10M59-1 Thorium (10,000µg/mL in 4% HNO3)

High-Purity Standards

Chemwatch Hazard Alert Code: **4**

Catalogue number: **10M59-1**
Version No: **3.3**
Safety Data Sheet according to OSHA HazCom Standard (2012) requirements

Issue Date: **05/19/2017**
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S.GHS.USA.EN

SECTION 1 IDENTIFICATION

Product Identifier

Product name	10M59-1 Thorium (10,000µg/mL in 4% HNO3)
Synonyms	10,000µg/mL Thorium in 4% HNO3
Proper shipping name	Corrosive liquid, acidic, inorganic, n.o.s. (contains nitric acid)
Other means of identification	10M59-1

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	Carcinogenicity Category 1A, Specific target organ toxicity - repeated exposure Category 2, Metal Corrosion Category 1, Skin Corrosion/Irritation Category 1A, Serious Eye Damage Category 1

Label elements

Hazard pictogram(s)	
SIGNAL WORD	**DANGER**

Hazard statement(s)

H350	May cause cancer.
H373	May cause damage to organs through prolonged or repeated exposure.
H290	May be corrosive to metals.
H314	Causes severe skin burns and eye damage.

Continued...

Hazard(s) not otherwise specified

Not Applicable

Precautionary statement(s) Prevention

P201	Obtain special instructions before use.

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
1314-20-1	1 (as Th)	thorium oxide
7697-37-2	4	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

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.

Continued...

	▸ 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:
- 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
EDTA is believed to merit consideration in removing thorium from the body following accidental overexposure. [*Patty's Industrial Hygiene & Toxicology*]
Personnel working with thorium compounds should be monitored for early symptoms and changes such as abnormal leukocytes in blood smears. Urine samples, whole body radiation counts and breath radon are useful tests to monitor exposure.

SECTION 5 FIRE-FIGHTING MEASURES

Continued...

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
Major Spills	▸ Clear area of personnel and move upwind. ▸ Alert Fire Brigade and tell them location and nature of hazard. ▸ Wear full body protective clothing with breathing apparatus. ▸ Prevent, by all means available, spillage from entering drains or water courses. ▸ Consider evacuation (or protect in place). ▸ No smoking, naked lights or ignition sources. ▸ Increase ventilation. ▸ Stop leak if safe to do so. ▸ Water spray or fog may be used to disperse / absorb vapour. ▸ Contain or absorb spill with sand, earth or vermiculite. ▸ Collect recoverable product into labelled containers for recycling. ▸ Collect solid residues and seal in labelled drums for disposal. ▸ Wash area and prevent runoff into drains. ▸ After clean up operations, decontaminate and launder all protective clothing and equipment before storing and re-using. ▸ If contamination of drains or waterways occurs, advise emergency services. ▸ **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.

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	▸ 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	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	Actinide (actinoid) Only thorium and uranium occur in usable quantities in nature. The other actinides are man-made elements. All actinides are radioactive. They share similar chemistry with the lanthanides (lanthanoids) The size of actinides decreases with increasing atomic number. ▸ 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
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
thorium oxide	Thorium oxide; (Thorium dioxide)	30 mg/m3	330 mg/m3	2,000 mg/m3
nitric acid	Nitric acid	Not Available	Not Available	Not Available

Ingredient	Original IDLH	Revised IDLH
thorium oxide	Not Available	Not Available
nitric acid	100 ppm	25 ppm
water	Not Available	Not Available

Exposure controls

Appropriate engineering controls	Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. 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: Process controls which involve changing the way a job activity or process is done to reduce the risk. 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. Employers may need to use multiple types of controls to prevent employee overexposure. ▸ Employees exposed to confirmed human carcinogens should be authorized to do so by the employer, and work in a regulated area. ▸ Work should be undertaken in an isolated system such as a "glove-box" . Employees should wash their hands and arms upon completion of the assigned task and before engaging in other activities not associated with the isolated system.

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	▸ Within regulated areas, the carcinogen should be stored in sealed containers, or enclosed in a closed system, including piping systems, with any sample ports or openings closed while the carcinogens are contained within. ▸ Open-vessel systems are prohibited. ▸ Each operation should be provided with continuous local exhaust ventilation so that air movement is always from ordinary work areas to the operation. ▸ Exhaust air should not be discharged to regulated areas, non-regulated areas or the external environment unless decontaminated. Clean make-up air should be introduced in sufficient volume to maintain correct operation of the local exhaust system. ▸ For maintenance and decontamination activities, authorized employees entering the area should be provided with and required to wear clean, impervious garments, including gloves, boots and continuous-air supplied hood. Prior to removing protective garments the employee should undergo decontamination and be required to shower upon removal of the garments and hood. ▸ Except for outdoor systems, regulated areas should be maintained under negative pressure (with respect to non-regulated areas). ▸ Local exhaust ventilation requires make-up air be supplied in equal volumes to replaced air. ▸ Laboratory hoods must be designed and maintained so as to draw air inward at an average linear face velocity of 0.76 m/sec with a minimum of 0.64 m/sec. Design and construction of the fume hood requires that insertion of any portion of the employees body, other than hands and arms, be disallowed. 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. 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	▸ Employees working with confirmed human carcinogens should be provided with, and be required to wear, clean, full body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), shoe covers and gloves prior to entering the regulated area. [AS/NZS ISO 6529:2006 or national equivalent] ▸ Employees engaged in handling operations involving carcinogens should be provided with, and required to wear and use half-face filter-type respirators with filters for dusts, mists and fumes, or air purifying canisters or cartridges. A respirator affording higher levels of protection may be substituted. [AS/NZS 1715 or national equivalent] ▸ Emergency deluge showers and eyewash fountains, supplied with potable water, should be located near, within sight of, and on the same level with locations where direct exposure is likely. ▸ Prior to each exit from an area containing confirmed human carcinogens, employees should be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers must be identified with suitable labels. For maintenance and decontamination activities, authorized employees entering the area should be provided with and required to wear clean, impervious garments, including gloves, boots and continuous-air supplied hood. ▸ Prior to removing protective garments the employee should undergo decontamination and be required to shower upon removal of the garments and hood. 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	colorless

Physical state	Liquid	**Relative density (Water = 1)**	Not Available
Odour	Not Available	**Partition coefficient n-octanol / water**	Not Available
Odour threshold	Not Available	**Auto-ignition temperature (°C)**	Not Available

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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
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. alpha-Radiation kills cells immediately adjacent to the source of contact. Damage may be irreversible. 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. 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. Acute toxicity of thorium is low through all routes.
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. alpha-Radiation produces severe inflammation of eyelid tissue and eye surface. There may be a delay of years before symptoms develop. 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	Substance accumulation, in the human body, is likely and may cause some concern following repeated or long-term occupational exposure. Long-term exposure to respiratory irritants may result in airways disease, involving difficulty breathing and related whole-body problems. There is sufficient evidence to suggest that this material directly causes cancer in humans. 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. Prolonged retention of thorium compounds in the body leads to long-term alpha-irradiation of the tissues. Symptoms only appear after a considerable length of exposure, and there are effects to the blood-forming, nervous and immune systems. The effects of exposure to internally deposited alpha-emitters largely depends on the dose and target organs. Sufficiently high doses may produce radiation sickness. 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.

10M59-1 Thorium (10,000µg/mL in 4% HNO3)	**TOXICITY**	**IRRITATION**
	Not Available	Not Available

Continued...

thorium oxide	

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*

THORIUM OXIDE	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. Tenth Annual Report on Carcinogens: Substance known to be Carcinogenic [*National Toxicology Program: U.S. Dep.* (liver tumours) Substance has been investigated as a tumorigen; Tumorigenic-carcinogenic in humans by RTECS criteria. Tumours, angiosarcoma, lymphoma recorded.
NITRIC ACID	Asthma-like symptoms may continue for months or even years after exposure to the material ends. 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]
WATER	No significant acute toxicological data identified in literature search.

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

10M59-1 Thorium (10,000µg/mL in 4% HNO3)	

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

thorium oxide	

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 with fish showed 96h-LC50 at about pH 3.5
DO NOT discharge into sewer or waterways.

Continued...

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
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

Continued...

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

THORIUM OXIDE(1314-20-1) IS FOUND ON THE FOLLOWING REGULATORY LISTS

US - California Proposition 65 - Carcinogens
US - Massachusetts - Right To Know Listed Chemicals
US - New Jersey Right to Know - Special Health Hazard Substance List (SHHSL): Carcinogens
US - Pennsylvania - Hazardous Substance List
US EPCRA Section 313 Chemical List
US National Toxicology Program (NTP) 14th Report Part A Known to be Human Carcinogens
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

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 - Alaska Limits for Air Contaminants
US - California OEHHA/ARB - Acute Reference Exposure Levels and Target Organs (RELs)
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 - Washington Toxic air pollutants and their ASIL, SQER and de minimis emission values
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants
US ACGIH Threshold Limit Values (TLV)
US CWA (Clean Water Act) - List of Hazardous Substances
US EPCRA Section 313 Chemical List
US NIOSH Recommended Exposure Limits (RELs)
US OSHA Permissible Exposure Levels (PELs) - Table Z1
US SARA Section 302 Extremely Hazardous Substances
US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory

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	Yes
Fire hazard	No
Pressure hazard	No
Reactivity hazard	No

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

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

Continued...

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

Thorium dioxide Listed

National Inventory	Status
Australia - AICS	Y
Canada - DSL	Y
Canada - NDSL	N (thorium oxide; water; nitric acid)
China - IECSC	N (thorium oxide)
Europe - EINEC / ELINCS / NLP	Y
Japan - ENCS	N (thorium oxide; water; nitric acid)
Korea - KECI	Y
New Zealand - NZIoC	N (thorium oxide)
Philippines - PICCS	N (thorium oxide)
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

Other information

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