

SECTION 1: Identification

1.1. Identification

Product form : Substance
 Substance name : Fluorine
 CAS No : 7782-41-4
 Product code : SG-1001-08336
 Formula : F₂

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

Use of the substance/mixture : Laboratory chemicals
 Manufacture of substances

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

Oxidizing gases H270
 Category 1
 Gases under pressure H280
 Compressed gas
 Acute toxicity H330
 (inhalation:gas)
 Category 1
 Skin corrosion/irritation H314
 Category 1A
 Serious eye H318
 damage/eye irritation
 Category 1
 Specific target organ H335
 toxicity (single
 exposure) Category 3

Full text of H statements : see section 16

2.2. Label elements

GHS-US labeling

Hazard pictograms (GHS-US) :



GHS03

GHS04

GHS05

GHS06

Signal word (GHS-US) :

Danger

Hazard statements (GHS-US) :

H270 - May cause or intensify fire; oxidizer
 H280 - Contains gas under pressure; may explode if heated
 H314 - Causes severe skin burns and eye damage
 H318 - Causes serious eye damage
 H330 - Fatal if inhaled
 CGA-HG22 - Corrosive to the respiratory tract
 CGA-HG23 - Extremely reactive

Precautionary statements (GHS-US) :

P202 - Do not handle until all safety precautions have been read and understood
 P220 - Keep/Store away from combustible materials, clothing
 P244 - Keep reduction valves/valves and fittings free from oil and grease
 P260 - Do not breathe gas

Fluorine

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

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
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
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
P370+P376 - In case of fire: Stop leak 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-PG20 - Use only with equipment of compatible materials of construction and rated for cylinder pressure
CGA-PG21 - Open valve slowly
CGA-PG22 - Use only with equipment cleaned for oxygen service
CGA-PG32 - Use only with equipment passivated before use

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
Fluorine (Main constituent)	(CAS No) 7782-41-4	> 99.9	Ox. Gas 1, H270 Compressed gas, H280 Acute Tox. 1 (Inhalation:gas), H330 Skin Corr. 1A, H314 Eye Dam. 1, H318 STOT SE 3, H335

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 : Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before reuse. Get immediate medical advice/attention.

First-aid measures after eye contact : Rinse immediately with plenty of water for 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. Corrosive to the respiratory tract.

Symptoms/injuries after skin contact : Causes severe skin burns and eye damage.

Symptoms/injuries after eye contact : Causes serious eye damage.

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

Symptoms/injuries upon intravenous administration : Not known.

Chronic symptoms : Adverse effects not expected from this product.

Fluorine

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

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 : The product is not flammable.
- Explosion hazard : Product is not explosive. Heat may build pressure, rupturing closed containers, spreading fire and increasing risk of burns and injuries.
- Reactivity : Reacts violently with water. Reacts with water to form corrosive acids.

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.

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.

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.
- 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.
- Hygiene measures : Do not eat, drink or smoke when using this product.

7.2. Conditions for safe storage, including any incompatibilities

- Technical measures : Comply with applicable regulations.
- 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 : Flammable materials. Combustible materials. Reducing agents.

Fluorine

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Fluorine (7782-41-4)		
ACGIH	ACGIH TWA (ppm)	1 ppm
ACGIH	ACGIH STEL (ppm)	2 ppm
OSHA	OSHA PEL (TWA) (mg/m³)	0.2 mg/m³
OSHA	OSHA PEL (TWA) (ppm)	0.1 ppm
IDLH	US IDLH (ppm)	25 ppm
NIOSH	NIOSH REL (TWA) (mg/m³)	0.2 mg/m³
NIOSH	NIOSH REL (TWA) (ppm)	0.1 ppm

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. Wear chemically resistant protective gloves when making or breaking process connections.
Eye protection	: Wear safety glasses with side shields. Wear goggles and a face shield when transfilling or breaking transfer connections. 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. Keep suitable chemically resistant protective clothing readily available for emergency use. 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	: Pale yellow to greenish gas.
Color	: Pale yellow to greenish
Odor	: Pungent.
Odor threshold	: No data available
pH	: If dissolved in water pH-value will be affected.
Melting point	: No data available
Freezing point	: -220 °C
Boiling point	: No data available
Critical temperature	: -129 °C
Critical pressure	: 5172 kPa
Flash point	: Not applicable (non-flammable gas)
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	: Not applicable (non-flammable gas)
Explosive properties	: Not applicable (non-flammable gas).
Oxidizing properties	: May intensify fire; oxidizer.
Vapor pressure	: No data available
Relative density	: No data available

Fluorine

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Relative vapor density at 20 °C	: No data available
Molecular mass	: 38 g/mol
Relative gas density	: Heavier than air
Solubility	: Water: No data available
Log Pow	: Not applicable for inorganic gases.
Auto-ignition temperature	: No data available
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 water. Reacts with water to form corrosive acids.

10.2. Chemical stability

May intensify fire; oxidizer.

10.3. Possibility of hazardous reactions

Violently oxidizes organic material. May react violently with reducing agents. Reacts with water to form corrosive acids.

10.4. Conditions to avoid

Avoid moisture in installation systems.

10.5. Incompatible materials

Moisture. May react violently with alkalis. With water causes rapid corrosion of some metals. Reacts with water to form corrosive acids. May react violently with combustible materials. May react violently with reducing agents.

10.6. Hazardous decomposition products

Under normal conditions of storage and use hazardous decomposition products should not be produced.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Inhalation:gas: Fatal if inhaled.

Fluorine (7782-41-4)	
LC50 inhalation rat (ppm)	92.5 ppm/4h
ATE US (gases)	92.500 ppmV/4h

Skin corrosion/irritation	: Causes severe skin burns and eye damage. pH: If dissolved in water pH-value will be affected.
Serious eye damage/irritation	: Causes serious eye damage. pH: If dissolved in water pH-value will be affected.
Respiratory or skin sensitization	: Not classified
Germ cell mutagenicity	: Not classified
Carcinogenicity	: Not classified
Reproductive toxicity	: Not classified
Specific target organ toxicity (single exposure)	: May cause respiratory irritation.
Specific target organ toxicity (repeated exposure)	: Not classified
Aspiration hazard	: Not classified
Symptoms/injuries after inhalation	: Fatal if inhaled. Corrosive to the respiratory tract.
Symptoms/injuries after skin contact	: Causes severe skin burns and eye damage.
Symptoms/injuries after eye contact	: Causes serious eye damage.
Symptoms/injuries after ingestion	: Ingestion is not considered a potential route of exposure.

Fluorine

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Symptoms/injuries upon intravenous administration : Not known.
Chronic symptoms : Adverse effects not expected from this product.

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : No data available.

12.2. Persistence and degradability

Fluorine (7782-41-4)

Persistence and degradability	Not applicable for inorganic gases.
-------------------------------	-------------------------------------

12.3. Bioaccumulative potential

Fluorine (7782-41-4)

Log Pow	Not applicable for inorganic gases.
Bioaccumulative potential	No data available.

12.4. Mobility in soil

Fluorine (7782-41-4)

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

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 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 : UN1045 Fluorine, compressed, 2.3

UN-No.(DOT) : UN1045

Proper Shipping Name (DOT) : Fluorine, compressed

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

Subsidiary risk (DOT) : 5.1 - Class 5.1 - Oxidizer 49 CFR 173.128, 8 - Class 8 - Corrosive material 49 CFR 173.136

Hazard labels (DOT) : 2.3 - Poison gas
5.1 - Oxidiser
8 - Corrosive



DOT Packaging Non Bulk (49 CFR 173.xxx) : 302

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

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
N86 - UN pressure receptacles made of aluminum alloy are not authorized

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

DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27) : Forbidden

Fluorine

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

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",89 - Segregation same as for oxidizers,90 - Stow "separated from" radioactive materials
Emergency Response Guide (ERG) Number	: 124 (UN1045)
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	: UN1045 FLUORINE, COMPRESSED, 2.3
UN-No. (TDG)	: UN1045
Proper Shipping Name	: FLUORINE, COMPRESSED
TDG Primary Hazard Classes	: 2.3 - Class 2.3 - Toxic Gas.
TDG Subsidiary Classes	: 5.1;8
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)	: UN1045
Proper Shipping Name (IMDG)	: FLUORINE, COMPRESSED
Class (IMDG)	: 2 - Gases

Air transport

UN-No. (IATA)	: Forbidden
---------------	-------------

Fluorine

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

SECTION 15: Regulatory information

15.1. US Federal regulations

Fluorine (7782-41-4)

Listed on the United States TSCA (Toxic Substances Control Act) inventory
Listed on the United States SARA Section 302
Subject to reporting requirements of United States SARA Section 313

SARA Section 302 Threshold Planning Quantity (TPQ)	500
SARA Section 313 - Emission Reporting	1.0 %

15.2. International regulations

CANADA

Fluorine (7782-41-4)

Listed on the Canadian DSL (Domestic Substances List)

WHMIS Classification	Class A - Compressed Gas Class D Division 1 Subdivision A - Very toxic material causing immediate and serious toxic effects Class E - Corrosive Material Class F - Dangerously Reactive Material
----------------------	---

EU-Regulations

Fluorine (7782-41-4)

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

National regulations

Fluorine (7782-41-4)

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 Korean ECL (Existing Chemicals List)
Listed on NZIoC (New Zealand Inventory of Chemicals)
Listed on PICCS (Philippines Inventory of Chemicals and Chemical Substances)
Listed on the Canadian IDL (Ingredient Disclosure List)

15.3. US State regulations

Fluorine (7782-41-4)

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
----------------------------	--

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:

H270	May cause or intensify fire; oxidizer
H280	Contains gas under pressure; may explode if heated
H314	Causes severe skin burns and eye damage
H318	Causes serious eye damage
H330	Fatal if inhaled
H335	May cause respiratory irritation

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.