SAFETY DATA SHEET
MONAZITE SAND ORE MATERIALS

SECTION 1: CHEMICAL PRODUCTS & COMPANY IDENTIFICATION

New Brunswick Laboratory
U. S. Department of Energy
9800 South Cass Avenue
Argonne, IL 60439
1-630-252-CRMS

Emergency Phone Numbers: 1-630-252-6130 or 630-252-5731

Chemical Name: Monazite Sand/Powdered Monazite Sand

Other Identifiers: CRM 7-A, 82Th1448

Use and Restriction: This material is prepared for use as a standard or in inter-laboratory comparison programs at analytic laboratories, which routinely handle uranium. New Brunswick Laboratory (NBL) expects that recipients of this material are in compliance with 29 CFR 1910.1200(h) which requires employers to provide employees with effective information and training on hazardous chemicals in their work area.

SECTION 2: HAZARDS IDENTIFICATION

Classifications/Hazards:

OSHA HAZARDS: Highly toxic by inhalation. Highly toxic by ingestion.

TARGET ORGANS: Kidney, liver, lungs, brain.

GHS Classification:

Acute toxicity, Oral (Category 3)
Acute toxicity, Inhalation (Category 3)
Acute toxicity, Dermal (Category 3)
Target organ toxicity repeated (Category 2)
Carcinogenicity (Category 1B)

Specific target organ toxicity – repeated exposure (Category 2)

GHS Label elements, including precautionary statements

Pictogram:

Signal Word: Danger

Hazard statements(s)

Fatal if swallowed or inhaled
May cause cancer
May cause damage to organs through prolonged or repeated exposure
Causes skin irritation

Precautionary statements (s)

Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Do not breath dust/fume/gas/mist/vapors/spray
Wash skin thoroughly after handling
Do not eat, drink, smoke when using this product

Other hazards
Radioactive

NFPA Rating (SCALE 0-4)

Health Hazard:	3
Fire:	2
Reactivity:	1

CERLA Rating (SCALE 0-3)

Health:	3
Fire:	2
Reactivity:	1
Persistence:	3

EMERGENCY OVERVIEW: Odorless, tasteless, and transparent to white hexagonal crystals or amorphous powder.

Cancer hazard (may cause lung cancer in humans if inhaled). Risk of cancer depends on duration and level of exposure. May damage the lungs. May be irritating to skin and eyes. May affect the heart. May cause blood disorders. May cause convulsions. May affect the central nervous system. May cause adverse reproductive effects. May cause eye damage. Do not breathe dust. Do not get in eyes, on skin, or on clothing. Keep container tightly closed. Wash thoroughly after handling. Use only with adequate ventilation. Handle with caution.

POTENTIAL HEALTH EFFECTS:

INHALATION:
Short Term Exposure: May cause coughing. No information available on significant adverse effects.

Long Term Effects: May cause coughing, weight loss, bloody sputum, difficulty in breathing, weakness, bluish skin color, lung damage and heart disorders. May also cause anemia, cataracts and cancer.

SKIN CONTACT:
Short Term Exposure: May cause irritation.

Long Term Effects: No information is available.

EYE CONTACT:
Short Term Exposure: May cause irritation, redness and swelling of the eyes and eye damage.

Long Term Effects: Same as short-term exposure with increased risk of eye damage due to scratching of corneas and radiation induced cataracts.

INGESTION:
Short Term Exposure: No information available on significant adverse effects.

Long Term Effects: No information is available.

CARCINOGEN STATUS:

OSHA: N

NTP: Y
IARC: Y

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Family: Cerium phosphate mineral sand and powdered cerium phosphate mineral sand. Ce(Ce, La, Pr, Nd, Th, Y)PO4

CAS #: 1306-41-8

Material	Component	CAS Number	Percent
Monazite	**Ce(Ce, La, Pr, Nd, Th, Y)PO4**	**1306-41-8**	**100**
Major Constituents:			
	Cerium Phosphate (CePO4)	13454-71-2	45-48%
	Lanthanum Phosphate (LaPO4)	14913-14-5	20-28%
	Praseodymium Phosphate (PrPO4)	14298-31-8	4-6%
	Neodymium Phosphate (NdPO4)	14298-32-9	13-21%
	Thorium Phosphate (Th3(PO4)4)	14485-31-5	0-20%
	Yttrium Phosphate (YPO4)	13990-54-0	0-10%
	Uranium Phosphate (UPO4)	18433-48-2	0-2%
Possible Contaminants:			
	Quartz (SiO2)	14808-60-7	<1%

SECTION 4: FIRST AID MEASURES

INHALATION: Remove from exposure area to fresh air immediately. If breathing has stopped, perform artificial respiration. Keep person warm and at rest. Treat symptomatically and supportively. Get medical attention immediately. Any evidence of contamination indicates that treatment must be instituted. (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. Get medical attention immediately. The victim may be contaminated with radioactive particles. Thorough decontamination should be started before the victim is moved to the medical area. Any personnel involved in rendering first aid must be monitored for radioactivity and thoroughly decontaminated if necessary.

SKIN CONTACT: Remove victim to a suitable area for decontamination as quickly as possible. Remove clothing and shoes immediately. Thoroughly wash the victim with soap and water, paying particular attention to the head, fingernails and palms of the hands. Upon completion of washing, monitor the victim for radioactivity. It is imperative that the skin should be decontaminated as quickly as possible. Minute skin injuries greatly increase the danger of isotope penetration into the victim; shaving should not be attempted. If water and soap have been inadequate in removing the radioactive material, decontamination 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.

EYE CONTACT: Wash eyes immediately with large amounts of water or normal saline, occasionally lifting upper and lower lids, until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention immediately. Monitor the victim for radioactivity. If activity is present, rewash the eyes, and remonitor until little or no radioactivity is present. Get medical attention immediately. 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.

INGESTION: In the case of ingestion of radioactive substances, the mouth should be rinsed out immediately after the accident. Care should be 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. Lavage may be useful. Care should be taken to avoid aspiration. The vomitus and lavage fluids should be saved for examination and monitoring. Further action depends on the nature of the radioactive substance. Get medical attention immediately. The gastric fluids and fluids used for lavage must be stored in metal containers for later disposal. 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.

NOTE TO PHYSICIAN: Treat symptomatically and supportively.

SECTION 5: FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARD: Negligible fire hazard when exposed to heat or flame.

EXTINGUISHING MEDIA: Dry chemical, carbon dioxide, water spray or regular foam (See the most recent *Emergency Response Guidebook* (ERG), developed jointly by Transport Canada (TC), the U. S. Department of Transportation (DOT) and the Secretariat of Transportation and Communications of Mexico (SCT).)

For Larger Fires, use water spray or fog (flooding amounts) (*Emergency Response Guidebook*).

FIREFIGHTING: Do not move damaged containers; move undamaged containers out of fire zone. (*Emergency Response Guidebook*).

Contact the local, State, or Department of Energy radiological response team. Use suitable agent for surrounding fire. Cool containers with flooding amounts of water, apply from as far a distance as possible. Avoid breathing dusts or vapors, keep upwind. Keep unnecessary people out of area until declared safe by radiological response team.

HAZARDOUS COMBUSTION PRODUCTS: Thermal decomposition may release toxic and/or hazardous gases.

SECTION 6: ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL SPILL: Do not touch damaged containers or spilled material. For large spills, dike far ahead of spill for later disposal. For dry spills, cover with plastic sheet of tarp to minimize spreading. Keep unnecessary people at least 150 feet upwind of spill. Isolate hazard area and deny entry. Limit entry to shortest time possible. Clean up should be performed only by qualified radiation worker(s).

WATER SPILL: Contaminating any known source of drinking water with substances known to cause cancer and/or reproductive toxicity is prohibited by the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).

SECTION 7: HANDLING AND STORAGE

Observe all Federal, State, and local regulations when storing this substance.

Store in accordance with 10 CFR 20.

Store in a designated radioactive materials area.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

EXPOSURE LIMITS:

NUISANCE DUST
5.0 mg/m^3 OSHA TWA (total respirable dust as a nuisance dust)

QUARTZ/CRYSTALLINE SILICA
$10mg/m^3$ / $\%SiO_2$ + 2	mg/m^3 OSHA TWA (respirable dust)
0.02	mg/m^3 ACGIH TWA (respirable dust)
0.05	mg/m^3 NIOSH recommended TWA (respirable dust)

YTTRIUM
1 mg/m^3	OSHA/PEL
1 mg/m^3	ACGIH/TLV

URANIUM

Uranium in urine = 200 ug/L at end of shift	ACGIH BIOLOGICAL EXPOSURE INDEX
0.2 mg/m3, as U	TLV ACGIH
0.6 mg/m3, as U	STEL ACGIH
0.05 mg/m3, as U (sol), 0.25 mg/m3, as U (insol)	PEL OSHA
10 mg/m3, as U	IDLH NIOSH

Subject to California Proposition 65 cancer and/or reproductive toxicity warning and release requirements - (October 1, 1988)

EXPOSURE LIMITS:

THORIUM PHOSPHATE:
At the time of revision, there are no occupational exposure limits established by OSHA, ACGIH, or NIOSH for thorium phosphate.

Subject to SARA Section 313 Annual Toxic Chemical Release Reporting Subject to California Proposition 65 cancer and/or reproductive toxicity warning and release requirements - (February 27, 1987)

VENTILATION: At a minimum, provide local exhaust or process enclosure ventilation. Depending upon the specific workplace activity, a more stringent ventilation system may be necessary to comply with OSHA exposure limits and those set forth in 10 CFR 20.103.

One method of controlling external radiation exposure is to provide adequate shielding.

ALPHA PARTICLES: The typical alpha particles emitted by thorium and uranium are easily shielded by a fraction of a millimeter of any ordinary material or a few inches of air. Thick paper, plastic, or cardboard will suffice.

BETA PARTICLES: Beta particles are more penetrating than alpha, and require additional shielding. These certified reference materials do not emit significant amounts of beta radiation.

GAMMA RAYS: Gamma rays are highly penetrating and are most easily shielded by heavier elements (high z number). These certified reference materials, in the quantities used for laboratory work, do not emit significant amounts of gamma radiation. If large (kg) quantities of this material are to be stored or used, consult a radiation protection specialist or health physicist to determine if shielding is required.

EYE PROTECTION: Employee must wear eye protection to prevent eye contact with this substance. Contact lenses should not be worn.

Emergency eyewash: If there is any possibility that an employee's eyes may be exposed to this substance, the employer must provide an eye wash station within the immediate area for emergency use.

CLOTHING: Employee must wear impervious clothing to prevent repeated or prolonged skin contact with this substance.

GLOVES: Employee must wear appropriate protective gloves to prevent contact with this substance. Used gloves that may have contacted this substance should be disposed of as radioactive waste.

RESPIRATOR: The following respirators and maximum use concentrations are recommendations by the U.S. Department of Health Services, NIOSH Pocket Guide to Chemical Hazards; or by the U.S. Department of Labor, 29 CFR 1910 Subpart Z.

The specific respirator selected must be based on contamination levels found in the work place. Airborne contamination levels must not exceed the working limits of the respirator. Respirators must be jointly approved by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration (NIOSH-MSHA).

SILICA (CRYSTALLINE): At any detectable concentration: Any self-contained breathing apparatus with full facepiece, operated in a pressure-demand or other positive pressure mode.

Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.

Escape - Any air-purifying full facepiece respirator with a high-efficiency particulate filter. Any appropriate escape-type self-contained breathing apparatus.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

SILICON DIOXIDE
DESCRIPTION: Odorless, tasteless, and transparent to white hexagonal crystals or amorphous powder.
Molecular weight: 60.09
Molecular formula: SiO_2
Boiling point: 4046°F (2230°C)
Melting point: 2930°F (1610°C)
Vapor Pressure: 0 mmHg @ 20°C
Specific Gravity: 2.635-2.660
Water Solubility: insoluble
Solvent Solubility: Soluble in hydrofluoric acid; very slightly soluble in alkalis and hot concentrated phosphoric acid; insoluble in most acids and organic solvents.

THORIUM PHOSPHATE
DESCRIPTION: White, heavy, infusible, crystal, cubes or powder.
Molecular weight: 264.04
Molecular formula: Th3(P04)4
Boiling point: 7952°F (4400°C)
Melting point: 5738-5918°F (3170-3270°C)

Specific Gravity: 9.86
Water Solubility: insoluble
Solvent Solubility: Soluble in hot sulfuric acid; insoluble in alkalies and dilute acids.

SECTION 10: STABILITY AND REACTIVITY

REACTIVITY: Stable under normal temperatures and pressures.

CONDITIONS TO AVOID: Prevent dispersion of dust in air. Thorium dioxide may burn but does not ignite readily.

INCOMPATIBILITIES:
QUARTZ:
Alkalies (Strong): May be attacked.
Chlorine Trifluoride: Possible explosion.
Hydrochloric Acid: May be attacked with exothermic reaction.
Manganese Trifluoride: Violent reaction.
Metals: May produce violent explosion.
Oxidizers (Strong): Fire and explosion hazard.
Oxygen Trifluoride: Possible explosive reaction.
Ozone: Possible explosive reaction in presence of organic materials.
Vinyl Acetate: Vigorous reaction
Xenon Hexafluoride: Possible detonation.

No data available for incompatibilities of Thorium Phosphate.

HAZARDOUS DECOMPOSITION:
Thermal decomposition may release toxic and/or hazardous gases.

POLYMERIZATION:
Hazardous polymerization has not been reported to occur under normal temperature and pressure.

SECTION 11: TOXICOLOGY INFORMATION

QUARTZ:
TOXICITY DATA: 565 million particles/m^3/8 hours/17.9 years intermittent inhalation-human TCLo; 300 $\mu g/m^3$/10 years intermittent inhalation-human LCLo; 90 mg/kg intravenous-rat LDLo; 40 mg/kg intravenous-mouse LDLo; 20 mg/kg intravenous-dog LDLo; 200 mg/kg intratracheal-rat LDLo; tumorigenic data (RTECS).

CARCINOGEN STATUS: Anticipated Human Carcinogen (NTP); Human Limited Evidence Animal Sufficient Evidence (IARC Group-2A). Adenocarcinomas and squamous-cell carcinomas of the lung in rats resulted after inhalation or repeated intratracheal instillation of various forms of crystalline silica. Malignant lymphomas developed in rats after intrapleural and intraperitoneal injections of quartz suspensions and intrapleural injection of cristobalite and tridymite. Lung cancer occurs more frequently among silicotics than in the general population.

ACUTE TOXICITY LEVEL: Insufficient data.

TARGET EFFECTS: Poisoning may affect the lungs.

AT INCREASED RISK FOR EXPOSURE: Persons with decreased pulmonary function.

ADDITIONAL DATA: Cigarette smoking increases the toxic effects by decreasing pulmonary function.

THORIUM PHOSPHATE:
TOXICITY DATA: Tumorigenic data (RTECS).

CARCINOGEN STATUS: Known Human Carcinogen (NTP). Intravascular injection in humans produced tumors of the liver, including hepatocellular carcinomas, cholangiocellular carcinomas, carcinomas of the extra-hepatic biliary system, sarcomas, hemangioendotheliomas, reticulum cell sarcomas, carcinomas of the common hepatic duct, adenocarcinomas, liver cell carcinomas, undifferentiated carcinomas, hepatomas, tumors of the kidney, including carcinomas of the renal parenchyma, and sarcomas and carcinomas of the renal pelvis. In addition, carcinomas of the maxillary sinuses. spindle cell sarcomas in the later cervical region, leukemias, and other hematologic disorders have been related to intravascular injection of thorium dioxide. Studies suggest a latency of 21-36 years. A variety of carcinomas have been induced in animals following intravenous, subcutaneous, and submucosal administration.

ACUTE TOXICITY LEVEL: No data available.
TARGET EFFECTS: Radioactive

HEALTH EFFECTS
INHALATION
QUARTZ:
CARCINOGEN.

ACUTE EXPOSURE: Exposure to high concentrations may cause physical discomfort of the upper respiratory tract.

CHRONIC EXPOSURE: Inhalation of very high concentrations of finely divided crystalline silica dust, exposure ranging from a few weeks to 4-5 years, may cause a rapidly developing silicosis, characterized by pulmonary insufficiency with severe dyspnea, violent coughing, tachypnea, weight loss, and cyanosis leading to the development of cor pulmonale and death within a relatively short period of time. A slowly developing silicosis may result from exposure for 6 months-30 years to relatively low levels of the dust. The first symptom is usually a slowly increasing, non-disabling, exertional dyspnea due to pulmonary fibrosis and the emphysema associated with it. Continued exposure may increase the rate of progression of the disease. Also, the fibrogenic action may continue when exposure ceases. As the fibrosis advances, other symptoms may include shortness of breath, productive cough, wheezing, chest tightness or pain, marked weakness, decreased capacity for work, and repeated non-specific chest illnesses. Cyanosis, clubbing of digits, orthopnea, or serious weight loss is not usually evident until the disease is advanced. Pulmonary infections, which may be indicated by hemoptysis, and cardiac decompensation may exacerbate the symptoms. Three major complications, which are the most frequent causes of death, are pulmonary tuberculosis, respiratory insufficiency that is due to the massive emphysematous and fibrotic changes and is sometimes accompanied by chronic cor pulmonale, and acute bronchopulmonary infection. A number of studies have shown that persons diagnosed as having silicosis have an increased risk for dying from lung cancer. This increase has been seen among miners, quarry workers, foundry workers, ceramic workers, granite workers, and stone cutters. In some of these studies, the risk of lung cancer increased with the duration of employment. Various forms and preparations of crystalline silica produced adenocarcinomas and squamous cell carcinomas of the lungs in rats.

THORIUM PHOSPHATE:
RADIOACTIVE.
Animal exposure to 11-76 mg/m^3 of thorium compounds for 2-10 weeks resulted in blood abnormalities. Inhalation of dusts of radioactive particles may result in permanent deposits in the lungs and pulmonary lymph nodes.

ALPHA RADIATION
ACUTE EXPOSURE - Alpha radiation is densely ionizing with very high energy. Cells immediately adjacent to the source of radiation may be killed or damaged. Damaged cells may not recover or be repaired. Thorium dioxide is biologically insoluble. Insoluble compounds may remain at or near the site of deposition as opposed to soluble compounds that may rapidly enter the bloodstream. Heavier particles will be brought up to the throat by ciliary action, and may then be swallowed. The lighter particles, typically less than 10 microns in diameter, may enter the gas exchange region of the lungs. These small particles are what are commonly referred to as the respirable particulate mass. The damage depends on how quickly they are eliminated, and the susceptibility of the tissue in which they are stored.

CHRONIC EXPOSURE - The effects of chronic exposure by internally deposited alpha radiation is dependent upon the dose and target organ(s). Possible disorders include lung cancer, anemia, leukemia, or bone cancer.

SKIN CONTACT:
QUARTZ:

ACUTE EXPOSURE - May cause irritation of intact skin via mechanical action. Skin abrasions may cause scarring.

CHRONIC EXPOSURE - No data available.

THORIUM PHOSPHATE:
RADIOACTIVE. See information on alpha radiation.

ALPHA RADIATION:
ACUTE EXPOSURE - Alpha radiation is not usually an external hazard as the large, highly charged particles are not very penetrating. However, absorption or penetration through damaged skin may result in internal damage or deposition of radioactive materials.

CHRONIC EXPOSURE - Prolonged or repeated uptake my result in increased cancer risks.

EYE CONTACT
QUARTZ:

ACUTE EXPOSURE - May cause irritation via mechanical action. Particles of silica in the range of 2-3 micrometers introduced into the corneal stroma of rabbit eyes caused very little reaction. These same particles introduced into the anterior chamber resulted in an inflammatory reaction in 3-5 weeks with the formation of fibrotic nodules in the iridocorneal angle. Finely divided silica injected into the vitreous of rabbit eyes has caused necrosis of the retina and atrophy of the choroid.

CHRONIC EXPOSURE - An abnormally high silicon content in the cornea, and a gradual decrease in visual acuity due to corneal opacities in the pupillary area, have been reported in a group of foundry workers who developed pulmonary silicosis.

THORIUM PHOSPHATE:
RADIOACTIVE. See information on alpha radiation.

ALPHA RADIATION:
ACUTE EXPOSURE - Radiation affects the eye by inducing acute inflammation of the conjunctiva and the cornea. The most sensitive part of the eye is the lens. An effect of eye irradiation is cataract formation. Cataracts may begin to develop anywhere from 6 months

to several years after a single, large exposure or after prolonged exposure. The rate of growth and the degree of opacity are dependent upon the dose of radiation. The silicon content of these certified reference materials is expected to preclude any long-term eye contact via irritation.

CHRONIC EXPOSURE - Repeated or prolonged exposure to alpha radiation may result in cataract formation, as described above. Of the well-documented late effects of radiation on man, leukemia and cataracts have been observed at doses lower than those producing skin scarring and cancer or bone tumors. The lens of the eye is considered to be a critical organ for exposure to radiation. It is important to note that long-term eye contact with these certified reference materials would most likely result in serious damage to the cornea long before cataracts would be formed.

INGESTION:
QUARTZ:

ACUTE EXPOSURE - Effects of ingestion are due to mechanical action. Crystalline silicas are biologically inert.

CHRONIC EXPOSURE: No data available.

THORIUM PHOSPHATE:
RADIOACTIVE. See information on alpha radiation.

ALPHA RADIATION:
ACUTE EXPOSURE - The fate of ingested alpha emitters depends on their solubility and valence. Thorium dioxide is not soluble and the primary dose received would be to the lining of the gut.

CHRONIC EXPOSURE - Repeated ingestion of alpha emitters may lead to increased cancer risk.

RARE EARTH METALS:

Toxicology Studies Animals: The rare earth metals (i.e. Yttrium, Cerium, Lanthanum, Praseodymium, Neoddymium, etc.) are moderately to highly toxic. The symptoms of toxicity of the rare earth elements in animals include: writhing, ataxia, labored respirations, walking on toes with arched back and sedation. There is a delayed lethality with death peaking between 48 and 96 hours. A sex difference with males being less susceptible than females is seen. If animals survive for 30 days these is generalized peritonitis, adhesions, and hemorrhagic ascetic fluid and true granulomatous peritonitis and focal hepatic necrosis. Chelating agents such as EDTA obscure the lethal effects of rare earths by either decreasing their rate of release or by increasing their lethality by exchanging with other elements such

as calcium. The effects of atomic weight on lethality is difficult to assess, but the transition elements (terbium group) appear to have a lesser toxicity than those above or below them in the periodic table. The rare earth metals exhibit low toxicity via oral exposure. However, the intra-peritoneal route is highly toxic while the subcutaneous route has high to moderate toxicity. The production of skin and lung granulomas after exposure to them requires extensive protection to prevent such exposure. Toxicity from exposure to rare earth radionuclide is related to absorbed radiation dose.

Toxicology Studies Humans: The characteristic oxidation state of rare earth elements is 3+. Europium oxidizes readily, but the other rare earth elements react with oxygen in air at room temperature slowly. All of the rare earth metals ignite in air at elevated temperatures. Since the rare earth metals have high radiodensity, some of pneumoconioses reported are thought to be benign pneumoconioses. Cases were reported among workers exposed to cerium oxide and other lanthanoid metals in the glass manufacturing, lens polishing, and photoengraving industries. Findings have included small nodular lung opacities by chest x-ray, restrictive and obstructive defects by spirometry, and respiratory tract symptoms. Unfortunately, there is very little histopathology data on these cases. The 14 lanthanide elements are associated with "rare earth pneumoconiosis," a condition most commonly reported among workers who were exposed to the fume from carbon arc lamps, and also reported in lens polishers and workers manufacturing cerium oxide polishing powder. The carbon arc lamp uses blends of lanthanide minerals as a metal core to stabilize the arc. With use of the carbon arc lamp, the carbon rod and metal core are eventually vaporized to form respirable fume and dust. Carbon arc lamps are used in movie projection, lithography, photoengraving, and floodlights. Respiratory symptoms in exposed workers were first reported in the 1930s. It is debated whether or not the stable lanthanides can cause pneumoconiosis. Some scientists believe that the lung disease is caused by radioactive contaminants such as thorium-238 and cerium-44. Recent animal studies support the view that the stable lanthanide elements can cause granulomatous and fibrotic lesions in the lungs.

SECTION 12: ECOLOGICAL INFORMATION

Environmental Impact Rating (0-4): No data available

Acute Aquatic Toxicity: No data available

Degradability: No data available

Log Bioconcentration Factor (BCF): No data available

Log Octanol/water partition coefficient: No data available

SECTION 13: DISPOSAL INFORMATION

Observe all Federal, State and local Regulations when disposing of this substance.

SECTION 14: TRANSPORTATION INFORMATION

The U.S. Department of Transportation (D.O.T.) Code of Federal Regulations (49 CFR Parts 100-185), the International Air Transportation Association (IATA), International Civil Aviation Organization (ICAO) and International Maritime Organization (IMDG) are all factored into the classification and transport of material.

Proper Shipping Name:
Hazard Class:
UN/ID Number:
Special Information:
Packing Group:

} To be determined on a case by case basis.

Classification of substances with multiple hazards must be determined in accordance with the criteria presented in the above mentioned regulations. Due to the various quantities/combinations of materials being shipped at one time, the information above must be determined based on the characteristics of the specific shipment.

SECTION 15: REGULATORY INFORMATION

TSCA STATUS: Y

CERCLA SECTION 103 (40 CFR 302.4):	N
SARA SECTION 302 (40 CFR 355.30):	N
SARA SECTION 304 (40 CFR 355.40):	N
SARA SECTION 313 (40 CFR 372.65):	Y
OSHA PROCESS SAFETY (29 CFR 1910.119):	N
CALIFORNIA PROPOSITION 65:	Y

SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40 CFR 370.21)

ACUTE HAZARD:	Y
CHRONIC HAZARD:	Y
FIRE HAZARD:	N

REACTIVITY HAZARD: N
SUDDEN RELEASE HAZARD: N

SECTION 16: OTHER INFORMATION

This material is prepared for use as a standard or in inter-laboratory comparison programs at analytical laboratories, which routinely handle thorium, uranium and/or plutonium. The material 82Th1448 is a stock of ore material stored at NBL but has not been prepared for any specific use. The New Brunswick Laboratory (NBL) assumes that recipients of this material have developed internal safety procedures, which guard against accidental exposure to radioactive and toxic materials, contamination of the laboratory environment, or criticality. NBL further expects that personnel who handle radioactive materials have been thoroughly trained in the safety procedures developed by and for their Laboratory.

The information and recommendations set forth herein are presented in good faith and believed to be correct as of the revision date. However, recipients of this material should use this information only as a supplement to other information gathered by them, and should make independent judgment of the suitability and accuracy of this information. This statement is not intended to provide comprehensive instruction in developing an appropriate safety program and does not include all regulatory guidelines.

This information is furnished without warranty, and any use of the product not in conformance with this Safety Data Sheet, or in combination with any other product or process, is the responsibility of the user.

Creation Date: July 29, 2011 Revision Date: October 8, 2014