ionz

SAFETY DATA SHEET

Updated on 20/07/2024

1. Material Identification

Product Name : Hydrogen fluoride (anhydrous)
Catalog Number : io-2515
CAS Number : 7664-39-3
Identified uses : Laboratory chemicals, manufacture of chemical compounds
Company : Ionz

>> R&D Use only

2. Hazards Identification

GHS Classification:

Flammable liquid (category 2)
Acute toxicity, oral (Category 3)
Acute toxicity, dermal (Category 3)
Acute toxicity, inhalation (Category 3)
Specific target organ toxicity, single exposure (Category 1)

Pictogram(s)

GHS Hazard Statements

>> H300 (99.9%): Fatal if swallowed [Danger Acute toxicity, oral]

>> H310 (99.9%): Fatal in contact with skin [Danger Acute toxicity, dermal]

>> H314 (100%): Causes severe skin burns and eye damage [Danger Skin corrosion/irritation]

>> H318 (17.94%): Causes serious eye damage [Danger Serious eye damage/eye irritation]

>> H330 (99.9%): Fatal if inhaled [Danger Acute toxicity, inhalation]

Precautionary Statement Codes

>> P260, P262, P264, P264+P265, P270, P271, P280, P284, P301+P316, P301+P330+P331, P302+P352, P302+P361+P354, P304+P340, P305+P354+P338, P316, P317, P320, P321, P330, P361+P364, P363, P403+P233, P405, and P501

NFPA 704 Diamond

NFPA Health Rating

>> 4 - Materials that, under emergency conditions, can be lethal.

NFPA Fire Rating

>> 0 - Materials that will not burn under typical fire conditions, including intrinsically noncombustible materials such as concrete, stone, and sand.

NFPA Instability Rating

>> 1 - Materials that in themselves are normally stable but that can become unstable at elevated temperatures and pressures.

Health Hazards:

>> Ingestion of an estimated 1.5 grams produced sudden death without gross pathological damage. Repeated ingestion of small amounts resulted in moderately advanced hardening of the bones. Contact of skin with anhydrous liquid produces severe burns. Inhalation of anhydrous hydrogen fluoride or hydrogen fluoride mist or vapors can cause severe respiratory tract irritation that may be fatal. (EPA, 1998)

ERG 2024, Guide 157 (Hydrofluoric acid)

>> TOXIC and/or CORROSIVE; inhalation, ingestion or contact (skin, eyes) with vapors, dusts or substance may cause severe injury, burns or death.

>> Reaction with water or moist air may release toxic, corrosive or flammable gases.

>> Reaction with water may generate much heat that will increase the concentration of fumes in the air.

>> Fire will produce irritating, corrosive and/or toxic gases.

>> Runoff from fire control or dilution water may be corrosive and/or toxic and cause environmental contamination.

ERG 2024, Guide 125 (Hydrogen fluoride, anhydrous)

>> TOXIC and/or CORROSIVE; may be fatal if inhaled, ingested or absorbed through skin.

>> Vapors are extremely irritating and corrosive.

>> Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.

>> Fire will produce irritating, corrosive and/or toxic gases.

>> Runoff from fire control or dilution water may cause environmental contamination.

>> When heated, it emits highly corrosive fumes of fluorides. Its corrosive action on metals can result in formation of hydrogen in containers and piping to create fire hazard. Toxic and irritating vapors are generated when heated. Will attack glass, concrete, and certain metals, especially those containing silica, such as cast iron. Will attack natural rubber, leather, and many organic materials. May generate flammable hydrogen gas in contact with some metals. (EPA, 1998)

ERG 2024, Guide 157 (Hydrofluoric acid)

>> Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes.

>> UN1802, UN2032, UN3084, UN3093, UN1796 (above 50%), UN1826 (above 50%), and UN2031 (above 65%) may act as oxidizers. Also consult GUIDE 140.

>> Vapors may accumulate in confined areas (basement, tanks, hopper/tank cars, etc.).

>> Substance may react with water (some violently), releasing corrosive and/or toxic gases and runoff.

>> Corrosives in contact with metals may evolve flammable hydrogen gas.

>> Containers may explode when heated or if contaminated with water.

ERG 2024, Guide 125 (Hydrogen fluoride, anhydrous)

>> Some may burn but none ignite readily.

>> Vapors from liquefied gas are initially heavier than air and spread along ground.

>> Some of these materials may react violently with water.

>> Cylinders exposed to fire may vent and release toxic and/or corrosive gas through pressure relief devices.

>> Containers may explode when heated.

>> Ruptured cylinders may rocket.

>> For UN1005: Anhydrous ammonia, at high concentrations in confined spaces, presents a flammability risk if a source of ignition is introduced.

>> Not combustible. Many reactions may cause fire or explosion. Risk of fire and explosion on contact with incompatible substances. See Chemical Dangers.

Hazards Identification

ERG Hazard Classes

>> Toxic/poison by inhalation (TIH/PIH)

3. Composition/Information On Ingredients

Chemical name : Hydrogen fluoride (anhydrous)
CAS Number : 7664-39-3
Molecular Formula : FH
Molecular Weight : 20.0064 g/mol

4. First Aid Measures

First Aid:

>> Warning: Hydrogen fluoride is highly corrosive. Effects may be delayed from 1 to 24 hours. Caution is advised.

>> Signs and Symptoms of Acute Hydrogen Fluoride Exposure: Acute exposure to hydrogen fluoride will result in irritation, burns, ulcerous lesions, and necrosis of the eyes, skin, and mucous membranes. Total destruction of the eyes is possible. Other effects include nausea, vomiting, diarrhea, pneumonitis (inflammation of the lungs), and circulatory collapse.

>> Emergency Life-Support Procedures: Acute exposure to hydrogen fluoride may require decontamination and life support for the victims. Emergency personnel should wear protective clothing appropriate to the type and degree of contamination. Air-purifying or supplied-air respiratory equipment should also be worn, as necessary. Rescue vehicles should carry supplies such as hydrogen fluoride-resistant plastic sheeting and disposable plastic bags to assist in preventing spread of contamination.

>> Inhalation Exposure:

>> 1. Move victims to fresh air. Emergency personnel should avoid self-exposure to hydrogen fluoride.

>> 2. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or other respiratory support. Humidified oxygen is preferred.

>> 3. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures.

>> 4. Transport to a health care facility.

>> Dermal/Eye Exposure:

>> 1. Remove victims from exposure. Emergency personnel should avoid self- exposure to hydrogen fluoride.

>> 3. Remove contaminated clothing as soon as possible.

>> 4. If eye exposure has occurred, eyes must be flushed with lukewarm water for at least 15 minutes.

>> 5. Wash exposed skin areas three times with soap and water.

>> 6. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures.

>> 7. Transport to a health care facility.

>> Ingestion Exposure:

>> 1. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or other respiratory support. Humidified oxygen is preferred.

>> 2. IMMEDIATELY give the victims milk or water to dilute the hydrofluoric acid: children up to 1 year old, 125 mL (4 oz or 1/2 cup); children 1 to 12 years old, 200 mL (6 oz or 3/4 cup); adults, 250 mL (8 oz or 1 cup). Milk or water should be given only if victims are conscious and alert.

>> 3. DO NOT induce vomiting.

>> 4. Milk of Magnesia should be administered if victims are conscious and alert. Use

>> 2.5 mL (1/2 tsp) for children up to 1 year old, 5 mL (1 tsp) for children 1 to 12 years old, and 10 mL (2 tsp) for adults. Do not exceed 15 mL (3 tsp or 1 tbsp).

>> 5. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures.

>> 6. Activated charcoal is of no value.

>> 7. Repeat the administration of water or milk to conscious and alert victims. Use quantities listed above (see No. 2).

>> 8. Transport to a health care facility. (EPA, 1998)

ERG 2024, Guide 157 (Hydrofluoric acid)

>> General First Aid:

>> Call 911 or emergency medical service.

>> Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and avoid contamination.

>> Move victim to fresh air if it can be done safely.

>> Administer oxygen if breathing is difficult.

>> If victim is not breathing:

>> DO NOT perform mouth-to-mouth resuscitation; the victim may have ingestedor inhaled the substance.

>> If equipped and pulse detected, wash face and mouth, then give artificial respiration using a proper respiratory medical device (bag-valve mask, pocket mask equipped with a one-way valve or other device).

>> If no pulse detected or no respiratory medical device available, provide continuouscompressions. Conduct a pulse check every two minutes or monitor for any signs of spontaneous respirations.

>> Remove and isolate contaminated clothing and shoes.

>> For minor skin contact, avoid spreading material on unaffected skin.

>> In case of contact with substance, remove immediately by flushing skin or eyes with running water for at least 20 minutes.

>> For severe burns, immediate medical attention is required.

>> Effects of exposure (inhalation, ingestion, or skin contact) to substance may be delayed.

>> Keep victim calm and warm.

>> Keep victim under observation.

>> For further assistance, contact your local Poison Control Center.

>> Note: Basic Life Support (BLS) and Advanced Life Support (ALS) should be done by trained professionals.

>> Specific First Aid:

>> For corrosives, in case of contact, immediately flush skin or eyes with running water for at least 30 minutes. Additional flushing may be required.

>> In case of skin contact with Hydrofluoric acid (UN1790), if calcium gluconate gel is available, rinse 5 minutes, then apply gel. Otherwise, continue rinsing until medical treatment is available.

>> In Canada, an Emergency Response Assistance Plan (ERAP) may be required for this product. Please consult the shipping paper and/or the "ERAP" section.

ERG 2024, Guide 125 (Hydrogen fluoride, anhydrous)

>> General First Aid:

>> Call 911 or emergency medical service.

>> Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and avoid contamination.

>> Move victim to fresh air if it can be done safely.

>> Administer oxygen if breathing is difficult.

>> If victim is not breathing:

>> DO NOT perform mouth-to-mouth resuscitation; the victim may have ingestedor inhaled the substance.

>> If equipped and pulse detected, wash face and mouth, then give artificial respiration using a proper respiratory medical device (bag-valve mask, pocket mask equipped with a one-way valve or other device).

>> If no pulse detected or no respiratory medical device available, provide continuouscompressions. Conduct a pulse check every two minutes or monitor for any signs of spontaneous respirations.

>> Remove and isolate contaminated clothing and shoes.

>> For minor skin contact, avoid spreading material on unaffected skin.

>> In case of contact with substance, remove immediately by flushing skin or eyes with running water for at least 20 minutes.

>> For severe burns, immediate medical attention is required.

>> Effects of exposure (inhalation, ingestion, or skin contact) to substance may be delayed.

>> Keep victim calm and warm.

>> Keep victim under observation.

>> For further assistance, contact your local Poison Control Center.

>> Note: Basic Life Support (BLS) and Advanced Life Support (ALS) should be done by trained professionals.

>> Specific First Aid:

>> In case of contact with liquefied gas, only medical personnel should attempt thawing frosted parts.

>> In case of skin contact with hydrogen fluoride, anhydrous (UN1052), if calcium gluconate gel is available, rinse 5 minutes, then apply gel. Otherwise, continue rinsing until medical treatment is available.

>> In Canada, an Emergency Response Assistance Plan (ERAP) may be required for this product. Please consult the shipping paper and/or the "ERAP" section.

First Aid Measures

Inhalation First Aid

>> Fresh air, rest. Half-upright position. Artificial respiration may be needed. Refer immediately for medical attention.

Skin First Aid

>> Wear protective gloves when administering first aid. Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer immediately for medical attention.

Eye First Aid

>> Rinse with plenty of water (remove contact lenses if easily possible). Refer immediately for medical attention.

Ingestion First Aid

>> Rinse mouth. Give nothing to drink. Do NOT induce vomiting. Refer immediately for medical attention.

5. Fire Fighting Measures

>> Hazardous decomposition products formed under fire conditions. - Hydrogen fluoride

>> Use water on fires in which hydrofluoric acid is involved. (EPA, 1998)

>> In case of fire in the surroundings, use appropriate extinguishing media. In case of fire: keep cylinder cool by spraying with water. Combat fire from a sheltered position.

>> UN 1052, anhydrous hydrogen (HF), may burn, but it does not ignite readily.

>> Fire will produce irritating, corrosive, and/or toxic gases.

>> For small fires involving UN 1052, use dry chemical or carbon dioxide.

>> For large fires involving UN 1052, use water spray, fog, or regular foam. Move containers from the fire area if it is possible to do so without risk to personnel. Do not get water inside containers. Damaged cylinders should be handled only by specialists.

>> For fire involving tanks of UN 1052, fight the fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of water until well after the fire is out. Do not direct water at the source of the leak or at safety devices; icing may occur. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tanks. Always stay away from tanks engulfed in fire.

>> Note: Most foams will react with UN 1790 and release corrosive/toxic gases.

>> For small fires involving UN 1790, hydrofluoric acid (HF), use carbon dioxide, dry chemical, dry sand, or alcohol-resistant foam.

>> For large fires involving UN 1790, use water spray, fog, or alcohol-resistant foam. Move containers from the fire area if it is possible to do so without risk to personnel. Use water spray or fog; do not use straight streams. Dike fire control water for later disposal; do not scatter the material.

>> For fire involving tanks or car/trailer loads of UN 1790, fight the fire from maximum distance or use unmanned hose holders or monitor nozzles. Do not get water inside containers. Cool containers with flooding quantities of water until well after the fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tanks. Always stay away from tanks engulfed in fire.

>> Run-off from fire control or dilution water may be corrosive and/or toxic, and it may cause pollution.

>> If the situation allows, control and properly dispose of run-off (effluent).

6. Accidental Release Measures

Isolation and Evacuation:

Isolation and evacuation measures to take when a large amount of this chemical is accidentally released in an emergency.

>> Excerpt from ERG Guide 125 [Gases - Toxic and/or Corrosive]:

>> IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area for at least 100 meters (330 feet) in all directions.

>> SPILL: See ERG Tables 1 and 3 - Initial Isolation and Protective Action Distances on the UN/NA 1052 datasheet.

>> FIRE: If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions. (ERG, 2024)

Evacuation: ERG 2024, Guide 157 (Hydrofluoric acid)

>> Immediate precautionary measure

>> Isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.

>> Spill

>> For non-highlighted materials: increase the immediate precautionary measure distance, in the downwind direction, as necessary.

>> Fire

>> If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

Evacuation: ERG 2024, Guide 125 (Hydrogen fluoride, anhydrous)

>> Immediate precautionary measure

>> Isolate spill or leak area for at least 100 meters (330 feet) in all directions.

>> Spill

>> For non-highlighted materials: increase the immediate precautionary measure distance, in the downwind direction, as necessary.

>> Fire

>> If tank, rail tank car or highway tank is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions.

Isolation

>> Small spill:

>> ISOLATE in all directions: 30 m (100 ft)

>> Large spill:

>> ISOLATE in all Directions:

>> Rail tank car: 500 m (1500 ft)

>> Highway tank truck or trailer: 200 m (700 ft)

>> Multiple small cylinders or single ton cylinder: 100 m (300 ft)

Protection

>> Small spill:

>> PROTECT people from downwind during DAY time: 0.1 km (0.1 mi)

>> PROTECT people from downwind during NIGHT time: 0.5 km (0.3 mi)

>> Large spill:

>> PROTECT people from downwind during DAY time:

>> Rail tank car:

>> - - Low wind (< 6 mph (<10 km/h)): 3.4 km (2.1 mi)

>> - - Moderate wind (6-12 mph (10-20 km/h)): 2.1 km (1.3 mi)

>> - - High wind (> 12 mph (>20 km/h)): 1.8 km (1.1 mi)

>> Highway tank truck or trailer:

>> - - Low wind (< 6 mph (<10 km/h)): 2.0 km (1.2 mi)

>> - - Moderate wind (6-12 mph (10-20 km/h)): 1.0 km (0.7 mi)

>> - - High wind (> 12 mph (>20 km/h)): 0.9 km (0.6 mi)

>> Multiple small cylinders or single ton cylinder:

>> - - Low wind (< 6 mph (<10 km/h)): 0.8 km (0.5 mi)

>> - - Moderate wind (6-12 mph (10-20 km/h)): 0.4 km (0.2 mi)

>> - - High wind (> 12 mph (>20 km/h)): 0.3 km (0.2 mi)

>> PROTECT people from downwind during NIGHT time:

>> - - Low wind (< 6 mph (<10 km/h)): 6.4 km (4.0 mi)

>> - - Moderate wind (6-12 mph (10-20 km/h)): 3.0 km (1.9 mi)

>> - - High wind (> 12 mph (>20 km/h)): 1.9 km (1.2 mi)

>> - - Low wind (< 6 mph (<10 km/h)): 3.6 km (2.3 mi)

>> - - Moderate wind (6-12 mph (10-20 km/h)): 1.5 km (1.0 mi)

>> - - Low wind (< 6 mph (<10 km/h)): 1.7 km (1.1 mi)

>> - - Moderate wind (6-12 mph (10-20 km/h)): 0.5 km (0.3 mi)

Spillage Disposal:

Methods for containment and safety measures to protect workers dealing with a spillage of this chemical.

>> Evacuate danger area! Consult an expert! Personal protection: gas-tight chemical protection suit including self-contained breathing apparatus. Do NOT let this chemical enter the environment. Ventilation. Remove vapour with fine water spray.

Accidental Release Measures

Public Safety: ERG 2024, Guide 157 (Hydrofluoric acid)

>> CALL 911. Then call emergency response telephone number on shipping paper. If shipping paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.

>> Keep unauthorized personnel away.

>> Stay upwind, uphill and/or upstream.

>> Ventilate closed spaces before entering, but only if properly trained and equipped.

Spill or Leak: ERG 2024, Guide 157 (Hydrofluoric acid)

>> ELIMINATE all ignition sources (no smoking, flares, sparks or flames) from immediate area.

>> All equipment used when handling the product must be grounded.

>> Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.

>> Stop leak if you can do it without risk.

>> A vapor-suppressing foam may be used to reduce vapors.

>> DO NOT GET WATER INSIDE CONTAINERS.

>> Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled material.

>> Prevent entry into waterways, sewers, basements or confined areas.

>> Small Spill

>> Cover with DRY earth, DRY sand or other non-combustible material followed with plastic sheet to minimize spreading or contact with rain.

>> Use clean, non-sparking tools to collect material and place it into loosely covered plastic containers for later disposal.

Public Safety: ERG 2024, Guide 125 (Hydrogen fluoride, anhydrous)

>> CALL 911. Then call emergency response telephone number on shipping paper. If shipping paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.

>> Keep unauthorized personnel away.

>> Stay upwind, uphill and/or upstream.

>> Many gases are heavier than air and will spread along the ground and collect in low or confined areas (sewers, basements, tanks, etc.).

>> Ventilate closed spaces before entering, but only if properly trained and equipped.

Spill or Leak: ERG 2024, Guide 125 (Hydrogen fluoride, anhydrous)

>> Do not touch or walk through spilled material.

>> Stop leak if you can do it without risk.

>> If possible, turn leaking containers so that gas escapes rather than liquid.

>> Prevent entry into waterways, sewers, basements or confined areas.

>> Do not direct water at spill or source of leak.

>> Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled material.

>> Isolate area until gas has dispersed.

7. Handling And Storage

Safe Storage:

>> Cool. Well closed. Fireproof if in building. Ventilation along the floor. Separated from food and feedstuffs and incompatible materials. Store in an area without drain or sewer access. See Chemical Dangers.

Storage Conditions:

>> Hydrogen fluoride should be stored in cool, dry, well ventilated areas out of the direct rays of the sun.

8. Exposure Control/ Personal Protection

REL-TWA (Time Weighted Average)

>> 3 ppm (2 mg/m³)

REL-C (Ceiling)

>> 6 ppm (5 mg/m³) [15 minutes]

>> TWA 3 ppm (2.5 mg/m3) C 6 ppm (5 mg/m3) [15-minute]

>> 3.0 [ppm], as F

PEL-TWA (8-Hour Time Weighted Average)

>> 3 ppm (2 mg/m³)

>> 0.5 [ppm], as F

TLV-Ceiling

>> 2.0 [ppm], as F

>> (as F): 0.5 ppm as TWA; 2 ppm as STEL; (skin); BEI issued.

TLV-TWA (Time Weighted Average)

>> 0.5 ppm [2004]

TLV-C (Ceiling)

>> 2 ppm [2004]

EU-OEL

>> 1.5 mg/m

MAK (Maximale Arbeitsplatz Konzentration)

>> (as F): 0.83 mg/m

Emergency Response: ERG 2024, Guide 157 (Hydrofluoric acid)

>> Note: Some foams will react with the material and release corrosive/toxic gases.

>> Small Fire

>> CO2 (except for Cyanides), dry chemical, dry sand, alcohol-resistant foam.

>> Large Fire

>> Water spray, fog or alcohol-resistant foam.

>> If it can be done safely, move undamaged containers away from the area around the fire.

>> Avoid aiming straight or solid streams directly onto the product.

>> Dike runoff from fire control for later disposal.

>> Fire Involving Tanks, Rail Tank Cars or Highway Tanks

>> Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles.

>> Do not get water inside containers.

>> Cool containers with flooding quantities of water until well after fire is out.

>> Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.

>> ALWAYS stay away from tanks in direct contact with flames.

Emergency Response: ERG 2024, Guide 125 (Hydrogen fluoride, anhydrous)

>> Small Fire

>> Dry chemical or CO2.

>> Large Fire

>> Water spray, fog or regular foam.

>> If it can be done safely, move undamaged containers away from the area around the fire.

>> Do not get water inside containers.

>> Damaged cylinders should be handled only by specialists.

>> Fire Involving Tanks

>> Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles.

>> Cool containers with flooding quantities of water until well after fire is out.

>> Do not direct water at source of leak or safety devices; icing may occur.

>> Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.

>> ALWAYS stay away from tanks in direct contact with flames.

>> ERPG-1: 2 ppm - one hour exposure limit: 1 = mild transient health effects or objectionable odor [AIHA]

>> ERPG-2: 20 ppm - one hour exposure limit: 2 = impaired ability to take protective action [AIHA]

>> ERPG-3: 50 ppm - one hour exposure limit: 3 = life threatening health effects [AIHA]

Inhalation Risk:

>> A harmful concentration of this gas in the air will be reached very quickly on loss of containment.

Effects of Short Term Exposure:

>> The substance is very corrosive to the eyes, skin and respiratory tract. Inhalation of the gas or vapour may cause lung oedema. Inhalation may cause asthma-like reactions (RADS). Exposure could cause asphyxiation due to swelling in the throat. Inhalation may cause pneumonitis. Exposure could cause hypocalcemia. The effects may be delayed. Exposure above the OEL could cause death.

>> Hydrogen fluoride/hydrofluoric acid has not been classified as a carcinogen. It is not known whether chronic or repeated exposure to hydrogen fluoride/hydrofluoric acid increases the risk of reproductive toxicity or developmental toxicity. Chronic or repeated exposure to hydrogen fluoride/hydrofluoric acid has been associated with fluorosis, mottling of the teeth, weight loss, malaise, anemia, leukopenia, discoloration of teeth, osteosclerosis, skeletal changes such as increased bone density of the spine and pelvis, calcification of ligaments, hyperostosis, and liver or kidney damage.

Effects of Long Term Exposure:

>> Fluoride can accumulate in teeth, joints and bones. This may result in stained tooth enamel up to joint and bone disorders (fluorosis).

Fire Prevention

>> NO contact with incompatible substances. See Chemical Dangers.

Exposure Prevention

>> AVOID ALL CONTACT! IN ALL CASES CONSULT A DOCTOR!

Inhalation Prevention

>> Use ventilation, local exhaust or breathing protection.

Skin Prevention

>> Protective gloves. Protective clothing. Apron.

Eye Prevention

>> Wear face shield or eye protection in combination with breathing protection.

Ingestion Prevention

>> Do not eat, drink, or smoke during work. Wash hands before eating.

Exposure Control and Personal Protection

Protective Clothing: ERG 2024, Guide 157 (Hydrofluoric acid)

>> Wear positive pressure self-contained breathing apparatus (SCBA).

>> Wear chemical protective clothing that is specifically recommended by the manufacturer when there is NO RISK OF FIRE.

>> Structural firefighters' protective clothing provides thermal protection but only limited chemical protection.

Protective Clothing: ERG 2024, Guide 125 (Hydrogen fluoride, anhydrous)

>> Wear positive pressure self-contained breathing apparatus (SCBA).

>> Wear chemical protective clothing that is specifically recommended by the manufacturer when there is NO RISK OF FIRE.

>> Structural firefighters' protective clothing provides thermal protection but only limited chemical protection.

Exposure Summary

>> TIH (Toxic Inhalation Hazard) - Term used to describe gases and volatile liquids that are toxic when inhaled. Some are TIH materials themselves, e.g., chlorine, and some release TIH gases when spilled in water, e.g., chlorosilanes. [ERG 2016].

Maximum Allowable Concentration (MAK)

>> 1.0 [ppm], as F[German Research Foundation (DFG)]

9. Physical And Chemical Properties

Molecular Weight:

>> 20.0064

Exact Mass:

>> 20.006228194

Physical Description:

>> Hydrogen fluoride, anhydrous appears as a colorless fuming liquid boiling at 67 °F. Shipped as a liquid confined under its own vapor pressure. Corrosive to metals and tissue. Very short contact with fumes or small quantities of the liquid can cause severe, painful burns. Vapors are heavier than air. Used as a catalyst and raw material in chemical manufacture. Rate of onset: Immediate & Delayed Persistence: Minutes to hours Odor threshold: 0.4 ppm Source/use/other hazard: Aluminum and other metal industries; insecticide manufacturing-corrosive liq.

>> COLOURLESS GAS OR COLOURLESS FUMING LIQUID WITH PUNGENT ODOUR.

Color/Form:

>> Colorless gas, fumes in air

Odor:

>> ... Strong, irritating odor ...

Boiling Point:

>> 67.1 °F at 760 mmHg (EPA, 1998)

>> 20 °C

Melting Point:

>> -118.4 °F (EPA, 1998)

>> -83 °C

Flash Point:

>> Not Flammable (EPA, 1998)

Solubility:

>> Miscible (NIOSH, 2024)

>> Solubility in water: very good

Density:

>> 0.991 at 67.1 °F (EPA, 1998) - Less dense than water; will float

>> Relative density (water = 1): 1.0 (liquid at 4 °C)

Vapor Density:

>> 0.7 (EPA, 1998) - Lighter than air; will rise (Relative to Air)

>> Relative vapor density (air = 1): 0.7-2.6

Vapor Pressure:

>> 400 mmHg at 36.5 °F (EPA, 1998)

>> Vapor pressure, kPa at 25 °C: 122

Stability/Shelf Life:

>> Stable under recommended storage conditions.

Autoignition Temperature:

>> Not flammable (USCG, 1999)

Decomposition:

>> When heated to decomp it emits highly corrosive fumes of /hydrogen fluoride/.

Corrosivity:

The ability of a chemical to damage or destroy other substances when it comes into contact.

>> Corrosive, dissolves silica, silicic acid, glass

Heat of Vaporization:

>> 7.493 kJ/mol at 101.3 kPa

pH:

pH is an expression of hydrogen ion concentration in water. Specifically, pH is the negative logarithm of hydrogen ion (H+) concentration (mol/L) in an aqueous solution. The term is used to indicate basicity or acidity of a solution on a scale of 0 to 14, with pH 7 being neutral.

>> In water a weak acid

Surface Tension:

>> Surface tension: 10.2 mN/m at 0 °C

Ionization Potential:

>> 15.98 eV

Odor Threshold:

>> Odor Threshold Low: 0.04 [mmHg]

>> Odor threshold from AIHA

Refractive Index:

>> Index of refraction, liquid: 1.1574 at 25 °C, 589.3 nm

Dissociation Constants:

>> pKa = 3.19

10. Stability And Reactivity

>> Fumes in air. Fumes are highly irritating, corrosive, and poisonous. Generates much heat on dissolution [Merck, 11th ed., 1989]. Heat can cause spattering, fuming, etc.

>> Water-Reactive

>> Air-Reactive

11. Toxicological Information

Toxicity Summary:

>> IDENTIFICATION AND USE: Hydrogen fluoride is a gas at room temperature but it is available most frequently in aqueous solutions. Solutions up to 70% are available. It is used for etching glass and cleaning in the manufacture of glass, semiconductors, computer chips and ceramics and industrial applications. It can also be used for rust removal in commercial and home laundry operations, as well as in milling titanium, petroleum exploration, metallurgy laboratories, dental laboratories, janitorial products for tile cleaning, aluminum brighteners. HUMAN STUDIES: Hydrogen fluoride is highly corrosive to all tissues. Systemic absorption occurs following skin exposure or ingestion; severe and rapid hypocalcemia may result with cardiac dysrhythmia and arrest. The effects on the heart are due to hypocalcemia. These include the prolongation of the QT interval, arrhythmias (ventricular tachycardia, fibrillation and electromechanical dissociation. These effects result in hypotension and cardiac arrest. After inhalation, severe pulmonary injury may occur with pulmonary edema and bronchopneumonia. Tetany may result due to hypocalcemia after systemic absorption. Severe and delayed injury can occur with burns may develop after a symptom free interval of 24 hours. This is particularly true of exposures of dilute (<20%) solutions. With concentrated solutions (>40%), the effects are more rapid and pronounced with immediate pain and skin damage. Eye contamination causes similarly severe toxicity. Fatal exposures to hydrogen fluoride have been reported. One case involved a death due to refractory hypocalcemia about 12 hours after exposure of 2.5% body surface area to anhydrous hydrogen fluoride. A death was reported after 13 hours from a 9%-10% body surface area burn from 70% hydrogen fluoride. ANIMAL STUDIES: Experimental splash burns in rabbits have shown 20% solution to cause immediate damage with total corneal opacification with conjunctival ischemia, and corneal stromal edema within an hour, followed by necrosis of anterior ocular structures. An 8% solution produced ischemia and corneal stromal edema persisting for 40-65 days, accompanied by corneal vascularization. Even a 2% solution caused mild persistent stromal edema and vascularization, but after 0.5% solution there was recovery in 10 days. In one study rats exposed to hydrogen fluoride had hepatic centrilobular injury. When rats were exposed through inhalation to hydrogen fluoride, irritation of the mucous membranes of the eyes and nose, weakness, and a decrease in body weight were observed in the poisoned animals. Severe irritant to guinea pigs and rabbits. On exposure, the animals' eyes were kept closed, paroxysms of coughing and sneezing were frequent, respiration was slowed, and there were copious discharges from the eyes and nose. Pulmonary damage included massive hemorrhage, edema, congestion, and emphysema.Thirty day exposures of five laboratory animal species to hydrogen fluoride at levels that bracketed the maximal and minimal effects were performed at 8.6 and 30 ppm in 6-hr, daily exposures. Exposure at the higher concentration was lethal to all the rats and mice, but not to guinea pigs, rabbits, and dogs. Among the surviving animals, the rabbits showed a slight reduction in body weight, the dogs were apparently unaffected, and the guinea pigs began to lose weight after the third week of exposure. Exposure at 8.6 ppm for 6 hr/day failed to alter significantly normal weight gains in any of the animals except rabbits. Hydrogen fluoride was negative for dominant lethal mutations following inhalation exposure in mice. Increases in the occurrence of chromosome aberrations were found in the bone marrow cells of rats exposed by inhalation to 1.0 mg/cu m hydrogen fluoride 6 hours/day, 6 days/week for 1 month. ECOTOXICITY STUDIES: Bufo gargarizans tadpoles were chronically exposed to waterborne fluoride at measured concentrations ranging from 0.4 to 61.2 mg F-/L for 70 days from Gosner stage 26 to completion of metamorphosis. The chronic exposure caused a concentration-dependent mortality in all tested fluoride concentrations. In adult zebrafish chronic fluoride exposure impairs the redox balance, affects DNA repair machinery with pro-apoptotic implications and suppresses pro-inflammatory cytokines expression abrogating host immunity to bacterial infections.

Carcinogen Classification:

This section provides the International Agency for Research on Cancer (IARC) Carcinogenic Classification and related monograph links. In the IARC Carcinogenic classification, chemicals are categorized into four groups: Group 1 (carcinogenic to humans), Group 2A (probably carcinogenic to humans), Group 2B (possibly carcinogenic to humans), and Group 3 (not classifiable as to its carcinogenicity to humans).

>> No indication of carcinogenicity to humans (not listed by IARC).

Health Effects:

>> Hydrogen fluoride is extremely corrosive. It may penetrate the skin and weaken the bones, as well as interfere with nerve function and react with blood calcium, causing cardiac arrest. (L968)

Exposure Routes:

>> Serious systemic effects and local effects by all routes of exposure.

>> inhalation, skin absorption (liquid), ingestion (solution), skin and/or eye contact

Inhalation Exposure

>> Burning sensation. Sore throat. Cough. Laboured breathing. Shortness of breath. Nausea. Vomiting. Symptoms may be delayed.

Skin Exposure

>> MAY BE ABSORBED! Redness. Pain. Serious skin burns. Blisters. See Inhalation.

Eye Exposure

>> Redness. Pain. Severe burns.

Ingestion Exposure

>> Burns in mouth and throat. Burning sensation. Abdominal pain. Vomiting. Shock or collapse.

>> irritation eyes, skin, nose, throat; pulmonary edema; eye, skin burns; rhinitis; bronchitis; bone changes

Target Organs:

Organs that are affected by exposure to this chemical. Information in this section reflects human data unless otherwise noted.

>> Eyes, skin, respiratory system, bones

Adverse Effects:

An adverse effect is an undesired harmful effect resulting from a medical treatment or other intervention.

>> Dermatotoxin - Skin burns.

>> Toxic Pneumonitis - Inflammation of the lungs induced by inhalation of metal fumes or toxic gases and vapors.

>> Fibrogenic - Inducing tissue injury and fibrosis (scarring).

Toxicity Data:

>> LC50 (rat) = 1,276 ppm/1 hr

Treatment:

Treatment when exposed to toxin

>> Hydrofluoric acid exposure is often treated with calcium gluconate, a source of Ca2+ that sequesters the fluoride ions. HF chemical burns can be treated with a water wash and 2.5% calcium gluconate gel or special rinsing solutions. However, because it is absorbed, medical treatment is necessary; rinsing off is usually not enough. Intra-arterial infusions of calcium chloride have also shown great effectiveness in treating burns.

Interactions:

>> We describe a nonlethal, delayed onset case of combined acute inhalation of hydrofluoric acid (HFA) and nitric acid (NA) together with a review of the literature. Our patient was exposed to fumes of a 12% HFA and 22% NA solution in a closed environment and suffered during several months after the incident from exertional dyspnoea but recovered completely. Since HFA and NA are dangerous and widely used substances, preparedness for exposure is mandatory. After inhalational exposure, the principles of decontamination with attention to treatment of the skin for HFA burns together with general medical incident management should be applied. The severity of combined NA and HFA intoxication depends on the concentration, the nature of the contact and the duration of exposure but other factors may also be involved. Therapy resistant hypoxia and death have been reported in the literature. Inhalation injury from HFA alone is rare but systemic toxicity should be anticipated. Calcium is advocated as the cornerstone of local and systemic therapy. NA inhalation alone is very rare and causes heavy pulmonary irritation. Massive pulmonary secretions seem a sign of very severe intoxication and treatment appears to be mainly supportive.

Antidote and Emergency Treatment:

>> Immediate first aid: Ensue that adequate decontamination has been carried out. If patient is not breathing, start artificial respiration, preferably with a demand-valve resuscitator, bag-valve-musk device, or pocket mask, as trained. Perform CPR if necessary. Immediately flush contaminated eyes with gently flowing water. Do not induce vomiting. if vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain an open airway and

prevent aspiration. Keep patient quiet and maintain normal body temperature. Effects may be delayed. obtain medical attention for any exposure. /Hydrofluoric Acid (HF) and Related Compounds/

Human Toxicity Excerpts:

>> /SIGNS AND SYMPTOMS/ Acute ... inhalation ... causes coughing ... chills ... after asymptomatic period of 1-2 days, fever ... tightness of chest, rales & cyanosis. ...

Non-Human Toxicity Excerpts:

>> /LABORATORY ANIMALS: Acute Exposure/ The danger of hydrofluoric acid solutions depends upon the concentration. Experimental splash burns in rabbits ... have shown 20% solution to cause immediate damage with total corneal opacification with conjunctival ischemia, and with corneal stromal edema within an hour, followed by necrosis of anterior ocular structures. An 8% solution produced ischemia and corneal stromal edema persisting for 40-65 days, accompanied by corneal vascularization. Even a 2% solution caused mild persistent stromal edema and vascularization, but after 0.5% solution there was recovery in 10 days.

Non-Human Toxicity Values:

>> LC50 Rat inhalation 996 ppm/1 hr

Populations at Special Risk:

>> In patients with kidney failure, fluoride excretion is decr, and the ionic plasma fluoride concn is higher than the normal ... . /Fluorides/

12. Ecological Information

Resident Soil (mg/kg)

>> 3.10e+03

Industrial Soil (mg/kg)

>> 4.70e+04

Resident Air (ug/m3)

>> 1.50e+01

Industrial Air (ug/m3)

>> 6.10e+01

Tapwater (ug/L)

>> 2.80e+01

MCL (ug/L)

>> 5.00e+01

Chronic Oral Reference Dose (mg/kg-day)

>> 4.00e-02

Chronic Inhalation Reference Concentration (mg/m3)

>> 1.40e-02

Volatile

>> Volatile

Mutagen

>> Mutagen

Fraction of Contaminant Absorbed in Gastrointestinal Tract

>> 1

ICSC Environmental Data:

>> The substance is harmful to aquatic organisms.

13. Disposal Considerations

Spillage Disposal

>> Evacuate danger area! Consult an expert! Personal protection: gas-tight chemical protection suit including self-contained breathing apparatus. Do NOT let this chemical enter the environment. Ventilation. Remove vapour with fine water spray.

Disposal Methods

>> Generators of waste (equal to or greater than 100 kg/mo) containing this contaminant, EPA hazardous waste number D002 and U134, must conform with USEPA regulations in storage, transportation, treatment and disposal of waste.

>> SRP: Wastewater from contaminant suppression, cleaning of protective clothing/equipment, or contaminated sites should be contained and evaluated for subject chemical or decomposition product concentrations. Concentrations shall be lower than applicable environmental discharge or disposal criteria. Alternatively, pretreatment and/or discharge to a permitted wastewater treatment facility is acceptable only after review by the governing authority and assurance that "pass through" violations will not occur. Due consideration shall be given to remediation worker exposure (inhalation, dermal and ingestion) as well as fate during treatment, transfer and disposal. If it is not practicable to manage the chemical in this fashion, it must be evaluated in accordance with EPA 40 CFR Part 261, specifically Subpart B, in order to determine the appropriate local, state and federal requirements for disposal.

>> Product: Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. Contaminated packaging: Dispose of as unused product.

14. Transport Information

DOT

Hydrogen fluoride (anhydrous)
8
UN Pack Group: I
Reportable Quantity of 100 lb or 45

IATA

Hydrogen fluoride (anhydrous)
8, 6.1
UN Pack Group: I

15. Regulatory Information

DHS Chemicals of Interest (COI):

This section provides the Department of Homeland Security (DHS) Chemicals of Interest (COI) and related information (Ref: 6 eCFR part 27 - https://www.ecfr.gov/current/title-6/chapter-I/part-27).

Chemicals of Interest(COI)

>> Hydrofluoric acid (conc.50% or greater)

Release: Minimum Concentration (%)

>> 50.00

Release: Screening Threshold Quantities (in pounds)

>> 1,000

Security Issue: Release - Toxic

>> Toxic chemical that can be released at a facility.

Theft: Minimum Concentration (%)

>> 42.53

Theft: Screening Threshold Quantities (in pounds unless otherwise noted)

>> 45

Security Issue: Theft - WME

>> Weapons of Mass Effect chemical material that, if stolen or diverted, can be converted into weapons using simple chemistry, equipment, or techniques.

Clean Water Act Requirements:

The Clean Water Act (CWA) of 1972 establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. Under CWA, the U.S. Environmental Protection Agency (EPA) developed the Toxic Pollutant List (40 CFR Part 401.15) and the Priority Pollutant List (40 CFR Part 423, Appendix A). These lists are to be used by EPA and States to develop the Effluent Guidelines regulations and ensure water quality criteria and standards.

>> Hydrofluoric acid is designated as a hazardous substance under section 311(b)(2)(A) of the Federal Water Pollution Control Act and further regulated by the Clean Water Act Amendments of 1977 and 1978. These regulations apply to discharges of this substance. This designation includes any isomers and hydrates, as well as any solutions and mixtures containing this substance.

Regulatory Information

The Australian Inventory of Industrial Chemicals

>> Chemical: Hydrofluoric acid

>> Specific Information Requirement: Obligations to provide information apply. You must tell us within 28 days if the circumstances of your importation or manufacture (introduction) are different to those in our assessment.

REACH Registered Substance

>> Status: Active Update: 26-04-2023 https://echa.europa.eu/registration-dossier/-/registered-dossier/16074

>> Status: Cease Manufacture Update: 26-03-2018 https://echa.europa.eu/registration-dossier/-/registered-dossier/23170

New Zealand EPA Inventory of Chemical Status

>> Hydrofluoric acid: Does not have an individual approval but may be used under an appropriate group standard

16. Other Information

Toxic Combustion Products:

Toxic products (e.g., gases and vapors) produced from the combustion of this chemical.

>> Reacts with water or steam to produce toxic and corrosive fumes.

Other Safety Information

Chemical Assessment

>> PEC / SN / Other assessments - Hydrofluoric acid: Health and Environment

Methods of Dissemination

>> Indoor Air: Hydrogen fluoride/hydrofluoric acid can be released into indoor air as a liquid spray (aerosol), or as a gas.

>> Water: Hydrogen fluoride/hydrofluoric acid can be used to contaminate water.

>> Food: Hydrogen fluoride/hydrofluoric acid can be used to contaminate food.

>> Outdoor Air: Hydrogen fluoride/hydrofluoric acid can be released into outdoor air as a liquid spray (aerosol), or as a gas.

>> Agricultural: If hydrogen fluoride/hydrofluoric acid is released into the air as a liquid spray (aerosol), it has the potential to contaminate agricultural products. If hydrofluoric acid (HF) is released as a gas, it is highly unlikely to contaminate agricultural products.

"The information provided is believed to be accurate but is not comprehensive and should be used as a reference. It reflects our current knowledge and is intended for safety guidance related to the product. This document does not constitute a warranty of the product's properties. Ionz is not responsible for any damages resulting from handling or contact with the product incorrectly."