

SECTION 1: Identification

1.1. Identification

Product form : Substance
 Substance name : Arsine
 CAS No : 7784-42-1
 Product code : SG-1001-08333
 Formula : AsH₃

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

Use of the substance/mixture : Semiconductors

1.3. Details of the supplier of the safety data sheet

Air Liquide USA LLC and its affiliates
 9811 Katy Freeway, Suite 100
 Houston, TX 77024 - USA
 T 1-800-819-1704
www.us.airliquide.com

1.4. Emergency telephone number

Emergency number : CHEMTREC: 1-800-424-9300

SECTION 2: Hazard(s) identification

2.1. Classification of the substance or mixture

GHS-US classification

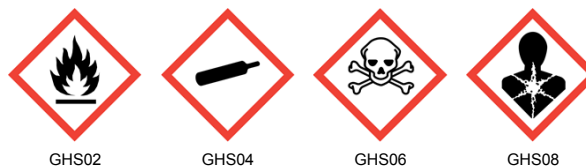
Flammable gases H220
 Category 1
 Gases under pressure H280
 Liquefied gas
 Acute toxicity H330
 (inhalation:gas)
 Category 1
 Carcinogenicity H351
 Category 2
 Specific target organ H373
 toxicity (repeated
 exposure) Category 2
 Hazardous to the H400
 aquatic environment -
 Acute Hazard Category
 1
 Hazardous to the H410
 aquatic environment -
 Chronic Hazard
 Category 1

Full text of H statements : see section 16

2.2. Label elements

GHS-US labeling

Hazard pictograms (GHS-US) :



Signal word (GHS-US) :

Danger

Hazard statements (GHS-US) :

H220 - Extremely flammable gas
 H280 - Contains gas under pressure; may explode if heated
 H330 - Fatal if inhaled
 H351 - Suspected of causing cancer
 H373 - May cause damage to organs (blood, liver, kidneys) through prolonged or repeated exposure (Inhalation)
 CGA-HG01 - May cause frostbite

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CGA-HG04 - May form explosive mixtures with air
CGA-HG11 - Symptoms may be delayed

Precautionary statements (GHS-US) :

- P202 - Do not handle until all safety precautions have been read and understood
- P210 - Keep away from heat, hot surfaces, open flames, sparks. - No smoking
- P260 - Do not breathe gas
- P271 - Use only outdoors or in a well-ventilated area
- P280 - Wear eye protection, face protection, protective gloves, protective clothing
- P284 - Wear respiratory protection. Consult respirator supplier's product information for the selection of the appropriate respiratory protection
- P302 - IF ON SKIN: Thaw frosted parts with lukewarm water. Do not rub affected area, Get immediate medical advice/attention
- P304+P340 - If inhaled: Remove person to fresh air and keep 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
- P307+P311 - If exposed: Call a poison center/doctor
- 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
- P405 - Store locked up
- P501 - Dispose of contents/container in accordance with local/regional/national/international regulations

CGA-PG02 - Protect from sunlight when ambient temperature exceeds 52°C (125°F)
CGA-PG05 - Use a back flow preventive device in the piping
CGA-PG06 - Close valve after each use and when empty
CGA-PG10 - Use only with equipment rated for cylinder pressure
CGA-PG14 - Approach suspected leak area with caution
CGA-PG18 - When returning cylinder, install leak tight valve outlet cap or plug
CGA-PG21 - Open valve slowly

2.3. Other hazards

No additional information available

2.4. Unknown acute toxicity (GHS US)

Not applicable

SECTION 3: Composition/Information on ingredients

3.1. Substance

Substance type : Mono-constituent

Name	Product identifier	%	GHS-US classification
Arsine (Main constituent)	(CAS No) 7784-42-1	> 99.9	Flam. Gas 1, H220 Liquefied gas, H280 Acute Tox. 1 (Inhalation:gas), H330 Carc. 2, H351 STOT RE 2, H373 Aquatic Acute 1, H400 Aquatic Chronic 1, H410

Full text of H-phrases: see section 16

3.2. Mixture

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures after inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Apply artificial respiration with bag and mask if breathing stopped. Get immediate medical advice/attention.

First-aid measures after skin contact : Thaw frosted parts with lukewarm water. Do not rub affected area. Get immediate medical advice/attention.

First-aid measures after eye contact : Immediately flush eyes thoroughly with water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get immediate medical advice/attention.

First-aid measures after ingestion : Ingestion is not considered a potential route of exposure.

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

Symptoms/injuries after inhalation : Fatal if inhaled.

Symptoms/injuries after skin contact : May cause frostbite.

Symptoms/injuries after eye contact : Contact with the product may cause cold burns or frostbite.

Symptoms/injuries after ingestion : Ingestion is not considered a potential route of exposure.

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Symptoms/injuries upon intravenous administration	: Not known.
Chronic symptoms	: Suspected of causing cancer. May cause damage to organs (blood, liver, kidneys) through prolonged or repeated exposure (Inhalation).

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

If you feel unwell, seek medical advice. If breathing is difficult, give oxygen.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media	: Use extinguishing media appropriate for surrounding fire.
Unsuitable extinguishing media	: Do not use water jet to extinguish.

5.2. Special hazards arising from the substance or mixture

Fire hazard	: This product is flammable.
Explosion hazard	: Heat may build pressure, rupturing closed containers, spreading fire and increasing risk of burns and injuries. May form flammable/explosive vapor-air mixture.
Reactivity	: Reacts violently with (strong) oxidizers.

5.3. Advice for firefighters

Firefighting instructions	: In case of fire: Evacuate area. Fight fire remotely due to the risk of explosion. Use water spray or fog for cooling exposed containers. Exercise caution when fighting any chemical fire.
Protection during firefighting	: Standard protective clothing and equipment (e.g., Self Contained Breathing Apparatus) for fire fighters. Do not enter fire area without proper protective equipment, including respiratory protection.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures	: Ensure adequate ventilation.
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6.1.1. For non-emergency personnel

Protective equipment	: Wear protective equipment consistent with the site emergency plan.
Emergency procedures	: Evacuate personnel to a safe area. Close doors and windows of adjacent premises. Keep containers closed. Mark the danger area. Seal off low-lying areas. Keep upwind.

6.1.2. For emergency responders

Protective equipment	: Standard protective clothing and equipment (e.g., Self Contained Breathing Apparatus) for fire fighters. Equip cleanup crew with proper protection.
Emergency procedures	: Evacuate and limit access. Ventilate area. Remove ignition sources. Monitor concentration of released product. Consider the risk of potentially explosive atmospheres. Wear self-contained breathing apparatus when entering atmospheres of unknown contaminant concentration until proven to be safe.

6.2. Environmental precautions

Try to stop release if without risk.

6.3. Methods and material for containment and cleaning up

For containment	: Try to stop release if without risk.
Methods for cleaning up	: Dispose of contents/container in accordance with local/regional/national/international regulations.

6.4. Reference to other sections

See also Sections 8 and 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Additional hazards when processed	: Pressurized container: Do not pierce or burn, even after use. Use only with equipment rated for cylinder pressure. Close valve after each use and when empty. Handle empty containers with care because residual vapors are flammable. In use, may form flammable vapor-air mixture.
Precautions for safe handling	: Do not handle until all safety precautions have been read and understood. Use only outdoors or in a well-ventilated area. Keep away from heat/sparks/open flames/hot surfaces. – No smoking. Use only non-sparking tools.
Hygiene measures	: Do not eat, drink or smoke when using this product.

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7.2. Conditions for safe storage, including any incompatibilities

Technical measures	: Comply with applicable regulations. Proper grounding procedures to avoid static electricity should be followed.
Storage conditions	: Do not expose to temperatures exceeding 52 °C/ 125 °F. Keep container closed when not in use. Protect cylinders from physical damage; do not drag, roll, slide or drop. Store in well ventilated area. Store locked up.
Incompatible products	: None known.
Incompatible materials	: Oxidizing materials. Air.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Arsine (7784-42-1)		
ACGIH	ACGIH TWA (ppm)	0.005 ppm
OSHA	OSHA PEL (TWA) (mg/m ³)	0.2 mg/m ³
OSHA	OSHA PEL (TWA) (ppm)	0.05 ppm
IDLH	US IDLH (ppm)	3 ppm
NIOSH	NIOSH REL (ceiling) (mg/m ³)	0.002 mg/m ³

8.2. Exposure controls

Appropriate engineering controls	: Ensure exposure is below occupational exposure limits (where available). Provide adequate general and local exhaust ventilation. Systems under pressure should be regularly checked for leakages. Consider work permit system e.g. for maintenance activities. Alarm detectors should be used when toxic gases may be released.
Hand protection	: Wear working gloves when handling gas containers. 29 CFR 1910.138: Hand protection.
Eye protection	: Wear safety glasses with side shields. 29 CFR 1910.133: Eye and Face Protection.
Skin and body protection	: Wear suitable protective clothing, e.g. lab coats, coveralls or flame resistant clothing.
Respiratory protection	: Wear a respirator when performing non-routine tasks not limited to line breaking or sampling. Wear a respirator during routine operations if determined to be necessary during a process-specific review. Consult respirator suppliers' product information or their representatives for the selection of the appropriate respirator. See Sections 5 & 6.
Thermal hazard protection	: None necessary during normal and routine operations.
Environmental exposure controls	: Refer to local regulations for restriction of emissions to the atmosphere. See section 13 for specific methods for waste gas treatment.
Other information	: Wear safety shoes while handling containers. 29 CFR 1910.136: Foot Protection.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	: Gas
Appearance	: Clear, colorless gas.
Color	: Colorless
Odor	: Garlic like.
Odor threshold	: No data available
pH	: Not applicable.
Melting point	: No data available
Freezing point	: -117 °C
Boiling point	: -62.5 °C
Critical temperature	: 100.95 °C
Flash point	: No data available
Relative evaporation rate (butyl acetate=1)	: No data available
Relative evaporation rate (ether=1)	: Not applicable.
Flammability (solid, gas)	: See Section 2.1 and 2.2
Explosion limits	: No data available
Explosive properties	: Without adequate ventilation formation of explosive mixtures may be possible.
Oxidizing properties	: None.

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Vapor pressure	: 1500 kPa
Relative density	: 1.6
Relative vapor density at 20 °C	: 2.69
Relative gas density	: Heavier than air
Solubility	: Water: No data available
Log Pow	: Not applicable for inorganic gases.
Auto-ignition temperature	: 285 °C
Decomposition temperature	: No data available
Viscosity	: No data available
Viscosity, kinematic	: Not applicable.
Viscosity, dynamic	: Not applicable.

9.2. Other information

Additional information : Gas/vapor heavier than air. May accumulate in confined spaces, particularly at or below ground level

SECTION 10: Stability and reactivity

10.1. Reactivity

Reacts violently with (strong) oxidizers.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

Can form explosive mixture with air. Reacts vigorously with strong oxidizers and acids.

10.4. Conditions to avoid

None under recommended storage and handling conditions (see section 7).

10.5. Incompatible materials

Oxidizing materials. Air.

10.6. Hazardous decomposition products

Under normal conditions of storage and use hazardous decomposition products should not be produced. When heated to decomposition, emits dangerous fumes.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Inhalation:gas: Fatal if inhaled.

Arsine (7784-42-1)	
LC50 inhalation rat (mg/l)	390 mg/m ³ (Exposure time: 10 min)
LC50 inhalation rat (ppm)	89 ppm/4h
ATE US (gases)	89.000 ppmV/4h
ATE US (vapors)	0.390 mg/l/4h
ATE US (dust, mist)	0.390 mg/l/4h

Skin corrosion/irritation	: Not classified pH: Not applicable.
Serious eye damage/irritation	: Not classified pH: Not applicable.
Respiratory or skin sensitization	: Not classified
Germ cell mutagenicity	: Not classified
Carcinogenicity	: Suspected of causing cancer.

Arsine (7784-42-1)	
IARC group	1 - Carcinogenic to humans
In OSHA Hazard Communication Carcinogen list	Yes

Reproductive toxicity	: Not classified
Specific target organ toxicity (single exposure)	: Not classified

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Specific target organ toxicity (repeated exposure)	: May cause damage to organs (blood, liver, kidneys) through prolonged or repeated exposure (Inhalation).
Aspiration hazard	: Not classified
Symptoms/injuries after inhalation	: Fatal if inhaled.
Symptoms/injuries after skin contact	: May cause frostbite.
Symptoms/injuries after eye contact	: Contact with the product may cause cold burns or frostbite.
Symptoms/injuries after ingestion	: Ingestion is not considered a potential route of exposure.
Symptoms/injuries upon intravenous administration	: Not known.
Chronic symptoms	: Suspected of causing cancer. May cause damage to organs (blood, liver, kidneys) through prolonged or repeated exposure (Inhalation).

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : Very toxic to aquatic life with long lasting effects.

12.2. Persistence and degradability

Arsine (7784-42-1)

Persistence and degradability	Not applicable for inorganic gases.
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12.3. Bioaccumulative potential

Arsine (7784-42-1)

Log Pow	Not applicable for inorganic gases.
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Bioaccumulative potential	No data available.
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12.4. Mobility in soil

Arsine (7784-42-1)

Ecology - soil	Because of its high volatility, the product is unlikely to cause ground or water pollution.
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12.5. Other adverse effects

Effect on ozone layer : No known effects from this product

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste treatment methods : Contact supplier if guidance is required. Do not discharge into any place where its accumulation could be dangerous. Ensure that the emission levels from local regulations or operating permits are not exceeded. Waste gas should be flared through a suitable burner with flash back arrestor. Do not discharge into areas where there is a risk of forming an explosive mixture with air.

Waste disposal recommendations : Refer to the CGA Pamphlet P-63 "Disposal of Gases" available at www.cganet.com for more guidance on suitable disposal methods.

SECTION 14: Transport information

Department of Transportation (DOT)

In accordance with DOT

Transport document description : UN2188 Arsine, 2.3

UN-No.(DOT) : UN2188

Proper Shipping Name (DOT) : Arsine

Class (DOT) : 2.3 - Class 2.3 - Poisonous gas 49 CFR 173.115

Subsidiary risk (DOT) : 2.1 - Class 2.1 - Flammable gas 49 CFR 173.115

DOT Packaging Non Bulk (49 CFR 173.xxx) : 192

DOT Packaging Bulk (49 CFR 173.xxx) : 245

DOT Special Provisions (49 CFR 172.102) : 1 - This material is poisonous by inhalation (see 171.8 of this subchapter) in Hazard Zone A (see 173.116(a) or 173.133(a) of this subchapter), and must be described as an inhalation hazard under the provisions of this subchapter

DOT Packaging Exceptions (49 CFR 173.xxx) : None

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DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27)	: Forbidden
DOT Quantity Limitations Cargo aircraft only (49 CFR 175.75)	: Forbidden
DOT Vessel Stowage Location	: D - The material must be stowed "on deck only" on a cargo vessel and on a passenger vessel carrying a number of passengers limited to not more than the larger of 25 passengers or one passenger per each 3 m of overall vessel length, but the material is prohibited on passenger vessels in which the limiting number of passengers is exceeded
DOT Vessel Stowage Other	: 40 - Stow "clear of living quarters"
Emergency Response Guide (ERG) Number	: 119
Other information	: No supplementary information available.
Special transport precautions	: 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 there is adequate ventilation. - Ensure that containers are firmly secured. - Ensure cylinder valve is closed and not leaking. - Ensure valve outlet cap nut or plug (where provided) is correctly fitted. - Ensure valve protection device (where provided) is correctly fitted.

TDG

Transport document description	: UN2188 ARSINE, 2.3
UN-No. (TDG)	: UN2188
Proper Shipping Name	: ARSINE
TDG Primary Hazard Classes	: 2.3 - Class 2.3 - Toxic Gas.
TDG Subsidiary Classes	: 2.1
TDG Special Provisions	: 23 - (1) A consignor of these dangerous goods must include, except for UN1005, ANHYDROUS AMMONIA, the words "toxic by inhalation" or "toxic — inhalation hazard" or "toxique par inhalation" or "toxicité par inhalation" in the following places, unless the words are already part of the shipping name: (a) on a shipping document, immediately after the description of the dangerous goods; (b) on a small means of containment, next to the shipping name of the dangerous goods; and (c) on a large means of containment, next to the placard for the primary class of the dangerous goods or the placard for the subsidiary class, if any. For example, the notation on a shipping document would be "UN1935, CYANIDE SOLUTION, N.O.S., Class 6.1, PG I, toxic by inhalation". (2) This special provision does not apply to a person who transports these dangerous goods in accordance with an exemption set out in sections 1.15, 1.17 or 1.17.1 of Part 1 (Coming Into Force, Repeal, Interpretation, General Provisions and Special Cases). (3) A consignor of UN1005, ANHYDROUS AMMONIA, must include the words "inhalation hazard" or "dangereux par inhalation": (a) on a shipping document, immediately after the shipping name of the dangerous goods; and (b) on a small means of containment, next to the shipping name of the dangerous goods. When UN1005, ANHYDROUS AMMONIA, is contained in a large means of containment on which is affixed the anhydrous ammonia placard, the words "Anhydrous Ammonia, Inhalation Hazard" or "Ammoniac anhydre, dangereux par inhalation" must be displayed next to the placard in accordance with paragraph 4.18.2(b). SOR/2014-306,38 - A person must not handle, offer for transport or transport these dangerous goods in a large means of containment if they are in direct contact with the large means of containment. SOR/2014-306
ERAP Index	: 25
Explosive Limit and Limited Quantity Index	: 0
Passenger Carrying Road Vehicle or Passenger Carrying Railway Vehicle Index	: Forbidden
Passenger Carrying Ship Index	: Forbidden

Transport by sea

UN-No. (IMDG)	: 2188
Proper Shipping Name (IMDG)	: ARSINE
Class (IMDG)	: 2 - Gases
MFAG-No	: 119

Air transport

UN-No. (IATA)	: Forbidden
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SECTION 15: Regulatory information

15.1. US Federal regulations

Arsine (7784-42-1)

Listed on the United States TSCA (Toxic Substances Control Act) inventory
Listed on the United States SARA Section 302

SARA Section 302 Threshold Planning Quantity (TPQ)	100
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15.2. International regulations

CANADA

Arsine (7784-42-1)

Listed on the Canadian DSL (Domestic Substances List)

WHMIS Classification	Class A - Compressed Gas Class B Division 1 - Flammable Gas Class D Division 1 Subdivision A - Very toxic material causing immediate and serious toxic effects Class D Division 2 Subdivision A - Very toxic material causing other toxic effects
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EU-Regulations

Arsine (7784-42-1)

Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)

National regulations

Arsine (7784-42-1)

Listed on IARC (International Agency for Research on Cancer)
Listed on the AICS (Australian Inventory of Chemical Substances)
Listed on IECSC (Inventory of Existing Chemical Substances Produced or Imported in China)
Listed on the Japanese ENCS (Existing & New Chemical Substances) inventory
Listed on the Korean ECL (Existing Chemicals List)
Listed on NZIoC (New Zealand Inventory of Chemicals)
Listed on PICCS (Philippines Inventory of Chemicals and Chemical Substances)
Japanese Poisonous and Deleterious Substances Control Law
Japanese Pollutant Release and Transfer Register Law (PRTR Law)
Listed on the Canadian IDL (Ingredient Disclosure List)

15.3. US State regulations

Arsine (7784-42-1)

State or local regulations	U.S. - Massachusetts - Right To Know List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List U.S. - Pennsylvania - RTK (Right to Know) List
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SECTION 16: Other information

Other information : This Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard, 29 CFR, 1910.1200. Other government regulations must be reviewed for applicability to this product.

Full text of H-phrases:

H220	Extremely flammable gas
H280	Contains gas under pressure; may explode if heated
H330	Fatal if inhaled
H351	Suspected of causing cancer
H373	May cause damage to organs through prolonged or repeated exposure
H400	Very toxic to aquatic life
H410	Very toxic to aquatic life with long lasting effects

SDS US (GHS HazCom 2012)

This Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard, 29 CFR, 1910.1200. Other government regulations must be reviewed for applicability to this product. To the best of Air Liquide USA LLC and its affiliates' knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness are not guaranteed and no warranties of any type, either express or implied, are provided. The information contained herein relates only to this specific product. If this product is combined with other materials, all component properties must be considered. Data may be changed from time to time. Be sure to consult the latest edition.