Safety Data Sheet (SDS)
HYDROFLUORIC ACID

Section 1: Product and Company Identification

Product Name:	HYDROFLUORIC ACID	**Index Number:**	009-003-00-1

Product Number(s):

S010501, S010501-SSED13, S010501-SSEW03, S010501-SSEW04, S010501-SSEW61, S010501-SSEX43, S010501-SSND13, S010501-SSNW03, S010501-SSNW04, S010501-SSNW61, S010501-SSNX43, S020502, S020502-SSEF07, S020502-SSEF08, S020502-SSEP01, S020502-SSEP02, S020502-SSEP03, S020502-SSEP04, S020502-SSEP05, S020502-SSEP06, S020502-SSNF07, S020502-SSNF08, S020502-SSNP01, S020502-SSNP02, S020502-SSNP03, S020502-SSNP04, S020502-SSNP05, S020502-SSNP06, S020502-SSRF07, S020502-SSRF08, S020502-SSRP01, S020502-SSRP02, S020502-SSRP03, S020502-SSRP04, S020502-SSRP05, S020502-SSRP06, S040501-SSED12, S040501-SSED13, S040501-SSED14, S040501-SSND12, S040501-SSND13, S040501-SSND14

Synonyms:	Fluohydric acid; Fluoric acid; Hydrofluoric acid solution
Chemical names:	DE Fluorwasserstoffsäure; ES Fluoruro de hidrógeno; FR Acide fluorhydrique; IT Acido fluoridrico; NL Fluorwaterstofzuur

Supplier:	SEASTAR CHEMICALS Inc.		
Address:	10005 McDonald Park Road, Sidney, BC V8L 5Y2 CANADA		
Phone Number:	250-655-5880	**Fax Number:**	250-655-5888
CANUTEC (CAN):	613-996-6666		

Section 2: Hazards Identification

Emergency Overview

Appearance:	Clear, colourless liquid. Concentrations above 40% fume in air.
Target Organs:	Lungs, teeth, eyes, skin, bone, mucous membranes.

GHS

Classification:	Acute toxicity, Oral – Category 2 Acute toxicity, Dermal – Category 1 Acute toxicity, Inhalation – Category 2 Skin corrosion – Category 1A Corrosive to metals – Category 1	**Pictograms:**	 GHS06  GHS05
		Signal Word:	Danger

Hazard Statements:

H300: Fatal if swallowed.
H310: Fatal in contact with skin.
H330: Fatal if inhaled.
H314: Causes severe skin burns and eye damage.
H290: May be corrosive to metals.

Precautionary Statements:

P234: Keep only in original container.
P260: Do not breathe fume/gas/mist/vapours/spray.
P262: Do not get in eyes, on skin, or on clothing.
P264: Wash thoroughly after handling.
P270: Do not eat, drink or smoke when using this product.
P271: Use only outdoors or in a well-ventilated area.
P280: Wear protective gloves/protective clothing/eye protection/face protection.
P284: Wear respiratory protection.
P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
P301 + P330 + P331: IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P302 + P350: IF ON SKIN: Gently wash with plenty of soap and water.
P303 + P361 + P353: IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304 + P340: IF INHALED: Remove victim to fresh air and keep at rest in a position 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.
P310: Immediately call a POISON CENTER or doctor/physician.
P320: Specific treatment is urgent (see Section 4 for first aid instructions in case of skin exposure).
P330: Rinse mouth.

P361: Remove/Take off immediately all contaminated clothing.
P363: Wash contaminated clothing before reuse.
P390: Absorb spillage to prevent material damage.
P403+P233: Store in a well-ventilated place. Keep container tightly closed.
P405: Store locked up.
P406: Store in corrosion resistant container with a resistant inner liner.
P501: Dispose of contents/container according to federal, regional and local government requirements.

Section 3: Composition/Information on Ingredients

CAS No.	Chemical Name	Percent	EINECS / ELINCS No.
7664-39-3	Hydrofluoric acid	47-51%	231-634-8
7732-18-5	Water	Balance	231-791-2

Section 4: First Aid Measures

In case of contact:

Inhalation:	Take proper precautions to ensure your own safety before attempting rescue (e.g. wear appropriate protective equipment, use the "buddy" system). Remove source of contamination or move victim to fresh air. If breathing is difficult, trained personnel should administer oxygen and 2.5% calcium gluconate, preferably with a doctor's advice. DO NOT allow victim to move about unnecessarily. Symptoms of pulmonary edema can be delayed up to 48 hours after exposure. If breathing has stopped, trained personnel should begin artificial respiration (AR) or, if the heart has stopped, cardiopulmonary resuscitation (CPR) or automated external defibrillation (AED) immediately. Avoid mouth-to-mouth contact by using mouth guards or shields. Quickly transport victim to an emergency care facility.
Skin:	Avoid direct contact. Wear chemical protective clothing, if necessary. As quickly as possible, remove contaminated clothing, shoes and leather goods (e.g. watchbands, belts). Immediately flush with lukewarm, gently flowing water. Limit flushing with water to 5 minutes if 0.13% benzalkonium chloride (Zephiran®) solution or 2.5% calcium gluconate gel is available. If these treatments are not available, continue flushing until medical treatment is available. It is suggested that a certain quantity of either prepared solution or the calcium gluconate gel be kept on hand at all times. Solutions should be replaced annually if not previously used. BENZALKONIUM CHLORIDE: Begin soaking the affected area in iced 0.13% benzalkonium chloride (Zephiran®) solution. Use ice cubes, not shaved ice, to prevent frostbite. If immersion is not practical, towels should be soaked with iced 0.13% benzalkonium chloride (Zephiran®) solutions and used as compresses for the burned area. Compresses should be changed every 2-4 minutes. Benzalkonium chloride (Zephiran®) soaks or compresses should be continued until medical attention is available. CALCIUM GLUCONATE GEL: Wearing chemical protective gloves, start massaging 2.5% calcium gluconate gel into the burn site. Apply gel frequently and massage continuously until medical attention is available. Quickly transport victim to an emergency care facility. Double bag, seal, label and leave contaminated clothing, shoes and leather goods at the scene for safe disposal.
Eye:	Avoid direct contact. Wear chemical protective gloves if necessary. Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for 15-20 minutes, while holding the eyelid(s) open. If a contact lens is present, DO NOT delay irrigation or attempt to remove the lens. Take care not to rinse contaminated water into the unaffected eye. DO NOT use benzalkonium chloride (Zephiran®) for eye contact. If sterile 1% calcium gluconate is available, limit water flushing to 5 minutes. Then, use the 1% calcium gluconate solution to repeatedly rinse the eye(s). Immediately transport victim to an emergency care facility. Continue flushing with water, neutral saline or 1% calcium gluconate during transport, if at all possible.
Ingestion:	NEVER give anything by mouth if victim is rapidly losing consciousness, is unconscious or is convulsing. Have victim rinse mouth thoroughly with water. DO NOT INDUCE VOMITING. If vomiting occurs naturally, have victim rinse mouth with water again. Quickly transport victim to an emergency care facility.
Notes to Physician / Doctor:	Due to delayed and persistent symptoms, observe patient closely for 48 hours. Prompt action is essential in all cases of contact and first aid procedures must be followed if any contact is suspected. Consult a doctor and/or the nearest Poison Control Centre for ALL EXPOSURES. Some first aid procedures recommended above require advanced first aid training. Protocols for undertaking advanced procedures must be developed in consultation with a doctor and routinely reviewed. All first aid procedures should be periodically reviewed by a doctor familiar with the material and its conditions of use in the workplace. ANTIDOTE: Always have calcium gluconate gel on hand. The use of infilitration therapy and intraarterial therapy for hydrofluoric acid burns resulting from concentrations greater than 20% should be made by qualified medical personnel. Calcium gluconate may be administered intravenously slowly to bind to the fluoride ion. This administration needs to be monitored under the supervision of a physician.

Section 5: Fire Fighting Measures

Fire Hazard Summary:

Will not burn. Cylinders or tanks may rupture and explode if heated. Highly reactive. Contact with metals, such as iron or steel, slowly releases extremely flammable and potentially explosive hydrogen gas. A large amount of heat is generated when highly concentrated hydrofluoric acid solutions are diluted with water. Firefighter's normal protective clothing (Bunker Gear) will not provide adequate protection. A full-body encapsulating chemical protective suit with positive pressure self-contained breathing apparatus (NIOSH approved or equivalent) may be necessary.

Extinguishing Media:	Hydrofluoric acid does not burn. Use extinguishing agents compatible with acid and appropriate for fire surrounding hydrofluoric acid containers. The extinguishing medium used depends on the concentration of the acid. Water spray or fog may be used where concentrations below 60% are present. Higher concentrations may react violently with water and a dry agent, e.g. dry chemical powder is recommended. Use water spray to keep fire exposed containers cool.
Extinguishing Media to be Avoided:	DO NOT use water or water-based extinguishers with highly concentrated solutions, since they react violently with water.
Flash Point:	Not combustible (does not burn).
Flammable (Explosive) Limit:	Lower (LFL/LEL): Not applicable; Upper (UFL/UEL): Not applicable
Autoignition Temperature:	Not applicable
Sensitivity to Mechanical Impact:	Not sensitive. Stable material.
Sensitivity to Static Charge:	Will not accumulate static charge or be ignited by a static discharge.
Electrical Conductivity:	7.9×10^{13} pS/m @ 0 °C (70% HF)
Minimum Ignition Energy:	Not applicable
Combustion and Thermal Decomposition Products:	Hydrogen fluoride gas.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) HAZARD IDENTIFICATION – Hydrogen fluoride	
Health:	4 – Very short exposure could cause death or major residual injury.
Flammability:	0 – Will not burn under typical fire conditions.
Reactivity:	1 – Normally stable, but can become unstable at elevated temperatures and pressures, or may react vigorously, but non-violently with water.
Special Hazard:	Not applicable

Section 6: Accidental Release Measures

Spill Precautions:

Evacuate spill area. Restrict access to area until completion of clean-up. Remove or isolate flammable and combustible materials. Ensure clean-up is conducted by trained personnel only. Wear adequate personal protective equipment. For maximum protection, a chemical protective full-body encapsulating suit with supplied air respiratory protection should be considered. Ventilate area. Notify government occupational health and safety and environmental authorities.

Clean-up:

Absolutely no unprotected contact with spilled material. Stop leak if without risk. Keep materials which can burn away from spilled material. Use water spray to knock down gas. Do not get water inside vessels. Dike corrosive water solutions to prevent entry into waterways, sewers or confined spaces.

SMALL SPILLS: Contain spill with absorbent material which does not react with spilled material. Shovel into clean, dry, labelled containers and cover. Contaminated absorbent material will pose the same hazards as the spilled product.

LARGE SPILLS: Contact fire and emergency services and supplier for advice.

Section 7: Handling and Storage

Handling:

This material is a VERY TOXIC (INHALATION and SKIN CONTACT HAZARD), CORROSIVE liquid. Before handling, it is extremely important that

engineering controls are operating and that protective equipment requirements and personal hygiene measures are being followed. People working with this chemical must be properly trained regarding its hazards and its safe use. Maintenance and emergency personnel must be advised of potential hazards.

Unprotected persons should avoid all contact with this chemical including contaminated equipment. Never work alone with this chemical. Another person should be in view at all times and be equipped and trained to rescue. Alternatively, precautions such as regular visual checks made by another person or a telephone call-in procedure should be taken to ensure the continued safety of lone workers or workers in remote locations.

In case of large leaks or spills, escape-type respiratory protective equipment should be available in the work area. If hydrofluoric acid is released, immediately evacuate the area. Immediately report leaks, spills or ventilation failures.

Ensure that emergency eyewash and showers are in the immediate vicinity of work involving hydrofluoric acid. Prior to working with hydrofluoric acid, ensure that appropriate first aid procedures are established and supplies are readily accessible to trained personnel.

Be aware of typical signs and symptoms of poisoning and first aid procedures. Any signs of illness should be reported immediately to supervisory personnel. Seek medical attention for all exposures even if an exposure did not seem excessive. Symptoms of a severe exposure can be delayed.

Closed handling systems for processes involving this material should be used. If closed handling systems are not feasible, use local exhaust ventilation such as a fumehood (sash should not be glass). Keep the fumehood sash as low as possible. If a closed handling system is not possible, use the smallest possible amounts in an area separate from the storage area. Avoid generating vapours or mists. Prevent the release of vapours/mist into workplace air.

Keep away from combustible materials. Protect from accidental contact with water. Do not use with incompatible materials such as metals, water, silicon-bearing materials (e.g. glass, concrete, ceramics, sand), antimony or arsenic containing metal alloys, strong bases, sulfides, sulfuric acid, cyanides. See Section 10 for more information.

Hydrofluoric acid should not be stored in glass or stoneware containers. Metal containers may react with HF to produce flammable hydrogen gas. Materials such as polyethylene or carbon steel are generally acceptable. Secondary protective containers must be used when this material is being stored or carried.

Inspect containers for leaks before handling. Prevent damage to containers. Label containers. Open containers carefully on a stable surface. Keep containers tightly closed when not in use. Stand upwind of all opening, pouring and mixing operations. Use corrosion-resistant transfer equipment when dispensing. Pour carefully from the container to avoid splashing and spurting. Carefully dispense into sturdy containers made of compatible materials. Never return contaminated material to its original container.

Never add water to a corrosive. Always add corrosives to water. When mixing with water, cautiously and slowly stir small amounts of acid into water. Use cold water to prevent excessive heat generation. Assume that empty containers contain residues which are hazardous.

Keep work areas clean. Use work surfaces that can be easily decontaminated. Have suitable emergency equipment for fires, spills and leaks readily available. Practice good housekeeping. Maintain handling equipment. Comply with applicable regulations.

Storage:

Store in a cool, dry, well-ventilated area, out of direct sunlight and away from combustible materials. Keep quantities stored as small as possible. Store away from incompatible materials, such as metals, water, silicon-bearing materials (e.g. sand, glass, ceramics, concrete), antimony or arsenic containing metal alloys, strong bases, sulfides, sulfuric acid, cyanides. See Section 10 for more information.

Storage area should be clearly identified, clear of obstruction and accessible only to trained and authorized personnel. Keep storage area separate from work areas. Post warning signs. Inspect periodically for damage or evidence of leaks or corrosion. Consider leak detection system with an alarm. Inspect all incoming containers to make sure they are properly labelled and not damaged. Protect the label and keep it visible. Keep containers tightly closed when not in use and when empty. Protect from damage. Always store in original labelled container. Hydrofluoric acid should not be stored in glass or stoneware containers. Metal containers may react with HF to produce highly flammable hydrogen gas. Materials such as polyethylene or carbon steel are generally acceptable. Secondary protective containers must be used when this material is being stored or carried. Inspect containers regularly for corrosion or leaks. Keep empty containers in separate storage area. Empty containers may contain hazardous residues. Keep closed.

Walls, floors, shelving, lighting and ventilation systems in storage area should be fire-resistant and be made from materials that resist attack from hydrofluoric acid. Avoid bulk storage indoors. Keep absorbents for leaks and spills readily available. Contain spills or leaks by storing in trays made from compatible materials. Provide raised sills or ramps at doorways or create a trench which drains to a safe location. Floors should be sealed to prevent absorption. Storage tanks should be above ground and surrounded with a dike capable of holding entire contents.

Section 8: Exposure Controls/Personal Protection

General Exposure Precautions:

NOTE: Exposure to this material can be controlled in many ways. The measures appropriate for a particular worksite depend on how this material is used and on the extent of exposure. This general information can be used to help develop specific control measures. Ensure that control systems are properly designed and maintained. Comply with occupational, environmental, fire, and other applicable regulations.

Engineering Controls:

Engineering methods to control hazardous conditions are the preferred means of protecting workers. Methods include mechanical ventilation (dilution and local exhaust), process or personnel enclosure, control of process conditions, and process modification (e.g. substitution of a less hazardous material). Administrative controls and personal protective equipment may also be required.

Because of the high potential hazard of hydrofluoric acid, stringent control measures such as enclosure (closed handling system) should be considered to prevent all contact with this chemical. If this is not feasible, local exhaust ventilation should be used to prevent release of vapour or mist into the workplace air. Consider installation of air monitoring systems that activate alarms in the event of ventilation system failure or leaks. Adequate general (dilution) is also required.

Use a properly designed corrosion-resistant ventilation system separate from other exhaust ventilation systems. Exhaust directly to the outside after taking the necessary precautions to protect the environment. Supply sufficient replacement air to make up for air removed by exhaust systems. Any use of this material in an elevated temperature process should be thoroughly evaluated to determine safe operating conditions.

Personal Protective Equipment:

If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protection equipment including approved respiratory protection. Have appropriate equipment available for use in emergencies such as spills or fire.

If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection. Refer to the CSA Standard Z94.4-11, "Selection, Use and Care of Respirators," available from the Canadian Standards Association.

Eye / Face protection:	Wear a full face shield and chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin protection:	Chemical protective gloves, coveralls, boots, and/or other chemical protective clothing (such as apron, sleeve protectors) to prevent all contact with this chemical. A chemical protective full-body encapsulating suit and respiratory protection may be required in some operations. Protective clothing used specifically for hydrofluoric acid operations should be clearly marked, preferably with a distinctive colour, to differentiate it from other protective clothing. Have a safety shower and eyewash fountain readily available in the immediate work area. It is recommended that the safety shower and eye wash are connected to an alarm system so that other workers can assist in the emergency.
Resistance of Materials for Protective Clothing:	Guidelines for hydrofluoric acid (30-70%): RECOMMENDED (resistance to breakthrough longer than 8 hours): Butyl rubber; Neoprene rubber; Viton®/Butyl rubber; Barrier (PE/PA/PE); Trellchem® HPS and VPS; Tychem® SL (Saranex®), BR/LV, Responder®, and TK. RECOMMENDED (resistance to breakthrough longer than 4 hours): Silver Shield/4H® (polyethylene/ethylene vinyl alcohol); Tychem® CPF 3. CAUTION, use for short periods only (resistance to breakthrough within 1 to 4 hours): Natural rubber; Polyethylene; Polyvinyl chloride; Viton®, Tychem® F. NOT RECOMMENDED for use (resistance to breakthrough less than 1 hour): Nitrile rubber; Polyvinyl alcohol.
Inhalation / Ventilation:	Use in a chemical fume hood. Where risk assessment shows air-purifying respirators are appropriate use a powered air-purifying respirator with cartridge(s) to protect against hydrogen fluoride (US) or type E–P3 (EN 141) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).
Personal Hygiene:	Remove contaminated clothing immediately. Keep contaminated clothing in closed containers until they can be safely discarded. Do not eat or drink in work areas. Wash hands thoroughly after handling this material. Maintain good housekeeping. Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

EXPOSURE GUIDELINES – Listed under Hydrogen Fluoride, as F	
NIOSH:	REL-TWA: 3 ppm (2.5 mg/m^3); REL-C: 6 ppm (5 mg/m^3); IDLH: 30 ppm
ACGIH:	TLV-TWA: 0.5 ppm as F, skin; TLV-C: 2 ppm as F, Skin
OSHA PELs:	PEL-TWA: 3 ppm (as F); PEL-STEL: 6 ppm (as F); PEL-T-TWA: 3 ppm

Section 9: Physical and Chemical Properties

Form:	Liquid	**Melting/Freezing Point:**	48% w/w: -37 °C (-34.6 °F)
Color:	Clear, colourless	**Boiling Point:**	47% w/w: 108.7 °C (227.7 °F)
Odour:	Strong odour		38.2% w/w: 112.2 °C (234 °F)
Odour Threshold:	0.04-0.14 ppm	**pH:**	50% w/w: 0.9 (calc.)
Chemical Formula:	HF	**Density:** (@20°C)	50% w/w: 1.18 g/cm^3 (water=1)
Formula Weight:	20.0054 g/mol	**Solubility:**	Soluble in water in all proportions; soluble in ethanol; slightly soluble in diethyl ether, benzene, toluene, xylene, and tetralin.
Vapour Density:	1.86 @ 25 °C (air=1) (HF gas)	**Vapour Pressure:** (@20°C)	50% w/w: 1.65 kPa (12.4 mmHg) (calc.)

Section 10: Stability and Reactivity

Normally stable. Hydrogen fluoride is one of the most stable diatomic molecules.

Incompatibility – Materials to Avoid:

NOTE: Chemical reactions that could result in a hazardous situation (e.g. generation of flammable or toxic chemicals, fire or detonation) are listed here. Many of these reactions can be done safely if specific control measures (e.g. cooling of the reaction) are in place. Although not intended to be complete, an overview of important reactions involving common chemicals is provided to assist in the development of safe work practices.

Hydrofluoric acid is highly reactive.

WATER - a large amount of heat is generated when highly concentrated solutions are diluted with water. Spattering or splashing may occur.
METALS (e.g. iron, steel; particularly in the presence of water) - may react to form extremely flammable and potentially explosive hydrogen gas.
ANTIMONY OR ARSENIC CONTAINING METAL ALLOYS - extremely toxic stibine may be released from antimony containing metal alloys and extremely toxic arsine from arsenic containing alloys.
CYANIDES - contact may release toxic and flammable hydrogen cyanide gas.
CYANOGEN FLUORIDE - may polymerize explosively at normal temperatures; may decompose violently at -80 °C.
SULFIDES - contact may liberate toxic and flammable hydrogen sulfide gas.
SILICON-BEARING MATERIALS (e.g. sand, concrete, glass and ceramics) - contact may generate toxic and irritating silicon tetrafluoride gas.
BISMUTHIC ACID - reacts violently with the evolution of ozonized oxygen.
METHANESULFONIC ACID - electrolysis of the mixture produces explosive oxygen difluoride.
FLUORINE GAS - reacts vigorously with a 50% hydrofluoric acid solution and may burst into flame.
NITRIC ACID and LACTIC ACID - mixtures of the 3 acids are unstable and can explode.
PROPYLENE GLYCOL and SILVER NITRATE - may form explosive silver fulminate.
SODIUM - reacts with explosive violence.
STRONG BASES (e.g. ammonium hydroxide, sodium hydroxide or calcium oxide) - may react very violently.
SULFURIC ACID - reaction is violent.
ARSENIC TRIOXIDE or PHOSPHOROUS PENTOXIDE (TETRAPHOSPHORUS DECAOXIDE) - reaction is vigorous.

Conditions to avoid:	High temperatures.
Hazardous Decomposition Products:	Hydrogen fluoride gas.
Hazardous Polymerization:	Tends to associate by means of hydrogen bonds to form polymers in both liquid and gaseous states. This polymerization is not hazardous.

Corrosivity to Metals:

Hydrofluoric acid is corrosive to aluminum alloy 3003 and carbon steel alloys 1010 and 1020, at any concentration and any temperature; to stainless steel (types 301 and 17-4PH), gray cast iron, nickel-base alloy, Incoloy 800, tantalum, titanium and zirconium at any temperature. It is corrosive to stainless steel (e.g. types 304, 347 and 400-series), metals containing silica (like cast iron, high silicon cast iron (Duriron), silicon bronze and silicon copper), ductile cast iron, 3% nickel cast iron and high nickel cast iron (Ni-resist), nickel-base alloys, Inconel and Incoloy 825, brass, naval brass, admiralty brass, aluminum bronze, and alloys containing appreciable amounts of tantalum, titanium and zirconium at 21.1 °C (70 °F). Concentrated solutions (50%-70%) are corrosive to copper, bronze, and lead, but not dilute solutions (40% and lower). Reaction with iron or steel produces hydrogen, which can seriously weaken and embrittle the iron or steel (observed with hardened carbon and alloy steels). It is not corrosive to nickel (at temperatures up to 65 °C), nickel-base alloys, Hastelloy B, C, C-22, C-276 and D, Monel, nickel-chromium iron alloy, nickel-copper alloy 400 (in absence of air), gold, platinum and silver.

Corrosivity to Non-Metals:

Hydrofluoric acid attacks plastics, like acrylonitrile-butadiene-styrene (ABS), chlorinated polyvinyl chloride (CPVC), acetal copolymer, nylon, polyetherether ketone (PEEK), polybutylene and polyethylene terephthalate; bisphenol A polyester; polyurethane; elastomers, like ethylene-propylene terpolymer (EPT), nitrile Buna-N (NBR), polyurethane, ethylene vinyl acetate and silicone rubbers; coatings, like coal tar epoxy, epoxy polyamide, polyester and vinyl; and glass and silicate ceramics, and leather. Concentrated solutions (70-100%) attack plastics, like polyvinylidene chloride (SARAN) and polyvinyl chloride (PVC); and elastomers, like isoprene, natural rubber and styrene-butadiene (SBR; Buna-S). Plastics, like Teflon (FEP and TFE) and other fluorocarbons, like polyvinylidene fluoride (Kynar), Tefzel and Halar, and reinforced phenolics; and elastomers, like Viton A and other fluorocarbons, like Kalrez and Chemraz, butyl rubber, chlorosulfonated polyethylene, and natural rubber and neoprene (both up to 70 °C), are resistant to hydrofluoric acid.

Section 11: Toxicological Information

Potential Health Effects

Inhalation:	May be fatal if inhaled. Hydrofluoric acid is extremely toxic by inhalation. Low concentrations (a few ppm) can cause irritation of the nose, throat, eyes and respiratory tract. Higher concentrations can cause severe burns to the throat, airways and lungs. Fluid accumulation in the lungs and irregular heartbeat has led to deaths within hours following inhalation and, in some cases, concurrent skin contact with unknown concentrations of HF. With serious exposures, throat irritation, coughing, chest pain, nausea and perhaps some difficulty breathing may be experienced during exposure. These symptoms usually resolve once exposure stops. The victim may feel fine and may even return to work. This latent period can last from 1-24 hours, depending on the extent of the exposure. Within 24-48 hours, the victim may experience a rapidly worsening difficulty in breathing, accompanied by coughing. These symptoms are due to the development of a life-threatening accumulation of fluid in the lungs (pulmonary edema). Severe short-term exposures may result in long- lasting effects such as shortness of breath and pulmonary emphysema (larger than normal air spaces in the lungs which decrease lung efficiency).
Skin:	May be fatal if absorbed through skin and penetration may continue for several days. Hydrofluoric acid is extremely corrosive and can cause very deep and excruciatingly painful burns and tissue loss. Burns from concentrated solutions (greater than 50%) are felt immediately and tissue destruction is readily apparent. Weaker solutions (20-50%) result in burns that are apparent after several hours. Burns from solutions of less than 20% may take up to 24 hours to become apparent. Weak solutions (less than 7%) penetrate deeply before causing tissue damage and surface involvement may be minimal. Pain is greater than expected for the skin involvement and is described as severe deep and throbbing. The severity of hydrofluoric acid burns depends on the concentration of the solution, surface area involved and the duration of exposure. Burns are swollen, hot and painful, then develop white or yellowish areas and blistering, with deep ulceration and destruction of tissue, which tends to heal slowly. The severity of the burns and absorption of the acid (with liquefaction necrosis of soft tissue and decalcification and corrosion of the bone) have resulted in permanent scarring, disability and death. Any serious skin contact may also involve inhalation exposure.
Eye:	Direct contact with hydrofluoric acid can cause severe and irreversible corrosive injury with possible corneal scarring and blindness. The acid penetrates to deep tissue layers and causes severe corrosive injury. The gas can dissolve in the moisture on the surface, forming corrosive hydrofluoric acid. Irritation has been reported with exposure to concentrations as low as 0.24 ppm for 1 hour.
Ingestion:	May be fatal if swallowed. Hydrofluoric acid is corrosive and can cause severe burning of the mouth, throat and stomach. Perforation of the digestive system may occur. Systemic fluoride toxicity has occurred following ingestion. Symptoms such as nausea, vomiting, abdominal pain, reduced heartbeat and blood pressure, shortness of breath have been reported. In some cases, death occurred in less than one hour following ingestion. Ingestion is not a typical route of occupational exposure.
Chronic:	Absorbed fluoride can cause metabolic imbalances with irregular heartbeat, central nervous system depression, seizures, and deaths. Long-term exposure may cause osteofluorosis (weakened bone structure), skin disorders, and respiratory, liver and kidney effects. To the best of our knowledge, the chronic toxicity of this substance has not been fully investigated.

Effects of Long-Term (Chronic) Exposure

RTECS#:	MW7875000
Descriptor:	Mutagen; Reproductive Effector; Human; Primary Irritant
LD50/LC50:	TDLo (lowest published toxic dose) Oral, man – 143 mg/kg – Cardiac: arrhythmias (including changes in conduction); Vascular: BP lowering not characterized in autonomic section; Kidney/Ureter/Bladder: changes in tubules (inc. acute renal failure, tubular necrosis) JTCTDW Journal of Toxicology, Clinical Toxicology. LC50 (lethal concentration, 50% kill) Inhalation, rat – 1,276 ppm/1H – Sense Organs (Eye): lacrimation; Behavioural: changes in motor activity; Gastrointestinal: changes in structure or function of salivary glands AIHAAP American Industril Hygiene Association Journal.
Epidemiology:	Standard Draize test – Eye, human – 50 mg, severe reaction AMLTAS Annales de Medecine Legale et de Criminologie.

Teratogenicity:	Hydrofluoric acid is not expected to cause developmental effects. There is no specific human information available.
Reproductive Effects:	TCLo Inhalation, rat – 470 µg/m³/4H (female 1-22D after conception) – Fertility: pre- & post-implantation mortality GTPZAB Gigiena Truda i Professional'nye Zabolevaniya.
Neurotoxicity:	No information available.
Mutagenicity:	Cytogenetic analysis – Inhalation, rat – 1 mg/m³/6H/24D (intermittent) CYGEDX Cytology and Genetics.
Carcinogenicity:	Not listed as a carcinogen by ACGIH, IARC, NTP, or CA Prop 65.

Section 12: Ecological Information

No information available.

Section 13: Disposal Considerations

Review local/regional/international regulations or requirements prior to disposal. Store material for disposal as indicated in Storage Conditions. **Contaminated packaging:** Dispose of as unused product.

Section 14: Transport Information

US DEPARTMENT OF TRANSPORT (DOT) HAZARDOUS MATERIALS SHIPPING INFORMATION (49 CFR)

Shipping Name and Description: HYDROFLUORIC ACID, with not more than 60 percent strength

UN Number: UN1790 | Class: 8 (6.1) | Packing Group/Category: II

Special Provisions: --- | Marine Pollutant: --- | Passenger Carrying Road/Railway Vehicle Index: 1 kg or L

CANADIAN TRANSPORTATION OF DANGEROUS GOODS (TDG) SHIPPING INFORMATION

Shipping Name and Description: HYDROFLUORIC ACID, solution, with not more than 60 per cent hydrofluoric acid

UN Number: UN1790 | Class: 8 (6.1) | Packing Group/Category: II

Special Provisions: --- | Marine Pollutant: --- | Passenger Carrying Road/Railway Vehicle Index: 1 kg or L

International Maritime Dangerous Goods (IMDG)

Proper Shipping Name / Description: HYDROFLUORIC ACID solution, with not more than 60% hydrogen fluoride

UN Number: 1790 | Class or Division (Sub Risk): 8 (6.1) | Packing Group/Category: II

Special Provisions: --- | Marine Pollutant: --- | EMS Number: F-A, S-B

International Air Transport Association (IATA)

Proper Shipping Name / Description: Hydrofluoric acid 60% or less strength

UN/ID Number: 1790 | Class or Division (Sub Risk): 8 (6.1) | Packing Group: II

Special Provisions: A803 | Passenger / Cargo Aircraft: 851 Pkg Inst, 1L Max Net | Cargo Aircraft Only: 855 Pkg Inst, 30L Max Net

Section 15: Regulatory Information

Hydrofluoric acid	CAS# 7664-39-3
US Federal:	
TSCA	Listed on the TSCA Inventory.
SARA Title III: Section 302	Subject to the reporting requirement of 100 lbs.
SARA Title III: Section 313	Does not exceed the threshold (De Minimis) reporting level of 100 lbs.
US State:	
Massachusetts Right To Know	Subject to this act, 10 lbs RQ.
Pennsylvania Right To Know	Subject to this act.
New Jersey Right To Know	Subject to this act, RTK# 3759.
California Prop. 65	Not subject to this act.
Canada	
DSL/NDSL Status:	Is listed, record number: 8318
WHMIS Classifications:	D1A, D2A – Very toxic E – Corrosive material

Section 16: Other Information

Revision Date:	07-2014, Supersedes 04-2014, 04-2011

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