THORIUM NITRATE

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
THORIUM NITRATE

OTHER NAMES
N4-O12-Th, Th(NO3)4.4H2O, "thorium (IV) nitrate", "nitric acid, thorium (4+) salt, pentahydrate", "H20. 4/5HNO3. 1/5Th", "nitric acid, thorium (4+) salt, tetrahydrate", "thorium (4+) nitrate", "thorium tetranitrate", "thorium (IV) nitrate tetrahydrate", "thorium (4+) nitrate tetrahydrate", "thorium nitrate tetrahydrate"

PROPER SHIPPING NAME
OXIDIZING SOLID, N.O.S.(contains thorium nitrate)

PRODUCT USE
■ This radioactive material may be supplied in a variety of package types and may exhibit a range of specific activities. This document is intended to describe one such material thought to be representative of a typical commercial product.
Reagent for determination of fluorine, for thoriated tungsten filaments and with 1% cerium nitrate constitutes the usual impregnating liquid for incandescent mantles.

SUPPLIER
Company: S D FINE- CHEM LIMITED
Address:
315- 317, T.V.Ind.Estate,
248, Worli Road,
Mumbai- 400030, India
www.sdfine.com
Telephone: 91- 22 24959898/99
Fax: 91- 22 2493 7232
Email: technical@sdfine.com

Section 2 - HAZARDS IDENTIFICATION

GHS Classification
Eye Irritation Category 2A
Oxidizing Solid Category 2

EMERGENCY OVERVIEW

HAZARD
DANGER

Determined by using GHS criteria

H272	May intensify fire; oxidiser.
H319	Causes serious eye irritation.

PRECAUTIONARY STATEMENTS
Prevention

continued...

Code	**Phrase**
P210	Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P220	Keep/Store away from clothing/ ... /combustible materials.
P221	Take any precaution to avoid mixing with combustibles.
P264	Wash ... thoroughly after handling.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
Response	
Code	**Phrase**
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P337+P313	If eye irritation persists: Get medical advice/attention.
Disposal	
Code	**Phrase**
P501	Dispose of contents/container to ...

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
thorium nitrate	13823-29-5	> 98

Section 4 - FIRST AID MEASURES

SWALLOWED
- 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.

EYE
- 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.

SKIN
■ 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.

INHALED
■ 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.

NOTES TO PHYSICIAN
■ The toxicity of nitrates and nitrites result from their vasodilating properties and their propensity to form methaemoglobin.
- Most produce a peak effect within 30 minutes.
- Clinical signs of cyanosis appear before other symptoms because of the dark pigmentation of methaemoglobin.

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• Initial attention should be directed towards improving oxygen delivery, with assisted ventilation, if necessary. Hyperbaric oxygen has not demonstrated conclusive benefits.
• Institute cardiac monitoring, especially in patients with coronary artery or pulmonary disease.
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.
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.
Toxic myocarditis may follow ingestion of oxidizing agents such as peroxides.

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 pulmonary oedema .

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA
■ FOR SMALL FIRE:
• USE FLOODING QUANTITIES OF WATER.
• DO NOT use dry chemical, CO_2, foam or halogenated-type extinguishers.
FOR LARGE FIRE
• Flood fire area with water from a protected position.

FIRE FIGHTING
• Use water delivered as a fine spray to control fire and cool adjacent area.
• Do not approach containers suspected to be hot.
• Cool fire exposed containers with water spray from a protected location.
• If safe to do so, remove containers from path of fire.

FIRE/EXPLOSION HAZARD
• Will not burn but increases intensity of fire.
• Heating may cause expansion or decomposition leading to violent rupture of containers.
• Heat affected containers remain hazardous.
• Contact with combustibles such as wood, paper, oil or finely divided metal may produce spontaneous combustion or violent decomposition.
Decomposition may produce toxic fumes of: nitrogen oxides (NOx), metal oxides.
• The material may provide sufficient oxygen to make the fire fierce and self sustaining.
• Smothering action may not be effective for established fire.
• Intense heat may cause spontaneous decomposition (detonation).
• Due to possibility of reignition, extinguished residues must be thoroughly cooled before approaching.

FIRE INCOMPATIBILITY
• Avoid storage with reducing agents.

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
■ Cleanup of small and large spills:
For spillages involving less than 20 times the "Annual Limit on Intake (ALI)" inhalation
• Wear rubber or plastic gloves
• 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)"

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• Treat all materials used in the decontamination process as radioactive waste
• Monitor all persons involved in the spillage or decontamination operation.

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.

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

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING
• Avoid personal contact and inhalation of dust, mist or vapours.
• Provide adequate ventilation.
• Always wear protective equipment and wash off any spillage from clothing.
• Keep material away from light, heat, flammables or combustibles.
• 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.

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.
For low viscosity materials
• Drums and jerricans must be of the non-removable head type.
• Where a can is to be used as an inner package, the can must have a screwed enclosure. <</>.
Type A packages (cartons, boxes, drums, articles, etc.), identified by marking on packages or by shipping papers, contain non-life-endangering amounts of radioactive substance. Partial release might be expected if packages are damaged in moderately severe accidents.<</>.

STORAGE INCOMPATIBILITY
■ for metal nitrates:
• Segregate from heavy metals, phosphides, sodium acetate, lead nitrate, tartrates, trichloroethylene,
• Avoid shock and heat.
• Mixtures of metal nitrates with alkyl esters may explode due to the formation of unstable alkyl nitrates.
• Mixtures of a nitrate with phosphorous, tin(II) chloride and other reducing agents may react explosively.
• Avoid storage with reducing agents.
• Keep storage area free of debris, waste and combustibles.
• Metals and their oxides or salts may react violently with chlorine trifluoride and bromine trifluoride.
• These trifluorides are hypergolic oxidisers. They ignites on contact (without external source of heat or ignition) with recognised fuels - contact with these materials, following an ambient or slightly elevated temperature, is often violent and may produce ignition.
• The state of subdivision may affect the results.

STORAGE REQUIREMENTS
• 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.

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Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS
The following materials had no OELs on our records
• thorium nitrate: CAS:13823- 29- 5 CAS:14767- 04- 5 CAS:13470- 07- 0

MATERIAL DATA
THORIUM NITRATE:
■ OCCUPATIONAL and PUBLIC DOSE LIMITS

Application	Dose Limit Occupational	Public
Effective Dose	20 mSv per year averaged over a period of five consecutive calendar years *	1 mSv in a year
Annual equivalent dose to - the lens of the eye - the skin - the hands and feet	150 mSv 500 mSv 500 mSv	15 mSv 50 mSv

.
Exposure Limits for radioactive materials are based upon their pulmonary clearance times. To describe the clearance of inhaled radioactive materials from the lungs, materials are classified as D, W, or Y which refers to their retention time in the pulmonary region.

D = less than 10 days; W = 10 - 100 days and Y = greater than 100 days.

For natural uranium (NAT U):

Annual Limits of Intake (ALI) (Inhalation): Class W 180 Bq

Class Y 4700 Bq

(Ingestion): No classes 59,200 Bq

[ICRP Pub. 6].
Radiation: Annual Limits on Intake (ALI) of radionuclides:
Radiation Workers - 20 milliSieverts (mSv) per year averaged over 5 years with a maximum of 50 mSV in any one year.
Members of Public - 1 mSv [ICRP Publication 60, 1990]
(10 mSv = 1 rem)
Recent debate(1) suggests that levels below 1 mSv a year can be harmful to humans as a result of cell damage that can only be detected after several divisions (radiation-induced genomic instability).
As the principal hazard of exposure to thorium compounds is radiological, concentration limits set for Th(232) and Th(228) should be observed. Exposure limits for radioactive materials are based upon their pulmonary clearance times.

D: less than 10 days; W: 10-100 days and for Y: greater than 100 days.

PERSONAL PROTECTION




RESPIRATOR
•Particulate. (AS/NZS 1716 & 1715, EN 143:2000 & 149:2001, ANSI Z88 or national equivalent)

EYE
• Most safety glasses will provide protection against alpha particles, some protection against beta particles (depending on thickness) but will not shield gamma radiation.

HANDS/FEET
■ The selection of the suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.

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The exact break through time for substances has to be obtained from the manufacturer of the protective gloves and has to be observed when making a final choice.
Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include:.
Disposable gloves. Most gloves will provide protection against alpha particles, some protection against beta particles (depending on thickness) but will not shield gamma radiation.
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.

OTHER
■ 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.<</>.

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.
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.
• For ALPHA PARTICLES fraction of a millimetre of any ordinary material will generally be sufficient to attenuate the energy of the particle.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE
Colourless or white deliquescent radioactive crystals.

PHYSICAL PROPERTIES
Solid.
Mixes with water.

State	Divided solid	Molecular Weight	480.06 (anhydr)
Melting Range (°C)	500 (dec) .4H2O	Viscosity	Not Applicable
Boiling Range (°C)	Not available.	Solubility in water (g/L)	Miscible
Flash Point (°C)	Not applicable	pH (1% solution)	2.0 - 6.0 (5 %)
Decomposition Temp (°C)	Not Available	pH (as supplied)	Not applicable
Autoignition Temp (°C)	Not available.	Vapour Pressure (kPa)	Negligible
Upper Explosive Limit (%)	Not available.	Specific Gravity (water=1)	> 1 @ 20C (est)
Lower Explosive Limit (%)	Not available.	Relative Vapour Density (air=1)	Not applicable
Volatile Component (%vol)	Negligible	Evaporation Rate	Not applicable

Section 10 - CHEMICAL STABILITY AND REACTIVITY INFORMATION

CONDITIONS CONTRIBUTING TO INSTABILITY
• Presence of incompatible materials.
• Product is considered stable.
• Hazardous polymerisation will not occur.
For incompatible materials - refer to Section 7 - Handling and Storage.

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Section 11 - TOXICOLOGICAL INFORMATION

Health hazard summary table:

Acute toxicity	Not applicable
Skin corrosion/irritation	Not applicable
Serious eye damage/irritation	Eye Irrit. 2A
Respiratory or skin sensitization	Not applicable
Germ cell mutagenicity	Not applicable
Carcinogenicity	Not applicable
Reproductive toxicity	Not applicable
STOT- single exposure	Not applicable
STOT- repeated exposure	Not applicable
Aspiration hazard	Not applicable

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED
■ Accidental ingestion of the material may be damaging to the health of the individual.
■ Acute toxicity of thorium is low through all routes.
■ The substance and/or its metabolites may bind to haemoglobin inhibiting normal uptake of oxygen.
This condition, known as "methaemoglobinemia", is a form of oxygen starvation (anoxia).

EYE
■ This material can cause eye irritation and damage in some persons.
■ alpha-Radiation produces severe inflammation of eyelid tissue and eye surface.
There may be a delay of years before symptoms develop.
■ The eye is particularly sensitive to radioactivity.
A single dose of 1 Gy can cause inflammation of the conjunctiva and cornea.

SKIN
■ Skin contact with the material may damage the health of the individual; systemic effects may result following absorption.
■ There is some evidence to suggest that this material can cause inflammation of the skin on contact in some persons.
■ 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.
■ 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.

INHALED
■ Inhalation of dusts, generated by the material during the course of normal handling, may be damaging to the health of the individual.
■ There is some evidence to suggest that the material can cause respiratory irritation in some persons.
The body's response to such irritation can cause further lung damage.
■ 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.
■ alpha-Radiation kills cells immediately adjacent to the source of contact.
Damage may be irreversible.

CHRONIC HEALTH EFFECTS
■ There has been concern that this material can cause cancer or mutations, but there is not enough data to make an assessment.
Substance accumulation, in the human body, may occur and may cause some concern following repeated or long-term occupational exposure.
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 bones and the lung may be damaged. Thorium may cause cancer of the liver, throat, bronchi and kidney.
The effects of exposure to internally deposited alpha-emitters largely depends on the dose and target organs. Sufficiently high doses may produce radiation sickness. Possible disorders may include lung cancer, problems of sterility, anaemia, leukaemia or bone-cancer. Leukaemia and cataracts have been observed at doses lower than those which produce skin scarring and cancer or bone tumours. The lens of the eye should be considered as critical.
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. Many and varied genetic changes can occur; if they affect cells of the reproductive system, they may only display themselves after being inherited.
Long term exposure to high dust concentrations may cause changes in lung function i.e. pneumoconiosis; caused by particles less

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than 0.5 micron penetrating and remaining in the lung. Prime symptom is breathlessness; lung shadows show on X-ray.

TOXICITY AND IRRITATION
■ 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.
No significant acute toxicological data identified in literature search.

Section 12 - ECOLOGICAL INFORMATION

This material and its container must be disposed of as hazardous waste.

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
thorium nitrate	No Data Available	No Data Available	No Data Available	No Data Available

Section 13 - DISPOSAL CONSIDERATIONS

• 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 MSDS and observe all notices pertaining to the product.
Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area.
A Hierarchy of Controls seems to be common - the user should investigate:
• Reduction.
• DO NOT allow wash water from cleaning or process equipment to enter drains.
• It may be necessary to collect all wash water for treatment before disposal.
• In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.
• Where in doubt contact the responsible authority.
• WARNING Radioactive materials must not be disposed of as Industrial Waste or domestic garbage. Consult supplier/ appropriate Radiation Control Authority for disposal procedures.
For small quantities of oxidising agent:
• Cautiously acidify a 3% solution to pH 2 with sulfuric acid.
• Gradually add a 50% excess of sodium bisulfite solution with stirring.
• Add a further 10% sodium bisulfite.
• If no further reaction occurs (as indicated by a rise in temperature) cautiously add more acid.

Section 14 - TRANSPORTATION INFORMATION

Labels Required: OXIDIZING AGENT

HAZCHEM:
1Y

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Land Transport UNDG:

Class or division:	5.1	Subsidiary risk:	None
UN No.:	1479	UN packing group:	II

Shipping Name:OXIDIZING SOLID, N.O.S. (contains thorium nitrate)

Air Transport IATA:

ICAO/IATA Class:	5.1	ICAO/IATA Subrisk:	None
UN/ID Number:	1479	Packing Group:	II
Special provisions:	A3		

Shipping name:OXIDIZING SOLID, N.O.S.(contains thorium nitrate)

Maritime Transport IMDG:

IMDG Class:	5.1	IMDG Subrisk:	None
UN Number:	1479	Packing Group:	II
EMS Number:	F- A, S- Q	Special provisions:	274 900
Limited Quantities:	1 kg		

Shipping name:OXIDIZING SOLID, N.O.S.(contains thorium nitrate)

Section 15 - REGULATORY INFORMATION

REGULATIONS

thorium nitrate (CAS: 13823-29-5,14767-04-5,13470-07-0) is found on the following regulatory lists;
"India Hazardous Wastes (Management, Handling and Transboundary Movement) Rules - Schedule 2: List of Wastes Constituents with Concentration Limits","Sigma-AldrichTransport Information"

Section 16 - OTHER INFORMATION

INGREDIENTS WITH MULTIPLE CAS NUMBERS

Ingredient Name	CAS
thorium nitrate	13823- 29- 5, 14767- 04- 5, 13470- 07- 0

■ Classification of the preparation and its individual components has drawn on official and authoritative sources using available literature references.

■ The (M)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.

The above information is believed to be accurate and represent the best information currently available to us, but does not represent any warranty expressed or implied of the properties of the product. User should make their own investigation to determine the suitability of the information for their particular purpose.

Issue Date: 20-Apr-2018