SECTION 1 IDENTIFICATION

Product Identifier

<table>
<thead>
<tr>
<th>Product name</th>
<th>ICP-MS Tuning Solution 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synonyms</td>
<td>ICP-MS-TS-4</td>
</tr>
<tr>
<td>Proper shipping name</td>
<td>Corrosive liquid, acidic, inorganic, n.o.s.</td>
</tr>
<tr>
<td>Other means of identification</td>
<td>ICP-MS-TS-4</td>
</tr>
</tbody>
</table>

Recommended use of the chemical and restrictions on use

| Relevant identified uses | Use according to manufacturer's directions. |

Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party

<table>
<thead>
<tr>
<th>Registered company name</th>
<th>High-Purity Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address</td>
<td>PO Box 41727 SC 29423 United States</td>
</tr>
<tr>
<td>Telephone</td>
<td>843-767-7900</td>
</tr>
<tr>
<td>Fax</td>
<td>843-767-7906</td>
</tr>
<tr>
<td>Website</td>
<td>highpuritystandards.com</td>
</tr>
<tr>
<td>Email</td>
<td>Not Available</td>
</tr>
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</table>

Emergency phone number

<table>
<thead>
<tr>
<th>Association / Organisation</th>
<th>INFOTRAC</th>
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</thead>
<tbody>
<tr>
<td>Emergency telephone numbers</td>
<td>1-800-535-5053</td>
</tr>
<tr>
<td>Other emergency telephone numbers</td>
<td>1-352-323-3500</td>
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</table>

SECTION 2 HAZARD(S) IDENTIFICATION

Classification of the substance or mixture

| Classification | Metal Corrosion Category 1, Skin Corrosion/Irritation Category 1A |

Label elements

| Hazard pictogram(s) | ☐ ☐ ☐ ☐ |

| SIGNAL WORD | DANGER |

Hazard statement(s)

| H290 | May be corrosive to metals. |
| H314 | Causes severe skin burns and eye damage. |

Hazard(s) not otherwise specified

| Not Applicable |

Precautionary statement(s) Prevention

| Continued... |
**Precautionary statement(s) Response**

P301+P330+P331 IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.

**Precautionary statement(s) Storage**

P405 Store locked up.

**Precautionary statement(s) Disposal**

P501 Dispose of contents/container in accordance with local regulations.

### SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

**Substances**

See section below for composition of Mixtures

**Mixtures**

<table>
<thead>
<tr>
<th>CAS No</th>
<th>[%weight]</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>7429-90-5</td>
<td>0.001</td>
<td>aluminum</td>
</tr>
<tr>
<td>7440-39-3</td>
<td>0.001</td>
<td>barium</td>
</tr>
<tr>
<td>543-81-7</td>
<td>0.001</td>
<td>beryllium acetate</td>
</tr>
<tr>
<td>7440-69-9</td>
<td>0.001</td>
<td>bismuth</td>
</tr>
<tr>
<td>7440-45-1</td>
<td>0.001</td>
<td>cerium</td>
</tr>
<tr>
<td>7440-48-4</td>
<td>0.001</td>
<td>cobalt</td>
</tr>
<tr>
<td>7440-74-6</td>
<td>0.001</td>
<td>indium</td>
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<td>7439-92-1</td>
<td>0.001</td>
<td>lead</td>
</tr>
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<td>7439-95-4</td>
<td>0.001</td>
<td>magnesium</td>
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<td>7440-02-0</td>
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<td>nickel</td>
</tr>
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<td>7803-55-6</td>
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<td>ammonium metavanadate</td>
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<td>7440-65-5</td>
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<td>yttrium</td>
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<tr>
<td>7697-37-2</td>
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</tr>
<tr>
<td>7732-18-5</td>
<td>Balance</td>
<td>water</td>
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</tbody>
</table>

### SECTION 4 FIRST-AID MEASURES

**Description of first aid measures**

**Eye Contact**

- If this product comes in contact with the eyes:
  - Immediately hold eyelids apart and flush the eye continuously with running water.
  - 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.
  - Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes.
  - Transport to hospital or doctor without delay.
  - Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

**Skin Contact**

- If skin or hair contact occurs:
  - Immediately flush body and clothes with large amounts of water, using safety shower if available.
  - Quickly remove all contaminated clothing, including footwear.
  - Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Centre.
  - Transport to hospital, or doctor.

For thermal burns:

- Decontaminate area around burn.
- Consider the use of cold packs and topical antibiotics.

For first-degree burns (affecting top layer of skin):

- Hold burned skin under cool (not cold) running water or immerse in cool water until pain subsides.
- Use compresses if running water is not available.
- Cover with sterile non-adhesive bandage or clean cloth.
- Do NOT apply butter or ointments; this may cause infection.
- Give over-the-counter pain relievers if pain increases or swelling, redness, fever occur.

For second-degree burns (affecting top two layers of skin):

- Cool the burn by immerse in cold running water for 10-15 minutes.
- Use compresses if running water is not available.
- Do NOT apply ice as this may lower body temperature and cause further damage.
- Do NOT break blisters or apply butter or ointments; this may cause infection.
- Protect burn by cover loosely with sterile, nonstick bandage and secure in place with gauze or tape.

To prevent shock (unless the person has a head, neck, or leg injury, or it would cause discomfort):

- Lay the person flat.
- Elevate feet about 12 inches.
- Elevate burn area above heart level, if possible.
- Cover the person with coat or blanket.
- Seek medical assistance.

For third-degree burns

Seek immediate medical or emergency assistance.

In the mean time:
Protect burn area cover loosely with sterile, non-stick bandage or, for large areas, a sheet or other material that will not leave lint in wound.

Separate burned toes and fingers with dry, sterile dressings.

Do not soak burn in water or apply ointments or butter; this may cause infection.

To prevent shock see above.

For an airway burn, do not place pillow under the person’s head when the person is lying down. This can close the airway.

Have a person with a facial burn sit up.

Check pulse and breathing to monitor for shock until emergency help arrives.

If burns or combustion products are inhaled remove from contaminated area.

Lay patient down. Keep warm and rested.

Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.

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.

Transport to hospital, or doctor, without delay.

Inhalation of vapours or aerosols (mists, fumes) may cause lung oedema.

Corrosive substances may cause lung damage (e.g. lung oedema, fluid in the lungs).

As this reaction may be delayed up to 24 hours after exposure, affected individuals need complete rest (preferably in semi-recumbent posture) and must be kept under medical observation even if no symptoms are (yet) manifested.

Before any such manifestation, the administration of a spray containing a dexamethasone derivative or beclomethasone derivative may be considered. This must definitely be left to a doctor or person authorised by him/her.

(Ellenhorn and Barceloux: Medical Toxicology)

**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**

| Fire Incompatibility | None known |

**Special protective equipment and precautions for fire-fighters**

**Fire Fighting**

Non combustible.

Not considered to be a significant fire risk.

Acids may react with metals to produce hydrogen, a highly flammable and explosive gas.

Heating may cause expansion or decomposition leading to violent rupture of containers.

May emit corrosive, poisonous fumes. May emit acid smoke.

When aluminium oxide dust is dispersed in air, firefighters should wear protection against inhalation of dust particles, which can also contain hazardous substances from the fire absorbed on the alumina particles.

**SECTION 6 ACCIDENTAL RELEASE MEASURES**

**Personal precautions, protective equipment and emergency procedures**
Conditions for safe storage, including any incompatibilities

Suitable container

- DO NOT use aluminium or galvanised containers
- Check regularly for spills and leaks
- Lined metal can, lined metal pail/ can
- Plastic pail
- Polyliner drum
- Packing as recommended by manufacturer.
- Check all containers are clearly labelled and free from leaks.
- For low viscosity materials
  - Drums and jerricans must be of the non-removable head type.
  - Where a can is to be used as an inner package, the can must have a screwed enclosure.
- For materials with a viscosity of at least 2680 cSt. (23 deg. C) and solids (between 15 C deg. and 40 deg C.):
  - Removable head packaging;
  - Cans with friction closures and
  - low pressure tubes and cartridges may be used.

Storage incompatibility

- For aluminas (aluminium oxide):
  - Incompatible with hot chlorinated rubber.
  - In the presence of chlorine trifluoride may react violently and ignite.
  - May initiate explosive polymerisation of olefin oxides including ethylene oxide.
  - Produces exothermic reaction above 200 C with halocarbons and an exothermic reaction at ambient temperatures with halocarbons in the presence of other metals.
  - Produces exothermic reaction with oxygen difluoride.
  - May form explosive mixture with oxygen difluoride.
  - Forms explosive mixtures with sodium nitrate.
  - Reacts vigorously with vinyl acetate.

- Aluminium oxide is an amphoteric substance, meaning it can react with both acids and bases, such as hydrofluoric acid and sodium hydroxide, acting as an acid with a base and a base with an acid, neutralising the other and producing a salt.
- Inorganic acids are generally soluble in water with the release of hydrogen ions. The resulting solutions have pHs of less than 7.0.
- Inorganic acids neutralise chemical bases (for example: amines and inorganic hydroxides) to form salts - neutralisation can generate dangerously large amounts of heat in small spaces.
- The dissolution of inorganic acids in water or the dilution of their concentrated solutions with additional water may generate significant heat.
- The addition of water to inorganic acids often generates sufficient heat in the small region of mixing to cause some of the water to boil explosively. The resulting "bumping" can spatter the acid.
- Inorganic acids react with active metals, including such structural metals as aluminium and iron, to release hydrogen, a flammable gas.
Inorganic acids can initiate the polymerisation of certain classes of organic compounds.
Inorganic acids react with cyanide compounds to release gaseous hydrogen cyanide.
Inorganic acids generate flammable and/or toxic gases in contact with dithiocarbamates, isocyanates, mercaptans, nitriles, nitrides, sulfides, and strong reducing agents. Additional gas-generating reactions occur with sulfites, thiocyanates, (to give HCN and CO3), dithionites (SO2), and even carbanilides.
Acids often catalyse (increase the rate of) chemical reactions.

**WARNING:** Avoid or control reaction with peroxides. All transition metal peroxides should be considered as potentially explosive. For example transition metal complexes of alkyl hydroperoxides may decompose explosively.
The π-complexes formed between chromium(0), vanadium(0) and other transition metals (haloarene-metal complexes) and mono- or poly-fluorobenzene show extreme sensitivity to heat and are explosive.
Avoid reaction with borohydrides or cyanoborohydrides.

### SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

#### OCCUPATIONAL EXPOSURE LIMITS (OEL)

<table>
<thead>
<tr>
<th>INGREDIENT DATA</th>
</tr>
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<tbody>
<tr>
<td>Source</td>
</tr>
<tr>
<td>US OSHA Permissible Exposure Levels (PELs) - Table Z1</td>
</tr>
<tr>
<td>US OSHA Permissible Exposure Levels (PELs) - Table Z1</td>
</tr>
<tr>
<td>US NIOSH Recommended Exposure Limits (RELs)</td>
</tr>
<tr>
<td>US OSHA Permissible Exposure Levels (PELs) - Table Z1</td>
</tr>
<tr>
<td>US NIOSH Recommended Exposure Limits (RELs)</td>
</tr>
<tr>
<td>US ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td>US NIOSH Recommended Exposure Limits (RELs)</td>
</tr>
<tr>
<td>US NIOSH Recommended Exposure Limits (RELs)</td>
</tr>
<tr>
<td>US NIOSH Recommended Exposure Limits (RELs)</td>
</tr>
<tr>
<td>US ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td>US OSHA Permissible Exposure Levels (PELs) - Table Z1</td>
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<tr>
<td>US NIOSH Recommended Exposure Limits (RELs)</td>
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<td>US OSHA Permissible Exposure Levels (PELs) - Table Z1</td>
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<tr>
<td>US NIOSH Recommended Exposure Limits (RELs)</td>
</tr>
<tr>
<td>US ACGIH Threshold Limit Values (TLV)</td>
</tr>
</tbody>
</table>

### EMERGENCY LIMITS

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<th>Ingredient</th>
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<th>TEEL-1</th>
<th>TEEL-2</th>
<th>TEEL-3</th>
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<tr>
<td>barium</td>
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<td>1.5 mg/m³</td>
<td>180 mg/m³</td>
<td>1,100 mg/m³</td>
</tr>
<tr>
<td>bismuth</td>
<td>Bismuth</td>
<td>15 mg/m³</td>
<td>170 mg/m³</td>
<td>990 mg/m³</td>
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<tr>
<td>cerium</td>
<td>Cerium</td>
<td>30 mg/m³</td>
<td>330 mg/m³</td>
<td>2,000 mg/m³</td>
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<tr>
<td>cobalt</td>
<td>Cobalt</td>
<td>0.18 mg/m³</td>
<td>2 mg/m³</td>
<td>20 mg/m³</td>
</tr>
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<td>indium</td>
<td>Indium</td>
<td>0.3 mg/m³</td>
<td>3.3 mg/m³</td>
<td>20 mg/m³</td>
</tr>
<tr>
<td>lead</td>
<td>Lead</td>
<td>0.15 mg/m³</td>
<td>120 mg/m³</td>
<td>700 mg/m³</td>
</tr>
<tr>
<td>magnesium</td>
<td>Magnesium</td>
<td>18 mg/m³</td>
<td>200 mg/m³</td>
<td>1,200 mg/m³</td>
</tr>
<tr>
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<td>Nickel</td>
<td>4.5 mg/m³</td>
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<td>99 mg/m³</td>
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<tr>
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<td>0.11 mg/m³</td>
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<td>Nitric acid</td>
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<td>Not Available</td>
<td>Not Available</td>
</tr>
</tbody>
</table>

Continued...
### Exposure controls

Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection.

The basic types of engineering controls are:

- Enclosure and/or isolation of emission source which keeps a selected hazard “physically” away from the worker and ventilation that strategically “adds” and “removes” air in the work environment. Ventilation can remove or dilute an air contaminant if designed properly. The design of a ventilation system must match the particular process and chemical or contaminant in use.
- Process controls which involve changing the way a job activity or process is done to reduce the risk. Employers may need to use multiple types of controls to prevent employee overexposure.
- Local exhaust ventilation usually required. If risk of overexposure exists, wear approved respirator. Correct fit is essential to obtain adequate protection.
- An approved self contained breathing apparatus (SCBA) may be required in some situations. Provide adequate ventilation in warehouse or closed storage area. Air contaminants generated in the workplace possess varying “escape” velocities which, in tum determine the “capture velocities” of fresh circulating air required to effectively remove the contaminant.

#### Appropriate engineering controls

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Original IDLH</th>
<th>Revised IDLH</th>
</tr>
</thead>
<tbody>
<tr>
<td>aluminium</td>
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<td>Not Available</td>
</tr>
<tr>
<td>barium</td>
<td>1,100 mg/m³</td>
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</tr>
<tr>
<td>beryllium acetate</td>
<td>10 mg/m³</td>
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</tr>
<tr>
<td>bismuth</td>
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<td>Not Available</td>
</tr>
<tr>
<td>cerium</td>
<td>Not Available</td>
<td>Not Available</td>
</tr>
<tr>
<td>cobalt</td>
<td>20 mg/m³</td>
<td>20 [L/min]/mg/m³</td>
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<td>700 mg/m³</td>
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<tr>
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<td>25 ppm</td>
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<tr>
<td>water</td>
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<td>Not Available</td>
</tr>
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</table>

Within each range the appropriate value depends on:

- **1:** Room air currents minimal or favourable to capture
- **2:** Contaminants of low toxicity or of nuisance value only.
- **3:** Intermittent, low production.
- **4:** Large hood or large air mass in motion

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 1-2 m/s (200-400 f/min.) for extraction of solvents generated in a tank 2 meters distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.

#### Personal protection

- Safety glasses with unperforated side shields may be used where continuous eye protection is desirable, as in laboratories; spectacles are not sufficient where complete eye protection is needed such as when handling bulk quantities, where there is a danger of splashing, or if the material may be under pressure.
- Chemical goggles, whenever there is a danger of the material coming in contact with the eyes; goggles must be properly fitted.
- Full face shield (20 cm, 8 in minimum) may be required for supplementary but never for primary protection of eyes; these afford face protection.
- Alternatively a gas mask may replace splash goggles and face shields.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lenses or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lenses should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59], [AS/NZS 1336 or national equivalent]

#### Eye and face protection

- Full face shield (20 cm, 8 in minimum) may be required for supplementary but never for primary protection of eyes; these afford face protection.
- Alternatively a gas mask may replace splash goggles and face shields.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lenses or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lenses should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59], [AS/NZS 1336 or national equivalent]

#### Skin protection

See Hand protection below

Continued...
Hands/feet protection
- Elbow length PVC gloves
- 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.
- PVC Apron.
- PVC protective suit may be required if exposure severe.
- Eyewash unit.
- Ensure there is ready access to a safety shower.

Thermal hazards
Not Available

Respiratory protection
Type A Filter of sufficient capacity (AS/NZS 1716 & 1715, EN 143:2000 & 149:2001, ANSI Z88 or national equivalent)

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Colourless</td>
</tr>
<tr>
<td>Physical state</td>
<td>Liquid</td>
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<td>Relative density (Water = 1)</td>
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<tr>
<td>Odour</td>
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<tr>
<td>Partition coefficient n-octanol / water</td>
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</tr>
<tr>
<td>Odour threshold</td>
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<tr>
<td>Auto-ignition temperature (°C)</td>
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<tr>
<td>pH (as supplied)</td>
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<tr>
<td>Decomposition temperature</td>
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<td>Melting point / freezing point (°C)</td>
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<tr>
<td>Viscosity (cSt)</td>
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<tr>
<td>Taste</td>
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<tr>
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<tr>
<td>Explosive properties</td>
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</tr>
<tr>
<td>Flammability</td>
<td>Not Available</td>
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<tr>
<td>Oxidising properties</td>
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<tr>
<td>Upper Explosive Limit (%)</td>
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<tr>
<td>Surface Tension (dyn/cm or mN/m)</td>
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</tr>
<tr>
<td>Lower Explosive Limit (%)</td>
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</tr>
<tr>
<td>Volatile Component (%vol)</td>
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<tr>
<td>Vapour pressure (kPa)</td>
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</tr>
<tr>
<td>Gas group</td>
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<tr>
<td>Solubility in water (g/L)</td>
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<tr>
<td>pH as a solution (1%)</td>
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<tr>
<td>Vapour density (Air = 1)</td>
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<tr>
<td>VOC g/L</td>
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</tbody>
</table>

SECTION 10 STABILITY AND REACTIVITY

Reactivity
See section 7

Chemical stability
- Contact with alkaline material liberates heat

Possibility of hazardous reactions
See section 7

Conditions to avoid
See section 7

Incompatible materials
See section 7

Hazardous decomposition products
See section 5

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects

Inhaled
The material can cause respiratory irritation in some persons. The body’s response to such irritation can cause further lung damage. Corrosive acids can cause irritation of the respiratory tract, with coughing, choking and mucous membrane damage. There may be dizziness, headache, nausea and weakness. Exposure to vapours of some rare earth salts can cause sensitivity to heat, itching, and increased sensitivity of smell and taste. Other effects include inflamed airways and lung, emphysema, regional narrowing of terminal airways and cell changes. The material has NOT been classified by EC Directives or other classification systems as “harmful by inhalation”. This is because of the lack of corroborating animal or human evidence.

Ingestion
Ingestion of acidic corrosives may produce burns around and in the mouth, the throat and oesophagus. Immediate pain and difficulties in swallowing and speaking may also be evident. The material has NOT been classified by EC Directives or other classification systems as “harmful by ingestion”. This is because of the lack of corroborating animal or human evidence.

Skin Contact
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. Skin contact is not thought to have harmful health effects (as classified under EC Directives); the material may still produce health damage following entry through wounds, lesions or abrasions. Though considered non-harmful, slight irritation may result from contact because of the abrasive nature of the aluminium oxide particles. Thus it may cause itching and skin reaction and inflammation. Open cuts, abraded or irritated skin should not be exposed to this material.

Continued...
Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.

**Eye**

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. Mild burns of the epithelia generally recover rapidly and completely.

**Chronic**

Repeated or prolonged exposure to acids may result in the erosion of teeth, swelling and/or ulceration of mouth lining. Initiation of airways to lung, with cough, and inflammation of lung tissue often occurs. Long-term exposure to respiratory irritants may result in airways disease, involving difficulty breathing and related whole-body problems. Substance accumulation, in the human body, may occur and may cause some concern following repeated or long-term occupational exposure. Animal testing shows long term exposure to aluminium oxides may cause lung disease and cancer, depending on the size of the particle. The smaller the size, the greater the tendencies of causing harm. Yttrium is a rare earth metal - heavy type (yttrium family). There have been no reports of poisoning in workers, although the metal can cause chest X-ray abnormalities due to its high density.

### ICP-MS Tuning Solution 4

<table>
<thead>
<tr>
<th>Substance</th>
<th>TOXICITY</th>
<th>IRRITATION</th>
</tr>
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<tbody>
<tr>
<td>aluminium</td>
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<td>Not Available</td>
</tr>
<tr>
<td>barium</td>
<td>Not Available</td>
<td>Not Available</td>
</tr>
<tr>
<td>beryllium acetate</td>
<td>Not Available</td>
<td>Not Available</td>
</tr>
<tr>
<td>bismuth</td>
<td>Oral (rat) LD50: 2000 mg/kg[^1]</td>
<td>Not Available</td>
</tr>
<tr>
<td>cerium</td>
<td>Oral (rat) LD50: &gt;5000 mg/kg[^1]</td>
<td>Not Available</td>
</tr>
<tr>
<td>cobalt</td>
<td>dermal (rat) LD50: &gt;2000 mg/kg[^1]</td>
<td>Not Available</td>
</tr>
<tr>
<td></td>
<td>Oral (rat) LD50: 6170 mg/kg[^2]</td>
<td></td>
</tr>
<tr>
<td>indium</td>
<td>Not Available</td>
<td>Not Available</td>
</tr>
<tr>
<td>lead</td>
<td>dermal (rat) LD50: &gt;2000 mg/kg[^1]</td>
<td>Not Available</td>
</tr>
<tr>
<td></td>
<td>Inhalation (rat) LC50: &gt;5.05 mg/l/4hr[^1]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oral (rat) LD50: &gt;2000 mg/kg[^1]</td>
<td></td>
</tr>
<tr>
<td>magnesium</td>
<td>Oral (rat) LD50: &gt;2000 mg/kg[^1]</td>
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</tr>
<tr>
<td>nickel</td>
<td>Oral (rat) LD50: 5000 mg/kg[^2]</td>
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<td>dermal (rat) LD50: 2102 mg/kg[^2]</td>
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<td></td>
<td>Oral (rat) LD50: 160 mg/kg[^2]</td>
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</tr>
<tr>
<td>yttrium</td>
<td>Not Available</td>
<td>Not Available</td>
</tr>
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</table>
BERYLLIUM ACETATE
WARNING: This substance has been classified by the IARC as Group 1: CARCINOGENIC TO HUMANS.

COBALT
Allergic reactions involving the respiratory tract are usually due to interactions between IgE antibodies and allergens and occur rapidly. Attention should be paid to atopic diathesis, characterised by increased susceptibility to nasal inflammation, asthma and eczema. Exogenous allergic alveolitis is induced essentially by allergen specific immune-complexes of the IgG type; cell-mediated reactions (T lymphocytes) may be involved.

LEAD
WARNING: Lead is a cumulative poison and has the potential to cause abortion and intellectual impairment to unborn children of pregnant workers.

NICKEL
The following information refers to contact allergens as a group and may not be specific to this product.

YTTRIUM
For typical lanthanides: Symptoms of toxicity from rare earth elements include writhing, inco-ordination, laboured breathing, and sedation.

NITRIC ACID
For acid mists, aerosols, vapours
Test results suggest that eukaryotic cells are susceptible to genetic damage when the pH falls to about 6.5.
The material may produce severe irritation to the eye causing pronounced inflammation.
The material may produce respiratory tract irritation, and result in damage to the lung including reduced lung function.
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.

ALUMINIUM & BARIUM & CERIUM & INDIUM & YTTRIUM & WATER
No significant acute toxicological data identified in literature search.

BARIUM & BERYLLIUM ACETATE & AMMONIUM METAVANADATE & NITRIC ACID
Asthma-like symptoms may continue for months or even years after exposure to the material ends.

BERYLLIUM ACETATE & COBALT & NICKEL
The following information refers to contact allergens as a group and may not be specific to this product.

CERIUM & YTTRIUM
Lanthanide poisoning causes immediate defaecation, writhing, inco-ordination, laboured breathing, and inactivity.

COBALT & NICKEL
WARNING: This substance has been classified by the IARC as Group 2B: Possibly Carcinogenic to Humans.

SECTION 12 ECOLOGICAL INFORMATION

Toxicity

ICP-MS Tuning Solution 4

<table>
<thead>
<tr>
<th>ENDPOINT</th>
<th>TEST DURATION (HR)</th>
<th>SPECIES</th>
<th>VALUE</th>
<th>SOURCE</th>
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<tbody>
<tr>
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<td>Not Applicable</td>
<td>Not Applicable</td>
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aluminium

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<tr>
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<th>VALUE</th>
<th>SOURCE</th>
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<tbody>
<tr>
<td>LC50</td>
<td>96</td>
<td>Fish</td>
<td>0.078-0.108mg/L</td>
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<tr>
<td>EC50</td>
<td>48</td>
<td>Crustacea</td>
<td>0.7364mg/L</td>
<td>2</td>
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<tr>
<td>EC50</td>
<td>96</td>
<td>Algae or other aquatic plants</td>
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<tr>
<td>BCF</td>
<td>360</td>
<td>Algae or other aquatic plants</td>
<td>9mg/L</td>
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<td>EC50</td>
<td>120</td>
<td>Fish</td>
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<tr>
<td>NOEC</td>
<td>72</td>
<td>Algae or other aquatic plants</td>
<td>&gt;=0.04mg/L</td>
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barium

<table>
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<tr>
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<th>VALUE</th>
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<td>Fish</td>
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<td>BCF</td>
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<td>----------</td>
<td>--------------------</td>
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<td>Not Applicable</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
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<td>Not Applicable</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
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<td>cobalt</td>
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<td>Fish</td>
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<td>NOEC 168</td>
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<td>Crustacea</td>
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<td>BCFD 8</td>
<td>Fish</td>
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<td>NOEC 672</td>
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<td>Fish</td>
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<tr>
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<tr>
<td></td>
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<tr>
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<td>NOEC 72</td>
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<td>Fish</td>
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<td></td>
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<td>EC50 72</td>
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<td>BCF 1440</td>
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<tr>
<td></td>
<td>NOEC 72</td>
<td>Algae or other aquatic plants</td>
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<tr>
<td>ammonium metavanadate</td>
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<td>Fish</td>
<td>0.693 mg/L</td>
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<td>EC50 48</td>
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<tr>
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<td>EC50 72</td>
<td>Algae or other aquatic plants</td>
<td>1.162 mg/L</td>
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<td>NOEC 72</td>
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<tr>
<td>yttrium</td>
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<tr>
<td>nitric acid</td>
<td>NOEC 16</td>
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Persistency and degradability

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<thead>
<tr>
<th>Ingredient</th>
<th>Persistence: Water/Soil</th>
<th>Persistence: Air</th>
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<tbody>
<tr>
<td>ammonium metavanadate</td>
<td>HIGH</td>
<td>HIGH</td>
</tr>
<tr>
<td>water</td>
<td>LOW</td>
<td>LOW</td>
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Bioaccumulative potential

<table>
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<tr>
<th>Ingredient</th>
<th>Bioaccumulation</th>
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</thead>
<tbody>
<tr>
<td>ammonium metavanadate</td>
<td>LOW (LogKOW = 2.229)</td>
</tr>
<tr>
<td>water</td>
<td>LOW (LogKOW = -1.38)</td>
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</table>

Mobility in soil

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Mobility</th>
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</thead>
<tbody>
<tr>
<td>ammonium metavanadate</td>
<td>LOW (KOC = 35.04)</td>
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<tr>
<td>water</td>
<td>LOW (KOC = 14.3)</td>
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</tbody>
</table>

SECTION 13 DISPOSAL CONSIDERATIONS

Waste treatment methods

- Recycle wherever possible.
- Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
- Treat and neutralise at an approved treatment plant. Treatment should involve: Neutralisation with soda-ash or soda-lime followed by: burial in a land-fill...
specifically licensed to accept chemical and/or pharmaceutical wastes or incineration in a licensed apparatus (after admixture with suitable combustible material). Decontaminate empty containers with 5% aqueous sodium hydroxide or soda ash, followed by water. Observe all label safeguards until containers are cleaned and destroyed.

### SECTION 14 TRANSPORT INFORMATION

#### Labels Required

<table>
<thead>
<tr>
<th>Marine Pollutant</th>
<th>NO</th>
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#### Land transport (DOT)

<table>
<thead>
<tr>
<th>UN number</th>
<th>UN proper shipping name</th>
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</thead>
<tbody>
<tr>
<td>3264</td>
<td>Corrosive liquid, acidic, inorganic, n.o.s.</td>
</tr>
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</table>

**Transport hazard class(es)**

<table>
<thead>
<tr>
<th>Class</th>
<th>8</th>
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</thead>
<tbody>
<tr>
<td>Subrisk</td>
<td>Not Applicable</td>
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</tbody>
</table>

**Packing group**

| II |

**Environmental hazard**

| Not Applicable |

**Special precautions for user**

| Hazard Label | 8 |
| Special provisions | 386, B2, IB2, T11, TP2, TP27 |

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

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<thead>
<tr>
<th>UN number</th>
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</thead>
<tbody>
<tr>
<td>3264</td>
<td>CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.</td>
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</tbody>
</table>

**Transport hazard class(es)**

| ICAO/IATA Class | 8 |
| ICAO / IATA Subrisk | Not Applicable |
| ERG Code | 8L |

**Packing group**

| II |

**Environmental hazard**

| Not Applicable |

**Special precautions for user**

| 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)

<table>
<thead>
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<th>UN number</th>
<th>UN proper shipping name</th>
</tr>
</thead>
<tbody>
<tr>
<td>3264</td>
<td>Corrosive liquid, acidic, inorganic, n.o.s. *</td>
</tr>
</tbody>
</table>

**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
### SECTION 15 REGULATORY INFORMATION

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

<table>
<thead>
<tr>
<th>Substance</th>
<th>Regulatory Lists</th>
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</thead>
<tbody>
<tr>
<td>Aluminum(7429-90-5)</td>
<td>US - Alaska Limits for Air Contaminants</td>
</tr>
<tr>
<td></td>
<td>US - California Permissible Exposure Limits for Chemical Contaminants</td>
</tr>
<tr>
<td></td>
<td>US - Hawaii Air Contaminant Limits</td>
</tr>
<tr>
<td></td>
<td>US - Massachusetts - Right To Know Listed Chemicals</td>
</tr>
<tr>
<td></td>
<td>US - Michigan Exposure Limits for Air Contaminants</td>
</tr>
<tr>
<td></td>
<td>US - Minnesota Permissible Exposure Limits (PELs)</td>
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<td></td>
<td>US - Oregon Permissible Exposure Limits (Z-1)</td>
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<tr>
<td></td>
<td>US - Pennsylvania - Hazardous Substance List</td>
</tr>
<tr>
<td></td>
<td>US - Rhode Island Hazardous Substance List</td>
</tr>
<tr>
<td></td>
<td>US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants</td>
</tr>
<tr>
<td></td>
<td>US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants</td>
</tr>
</tbody>
</table>

| Bismuth(7440-39-9)         | US - Alaska Limits for Air Contaminants                                           |
|                            | US - Hawaii Air Contaminant Limits                                                |
|                            | US - Idaho - Limits for Air Contaminants                                          |
|                            | US - Massachusetts - Right To Know Listed Chemicals                               |
|                            | US - Minnesota Permissible Exposure Limits (PELs)                                 |
|                            | US - Pennsylvania - Hazardous Substance List                                      |
|                            | US - Rhode Island Hazardous Substance List                                         |
|                            | US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants         |
|                            | US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants |

| Beryllium acetate(543-81-7) | International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs |
|                            | US - Alaska Limits for Air Contaminants                                           |
|                            | US - California OEHHA/ARB - Chronic Reference Exposure Levels and Target Organs (CRELS) |
|                            | US - California Permissible Exposure Limits for Chemical Contaminists             |
|                            | US - Hawaii Air Contaminant Limits                                                |
|                            | US - Idaho - Acceptable Maximum Peak Concentrations                               |
|                            | US - Idaho - Limits for Air Contaminants                                          |
|                            | US - Michigan Exposure Limits for Air Contaminants                                |
|                            | US - Minnesota Permissible Exposure Limits (PELs)                                 |
|                            | US - Oregon Permissible Exposure Limits (Z-1)                                     |
|                            | US - Oregon Permissible Exposure Limits (Z-2)                                     |
|                            | US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants         |
|                            | US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants |

| Bismuth(7440-39-9)         | International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs |
|                            | US - Alaska Limits for Air Contaminants                                           |
|                            | US - California Permissible Exposure Limits for Chemical Contaminists             |
|                            | US - California Proposition 65 - Carcinogens                                      |
|                            | US - Hawaii Air Contaminant Limits                                                |
|                            | US - Idaho - Limits for Air Contaminants                                          |
|                            | US - Massachusetts - Right To Know Listed Chemicals                               |
|                            | US - Michigan Exposure Limits for Air Contaminants                                |
|                            | US - Minnesota Permissible Exposure Limits (PELs)                                 |
|                            | US - Oregon Permissible Exposure Limits (Z-1)                                     |
|                            | US - Pennsylvania - Hazardous Substance List                                      |
|                            | US - Rhode Island Hazardous Substance List                                         |
|                            | US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants         |
|                            | US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants |

| Indium(7440-74-6)          | International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs |
|                            | US - Alaska Limits for Air Contaminants                                           |
|                            | US - California Permissible Exposure Limits for Chemical Contaminists             |
|                            | US - Hawaii Air Contaminant Limits                                                |
|                            | US - Massachusetts - Right To Know Listed Chemicals                               |
|                            | US - Michigan Exposure Limits for Air Contaminants                                |
|                            | US - Minnesota Permissible Exposure Limits (PELs)                                 |
|                            | US - Oregon Permissible Exposure Limits (Z-1)                                     |
|                            | US - Pennsylvania - Hazardous Substance List                                      |
|                            | US - Rhode Island Hazardous Substance List                                         |
|                            | US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants         |
|                            | US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants |

Continued...
YTTRIUM (7440-65-5) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs
US - Alaska Limits for Air Contaminants
US - California OEHHA/ARB - Chronic Reference Exposure Levels and Target Organs (CRELS)
US - California Permissible Exposure Limits for Chemical Contaminants
US - Hawaii Air Contaminant Limits
US - Massachusetts - Right To Know Listed Chemicals
US - Michigan Exposure Limits for Air Contaminants
US - Minnesota Permissible Exposure Limits (PELS)
US - Oregon Permissible Exposure Limits (Z-1)
US - Pennsylvania - Hazardous Substance List

MAGNESIUM (7439-95-4) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs
US - California OEHHA/ARB - Chronic Reference Exposure Levels and Target Organs (CRELS)
US - California Permissible Exposure Limits for Chemical Contaminants
US - Hawaii Air Contaminant Limits
US - Massachusetts - Right To Know Listed Chemicals
US - Michigan Exposure Limits for Air Contaminants
US - Oregon Permissible Exposure Limits (Z-1)

NICKEL (7440-02-0) IS FOUND ON THE FOLLOWING REGULATORY LISTS

US - Alaska Limits for Air Contaminants
US - California OEHHA/ARB - Acute Reference Exposure Levels and Target Organs (RELS)
US - California OEHHA/ARB - Chronic Reference Exposure Levels and Target Organs (CRELS)
US - California Permissible Exposure Limits for Chemical Contaminants
US - Hawaii Air Contaminant Limits
US - Massachusetts - Right To Know Listed Chemicals
US - Michigan Exposure Limits for Air Contaminants
US - Minnesota Permissible Exposure Limits (PELS)
US - New Jersey Right to Know: Special Health Hazard Substance List (SHHSL): Carcinogens
US - Oregon Permissible Exposure Limits (Z-1)

AMMONIUM METAVANADATE (7803-55-6) IS FOUND ON THE FOLLOWING REGULATORY LISTS

US - California OEHHA/ARB - Acute Reference Exposure Levels and Target Organs (RELS)
US - Massachusetts - Right To Know Listed Chemicals
US - Pennsylvania - Hazardous Substance List

Continued...
### US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

<table>
<thead>
<tr>
<th>Name</th>
<th>Reportable Quantity in Pounds (lb)</th>
<th>Reportable Quantity in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead</td>
<td>10</td>
<td>4.54</td>
</tr>
<tr>
<td>Nickel</td>
<td>100</td>
<td>45.4</td>
</tr>
<tr>
<td>Ammonium vanadate</td>
<td>1000</td>
<td>454</td>
</tr>
<tr>
<td>Nitric acid</td>
<td>1000</td>
<td>454</td>
</tr>
</tbody>
</table>

### Federal Regulations

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

<table>
<thead>
<tr>
<th>Section</th>
<th>Hazard Categories</th>
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</thead>
<tbody>
<tr>
<td>311/312</td>
<td>Immediate (acute) health hazard Yes</td>
</tr>
<tr>
<td></td>
<td>Delayed (chronic) health hazard No</td>
</tr>
<tr>
<td></td>
<td>Fire hazard No</td>
</tr>
<tr>
<td></td>
<td>Pressure hazard No</td>
</tr>
<tr>
<td></td>
<td>Reactivity hazard No</td>
</tr>
</tbody>
</table>

### US EPA CERCLA HAZARDOUS SUBSTANCES AND REPORTABLE QUANTITIES (40 CFR 320.4)

<table>
<thead>
<tr>
<th>Name</th>
<th>Reportable Quantity in Pounds (lb)</th>
<th>Reportable Quantity in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitric acid</td>
<td>1000</td>
<td>454</td>
</tr>
</tbody>
</table>

### State Regulations

**US - CALIFORNIA PROPOSITION 65**

**WARNING:** This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm.

### US - CALIFORNIA PROPOSITION 65 - CARCINOGENS & REPRODUCTIVE TOXICITY (CRT): LISTED SUBSTANCE

- Cobalt metal powder, Lead and lead compounds: Lead, Nickel (Metallic) Listed

###传说列表

- **Nitric Acid**: 7697-37-2
- **Ammonium Vanadate**: 12017-82-6
- **Nickel**: 7440-02-0

**Warning:** This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm.

**Legend**

- **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

<table>
<thead>
<tr>
<th>Name</th>
<th>CAS No</th>
</tr>
</thead>
<tbody>
<tr>
<td>aluminium</td>
<td>7429-90-5, 91728-14-2</td>
</tr>
</tbody>
</table>

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. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

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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