



## 10M34-3 Molybdenum (10,000µg/mL in 4% HNO<sub>3</sub> + 2% HF)

### High-Purity Standards

Catalogue number: 10M34-3

Version No: 1.1

Safety Data Sheet according to OSHA HazCom Standard (2012) requirements

Chemwatch Hazard Alert Code: 3

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S.GHS.USA.EN

## SECTION 1 IDENTIFICATION

### Product Identifier

Product name	10M34-3 Molybdenum (10,000µg/mL in 4% HNO <sub>3</sub> + 2% HF)
Synonyms	10,000µg/mL Molybdenum in 4% HNO <sub>3</sub> + 2% HF
Proper shipping name	Corrosive liquid, acidic, inorganic, n.o.s (contains nitric acid and hydrofluoric acid)
Other means of identification	10M34-3

### Recommended use of the chemical and restrictions on use

Relevant identified uses	Use according to manufacturer's directions.
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### Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party

Registered company name	High-Purity Standards
Address	PO Box 41727 SC 29423 United States
Telephone	843-767-7900
Fax	843-767-7906
Website	highpuritystandards.com
Email	Not Available

### Emergency phone number




Association / Organisation	INFOTRAC
Emergency telephone numbers	1-800-535-5053
Other emergency telephone numbers	1-352-323-3500

## SECTION 2 HAZARD(S) IDENTIFICATION

### Classification of the substance or mixture

Classification	Serious Eye Damage Category 1, Skin Corrosion/Irritation Category 1B, Acute Toxicity (Oral) Category 3, Acute Toxicity (Dermal) Category 3, Specific target organ toxicity - repeated exposure Category 2, Metal Corrosion Category 1, Specific target organ toxicity - single exposure Category 3 (respiratory tract irritation)
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### Label elements

GHS label elements	  
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SIGNAL WORD DANGER

### Hazard statement(s)

H318	Causes serious eye damage.
H314	Causes severe skin burns and eye damage.
H301	Toxic if swallowed.
H311	Toxic in contact with skin.
H373	May cause damage to organs.

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H290	May be corrosive to metals.
H335	May cause respiratory irritation.

## Hazard(s) not otherwise specified

Not Applicable

## Precautionary statement(s) Prevention

P260	Do not breathe dust/fume/gas/mist/vapours/spray.
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## Precautionary statement(s) Response

P301+P310	IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
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## Precautionary statement(s) Storage

P405	Store locked up.
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## Precautionary statement(s) Disposal

P501	Dispose of contents/container in accordance with local regulations.
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## SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

## Substances

See section below for composition of Mixtures

## Mixtures

CAS No	%[weight]	Name
7439-98-7	1	<u>molybdenum</u>
7697-37-2	4	<u>nitric acid</u>
7664-39-3	2	<u>hydrofluoric acid</u>
7732-18-5	balance	<u>water</u>

## SECTION 4 FIRST-AID MEASURES

## Description of first aid measures

Eye Contact	<p>If this product comes in contact with the eyes:</p> <ul style="list-style-type: none"> <li>▶ Immediately hold eyelids apart and flush the eye continuously with running water.</li> <li>▶ Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.</li> <li>▶ Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes.</li> <li>▶ Transport to hospital or doctor without delay.</li> <li>▶ Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.</li> </ul>
Skin Contact	<p>If there is evidence of severe skin irritation or skin burns:</p> <ul style="list-style-type: none"> <li>▶ Avoid further contact. Immediately remove contaminated clothing, including footwear.</li> <li>▶ Flush skin under running water for 15 minutes.</li> <li>▶ Avoiding contamination of the hands, massage <b>calcium gluconate gel</b> into affected areas, pay particular attention to creases in skin.</li> <li>▶ Contact the Poisons Information Centre.</li> <li>▶ Continue gel application for at least 15 minutes after burning sensation ceases.</li> <li>▶ If pain recurs, repeat application of <b>calcium gluconate gel</b> or apply every 20 minutes.</li> <li>▶ If no gel is available, continue washing for at least 15 minutes, using soap if available. If patient is conscious, give six <b>calcium gluconate or calcium carbonate</b> tablets in water by mouth.</li> <li>▶ Transport to hospital, or doctor, urgently.</li> </ul>
Inhalation	<ul style="list-style-type: none"> <li>▶ If fumes or combustion products are inhaled remove from contaminated area.</li> <li>▶ Lay patient down. Keep warm and rested.</li> <li>▶ Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.</li> <li>▶ Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.</li> <li>▶ Transport to hospital, or doctor, without delay.</li> </ul> <p>For massive exposures:</p> <ul style="list-style-type: none"> <li>▶ If dusts, vapours, aerosols, fumes or combustion products are inhaled, remove from contaminated area.</li> <li>▶ Lay patient down.</li> <li>▶ Keep warm and rested.</li> <li>▶ Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.</li> <li>▶ Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.</li> <li>▶ If victim is conscious, give six <b>calcium gluconate or calcium carbonate</b> tablets in water by mouth.</li> <li>▶ Transport to hospital, or doctor, urgently.</li> </ul>
Ingestion	<ul style="list-style-type: none"> <li>▶ For advice, contact a Poisons Information Centre or a doctor at once.</li> <li>▶ Urgent hospital treatment is likely to be needed.</li> <li>▶ <b>If swallowed do NOT induce vomiting.</b></li> <li>▶ If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.</li> <li>▶ Observe the patient carefully.</li> <li>▶ Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.</li> <li>▶ Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink.</li> <li>▶ Transport to hospital or doctor without delay.</li> </ul>

**Most important symptoms and effects, both acute and delayed**

See Section 11

**Indication of any immediate medical attention and special treatment needed**

Following acute or short term repeated exposure to hydrofluoric acid:

- Subcutaneous injections of Calcium Gluconate may be necessary around the burnt area. Continued application of Calcium Gluconate Gel or subcutaneous Calcium Gluconate should then continue for 3-4 days at a frequency of 4-6 times per day. If a "burning" sensation recurs, apply more frequently.
- Systemic effects of extensive hydrofluoric acid burns include renal damage, hypocalcaemia and consequent cardiac arrhythmias. Monitor haematological, respiratory, renal, cardiac and electrolyte status at least daily. Tests should include FBE, blood gases, chest X-ray, creatinine and electrolytes, urine output, Ca ions, Mg ions and phosphate ions. Continuous ECG monitoring may be required.
- Where serum calcium is low, or clinical, or ECG signs of hypocalcaemia develop, infusions of calcium gluconate, or if less serious, oral Sandocal, should be given. Hydrocortisone 500 mg in a four to six hourly infusion may help.
- Antibiotics should not be given as a routine, but only when indicated.
- Eye contact pain may be excruciating and 2-3 drops of 0.05% pentocaine hydrochloride may be instilled, followed by further irrigation

**BIOLOGICAL EXPOSURE INDEX - BEI**

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
1. Methaemoglobin in blood	1.5% of haemoglobin	During or end of shift	B, NS, SQ

B: Background levels occur in specimens collected from subjects **NOT** exposed.

NS: Non-specific determinant; Also seen after exposure to other materials

SQ: Semi-quantitative determinant - Interpretation may be ambiguous; should be used as a screening test or confirmatory test.

For acute or short term repeated exposures to fluorides:

- Fluoride absorption from gastro-intestinal tract may be retarded by calcium salts, milk or antacids.
- Fluoride particulates or fume may be absorbed through the respiratory tract with 20-30% deposited at alveolar level.
- Peak serum levels are reached 30 mins. post-exposure; 50% appears in the urine within 24 hours.
- For acute poisoning (endotracheal intubation if inadequate tidal volume), monitor breathing and evaluate/monitor blood pressure and pulse frequently since shock may supervene with little warning. Monitor ECG immediately; watch for arrhythmias and evidence of Q-T prolongation or T-wave changes. Maintain monitor. Treat shock vigorously with isotonic saline (in 5% glucose) to restore blood volume and enhance renal excretion.
- Where evidence of hypocalcaemic or normocalcaemic tetany exists, calcium gluconate (10 ml of a 10% solution) is injected to avoid tachycardia.

**BIOLOGICAL EXPOSURE INDEX - BEI**

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
Fluorides in urine	3 mg/gm creatinine 10mg/gm creatinine	Prior to shift End of shift	B, NS B, NS

B: Background levels occur in specimens collected from subjects **NOT** exposed

NS: Non-specific determinant; also observed after exposure to other exposures.

**SECTION 5 FIRE-FIGHTING MEASURES****Extinguishing media**

- There is no restriction on the type of extinguisher which may be used.
- Use extinguishing media suitable for surrounding area.

**Special hazards arising from the substrate or mixture**

<b>Fire Incompatibility</b>	None known.
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**Special protective equipment and precautions for fire-fighters**

<b>Fire Fighting</b>	Alert Fire Brigade and tell them location and nature of hazard.
<b>Fire/Explosion Hazard</b>	Non combustible. May emit poisonous fumes.

**SECTION 6 ACCIDENTAL RELEASE MEASURES****Personal precautions, protective equipment and emergency procedures**

See section 8

**Environmental precautions**

See section 12

**Methods and material for containment and cleaning up**

<b>Minor Spills</b>	Clean up all spills immediately.
<b>Major Spills</b>	#

Personal Protective Equipment advice is contained in Section 8 of the SDS.

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## SECTION 7 HANDLING AND STORAGE

## Precautions for safe handling

Safe handling	► Avoid all personal contact, including inhalation.
Other information	► Store in original containers.

## Conditions for safe storage, including any incompatibilities

Suitable container	<ul style="list-style-type: none"> <li>► Lined metal can, lined metal pail/ can.</li> <li>For low viscosity materials</li> <li>► Drums and jerricans must be of the non-removable head type.</li> </ul> <p>All inner and sole packagings for substances that have been assigned to Packaging Groups I or II on the basis of inhalation toxicity criteria, must be hermetically sealed.</p> <ul style="list-style-type: none"> <li>► Material is corrosive to most metals, glass and other siliceous materials.</li> </ul>
Storage incompatibility	<ul style="list-style-type: none"> <li>► WARNING: Avoid or control reaction with peroxides.</li> </ul> <p>Salts of inorganic fluoride:</p> <ul style="list-style-type: none"> <li>► react with water forming acidic solutions.</li> <li>► Reacts with mild steel, galvanised steel / zinc producing hydrogen gas which may form an explosive mixture with air.</li> </ul> <p>Hydrogen fluoride:</p> <ul style="list-style-type: none"> <li>► reacts violently with strong oxidisers, acetic anhydride, alkalis, 2-aminoethanol, arsenic trioxide (with generation of heat), bismuthic acid, calcium oxide, chlorosulfonic acid, cyanogen fluoride, ethylenediamine, ethyleneimine, fluorine (fluorine gas reacts vigorously with a 50% hydrofluoric acid solution and may burst into flame), nitrogen trifluoride, N-phenylazopiperidine, oleum, oxygen difluoride, phosphorus pentoxide, potassium permanganate, potassium tetrafluorosilicate(2-), beta-propiolactone, propylene oxide, sodium, sodium tetrafluorosilicate, sulfuric acid, vinyl acetate</li> <li>► reacts (possibly violently) with aliphatic amines, alcohols, alkanolamines, alkylene oxides, aromatic amines, amides, ammonia, ammonium hydroxide, epichlorohydrin, isocyanates, metal acetylides, metal silicides, methanesulfonic acid, nitrogen compounds, organic anhydrides, oxides, silicon compounds, vinylidene fluoride</li> <li>► attacks glass and siliceous materials, concrete, ceramics, metals (flammable hydrogen gas may be produced), metal alloys, some plastics, rubber coatings, leather, and most other materials with the exception of lead, platinum, polyethylene, wax.</li> <li>► Avoid strong bases.</li> </ul>

## SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

## Control parameters

## OCCUPATIONAL EXPOSURE LIMITS (OEL)

## INGREDIENT DATA

Source	Ingredient	Material name	TWA	STEL	Peak	Notes
US OSHA Permissible Exposure Levels (PELs) - Table Z1	molybdenum	Molybdenum - Insoluble compounds	15 mg/m <sup>3</sup>	Not Available	Not Available	Total dust; (as Mo)
US OSHA Permissible Exposure Levels (PELs) - Table Z3	molybdenum	Inert or Nuisance Dust	5 mg/m <sup>3</sup> / 15 mg/m <sup>3</sup> / 15 mppcf / 50 mppcf	Not Available	Not Available	Respirable fraction; All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by this limit, which is the same as the Particulates Not Otherwise Regulated (PNOR) limit in Table Z-1. / Total dust; All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by this limit, which is the same as the Particulates Not Otherwise Regulated (PNOR) limit in Table Z-1.
US ACGIH Threshold Limit Values (TLV)	molybdenum	Molybdenum, as Mo	0.5 mg/m <sup>3</sup>	Not Available	Not Available	TLV® Basis: LRT irr
US NIOSH Recommended Exposure Limits (RELs)	molybdenum	Molybdenum metal	Not Available	Not Available	Not Available	See Appendix D
US OSHA Permissible Exposure Levels (PELs) - Table Z1	nitric acid	Nitric acid	5 mg/m <sup>3</sup> / 2 ppm	Not Available	Not Available	Not Available
US ACGIH Threshold Limit Values (TLV)	nitric acid	Nitric acid	2 ppm	4 ppm	Not Available	TLV® Basis: URT & eye irr; dental erosion
US NIOSH Recommended Exposure Limits (RELs)	nitric acid	Aqua fortis, Engravers acid, Hydrogen nitrate, Red fuming nitric acid (RFNA), White fuming nitric acid (WFNA)	5 mg/m <sup>3</sup> / 2 ppm	10 mg/m <sup>3</sup> / 4 ppm	Not Available	Not Available
US OSHA Permissible Exposure Levels (PELs) - Table Z1	hydrofluoric acid	Hydrogen fluoride	Not Available	Not Available	Not Available	See Table Z-2; (as F)
US OSHA Permissible Exposure Levels (PELs) - Table Z2	hydrofluoric acid	Hydrogen fluoride	3 ppm	Not Available	Not Available	(Z37.28-1969)
US ACGIH Threshold Limit Values (TLV)	hydrofluoric acid	Hydrogen fluoride, as F	0.5 ppm	Not Available	2 ppm	TLV® Basis: URT, LRT, skin, & eye irr; fluorosis; BEI
US NIOSH Recommended Exposure Limits (RELs)	hydrofluoric acid	Anhydrous hydrogen fluoride; Aqueous hydrogen fluoride (i.e., Hydrofluoric acid); HF-A	2.5 mg/m <sup>3</sup> / 3 ppm	Not Available	5 mg/m <sup>3</sup> / 6 ppm	[15-minute]

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## EMERGENCY LIMITS

Ingredient	Material name	TEEL-1	TEEL-2	TEEL-3
molybdenum	Molybdenum	10 mg/m <sup>3</sup>	10 mg/m <sup>3</sup>	17 mg/m <sup>3</sup>
nitric acid	Nitric acid	Not Available	Not Available	Not Available
hydrofluoric acid	Hydrogen fluoride; (Hydrofluoric acid)	Not Available	Not Available	Not Available

Ingredient	Original IDLH	Revised IDLH
molybdenum	N.E. / N.E.	5,000 mg/m <sup>3</sup>
nitric acid	100 ppm	25 ppm
hydrofluoric acid	30 ppm	30 [Unch] ppm
water	Not Available	Not Available

## Exposure controls

Appropriate engineering controls	Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard.
Personal protection	
Eye and face protection	► Chemical goggles.
Skin protection	See Hand protection below
Hands/feet protection	► Wear chemical protective gloves, e.g. PVC. ► When handling corrosive liquids, wear trousers or overalls outside of boots, to avoid spills entering boots.
Body protection	See Other protection below
Other protection	► Overalls.
Thermal hazards	Not Available

## Respiratory protection

Type A Filter of sufficient capacity.

## SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

## Information on basic physical and chemical properties

Appearance	colorless		
Physical state	Liquid	Relative density (Water = 1)	Not Available
Odour	Not Available	Partition coefficient n-octanol / water	Not Available
Odour threshold	Not Available	Auto-ignition temperature (°C)	Not Available
pH (as supplied)	<2	Decomposition temperature	Not Available
Melting point / freezing point (°C)	Not Available	Viscosity (cSt)	Not Available
Initial boiling point and boiling range (°C)	Not Available	Molecular weight (g/mol)	Not Available
Flash point (°C)	Not Available	Taste	Not Available
Evaporation rate	Not Available	Explosive properties	Not Available
Flammability	Not Available	Oxidising properties	Not Available
Upper Explosive Limit (%)	Not Available	Surface Tension (dyn/cm or mN/m)	Not Available
Lower Explosive Limit (%)	Not Available	Volatile Component (%vol)	Not Available
Vapour pressure (kPa)	Not Available	Gas group	Not Available
Solubility in water (g/L)	Miscible	pH as a solution (1%)	Not Available
Vapour density (Air = 1)	Not Available	VOC g/L	Not Available

## SECTION 10 STABILITY AND REACTIVITY

Reactivity	See section 7
Chemical stability	► Unstable in the presence of incompatible materials.
Possibility of hazardous reactions	See section 7
Conditions to avoid	See section 7
Incompatible materials	See section 7

Continued...

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## Hazardous decomposition products

See section 5

## SECTION 11 TOXICOLOGICAL INFORMATION

## Information on toxicological effects

Inhaled	Inhalation of vapours or aerosols (mists, fumes), generated by the material during the course of normal handling, may produce toxic effects. The material can cause respiratory irritation in some persons. Corrosive acids can cause irritation of the respiratory tract, with coughing, choking and mucous membrane damage. Bronchial and alveolar exudate are apparent in animals exposed to molybdenum by inhalation. Acute effects of fluoride inhalation include irritation of nose and throat, coughing and chest discomfort. Acute inhalation exposures to hydrogen fluoride (hydrofluoric acid) vapours produce severe eye, nose, and throat irritation; delayed fever, cyanosis, and pulmonary edema; and may cause death.
Ingestion	<b>Toxic effects</b> may result from the accidental ingestion of the material; animal experiments indicate that ingestion of less than 40 gram may be fatal or may produce serious damage to the health of the individual. The material can produce chemical burns within the oral cavity and gastrointestinal tract following ingestion. Ingestion of acidic corrosives may produce burns around and in the mouth, the throat and oesophagus. Molybdenum, an essential trace element, can in large doses hamper growth and cause loss of appetite, listlessness and diarrhoea. Fluoride causes severe loss of calcium in the blood, with symptoms appearing several hours later including painful and rigid muscle contractions of the limbs.
Skin Contact	Skin contact with the material may produce toxic effects; systemic effects may result following absorption. The material can produce chemical burns following direct contact with the skin. Skin contact with acidic corrosives may result in pain and burns; these may be deep with distinct edges and may heal slowly with the formation of scar tissue. Contact of the skin with liquid hydrofluoric acid (hydrogen fluoride) may cause severe burns, erythema, and swelling, vesiculation, and serious crusting. Fluorides are easily absorbed through the skin and cause death of soft tissue and erode bone. Open cuts, abraded or irritated skin should not be exposed to this material Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects.
Eye	The material can produce chemical burns to the eye following direct contact. If applied to the eyes, this material causes severe eye damage. Direct eye contact with acid corrosives may produce pain, tears, sensitivity to light and burns. Experiments in which a 20-percent aqueous solution of hydrofluoric acid (hydrogen fluoride) was instilled into the eyes of rabbits caused immediate damage in the form of total corneal opacification and conjunctival ischemia; within an hour, corneal stroma edema occurred, followed by necrosis of anterior ocular structures.
Chronic	Substance accumulation, in the human body, is likely and may cause some concern following repeated or long-term occupational exposure. Long-term exposure to respiratory irritants may result in disease of the airways involving difficult breathing and related systemic problems. High levels of molybdenum can cause joint problems in the hands and feet with pain and lameness. Repeated or prolonged exposure to acids may result in the erosion of teeth, swelling and/or ulceration of mouth lining. Extended exposure to inorganic fluorides causes fluorosis, which includes signs of joint pain and stiffness, tooth discolouration, nausea and vomiting, loss of appetite, diarrhoea or constipation, weight loss, anaemia, weakness and general unwellness. Hydrogen fluoride easily penetrates the skin and causes destruction and corrosion of the bone and underlying tissue.

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	Not Available	Not Available
molybdenum	TOXICITY	IRRITATION
	dermal (rat) LD50: >2000 mg/kg <sup>[1]</sup>	Not Available
	Oral (rat) LD50: >2000 mg/kg <sup>[1]</sup>	
nitric acid	TOXICITY	IRRITATION
	Inhalation (rat) LC50: 0.13 mg/L/4hr <sup>[2]</sup>	* DuPont
	Inhalation (rat) LC50: 2500 ppm/1h <sup>[2]</sup>	Nil reported
hydrofluoric acid	TOXICITY	IRRITATION
	Inhalation (rat) LC50: 1.1 mg/L/60M <sup>[2]</sup>	Eye (human): 50 mg - SEVERE
	Inhalation (rat) LC50: 1276 ppm/1hr <sup>[2]</sup>	
water	TOXICITY	IRRITATION
	Oral (rat) LD50: >90000 mg/kg <sup>[2]</sup>	Not Available

## Legend:

1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2. \* Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances

## NITRIC ACID

for acid mists, aerosols, vapours  
Data from assays for genotoxic activity in vitro suggest that eukaryotic cells are susceptible to genetic damage when the pH falls to about 6.5. Cells from the respiratory tract have not been examined in this respect. Mucous secretion may protect the cells of the airways from direct exposure to inhaled acidic mists, just as mucous plays an important role in protecting the gastric epithelium from its auto-secreted hydrochloric acid. In considering whether pH itself induces genotoxic events in vivo in the respiratory system, comparison should be made with the human stomach, in which gastric juice may be at pH 1-2 under fasting or nocturnal conditions, and with the human urinary bladder, in which the pH of urine can range from <5 to > 7 and normally averages 6.2. Furthermore, exposures to low pH in vivo differ from exposures *in vitro* in that, *in vivo*, only a portion of the cell surface is subjected to the adverse conditions, so that perturbation of

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	intracellular homeostasis may be maintained more readily than in vitro. The material may cause severe skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin. Repeated exposures may produce severe ulceration. Oral (?) LD50: 50-500 mg/kg * [Various Manufacturers]
<b>HYDROFLUORIC ACID</b>	(liver and kidney damage) [Manufacturer] for hydrogen fluoride (as vapour)
<b>10M34-3 Molybdenum (10,000µg/mL in 4% HNO<sub>3</sub> + 2% HF) &amp; NITRIC ACID &amp; HYDROFLUORIC ACID</b>	Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Key criteria for the diagnosis of RADS include the absence of preceding respiratory disease, in a non-atopic individual, with abrupt onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. A reversible airflow pattern, on spirometry, with the presence of moderate to severe bronchial hyperreactivity on methacholine challenge testing and the lack of minimal lymphocytic inflammation, without eosinophilia, have also been included in the criteria for diagnosis of RADS. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. Industrial bronchitis, on the other hand, is a disorder that occurs as result of exposure due to high concentrations of irritating substance (often particulate in nature) and is completely reversible after exposure ceases. The disorder is characterised by dyspnea, cough and mucus production.
<b>MOLYBDENUM &amp; HYDROFLUORIC ACID &amp; WATER</b>	No significant acute toxicological data identified in literature search.
<b>NITRIC ACID &amp; HYDROFLUORIC ACID</b>	The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.
<b>NITRIC ACID &amp; HYDROFLUORIC ACID</b>	The material may produce respiratory tract irritation, and result in damage to the lung including reduced lung function.
<b>Acute Toxicity</b>	✓
<b>Skin Irritation/Corrosion</b>	✓
<b>Serious Eye Damage/Irritation</b>	✓
<b>Respiratory or Skin sensitisation</b>	⊖
<b>Mutagenicity</b>	⊖
<b>Carcinogenicity</b>	⊖
<b>Reproductivity</b>	⊖
<b>STOT - Single Exposure</b>	✓
<b>STOT - Repeated Exposure</b>	✓
<b>Aspiration Hazard</b>	⊖

**Legend:** ✗ – Data available but does not fill the criteria for classification  
✓ – Data required to make classification available  
⊖ – Data Not Available to make classification

## SECTION 12 ECOLOGICAL INFORMATION

## Toxicity

Ingredient	Endpoint	Test Duration (hr)	Species	Value	Source
molybdenum	BCF	336	Algae or other aquatic plants	64mg/L	4
molybdenum	LC50	96	Fish	211mg/L	2
molybdenum	EC50	48	Crustacea	130.9mg/L	2
molybdenum	NOEC	672	Crustacea	0.67mg/L	2
molybdenum	EC50	288	Algae or other aquatic plants	2.5mg/L	2
molybdenum	EC50	72	Algae or other aquatic plants	26mg/L	2
nitric acid	NOEC	2160	Fish	97.8mg/L	2
nitric acid	EC50	48	Crustacea	490mg/L	2
nitric acid	EC50	96	Crustacea	39mg/L	2
hydrofluoric acid	LC50	96	Fish	51mg/L	2
hydrofluoric acid	EC50	48	Crustacea	97mg/L	2
hydrofluoric acid	EC50	96	Crustacea	10.5mg/L	2
hydrofluoric acid	NOEC	504	Crustacea	3.7mg/L	2
hydrofluoric acid	EC50	96	Algae or other aquatic plants	43mg/L	2
water	EC50	384	Crustacea	199.179mg/L	3
water	EC50	96	Algae or other aquatic plants	8768.874mg/L	3
water	LC50	96	Fish	897.520mg/L	3
<b>Legend:</b>	Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 3. EPIWIN Suite V3.12 - Aquatic Toxicity Data (Estimated) 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data				

For Molybdenum:

Environmental Fate: Molybdenum is an essential micronutrient in plants and animals.

**Ecotoxicity:**

The tolerance of water organisms towards pH margin and variation is diverse.

For Fluorides: Small amounts of fluoride have beneficial effects however; excessive intake over long periods may cause dental and/or skeletal fluorosis.

**DO NOT discharge into sewer or waterways.**

## Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air
water	LOW	LOW

Continued...

**Bioaccumulative potential**

Ingredient	Bioaccumulation
water	LOW (LogKOW = -1.38)


**Mobility in soil**

Ingredient	Mobility
water	LOW (KOC = 14.3)

**SECTION 13 DISPOSAL CONSIDERATIONS****Waste treatment methods**

Product / Packaging disposal	<ul style="list-style-type: none"> <li>Containers may still present a chemical hazard/ danger when empty.</li> <li>Recycle wherever possible.</li> </ul>
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**SECTION 14 TRANSPORT INFORMATION****Labels Required**

	
Marine Pollutant	NO

**Land transport (DOT)**

UN number	3264				
UN proper shipping name	Corrosive liquid, acidic, inorganic, n.o.s (contains nitric acid and hydrofluoric acid)				
Transport hazard class(es)	<table border="1"> <tr> <td>Class</td><td>8</td></tr> <tr> <td>Subrisk</td><td>Not Applicable</td></tr> </table>	Class	8	Subrisk	Not Applicable
Class	8				
Subrisk	Not Applicable				
Packing group	II				
Environmental hazard	Not Applicable				
Special precautions for user	<table border="1"> <tr> <td>Hazard Label</td><td>8</td></tr> <tr> <td>Special provisions</td><td>B2, IB2, T11, TP2, TP27</td></tr> </table>	Hazard Label	8	Special provisions	B2, IB2, T11, TP2, TP27
Hazard Label	8				
Special provisions	B2, IB2, T11, TP2, TP27				

**Air transport (ICAO-IATA / DGR)**

UN number	3264														
UN proper shipping name	Corrosive liquid, acidic, inorganic, n.o.s. * (contains nitric acid and hydrofluoric acid)														
Transport hazard class(es)	<table border="1"> <tr> <td>ICAO/IATA Class</td><td>8</td></tr> <tr> <td>ICAO / IATA Subrisk</td><td>Not Applicable</td></tr> <tr> <td>ERG Code</td><td>8L</td></tr> </table>	ICAO/IATA Class	8	ICAO / IATA Subrisk	Not Applicable	ERG Code	8L								
ICAO/IATA Class	8														
ICAO / IATA Subrisk	Not Applicable														
ERG Code	8L														
Packing group	II														
Environmental hazard	Not Applicable														
Special precautions for user	<table border="1"> <tr> <td>Special provisions</td><td>A3A803</td></tr> <tr> <td>Cargo Only Packing Instructions</td><td>855</td></tr> <tr> <td>Cargo Only Maximum Qty / Pack</td><td>30 L</td></tr> <tr> <td>Passenger and Cargo Packing Instructions</td><td>851</td></tr> <tr> <td>Passenger and Cargo Maximum Qty / Pack</td><td>1 L</td></tr> <tr> <td>Passenger and Cargo Limited Quantity Packing Instructions</td><td>Y840</td></tr> <tr> <td>Passenger and Cargo Limited Maximum Qty / Pack</td><td>0.5 L</td></tr> </table>	Special provisions	A3A803	Cargo Only Packing Instructions	855	Cargo Only Maximum Qty / Pack	30 L	Passenger and Cargo Packing Instructions	851	Passenger and Cargo Maximum Qty / Pack	1 L	Passenger and Cargo Limited Quantity Packing Instructions	Y840	Passenger and Cargo Limited Maximum Qty / Pack	0.5 L
Special provisions	A3A803														
Cargo Only Packing Instructions	855														
Cargo Only Maximum Qty / Pack	30 L														
Passenger and Cargo Packing Instructions	851														
Passenger and Cargo Maximum Qty / Pack	1 L														
Passenger and Cargo Limited Quantity Packing Instructions	Y840														
Passenger and Cargo Limited Maximum Qty / Pack	0.5 L														

**Sea transport (IMDG-Code / GGVSee)**

UN number	3264
UN proper shipping name	CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S. (contains nitric acid and hydrofluoric acid)



## 10M34-3 Molybdenum (10,000µg/mL in 4% HNO3 + 2% HF)

Transport hazard class(es)	IMDG Class	8
	IMDG Subrisk	Not Applicable
Packing group	II	
Environmental hazard	Not Applicable	
Special precautions for user	EMS Number	F-A, S-B
	Special provisions	274
	Limited Quantities	1 L

## Transport in bulk according to Annex II of MARPOL and the IBC code

Not Applicable

## SECTION 15 REGULATORY INFORMATION

## Safety, health and environmental regulations / legislation specific for the substance or mixture

## MOLYBDENUM(7439-98-7) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs	US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants
US - Alaska Limits for Air Contaminants	US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants
US - California OEHHA/ARB - Chronic Reference Exposure Levels and Target Organs (CRELs)	US - Washington Permissible exposure limits of air contaminants
US - California Permissible Exposure Limits for Chemical Contaminants	US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants
US - Hawaii Air Contaminant Limits	US ACGIH Threshold Limit Values (TLV)
US - Idaho - Limits for Air Contaminants	US ACGIH Threshold Limit Values (TLV) - Carcinogens
US - Michigan Exposure Limits for Air Contaminants	US NIOSH Recommended Exposure Limits (RELs)
US - Minnesota Permissible Exposure Limits (PELs)	US OSHA Permissible Exposure Levels (PELs) - Table Z1
US - Oregon Permissible Exposure Limits (Z-1)	US OSHA Permissible Exposure Levels (PELs) - Table Z3
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

## NITRIC ACID(7697-37-2) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Air Transport Association (IATA) Dangerous Goods Regulations - Prohibited List Passenger and Cargo Aircraft	US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants
US - Alaska Limits for Air Contaminants	US - Washington Permissible exposure limits of air contaminants
US - California OEHHA/ARB - Acute Reference Exposure Levels and Target Organs (RELs)	US - Washington Toxic air pollutants and their ASIL, SQER and de minimis emission values
US - California Permissible Exposure Limits for Chemical Contaminants	US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants
US - Hawaii Air Contaminant Limits	US ACGIH Threshold Limit Values (TLV)
US - Idaho - Limits for Air Contaminants	US EPCRA Section 313 Chemical List
US - Michigan Exposure Limits for Air Contaminants	US NIOSH Recommended Exposure Limits (RELs)
US - Minnesota Permissible Exposure Limits (PELs)	US OSHA Permissible Exposure Levels (PELs) - Table Z1
US - Oregon Permissible Exposure Limits (Z-1)	US SARA Section 302 Extremely Hazardous Substances
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	

## HYDROFLUORIC ACID(7664-39-3) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs	US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants
US - Alaska Limits for Air Contaminants	US - Washington Permissible exposure limits of air contaminants
US - California OEHHA/ARB - Acute Reference Exposure Levels and Target Organs (RELs)	US - Washington Toxic air pollutants and their ASIL, SQER and de minimis emission values
US - California OEHHA/ARB - Chronic Reference Exposure Levels and Target Organs (CRELs)	US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants
US - California Permissible Exposure Limits for Chemical Contaminants	US - Wyoming Toxic and Hazardous Substances Table Z-2 Acceptable ceiling concentration, Acceptable maximum peak above the acceptable ceiling concentration for an 8-hr shift
US - Hawaii Air Contaminant Limits	US ACGIH Threshold Limit Values (TLV)
US - Idaho - Acceptable Maximum Peak Concentrations	US ACGIH Threshold Limit Values (TLV) - Carcinogens
US - Idaho - Limits for Air Contaminants	US ATSDR Minimal Risk Levels for Hazardous Substances (MRLs)
US - Michigan Exposure Limits for Air Contaminants	US EPCRA Section 313 Chemical List
US - Minnesota Permissible Exposure Limits (PELs)	US NIOSH Recommended Exposure Limits (RELs)
US - Oregon Permissible Exposure Limits (Z-1)	US OSHA Permissible Exposure Levels (PELs) - Table Z1
US - Oregon Permissible Exposure Limits (Z-2)	US OSHA Permissible Exposure Levels (PELs) - Table Z2
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	US SARA Section 302 Extremely Hazardous Substances
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

## WATER(7732-18-5) IS FOUND ON THE FOLLOWING REGULATORY LISTS

US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
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## Federal Regulations

## Superfund Amendments and Reauthorization Act of 1986 (SARA)

## SECTION 311/312 HAZARD CATEGORIES

Immediate (acute) health hazard	Yes
Delayed (chronic) health hazard	Yes

Continued...

10M34-3 Molybdenum (10,000µg/mL in 4% HNO<sub>3</sub> + 2% HF)

Fire hazard	No
Pressure hazard	No
Reactivity hazard	No

## US. EPA CERCLA HAZARDOUS SUBSTANCES AND REPORTABLE QUANTITIES (40 CFR 302.4)

Name	Reportable Quantity in Pounds (lb)	Reportable Quantity in kg
Nitric acid	1000	454
Hydrofluoric acid	100	45.4

## State Regulations

## US. CALIFORNIA PROPOSITION 65

None Reported

National Inventory	Status
Australia - AICS	Y
Canada - DSL	Y
Canada - NDSL	N (water; molybdenum; hydrofluoric acid; nitric acid)
China - IECSC	Y
Europe - EINEC / ELINCS / NLP	Y
Japan - ENCS	N (water; molybdenum)
Korea - KECI	Y
New Zealand - NZIoC	Y
Philippines - PICCS	Y
USA - TSCA	Y
<b>Legend:</b>	Y = All ingredients are on the inventory N = Not determined or one or more ingredients are not on the inventory and are not exempt from listing(see specific ingredients in brackets)

## SECTION 16 OTHER INFORMATION

## Other information

## Ingredients with multiple cas numbers

Name	CAS No
hydrofluoric acid	7664-39-3, 790596-14-4

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

The SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment.

## Definitions and abbreviations

PC—TWA: Permissible Concentration-Time Weighted Average  
PC—STEL: Permissible Concentration-Short Term Exposure Limit  
IARC: International Agency for Research on Cancer  
ACGIH: American Conference of Governmental Industrial Hygienists  
STEL: Short Term Exposure Limit  
TEEL: Temporary Emergency Exposure Limit,  
IDLH: Immediately Dangerous to Life or Health Concentrations  
OSF: Odour Safety Factor  
NOAEL :No Observed Adverse Effect Level  
LOAEL: Lowest Observed Adverse Effect Level  
TLV: Threshold Limit Value  
LOD: Limit Of Detection  
OTV: Odour Threshold Value  
BCF: BioConcentration Factors  
BEI: Biological Exposure Index

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