safety data sheet

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU

n-Nonane ≥99 %, for synthesis

article number: **4310**
Version: **2.0 en**
Replaces version of: 2015-05-12
Version: (1.0)

date of compilation: 2015-05-12
Revision: 2016-03-17

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Identification of the substance	**n-Nonane**
Article number	4310
Registration number (REACH)	01-2119463259-31-xxxx
EC number	203-913-4
CAS number	111-84-2

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: laboratory chemical

1.3 Details of the supplier of the safety data sheet

Carl Roth GmbH + Co KG
Schoemperlenstr. 3-5
D-76185 Karlsruhe
Germany

Telephone: +49 (0) 721 - 56 06 0
Telefax: +49 (0) 721 - 56 06 149
e-mail: sicherheit@carlroth.de
Website: www.carlroth.de

Competent person responsible for the safety data sheet : Department Health, Safety and Environment

e-mail (competent person) **: sicherheit@carlroth.de**

1.4 Emergency telephone number

Emergency information service **Poison Centre Munich: +49/(0)89 19240**

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 (CLP)

Classification acc. to GHS

Section	Hazard class	Hazard class and category	Hazard statement
2.6	flammable liquid	(Flam. Liq. 3)	H226
3.1I	acute toxicity (inhal.)	(Acute Tox. 4)	H332
3.2	skin corrosion/irritation	(Skin Irrit. 2)	H315
3.3	serious eye damage/eye irritation	(Eye Irrit. 2)	H319
3.8D	specific target organ toxicity - single exposure (narcotic effects, drowsiness)	(STOT SE 3)	H336
3.10	aspiration hazard	(Asp. Tox. 1)	H304

Classification acc. to GHS			
Section	**Hazard class**	**Hazard class and category**	**Hazard statement**
4.1A	hazardous to the aquatic environment - acute hazard	(Aquatic Acute 1)	H400
4.1C	hazardous to the aquatic environment - chronic hazard	(Aquatic Chronic 1)	H410

Remarks
For full text of Hazard- and EU Hazard-statements: see SECTION 16.

The most important adverse physicochemical, human health and environmental effects
Narcotic effects.

2.2 Label elements

Labelling according to Regulation (EC) No 1272/2008 (CLP)

Signal word **Danger**

Pictograms

Hazard statements

H226	Flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H332	Harmful if inhaled.
H336	May cause drowsiness or dizziness.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary statements

Precautionary statements - prevention

P210	Keep away from heat. No smoking.
P280	Wear protective clothing/eye protection.

Precautionary statements - response

P301+P310	IF SWALLOWED: Immediately call a POISON CENTER/doctor/physician.
P304+P340	IF INHALED: Remove person to fresh air and keep at rest in a position comfortable for breathing.
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P331	Do NOT induce vomiting.

Labelling of packages where the contents do not exceed 125 ml
Signal word: **Danger**

Symbol(s)

H304	May be fatal if swallowed and enters airways.
P301+P310	IF SWALLOWED: Immediately call a POISON CENTER/doctor/physician.
P331	Do NOT induce vomiting.

2.3 Other hazards

There is no additional information.

SECTION 3: Composition/information on ingredients

3.1 Substances

Name of substance	n-Nonane
Registration number (REACH)	01-2119463259-31-xxxx
EC number	203-913-4
CAS number	111-84-2
Molecular formula	C_9H_{20}
Molar mass	128.3 $^{g}/_{mol}$

SECTION 4: First aid measures

4.1 Description of first aid measures

General notes
Take off contaminated clothing.

Following inhalation
Provide fresh air. In all cases of doubt, or when symptoms persist, seek medical advice.

Following skin contact
Rinse skin with water/shower. In case of skin irritation, consult a physician.

Following eye contact
Irrigate copiously with clean, fresh water for at least 10 minutes, holding the eyelids apart. In case of eye irritation consult an ophthalmologist.

Following ingestion
Rinse mouth. Do not induce vomiting. Call a physician immediately. Observe aspiration hazard if vomiting occurs.

4.2 Most important symptoms and effects, both acute and delayed

Aspiration hazard, Irritation, Dizziness, Drowsiness, Narcosis

4.3 Indication of any immediate medical attention and special treatment needed

none

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media

Co-ordinate fire-fighting measures to the fire surroundings
foam, dry extinguishing powder, carbon dioxide (CO2)

Unsuitable extinguishing media

water jet

5.2 Special hazards arising from the substance or mixture

Combustible. Vapours are heavier than air, spread along floors and form explosive mixtures with air.

Hazardous combustion products

In case of fire may be liberated: carbon monoxide (CO), carbon dioxide (CO2)

5.3 Advice for firefighters

Do not allow firefighting water to enter drains or water courses. Fight fire with normal precautions from a reasonable distance. Wear self-contained breathing apparatus.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

For non-emergency personnel

Wearing of suitable protective equipment (including personal protective equipment referred to under Section 8 of the safety data sheet) to prevent any contamination of skin, eyes and personal clothing. Avoid contact with skin, eyes and clothes. Do not breathe vapour/spray. Avoidance of ignition sources.

6.2 Environmental precautions

Keep away from drains, surface and ground water. Retain contaminated washing water and dispose it. Explosive properties.

6.3 Methods and material for containment and cleaning up

Advices on how to contain a spill

Covering of drains.

Advices on how to clean up a spill

Absorb with liquid-binding material (e.g. sand, diatomaceous earth, acid- or universal binding agents).

Other information relating to spills and releases

Place in appropriate containers for disposal. Ventilate affected area.

Reference to other sections

Hazardous combustion products: see section 5. Personal protective equipment: see section 8. Incompatible materials: see section 10. Disposal considerations: see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Provision of sufficient ventilation.

• Measures to prevent fire as well as aerosol and dust generation


Keep away from sources of ignition - No smoking.

Take precautionary measures against static discharge.

Advice on general occupational hygiene

Wash hands before breaks and after work. Keep away from food, drink and animal feedingstuffs. When using do not smoke.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed.

Incompatible substances or mixtures

Observe hints for combined storage.

Consideration of other advice

Ground/bond container and receiving equipment.

• Ventilation requirements

Use local and general ventilation.

• Specific designs for storage rooms or vessels

Recommended storage temperature: 15 - 25 °C.

7.3 Specific end use(s)

No information available.

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

National limit values

Occupational exposure limit values (Workplace Exposure Limits)

No data available.

Country	Name of agent	CAS No	Notation	Identifier	TWA [ppm]	TWA [mg/m³]	STEL [ppm]	STEL [mg/m³]	Source
GB	normal and branched chain alkanes (>C7)	111-84-2		WEL		1,200			EH40/2005

Notation

STEL	Short-term exposure limit: a limit value above which exposure should not occur and which is related to a 15-minute period unless otherwise specified
TWA	Time-weighted average (long-term exposure limit): measured or calculated in relation to a reference period of 8 hours time-weighted average

Relevant DNELs/DMELs/PNECs and other threshold levels

• human health values

Endpoint	Threshold level	Protection goal, route of exposure	Used in	Exposure time
DNEL	773 mg/kg	human, dermal	worker (industry)	chronic - systemic effects
DNEL	2,035 mg/m³	human, inhalatory	worker (industry)	chronic - systemic effects

• environmental values

Endpoint	Threshold level	Environmental compartment	Exposure time
PNEC	3.6 µg/l	freshwater	short-term (single instance)
PNEC	3.6 µg/l	marine water	short-term (single instance)
PNEC	54 µg/l	sewage treatment plant (STP)	short-term (single instance)
PNEC	0.62 mg/kg	freshwater sediment	short-term (single instance)
PNEC	0.62 mg/kg	marine sediment	short-term (single instance)
PNEC	0.25 mg/kg	soil	short-term (single instance)
PNEC	14 µg/l	water	continuous

8.2 Exposure controls

Individual protection measures (personal protective equipment)

Eye/face protection

Use safety goggle with side protection.

Skin protection

• hand protection

Wear suitable gloves. Chemical protection gloves are suitable, which are tested according to EN 374. For special purposes, it is recommended to check the resistance to chemicals of the protective gloves mentioned above together with the supplier of these gloves.

• type of material

NBR (Nitrile rubber)

• material thickness

0,4 mm.

• breakthrough times of the glove material

>480 minutes (permeation: level 6)

• other protection measures

Take recovery periods for skin regeneration. Preventive skin protection (barrier creams/ointments) is recommended.

Respiratory protection

Respiratory protection necessary at: Aerosol or mist formation. Type: A (against organic gases and vapours with a boiling point of > 65 °C , colour code: Brown).
Observe the wear time limits according GefStoffV in combination with the rules for using respiratory protection apparatus (BGR 190).

Environmental exposure controls

Keep away from drains, surface and ground water.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance

Physical state	liquid (fluid)
Colour	colourless
Odour	characteristic
Odour threshold	No data available

Other physical and chemical parameters

pH (value)	This information is not available.
Melting point/freezing point	-53 °C
Initial boiling point and boiling range	151 °C
Flash point	31 °C
Evaporation rate	no data available
Flammability (solid, gas)	not relevant (fluid)
Explosive limits	
• lower explosion limit (LEL)	0.7 vol% (37 g/m³)
• upper explosion limit (UEL)	5.6 vol% (300 g/m³)
Explosion limits of dust clouds	not relevant
Vapour pressure	5 hPa at 20 °C
Density	0.72 $^{g}/_{cm^3}$
Vapour density	4.43 (air = 1)
Bulk density	Not applicable
Relative density	Information on this property is not available.
Solubility(ies)	
Water solubility	0.2 $^{mg}/_{l}$ at 25 °C
Partition coefficient	
n-octanol/water (log KOW)	4.76
Auto-ignition temperature	205 °C
Decomposition temperature	no data available

Viscosity	
• kinematic viscosity	<7 $^{mm^2}/_{s}$ at 40 °C
• dynamic viscosity	1 mPa s at 20 °C
Explosive properties	none
Oxidising properties	none

9.2 Other information

Surface tension	22.38 $^{mN}/_{m}$ (25 °C)
Refractive index	1.405

SECTION 10: Stability and reactivity

10.1 Reactivity
risk of ignition. In case of warming: Vapours can form explosive mixtures with air.

10.2 Chemical stability
The material is stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.

10.3 Possibility of hazardous reactions
Violent reaction with: Strong oxidiser

10.4 Conditions to avoid
Keep away from heat.

10.5 Incompatible materials
There is no additional information.

10.6 Hazardous decomposition products
Hazardous combustion products: see section 5.

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Exposure route	Endpoint	Value	Species	Source
inhalation: vapour	LC50	17 $^{mg}/_{l}$/4h	rat	GESTIS
inhalation: vapour	LC50	23.76 $^{mg}/_{l}$/4h	rat	

Skin corrosion/irritation
Causes skin irritation.

Serious eye damage/eye irritation
Causes serious eye irritation.

Respiratory or skin sensitisation
Shall not be classified as a respiratory or skin sensitiser.

Summary of evaluation of the CMR properties
Shall not be classified as germ cell mutagenic, carcinogenic nor as a reproductive toxicant

• Specific target organ toxicity - single exposure
May cause drowsiness or dizziness.

• Specific target organ toxicity - repeated exposure
Shall not be classified as a specific target organ toxicant (repeated exposure).

Aspiration hazard
May be fatal if swallowed and enters airways.

Symptoms related to the physical, chemical and toxicological characteristics

• If swallowed
data are not available

• If in eyes
data are not available

• If inhaled
irritability, fatigue, narcosis

• If on skin
has degreasing effect on the skin, causes skin irritation, repeated exposure may cause skin dryness or cracking

Other information
None

SECTION 12: Ecological information

12.1 Toxicity

Very toxic to aquatic life. Very toxic to aquatic life with long lasting effects.

Aquatic toxicity (acute)
Very toxic to aquatic organisms.

Endpoint	Value	Species	Source	Exposure time
EC50	0.2 $^{mg}/_{l}$	aquatic invertebrates	ECHA	48 hours

Aquatic toxicity (chronic)
May cause long-term adverse effects in the aquatic environment.

12.2 Process of degradability

The substance is readily biodegradable.
Theoretical Oxygen Demand: 3.493 $^{mg}/_{mg}$
Theoretical Carbon Dioxide: 3.088 $^{mg}/_{mg}$

12.3 Bioaccumulative potential

The substance fulfils the very bioaccumulative criterion.

n-octanol/water (log KOW)	4.76

12.4 Mobility in soil

Data are not available.

12.5 Results of PBT and vPvB assessment

Data are not available.

12.6 Other adverse effects

Strongly hazardous to water.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

This material and its container must be disposed of as hazardous waste. Dispose of contents/container in accordance with local/regional/national/international regulations.

Sewage disposal-relevant information

Do not empty into drains. Avoid release to the environment. Refer to special instructions/safety data sheets.

Waste treatment of containers/packagings

It is a dangerous waste; only packagings which are approved (e.g. acc. to ADR) may be used.

13.2 Relevant provisions relating to waste

The allocation of waste identity numbers/waste descriptions must be carried out according to the EEC, specific to the industry and process.

13.3 Remarks

Waste shall be separated into the categories that can be handled separately by the local or national waste management facilities. Please consider the relevant national or regional provisions.

SECTION 14: Transport information

14.1	UN number	**1920**
14.2	UN proper shipping name	**NONANES**
	Hazardous ingredients	Nonane
14.3	Transport hazard class(es)	
	Class	3 (flammable liquids)
14.4	Packing group	III (substance presenting low danger)
14.5	Environmental hazards	hazardous to the aquatic environment

14.6 Special precautions for user

Provisions for dangerous goods (ADR) should be complied within the premises.

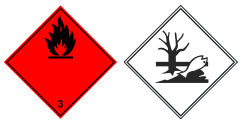
14.7 Transport in bulk according to Annex II of MARPOL and the IBC Code

The cargo is not intended to be carried in bulk.

14.8 Information for each of the UN Model Regulations

• Transport of dangerous goods by road, rail and inland waterway (ADR/RID/ADN)

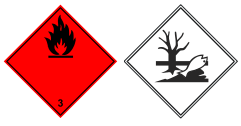
UN number	1920
Proper shipping name	NONANES
Particulars in the transport document	UN1920, NONANES, 3, III, (D/E), environmentally hazardous
Class	3
Classification code	F1
Packing group	III
Danger label(s)	3 + "fish and tree"



Environmental hazards	yes (hazardous to the aquatic environment)
Excepted quantities (EQ)	E1
Limited quantities (LQ)	5 L
Transport category (TC)	3
Tunnel restriction code (TRC)	D/E
Hazard identification No	30
Emergency Action Code	3Y

• International Maritime Dangerous Goods Code (IMDG)

UN number	1920
Proper shipping name	NONANES
Particulars in the shipper's declaration	UN1920, NONANES, 3, III, 31°C c.c., MARINE POLLUTANT
Class	3
Marine pollutant	yes (hazardous to the aquatic environment)
Packing group	III
Danger label(s)	3 + "fish and tree"



Special provisions (SP)	-
Excepted quantities (EQ)	E1
Limited quantities (LQ)	5 L
EmS	F-E, S-E
Stowage category	A

n-Nonane ≥99 %, for synthesis

article number: **4310**

SECTION 15: Regulatory information

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

Relevant provisions of the European Union (EU)

• Regulation 649/2012/EU concerning the export and import of hazardous chemicals (PIC)
Not listed.

• Regulation 1005/2009/EC on substances that deplete the ozone layer (ODS)
Not listed.

• Regulation 850/2004/EC on persistent organic pollutants (POP)
Not listed.

• Restrictions according to REACH, Annex XVII
not listed

• List of substances subject to authorisation (REACH, Annex XIV)
not listed

• Seveso Directive

2012/18/EU (Seveso III)

No	Dangerous substance/hazard categories	Qualifying quantity (tonnes) for the application of lower and upper-tier requirements		Notes
P5c	flammable liquids (cat. 2, 3)	5,000	50,000	51)
E1	environmental hazards (hazardous to the aquatic environment, cat. 1)	100	200	56)

Notation
51) Flammable liquids, categories 2 or 3 not covered by P5a and P5b
56) Hazardous to the Aquatic Environment in category Acute 1 or Chronic 1

• Limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products (2004/42/EC, Deco-Paint Directive)

VOC content 100 %

• Directive on industrial emissions (VOCs, 2010/75/EU)

VOC content 100 %

Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) - Annex II
not listed

Regulation 166/2006/EC concerning the establishment of a European Pollutant Release and Transfer Register (PRTR)
not listed

Directive 2000/60/EC establishing a framework for Community action in the field of water policy (WFD)
not listed

National inventories

Substance is listed in the following national inventories:

- EINECS/ELINCS/NLP (Europe)
- REACH (Europe)

15.2 Chemical Safety Assessment

No Chemical Safety Assessment has been carried out for this substance.

SECTION 16: Other information

16.1 Indication of changes (revised safety data sheet)

Section	Former entry (text/value)	Actual entry (text/value)
4.2	Most important symptoms and effects, both acute and delayed: Aspiration hazard, Irritation	Most important symptoms and effects, both acute and delayed: Aspiration hazard, Irritation, Dizziness, Drowsiness, Narcosis
5.2	Special hazards arising from the substance or mixture: Vapours may form explosive mixtures with air. Combustible.	Special hazards arising from the substance or mixture: Combustible. Vapours are heavier than air, spread along floors and form explosive mixtures with air.
8.1		Occupational exposure limit values (Workplace Exposure Limits): No data available.
8.1		Occupational exposure limit values (Workplace Exposure Limits): change in the listing (table)
11.1	• If inhaled: irritability	• If inhaled: irritability, fatigue, narcosis
12.1		Toxicity: Very toxic to aquatic life. Very toxic to aquatic life with long lasting effects.
14.8		Emergency Action Code: 3Y

Abbreviations and acronyms

Abbr.	Descriptions of used abbreviations
ADN	Accord européen relatif au transport international des marchandises dangereuses par voies de navigation intérieures (European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways)
ADR	Accord européen relatif au transport international des marchandises dangereuses par route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
CAS	Chemical Abstracts Service (service that maintains the most comprehensive list of chemical substances)
CLP	Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures
CMR	Carcinogenic, Mutagenic or toxic for Reproduction
DMEL	Derived Minimal Effect Level
DNEL	Derived No-Effect Level
EH40/2005	EH40/2005 Workplace exposure limits (http://www.nationalarchives.gov.uk/doc/open-government-licence/)
EINECS	European Inventory of Existing Commercial Chemical Substances
ELINCS	European List of Notified Chemical Substances
EmS	Emergency Schedule

Abbr.	Descriptions of used abbreviations
GHS	"Globally Harmonized System of Classification and Labelling of Chemicals" developed by the United Nations
IMDG	International Maritime Dangerous Goods Code
MARPOL	International Convention for the Prevention of Pollution from Ships (abbr. of "Marine Pollutant)
NLP	No-Longer Polymer
PBT	Persistent, Bioaccumulative and Toxic
PNEC	Predicted No-Effect Concentration
ppm	parts per million
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RID	Règlement concernant le transport International ferroviaire des marchandises Dangereuses (Regulations concerning the International carriage of Dangerous goods by Rail)
STEL	short-term exposure limit
TWA	time-weighted average
VOC	Volatile Organic Compounds
vPvB	very Persistent and very Bioaccumulative
WEL	workplace exposure limit

Key literature references and sources for data

- Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU
- Regulation (EC) No. 1272/2008 (CLP, EU GHS)

List of relevant phrases (code and full text as stated in chapter 2 and 3)

Code	Text
H226	flammable liquid and vapour
H304	may be fatal if swallowed and enters airways
H315	causes skin irritation
H319	causes serious eye irritation
H332	harmful if inhaled
H336	may cause drowsiness or dizziness
H400	very toxic to aquatic life
H410	very toxic to aquatic life with long lasting effects

Disclaimer

The above information describes exclusively the safety requirements of the product and is based on our present-day knowledge. The information is intended to give you advice about the safe handling of the product named in this safety data sheet, for storage, processing, transport and disposal. The information cannot be transferred to other products. In the case of mixing the product with other products or in the case of processing, the information on this safety data sheet is not necessarily valid for the new made-up material.

Material Safety Data Sheet

Octane

MSDS# 17260

Section 1 - Chemical Product and Company Identification

MSDS Name:	Octane
Catalog Numbers:	O3980-1
Synonyms:	n-Octane.
Company Identification:	Fisher Scientific One Reagent Lane Fair Lawn, NJ 07410
For information in the US, call:	201-796-7100
Emergency Number US:	201-796-7100
CHEMTREC Phone Number, US:	800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#:	111-65-9
Chemical Name:	Octane
%:	>95
EINECS#:	203-892-1

Hazard Symbols: XN F N



Risk Phrases: 11 38 50/53 65 67

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Warning! Flammable liquid and vapor. Aspiration hazard if swallowed. Can enter lungs and cause damage. Breathing vapors may cause drowsiness and dizziness. Causes eye, skin, and respiratory tract irritation. Target Organs: Central nervous system.

Potential Health Effects

Eye:	Causes eye irritation.
Skin:	Causes skin irritation. May be absorbed through the skin in harmful amounts. Prolonged and/or repeated contact may cause defatting of the skin and dermatitis.
Ingestion:	Aspiration hazard. May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure. Aspiration of material into the lungs may cause chemical pneumonitis, which may be fatal.
Inhalation:	Causes respiratory tract irritation. May cause narcotic effects in high concentration.
Chronic:	Prolonged or repeated skin contact may cause defatting and dermatitis.

Section 4 - First Aid Measures

Eyes:	In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical aid.
Skin:	In case of contact, flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid if irritation develops and persists. Wash clothing before reuse.
Ingestion:	Potential for aspiration if swallowed. Get medical aid immediately. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If vomiting occurs

naturally, have victim lean forward.

Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician:

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Use water spray to keep fire-exposed containers cool. Flammable liquid and vapor. May accumulate static electrical charges, and may cause ignition of its own vapors. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas. This liquid floats on water and may travel to a source of ignition and spread fire.

Extinguishing Media: Use foam, dry chemical, or carbon dioxide. Water may be ineffective. Water may spread fire.

Autoignition Temperature: 206 deg C (402.80 deg F)

Flash Point: 13 deg C (55.40 deg F)

Explosion Limits: Lower: 1.0

Explosion Limits: Upper: 6.5

NFPA Rating: health: 1; flammability: 3; instability: 0;

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Remove all sources of ignition. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Ground and bond containers when transferring material. Use spark-proof tools and explosion proof equipment. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep away from heat, sparks and flame. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.

Storage: Keep away from sources of ignition. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Octane	300 ppm	75 ppm TWA; 350 mg/m3 TWA 1000 ppm IDLH (10% LEL)	500 ppm TWA; 2350 mg/m3 TWA

OSHA Vacated PELs: Octane: 300 ppm TWA; 1450 mg/m3 TWA

Engineering Controls:

Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Personal Protective Equipment

Eyes: Wear chemical splash goggles.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State:	Liquid
Color:	clear, colorless
Odor:	mild odor - gasoline-like
pH:	Not available
Vapor Pressure:	11 mm Hg @ 20 deg C
Vapor Density:	3.9 (air=1)
Evaporation Rate:	0.6 (butyl acetate=1)
Viscosity:	Not available
Boiling Point:	124-127 deg C
Freezing/Melting Point:	-57 deg C (-70.60°F)
Decomposition Temperature:	Not available
Solubility in water:	Insoluble
Specific Gravity/Density:	0.708
Molecular Formula:	C8H18
Molecular Weight:	114.23

Section 10 - Stability and Reactivity

Chemical Stability:	Stable under normal temperatures and pressures.
Conditions to Avoid:	Ignition sources, excess heat.
Incompatibilities with Other Materials	Strong oxidizing agents.
Hazardous Decomposition Products	Carbon monoxide, carbon dioxide.
Hazardous Polymerization	Has not been reported.

Section 11 - Toxicological Information

RTECS#: CAS# 111-65-9: RG8400000
RTECS:

LD50/LC50: **CAS# 111-65-9:** Inhalation, rat: LC50 = 118 gm/m3/4H;
.

Carcinogenicity: Octane - Not listed as a carcinogen by ACGIH, IARC, NTP, or CA Prop 65.

Other: See actual entry in RTECS for complete information.

Section 12 - Ecological Information

Ecotoxicity: Water flea EC50 = 0.38 mg/L; 48 Hr.; Unspecified Conditions
Bacteria: Phytobacterium phosphoreum: EC50 = 890 mg/L; 30 minutes; Microtox test

Section 13 - Disposal Considerations

Dispose of in a manner consistent with federal, state, and local regulations.

Section 14 - Transport Information

US DOT
Shipping Name: OCTANES
Hazard Class: 3
UN Number: UN1262
Packing Group: II
Canada TDG
Shipping Name: OCTANES
Hazard Class: 3
UN Number: UN1262
Packing Group: II

Section 15 - Regulatory Information

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: XN F N

Risk Phrases:

R 11 Highly flammable.

R 38 Irritating to skin.

R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

R 65 Harmful: may cause lung damage if swallowed.

R 67 Vapours may cause drowsiness and dizziness.

Safety Phrases:

S 9 Keep container in a well-ventilated place.

S 16 Keep away from sources of ignition - No smoking.

S 29 Do not empty into drains.

S 33 Take precautionary measures against static discharges.

S 60 This material and its container must be disposed of as hazardous waste.

S 61 Avoid release to the environment. Refer to special instructions/safety data sheets.

S 62 If swallowed, do not induce vomiting: seek medical advice immediately and show this container or label.

WGK (Water Danger/Protection)

CAS# 111-65-9: 1

Canada

CAS# 111-65-9 is listed on Canada's DSL List

Canadian WHMIS Classifications: B2, D2B

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

CAS# 111-65-9 is listed on Canada's Ingredient Disclosure List

US Federal

TSCA

CAS# 111-65-9 is listed on the TSCA Inventory.

Section 16 - Other Information

MSDS Creation Date: 6/08/1999

Revision #7 Date 7/20/2009

Safety data sheet
n-Pentane

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier
Product name
n-Pentane

EC No (from EINECS): 203-692-4
CAS No: 109-66-0
Index-Nr. 601-006-00-1
Chemical formula n-C5H12
REACH Registration number:
01-2119459286-30

1.2. Relevant identified uses of the substance or mixture and uses advised against
Relevant identified uses
Industrial and professional. Perform risk assessment prior to use.
Uses advised against
Consumer use.

1.3. Details of the supplier of the safety data sheet
Company identification
BOC, PO Box 1201, Bluebell, Dublin
E-Mail Address ReachSDS@boc.com

1.4. Emergency telephone number
Emergency phone numbers (24h): 1850 333 435

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification acc. to Regulation (EC) No 1272/2008/EC (CLP/GHS)
Flammable liquid: Flam. Liq. 1 – Extremely flammable liquid and vapour
Aspiration hazard: Asp. Tox. 1 – May be fatal if swallowed and enters airways
Specific target organ toxicity - single: STOT SE 3 – May cause drowsiness or dizziness
Aquatic Chronic 2 - Hazardous to the aquatic environment – Toxic to aquatic life with long lasting effects

Classification acc. to Directive 67/548/EEC & 1999/45/EC:
F+; R12 **|** Xn; R65, R66, R67 **|** N; R51/53
Extremely flammable.
Harmful: may cause lung damage if swallowed.
Repeated exposure may cause skin dryness or cracking.
Vapours may cause drowsiness and dizziness.
Toxic to aquatic organisms, may cause long term adverse effects in the aquatic environment.

2.2. Label elements
- Labelling Pictograms

- Signal word

Danger

- Hazard Statements

H224	Extremely flammable liquid and vapour
H304	May be fatal if swallowed and enters airways
H336	May cause drowsiness or dizziness.
H411	Toxic to aquatic life with long lasting effects.
EUH066	Repeated exposure may cause skin dryness or cracking.

- Precautionary Statements

Precautionary Statement Prevention

P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P233	Keep container tightly closed.
P240	Ground / bond container and receiving equipment.
P241	Use explosion-proof electrical, ventilating, and lighting equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P261	Avoid breathing mist / vapours.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves / eye protection / face protection.

Precautionary Statement Response

P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER/doctor/physician.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
P304 + P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P312	Call a POISON CENTER/doctor/physician if you feel unwell.
P331	Do NOT induce vomiting.
P370 + P378	In case of fire: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish.
P391	Collect spillage.

Precautionary Statement Storage

P403 + P233 + P235	Store in a well-ventilated place. Keep container tightly closed. Keep cool.
P405	Store locked up.

Precautionary Statement Disposal

P501	Dispose of contents and container in accordance with local regulations.

2.3. Other hazards
None.
.

SECTION 3: Composition/information on ingredients

Substance / Mixture: Substance.

3.1. Substances

CAS No: 109-66-0
Index-Nr.: 601-006-00-1
EC No (from EINECS): 203-692-4
REACH Registration number:
01-2119459286-30
Contains no other components or impurities which will influence the classification of the product.

3.2. Mixtures
Not applicable.

SECTION 4: First aid measures

4.1. Description of first aid measures
First Aid General Information:
Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.
First Aid Inhalation:
Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.
First Aid Skin / Eye:
Remove contaminated clothing. Drench affected area with water for at least 15 minutes. Obtain medical assistance. Immediately flush eyes thoroughly with water for at least 15 minutes.
First Aid Ingestion:
Do not let victim drink anything.
Do NOT induce vomiting.
Get immediate medical advice/attention.

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

In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation. In low concentrations may cause narcotic effects. Symptoms may include dizziness, headache, nausea and loss of co-ordination.
May have damaging effect on respiratory system, central nervous system and liver. Depression of central nervous system.
Symptoms may include dizziness, headache, nausea, unconsciousness, irritation of the mucous membranes and dry coughs. Irregular cardiac activity.

4.3. Indication of any immediate medical attention and special treatment needed
Get immediate medical advice/attention.

SECTION 5: Fire fighting measures

5.1. Extinguishing media
Suitable extinguishing media
Alcohol-resistant foam. Dry Powder. Carbon dioxide. Water fog. Use water spray or fog to control fire fumes

Unsuitable extinguishing media
Do not use a solid water stream.

5.2. Special hazards arising from the substance or mixture
Specific hazards
Exposure to fire may cause containers to rupture/explode.
Hazardous combustion products
If involved in a fire the following toxic and/or corrosive fumes may be produced by thermal decomposition:
Carbon dioxide, Carbon monoxide.

5.3. Advice for fire-fighters
Specific methods
If possible, stop flow of product. Move container away or cool with water from a protected position. If leaking do not extinguish a flame unless absolutely necessary.

Spontaneous/explosive re-ignition may occur. Extinguish any other fire. Prevent water used in emergency cases from entering sewers and drainage systems.

Special protective equipment for fire-fighters

Normal firefighters' equipment consists of an appropriate SCBA (open-circuit positive pressure compressed air type) in combination with fire kit. Equipment and clothing to the following standards will provide a suitable level of protection for firefighters.

Guideline:

EN 469:2005: Protective clothing for firefighters. Performance requirements for protective clothing for firefighting., EN 137 Respiratory protective devices — Self-contained open-circuit compressed air breathing apparatus with full face mask — Requirements, testing, marking., EN 15090 Footwear for firefighters., EN 443 Helmets for fire fighting in buildings and other structures., EN 659 Protective gloves for firefighters.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Consider the risk of potentially explosive atmospheres. Evacuate area. Ensure adequate air ventilation. Use self-contained breathing apparatus and chemically protective clothing. Eliminate ignition sources. Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.

6.2. Environmental precautions

Try to stop release.

6.3. Methods and material for containment and cleaning up

Ventilate area. Keep away from ignition sources (including static discharges). Evacuate area. Prevent evaporation by covering with foam. Absorb excess liquid spillage on inorganic adsorbent material such as fine sand, brick dust etc. Place spent adsorbent in sealed packages and contact specialist waste disposal contractor.

6.4. Reference to other sections

See also sections 8 and 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Only experienced and properly instructed persons should handle the product. The substance must be handled in accordance with good industrial hygiene and safety procedures. Avoid contact with skin. Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Contact your supplier if in doubt. Take precautionary measures against static discharges. Ensure equipment is adequately earthed. Purge air from system before introducing product. Do not smoke while handling product. Assess the risk of potentially explosive atmosphere and the need for explosion-proof equipment. Consider the use of only non-sparking tools. Ensure the complete system has been (or is regularly) checked for leaks before use. Refer to supplier's handling instructions. Suck back of water into the container must be prevented. Do not allow backfeed into the container. Protect cylinders from physical damage; do not drag, roll, slide or drop. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Never attempt to repair or modify container valves or safety relief devices. Damaged valves should be reported immediately to the supplier. Keep container valve outlets clean and free from contaminates particularly oil and water. Replace valve outlet caps or plugs and container caps where supplied as soon as container is disconnected from equipment. Close container valve after each use and when empty, even if still connected to equipment. Never attempt to transfer products from one cylinder/container to another. Never use direct flame or electrical heating devices to raise the pressure of a container. Do not remove or deface labels provided by the supplier for the identification of the cylinder contents.

7.2. Conditions for safe storage, including any incompatibilities

Observe all regulations and local requirements regarding storage of containers. Segregate from other oxidants in store. Keep container below 35°C in a well ventilated place. Containers should be stored in the vertical position and properly secured to prevent falling over. Stored containers should be periodically checked for general conditions and leakage. Container valve guards or caps should be in place. Store containers in location free from fire risk and away from sources of heat and ignition. Keep away from combustible materials. All electrical equipment in the storage areas should be compatible with the risk of potentially explosive atmosphere. Containers should not be stored in conditions likely to encourage corrosion.

7.3. Specific end use(s)

None.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Exposure limit value

Value type	value	Note
IOELV 8 hrs (EU)	1000 ppm	
IOELV 15 min (EU)	750 ppm	

Derived No Effect Levels

Product/ingredient name	Type	Exposure	Value	Population	Effects
n-Pentane	DNEL	Long term Dermal	432 mg/kg bw/day	Workers	Systemic
	DNEL	Long term Inhalation	3.000 mg/m^3	Workers	Systemic

Predicted No Effect Concentrations

Type	Environmental Compartment	Value
PNEC	Fresh water	0,23 mg/l
PNEC	Marine	0,23 mg/l
PNEC	Intermittent release	0,88 mg/l
PNEC	STP (Sewage Treatment Plant)	3,6 mg/l
PNEC	Sediment	1,2 mg/kg dw
PNEC	Soil	0,55 mg/kg

8.2. Exposure controls
Appropriate engineering controls
A risk assessment should be conducted and documented in each work area to assess the risks related to the use of the product and to select the PPE that matches the relevant risk. The following recommendations should be considered. Gas detectors should be used when quantities of flammable gases/vapours may be released. Consider work permit system e.g. for maintenance activities. Systems under pressure should be regularly checked for leakages. Provide adequate general or local ventilation. Keep concentrations well below occupational exposure limits.

Personal protective equipment
Eye and face protection
Protect eyes, face and skin from liquid splashes. Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Wear a face -shield when transfilling and breaking transfer connections. Safety eyewear, goggles or face-shield to EN166 should be used to avoid exposure to liquid splashes.

Skin protection
Hand protection
Advice: Wear working gloves and safety shoes while handling containers. Chemically resistant gloves complying with EN 374 should be worn at all times when handling chemical products if a risk assessment indicates this is necessary
Material:
Nitrile
Guideline:
EN 374-1/2/3 Protective gloves against chemicals and microorganisms

Body protection
Protect eyes, face and skin from contact with product. Keep suitable chemically resistant protective clothing readily available for emergency use. Personal protective equipment for the body should be selected based on the task being performed and the risks involved.
Guideline:
EN 943: Protective clothing against liquid and gaseous chemicals, aerosols and solid particles.

Other protection
Wear flame resistant/retardant clothing. Take precautionary measures against static discharges. Wear working gloves and safety shoes when handling cylinders.
EN ISO 20345 Personal protective equipment - Safety footwear. ISO/TR 2801:2007 Clothing for protection against heat and flame - General recommendations for selection, care and use of protective clothing.

Respiratory protection
Keep self contained breathing apparatus readily available for emergency use. Use SCBA in the event of high concentrations. The selection of the Respiratory Protective Device (RPD) must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected RPD. When allowed by a risk assessment Respiratory Protective Equipment (RPE) may be used.

Guideline:
EN 136: Respiratory protective devices. Full face masks. Requirements, testing, marking.
Material:
Filter AX
Guideline:
EN 14387: Respiratory protective devices. Gas filter(s) and combined filter(s). Requirements, testing, marking

Environmental Exposure Controls
Refer to local regulations for restriction of emissions to the atmosphere. See section 13 for specific methods for waste product treatment. Provide adequate general or local ventilation.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties
General information

Appearance/Colour: Colourless liquid.
Odour: Faint. Poor warning properties at low concentrations.
Odour threshold:
Odour threshold is subjective and inadequate to warn for over exposure.
Melting point: -130°C
Boiling point: 35°C
Flash point: -49 °C
Flammability range: 1,1 %(V) – 7,8%(V)
Vapour Pressure 20 °C: 0,566 bar
Relative density, gas: 2,49
Solubility in water: 40 mg/l
Partition coefficient: n-octanol/water: No data available.
Autoignition temperature: 260 °C
Molecular weight: 72,15 g/mol
Relative density, liquid: 0,601 – 0,651

9.2. Other information
Gas/vapour heavier than air. May accumulate in confined spaces, particularly at or below ground level.

SECTION 10: Stability and reactivity

10.1. Reactivity
Unreactive under normal conditions.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions
Can form potential explosive atmosphere in air., May react violently with oxidants.

10.4. Conditions to avoid
Keep away from heat/sparks/open flames/hot surfaces. - No smoking.

10.5. Incompatible materials
Air, Oxidiser.

10.6. Hazardous decomposition products
Under normal conditions of storage and use, hazardous decomposition products should not be produced. If involved in a fire the following toxic and/or corrosive fumes may be produced by thermal decomposition:
Carbon dioxide, Carbon monoxide.

SECTION 11: Toxicological information

11.1. Information on toxicological effects
Acute oral toxicity
Value: LD50
Species: Rat
Value in non-standard unit: > 2.000 mg/kg
Slightly toxic.

Acute inhalation toxicity
Value: LC50
Species: Rat
Value in non-standard unit: > 25,3 mg/l
Slightly toxic.
Acute dermal toxicity
Slightly toxic
Acute toxicity other routes
May be fatal if swallowed and enters airways.
Skin irritation
Not classified as an irritant. Repeated exposure may cause skin dryness or cracking. May cause dermatitis by skin contact.
Eye irritation
Not classified as an irritant. May cause mild, short-term discomfort to eyes.
Sensitization
This substance is not classified as a sensitiser.
Repeated dose toxicity
Not expected to cause damage to organs from prolonged or repeated exposure.
Assessment mutagenicity
There is no evidence of mutagenic potential.
Assessment carcinogenicity
No evidence of carcinogenic effects.
Assessment toxicity to reproduction
No indication of toxic effects.
Assessment teratogenicity
No indication of teratogenic effects.

SECTION 12: Ecological information

12.1. Toxicity
May cause long-term adverse effects in the aquatic environment.
Acute and prolonged toxicity fish
Species: Rainbow trout (Oncorhynchus mykiss)
Exposure time: 96 h
Value type: LC50
Value in standard unit mg/l: 4,26 mg/l
Acute toxicity aquatic invertebrates
Species: Daphnia magna
Exposure time: 48 h
Value type: EC50
Value in standard unit mg/l: 2,7 mg/l
Toxicity aquatic plants
Species: Algae
Exposure time: 72 h
Value type: NOEC
Value in standard unit mg/l: 7,51 mg/l

Species: Algae
Exposure time: 72 h
Value type: EC50
Value in standard unit mg/l: 10,7 mg/l

12.2. Persistence and degradability
Atmospheric degradation
The substance degrades rapidly in the atmosphere.
Readily biodegradable
Photo degradation
Half life (direct photolysis): 3,95 d
Non-significant photolysis.
Stability in water
Degradation: 87%
Duration: 28 days
Non-significant hydrolysis

12.3. Bioaccumulative potential
Not determined

12.4. Mobility in soil
Because of its high volatility, the product is unlikely to cause ground or water pollution.

12.5. Results of PBT and vPvB assessment
Not classified as PBT or vPvB.

12.6. Other adverse effects
None

SECTION 13: Disposal considerations

13.1. Waste treatment methods
Do not discharge into areas where there is a risk of forming an explosive mixture with air. Waste product should be flared through a suitable burner with flash back arrestor. Toxic and corrosive gases formed during combustion should be scrubbed before discharge to atmosphere. Do not discharge into any place where its accumulation could be dangerous. Contact supplier if guidance is required. Dispose of container via supplier only.

SECTION 14: Transport information

ADR/RID

14.1. UN number
1265

14.2. UN proper shipping name
PENTANES

14.3. Transport hazard class(es)
Class: 3
Classification Code: F1
Labels: 3
Hazard number: 33
Emergency Action Code: 3YE
Tunnel code: (D/E)

14.4. Packing group (Packing Instruction)
I

14.5. Environmental hazards
Environmentally Hazardous.

14.6. Special precautions for user
None.

IMDG

14.1. UN number
1265

14.2. UN proper shipping name
PENTANES

14.3. Transport hazard class(es)
Class: 3
Labels: 3
EmS: F-E,S-D

14.4. Packing group (Packing Instruction)
I

14.5. Environmental hazards
None

14.6. Special precautions for user
None.

14.7. Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code
Substance name: PENTANE (ALL ISOMERS)
Ship type required: 3
Pollution category: Y

IATA

14.1. UN number
1265

14.2. UN proper shipping name
PENTANES

14.3. Transport hazard class(es)
Class: 3
Labels: 3

14.4. Packing group (Packing Instruction)
I

14.5. Environmental hazards
Environmentally Hazardous.

14.6. Special precautions for user
None.

Other transport information
Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. Before transporting product containers ensure that they are firmly secured. Ensure that the cylinder valve is closed and not leaking. Ensure that the valve outlet cap nut or plug (where provided) is correctly fitted. Ensure that the valve protection device (where provided) is correctly fitted. Ensure adequate ventilation. Ensure compliance with applicable regulations.

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture
Seveso Directive 96/82/EC: Covered.

Other regulations
Council Directive 89/391/EEC on the introduction of measures to encourage improvements in the safety and health of workers at work
Directive 94/9/EC on equipment and protective systems intended for use in potentially explosive atmospheres (ATEX)
Directive 89/686/EEC on personal protective equipment
Council Directive 67/548/EEC on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances
Directive 1999/45/EC concerning the approximation of the laws, regulations and administrative provisions of the Member States relating to the classification, packaging and labelling of dangerous preparations
Directive 97/23/EC on the approximation of the laws of the Member States concerning pressure equipment.
This Safety Data Sheet has been produced to comply with Regulation (EU) 453/2010.

15.2. Chemical safety assessment
CSA has been carried out

SECTION 16: Other information

Ensure all national/local regulations are observed. Ensure operators understand the flammability hazard. The hazard of asphyxiation is often overlooked and must be stressed

during operator training. Before using this product in any new process or experiment, a thorough material compatibility and safety study should be carried out.

Advice

Whilst proper care has been taken in the preparation of this document, no liability for injury or damage resulting from its use can be accepted. Details given in this document are believed to be correct at the time of going to press.

Further information

Note:
When using this document care should be taken, as the decimal sign and its position complies with rules for the structure and drafting of international standards, and is a comma on the line.
As an example 2,000 is two (to three decimal places) and not two thousand, whilst 1.000 is one thousand and not one (to three decimal places).

References

Various sources of data have been used in the compilation of this
SDS, they include but are not exclusive to:
Agency for Toxic Substances and Diseases Registry (ATSDR) (http://www.atsdr.cdc.gov/)
European Chemical Agency: Guidance on the Compilation of Safety Data Sheets.
European Chemical Agency: Information on Registered Substances http://apps.echa.europa.eu/registered/registered-sub.aspx#search
European Industrial Gases Association (EIGA) Doc. 169/11 Classification and Labelling guide.
ISO 10156:2010 Gases and gas mixtures -- Determination of fire potential and oxidizing ability for the selection of cylinder valve outlets.
International Programme on Chemical Safety (http://www.inchem.org/)
Matheson Gas Data Book, 7th Edition.
National Institute for Standards and Technology (NIST) Standard Reference Database Number 69
The ESIS (European chemical Substances 5 Information System) platform of the former European Chemicals Bureau (ECB) ESIS (http://ecb.jrc.ec.europa.eu/esis/).
The European Chemical Industry Council (CEFIC) ERICards.
Threshold Limit Values (TLV) from the American Conference of Governmental Industrial Hygienists (ACGIH).
United States of America's National Library of Medicine's toxicology data network TOXNET (http://toxnet.nlm.nih.gov/index.html)
Substance specific information from suppliers.
2011 Code of Practice for the Safety, Health and Welfare at Work (S.I. No. 619 of 2001).

End of document

MATERIAL SAFETY DATA SHEET (MSDS)
PROPANE

Please ensure that this MSDS is received by the appropriate person

DATE: February 2014 Version 2

Ref. No.: MS110

1 PRODUCT AND COMPANY IDENTIFICATION

PRODUCT IDENTIFICATION

Product Name	PROPANE
Chemical Formula	C_3H_8
Trade Name	Propane, Technical Grade Propane, Instrument Grade Propane, Pure
Colour coding	Propane, Technical Grade Propane, Instrument Grade Silver (Plascon 720/022) body with a Red (A11) circle, 250 mm dia, below the valve. Propane Pure Dulux Light Weatherwork Grey body with a Red (A11) shoulder.
Valves	OMECA – Brass 5/8 inch BSP left hand female for all the above grades (Vapour outlet). ¼ inch flare for liquid withdrawal on Propane, Pure cylinders
Company Identification	African Oxygen Limited 23 Webber Street Johannesburg, 2001 Tel. No: (011) 490-0400 Fax No: (011) 490-0506

EMERGENCY NUMBER 0860 020202 or +27(0) 11 821 3000 (24 hours)

2 COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	Propane
Chemical Family	Paraffins
CAS No.	74-98-6
UN No.	1978
ERG No.	115
Hazchem Warning	2 A Flammable gas

3 HAZARDS IDENTIFICATION

Main Hazards	All cylinders are portable gas containers. The hazards due to the handling of Propane stem mainly from its extreme flammability. The flammability limits in the air are between 2,2 and 9,5%. by volume.	
Adverse Health effects	Propane has some degree of anaesthetic action and is mildly irritating to the mucous membranes and/or acts as a simple asphyxiant.	
Chemical hazards	None. Propane is a stable gas.	
Biological Hazards	No known effect	
Vapour Inhalation	Propane is non-toxic. Prolonged inhalation could have an anaesthetic effect. Since it can displace oxygen in the air it could also act as a simple asphyxiant.	
Eye contact	Gas	No known effect
	Liquid	Could cause frostbite
Skin contact	Gas	No known effect
	Liquid	Could cause frostbite
Ingestion	Not likely, however the liquid could cause frostbite.	

Hazard Category 1

Danger
Extremely flammable gas

4 FIRST AID MEASURES

If the subject is conscious, he should be taken to an uncontaminated area and inhale fresh air or oxygen. In the event the subject is overcome by a massive exposure, he should be carried to an uncontaminated area and given artificial respiration and oxygen simultaneously. Treat symptomatically thereafter. In case of skin contact with liquid propane, frostbite may develop. If frostbite occurs, cover the frost-bitten part with a warm hand or woollen material. If the fingers or hand are frost-bitten, have the victim hold his hand in his armpit, next to his body. Then place the frost-bitten part in warm water, about 42°C. If warm water is not available, or impractical to use, wrap the affected part gently in blankets. Let the circulation re-establish itself naturally. Encourage the victim to exercise the affected part while it is being warmed.

5 FIRE FIGHTING MEASURES

Extinguishing media	Do not extinguish fire unless the leakage can be stopped. Do not use water jet. Use dry chemical, CO_2 or foam.
Specific hazards	The rupturing of cylinders or bulk containers due to excessive exposure to a fire could result in a BLEVE (Boiling Liquid Expanding Vapour Explosion), with disastrous effects. As the flammability limits in the air for Propane are between 2,2 and 9,5%, extreme care must be taken when handling leaks.
Emergency actions	If possible, shut off the source of the spillage. Evacuate area. Post notices, "No naked lights - No smoking." Prevent liquid or vapour from entering sewers, basements and workpits. Keep cylinders or bulk vessels cool by spraying with water if exposed to a fire. If tanker has overturned, do not attempt to right or move it. CONTACT THE NEAREST AFROX BRANCH.
Protective clothing	Self-contained breathing apparatus. Safety gloves and shoes, or boots, should be worn when handling containers.
Environmental precautions	Vapourised propane gas is heavier than air and could form pockets of oxygen-deficient atmosphere in low-lying areas

6 ACCIDENTAL RELEASE MEASURES

Personal precautions	Do not enter any area where Propane has been spilled unless tests have shown that it is safe to do so.
Environmental precautions	The danger of widespread formation of explosive propane/air mixtures should be taken into account. Accidental ignition could result in a massive explosion.
Small spills	Do not extinguish the fire unless the leakage can be stopped immediately. Once the fire has been extinguished, and all spills have been stopped, ventilate the area.
Large spills	Stop the source if it can be done without risk. Contain the leaking liquid with sand or earth, or disperse with special water/fog spray nozzle. Allow to evaporate. Take the precautions as listed above under "Emergency Actions". Restrict access to the area until completion of the clean-up procedure. Ventilate the area using forced draught if necessary. All electrical equipment should be flameproof.

7 HANDLING AND STORAGE

Cylinders containing Propane should only be handled and stored in the vertical position. Cylinders should never be rolled. Do not allow cylinders to slide or come into contact with sharp edges and they should be handled carefully. Ensure that cylinders are stored away from other oxidants. Comply with all local legislation. Keep out of reach of children.

8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational exposure hazards	As vapourised Propane is a simple asphyxiant, avoid any areas where spillage has taken place. Only enter once testing has proved the atmosphere to be safe.
Engineering control measures	Engineering control measures are preferred to reduce exposures. General methods include forced draught ventilation, separate from other exhaust ventilation systems. Ensure that sufficient fresh air enters at, or near, floor level. Ensure that all electrical equipment is flameproof.
Personal protection	Self contained breathing apparatus should always be worn when entering area where oxygen depletion may have occurred. Safety goggles, gloves and shoes or boots should be worn when handling containers.

Skin Wear loose-fitting overalls, preferably without pockets.

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9 PHYSICAL AND CHEMICAL PROPERTIES

Chemical Symbol	C_3H_8
Molecular Weight	44,10
Specific volume @ 20°C & 101,325 kPa	547 ml/g
Autoignition temperature	480°C
Relative density (air = 1)	1,55
Flammability limits in air	2,2 - 9,5% (by volume)
Critical temperature	96,67°C
Colour	Clear
Taste	None
Odour	Ethyl mercaptan added For Pure grade the odour is pleasant.

10 STABILITY AND REACTIVITY

Conditions to avoid	The dilution of the oxygen concentration in the atmosphere to levels which cannot support life. The formation of explosive gas/air mixtures.
Incompatible materials	Any common, commercially available metals may be used with commercial (or higher) grades of propane because it is non-corrosive, though installations must be designed to withstand the pressures involved and must comply with all state and local regulations.
Hazardous Decomposition Products	Propane is relatively stable. However, on combustion, toxic compositions, typically carbon monoxide may be formed, depending on conditions.

11 TOXICOLOGICAL INFORMATION

Acute Toxicity	TLV 800 ppm
Skin & eye contact	No known effect.
Chronic Toxicity	No known effect.
Carcinogenicity	Severe cold burns can result in carcinoma
Mutagenicity	No known effect.
Reproductive Hazards	No known effect

(For further information see Section 3, Adverse health effects

12 ECOLOGICAL INFORMATION

Vapourised Propane is heavier than air, and can cause pockets of oxygen-depleted atmosphere in low-lying areas. It does not pose a hazard to the ecology, unless the gas/air mixture is ignited.

13 DISPOSAL CONSIDERATIONS

Disposal Methods	Disposal of Propane, as with other flammable gases, should be undertaken only by personnel familiar with the gas and the procedures for disposal. Contact the supplier for instructions. In general, should it become necessary to dispose of Propane, the best procedure, as for other flammable gases, is to burn them in suitable burning unit available in the plant. This should be done in accordance with appropriate regulations.
Disposal of packaging	The disposal of cylinders must only be handled by the gas supplier.

14 TRANSPORT INFORMATION

ROAD TRANSPORTATION

UN No.	1978
ERG No	115
Hazchem warning	2 A Flammable gas

SEA TRANSPORTATION

IMDG	1978
Class	2.1
Label	Flammable gas

AIR TRANSPORTATION

ICAO/IATA Code	1978
Class	2.1
Packaging group	None
Packaging instructions	
- Cargo	200
- Passenger	Forbidden
Maximum quantity allowed	
- Cargo	150 kg
- Passenger	Forbidden

15 REGULATORY INFORMATION

SUPPLEMENT TO SANS 10234:2008
Edition 1
Annex A Index No. 608-011-00-8

Hazard & Precautionary statement codes

H220	Extremely Flammable Gas
P210	Keep away from heat/sparks/open flames/ hot surfaces – NO SMOKING (Manufacture, supplier or the competent authority to specify ignition sources)
P377	Leaking gas fire: Do not extinguish unless leak can be stopped safely
P381	Eliminate all ignition sources if safe to do so
P403	Store in a well-ventilated place

16 OTHER INFORMATION

Bibliography

Handbook of Compressed Gases - 3rd Edition
Matheson. Matheson Gas Data Book - 6th Edition
Supplement to SANS 10234 – List of classification and labelling of chemicals in accordance with Globally Harmonized System (GHS)

EXCLUSION OF LIABILITY