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

1.1. Product identifier : Carbon monoxide

CAS No. : 630-08-0

Chemical formula : CO

Synonyms : Carbon monoxide, Carbonic Oxide, Carbon Oxide

REACH Registration Number: 01-2119480165-39

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

Use of the Substance/Mixture : Industrial and professional use. Perform risk assessment prior to use.

Restrictions on Use : Not for consumer use.

1.3. Details of the supplier of the safety data sheet : Air Products Ireland Ltd
Unit 950 Western Industrial Estate
Kileen Road
Dublin 12
Ireland

Email Address – Technical Information : GASTECH@airproducts.com

Telephone : 1-4659650

1.4. Emergency telephone number : (01) 463 4200 / +353 1 463 4200

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Flammable gases - Category 1B H221:Flammable gas.
Gases under pressure - Compressed gas. H280:Contains gas under pressure; may explode if heated.
Acute toxicity - Inhalation Category 3 H331:Toxic if inhaled.
Reproductive toxicity - Category 1A H360D:May damage the unborn child.
Specific target organ toxicity - repeated exposure - Category 1 H372:Causes damage to organs through prolonged or repeated exposure

2.2. Label elements

Hazard pictograms/symbols

Signal Word: Danger

Hazard Statements:

H221:Flammable gas.
H280:Contains gas under pressure; may explode if heated.
H331:Toxic if inhaled.
H360D:May damage the unborn child.
H372:Causes damage to organs through prolonged or repeated exposure

Precautionary Statements:

Prevention : P202:Do not handle until all safety precautions have been read and understood.
P210:Keep away from heat, hot surfaces, sparks, open flames, and other ignition sources. No smoking.
P260:Do not breathe dust/fume/gas/mist/vapours/spray.

Response : P304+P340 :IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P308+P313 :IF exposed or concerned: Get medical advice/attention.
P377 :Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381 :In case of leakage, eliminate all ignition sources.
P315 :Get immediate medical advice/attention.

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

2.3. Other hazards

Toxic by inhalation.
High pressure gas.
Extremely flammable.
May form explosive mixtures in air.
Immediate fire and explosion hazard exists when mixed with air at concentrations exceeding the lower flammability limit (LFL).
Do not breathe gas.
Self-contained breathing apparatus (SCBA) may be required.
Substance does not meet the criteria for PBT and vPvB according to Regulation (EC) No 1907/2006, Annex XIII.

Environmental Effects

Dangerous for the environment.

SECTION 3: Composition/information on ingredients

3.1. Substances

Components	EINECS / ELINCS Number	CAS Number	Concentration

			(Volume)
Carbon monoxide	211-128-3	630-08-0	100 %

Components	Classification (CLP)	REACH Reg. #
Carbon monoxide	Flam. gas 1B ;H221 Press. Gas (Comp.) ;H280 Repr. 1A ;H360D Acute Tox. Inha 3 ;H331 STOT RE Inha 1 ;H372	01-2119480165-39

Refer to section 16 for full text of each relevant hazard statement (H).

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

3.2. Mixtures : Not applicable.

SECTION 4: First aid measures

4.1. Description of first aid measures

General advice : 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 : Flush with copious amounts of water until treatment is available.

Ingestion : Ingestion is not considered a potential route of exposure.

Inhalation : In case of shortness of breath, give oxygen. Move to fresh air. Consult a doctor. 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.

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

Symptoms : No data available.

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

Treatment : Hyperbaric oxygen is the most efficient treatment of carbon monoxide and dramatically reduces the biological half-life of carboxyhemoglobin. Although less effective, 100% oxygen by mask is useful if hyperbaric facilities are not available. Stimulant drugs are not indicated. If exposed or concerned: Get medical attention/advice.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Shutting off the source of the gas is the preferred method of control.
Be aware of the risk of formation of static electricity with the use of CO2 extinguishers and do not use them in places where a flammable atmosphere may be present.

Extinguishing media which must not be used for safety reasons.	:	Do not use water jet to extinguish.
5.2. Special hazards arising from the substance or mixture	:	Upon exposure to intense heat or flame, cylinder will vent rapidly and or rupture violently. 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). If possible, shut off the source of gas and allow the fire to burn itself out. Do not extinguish a leaking gas flame unless absolutely necessary. Spontaneous/explosive re-ignition may occur. Extinguish any other fire. 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 firefighting to enter drains or water courses.
5.3. Advice for firefighters	:	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.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures	:	Evacuate personnel to safe areas. Remove all sources of ignition. Approach suspected leak areas with caution. 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.
6.2. 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.
6.3. Methods and material for containment and cleaning up	:	Ventilate the area. Approach suspected leak areas with caution.
Additional advice	:	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 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.
6.4. Reference to other sections	:	For more information refer to Sections 8 & 13

SECTION 7: Handling and storage

7.1. Precautions for safe handling

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). Ensure equipment is adequately earthed.

7.2. Conditions for safe storage, including any incompatibilities

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 stock 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. Keep away from combustible material. All electrical equipment in the storage areas should be compatible with flammable materials stored. Containers containing flammable gases should be stored away from other combustible materials. Where necessary containers containing oxygen and oxidants should be separated from flammable gases by a fire resistant partition.

7.3. Specific end use(s)

Refer to section 1 or the extended SDS if applicable.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Exposure limit(s)

Carbon monoxide	Time Weighted Average (TWA)	20 ppm	23 mg/m3	EU. Scientific Committee on Occupational Exposure Limit Values (SCOELs), European Commission - SCOEL, as amended
Carbon monoxide	Short Term Exposure Limit (STEL)	100 ppm	117 mg/m3	EU. Scientific Committee on Occupational Exposure Limit Values (SCOELs), European Commission - SCOEL, as amended

If applicable, refer to the extended section of the SDS for further information on CSA.

DNEL: Derived no effect level (Workers)

Acute - local effects, inhalation	: 117 ppm
Acute - systemic effects, inhalation	: 117 mg/m3
Long-term - local effects, inhalation	: 23 ppm
Long-term - systemic effects, inhalation	: 23 mg/m3

PNEC: predicted no effect concentration
None established.

8.2. Exposure controls

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 : Wear work gloves when handling gas containers.

		Standard EN 388 - Protective gloves against mechanical risk.
Eye/face Protection	:	Safety glasses recommended when handling cylinders. Standard EN 166 - Personal eye-protection.
Skin and body protection	:	Flame retardant antistatic protective clothing. 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	:	Ensure adequate ventilation, especially in confined areas. Provide good ventilation and/or local exhaust to prevent accumulation of concentrations above exposure limits.
Environmental Exposure Controls	:	If applicable, refer to the extended section of the SDS for further information on CSA.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

(a/b) Physical state/Colour	:	Compressed gas. Colorless gas
(c) Odour	:	No odor warning properties.
(d) Density	:	0.0012 g/cm3 (0.075 lb/ft3) at 21 °C (70 °F) Note: (as vapor)
(e) Relative Density	:	0.79 (water = 1)
(f) Melting point / freezing point	:	-337 °F (-205.1 °C)
(g) Boiling point/range	:	-313 °F (-191.5 °C)
(h) Vapor pressure	:	Not applicable.
(i) Water solubility	:	0.030 g/l
(j) Partition coefficient: n-octanol/water [log Kow]	:	1.78
(k) pH	:	Not applicable for gases and gas mixtures.
(l) Viscosity	:	No reliable data available.
(m) Particle characteristics	:	Not applicable for gases and gas mixtures.
(n) Upper and lower explosion / flammability limits	:	74 %(V) / 10.9 %(V)
(o) Flash point	:	Not applicable for gases and gas mixtures.

(p) Autoignition temperature	:	607 °C
(q) Decomposition temperature	:	Not applicable.

9.2. Other information

Explosive properties	:	Not applicable.
Oxidizing properties	:	Not applicable.
Molecular Weight	:	28 g/mol
Odor threshold	:	Odour threshold is subjective and inadequate to warn of overexposure.
Evaporation rate	:	Not applicable for gases and gas mixtures.
Flammability (solid, gas)	:	Refer to product classification in Section 2
Specific Volume	:	0.8615 m3/kg (13.80 ft3/lb) at 21 °C (70 °F)
Upper flammability limit	:	74 %(V)
Lower flammability limit	:	10.9 %(V)
Relative vapor density	:	0.967 (air = 1) Lighter or similar to air.

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. Stable.
10.3. Possibility of hazardous reactions	:	No data available.
10.4. Conditions to avoid	:	Heat, flames and sparks.
10.5. Incompatible materials	:	Iron. Natural rubber. Neoprene. Nickel. Oxygen. Oxidizing agents.
10.6. Hazardous decomposition products	:	No data available.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Likely routes of exposure

Effects on Eye	:	In case of direct contact with eyes, seek medical advice.
Effects on Skin	:	No data available.
Inhalation Effects	:	May be fatal if inhaled.
Ingestion Effects	:	Ingestion is not considered a potential route of exposure.
Symptoms	:	No data available.

Acute toxicity

Acute Oral Toxicity	:	No data is available on the product itself.
Acute Inhalation Toxicity	:	LC50 (1 h) : 3760 ppm Species : Rat.
Acute Dermal Toxicity	:	No data is available on the product itself.
Skin corrosion/irritation	:	No data available.
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	:	Inhalation may damage fertility or the unborn child (Increased risk of preterm birth; risk of cardiac defects)
Germ cell mutagenicity	:	No data is available on the product itself.
Specific target organ systemic toxicity (single exposure)	:	No data available.
Specific target organ systemic toxicity (repeated exposure)	:	Prolonged or repeated inhalation may cause damage to the heart. Inhalation may damage fertility or the unborn child (Increased risk of preterm birth; risk of cardiac defects)
Aspiration hazard	:	No data available.

SECTION 12: Ecological information

12.1. Toxicity

Aquatic toxicity	:	No data is available on the product itself.
Toxicity to other organisms	:	No data is available on the product itself.

12.2. Persistence and degradability

No data available.

12.3. Bioaccumulative potential

Does not bioaccumulate. Refer to Section 9 "Partition Coefficient (n-octanol/water)".

12.4. Mobility in soil

Carbon Monoxide will not be mobile in the environment. Because of its high volatility, the product is unlikely to cause ground pollution.

12.5. Results of PBT and vPvB assessment

If applicable, refer to the extended section of the SDS for further information on CSA.

12.6. Other adverse effects

This product has no known eco-toxicological effects.

Effect on the ozone layer	:	No known effects from this product.
Ozone Depleting Potential	:	None
Effect on global warming	:	No known effects from this product.
Global Warming Potential	:	None

SECTION 13: Disposal considerations

13.1. Waste treatment methods : 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 hazardous substances.

Contaminated packaging : Return cylinder to supplier.

SECTION 14: Transport information

14.1. UN number

UN/ID No. : UN1016

14.2. UN proper shipping name

Transport by road/rail (ADR/RID)	:	CARBON MONOXIDE, COMPRESSED
Transport by air (ICAO-TI / IATA-DGR)	:	Carbon monoxide, compressed
Transport by sea (IMDG)	:	CARBON MONOXIDE, COMPRESSED

14.3. Transport hazard class(es)

Label(s) : 2.3 (2.1)

Transport by road/rail (ADR/RID)
Class or Division : 2
ADR/RID Hazard ID no. : 263
Tunnel Code : (B/D)

Transport by sea (IMDG)
Class or Division : 2.3

14.4. Packing group

Transport by road/rail (ADR/RID) : Not applicable.
Transport by air (ICAO-TI / IATA-DGR) : Not applicable.
Transport by sea (IMDG) : Not applicable.

14.5. Environmental hazards

Transport by road/rail (ADR/RID)
Marine Pollutant : No

Transport by air (ICAO-TI / IATA-DGR)
Marine Pollutant : No

Transport by sea (IMDG)
Marine Pollutant : No
Segregation Group : None

14.6. Special precautions for user

Transport by air (ICAO-TI / IATA-DGR)
Passenger and Cargo Aircraft : Transport forbidden
Cargo Aircraft only : Transport forbidden

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 customer service.

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

Not applicable.

SECTION 15: Regulatory information

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

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.

Other Regulations
REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC.

COMMISSION REGULATION (EU) 2015/830 of 28 May 2015 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

Regulation (EC) No 1272/2008 the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006.

15.2. Chemical safety assessment

A CSA has been carried out. Applicable EXPOSURE SCENARIOS are available at the following link: www.airproducts.com/esds/630-08-0

SECTION 16: Other information

Ensure all national/local regulations are observed.

Hazard Statements:
H221 Flammable gas.
H280 Contains gas under pressure; may explode if heated.
H331 Toxic if inhaled.
H360D May damage the unborn child.
H372 Causes damage to organs through prolonged or repeated exposure

Indication of Method:
Flammable gases Category 1B Flammable gas. Calculation method

Gases under pressure Compressed gas. Contains gas under pressure; may explode if heated. Calculation method

Acute toxicity Category 3 Toxic if inhaled. Calculation method

Reproductive toxicity Category 1A May damage the unborn child. Calculation method

Specific target organ toxicity - repeated exposure Category 1 Causes damage to organs through prolonged or repeated exposure Calculation method

Abbreviations and acronyms:
ATE - Acute Toxicity Estimate
CLP - Classification Labelling Packaging Regulation; Regulation (EC) No 1272/2008

REACH - Registration, Evaluation, Authorisation and Restriction of Chemicals Regulation (EC) No 1907/2006
EINECS - European Inventory of Existing Commercial Chemical Substances
ELINCS - European List of Notified Chemical Substances
CAS# - Chemical Abstract Service number
PPE - Personal Protection Equipment
Kow - octanol-water partition coefficient
DNEL - Derived No Effect Level
LC50 - Lethal Concentration to 50 % of a test population
LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose)
NOEC - No Observed Effect Concentration
PNEC - Predicted No Effect Concentration
RMM - Risk Management Measure
OEL - Occupational Exposure Limit
PBT - Persistent, Bioaccumulative and Toxic
vPvB - Very Persistent and Very Bioaccumulative
STOT - Specific Target Organ Toxicity
CSA - Chemical Safety Assessment
EN - European Standard
UN - United Nations
ADR - European Agreement concerning the International Carriage of Dangerous Goods by Road
IATA - International Air Transport Association
IMDG - International Maritime Dangerous Goods
RID - Regulations concerning the International Carriage of Dangerous Goods by Rail
WGK - Water Hazard Class

Key literature references and sources for data:
ECHA - Guidance on the compilation of safety data sheets
ECHA - Guidance on the application of the CLP Criteria
ARIEL database

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

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

This Safety Data Sheet has been established in accordance with the applicable European Directives and applies to all countries that have translated the Directives in their national laws. COMMISSION REGULATION (EU) 2015/830 of 28 May 2015 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

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