ICP Multielement Calibration Standard 11

High-Purity Standards

Chemwatch Hazard Alert Code: **3**

Catalogue number: **ICP-MCS-11**
Version No: **1.1**
Safety Data Sheet according to OSHA HazCom Standard (2012) requirements

Issue Date: **06/02/2017**
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S.GHS.USA.EN

SECTION 1 IDENTIFICATION

Product Identifier

Product name	ICP Multielement Calibration Standard 11
Synonyms	ICP-MCS-11
Proper shipping name	Corrosive liquid, acidic, inorganic, n.o.s. (contains nitric acid)
Other means of identification	ICP-MCS-11

Recommended use of the chemical and restrictions on use

Relevant identified uses	*This radioactive material may be supplied in a variety of package types and may exhibit a range of specific activities.*

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, 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...

P260	Do not breathe dust/fume/gas/mist/vapours/spray.

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

CAS No	%[weight]	Name
7440-45-1	0.01	cerium
7429-91-6	0.01	dysprosium
7440-52-0	0.01	erbium
7440-53-1	0.01	europium
7440-54-2	0.01	gadolinium
7440-60-0	0.01	holmium
7439-91-0	0.01	lanthanum
7439-94-3	0.01	lutetium
7440-00-8	0.01	neodymium
7440-10-0	0.01	praseodymium
7440-19-9	0.01	samarium
7440-20-2	0.01	scandium
7440-27-9	0.01	terbium
7440-29-1	0.01	thorium
7440-30-4	0.01	thulium
10102-06-4	0.01 (as U)	uranyl nitrate
7440-64-4	0.01	ytterbium
7440-65-5	0.01	yttrium
7697-37-2	5	nitric acid
7732-18-5	balance	water

SECTION 4 FIRST-AID MEASURES

Description of first aid measures

Eye Contact	▸ **GET MEDICAL ATTENTION IMMEDIATELY** ▸ Remove victim to a restricted area for decontamination. ▸ Thoroughly wash eyes with large amounts of water, occasionally lifting the upper and lower eyelids (for approximately 15 minutes). ▸ Following the water treatment, provide an isotonic solution. ▸ **DO NOT** use eye baths, rather provide a continuous and copious supply of fluid. ▸ Monitor the victim for radioactivity. If activity is present, rewash the eyes and remonitor until little or no radioactivity is present. ▸ Any water used to wash the victim's eyes must be stored in a metal container for later disposal. Any other articles that are used to decontaminate the victim must also be stored in metal containers for later decontamination or disposal. ▸ Any personnel involved in rendering first aid to the victim must be monitored for radioactivity and decontaminated if necessary IAEA Safety Series No.: 47 Manual on Early Medical Treatment of Possible Radiation Injury, 1978, p.35.
Skin Contact	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):

Continued...

	▸ 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, nonstick 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. The objectives of skin decontamination are to remove as much of the radionucleotide as practicable in order to reduce the surface dose rate and to prevent activity from entering the body. Over-aggressive skin decontamination procedures must be avoided since these may injure the natural barriers of the skin and increase percutaneous absorption. **IT IS IMPERATIVE THAT THE SKIN SHOULD BE DECONTAMINATED AS QUICKLY AS POSSIBLE** It is **IMPORTANT** to review each potential exposure, prior to the first use of the radioactive substance, to establish whether an alternative decontamination regime exists should simple washing techniques prove to be inadequate. (see point 4 below) If radioactive contamination is suspected: ▸ Gently brush away dry particles or blot excess liquids with absorbent materials; ensure responders are adequately protected. ▸ Where possible, rinse victim in warm water (30 deg. C.); caution must be exercised to ensure that areas of tissue damage or body cavity openings are **NOT** rinsed. ▸ Wash victim with mild liquid soap and large quantities of water. Pay particular attention to the head, finger nails and palms of the hands ▸ On completion of the washing, monitor the victim for radioactivity. If water and soap have been inadequate in removing the radioactive material, decontaminating compounds consisting of surfactants and absorbent substances may be effective. Complexing reagents may also be of use. ▸ The use of organic solvents is to be avoided as they may increase the solubility and absorption of the radioactive substance. ▸ Skin contamination with radiation may be an indication that other parts of the body have been exposed. ▸ Contaminated clothing must be stored in a metal container for later decontamination or disposal. ▸ The water used to wash the victim must be stored in metal containers for later disposal. ▸ Any personnel involved in rendering first aid to the victim must be monitored for radioactivity and decontaminated if necessary. IAEA Safety Series No.: 47 Manual on Early Medical Treatment of Possible Radiation Injury, 1978, p.9.
Inhalation	**IMPORTANT**: For patients with life-threatening injuries (from incidents involving small quantity release) and particle or liquid exposure, decontamination procedures must be initiated: **GET MEDICAL ATTENTION IMMEDIATELY.** ▸ **NOTE:** Personal Protective Equipment (PPE), including positive pressure self-contained breathing apparatus may be required to assure the safety of the rescuer. ▸ Remove from exposure area to a restricted area with fresh air as quickly as possible. ▸ Remove, as soon as possible, patient's clothing, jewelry and shoes. ▸ Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures ▸ If breathing has stopped, perform artificial respiration by administering oxygen; mouth-to-mouth resuscitation should be avoided to prevent exposure to the person rendering first aid. ▸ Any evidence of serious contamination indicates that treatment must be initiated. (Inhalation of radioactive particles may indicate that other parts of the body were also contaminated, such as the digestive tract, skin and eyes.) ▸ If time permits, wipe the face with wet filter paper, force coughing and blowing of the nose. Thorough decontamination should be started prior to the victim being removed to the medical area ▸ Package the patient using transportation bags, plastic or blankets; this ensures that contamination is limited during transportation. ▸ Provide adequate ambulance ventilation (intake and exhaust fans of appropriate design and capacity). ▸ Notify Emergency Department that a potentially contaminated patient is enroute; supply all available information regarding the nature and identity of the contaminant. ▸ Any personnel involved in rendering first aid must be monitored for radioactivity and thoroughly decontaminated if necessary.
Ingestion	If poisoning occurs, contact a doctor or Poisons Information Centre. ▸ In case of ingestion of radioactive substances, the mouth should be rinsed out immediately after the accident, care being taken not to swallow the water used for this purpose. ▸ Vomiting should be induced either mechanically, or with syrup of Ipecac. **DO NOT** induce vomiting in an unconscious person. * ▸ Further action depends on the nature of the radioactive substance. ▸ Get medical attention immediately. ▸ The victim must be monitored for radioactivity and decontaminated, if necessary, before being transported to a medical facility. ▸ Any personnel involved in rendering first aid to the victim must be monitored for radioactivity and decontaminated if necessary. - * The vomitus and lavage fluids should be saved for examination and monitoring. The gastric fluids and fluids used for lavage must be stored in metal containers for later disposal. IAEA Safety Series No.: 47 Manual on Early Medical Treatment of Possible Radiation Injury, 1978, p.59.

Most important symptoms and effects, both acute and delayed

See Section 11

Indication of any immediate medical attention and special treatment needed

For acute or short term repeated exposures to strong acids:
▸ Airway problems may arise from laryngeal edema and inhalation exposure. Treat with 100% oxygen initially.
▸ Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling
▸ Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.
▸ Strong acids produce a coagulation necrosis characterised by formation of a coagulum (eschar) as a result of the dessicating action of the acid on proteins in specific tissues.

INGESTION:
▸ Immediate dilution (milk or water) within 30 minutes post ingestion is recommended.
▸ **DO NOT** attempt to neutralise the acid since exothermic reaction may extend the corrosive injury.
▸ Be careful to avoid further vomit since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.
▸ Charcoal has no place in acid management.
▸ Some authors suggest the use of lavage within 1 hour of ingestion.

SKIN:
▸ Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.
▸ Deep second-degree burns may benefit from topical silver sulfadiazine.

EYE:

Continued...

- Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjuctival cul-de-sacs. Irrigation should last at least 20-30 minutes. **DO NOT** use neutralising agents or any other additives. Several litres of saline are required.
- Cycloplegic drops, (1% cyclopentolate for short-term use or 5% homatropine for longer term use) antibiotic drops, vasoconstrictive agents or artificial tears may be indicated dependent on the severity of the injury.
- Steroid eye drops should only be administered with the approval of a consulting ophthalmologist).

[Ellenhorn and Barceloux: Medical Toxicology]

For radiation poisoning:

- Lavage may be useful. Care should be taken to avoid aspiration.
- The vomitus and lavage fluids should be saved for examination and monitoring. The gastric fluids and fluids used for lavage must be stored in metal containers for later disposal.
- There is no antidote for radiation sickness
- Treatment should be symptomatic and supportive, regardless of the dose received. IAEA Safety Series No.: 47; Manual on Early Medical Treatment of Possible Radiation Injury, 1978, p.35.

BASIC TREATMENT

- Establish a patent airway with suction where necessary.
- Watch for signs of respiratory insufficiency and assist ventilation as necessary.
- Administer oxygen by non-rebreather mask at 10 to 15 l/min.
- Monitor and treat, where necessary, for shock.
- Anticipate seizures.
- Routine emergency care may be necessary for associated injuries.
- Do not use emetics. Where ingestion is suspected rinse mouth and give up to 200 ml water (5 ml/kg recommended) for dilution where patient is able to swallow, has a strong gag reflex and does not drool.
- If necessary, perform BLS care.

ADVANCED TREATMENT

- Consider orotracheal or nasotracheal intubation for airway control in unconscious patient or where respiratory arrest has occurred.
- Monitor and treat, where necessary, for arrhythmias.
- Support vital signs with IV lactated Ringer's solution.
- Hypotension with signs of hypovolaemia requires the cautious administration of fluids. Fluid overload might create complications.
- Treat seizures with diazepam.
- Advanced life-support care may be needed.
- Proparacaine hydrochloride should be used to assist eye irrigation.
- Chelating agents may be useful if given before or immediately after exposure.

SPECIAL CONSIDERATIONS

- Symptoms associated with radioactives exposure are generally delayed. Treatment should address other medical problems or trauma.
- An accurate history of exposure is essential to determine proper treatment; Exposure to 100 rads is expected to produce GI symptoms such as nausea, vomiting, abdominal cramps, diarrhoea; onset of symptoms may be delayed for several hours. Exposure to 600 rads is expected to result in severe GI symptoms such as necrotic gastroenteritis which may result in dehydration and may be fatal within days. Exposure to several thousand rads is expected to produce neurological/ cardiovascular symptoms including confusion, lethargy, ataxia, seizures, coma, and cardiovascular collapse, within minutes or hours. Severe exposures may also produce bone marrow depression, leukopenia and infection.

BRONSTEIN, A.C. and CURRANCE, P.L. EMERGENCY CARE FOR HAZARDOUS MATERIALS EXPOSURE: 2nd Ed. 1994

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	
Fire/Explosion Hazard	• 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 acrid smoke.

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

Minor Spills	Prior to working with radioactive material, devise a written procedure for handling a cleanup of small and large spills. For spillages involving less than 20 times the "Annual Limit on Intake (ALI)" value for inhalation • Wear rubber or plastic gloves • Clean up liquid spillages with absorbent material • Monitor the affected area when no visible spill material remains, to check the progress of the decontamination, preferably less than one "Derived Working Limit (DWL)" • Treat all materials used in the decontamination process as radioactive waste • Monitor all persons involved in the spillage or decontamination operation • Remove contaminated clothing, place in plastic bags and seal

Continued...

Major Spills	▸ **DO NOT** touch damaged containers or spilled materials. Damage to outer container may not affect primary inner container. ▸ Isolate hazard area and deny entry. ▸ Evacuate the area if there is a significant radiological hazard to persons ▸ It may be necessary to dike far ahead of the spill area ▸ Enter spill area only to save life; limit entry to shortest possible time. ▸ Detain uninjured persons and equipment exposed to radioactive material until arrival or instruction of qualified radiation authority. ▸ Delay cleanup until arrival or instruction of qualified radiation authority.

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

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling

Safe handling	▸ All work with unsealed radioactive substances shall be segregated from other work and, where possible, carried out in a laboratory or workplace reserved solely for this purpose. Where widely different levels of activity and radiotoxicity are to be in use, separate rooms are preferred. ▸ Eating, drinking, smoking and the application of cosmetics should not take place in a radioactive substances designated area. ▸ Before work with unsealed radioactive substances proceeds, written procedures describing good working practices, should be available. ▸ Practice runs might be made with non-radioactive substances, so that when radioactive substances are used, operations are performed speedily and confidently with minimum exposure and risk of accident. ▸ Working procedures and a contingency plan, taking into account every radiation spill that is reasonably foreseen, should be available for periodic review. ▸ A high standard of cleanliness should be maintained in radioactive substances work-places. ▸ Appropriate means of monitoring for contamination should be available. ▸ Radiation and contamination surveys should be carried out regularly. ▸ No mouth operations should be carried out in areas where radioactive materials are used. Pipettes should be syringe or bulb-operated, or be of the automatic plunger type with disposable single-use trips. ▸ All reagents, tools and, where possible, apparatus used in the "active" area shall be clearly labelled and should remain where practical in the "actives" area. ▸ Any items removed from the actives area shall be monitored, decontaminated if necessary and labelled. The label might include details of the individual certifying the item is free from contamination. ▸ All work surfaces in the actives (including sinks) should be marked be a radiation symbol. ▸ Never store [human] food and beverage in refrigerators/freezers used for storing radioisotopes. ▸ Prevent skin contact with skin-absorbable solvents containing radioactive material. ▸ Fume hoods and biological safety cabinets for use with non-airborne radioactive material must be approved (through the protocol) and must be labelled "Caution Radioactive Material". ▸ All volatile, gaseous, or aerosolized radioactive material must be used only in a properly operating charcoal and/or HEPA filtered fume hood or Biological Safety Cabinet bearing a Caution Airborne Radioactivity hood label, unless otherwise specified in writing by the Radiation Safety Officer. ▸ Radioactive preparations should be marked with the radiation symbol, details of the chemical compound, radionuclide, activity, and as appropriate date and name of responsible user ▸ Work with unsealed liquid sources should be carried out in a double container or large tray (stainless seal or plastic) lined with absorbent material to restrict the spread of spilled materials. ▸ Operations producing vapour, spray, dust or radioactive gas shall be carried out in a fume cupboard, glove box or other enclosed areas. ▸ Appropriate waste receptacles should be provided. Foot-operated waste-bins are preferable. ▸ When leaving designated radiation areas, workers should wash hands thoroughly. Hands, clothing and shoes should be monitored to ensure that the contamination derived working level (DWL) (see "Engineering Controls") is not exceeded. These procedures should be followed before meals, visits to the toilet and prior to leaving the designated radiation area at the end of each day' s work. ▸ Cleaning of designated radiation areas should be carried out by suitably trained people. Wet cleaning is generally recommended to reduce the possibility of airborne contamination. Separate cleaning equipment should be reserved for use in these areas, Vacuum cleaners should only be used if equipped with high-efficiency exhaust (HEPA) filtration. ▸ Electrical heating should be used for laboratory operation. Evaporation by infra-red lamp reduces splashing, spraying and droplet contamination. ▸ Written procedures for maintenance work should be available.
Other information	▸ Special security requirements apply in Federal/State regulation to the storage, packaging and handling of radioactive materials. ▸ Regulation may include restriction on package size and quantities stored. ▸ Store in an approved storage area and ensure that packages are appropriately labelled as required by relevant legislation. ▸ Keep locked up at all times.

Conditions for safe storage, including any incompatibilities

Suitable container	▸ **DO NOT** use aluminium or galvanised containers For packaging of radioisotopes. Packaging should be designed and finished so that external surfaces are free of protruding features and can be easily decontaminated. The outer layer of packaging should be designed so as to prevent the collection and retention of water. Many international standards, relating to correct package type and design, are in force and should be observed when repacking the contents of the original containers.
Storage incompatibility	▸ 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 pi-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 ▸ Avoid strong bases.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

OCCUPATIONAL EXPOSURE LIMITS (OEL)

INGREDIENT DATA

Source	Ingredient	Material name	TWA	STEL	Peak	Notes

Continued...

US OSHA Permissible Exposure Levels (PELs) - Table Z1	yttrium	Yttrium	1 mg/m3	Not Available	Not Available	[*Note: The REL also applies to other yttrium compounds (as Y).]
US NIOSH Recommended Exposure Limits (RELs)	yttrium	Yttrium metal	1 mg/m3	Not Available	Not Available	Not Available
US OSHA Permissible Exposure Levels (PELs) - Table Z1	nitric acid	Nitric acid	5 mg/m3 / 2 ppm	10 mg/m3 / 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/m3 / 2 ppm	4 ppm	Not Available	Not Available
US ACGIH Threshold Limit Values (TLV)	nitric acid	Nitric acid	2 ppm	Not Available	Not Available	Not Available

EMERGENCY LIMITS

Ingredient	Material name	TEEL-1	TEEL-2	TEEL-3
cerium	Cerium	30 mg/m3	330 mg/m3	2,000 mg/m3
dysprosium	Dysprosium	30 mg/m3	330 mg/m3	2,000 mg/m3
europium	Europium	30 mg/m3	330 mg/m3	2,000 mg/m3
gadolinium	Gadolinium	30 mg/m3	330 mg/m3	2,000 mg/m3
holmium	Holmium	12 mg/m3	130 mg/m3	790 mg/m3
lanthanum	Lanthanum	30 mg/m3	330 mg/m3	2,000 mg/m3
lutetium	Lutetium	30 mg/m3	330 mg/m3	2,000 mg/m3
neodymium	Neodymium	30 mg/m3	330 mg/m3	2,000 mg/m3
praseodymium	Praseodymium	1.2 mg/m3	13 mg/m3	79 mg/m3
samarium	Samarium	30 mg/m3	330 mg/m3	2,000 mg/m3
scandium	Scandium	30 mg/m3	330 mg/m3	2,000 mg/m3
terbium	Terbium	1.2 mg/m3	13 mg/m3	79 mg/m3
thorium	Thorium	30 mg/m3	330 mg/m3	2,000 mg/m3
thulium	Thulium	30 mg/m3	330 mg/m3	2,000 mg/m3
uranyl nitrate	Uranyl nitrate (solid); (Bis(nitrato-O,O')dioxouranium)	0.99 mg/m3	5.5 mg/m3	33 mg/m3
uranyl nitrate	Uranyl nitrate hexahydrate	1.3 mg/m3	7 mg/m3	42 mg/m3
uranyl nitrate	Uranyl nitrate (yellow salt)	0.99 mg/m3	5.5 mg/m3	33 mg/m3
yttrium	Yttrium	3 mg/m3	33 mg/m3	200 mg/m3
nitric acid	Nitric acid	Not Available	Not Available	Not Available

Ingredient	Original IDLH	Revised IDLH
cerium	Not Available	Not Available
dysprosium	Not Available	Not Available
erbium	Not Available	Not Available
europium	Not Available	Not Available
gadolinium	Not Available	Not Available
holmium	Not Available	Not Available
lanthanum	Not Available	Not Available
lutetium	Not Available	Not Available
neodymium	Not Available	Not Available
praseodymium	Not Available	Not Available
samarium	Not Available	Not Available
scandium	Not Available	Not Available
terbium	Not Available	Not Available
thorium	Not Available	Not Available
thulium	Not Available	Not Available
uranyl nitrate	20 mg/m3	10 mg/m3
ytterbium	Not Available	Not Available
yttrium	Not Available	Not Available
nitric acid	100 ppm	25 ppm
water	Not Available	Not Available

Exposure controls

Appropriate engineering controls	For potential exposure to radioactive substances, local exhaust or process enclosure ventilation should be provided as a minimum. External radiation exposure may be controlled with adequate shielding. The absorbing material and its thickness will depend on the type of radiation, its energy, the flux and dimensions of the source. ▸ For **ALPHA PARTICLES** fraction of a millimetre of any ordinary material will generally be sufficient to attenuate the energy of the particle. ▸ For the more energetic **BETA PARTICLES**, extra shielding will be required. This may comprise materials such as acrylics, aluminium and thick rubber.

Continued...

	▸ For example, 6 mm (approx. 1/4 inch) of acrylic will absorb all beta particles up to 1 MeV. With high energy beta radiation from large sources, Bremmstrahlung (X-ray production) contribution may be significant and it may be necessary to provide additional shielding of high atomic weight material, such as lead, to attenuate the Bremsstrahlung radiation. ▸ For highly energetic **GAMMA PARTICLES** the most suitable shielding materials are lead and iron. Thickness will depend on whether the source is producing narrow or broad beam radiation. Primary and secondary barriers may be required to block all radiation.
Personal protection	
Eye and face protection	▸ Most safety glasses will provide protection against alpha particles, some protection against beta particles (depending on thickness) but will not shield gamma radiation.
Skin protection	See Hand protection below
Hands/feet protection	▸ When handling corrosive liquids, wear trousers or overalls outside of boots, to avoid spills entering boots. Disposable gloves. Most gloves will provide protection against alpha particles, some protection against beta particles (depending on thickness) but will not shield gamma radiation. Used gloves may present a radiation hazard and should be disposed of as radioactive waste. Suitable gloves should be worn for all work with unsealed radioactive substances, and special care is to be exercised when putting on or removing gloves, to avoid contaminating the hands and the inside surfaces of the gloves.
Body protection	See Other protection below
Other protection	Disposable overgarments, including head and foot coverings should be worn by any employee engaged in handling radioactive substances *in the workplace*. These garments are recommended even if the employee is working with a "glove-box" containment system. Protective clothing reserved specifically for radioactive work, shall be worn at all times *in a laboratory,* even for very low levels of specific activity. The following should be considered. ▸ For work in low level laboratories, a normal laboratory coat or overall is sufficient. ▸ For work in medium level laboratories, the laboratory coat should have elasticised sleeve cuffs and a crossover front with high neck fastened with hook and loop fastening fabric. Pockets are not recommended. NOTE: Velcro strips are suitable. ▸ In high level laboratories, in addition to coats and overalls, overshoes or similar specially designed footwear should be worn to prevent the transfer of radioactive contamination from laboratory floors. All protective clothing worn in radioisotope and radiological laboratories should be removed prior to leaving and left in a specifically designated area in or immediately outside the laboratory. This area should be considered as a source of radioactive hazard. Contaminated clothing shall not be laundered with uncontaminated items. Certain clothing fibres may be useful in dosimetry studies so clothing should be kept in event of accident, large scale release or a large scale clean-up.
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

Appearance	Not Available

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. ▸ Product is considered stable. ▸ Hazardous polymerisation will not occur.
Possibility of hazardous reactions	See section 7

Continued...

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. Inhalation of vapours or aerosols (mists, fumes), generated by the material during the course of normal handling, may be damaging to the health of the individual. 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. Corrosive acids can cause irritation of the respiratory tract, with coughing, choking and mucous membrane damage. There may be dizziness, headache, nausea and weakness. A whole body dose of 2-10 Gray may cause loss of appetite, tiredness, nausea and vomiting, most severe after 6-12 hours. After this subsides a gross disturbance in blood cell distribution occurs with loss of white blood cells and platelets over weeks.
Ingestion	The material can produce chemical burns within the oral cavity and gastrointestinal tract following ingestion. Accidental ingestion of the material may be damaging to the health of the individual. Dysprosium 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. The kidney and liver can be damaged by uranium, causing excessive acid and urea in the blood and generalised ill health. 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.
Skin Contact	The material can produce chemical burns following direct contact with the skin. 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. 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. 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. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.
Eye	The material can produce chemical burns to the eye following direct contact. Vapours or mists may be extremely irritating. 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. The eye is particularly sensitive to radioactivity. A single dose of 1 Gy can cause inflammation of the conjunctiva and cornea.
Chronic	There has been concern that this material can cause cancer or mutations, but there is not enough data to make an assessment. 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. Repeated or prolonged exposure to acids may result in the erosion of teeth, swelling and/or ulceration of mouth lining. Irritation of airways to lung, with cough, and inflammation of lung tissue often occurs. Thulium 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. 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. A single large or prolonged low exposure to radiation can cause delayed effects, including blood cancers, genetic disorders, shortened lifespan and cataracts. Leukaemia is the most common cancer caused; cancers of the thyroid, bone, lung (due to radioactive particle deposits) and skin are also seen. Dysprosium 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 Multielement Calibration Standard 11

TOXICITY	IRRITATION
Not Available	Not Available

cerium

TOXICITY	IRRITATION
Oral (rat) LD50: >5000 mg/kg[1]	Not Available

dysprosium

TOXICITY	IRRITATION
Not Available	Not Available

erbium

TOXICITY	IRRITATION
Not Available	Not Available

europium

TOXICITY	IRRITATION
Not Available	Not Available

gadolinium

TOXICITY	IRRITATION
Not Available	Not Available

Continued...

holmium	**TOXICITY**	**IRRITATION**
	Not Available	Not Available
lanthanum	**TOXICITY**	**IRRITATION**
	Not Available	Not Available
lutetium	**TOXICITY**	**IRRITATION**
	Not Available	Not Available
neodymium	**TOXICITY**	**IRRITATION**
	Not Available	Not Available
praseodymium	**TOXICITY**	**IRRITATION**
	Not Available	Not Available
samarium	**TOXICITY**	**IRRITATION**
	Not Available	Not Available
scandium	**TOXICITY**	**IRRITATION**
	Not Available	Not Available
terbium	**TOXICITY**	**IRRITATION**
	Not Available	Not Available
thorium	**TOXICITY**	**IRRITATION**
	Not Available	Not Available
thulium	**TOXICITY**	**IRRITATION**
	Not Available	Not Available
uranyl nitrate	**TOXICITY**	**IRRITATION**
	dermal (rat) LD50: 1040 mg/kg[2]	Not Available
ytterbium	**TOXICITY**	**IRRITATION**
	Not Available	Not Available
yttrium	**TOXICITY**	**IRRITATION**
	Not Available	Not Available
nitric acid	**TOXICITY**	**IRRITATION**
	Inhalation (rat) LC50: 625 ppm/1h*t[2]	Not Available
water	**TOXICITY**	**IRRITATION**
	Not Available	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*

NEODYMIUM	Nausea and vomiting, gastrointestinal changes, sweating recorded.
SCANDIUM	Scandium metal on its own is not considered to be toxic.
THORIUM	Thorium and its compounds are mainly alpha particle emitters although beta and gamma radiation is also encountered The radiological danger is considerably more serious than the chemical danger in view of the long time that all thorium compounds remain in the organs where they are deposited (mainly in bones, lungs, lymphatic glands etc.) leading to long-term alpha-irradiation of the tissues.

Continued...

	WARNING: This substance has been classified by the IARC as Group 1: **CARCINOGENIC TO HUMANS**.
URANYL NITRATE	US NRCP Permissible quarterly intakes of radionuclides for occupational Insolubles- 3.2 microcuries per quarter oral intake; critical organ being the GI tract Lower large intestine. 4.0 x 10^-2 per quarter inhalation; critical organ being the lungs. Solubles- 1.2 microcuries per quarter oral intake; critical organ being the kidneys. 4.5 x 10^-2 per quarter inhalation; critical organ being the kidneys.
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. Oral (?) LD50: 50-500 mg/kg * [Various Manufacturers]
CERIUM & ERBIUM & EUROPIUM & GADOLINIUM & HOLMIUM & LANTHANUM & NEODYMIUM & PRASEODYMIUM & SAMARIUM & THULIUM & YTTERBIUM & YTTRIUM	Lanthanide poisoning causes immediate defaecation, writhing, inco-ordination, laboured breathing, and inactivity.
CERIUM & DYSPROSIUM & ERBIUM & EUROPIUM & GADOLINIUM & HOLMIUM & LANTHANUM & LUTETIUM & NEODYMIUM & PRASEODYMIUM & SAMARIUM & TERBIUM & THORIUM & THULIUM & URANYL NITRATE & YTTERBIUM & YTTRIUM & WATER	No significant acute toxicological data identified in literature search.
SCANDIUM & THULIUM & NITRIC ACID	Asthma-like symptoms may continue for months or even years after exposure to the material ends.
YTTERBIUM & YTTRIUM	For typical lanthanides: Symptoms of toxicity from rare earth elements include writhing, inco-ordination, laboured breathing, and sedation.

Acute Toxicity	⊘	**Carcinogenicity**	⊘
Skin Irritation/Corrosion	✔	**Reproductivity**	⊘
Serious Eye Damage/Irritation	✔	**STOT - Single Exposure**	⊘
Respiratory or Skin sensitisation	⊘	**STOT - Repeated Exposure**	⊘
Mutagenicity	⊘	**Aspiration Hazard**	⊘

Legend: ✘ *– Data available but does not fill the criteria for classification*
✔ *– Data available to make classification*
⊘ *– Data Not Available to make classification*

SECTION 12 ECOLOGICAL INFORMATION

Toxicity

ICP Multielement Calibration Standard 11

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

cerium

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

dysprosium

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

erbium

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

europium

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

gadolinium

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

Continued...

holmium

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

lanthanum

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
EC50	24	Crustacea	1352mg/L	5

lutetium

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

neodymium

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

praseodymium

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

samarium

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

scandium

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

terbium

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

thorium

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

thulium

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

uranyl nitrate

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
LC50	96	Fish	3.1mg/L	4
EC50	48	Crustacea	5.34mg/L	4
BCF	144	Fish	0.963mg/L	4
EC50	48	Crustacea	6.19mg/L	4
NOEC	480	Algae or other aquatic plants	0.5mg/L	4

ytterbium

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

yttrium

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

nitric acid

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
NOEC	16	Crustacea	107mg/L	4

water

ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

Legend: *Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 3. EPIWIN Suite V3.12 (QSAR) - 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*

Ecotoxicity:
The tolerance of water organisms towards pH margin and variation is diverse. Recommended pH values for test species listed in OECD guidelines are between 6.0 and almost 9. Acute testing

Continued...

with fish showed 96h-LC50 at about pH 3.5
For Lanthanoids (Formerly Lanthanides: Synonym Rare Earth Metals and their Salts):
Environmental Fate: Rare earths, such as the lanthanoids, are relatively abundant in the crust of the Earth. These elements are not "rare"-scientists once thought these substances were only found in very small amounts on the Earth Most of the lanthanides occur together in nature, and they are very difficult to separate from each other. The lanthanides form alloys, (mixtures), with many other metals, and these alloys exhibit a wide range of physical properties. Lanthanoid emissions to the environment have increased as a result of the growing industrial applications of these elements; however, robust data to evaluate the environmental fate of lanthanoids are scarce.
Atmospheric Fate: These substances react with oxygen in the atmosphere to form an oxide residue which tarnishes surfaces exposed to these elements. They burn readily in air to form oxides.
Terrestrial Fate: Soil - Lanthanoids can be found in most soils. These substances are expected to strongly sorb to soil and are not expected to evaporate from soil surfaces.
Plants " These substances are expected to accumulate in plants, especially duckweed.
Aquatic Fate: Rare earth chlorides are very poorly soluble in water. These substances will bind to carbonated and dissolved organic matter in water. The lanthanides react slowly with cold water and more rapidly with hot water to form hydrogen gas. The lanthanum ion is expected to have high attraction to the negatively charged humic material present in most natural waters. This mechanism will also remove lanthanum from the water column.
Ecotoxicity: These elements have a high tendency to accumulate in plants and organisms. A typical oxide of this group, cerium oxide, has low toxicity to the fathead minnow, green algae, and Daphnia water fleas. Rare earth chlorides exhibit acute aquatic toxicity at concentrations exceeding 100 ppm and chronic toxicity, persisting for more than 21 days, at concentrations greater than 30 ppm. Industrial processes have little impact on altering background levels. Lanthanum 3+ is toxic to some aquatic organisms. Dissolved lanthanum is very toxic to species of Daphnia in both chronic and acute tests and may also be toxic to other species. There seems little doubt that dissolved lanthanum has at least high acute and chronic toxicity to fresh water fish and to various species of Daphnia in soft water, although water quality appears to have a very large effect on the toxicity.

DO NOT discharge into sewer or waterways.

Persistence and degradability

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

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	▸ Containers may still present a chemical hazard/ danger when empty. ▸ Return to supplier for reuse/ recycling if possible. Otherwise: ▸ If container can not be cleaned sufficiently well to ensure that residuals do not remain or if the container cannot be used to store the same product, then puncture containers, to prevent re-use, and bury at an authorised landfill. ▸ Where possible retain label warnings and SDS and observe all notices pertaining to the product. ▸ WARNING Radioactive materials must not be disposed of as Industrial Waste or domestic garbage. Consult supplier/ appropriate Radiation Control Authority for disposal procedures

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)
Transport hazard class(es)	Class: 8 Subrisk: Not Applicable
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)

UN number	3264

Continued...

UN proper shipping name	Corrosive liquid, acidic, inorganic, n.o.s. * (contains nitric acid)
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)

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

Source	Product name	Pollution Category	Ship Type
IMO MARPOL (Annex II) - List of Noxious Liquid Substances Carried in Bulk	Nitric acid (70% and over)|Nitric acid (less than 70%)	Y; Y	2|2

SECTION 15 REGULATORY INFORMATION

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

CERIUM(7440-45-1) IS FOUND ON THE FOLLOWING REGULATORY LISTS

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

DYSPROSIUM(7429-91-6) IS FOUND ON THE FOLLOWING REGULATORY LISTS

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

ERBIUM(7440-52-0) 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 - Michigan Exposure Limits for Air Contaminants
US - Oregon Permissible Exposure Limits (Z-1)
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants
US - Washington Permissible exposure limits of air contaminants
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

EUROPIUM(7440-53-1) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Air Transport Association (IATA) Dangerous Goods Regulations - Prohibited List Passenger and Cargo Aircraft
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

GADOLINIUM(7440-54-2) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Air Transport Association (IATA) Dangerous Goods Regulations - Prohibited List Passenger and Cargo Aircraft
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

HOLMIUM(7440-60-0) IS FOUND ON THE FOLLOWING REGULATORY LISTS

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

LANTHANUM(7439-91-0) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Continued...

International Air Transport Association (IATA) Dangerous Goods Regulations - Prohibited List Passenger and Cargo Aircraft
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

LUTETIUM(7439-94-3) IS FOUND ON THE FOLLOWING REGULATORY LISTS

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

NEODYMIUM(7440-00-8) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Air Transport Association (IATA) Dangerous Goods Regulations - Prohibited List Passenger and Cargo Aircraft
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

PRASEODYMIUM(7440-10-0) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Air Transport Association (IATA) Dangerous Goods Regulations - Prohibited List Passenger and Cargo Aircraft
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

SAMARIUM(7440-19-9) 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 - Michigan Exposure Limits for Air Contaminants
US - Oregon Permissible Exposure Limits (Z-1)
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants
US - Washington Permissible exposure limits of air contaminants
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

SCANDIUM(7440-20-2) 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 - Michigan Exposure Limits for Air Contaminants
US - Oregon Permissible Exposure Limits (Z-1)
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants
US - Washington Permissible exposure limits of air contaminants
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

TERBIUM(7440-27-9) 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 - Michigan Exposure Limits for Air Contaminants
US - Oregon Permissible Exposure Limits (Z-1)
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants
US - Washington Permissible exposure limits of air contaminants
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

THORIUM(7440-29-1) IS FOUND ON THE FOLLOWING REGULATORY LISTS

International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs
US - California Proposition 65 - Carcinogens
US - Pennsylvania - Hazardous Substance List
US Clean Air Act - Hazardous Air Pollutants
US Priority List for the Development of Proposition 65 Safe Harbor Levels - No Significant Risk Levels (NSRLs) for Carcinogens and Maximum Allowable Dose Levels (MADLs) for Chemicals Causing Reproductive Toxicity
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

THULIUM(7440-30-4) 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 - Michigan Exposure Limits for Air Contaminants
US - Oregon Permissible Exposure Limits (Z-1)
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants
US - Washington Permissible exposure limits of air contaminants
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

URANYL NITRATE(10102-06-4) IS FOUND ON THE FOLLOWING REGULATORY LISTS

US - Alaska Limits for Air Contaminants
US - California Permissible Exposure Limits for Chemical Contaminants
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
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants
US - Washington Permissible exposure limits of air contaminants
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants
US ACGIH Threshold Limit Values (TLV)
US ACGIH Threshold Limit Values (TLV) - Carcinogens
US ATSDR Minimal Risk Levels for Hazardous Substances (MRLs)
US CWA (Clean Water Act) - List of Hazardous Substances
US NIOSH Recommended Exposure Limits (RELs)
US OSHA Permissible Exposure Levels (PELs) - Table Z1
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

YTTERBIUM(7440-64-4) IS FOUND ON THE FOLLOWING REGULATORY LISTS

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

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

Continued...

International Air Transport Association (IATA) Dangerous Goods Regulations - Prohibited List Passenger and Cargo Aircraft	US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants
US - Alaska Limits for Air Contaminants	US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants
US - Hawaii Air Contaminant Limits	US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants
US - Idaho - Limits for Air Contaminants	US - Washington Permissible exposure limits of air contaminants
US - Massachusetts - Right To Know Listed Chemicals	US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants
US - Michigan Exposure Limits for Air Contaminants	US ACGIH Threshold Limit Values (TLV)
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 - Pennsylvania - Hazardous Substance List	US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US - Rhode Island Hazardous Substance List	

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 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 - Acute Reference Exposure Levels and Target Organs (RELs)	US - Washington Permissible exposure limits of air contaminants
US - California Permissible Exposure Limits for Chemical Contaminants	US - Washington Toxic air pollutants and their ASIL, SQER and de minimis emission values
US - Hawaii Air Contaminant Limits	US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants
US - Idaho - Limits for Air Contaminants	US ACGIH Threshold Limit Values (TLV)
US - Massachusetts - Right To Know Listed Chemicals	US CWA (Clean Water Act) - List of Hazardous Substances
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 - Pennsylvania - Hazardous Substance List	US SARA Section 302 Extremely Hazardous Substances
US - Rhode Island Hazardous Substance List	US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	

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

US - Pennsylvania - Hazardous Substance List	US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

Federal Regulations

Superfund Amendments and Reauthorization Act of 1986 (SARA)

SECTION 311/312 HAZARD CATEGORIES

Immediate (acute) health hazard	Yes
Delayed (chronic) health hazard	No
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
Uranyl nitrate	100	45.4
Nitric acid	1000	454

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 PREPOSITION 65 - CARCINOGENS & REPRODUCTIVE TOXICITY (CRT): LISTED SUBSTANCE

Radionuclides Listed

National Inventory	Status
Australia - AICS	N (ytterbium; erbium; terbium; dysprosium; europium; yttrium; lutetium; holmium; gadolinium; thulium)
Canada - DSL	N (erbium; uranyl nitrate; terbium; dysprosium; europium; holmium; gadolinium; scandium)
Canada - NDSL	N (ytterbium; cerium; neodymium; water; thorium; lanthanum; samarium; yttrium; praseodymium; lutetium; thulium; nitric acid)
China - IECSC	N (ytterbium; erbium; terbium; cerium; thorium; lanthanum; europium; praseodymium; lutetium; holmium; gadolinium; thulium)
Europe - EINEC / ELINCS / NLP	Y
Japan - ENCS	N (ytterbium; erbium; uranyl nitrate; terbium; cerium; dysprosium; neodymium; water; thorium; lanthanum; europium; yttrium; praseodymium; lutetium; holmium; gadolinium; scandium; thulium; nitric acid)
Korea - KECI	N (erbium; uranyl nitrate; dysprosium; thorium; praseodymium; lutetium; holmium; thulium)
New Zealand - NZIoC	N (ytterbium; erbium; terbium; dysprosium; europium; lutetium; holmium; gadolinium; scandium; thulium)
Philippines - PICCS	N (ytterbium; erbium; terbium; dysprosium; neodymium; europium; yttrium; praseodymium; lutetium; holmium; gadolinium; scandium; thulium)
USA - TSCA	Y
Legend:	*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

Continued...

Other information

Ingredients with multiple cas numbers

Name	CAS No
uranyl nitrate	10102-06-4, 13520-83-7, 36478-76-9

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