

Section 1. Chemical product and company identification

| | |
|-------------------------------------|---|
| Product name | : Fluorine |
| Supplier | : AIRGAS INC., on behalf of its subsidiaries 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253 |
| Product use | : Synthetic/Analytical chemistry. |
| Synonym | : |
| MSDS # | : 001061 |
| Date of Preparation/Revision | : 1/13/2012. |
| In case of emergency | : 1-866-734-3438 |

Section 2. Hazards identification

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|---|--|
| Physical state | : Gas. [Compressed gas.] |
| Emergency overview | : DANGER! OXIDIZER. MAY BE FATAL IF INHALED. CAUSES SEVERE RESPIRATORY TRACT, EYE AND SKIN BURNS. MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA. CONTACT WITH COMBUSTIBLE MATERIAL MAY CAUSE FIRE. CONTENTS UNDER PRESSURE. Do not puncture or incinerate container. Do not breathe gas. Do not get on skin or clothing. May cause target organ damage, based on animal data. Use only with adequate ventilation. Keep container closed. Do not get in eyes, on skin or on clothing. Avoid breathing gas. Wash thoroughly after handling. Store in tightly-closed container. Avoid contact with combustible materials. Contact with rapidly expanding gases can cause frostbite. |
| Target organs | : May cause damage to the following organs: kidneys, liver, upper respiratory tract, skin, eye, lens or cornea, testes. |
| Routes of entry | : Inhalation Dermal Eyes |
| Potential acute health effects | |
| Eyes | : Severely corrosive to the eyes. Causes severe burns. Contact with rapidly expanding gas may cause burns or frostbite. |
| Skin | : Severely corrosive to the skin. Causes severe burns. Contact with rapidly expanding gas may cause burns or frostbite. |
| Inhalation | : Very toxic by inhalation. Severely corrosive to the respiratory system. |
| Ingestion | : Ingestion is not a normal route of exposure for gases |
| Potential chronic health effects | |
| Chronic effects | : May cause target organ damage, based on animal data. |
| Target organs | : May cause damage to the following organs: kidneys, liver, upper respiratory tract, skin, eye, lens or cornea, testes. |
| Medical conditions aggravated by over-exposure | : Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product. |

See toxicological information (Section 11)

Section 3. Composition, Information on Ingredients

| <u>Name</u> | <u>CAS number</u> | <u>% Volume</u> | <u>Exposure limits</u> |
|-------------|-------------------|-----------------|---|
| Fluorine | 7782-41-4 | 100 | <p>ACGIH TLV (United States, 2/2010). STEL: 3.1 mg/m³ 15 minute(s). STEL: 2 ppm 15 minute(s). TWA: 1.6 mg/m³ 8 hour(s). TWA: 1 ppm 8 hour(s).</p> <p>NIOSH REL (United States, 6/2009). TWA: 0.2 mg/m³ 10 hour(s). TWA: 0.1 ppm 10 hour(s).</p> <p>OSHA PEL (United States, 6/2010). TWA: 0.2 mg/m³ 8 hour(s). TWA: 0.1 ppm 8 hour(s).</p> <p>OSHA PEL 1989 (United States, 3/1989). TWA: 0.2 mg/m³ 8 hour(s). TWA: 0.1 ppm 8 hour(s).</p> |

Section 4. First aid measures

No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

- Eye contact** : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.
- Skin contact** : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.
- Frostbite** : Try to warm up the frozen tissues and seek medical attention.
- Inhalation** : Call medical doctor or poison control center immediately. Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.
- Ingestion** : As this product is a gas, refer to the inhalation section.

Section 5. Fire-fighting measures

- Flammability of the product** : Non-flammable.
- Products of combustion** : Decomposition products may include the following materials: halogenated compounds
- Fire hazards in the presence of various substances** : Extremely flammable in the presence of the following materials or conditions: reducing materials, combustible materials and organic materials.
- Fire-fighting media and instructions** : Use an extinguishing agent suitable for the surrounding fire.

 Apply water from a safe distance to cool container and protect surrounding area. If involved in fire, shut off flow immediately if it can be done without risk.

 Contains gas under pressure. Contact with combustible material may cause fire. This material increases the risk of fire and may aid combustion. In a fire or if heated, a pressure increase will occur and the container may burst or explode.
- Special protective equipment for fire-fighters** : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

- Personal precautions** : Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (section 8). Eliminate all ignition sources if safe to do so. Do not touch or walk through spilled material. Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.
- Environmental precautions** : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.
- Methods for cleaning up** : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Section 7. Handling and storage

- Handling** : Use only with adequate ventilation. Wash thoroughly after handling. High pressure gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Do not get in eyes, on skin or on clothing. Keep container closed. Do not get on skin or clothing. Store in tightly-closed container. Avoid contact with combustible materials. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.
- Storage** : Keep container tightly closed. Keep container in a cool, well-ventilated area. Separate from acids, alkalis, reducing agents and combustibles. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

- Engineering controls** : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.
- Personal protection**
 - Eyes** : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.
 - Skin** : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
 - Respiratory** : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.
The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93
 - Hands** : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
- Personal protection in case of a large spill** : Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product. Full chemical-resistant suit and self-contained breathing apparatus should be worn only by trained and authorized persons.

Product name

fluorine

ACGIH TLV (United States, 2/2010).

STEL: 3.1 mg/m³ 15 minute(s).

STEL: 2 ppm 15 minute(s).

TWA: 1.6 mg/m³ 8 hour(s).

TWA: 1 ppm 8 hour(s).

NIOSH REL (United States, 6/2009).

TWA: 0.2 mg/m³ 10 hour(s).

TWA: 0.1 ppm 10 hour(s).

OSHA PEL (United States, 6/2010).

TWA: 0.2 mg/m³ 8 hour(s).

TWA: 0.1 ppm 8 hour(s).

OSHA PEL 1989 (United States, 3/1989).

Fluorine

TWA: 0.2 mg/m³ 8 hour(s).
TWA: 0.1 ppm 8 hour(s).

Consult local authorities for acceptable exposure limits.

Section 9. Physical and chemical properties

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|--|------------------------|
| Molecular weight | : 38 g/mole |
| Molecular formula | : F ₂ |
| Boiling/condensation point | : -188°C (-306.4°F) |
| Melting/freezing point | : -219.61°C (-363.3°F) |
| Critical temperature | : -128.5°C (-199.3°F) |
| Vapor density | : 1.312 (Air = 1) |
| Specific Volume (ft³/lb) | : 10.2041 |
| Gas Density (lb/ft³) | : 0.098 |

Section 10. Stability and reactivity

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| Stability and reactivity | : The product is stable. |
| Incompatibility with various substances | : Extremely reactive or incompatible with the following materials: reducing materials, combustible materials, organic materials, metals, alkalis and moisture. |
| Hazardous decomposition products | : Under normal conditions of storage and use, hazardous decomposition products should not be produced. |
| Hazardous polymerization | : Under normal conditions of storage and use, hazardous polymerization will not occur. |

Section 11. Toxicological information

Toxicity data

| Product/ingredient name | Result | Species | Dose | Exposure |
|--------------------------------|-----------------------|----------------|------------------------|-----------------|
| fluorine | LC50 Inhalation Vapor | Rat | 1250 mg/m ³ | 5 minutes |
| | LC50 Inhalation Vapor | Rat | 250 mg/m ³ | 60 minutes |
| | LC50 Inhalation Gas. | Rat | 185 ppm | 1 hours |
| | LC50 Inhalation Gas. | Rat | 185 ppm | 1 hours |
| | LC50 Inhalation Gas. | Mouse | 150 ppm | 1 hours |

IDLH : 25 ppm

Chronic effects on humans : May cause damage to the following organs: kidneys, liver, upper respiratory tract, skin, eye, lens or cornea, testes.

Other toxic effects on humans : Extremely hazardous by the following route of exposure: of skin contact (corrosive), of eye contact (corrosive), of inhalation (lung corrosive).

Specific effects

| | |
|------------------------------|---|
| Carcinogenic effects | : No known significant effects or critical hazards. |
| Mutagenic effects | : No known significant effects or critical hazards. |
| Reproduction toxicity | : No known significant effects or critical hazards. |

Section 12. Ecological information

Aquatic ecotoxicity

| Product/ingredient name | Test | Result | Species | Exposure |
|--------------------------------|-------------|---------------------------------------|---|-----------------|
| fluorine | - | Acute EC50 >60000 ug/L Fresh water | Aquatic plants - Duckweed - Lemna minor | 4 days |

Environmental fate : Not available.

Environmental hazards : No known significant effects or critical hazards.

Fluorine

Toxicity to the environment : Not available.

Section 13. Disposal considerations

Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, local regulation. Return cylinders with residual product to Airgas, Inc. Do not dispose of locally.

Section 14. Transport information

| Regulatory information | UN number | Proper shipping name | Class | Packing group | Label | Additional information |
|---------------------------|-----------|----------------------|-------|-----------------------|---|---|
| DOT Classification | UN1045 | FLUORINE, COMPRESSED | 2.3 | Not applicable (gas). |    | <p>Inhalation hazard zone A</p> <p>Reportable quantity 10 lbs. (4.54 kg)</p> <p>Limited quantity Yes.</p> <p>Packaging instruction Passenger aircraft Quantity limitation: Forbidden.</p> <p>Cargo aircraft Quantity limitation: Forbidden.</p> <p>Special provisions 1</p> |
| TDG Classification | UN1045 | FLUORINE, COMPRESSED | 2.3 | Not applicable (gas). |    | <p>Explosive Limit and Limited Quantity Index 0</p> <p>ERAP Index 25</p> <p>Passenger Carrying Ship Index Forbidden</p> <p>Passenger Carrying Road or Rail Index Forbidden</p> <p>Special provisions</p> |

| Fluorine | | | | | | |
|------------------------------|--------|----------------------|-----|-----------------------|---|----|
| | | | | | | 38 |
| Mexico Classification | UN1045 | FLUORINE, COMPRESSED | 2.3 | Not applicable (gas). |    | - |

“Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product.”

Section 15. Regulatory information

United States

- U.S. Federal regulations** : TSCA 8(a) IUR: Not determined
United States inventory (TSCA 8b): This material is listed or exempted.
SARA 302/304/311/312 extremely hazardous substances: fluorine
SARA 302/304 emergency planning and notification: fluorine
SARA 302/304/311/312 hazardous chemicals: fluorine
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: fluorine: Fire hazard, reactive, Sudden release of pressure, Immediate (acute) health hazard
Clean Air Act (CAA) 112 accidental release prevention - Toxic Substances: Fluorine
Clean Air Act (CAA) 112 regulated toxic substances: fluorine

SARA 313

| | <u>Product name</u> | <u>CAS number</u> | <u>Concentration</u> |
|--|---------------------|-------------------|----------------------|
| Form R - Reporting requirements | : Fluorine | 7782-41-4 | 100 |
| Supplier notification | : Fluorine | 7782-41-4 | 100 |

SARA 313 notifications must not be detached from the MSDS and any copying and redistribution of the MSDS shall include copying and redistribution of the notice attached to copies of the MSDS subsequently redistributed.

- State regulations** :
- Connecticut Carcinogen Reporting**: This material is not listed.
 - Connecticut Hazardous Material Survey**: This material is not listed.
 - Florida substances**: This material is not listed.
 - Illinois Chemical Safety Act**: This material is not listed.
 - Illinois Toxic Substances Disclosure to Employee Act**: This material is not listed.
 - Louisiana Reporting**: This material is not listed.
 - Louisiana Spill**: This material is not listed.
 - Massachusetts Spill**: This material is not listed.
 - Massachusetts Substances**: This material is listed.
 - Michigan Critical Material**: This material is not listed.
 - Minnesota Hazardous Substances**: This material is not listed.
 - New Jersey Hazardous Substances**: This material is listed.
 - New Jersey Spill**: This material is not listed.
 - New Jersey Toxic Catastrophe Prevention Act**: This material is listed.
 - New York Acutely Hazardous Substances**: This material is listed.
 - New York Toxic Chemical Release Reporting**: This material is not listed.
 - Pennsylvania RTK Hazardous Substances**: This material is listed.
 - Rhode Island Hazardous Substances**: This material is not listed.

Canada

Fluorine

- WHMIS (Canada)** : Class A: Compressed gas.
Class D-1A: Material causing immediate and serious toxic effects (Very toxic).
Class E: Corrosive material
Class F: Dangerously reactive material.
- CEPA Toxic substances:** This material is not listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

United States

- Label requirements** : OXIDIZER.
MAY BE FATAL IF INHALED.
CAUSES SEVERE RESPIRATORY TRACT, EYE AND SKIN BURNS.
MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.
CONTACT WITH COMBUSTIBLE MATERIAL MAY CAUSE FIRE.
CONTENTS UNDER PRESSURE.

Canada

- Label requirements** : Class A: Compressed gas.
Class D-1A: Material causing immediate and serious toxic effects (Very toxic).
Class E: Corrosive material
Class F: Dangerously reactive material.

Hazardous Material Information System (U.S.A.)

| | | |
|------------------|---|---|
| Health | * | 4 |
| Flammability | | 0 |
| Physical hazards | | 4 |
| | | |

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



Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.