NBL Program Office
U. S. Department of Energy

SAFETY DATA SHEET

URANIUM OXIDE
(U_3O_8)

SECTION 1: CHEMICAL PRODUCTS & COMPANY IDENTIFICATION

NBL Program Office
U. S. Department of Energy,
1 Science.gov Way,
Oak Ridge, TN 37830
1-240-780-6842

Emergency Phone Numbers: 1-240-780-6842

Chemical Name: Uranium oxide (U_3O_8), 100%.

Other Identifiers: Certified Reference Material (CRM) standard or Safeguards Measurement Evaluation (SME) sample.

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

SECTION 2: HAZARDS IDENTIFICATION

OSHA Hazards
Toxic by inhalation, toxic by ingestion.

Target Organs
Kidney, Liver, Lungs, Brain.

GHS Label Elements

Pictogram 

Signal Words: Danger

Hazard Statements:	Toxic by inhalation and ingestion Danger of cumulative effects May damage kidneys
Precautionary Statements:	Avoid Breathing Dust Avoid contact with skin, eyes and clothing When using do not eat, drink or smoke In case of accident or if you feel unwell seek medical advice immediately Use only with adequate ventilation .

GHS Classification
Skin Irritation (Category 2)
Eye Irritation (Category 2)
Specific target organ toxicity - repeated exposure (Category 2) Specific target organ toxicity – acute exposure (Category 2)

GHS Hazard Ratings
R23/25: Toxic by inhalation and ingestion
R33: Danger of cumulative effects
S20/21 When using do not eat, drink or smoke
S45: In case of accident or if you feel unwell seek medical advice immediately S61: Avoid release to the environment.

Other Hazards:

Radioactive 

CERCLA Ratings (SCALE 0-3): HEALTH=U FIRE=0 REACTIVITY=0 PERSISTENCE = 0 NFPA RATINGS (SCALE 0-4): HEALTH=U FIRE=0 REACTIVITY=0
U=Unknown

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

Common Names/Synonyms: URANOUS OXIDE, TRIURANIUM OCTAOXIDE, URANIUM PITCHBLENDE, URANITE NASTURAN, CRM 149, CRM 969, CRM U970, CRM U900, CRM U850, CRM U800; CRM U750, CRM U630, CRM U500, CRM U350, CRM U200, CRM U150, CRM U100, CRM U030-A, CRM U020-A, CRM U015, CRM U010, CRM U005-A, CRM U0002, CRM 129-A, CRM 124 (1-7), CRM 123 (1-7), NFRM U-1, NFRM U-2, U_3O_8 FOR SAFEGUARDS MEASUREMENT EVALUATION (SME) PROGRAM.

IUPAC Name: Hexaoxotriuranium-1,3-bis(olate).

CAS Number: 1344-59-8

SECTION 4: FIRST AID MEASURES

Indication of Immediate Medical Attention: In all routes of exposure, seek medical treatment immediately. See treatment/first aid measures below.

Necessary First-aid Measures:

INHALATION: Remove from exposure area to a restricted area with fresh air as quickly as possible. 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 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. Decontaminate any radiological contamination after individual is stabilized from initial medical treatment. 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 compound, 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.

EYE CONTACT: Remove victim to a restricted area for decontamination. Thoroughly wash eyes with large amounts of water, occasionally lifting the upper and lower lids (approximately 15 minutes). Following the water treatment, provide an isotonic solution. Do not use eyebaths, rather provide a continuous and copious supply of fluid. Monitor the victim for radioactivity. If activity is present, rewash the eyes, and re-monitor 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 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. 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:

There is no antidote for radiation sickness. Treatment should be symptomatic and supportive, regardless of the dose received. In all cases, medical attention should be obtained immediately

Although chelating agents act on uranium, they should not be used because the increased migrant fraction leads through renal precipitation to a greater kidney burden than would be received if there were no treatment at all; there is thus the risk of serious toxic nephritis. The basic treatment should be administration of a bicarbonate solution given locally and in intravenous perfusion (one bottle of 250 mL at 1.4%).

Most Important Symptoms/Effects, Acute and Delayed:

INHALATION:
Short Term Exposure: May cause irritation. May cause kidney damage, yellowing of the skin and eyes, lack of appetite, nausea, vomiting, diarrhea, and dehydration, blood in the urine, weakness, drowsiness, incoordination, twitching, sterility, blood disorders, convulsions and shock.

Long Term Effects: In addition to effects from short-term exposure, anemia, cataracts, lung damage, liver damage and bone effects may occur.

INGESTION:
Short Term Exposure*:* May cause kidney damage.

Long Term Effects: Same effects as short-term exposure.

SKIN CONTACT:
Short Term Exposure: May cause irritation.

Long Term Effects: May cause irritation. EYE

CONTACT:
Short Term Exposure: May cause irritation, redness and swelling. Additional effects may include sores and eye damage.

Long Term Effects: In addition to effects from short-term exposure, cataracts may occur.

SECTION 5: FIRE FIGHTING MEASURES

Suitable Extinguishing Media: Dry chemical, carbon dioxide, water spray or regular foam (2012 *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) (2012 *Emergency Response Guidebook*, ERG 2012)

Fire and Explosion Hazard: Negligible when exposed to flame or heat.

Hazardous Combustion Products: Thermal decomposition may release toxic/hazardous gases.

Special Protective Equipment and Precautions for Fire-Fighters: Move container from fire area if you can do it without risk. Apply cooling water to sides of containers exposed to flames until well after fire is out (2012 *Emergency Response Guidebook*, ERG 2012).

Do not move damaged containers; move undamaged containers out of fire zone. For massive fire in cargo area, use unmanned hose holder or monitor nozzles (2012 *Emergency Response Guidebook*, ERG 2012).

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.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions and Protective Equipment: Do not touch damaged containers or spilled material. Damage to outer container may not affect primary inner container.

Emergency Procedures/Methods and Materials for Containment and Clean-up: For small liquid spills, take up with sand, earth or other absorbent material. For large spills, dike far ahead of spill for later disposal. Keep unnecessary people at least 150 feet upwind; greater distances may be necessary if advised by qualified radiation authority. Isolate hazard area and deny entry. 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

SECTION 7: HANDLING AND STORAGE

Precautions for Safe Handling: Avoid contact with skin, eyes and clothing. When using do not eat, drink or smoke. Avoid Breathing Dust. Wash thoroughly after handling. Use only with adequate ventilation.

Conditions for Safe Storage: Store in radioactive materials area. Keep storage container tightly closed. Store separately from incompatible materials. Observe all Federal, State, and local regulations regarding storage of this substance.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Limits (Chemical):

ACGIH TLV 8 hour TWA 0.2 mg/m3
ACGIH STEL 15 minutes 0.6 mg/m3
OSHA. PEL 8-hour TWA 0.05 mg/m3 as soluble uranium and 0.25 mg/m3 as insoluble uranium
NIOSH IDLH 10 mg/m3 as uranium
NIOSH REL 10 Hours TWA 0.05 mg/m3
Cal/OSHA PEL 8-hour TWA 0.05 mg/m3

Occupational exposure to radioactive substances must adhere to standards established by the Occupational Safety and Health Administration. 29 CFR 1910.96, and/or the Nuclear Regulatory Commission, 10 CFR Part 20. For DOE and its contractors 10 CFR 835, Occupational Radiation Protection must be followed.

Engineering Controls:

VENTILATION: At a minimum, provide local exhaust or process enclosure ventilation. Depending upon the specific workplace activity and the radioactivity of the isotope, a more stringent ventilation system may be necessary to comply with exposure limits set forth by law (10 CFR 20.103)

RADIATION SHIELDING: One method of controlling external radiation exposure is to provide adequate shielding. The absorbing material used and the thickness required to attenuate the radiation to acceptable levels depends on the type of radiation, its energy, the flux and the dimensions of the source.

ALPHA PARTICLES: For the energy range of alpha particles usually encountered, a fraction of a millimeter of any ordinary material is sufficient for absorbance. Thin rubber, acrylic, stout paper, or cardboard will suffice.

BETA PARTICLES: Beta particles are more penetrating than alpha, and require more shielding. Materials composed mostly of elements of low atomic number such as acrylic, aluminum and thick rubber are most appropriate for the absorption of beta particles. For example, 1/4 inch of acrylic will absorb all beta particles up to 1 MeV. With high-energy beta radiation from large sources, Bremsstrahlung (X-ray production) contribution may become significant and it may be necessary to provide additional shielding of high atomic weight material, such as lead, to attenuate the Bremsstrahlung radiation.

GAMMA RAYS: The most suitable materials shielding gamma radiation are lead and iron. The thickness required would depend on whether the source is producing narrow or broad beam radiation. Primary and secondary protective barriers may be required to block all radiation.

Personal Protective Equipment:

EYE PROTECTION: Employee must wear appropriate eye protection that will not allow the introduction of particles into the eyes. Contact lenses should not be worn.

Clothing, glove and eye protection equipment will provide protection against alpha particles, and some protection against beta particles, depending on thickness, but will not shield gamma radiation.

CLOTHING: Disposable over garments, including head coverings and foot covering, should be worn by any employee engaged in handling any radioactive substance. These garments are also recommended even if the employee is working with a "glovebox" containment system. Certain clothing fibers may be useful in dosimetry so clothing should be kept.

In the event of an accident, large-scale release or a large-scale clean-up full protective clothing will be necessary.

GLOVES: Employee must wear appropriate protective gloves to prevent contact with this substance. Used gloves may present a radiation hazard and should be disposed of as radioactive waste.

RESPIRATOR: The following respirators and maximum use concentrations are recommendations by the U.S. Department of Health and Human Services, NIOSH pocket guide to chemical hazards; NIOSH criteria documents 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, must not exceed the working limits of the respirator and be jointly approved by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration (NIOSH-MSHA).

URANIUM, Insoluble compounds (As U):

AT ANY DETECTABLE CONCENTRATION:
Any self-contained breathing apparatus that has a full face piece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied air respirator that has a full face piece 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.

Escape - any air-purifying, full-face piece respirator with a high-efficiency particulate filer.

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 face piece respirator with a high-efficiency particulate filter.

Any supplied-air respirator that has a full face piece 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

Appearance: Dark green or black, dense, radioactive powder or crystals.
Odor: N/A
Odor Threshold: N/A
pH: N/A
Melting point: 1300°C (2372°F) decomposes
Freezing Point: N/A
Boiling point: Decomposes
Flash Point: Non-flammable solid.
Evaporation Rate: Data Not Available
Flammability: Data Not Available
Explosive Limits: Data Not Available
Vapor Pressure: N/A
Vapor Density: N/A
Relative Density: Data Not Available
Solubility: Water Solubility: Insoluble. Solvent Solubility: Nitric acid, sulfuric acid
Partition Coefficient: Data Not Available
Auto-Ignition Temperature: Data Not Available
Decomposition Temperature: Data Not Available
Viscosity: Data Not Available
Molecular weight: Approximately 833 to 842 (depending on enrichment)
Molecular formula: U_3O_8
Specific Gravity: 8.30
Chemical Family: metal oxide, radioactive

The half-lives of the various uranium isotopes are as follows:

$^{233}U = 1.59 \times 10^5$ y, $^{234}U = 2.47 \times 10^5$ y; $^{235}U = 7.04 \times 10^8$ y; $^{236}U = 2.39 \times 10^7$ y;

$^{238}U = 4.51 \text{ X } 10^{9}$ y.

The specific activities of the various uranium isotopes are as follows:

$^{233}U = 3.6 \text{ x } 10^{2}$ MBq/g ($9.7 \text{ X } 10^{-3}$ Ci/g)

$^{234}U = 2.3 \text{ X } 10^{2}$ MBq/g ($6.2 \text{ X } 10^{-3}$ Ci/g)

$^{235}U = 7.8 \text{ X } 10^{-2}$ MBq/g ($2.1 \text{ X } 10^{-6}$ Ci/g)

$^{236}U = 2.3$ MBq/g ($6.3 \text{ X } 10^{-5}$ Ci/g)

$^{238}U = 1.2 \text{ X } 10^{-2}$ MBq/g ($3.3 \text{ X } 10^{-7}$ Ci/g)

SECTION 10: STABILITY AND REACTIVITY

Reactivity: See below.

Chemical Stability: Stable under normal temperatures and pressures.

Possibility of Hazardous Reactions: No potentially hazardous conditions could be found in the literature, nor could any accidents be recalled in which uranium oxide reacted in a hazardous manner.

Conditions to Avoid: Excessive heat.

Incompatible Materials: Bromine Trifluoride: Reaction is rapid below the boiling point of the trifluoride.

Hazardous Decomposition Products: Thermal decomposition may release hazardous and toxic gases.

SECTION 11: TOXICOLOGY INFORMATION

Likely Routes of Exposure: Inhalation, ingestions, skin and eye contact.

Uranium oxide is a skin, eye, and mucous membrane irritant, as well as a nephrotoxin. Chronic inhalation may affect the lungs and lymph nodes. Pneumoconiosis may occur. If uranium is deposited in the bone, there is a potential for blood disorders such as anemia and leukopenia. In humans, cancer of the lung, lymphatic and hemopoietic systems, and osteosarcoma have been reported. Uranium compounds usually do not constitute an external radiation exposure hazard since uranium emits mainly alpha-radiation at a low energy level. It may constitute an internal radiation hazard if it is absorbed into the body, thus delivering alpha emission onto tissues in which it is stored. Significant quantities of highly enriched material may also pose a gamma radiation hazard.

INHALATION

RADIOACTIVE/NEPHROTOXIN. 30 mg/m^3 immediately dangerous to life and health.

Acute Exposure: May cause irritation.

Chronic Exposure: In animals, repeated inhalation of insoluble uranium compounds resulted in fibrotic changes indicative of radiation damage in the lungs and tracheobronchial lymph nodes. Pneumoconiosis may occur. If uranium is deposited in the bone, there is a potential for blood disorders such as anemia and leukopenia. In humans, cancer of the lung, lymphatic and hemopoietic systems, and osteosarcoma have been reported. Uranium is a nephrotoxin and exposure may lead to kidney failure. Kidney failure may result in liver damage. See the following section on effects of alpha radiation and radiation sickness.

ALPHA RADIATION:

Acute Exposure: Alpha radiation is densely ionizing with very high energy and will kill cells immediately adjacent to the source of contact. Damaged cells may not recover or be repaired. Alpha emitters may or may not be absorbed, depending on the solubility and particle size. Insoluble compounds may remain at or near the site of deposition, and soluble compounds 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 may be lodged deep in the alveolar air sacs and remain. The damage depends on how quickly they are eliminated, and the susceptibility of the tissue in which they are stored. A single large dose of radiation may lead to radiation sickness.

Chronic Exposure: The effects of chronic exposure by internally deposited alpha radiation is dependent upon the dose and target organ(s). If the total dose is sufficient, radiation sickness may occur. Possible disorders include lung cancer, sterility, anemia, leukemia, or bone cancer.

RADIATION SICKNESS:

Acute Exposure: Whole body doses of 200-1000 Rads may cause anorexia, apathy, nausea and vomiting and may become maximal within 6-12 hours. An asymptomatic period of 24-36 hours may be followed by lymphopenia and slowly developing neutropenia. Thrombocytopenia may become prominent within 3-4 weeks. The lymph nodes, spleen and bone marrow may begin to atrophy. If bone marrow depression reaches a critical level, death may occur from overwhelming infection. Whole body doses of 400 or more rads may cause intractable nausea, vomiting and diarrhea that may lead to severe dehydration, vascular collapse and death. Regeneration of the intestinal epithelium may occur, but may be followed by hematopoietic failure within 2-3 weeks. Whole body doses of 600 or more rads may be fatal due to gastrointestinal or hematopoietic malfunction, with doses fatal <600 Rads, the possibility of survival is inversely related to the dose. Whole body doses >3000 Rads generally cause nausea, vomiting, listlessness, and drowsiness ranging from apathy to prostration, tremors, convulsions, ataxia and death within a few hours. The gonads are also particularly radiosensitive among men. In women, loss of fertility may be indicated by loss of menstruation.

Chronic Exposure: The delayed effects of radiation may be due either to a single large overexposure or continuing low-level overexposure and may include cancer, genetic effects, shortening of life span and cataracts. Cancer is observed most frequently in the hematopoietic system, thyroid, bone and skin. Leukemia is among the most likely forms of malignancy. Lung cancer may also occur due to radioactive materials residing in the lungs. Genetic effects may range from point mutations to severe chromosome damage such as strand breakage, translocations, and deletions. If the germ cells have been affected, the effects of the mutation may not become apparent until the next generation, or even later.

SKIN CONTACT

Acute Exposure: There is no evidence that insoluble uranium compounds can be absorbed through the skin; insoluble salts produced no signs of poisoning after skin contact. Animal tests on a variety of uranium compounds caused varying degrees of eye damage, with the oxides causing the mildest. Uranium oxide may irritate the skin.

Chronic Exposure: Prolonged skin contact with insoluble uranium compounds should be avoided because of potential radiation damage to basal cells. Dermatitis has occurred as a result of handling some insoluble uranium compounds. Repeated or prolonged contact may cause conjunctivitis. Cataract formation as in acute exposure may occur with significant exposure. See the following sections regarding alpha radiation and radiation sickness.

ALPHA RADIATION:
ACUTE EXPOSURE - Alpha radiation is not usually an external hazard. However, local damage may occur at the site of a wound. Absorption or penetration through damaged skin may result in radiation sickness.

Chronic Exposure: Prolonged or repeated contact my result in radiation sickness.

RADIATION SICKNESS: The clinical course of radiation sickness depends upon the dose, dose rate, area of the body affected and time after exposure. External and internal radioactivity of any type may cause radiation sickness.

Radiation sickness has three (3) clearly defined syndromes, which are described in detail in the inhalation section.

EYE CONTACT

Acute Exposure: Dust may be irritating to the eyes. A variety of soluble and insoluble compounds or uranium were tested on the eyes of rabbits. The insoluble compounds caused the mildest degree of injury. The effects of eye contact with any uranium compound tend to be necrosis of the conjunctivae and eyelids, and ulceration of the cornea.

Chronic Exposure: Prolonged exposure to uranium may produce conjunctivitis, or the symptoms of radiation injury, such as cataracts. See the following sections regarding the effects of alpha radiation on the eyes, and radiation sickness.

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 crystalline lens. A late effect of eye irradiation is cataract formation. It may begin anywhere from 6 months to several years after a single exposure. Cataract formation begins at the posterior pole of the lens, and continues until the entire lens has been affected. Growth of the opacity may stop at any point. The rate of growth and the degree of opacity are dependent upon the dose of radiation.

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 should be considered to be a critical organ.

RADIATION SICKNESS: The eyes are very radiosensitive; a single dose of 100 rads may cause conjunctivitis and keratitis. It is unlikely that a dose sufficient to cause radiation sickness would occur if only the eyes were irradiated. However, if eye damage by ionizing radiation occurs. It may be best to assume that other parts of the body have also been contaminated. Symptoms of radiation sickness are described in the inhalation section.

INGESTION

Acute Exposure: Feeding studies on animals indicate that insoluble uranium is much less toxic than soluble uranium compounds. Uranium entering the bloodstream will become stored in the bone marrow, but the majority will become lodged in the kidney, which is the major site of toxicity. More than a year and a half are required to rid the body of an accidental high dose of uranium, after which time measurable uranium is present in the bone and kidney.

Chronic Exposure: The toxic action of uranium resides more in its chemical action on the renal tubules, rather than radiation effects. Rats injected with uranium metal in the femoral marrow developed sarcomas, whether this was due to metallocarcinogenic or radiocarcinogenic ingestion of alpha emitters, and radiation sickness. Also see the first aid section for uranium compounds.

ALPHA RADIATION:

Acute Exposure: The fate of ingested alpha emitters depends on their solubility and valence. High doses may lead to radiation sickness as described in inhalation exposure.

Chronic Exposure: Repeated ingestion of alpha emitters may lead to radiation sickness as described in inhalation exposure.

RADIATION SICKNESS: The symptoms of radiation sickness depends upon the dose received. It may result from acute or chronic exposure to any form of radiation. The symptoms are described in the inhalation section.

CARCINOGEN STATUS (As a Chemical):

OSHA:	N
NTP:	N
IARC*:	N

**Ionizing radiation is listed by the IARC as a carcinogen*

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:	To be determined on a case by case basis.
Special Information:	
Packing Group:	

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):	N
OSHA PROCESS SAFETY (29 CFR 1910.119):	N
CALIFORNIA PREPOSITION 65:	N

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

European Inventory of Existing Commercial Chemical Substances (EINECS)	Y
EC Inventory	Y
China Catalog of Hazardous Chemicals 2015	N
New Zealand Inventory of Chemicals	N
Philippines Inventory of Chemicals and Chemical Substances	N
Vietnam National Chemical Inventory	N
Chinese Chemical Inventory of Existing Chemical Substances (IECSC)	N

SECTION 16: OTHER INFORMATION

This material is prepared for use as a standard or in interlaboratory comparison programs at analytical laboratories, which routinely handle uranium and/or plutonium. The NBL Program Office (NBL PO) 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 PO 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 judgement 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.

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