

Material Safety Data Sheet

Material Name: Ammonium Bifluoride

ID: C1-102

*** Section 1 - Chemical Product and Company Identification ***

Chemical Name: Ammonium Bifluoride, Technical Flake Grade

Product Use: For Commercial Use

Synonyms: Ammonium Fluoride; Ammonium Hydrogen Fluoride; Ammonium hydrogendifluoride; Ammonium Difluoride; Acid Ammonium Fluoride.

Supplier Information

Chem One Ltd.
14140 Westfair East Dr
Houston, Texas 77041-1104

Phone: (713) 896-9966
Fax: (713) 896-7540
Emergency # (800) 424-9300 or (703) 527-3887

General Comments: FOR COMMERCIAL USE ONLY; NOT TO BE USED AS A PESTICIDE.

NOTE: Emergency telephone numbers are to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure, or accident involving chemicals. All non-emergency questions should be directed to customer service.

*** Section 2 - Composition / Information on Ingredients ***

CAS #	Component	Percent
1341-49-7	Ammonium Bifluoride	> 94
12125-01-8	Ammonium Fluoride	4

Component Related Regulatory Information

This product may be regulated have exposure limits or other information identified as the following: Fluorides (16984-48-8), Fluorides, inorganic.

Component Information/Information on Non-Hazardous Components

This product is considered hazardous under 29 CFR 1910.1200 (Hazard Communication).

*** Section 3 - Hazards Identification ***

Emergency Overview

Ammonium Bifluoride is a white, solid that consists of crystals or flakes with a pungent odor. This product is corrosive and causes severe irritation and burning of the eyes, skin and mucous membranes. Harmful or fatal if swallowed, inhaled or if absorbed through the skin. Chronic, low level exposure can lead to bone or dental fluorosis. Fire may produce irritating, corrosive and/or toxic vapors (e.g. ammonia, hydrogen fluoride, and nitrogen oxides). Firefighters should use full protective equipment and clothing.

Hazard Statements

CORROSIVE. CAUSES SKIN, EYE AND RESPIRATORY TRACT BURNS. HARMFUL OR FATAL IF SWALLOWED, INHALED OR IF ABSORBED THROUGH THE SKIN. Do not taste or swallow. Avoid breathing dusts or particulates. Avoid contact with eyes, skin or clothing. Avoid breathing dusts. Wash thoroughly after handling. Keep container closed. Do not store in glass or silicate-based containers. Use with adequate ventilation.

Potential Health Effects: Eyes

Exposure to particulates or solution of this product may cause redness, pain and blurred vision. Prolonged contact may cause corneal injury or, in severe cases, blindness. Effects may be delayed.

Potential Health Effects: Skin

This product can cause irritation of the skin with pain, itching and redness. Ammonium Bifluoride can cause severe necrosis to tissue, with symptoms such as redness, itching, burns and scarring. Burns may not be immediately visible or painful. Ammonium Bifluoride can cause a unique, large, pustular skin rash, which is apparently not an irritant or allergic dermatitis. As a fluoride compound, Ammonium Bifluoride has the potential to decompose upon contact with moisture to form hydrofluoric acid, which can penetrate the skin, causing destruction of the deep tissue layers, including bone tissue. This damage to the body's tissues may continue for days, as the fluoride ion reacts with the calcium in the skin and bone. Severe skin-contact exposures (especially when the skin contamination exceeds 160 cm²) can lead to hypocalcemia, a life-threatening lowering of serum calcium in the body. Ammonium Bifluoride may be systematically absorbed in lethal amounts through intact skin. Effects may be delayed **and not felt for hours.**

Potential Health Effects: Ingestion

Harmful if swallowed. Data indicate that ingestion of between 1 teaspoon and 1 ounce may be fatal. This product may cause corrosive damage to gastrointestinal tract, symptoms of such over-exposure include, salivation, nausea, vomiting, diarrhea, hypocalcemia, burning pain, convulsions, shock, muscle spasms, coma, cardiac arrhythmias, cardio and pulmonary arrest, and possibly, death. At high concentrations, there is a risk of hypocalcemia.

Potential Health Effects: Inhalation

This product is irritating to the nose, throat and respiratory tract. Symptoms can include sore throat, coughing and shortness of breath. In severe cases, ulceration and perforation of the nasal septum and upper respiratory tract can occur. Inhalation of high concentrations can lead to chemical pneumonia, pulmonary edema, and hypocalcemia. Effects may be delayed.

Material Safety Data Sheet

Material Name: Ammonium Bifluoride

ID: C1-102

*** Section 3 - Hazards Identification (Continued) ***

HMIS Ratings: Health Hazard: 3* Fire Hazard: 0 Physical Hazard: 1

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe * = Chronic hazard

*** Section 4 - First Aid Measures ***

First Aid: Eyes

In case of contact with eyes, rinse immediately with plenty of water for at least 20 minutes. If there is a difficulty in keeping eyes open during irrigation, administer anesthetic drops. If calcium gluconate 1% solution is available, it should be administered. Seek immediate medical attention, preferably an ophthalmologist.

First Aid: Skin

Remove all contaminated clothing. For skin contact, wash thoroughly with soap and water for at least 20 minutes. Apply calcium gluconate gel (2.5%) and massage into affected area (hands must be gloved); continue massage while repeatedly applying gel until 15 minutes after pain has ceased. Seek immediate medical attention.

First Aid: Ingestion

DO NOT INDUCE VOMITING. Never give anything by mouth to a victim who is unconscious or having convulsions. Have victim rinse mouth thoroughly with water, if conscious. Attempt immediate administration of a fluoride binding substance with oral exposures. Options include milk (4 to 8 ounces), chewable calcium carbonate tablets or Milk of Magnesia. Avoid large amounts of liquid, since this may induce vomiting. Contact a physician or poison control center immediately.

First Aid: Inhalation

Remove source of contamination or move victim to fresh air. Apply artificial respiration if victim is not breathing. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Administer oxygen if breathing is difficult. Get immediate medical attention.

First Aid: Notes to Physician

Provide general supportive measures and treat symptomatically. For eye contamination rinse eye(s) with a calcium gluconate 1% solution in physiological serum (10 mL of calcium gluconate 10% in 90 mL of physiological serum). In case of difficulty of opening lids, administer an analgesic eye wash (oxybuprocaine). For skin contact, application of calcium gluconate gel (2.5%) should occur 4 to 6 times per day. If victim suffers second or third degree burns, subcutaneous injection of 10% calcium gluconate at a distance of 7 mm around the affected area. If fingers or toes have been contaminated, dip in a bath of 5% calcium gluconate for 15 to 20 minutes. For severe burns of the digits, slow intraarterial infusion (over a 4 hour period) of 10 mL of a 10% calcium gluconate solution diluted in 40 mL of physiological serum. Phlyctenae and necrotic tissue should be debrided (warning: liquid in phlyctenae is corrosive). For ingestion exposure, provide oxygen therapy via intratracheal intubation, if breathing is difficult or victim is not breathing. If throat is constricted due to burns, perform tracheotomy. Careful gastric lavage should be performed after administration of 10 vials of calcium gluconate. Repeat as often as necessary. In case of intense pain, inject an I.M. morphomimetic analgesic drug (e.g. piritramide) prior to transport. Prevention and treatment for shock, pulmonary edema and esophageal stenosis, as well as hypocalcemia should occur. Examination by digestive tract endoscopy should be performed in all cases. In case of hypocalcemia, administer I.V. perfusion of 20 mL of a 10% calcium gluconate solution diluted in 1 liter of physiological serum. Surveillance of hyperfluoremia should occur, with possible treatment with hemodialysis should occur, as well as surveillance of cardiac ECG, and respiratory and renal function.

*** Section 5 - Fire Fighting Measures ***

Flash Point: Not flammable

Upper Flammable Limit (UEL): Not applicable

Auto Ignition: Not available

Rate of Burning: Not available

General Fire Hazards

This product is not combustible; however, this product is corrosive and presents a severe inhalation and contact hazard to firefighters. When involved in a fire, this material may decompose and produce corrosive and/or toxic gases (i.e. ammonia, hydrogen fluoride and nitrogen oxides).

Hazardous Combustion Products

Nitrogen oxides, hydrogen fluoride, and ammonia.

Extinguishing Media

Dry chemical, foam, carbon dioxide, water fog. Use water to cool fire-exposed containers and to protect personnel. Contact of this product with water produces hydrofluoric acid, which is capable of etching glass, cement and many metals.

Method Used: Not applicable

Lower Flammable Limit (LEL): Not applicable

Flammability Classification: Not available

Material Safety Data Sheet

Material Name: Ammonium Bifluoride

ID: C1-102

*** Section 5 - Fire Fighting Measures (Continued) ***

Fire Fighting Equipment/Instructions

Firefighters should wear full protective clothing including self-contained breathing apparatus. Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution.

NFPA Ratings: Health: 3 Fire: 0 Reactivity: 1 Other:

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

*** Section 6 - Accidental Release Measures ***

Containment Procedures

Stop the flow of material, if this can be done without risk. Contain the discharged material. If sweeping of a contaminated area is necessary use a dust suppressant agent, which does not react with product (see Section 10 for incompatibility information).

Clean-Up Procedures

Wear appropriate protective equipment and clothing during clean-up. This includes full, chemically-resistant clothing if spill is substantial. All contact with Ammonium Bifluoride must be avoided during clean-up. Shovel the material into waste container. Thoroughly wash the area after a spill or leak clean-up. Prevent spill rinsate from contamination of storm drains, sewers, soil or groundwater.

Evacuation Procedures

Evacuate the area promptly and keep upwind of the spilled material. Isolate the spill area to prevent people from entering. Keep materials that burn away from spilled material. In case of large spills, follow all facility emergency response procedures.

Special Procedures

Remove soiled clothing and launder before reuse. Avoid all skin contact with the spilled material. Have emergency equipment readily available. Emergency first aid kits which include calcium gluconate preparations should be readily available in case of exposure to response personnel during clean-up. Personnel should be trained in the use of these first aid materials.

*** Section 7 - Handling and Storage ***

Handling Procedures

All employees who handle this material should be trained to handle it safely. Do not breathe dust. Avoid all contact with skin and eyes. Use this product only with adequate ventilation. Wash thoroughly after handling.

Storage Procedures

Keep container tightly closed when not in use. Store containers in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Do not store this product in glass or silicate-based containers. Material should be stored in secondary containers or in a diked area, as appropriate. Store containers away from incompatible chemicals (see Section 10, Stability and Reactivity). Storage areas should be made of corrosion- and fire-resistant materials. Post warning and "NO SMOKING" signs in storage and use areas, as appropriate. Use corrosion-resistant structural materials, lighting, and ventilation systems in the storage area. Floors should be sealed to prevent absorption of this material. Inspect all incoming containers before storage, to ensure containers are properly labeled and not damaged. Have appropriate extinguishing equipment in the storage area (i.e., sprinkler system, portable fire extinguishers).

Empty containers may contain residual particulates; therefore, empty containers should be handled with care. Do not cut, grind, weld, or drill near this container. Never store food, feed, or drinking water in containers that held this product. Keep this material away from food, drink and animal feed. Do not store this material in open or unlabeled containers. Limit quantity of material stored. Emergency first aid kits which include calcium gluconate preparations should be readily available in storage areas, in case of exposure to personnel during use. Personnel should be trained in the use of these first aid materials.

Exposure Guidelines

A: General Product Information

Follow the applicable exposure limits.

B: Component Exposure Limits

The exposure limits given are for Fluorides, as F.

ACGIH: 2.5 mg/m³ TWA (as Fluorides)

OSHA: 2.5 mg/m³ TWA (as Fluorides)

NIOSH 2.5 mg/m³ TWA (as Fluorides)

DFG MAKs 2.5 mg/m³ TWA (as Fluorides)

2.5 mg/m³ Peak, 30 minute, average value

Engineering Controls

Use mechanical ventilation such as dilution and local exhaust. Use a corrosion-resistant ventilation system and exhaust directly to the outside. Supply ample air replacement. Provide dust collectors with explosion vents.

Material Safety Data Sheet

Material Name: Ammonium Bifluoride

ID: C1-102

*** Section 8 - Exposure Controls / Personal Protection (Continued) ***

PERSONAL PROTECTIVE EQUIPMENT

The following information on appropriate Personal Protective Equipment is provided to assist employers in complying with OSHA regulations found in 29 CFR Subpart I (beginning at 1910.132) or equivalent Standards of Canada. Please reference applicable regulations and standards for relevant details.

Personal Protective Equipment: Eyes/Face

Wear safety glasses with side shields (or goggles) and a face shield. . If necessary, refer to U.S. OSHA 29 CFR 1910.133.

Personal Protective Equipment: Skin

Wear impervious gloves, boots and coveralls to avoid skin contact. Natural rubber, nitrile, polyvinyl chloride or neoprene gloves are recommended. Gloves should be tested to determine their suitability for prolonged contact with this material. If necessary, refer to U.S. OSHA 29 CFR 1910.138.

Personal Protective Equipment: Respiratory

If airborne concentrations are above the applicable exposure limits, use cartridge respirator or other NIOSH-approved respiratory protection. If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998). If airborne concentrations are above the applicable exposure limits, use NIOSH-approved respiratory protection. The following NIOSH recommended respiratory protection equipment guidelines for fluorine are presented for further information:

Concentration Respiratory Equipment

1 ppm: Any Supplied Air Respirator (SAR).

2.5 ppm: Any SAR operated in a continuous-flow mode.

5 ppm: Any Self-Contained Breathing Apparatus (SCBA) with a full facepiece or any SAR with a full facepiece.

25 ppm: Any SAR with a full facepiece operated in a positive pressure mode.

Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Any SAR with full facepiece operated in a positive pressure mode in combination with an auxiliary SCBA operated in positive pressure mode.

Escape: Any air purifying, full facepiece respirator or any appropriate escape type SCBA.

Note: The IDLH limit for this product is 25 mg/m³ as fluorine.

In addition, the ACGIH has the following Excursion Limit Recommendation: Excursions in worker exposure levels may exceed three times the TLV-TWA for no more than a total of 30 minutes during a work day, and under no circumstances should they exceed five times the TLV-TWA, provided that the TLV-TWA is not exceeded (for fluorides [as F]).

Personal Protective Equipment: General

Have an eyewash fountain and safety shower available in the work area. Emergency first aid kits which include calcium gluconate preparations should be readily available in storage areas, in case of exposure to personnel during use. Personnel should be trained in the use of these first aid materials.

*** Section 9 - Physical & Chemical Properties ***

Physical Properties: Additional Information

The data provided in this section are to be used for product safety handling purposes. Please refer to Product Data Sheets, Certificates of Conformity or Certificates of Analysis for chemical and physical data for determinations of quality and for formulation purposes.

Appearance:	White crystals or flakes	Odor:	Pungent odor
Physical State:	Solid	pH:	2 (5.7 g/l, 20 deg C)
Vapor Pressure:	< 0.75 mmHg @ 20 deg C	Vapor Density (air = 1):	Not determined
Boiling Point:	462 deg F (239 deg C)	Freezing/Melting Point:	124-125 deg C (255-257 deg F)
Solubility (H2O):	63 g/L (@ 20 deg C)	Specific Gravity:	1.503 @ 25 deg C (H2O = 1)
Softening Point:	Not available	Particle Size:	Not available
Molecular Weight:	57.04	Bulk Density:	Not available
Volatile Organic Carbons:	Not applicable.	Chemical Formula:	NH4HF2

*** Section 10 - Chemical Stability & Reactivity Information ***

Chemical Stability

Stable under normal conditions. Contact with moisture will cause this product to decompose to form hydrofluoric acid.

Chemical Stability: Conditions to Avoid

Avoid dispersion of Ammonium Bifluoride particulates into air, contact with heat, moisture and ignition sources.

Material Safety Data Sheet

Material Name: Ammonium Bifluoride

ID: C1-102

*** Section 10 - Chemical Stability & Reactivity Information (Continued) ***

Incompatibility

Incompatible with strong acids, strong bases, and oxidizers. Contact with water forms hydrofluoric acid which can corrode glass, cement, and many metals.

Hazardous Decomposition

Thermal Decomposition: Nitrogen oxides, fluorine and ammonia gas. Contact with Moisture: Hydrofluoric acid.

Hazardous Polymerization

Will not occur.

*** Section 11 - Toxicological Information ***

Acute and Chronic Toxicity

A: General Product Information

Harmful or fatal if swallowed. Product is corrosive and can cause burns to contaminated eyes, skin and any other contaminated tissue. Effects may be delayed. Ammonium Bifluoride is a respiratory tract irritant, and inhalation may cause nose irritation, sore throat, coughing, and chest tightness and possibly, ulceration and perforation of the nasal septum. Inhalation exposure to high levels could cause pulmonary edema (buildup of fluid in the lungs), which could result in death. Ingestion can result in severe gastric distress with possible vomiting, bloody diarrhea, hypocalcemia, CNS depression, shock, muscle spasms and death. Ammonium Bifluoride can be absorbed through intact skin in lethal amounts.

Chronic: Long term skin overexposure to this product may lead to mottled tooth enamel and osteosclerosis (an increased density in the bones and calcification ligaments due to accumulation of fluoride). Chronic ingestion of this product may result in fluorosis (an excess of fluoride in the body) with skeletal abnormalities, anemia and kidney damage.

B: Component Analysis - LD₅₀/LC₅₀

Ammonium Fluoride:

LD₅₀ (Intraperitoneal-Rat) 32 mg/kg

B: Component Analysis - TDLo/LDLo/TCLo

Ammonium Fluoride:

LDLo (Subcutaneous-Frog, adult) 280 mg/kg; TCLo (Inhalation-Rat) 1600 µg/m³/6 hours/39 weeks-intermittent: Blood: changes in serum composition (e.g. TP, bilirubin, cholesterol); Musculoskeletal: other changes; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: phosphatases

Carcinogenicity

A: General Product Information

No information available.

B: Component Carcinogenicity

The components of this product are found on the following lists:

Fluorides, as F:

ACGIH TLV-A4	Not Classifiable as a Human Carcinogen.
IARC-3	Unclassifiable as to Carcinogenicity in Humans

Epidemiology

No information available.

Neurotoxicity

Central Nervous System depression, seizures, muscle spasms, and paralysis may occur after ingestion of this product.

Mutagenicity

Some fluorides have shown mutagenic effects at very high concentrations *in vitro*.

Teratogenicity

No information available for this product, but large prenatal exposures to fluoride ions, have been shown to cause mottling of baby teeth.

Other Toxicological Information

Persons that suffer from diabetes insipidus or some forms of renal impairment have increased risk from the effects of this product.

The following Biological Exposure Indices are currently available for Fluorides:

<u>Chemical Determinant</u>	<u>Sampling Time</u>	<u>BEI</u>
Fluorides (fluorides in urine)	Prior to Shift	3 mg/g creatinine
	End of Shift	10 mg/g Creatinine

Material Safety Data Sheet

Material Name: Ammonium Bifluoride

ID: C1-102

*** Section 12 - Ecological Information ***

Ecotoxicity

A: General Product Information

Effects of this product on aquatic life are unknown. This product may be toxic to fish and marine organisms when applied to streams, rivers, ponds or lakes.

B: Ecotoxicity

Ammonium Fluoride (12125-01-8):

LC₁ (*Mugil cephalus*, juvenile) 96 hours = 0.76 mg/L (pH 8.08, seawater @ 21°C, salinity 10%, dissolved oxygen in water 7.9 mg/L, water hardness 130-150 mg/L, CaCo₃, static bioassay); LC₁ (*Latreutes fucorum*) 96 hours = 0.409 mg/L (pH 8.07 synthetic seawater @ 23.4°C, salinity 28%, static bioassay, dissolved oxygen in water 6.7 mg/L); LC₁ (*Monacanthus hispidus*, planehead filefish) 96 hours = 0.428 mg/L (pH 8.07 synthetic seawater @ 23.4°C, salinity 28%, static bioassay, dissolved oxygen in water 6.7 mg/L); LC₁₀ (*Latreutes fucorum*) 96 hours = 0.593 mg/L (pH 8.07 synthetic seawater @ 23.4°C, salinity 28%, static bioassay, dissolved oxygen in water 6.7 mg/L); LC₁₀ (*Gaidropsarus capensis*, larva) 24 hours = 0.43 mg/L (pH 7.79-7.75, salinity 34-36%, dissolved oxygen in water 7.90-8.10 mg/L, seawater @ 14.80-15.20°C, static bioassay); LC₁₀ (*Diplodus sargus*, white bream, larva) 24 hours = 0.29 mg/L (pH 7.79-7.75, salinity 3.4-3.6%, seawater @ 14.80-15.20°C, static bioassay); LC₁₀ (*Lithognathus mormyrus*, stripped bream, larva) 24 hours = 0.34 mg/L (pH 7.79-7.75, salinity 3.4-3.6%, seawater @ 14.80-15.20°C, static bioassay); LC₁₀ (*Mugil cephalus*, juvenile) 96 hours = 0.94 mg/L (pH 8.08, seawater @ 21°C, salinity 10%, dissolved oxygen in water 7.9 mg/L, water hardness 130-150 mg/L, CaCo₃, static bioassay); LC₁₀ (*Monacanthus hispidus*, planehead filefish) 96 hours = 0.53 mg/L (pH 8.07 synthetic seawater @ 23.4°C, salinity 28%, static bioassay, dissolved oxygen in water 6.7 mg/L); LC₅₀ (*Pimephales promelas* fathead minnows) 24 hours = 364 mg/L; LC₅₀ (*Pimephales promelas* fathead minnows) 48 hours = 438 mg/L; LC₅₀ (*Pimephales promelas* fathead minnows) 96 hours = 417 mg/L; LC₅₀ (*Palaemonetes pugio* grass shrimp) 24 hours = 75 mg/L; LC₅₀ (*Palaemonetes pugio* grass shrimp) 48 hours = 160 mg/L; LC₅₀ (*Palaemonetes pugio* grass shrimp) 96 hours = 93 mg/L; LC₅₀ (*Daphnia magna* water flea) 24 hours = 202 mg/L; LC₅₀ (*Daphnia magna* water flea) 48 hours = 161 mg/L; LC₅₀ (*Daphnia magna* water flea) 72 hours = 67 mg/L; LC₅₀ (*Daphnia magna* water flea) 96 hours = 50 mg/L; LC₅₀ (*Daphnia magna* water flea) 100 hours = 139 mg/L; LC₅₀ (*Lymnaea sp.* Snail egg) 24 hours = 241 mg/L; LC₅₀ (*Lymnaea sp.* Snail egg) 48 hours = 173 mg/L; LC₅₀ (*Lymnaea sp.* Snail egg) 72 hours = 73 mg/L; LC₅₀ (*Lymnaea sp.* Snail egg) 96 hours = 70 mg/L; LC₅₀ (*Lepomis macrochirus*) 24-96 hours = 725 mg/L; LC₅₀ (*Carassius carassius*) 24 hours = 640 mg/L; LC₅₀ (*Diplodus sargus*, white bream, larva) 24 hours = 0.46 mg/L (pH 7.79-7.75, salinity 3.4-3.6%, seawater @ 14.80-15.20°C, static bioassay); LC₅₀ (*Gaidropsarus capensis*, larva) 24 hours = 0.46 mg/L (pH 7.79-7.75, salinity 34-36%, dissolved oxygen in water 7.90-8.10 mg/L, seawater @ 14.80-15.20°C, static bioassay); LC₅₀ (*Lithognathus mormyrus*, stripped bream, larva) 24 hours = 0.38 mg/L (pH 7.79-7.75, salinity 3.4-3.6%, seawater @ 14.80-15.20°C, static bioassay); LC₅₀ (*Poecilia reticulata*, guppy) 24 hours = 11.5 mg/L (pH 7.2-7.8, tap water @ 27-28°C, dissolved oxygen in water 6.8-7.4 mg/L, water hardness 130-150 mg/L, CaCo₃, static bioassay); LC₅₀ (*Poecilia reticulata*, guppy) 48 hours = 9.4 mg/L (pH 7.2-7.8, tap water @ 27-28°C, dissolved oxygen in water 6.8-7.4 mg/L, water hardness 130-150 mg/L, CaCo₃, static bioassay); LC₅₀ (*Poecilia reticulata*, guppy) 72 hours = 8.8 mg/L (pH 7.2-7.8, tap water @ 27-28°C, dissolved oxygen in water 6.8-7.4 mg/L, water hardness 130-150 mg/L, CaCo₃, static bioassay); LC₅₀ (*Poecilia reticulata*, guppy) 96 hours = 7.2 mg/L (pH 7.2-7.8, tap water @ 27-28°C, dissolved oxygen in water 6.8-7.4 mg/L, water hardness 130-150 mg/L, CaCo₃, static bioassay); LC₅₀ (*Mugil cephalus*, juvenile) 96 hours = 1.23 mg/L (pH 8.08, seawater @ 21°C, salinity 10%, dissolved oxygen in water 7.9 mg/L, water hardness 130-150 mg/L, CaCo₃, static bioassay); LC₅₀ (*Eucalanus elongatus*, adult) 96 hours = 0.908 mg/L (pH 8.2, seawater @ 20.3°C, salinity 34%, static bioassay); LC₅₀ (*Latreutes fucorum*) 96 hours = 0.936 mg/L (pH 8.07 synthetic seawater @ 23.4°C, salinity 28%, static bioassay, dissolved oxygen in water 6.7 mg/L); LC₅₀ (*Monacanthus hispidus*, planehead filefish) 96 hours = 0.69 mg/L (pH 8.07 synthetic seawater @ 23.4°C, salinity 28%, static bioassay, dissolved oxygen in water 6.7 mg/L); LC₅₀ (*Salmo salar*, Atlantic salmon, smelt) 24 hours = 0.16 mg/L (pH 7.84 seawater @ 13.8°C, salinity 28%, static bioassay, dissolved oxygen in water 3.1 mg/L); LC₅₀ (*Salmo salar*, Atlantic salmon, smelt) 24 hours = 0.2 mg/L (pH 7.46 seawater @ 23.4°C, salinity 28%, static bioassay, dissolved oxygen in water 8 mg/L); LC₅₀ (*Salmo salar*, Atlantic salmon, smelt) 24 hours = 0.24 mg/L (pH 7.9 seawater @ 13.3°C, salinity 10%, static bioassay, dissolved oxygen in water 8.9 mg/L); LC₅₀ (*Potamopyrgus jenkinsi*, juvenile) 48 hours = 0.46 mg/L (pH 8 pond water @ 15°C, water hardness 298 mg/L CaCo₃, static bioassay, dissolved oxygen in water 8.3 mg/L); LC₅₀ (*Potamopyrgus jenkinsi*, adult) 48 hours = 1.6 mg/L (pH 8 pond water @ 15°C, water hardness 298 mg/L CaCo₃, static bioassay, dissolved oxygen in water 8.3 mg/L); LC₅₀ (*Potamopyrgus jenkinsi*, juvenile) 96 hours = 0.315 mg/L (pH 8 pond water @ 15°C, water hardness 298 mg/L CaCo₃, static bioassay, dissolved oxygen in water 8.3 mg/L); LC₅₀ (*Potamopyrgus jenkinsi*, adult) 96 hours = 0.85 mg/L (pH 8 pond water @ 15°C, water hardness 298 mg/L CaCo₃, static bioassay, dissolved oxygen in water 8.3 mg/L); LC₅₀ (*Micropterus dolomieu*, smallmouth bass, juvenile) 96 hours = 371 mg/L (pH 6.53 lake water @ 22.3°C, water hardness 42.3 mg/L CaCo₃, static bioassay, dissolved oxygen in water 7.95 mg/L);

Material Safety Data Sheet

Material Name: Ammonium Bifluoride

ID: C1-102

*** Section 12 - Ecological Information (Continued) ***

Ecotoxicity (continued)

Ammonium Fluoride (continued):

LC₅₀ (*Micropterus dolomieu*, smallmouth bass, juvenile) 96 hours = 117 mg/L (pH 7.16 lake water @ 22.3°C, water hardness 7.95 mg/L CaCO₃, static bioassay, dissolved oxygen in water 7.95 mg/L); LC₅₀ (*Lepomis cyanellus*, green sunfish, juvenile) 96 hours = 0.5 mg/L (pH 6.6 lake water @ 22.4°C, water hardness 43.1 mg/L CaCO₃, static bioassay, dissolved oxygen in water 8.1 mg/L); LC₅₀ (*Lepomis cyanellus*, green sunfish, juvenile) 96 hours = 1.06 mg/L (pH 7.2 lake water @ 22.4°C, water hardness 43.1 mg/L CaCO₃, static bioassay, dissolved oxygen in water 8.1 mg/L); LC₅₀ (*Acartia hudsonica*, embryo) 48 hours = 0.183-0.259 mg/L (seawater @ 20°C, salinity 30-32%); LC₅₀ (*Cynoscion nebulosus*, spotted seatrout) 24 hours = 0.28 mg/L (pH 7.45-8, salinity 25-30%, seawater @ 26-27°C, static bioassay); LC₅₀ (*Cynoscion nebulosus*, spotted seatrout) 24 hours = 1.38 mg/L (pH 7.8-8, salinity 13-14%, seawater @ 26-27°C, static bioassay); LC₅₀ (*Cynoscion nebulosus*, spotted seatrout) 96 hours = 0.98 mg/L (pH 7.8-8, salinity 13-14%, seawater @ 26-27°C, static bioassay); LC₅₀ (*Crangon crangon*, shrimp) 96 hours = 19.5 mg/L (salinity 17%, estuarine water @ 15°C, static bioassay); LC₅₀ (*Brachionus plicatilis*) 24 hours = 20.4 mg/L (pH 7.7, salinity 15%, synthetic seawater @ 25°C, static bioassay); LC₅₀ (*Brachionus plicatilis*) 24 hours = 17.7 mg/L (pH 7.7, salinity 30%, synthetic seawater @ 25°C, static bioassay); LC₉₉ (*Monacanthus hispidus*, planehead filefish) 96 hours = 1.11 mg/L (pH 8.07 synthetic seawater @ 23.4°C, salinity 28%, static bioassay, dissolved oxygen in water 6.7 mg/L); LC₉₉ (*Mugil cephalus*, juvenile) 96 hours = 1.99 mg/L (pH 8.08, seawater @ 21°C, salinity 10%, dissolved oxygen in water 7.9 mg/L, water hardness 130-150 mg/L, CaCO₃, static bioassay); LC₉₉ (*Latreutes fucorum*) 96 hours = 2.15 mg/L (pH 8.07 synthetic seawater @ 23.4°C, salinity 28%, static bioassay, dissolved oxygen in water 6.7 mg/L); EC₁₀ (*Diplodus sargus*, white bream, larva) 24 hours = 0.03 mg/L (pH 7.79-7.75, salinity 3.4-3.6%, seawater @ 14.80-15.20°C, static bioassay); EC₁₀ (*Gaidropsarus capensis*, larva) 24 hours = 0.07 mg/L (pH 7.79-7.75, salinity 34-36%, dissolved oxygen in water 7.90-8.10 mg/L, seawater @ 14.80-15.20°C, static bioassay); EC₁₀ (*Lithognathus mormyrus*, striped bream, larva) 24 hours = 0.16 mg/L (pH 7.79-7.75, salinity 3.4-3.6%, seawater @ 14.80-15.20°C, static bioassay); EC₅₀ (*Gaidropsarus capensis*, larva) 24 hours = 0.11 mg/L (pH 7.79-7.75, salinity 34-36%, dissolved oxygen in water 7.90-8.10 mg/L, seawater @ 14.80-15.20°C, static bioassay).

Environmental Fate

No potential for food chain accumulation.

*** Section 13 - Disposal Considerations ***

US EPA Waste Number & Descriptions

A: General Product Information

Wastes of this product must be tested using methods described in 40 CFR Part 261 to determine if it meets applicable definitions of hazardous wastes. Liquid or aqueous solutions of this product may require an EPA waste code D002, for corrosivity.

B: Component Waste Numbers

No EPA Waste Numbers are applicable for this product's components.

Disposal Instructions

All wastes must be handled in accordance with local, state and federal regulations. Material can be converted to a less hazardous material by weak reducing agents followed by neutralization.

*** Section 14 - Transportation Information Ground ***

NOTE: The shipping classification information in this section (Section 14) is meant as a guide to the overall classification of the product. However, transportation classifications may be subject to change with changes in package size. Consult shipper requirements under 49 CFR, IATA and IMDG to assure regulatory compliance.

US DOT 49 CFR 100-185 Revised July 24, 2009 Information

UN/NA #: UN 1727

Shipping Name: Ammonium hydrogendifluoride, solid

Hazard Class: 8

Packing Group: II

Required Label(s): Class 8 (Corrosive)

Special Provision: IB8, IP2, IP4, N34

Packaging: 172.212

Additional Shipping Information

For a single package less than the RQ of 100 lb (45.4 kg), the RQ designation should be not be used.

Limited Quantity Shipments: Shipments, except for air, need not be marked with the Proper Shipping Name of the contents, but shall be marked with the UN Number (1727) of the contents, preceded by the letters "UN", placed within a diamond. The width of the line forming the diamond shall be at least 2 mm; the number shall be at least 6 mm high. The total weight of each outer packaging cannot exceed 30 kg (66 pounds.)

Small Quantities for Highway and Rail: The maximum quantity of this material per inner receptacle is limited to 30 g (1 ounce) per receptacle. The inner receptacles must be securely packed in an inside packaging with cushioning material to prevent movement of the

Material Safety Data Sheet

Material Name: Ammonium Bifluoride

ID: C1-102

inner receptacles and packed in a strong outer box with a gross mass not to exceed 29kg (64 pounds). The completed package must meet the drop test requirements of 173.4(6) (i). The outside of the package must be marked with the statement "**This package conforms to 49 CFR 173.4 for domestic highway or rail transport only.**"

Excepted Quantities: The maximum quantity of this material per inner receptacle is limited to 30 g (1 ounce) per receptacle and the aggregate quantity of this material per completed package does not exceed 500 g (1.1 pounds). The inner receptacles must be securely packed in an inside packaging with cushioning material to prevent movement in the inner receptacles and packed in a strong outer box with a gross mass not to exceed 29kg (64 pounds). The completed package must meet a drop test. The requirements are found in 173.4(6) (i). The package must not be opened or otherwise altered until it is no longer in commerce. For highway or rail transportation no shipping paper is required. The package must be legibly marked with the following marking:



NOTE: The "*" must be replaced by the primary hazard class, or when assigned, the division of each of the hazardous materials contained in the package. The "**" must be replaced by the name of the shipper or consignee if not shown elsewhere on the package. The symbol shall be not less than 100 mm (3.9 inches) x 100 mm (3.9 inches), and must be durable and clearly visible.

De minimis Exceptions: The maximum quantity of this material per inner receptacle is limited to 1g (0.04 ounce) per receptacle and the aggregate quantity of this material per completed package does not exceed 100 g (0.22 pounds). The inner receptacles must be securely packed in an inside packaging with cushioning material to prevent movement in the inner receptacles and packed in a strong outer box with a gross mass not to exceed 29kg (64 pounds). The completed package must meet the drop test. The requirements are found in 173.4(6) (i). The package must not be opened or otherwise altered until it is no longer in commerce and may be transported by aircraft. If all of the above requirements are met, then this material is not regulated.

*** Section 14 – Transportation Information Air ***

50th Edition International Air Transport Association (IATA):

For Shipments by Air transport: This information applies to air shipments both within the U.S. and for shipments originating in the U.S., but being shipped to a different country.

UN/NA #: UN 1727

Proper Shipping Name: Ammonium hydrogendifluoride, solid

Hazard Class: 8

Packing Group: II

Passenger & Cargo Aircraft Packing Instruction: 815

Passenger & Cargo Aircraft Maximum Net Quantity: 15 kg

Limited Quantity Packing Instruction (Passenger & Cargo Aircraft): Y815

Limited Quantity Maximum Net Quantity (Passenger & Cargo Aircraft): 5 kg

Cargo Aircraft Only Packing Instruction: 817

Cargo Aircraft Only Maximum Net Quantity: 50 kg

Excepted Quantities: E2

Special Provisions: A3

ERG Code: 8L

Limited Quantity Shipments: Shipments for air must be marked with the Proper Shipping Name, Ammonium hydrogendifluoride, solid, and shall be marked with the UN Number (1727) preceded by the letters "UN", placed within a diamond. The width of the line forming the diamond shall be at least 2 mm; the number shall be at least 6 mm high. The total weight of each outer packaging cannot exceed 30 kg.

Excepted Quantities: The maximum quantity of this material per inner receptacle is limited to 30 g per receptacle and the aggregate quantity of this material per completed package does not exceed 500 g. The inner receptacles must be securely packed in an intermediate packaging with cushioning material to prevent movement in the inner receptacles and packed in a strong outer box with a gross mass not to exceed 29kg. The completed package must meet a drop test. The requirements are found in 2.7.6.1. The package must not be opened or otherwise altered until it is no longer in commerce. For air transportation no shipping paper is required. The package must be legibly marked with the following marking:

Material Safety Data Sheet

Material Name: Ammonium Bifluoride

ID: C1-102



NOTE: The "*" must be replaced by the primary hazard class, or when assigned, the division of each of the hazardous materials contained in the package. The "**" must be replaced by the name of the shipper or consignee if not shown elsewhere on the package. The symbol shall be not less than 100 mm x 100 mm and must be durable and clearly visible.

*** Section 14 – Transportation Information Vessel ***

Amendment 34-08 International Maritime Dangerous Goods (IMDG) Code

For shipments via marine vessel transport, the following classification information applies.

UN/NA #: UN 1727

Proper Shipping Name: AMMONIUM HYDROGENDIFLUORIDE, SOLID

Hazard Class: Class 8

Packing Group: II

Special Provisions: None

Limited Quantities: 1 kg

Excepted Quantities: E2

Packing Instructions: P002

Provisions: None

IBC Instructions IBC08

IBC Provisions: B2, B4

EmS: F-A, S-B

Stowage and Segregation: Category A. Shade from radiant heat. Clear of living quarters and "Separated from" acids.

Limited Quantity Shipments: Shipments need not be marked with the Proper Shipping Name of the contents, but shall be marked with the UN Number (1727) of the contents, preceded by the letters "UN", placed within a diamond. The width of the line forming the diamond shall be at least 2 mm; the number shall be at least 6 mm high. The total weight of each outer packaging cannot exceed 30 kg.

Excepted Quantities: The maximum quantity of this material per inner receptacle is limited to 30 g per receptacle and the aggregate quantity of this material per completed package does not exceed 500 g. Maximum number of packages per Cargo Transport Unit (CTU) shall not exceed 1,000 packages. The inner receptacles must be securely packed in an intermediate packaging with cushioning material to prevent movement in the inner receptacles and packed in a strong outer box with a gross mass not to exceed 29 kg. The completed package must meet a drop test. The requirements are found in 3.5.3.1. Packages must not be opened or otherwise altered until it is no longer in commerce and a shipping paper is required. The package must be legibly marked with the following marking:



NOTE: The "*" must be replaced by the primary hazard class, or when assigned, the division of each of the hazardous materials contained in the package. The "**" must be replaced by the name of the shipper or consignee if not shown elsewhere on the package. The symbol shall be not less than 100 mm x 100 mm and must be durable and clearly visible.

Material Safety Data Sheet

Material Name: Ammonium Bifluoride

ID: C1-102

***** Section 15 – Regulatory Information *****

US Federal Regulations

A: General Product Information

Ammonium Bifluoride (CAS # 1341-49-7) and Ammonium Fluoride (CAS # 12125-01-8) are designated as hazardous substances under section 311(b)(2)(A) of the Federal Water Pollution Control Act and are further regulated by the Clean Water Act Amendments of 1977 and 1978. These regulations apply to discharges of these substances.

B: Component Analysis

This product contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4).

Ammonium Bifluoride (1341-49-7):

CERCLA: Final RQ = 100 pounds (45.4 kg)

SARA 302 (EHS TPQ) There are no specific Threshold Planning Quantities for Ammonium Bifluoride. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lbs. (4,540 kg) therefore applies, per 40 CFR 370.20.

Ammonium Fluoride (12125-01-8):

CERCLA: Final RQ = 100 pounds (45.4 kg)

SARA 302 (EHS TPQ) There are no specific Threshold Planning Quantities for Ammonium Fluoride. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lbs. (4,540 kg) therefore applies, per 40 CFR 370.20.

US Federal Regulations (continued)

C: Sara 311/312 Tier II Hazard Ratings:

Component	CAS #	Fire Hazard	Reactivity Hazard	Pressure Hazard	Immediate Health Hazard	Chronic Health Hazard
Ammonium Bifluoride	1341-49-7	No	Yes	No	Yes	Yes
Ammonium Fluoride	12125-01-8	No	Yes	No	Yes	Yes

State Regulations

A: General Product Information

California Proposition 65

Ammonium Bifluoride is not on the California Proposition 65 chemical lists.

B: Component Analysis - State

The following components appear on one or more of the following state hazardous substance lists:

Component	CAS #	CA	FL	MA	MN	NJ	PA
Ammonium Bifluoride	1341-49-7	No	No	No	No	Yes	Yes
Ammonium Fluoride	12125-01-8	No	Yes	Yes	No	Yes	Yes

Other Regulations

A: General Product Information

U.S. Export Administration Regulations (EAR) (15 CFR Parts 736, 738, 740, 742, 745, 770 and 774): Under the Chemical Weapons Convention (CWC) Ammonium Bifluoride (Ammonium hydrogen fluoride, CAS # 1341-49-7) is on the list of Other Australia Group-controlled precursor chemicals not also identified as Schedule 1, 2 or 3 chemicals.

B: Component Analysis - Inventory

Component	CAS #	TSCA	DSL	EINECS
Ammonium Bifluoride	1341-49-7	Yes	Yes	Yes
Ammonium Fluoride	12125-01-8	Yes	Yes	Yes

C: Component Analysis - WHMIS IDL

This product is listed under the Canadian Hazardous Products Act Ingredient Disclosure List:

Component	CAS #	Minimum Concentration
Fluoride Inorganic Compounds, n.o.s.	N/A (general class)	1%

ANSI LABELING (Z129.1):

DANGER! HARMFUL OR FATAL IF SWALLOWED, INHALED OR IF ABSORBED THROUGH THE SKIN. CAUSES SKIN AND EYE BURNS. EFFECTS MAY BE DELAYED. Do not taste or swallow. Do not get on skin or in eyes. Avoid breathing dusts or particulates. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Wear gloves, goggles, face shields, suitable body protection, and NIOSH/MSHA-approved respiratory protection, as appropriate. **FIRST-AID:** In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Apply calcium gluconate gel to skin contaminations; apply 1% calcium gluconate solution to exposed eyes. If inhaled, remove to fresh air. If ingested, do not induce vomiting. Get medical attention. **IN CASE OF FIRE:** Use water fog, dry chemical, CO₂, or "alcohol" foam. **IN CASE OF SPILL:** Absorb spill with inert material. Place residue in suitable container. Do

Material Safety Data Sheet

Material Name: Ammonium Bifluoride

ID: C1-102

not use glass or silicate-based containers. Consult Material Safety Data Sheet for additional information.

***** Section 16 - Other Information *****

Other Information

Chem One Ltd. ("Chem One") shall not be responsible for the use of any information, product, method, or apparatus herein presented ("Information"), and you must make your own determination as to its suitability and completeness for your own use, for the protection of the environment, and for health and safety purposes. You assume the entire risk of relying on this Information. In no event shall Chem One be responsible for damages of any nature whatsoever resulting from the use of this product or products, or reliance upon this Information. By providing this Information, Chem One neither can nor intends to control the method or manner by which you use, handle, store, or transport Chem One products. If any materials are mentioned that are not Chem One products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be observed. Chem One makes no representations or warranties, either express or implied of merchantability, fitness for a particular purpose or of any other nature regarding this information, and nothing herein waives any of Chem One's conditions of sale. This information could include technical inaccuracies or typographical errors. Chem One may make improvements and/or changes in the product (s) and/or the program (s) described in this information at any time. If you have any questions, please contact us at Tel. 713-896-9966 or E-mail us at Safety@chemone.com.

Key/Legend

EPA = Environmental Protection Agency; TSCA = Toxic Substance Control Act; ACGIH = American Conference of Governmental Industrial Hygienists; IARC = International Agency for Research on Cancer; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration

Contact: Sue Palmer-Koleman, PhD

Contact Phone: (713) 896-9966

Revision Log

07/21/00 4:20 PM SEP Changed company name. Sect 1 and 16, from Corporation to Ltd.
12/12/00 1:20 PM HDF Added more detailed health hazard information related to hypocalcemia in Section 3. Added IARC-3 designation in Section 11. Added TClO data for Ammonium Fluoride.
05/14/01 9:31 AM Checked exposure limits; made changes to Section 9; overall review, add SARA 311/312 Hazard Ratings.
07/24/01 3:24 PM Changed contact to Sue, non-800 Chemtrec Phone Number added.
07/31/03 12:00 pm HDF General review of entire MSDS. Up-graded Section 10 Reactivity Information. Up-Dated entire Section 14 Transportation Information to include IATA, IMO transport information.
03/22/04 9:06 AM HDF Addition of Export Administration Regulations, Section 15.
06/22/05 11:54AM SEP Updated IATA Section 14.
06/08/06 2:00 PM HDF Addition of text to Section 3 related to delay of symptoms.
09/05/06 2:29 PM SEP Updated DOT & IMO Section 14.
10/10/08 3:07 PM DLY Changed Chem One Physical Address
09/18/09 MMK Updated Section 14 limited & excepted quantites and exceptions.
This is the end of MSDS # C1-102