

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: Fluorine: Compressed **CHEMICAL FORMULA:** F₂ **PRODUCT CODE:**

COMPANY NAME:

PELCHEM: The Chemical Division of NECSA

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2. COMPOSITION/INFORMATION ON INGREDIENTS

CHEMICAL NAME OF SUBSTANCE: **CONCENTRATION:**

SYNONYMS:

Diatomic fluorine, Difluorine

CONCENTRATION: 100% **UN No:** 1045 **CAS-No:** 7782-41-4

3. HAZARDS IDENTIFICATIONS

EMERGENCY OVERVIEW

Pale yellow gas with pungent odor. Potentially fatal if inhaled, respiratory tract burns, skin burns, and eye burns. May explode on contact with water. Strong oxidizer. May ignite or explode on contact with combustible materials. Containers may rupture or explode if exposed to heat. May react on contact with water. Releases toxic, corrosive, flammable or explosive gases.

4. FIRST AID MEASURES

CARCINOGEN STATUS:

OSHA: N

NTP: N

IARC: N

INHALATION:

Burns, chest pain, bluish skin color, lung congestion, convulsions, and death. Long term exposure may result in tooth discoloration, kidney damage, and liver damage.

When safe to enter area, remove from exposure. Use a bag valve mask or similar device to perform artificial respiration (rescue breathing) if needed. Keep warm and at rest. Get medical attention immediately.

SKIN CONTACT:

Burns. Remove contaminated clothing, jewelry, and shoes immediately. Wash with soap or mild detergent and large amounts of water until no evidence of chemical remains (at

least 15-20 minutes). For burns, cover affected area securely with sterile, dry, loose-fitting dressing. Get medical attention.

EYE CONTACT:

Burns. Wash eyes immediately with large amounts of water, occasionally lifting upper and lower lids, until no evidence of chemical remains. Continue irrigating with normal saline until ready to transport to hospital. Cover with sterile bandages. Get medical attention immediately.

INGESTION:

It is unlikely that emergency treatment will be required. Get medical attention, if needed.

NOTE TO PHYSICIAN:

For inhalation, consider oxygen. For skin contact, consider magnesium oxide/water/glycerin paste; calcium gluconate gel.

5. FIRE-FIGHTING MEASURES

FIRE AND EXPLOSION HAZARD:

Negligible fire hazard. Oxidizer. May ignite or explode on contact with combustible materials. Containers may rupture or explode if exposed to heat.

EXTINGUISHING MEDIA:

Water. Do not use dry chemicals, carbon dioxide or halogenated extinguishing agents. Flood large fires with fine water spray.

FIREFIGHTING:

Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. For small fires, contain and let burn.

6. ACCIDENTAL RELEASE MEASURES

ACCIDENTAL SPILL:

Stop leak if possible without personal risk. Avoid contact with combustible materials. Keep unnecessary people away, isolate hazard area and deny entry. Ventilate closed spaces before entering. Notify Local Emergency Center.

7. HANDLING AND STORAGE

Store and handle in accordance with all current regulations and standards. Subject to storage regulations. Protect from physical damage. Keep separated from incompatible substances. Avoid heat, flames, sparks and other sources of ignition.

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

EXPOSURE LIMITS:

FLUORINE:

OSHA 0.1 ppm (0.2 mg/m³)

TWA 1 ppm (2 mg/m³)

ACGIH TWA 2 ppm (4 mg/m³)

ACGIH STEL 0.1 ppm (0.2 mg/m³)

NIOSH recommended TWA 10hour(s) 0.2 mg/m³ (0.1 ml/m³)

VENTILATION:

Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

EYE PROTECTION:

Wear splash resistant safety goggles with a face shield. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING:

Wear appropriate chemical resistant clothing.

GLOVES:

Wear appropriate chemical resistant gloves.

RESPIRATOR:

The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.

1 ppm Any supplied-air respirator.

2.5 ppm Any supplied-air respirator.

5 ppm Any self-contained breathing apparatus with a full-face piece. Any supplied-air respirator with a full-face piece.

25 ppm Any supplied-air respirator with a full face piece that is operated in a pressure-demand or other positive-pressure mode.

Escape - Any air-purifying respirator with a full-face piece and a canister providing protection against this substance. Only non-oxidisable sorbents are allowed (not charcoal). Any appropriate escape-type, self-contained breathing apparatus.

For Unknown Concentrations or Immediately Dangerous to Life or Health - Any supplied-air respirator with full face piece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply. Any self-contained breathing apparatus with a full-face piece.

9. PHYSICAL AND CHEMICAL PROPERTIES

FORM:

Gas

MOLECULAR FORMULA

F₂

BOILING POINT @ 1

ATM:

-188.2°C

ODOUR:

Strong, sharp penetrating ozone-like odour

ODOUR THRESHOLD:

20 ppb

MOLECULAR WEIGHT:

37.997 kg/kmole

MELTING POINT:

-364°F (-220°C)

VAPOUR DENSITY:

1312

Physical state:

Gas: above -188.2°C

Liquid: -188°C to -220°C

Solid: below -220°C

COLOUR:

Gas: Pale yellow (fuming in air)

Liquid: Yellowish orange

Solid: Yellow

VAPOUR PRESSURE:

1219 mmHg @ -189°C

WATER SOLUBILITY:

reacts

Specific gravity of Gas:

21.1°C and 1 ATM 1.3.12

Specific volume of Gas:

21.1°C and 1 ATM 0.635

Density of Gas: 0°C and 1 ATM 1.70 kg/m ³ 21.1°C and 1 ATM 1.57 kg/m ³	Density of liquid: -188.2°C 1509 kg/m ³ -195.8°C 1586 kg/m ³	Critical temperature (Tc): -128.2°C
Critical pressure (Cp): 5215 kPa(a)	Critical Density: 573.6 kg/m ³ Thermal conductivity of Gas: 0.248 W/m.K	Latent heat of vaporization: 173.5 kJ/kg Heat capacity of Gas (Cp): 0°C 0.828 kJ/kg °C 21.1°C 0.828 kJ/kg °C
Latent Heat of Fusion: 13.4 kJ/kg Heat capacity of Gas (Cv): 21.1°C 0.610 kJ/kg °C	Ratio of specific heats (Cp/Cv): 1.353	Viscosity of Gas at 1 ATM and: 0°C 0.0218 mPa.sec -192.2°C 0.257 mPa.sec

10. STABILITY AND REACTIVITY

REACTIVITY:

May react with evolution of heat on contact with water. Releases toxic, corrosive, flammable or explosive gases. May explode on contact with water.

CONDITIONS TO AVOID:

Avoid contact with combustible materials. Minimize contact with material. Avoid inhalation of material or combustion by-products. Keep out of water supplies and sewers.

INCOMPATIBILITIES:

combustible materials, metal oxides, bases, metal salts, peroxides, halogens, halo carbons, acids, metal carbide, metals, oxidizing materials, reducing agents

FLUORINE:

ACETONITRILE + CHLORINE FLUORIDE: May explode at greatly reduced temperatures

ACETYLENE: Violent reaction

ALCOHOLS: Possible ignition on contact

ALDEHYDES: Possible ignition on contact

ALKALI OXIDES: Fire and explosion hazards

ALKANES + OXYGEN: Form explosive peroxides

AMMONIA: Ignition and possible explosion

BORON NITRIDE: Incandescent reaction

CALCIUM DISILICIDE: Ignites on contact

CERAMIC MATERIALS: May ignite

CESIUM HEPTAFLUOROPROPEROXIDE: Possible violent explosion

COMBUSTIBLE MATERIALS: Ignition and possible violent explosion

COVALENT HALIDES: Ignition

CYANOQUANIDINE: Forms explosive products

FLUOROCARBOXYLIC ACIDS + CESIUM FLUORIDE: Possible explosive reaction

1-OR 2-FLUORIMINOPERFLUOROPROPANE: Explosive reaction

GRAPHITE: Possible explosive reaction

HALOCARBONS: Violent or explosive reaction

HALOGENS: Ignites on contact

HEXALITHIUM DISILICIDE: Incandescens when warmed
HYDROCARBONS: Ignites on contact
HYDROGEN: Violent explosive reaction
HYDROGEN HALIDES: Ignites on contact
KETONES: Possible ignition on contact
METAL ACETYLIDES: Ignite on contact
METAL BORIDES: Incandescent reaction
METAL CYANOCOMPLEXES: Incandescent reaction
METAL HYDRIDES: Ignites on contact
METAL IODIDES: Decomposition reaction, with subsequent ignition
METAL OXIDES: Incandescent reaction
METAL SALTS: Ignition and possible formation of explosive products
METALS: Ignites on contact
NITRIC ACID: Explodes on contact
NITROGENOUS BASES: Incandescent reaction
NON-METAL OXIDES: Possible explosion or ignition on contact
NON-METALS: Ignites on contact
ORGANIC ACIDS: Possible ignition
PERCHLORIC ACID + CHLORATES: Form explosive fluorine perchlorate
POLYMERIC MATERIALS: Ignition or possible violent reaction
STAINLESS STEEL: Explosive reaction
SULFIDES: Ignition and possible violent reaction
TEFLON: Possible ignition
TRINITROMETHANE: Possible dangerous reaction

HAZARDOUS DECOMPOSITION:

Thermal decomposition products: halogenated compounds

POLYMERIZATION:

Will not polymerize.

11. TOXICOLOGICAL INFORMATION

IRRITATION DATA:

25 ppm/5 minute(s) eyes-human mild; 140 ppm/30 minute(s) eyes-rat; 467 ppm/5 minute(s) eyes-mouse; 68 ppm/1 hour(s) eyes-dog

TOXICITY DATA:

185 ppm/1 hour(s) inhalation-rat LC50; 150 ppm/1 hour(s) inhalation-mouse LC50; >93 ppm/1 hour(s) inhalation-dog LC; 270 ppm/30 minute(s) inhalation-rabbit LC50; 170 ppm/1 hour(s) inhalation-guinea pig LC50

LOCAL EFFECTS:

Corrosive: inhalation, skin, eye

ACUTE TOXICITY LEVEL:

Highly Toxic: inhalation

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:

respiratory disorders

HEALTH EFFECTS:

INHALATION:

ACUTE EXPOSURE:

FLUORINE: When in contact with water, hydrofluoric acid is formed. May be extremely irritating to nose, throat, and respiratory tract. Exposure to 25 ppm for 5 minutes has been reported to be fatal in man. Momentary exposure to 50 ppm was intolerable to man; 25 ppm was tolerated briefly but subjects developed sore throat and chest pain that persisted for 6 hours. Exposure to high levels may cause coughing, choking and chills lasting 1-2 hours after exposure. After an asymptomatic period of 1-2 days, fever, cough, tightness in the chest, rales and cyanosis may indicate pulmonary edema. Flooding amounts may cause asphyxia due to laryngeal and bronchiole spasms and later by bronchiole obstruction. High concentrations may also cause gastroenteric disturbances. These symptoms may progress for 1-2 days and then regress slowly over a period of 10-30 days. Other reported symptoms may include loss of appetite, reduced body weight, muscular weakness, clonic convulsions, and respiratory and cardiac failure. In severe cases, death may occur due to respiratory damage. Animal experimentation resulted in liver and kidney damage. Exposure to 25/m³ caused testicular degeneration in rats.

CHRONIC EXPOSURE:

FLUORINE: Repeated and prolonged exposure to low concentrations of fluorine may cause nosebleeds and sinus trouble. Repeated exposure to more than 6 mg of fluorine per day may result in fluorosis. Symptoms may include weight loss, brittles of bones, anemia, weakness, general ill health, stiffness of the joints and discoloration of the teeth when exposure occurs during tooth formation. Repeated short-term exposures to laboratory animals at levels of 55 to 75 ppm showed no, or very slight effects in the lungs, liver and kidneys.

SKIN CONTACT:

ACUTE EXPOSURE:

FLUORINE: In contact with moisture or water, hydrofluoric acid is formed which may cause severe skin burns and ulceration. Direct exposure can cause severe burns in 0.2 seconds, and an exposure for as long as 0.6 seconds can result in thermal flash burns comparable with those produced by an oxyacetylene flame. May be absorbed through the skin and cause systemic toxicity.

CHRONIC EXPOSURE:

FLUORINE: Repeated and prolonged contact with corrosive substances may result in dermatitis or effects similar to acute exposure.

EYE CONTACT:

ACUTE EXPOSURE:

FLUORINE: In contact with moisture or water, hydrofluoric acid is formed which may cause severe irritation with corneal and conjunctival burns with possible blindness. Contact with low concentration vapors, 5 ppm, may cause irritation.

CHRONIC EXPOSURE:

FLUORINE: Repeated or prolonged contact with corrosive substances may result in conjunctivitis or effects as in acute exposure.

INGESTION:

ACUTE EXPOSURE:

FLUORINE: Ingestion of a gas is unlikely.

CHRONIC EXPOSURE:

FLUORINE: No data available.

12. ECOLOGICAL INFORMATION:

ECOTOXICITY:

PHYTOTOXICITY:

>60000 ug/L 4 week(s) EC50 (Growth) Duckweed (Lemna minor)

13. DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable regulations.

14. TRANSPORT INFORMATION

UN NO: 1045 ADR/RID:	HAZARD CLASS: Class: 2.3; 5.1; 8 Labels: Toxic gas Subrisk: Oxidizer; Corrosive	LABELLING: CORRECT TECHNICAL NAME: Fluorine , compressed, N.O.S
IMDG:	Class: 2.3; 5.1; 8 Labels: Toxic gas Subrisk: Oxidizer; Corrosive	CORRECT TECHNICAL NAME: Fluorine , compressed, N.O.S
IATA: Passenger aircraft or railcar: Forbidden Cargo Aircraft only:: Forbidden	Class: 2.3; 5.1; 8 Labels: Toxic gas Subrisk: Oxidizer; Corrosive	Passenger aircraft or railcar: Forbidden Cargo Aircraft only:: Forbidden

15. REGULATORY INFORMATION

APPLICABLE REGULATIONS:

Refer to country of destination.

SAFETY AND RISK PHRASES:

Refer to country of destination.

16. OTHER INFORMATION

No other information is currently available for this record

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