1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND THE COMPANY/UNDERTAKING

Identification of the substance/preparation	:	Hydrogen sulphide
Chemical formula	:	H2S
Other means of identification	:	Hydrogen sulphide, Sulfuretted Hydrogen, Hydrogen Sulphide, Hydrosulfuric Acid, Sulfur Hydride, Sewer Gas
Use of the Substance/Mixture	:	General Industrial
Restrictions on Use	:	No data available.
Manufacturer/Importer/Distributor	:	Air Products Singapore Industrial Gases Pte. Ltd. 2 International Business Park The Strategy, #03-20 Singapore 609930 Toll Free No: 800 448 1755
Email Address – Technical Information	:	GASTECH@airproducts.com
Telephone	:	6332 2440
Emergency telephone number (24h)	:	+65 6853 6800 +1 610 481 7711 International

2. HAZARDS IDENTIFICATION

GHS classification

Flammable gases - Category 1
Gases under pressure - Liquefied gas.
Acute toxicity - Inhalation Category 2
Acute aquatic toxicity. - Category 1
Specific target organ toxicity - single exposure - Category 3

GHS label elements

Hazard pictograms/symbols

Signal Word: Danger

Hazard Statements:

H220:Extremely flammable gas.
H280:Contains gas under pressure; may explode if heated.
H330:Fatal if inhaled.
H335:May cause respiratory irritation.
H400:Very toxic to aquatic life

Precautionary Statements:

Prevention : P210:Keep away from heat, hot surfaces, sparks, open flames, and other ignit sources. No smoking.
P260:Do not breathe dust/fume/gas/mist/vapours/spray.
P273:Avoid release to the environment.

Response : P304+P340 :IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P315 :Get immediate medical advice/attention.
P377 :Leaking gas fire: Do not extinguish, unless leak can be stopped safely
P381 :Eliminate all ignition sources if safe to do so.

Storage : P403:Store in a well-ventilated place.
P405:Store locked up.

Other hazards which do not result in classification

Exposures to fatal concentrations could occur wit hout any significant warning symptoms.
Distinctive rotten egg odor.
Olfactory fatigue may lead to loss of this warning property.
Symptoms may be delayed.
Use a back flow preventative device in the piping.
Use only with equipment purged with and inert gas or evacuated prior to discharge.
Use only with equipment of compatible materials of construction, rated for cylinder pressure.
Do not open valve until connected to equipment prepared for use.
When returning cylinder install valve outlet cap or plug leak tight.
Close valve after each use and when empty.
Extremely flammable liquefied gas.
May form explosive mixtures in air.
Vapors may spread long distances and ignite.
Immediate fire and explosion hazard exists when mixed with air at concentrations exceeding the lower flammability limit (LFL).
Do not breathe gas.
Direct contact with liquid can cause frostbite.
Self contained breathing apparatus (SCBA) may be required.

Environmental Effects

Dangerous for the environment.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance/Mixture : Substance

Components	Chemical formula	CAS Number	Concentration (Volume)
Hydrogen sulphide	H2S	7783-06-4	100 %

Concentration is nominal. For the exact product composition, please refer to Air Products technical

specifications.

4. FIRST AID MEASURES

General advice	:	Prompt medical attention is required in all cases of exposure. Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.
Eye contact	:	In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Keep eye wide open while rinsing.
Skin contact	:	Wash frost-bitten areas with plenty of water. Do not remove clothing. Cover wound with sterile dressing.
Ingestion	:	Ingestion is not considered a potential route of exposure.
Inhalation	:	Move to fresh air. If breathing has stopped or is labored, give assisted respirations. Supplemental oxygen may be indicated. If the heart has stopped, trained personnel should begin cardiopulmonary resuscitation immediately. In case of shortness of breath, give oxygen. Consult a doctor.
Symptoms	:	Sensitivity to light. Halo-vision.
Notes to physician		
Treatment	:	Central nervous system toxicity may cause respiratory paralysis requiring assisted ventilation. Irritation of the deep lung may cause chemical pneumonitis and pulmonary edema.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media	:	All known extinguishing media can be used.
Specific hazards	:	Gas is heavier than air and may collect in low areas or travel along the ground where there may be an ignition source present. Upon exposure to intense heat or flame, cylinder will vent rapidly and or rupture violently. Do not extinguish a leaking gas flame unless absolutely necessary. Spontaneous/explosive re-ignition may occur. Extinguish any other fire. If possible, shut off the source of gas and allow the fire to burn itself out. If flames are accidentally extinguished, explosive re-ignition may occur; therefore, appropriate measures should be taken(e.g. total evacuation to protect persons from cylinder fragments and toxic fumes should a rupture occur). Extinguish fire only if gas flow can be stopped. Move away from container and cool with water from a protected position. Keep adjacent cylinders cool by spraying with large amounts of water until the fire burns itself out. Combustion by-products may be toxic. Do not allow run-off from fire fighting to enter drains or water courses.
Special protective equipment for fire-fighters	:	Use self-contained breathing apparatus. Standard protective clothing and equipment (Self Contained Breathing Apparatus) for fire fighters. Standard EN 137 - Self-contained open-circuit compressed air breathing apparatus with full face mask. Standard EN 469 - Protective clothing for firefighters. Standard - EN 659: Protective gloves for firefighters.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions	:	Evacuate personnel to safe areas. Remove all sources of ignition. Use self-contained breathing apparatus or positive pressure air line with mask and escape pack in areas where concentration is unknown or above the exposure limits. Never enter a confined space or other area where the flammable gas concentration is greater the 10% of its lower flammable limit. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe. Ventilate the area.
Environmental precautions	:	Should not be released into the environment. Prevent further leakage or spillage if safe to do so. Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.
Methods for cleaning up	:	Ventilate the area. Approach suspected leak areas with caution. Keep area evacuated and free from ignition sources until any spilled liquid has evaporated. (Ground free from frost).
Additional advice	:	Large releases may require considerable downwind evacuation. If possible, stop flow of product. Increase ventilation to the release area and monitor concentrations. If leak is from cylinder or cylinder valve, call the Air Products emergency telephone number. If the leak is in the user's system, close the cylinder valve, safely vent the pressure, and purge with an inert gas before attempting repairs.

7. HANDLING AND STORAGE

Handling

Cylinders should be stored upright with valve protection cap in place and firmly secured to prevent falling or being knocked over. Protect cylinders from physical damage; do not drag, roll, slide or drop. Do not allow storage area temperature to exceed 50°C (122°F). Only experienced and properly instructed persons should handle compressed gases/cryogenic liquids. Before using the product, determine its identity by reading the label. Know and understand the properties and hazards of the product before use. When doubt exists as to the correct handling procedure for a particular gas, contact the supplier. Do not remove or deface labels provided by the supplier for the identification of the cylinder contents. 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. Use an adjustable strap wrench to remove over-tight or rusted caps. Before connecting the container, check the complete gas system for suitability, particularly for pressure rating and materials. Before connecting the container for use, ensure that back feed from the system into the container is prevented. Ensure the complete gas system is compatible for pressure rating and materials of construction. Ensure the complete gas system has been checked for leaks before use. Employ suitable pressure regulating devices on all containers when the gas is being emitted to systems with lower pressure rating than that of the container. Never insert an object (e.g. wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing a leak to occur. Open valve slowly. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Close container valve after each use and when empty, even if still connected to equipment. Never attempt to repair or modify container valves or safety relief devices. Damaged valves should be reported immediately to the supplier. Close valve after each use and when empty. Replace outlet caps or plugs and container caps as soon as container is disconnected from equipment. Do not subject containers to abnormal mechanical shock. Never attempt to lift a cylinder by its valve protection cap or guard. Do not use containers as rollers or supports or for any other purpose than to contain the gas as supplied. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit. Do not smoke while handling product or cylinders. Never re-compress a gas or a gas mixture without first consulting the supplier. Never attempt to transfer gases from one cylinder/container to another. Always use backflow protective device in piping. Purge air from system before introducing gas. Installation of a

cross purge assembly between the cylinder and the regulator is recommended. When returning cylinder install valve outlet cap or plug leak tight. Never use direct flame or electrical heating devices to raise the pressure of a container. Containers should not be subjected to temperatures above 50°C (122°F). Never attempt to increase liquid withdrawal rate by pressurizing the container without first checking with the supplier. Never permit liquefied gas to become trapped in parts of the system as this may result in hydraulic rupture. Ensure equipment is adequately earthed.

Storage

Containers should be stored in a purpose build compound which should be well ventilated, preferably in the open air. Full containers should be stored so that oldest s tock is used first. Observe all regulations and local requirements regarding storage of containers. Stored containers should be periodically checked for general condition and leakage. Local codes may have special requirements for toxic gas storage. Protect containers stored in the open against rusting and extremes of weather. Containers should not be stored in conditions likely to encourage corrosion. Containers should be stored in the vertical position and properly secured to prevent toppling. The container valves should be tightly closed and where appropriate valve outlets should be capped or plugged. Container valve guards or caps should be in place. Keep containers tightly closed in a cool, well-ventilated place. Store containers in location free from fire risk and away from sources of heat and ignition. Full and empty cylinders should be segregated. Do not allow storage temperature to exceed 50°C (122°F). Smoking should be prohibited within storage areas or while handling product or containers. Display "No Smoking or Open Flames" signs in the storage areas. The amounts of flammable or toxic gases in storage should be kept to a minimum. Return empty containers in a timely manner.

Technical measures/Precautions

Containers should be segregated in the storage area according to the various categories (e.g. flammable, toxic, etc.) and in accordance whit local regulations. Provide sufficient air exchange and/or exhaust in work rooms.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering measures

Handle product only in closed system or provide appropriate exhaust ventilation at machinery.
Provide natural or mechanical ventilation to prevent accumulation above exposure limits.

Personal protective equipment

Respiratory protection	:	Keep self contained breathing apparatus readily available for emergency use. Users of breathing apparatus must be trained. Use gas filters and full face mask, where exposure limits may be exceeded for a short-term period, e.g. connecting or disconnecting containers. Gas filters do not protect against oxygen deficiency. Gas filters may be used if all surrounding conditions e.g. type and concentration of the contaminant(s) and duration of use are known. Standard EN 14387 - Gas filter(s), combined filter(s) and full face mask - EN 136. Consult respiratory device supplier´s product information for the selection of the appropriate device. Self contained breathing apparatus is recommended, where unknown exposure may be expected, e.g. during maintenance activities on installation systems. Standard EN 137 - Self-contained open-circuit compressed air breathing apparatus with full face mask.
Hand protection	:	Butyl rubber, chlorinated polyethylene, neoprene, nitrile, or polyvinyl rubber gloves. Wear working gloves when handling gas containers. Standard EN 388 - Protective gloves against mechanical risk.

Eye protection	:	Safety glasses recommended when handling cylinders. Standard EN 166 - Personal eye-protection.
Skin and body protection	:	Acid resistant gloves (e.g. butyl rubber, neoprene, polyethylene) and splash suit when connecting, disconnecting or opening cylinders. Cold temperatures may cause embrittlement of protective material resulting in breakage and exposure. Contact with cold evaporating liquid on gloves or suit may cause cryogenic burns or frostbite. Consider the use of flame resistant anti-static safety clothing. Standard EN ISO 14116 - Limited flame spread materials. Standard EN ISO 1149-5 - Protective clothing: Electrostatic properties. Safety shoes are recommended when handling cylinders. Standard EN ISO 20345 - Personal protective equipment - Safety footwear.
Special instructions for protection and hygiene	:	Work operations should be monitored in such a way that emergency personnel can be immediately contacted in the event of a release. Ensure adequate ventilation, especially in confined areas. Provide good ventilation and/or local exhaust to prevent accumulation of concentrations above exposure limits.

Exposure limit(s)

Hydrogen sulphide	Time Weighted Average (TWA): EH40 WEL	5 ppm	7 mg/m3
Hydrogen sulphide	Short Term Exposure Limit (STEL): EH40 WEL	10 ppm	14 mg/m3

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Gaseous. Colorless gas
Odor	:	Not determined.
Odor	:	Mixture contains one or more component(s) which have the following odor: Rotten eggs.
Odor threshold	:	No data available.
pH	:	Not applicable.
Melting point/range	:	-123 °F (-86 °C)
Boiling point/range	:	-1,052 °F (-60,2 °C)
Flash point	:	Not applicable.
Evaporation rate	:	Not applicable.
Flammability (solid, gas)	:	Refer to product classification in Section 2
Upper/lower explosion/flammability limit	:	45.5 %(V) / 4.3 %(V)
Vapor pressure	:	272.66 psia (18.80 bara) at 68 °F (20 °C)
Water solubility	:	3.98 g/l

Relative vapor density	:	1.2 (air = 1) Heavier than air.
Relative density	:	0.92 (water = 1)
Partition coefficient (n-octanol/water)	:	Not applicable.
Auto-ignition temperature	:	270 °C
Decomposition temperature	:	No data available.
Viscosity	:	Not applicable.
Molecular Weight	:	34 g/mol
Density	:	0.087 lb/ft3 (0.0014 g/cm3) at 70 °F (21 °C) Note: (as vapor)
Specific Volume	:	11.26 ft3/lb (0.7029 m3/kg) at 70 °F (21 °C)

10. STABILITY AND REACTIVITY

Chemical Stability	:	Stable under normal conditions.
Conditions to avoid	:	Heat, flames and sparks.
Reactivity/Incompatible Materials	:	Oxidizing agents. Oxygen.
Hazardous decomposition products	:	Sulphur compounds. Hydrogen.

11. TOXICOLOGICAL INFORMATION

Likely routes of exposure

Effects on Eye	:	Contact with liquid may cause cold burns/frostbite.
Effects on Skin	:	Contact with liquid may cause cold burns/frostbite.
Inhalation Effects	:	Inhalation may cause central nervous system effects. May cause respiratory tract irritation. Exposure to concentrations greater than 500 ppm can result in respiratory arrest, coma, unconsciousness and death. Severe exposures which do not result in death may cause long-term symptoms such as memory loss, paralysis of facial muscles, or nerve tissue damage. May be fatal if inhaled.
Ingestion Effects	:	Ingestion is not considered a potential route of exposure.
Symptoms	:	Sensitivity to light. Halo-vision.

Acute toxicity

Acute Oral Toxicity	:	No data is available on the product itself.
Inhalation	:	LC50 (1 h) : 712 ppm Species : Rat.
Acute Dermal Toxicity	:	No data is available on the product itself.
Serious eye damage/eye irritation	:	No data available.
Sensitization.	:	No data available.

Chronic toxicity or effects from long term exposures

Carcinogenicity	:	No data available.
Reproductive toxicity	:	No data is available on the product itself.
Germ cell mutagenicity	:	No data is available on the product itself.
Specific target organ systemic toxicity (single exposure)	:	Respiratory system., Skin., Central nervous system.
Specific target organ systemic toxicity (repeated exposure)	:	Rats and mice that were exposed for 90 days to Hydrogen Sulfide at a concentration of 80 ppm had significantly decreased body weights compared to controls. Rats exposed to 80 ppm had depressed brain weights compared to controls. The only histological finding was inflammation of the nasal mucosa. This material was not mutagenic in a bacterial assay.
Aspiration hazard	:	No data available.

12. ECOLOGICAL INFORMATION

Ecotoxicity effects

Aquatic toxicity	:	May cause pH changes in aqueous ecological systems.May cause pH changes in aqueous ecological systems.
Toxicity to other organisms	:	No data available.

Persistence and degradability

Biodegradability	:	No data is available on the product itself.
Mobility	:	No data available.
Bioaccumulation	:	No data is available on the product itself.

Further information

Endangering to drinking water.

13. DISPOSAL CONSIDERATIONS

Waste from residues / unused products	:	In accordance with local and national regulations. Contact supplier if guidance is required. Return unused product in original cylinder to supplier. Must not be discharged to atmosphere. Refer to the EIGA code of practice Doc. 30 "Disposal of Gases", downloadable at http://www.eiga.org for more guidance on suitable disposal methods. List of hazardous waste codes: 16 05 04: Gases in pressure containers (including halons) containing dangerous substances.
Contaminated packaging	:	Return cylinder to supplier.

14. TRANSPORT INFORMATION

ADR

UN/ID No.	:	UN1053
Proper shipping name	:	HYDROGEN SULPHIDE
Class or Division	:	2
Tunnel Code	:	(B/D)
Label(s)	:	2.3 (2.1)
ADR/RID Hazard ID no.	:	263
Marine Pollutant	:	Yes

** NOTE: This product contains a substance that: 1) is regulated as a Marine Pollutant, or 2) meets the definition of toxic to the aquatic environment.

IATA

Transport Forbidden

IMDG

UN/ID No.	:	UN1053
Proper shipping name	:	HYDROGEN SULPHIDE
Class or Division	:	2.3
Label(s)	:	2.3 (2.1)
RQ Substance	:	Yes
Marine Pollutant	:	Yes
Segregation Group:	:	None

* NOTE: This product contains a USDOT Hazardous Substance and will meet the Reportable Quantity definition when shipped to, from, or within the United States, in the amount specified in 49CFR 172.101 Appendix A.
** NOTE: This product contains a substance that: 1) is regulated as a Marine Pollutant, or 2) meets the definition of toxic to the aquatic environment.

RID

UN/ID No.	:	UN1053
Proper shipping name	:	HYDROGEN SULPHIDE
Class or Division	:	2
Label(s)	:	2.3 (2.1)
Marine Pollutant	:	Yes

** NOTE: This product contains a substance that: 1) is regulated as a Marine Pollutant, or 2) meets the definition of toxic to the aquatic environment.

Further 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. The transportation information is not intended to convey all specific regulatory data relating to this material. For complete transportation information, contact an Air Products customer service representative.

15. REGULATORY INFORMATION

Workplace Safety and Health Act & Workplace Safety and Health (General Provisions) Regulations

Workplace Health and Safety Act , SS586 Labeling.

Flammable Materials Regulation Licensable Chemicals (Singapore Civil Defense Force).

Poison Act (Health Sciences Authority).

Country	Regulatory list	Notification
USA	TSCA	Included on Inventory.
EU	EINECS	Included on Inventory.
Canada	DSL	Included on Inventory.
Australia	AICS	Included on Inventory.
Japan	ENCS	Included on Inventory.
South Korea	ECL	Included on Inventory.
China	SEPA	Included on Inventory.
Philippines	PICCS	Included on Inventory.

16. OTHER INFORMATION

Ensure all national/local regulations are observed.

Prepared by : Air Products and Chemicals, Inc. Global EH&S Product Safety Department

For additional information, please visit our Product Stewardship web site at
http://www.airproducts.com/productstewardship/