Safety Data Sheet

Version 1.3
Revision Date 04/23/2024

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name	**Radioactive Curium Nitrate, Cm-248**
Synonyms	Curium Tri-Nitrate, Cm-248 labeled Nitrate, nitric acid, curium(3+) salt (3:1)
Chemical Formula	$Cm(NO_3)_3$
Molecular Weight	434.1
CAS No.	35311-12-7
Hazardous Substances	7391
Supplier Address*	ISOFLEX USA PO Box 472615 San Francisco CA 94147 United States
Telephone	+1 415-440-4433
Fax	+1 415-563-4433
Emergency Phone Number (both supplier and manufacturer)	Infotrac/ +1 800-535-5053 *May include subsidiaries or affiliate companies/divisions
Email	iusa@isoflex.com
Website	www.isoflex.com
Preparation Information	ISOFLEX USA Product Safety +1 415-440-4433

2. HAZARDOUS IDENTIFICATION

Emergency Overview:

Caution: **RADIOACTIVE**: Avoid contact and inhalation. Carcinogen, alpha emitter.

HMIS Rating: N/A

NFPA Rating: N/A

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name:	Curium Nitrate
CAS Number:	35311-12-7
Chemical Formula:	$Cm(NO_3)_3$
Molecular Weight:	518.6

4. FIRST AID MEASURES

Antidote and Emergency Treatment

Basic Treatment: Establish an airway (oropharyngeal or nasopharyngeal airway, if needed). Watch for signs of respiratory insufficiency and assist ventilations if necessary. Administer oxygen by nonrebreather mask at 10 to 15 L/min. Monitor for shock and treat if necessary. Anticipate seizures and treat if necessary. Perform routine emergency care for associated injuries. For eye contamination, flush eyes immediately with water. Irrigate each eye continuously during transport. Do not use emetics. For ingestion, rinse mouth and administer 5 mL/kg up to 200 mL of water for dilution if the patient can swallow, has a good gag reflex, and does not drool. Perform routine BLS care as necessary.

*[Currance, P.L. Clements, B., Bronstein, A.C. (Eds).; Emergency Care For Hazardous Materials Exposure. 3Rd edition, Elsevier Mosby, St. Louis, MO 2005, p. 502]**PEER REVIEWED***

Advanced Treatment: Consider orotracheal or nasotracheal intubation for airway control in the patient who is unconscious or is in severe respiratory distress. Monitor cardiac rhythm and treat arrhythmias as necessary. Start IV administration of 0.9% saline (NS) or lactated Ringer's (LR). For hypotension with signs of hypovolemia, administer fluid cautiously. Watch for signs of fluid overload. Treat seizures with diazepam (Valium) or lorazepam (Ativan). Perform routine advanced life support care as needed. Use proparacaine hydrochloride to assist eye irrigation.

*[Currance, P.L. Clements, B., Bronstein, A.C. (Eds).; Emergency Care For Hazardous Materials Exposure. 3Rd edition, Elsevier Mosby, St. Louis, MO 2005, p. 503]**PEER REVIEWED***

Special Considerations (I): Most symptoms from radioactive product exposure are delayed; treat other medical or trauma problems according to normal protocols. An accurate history of the exposure is essential to determine risk and proper treatment modalities. The dose of radiation determines the type and clinical course of exposure: 100 rads: GI symptoms (nausea, vomiting, abdominal cramps, diarrhea). Symptom onset within a few hours. 600 rads: Several GI symptoms (necrotic gastroenteritis) may result in dehydration and death within a few days. Several thousand rads: neurological/cardiovascular symptoms (confusion, lethargy, ataxia, seizures, coma, cardiovascular collapse) within minutes to hours. Bone marrow depression, leukopenia and infections usually follow severe exposures.

*[Currance, P.L. Clements, B., Bronstein, A.C. (Eds).; Emergency Care For Hazardous Materials Exposure. 3Rd edition, Elsevier Mosby, St. Louis, MO 2005, p. 167]**PEER REVIEWED***

Special Considerations (II): Radiation monitors should be available to evaluate the radiation dose rates and compute/verify safe times to remain in contaminated areas. Experts are needed to review the data and provide specific recommendations to the Incident Commander as to the hazards present in the affected areas. Medical radiation experts should be available to guide patient treatment. Most symptoms from radioactive product exposure are delayed; treat other medical or trauma problems according to normal protocols. An accurate history of the exposure is essential to determine risk and proper treatment modalities. The dose of radiation determines the type and clinical course of exposure: 100 rads: GI symptoms (nausea, vomiting, abdominal cramps, diarrhea). Symptom onset within a few hours. 600 rads: Severe GI symptoms (Necrotic gastroenteritis) may result in dehydration and death within a few days. Several thousand rads: neurological/cardiovascular symptoms (confusion, lethargy, ataxia, seizures, coma, cardiovascular collapse) within minutes to hours. Bone marrow depression, leukopenia, and infections usually follow severe exposures. Assistance and advice on patient care concerns may be obtained from the Oak Ridge Radiation Emergency Assistance Center and Training Site 24 hours a day by calling (615) 576-3131 or (615) 481-1000, ext. 1502

*[Currance, P.L. Clements, B., Bronstein, A.C. (Eds).; Emergency Care For Hazardous Materials Exposure. 3Rd edition, Elsevier Mosby, St. Louis, MO 2005, p. 503]**PEER REVIEWED***

Further Emergency Measures: Treatment of serious medical problems takes precedence over radiologic concerns. Maintain an open airway and assist ventilation if necessary. Treat coma and seizures if they occur. Replace fluid losses from gastroenteritis with intravenous crystalloid solutions. Treat leukopenia and resulting infections as needed. Immunosuppressed patients require reverse isolation and appropriate broad-spectrum antibiotic therapy. Bone marrow stimulants may help selected patients. Specific drugs and antidotes, chelating agents or pharmacologic blocking drugs may be useful in some cases of ingestion or inhalation of certain biologically active radioactive materials, if they are given before or shortly after exposure.

*[Olson, K.R. (Ed.); Poisoning & Drug Overdose. 4th ed. Lange Medical Books/McGraw-Hill. New York, N.Y. 2004, p. 329]**PEER REVIEWED***

Decontamination: Exposure to particle-emitting solids or liquids. The victim is potentially highly contaminating to rescuers, transport vehicles, and attending health personnel. a) Remove victims from exposure, and if their conditions permit, remove all contaminated clothing and wash the victims with soap and water; b) All clothing and cleansing water must be saved, evaluated for radioactivity, and properly disposed of; c) Rescuers should wear protective clothing and respiratory gear to avoid contamination. At the hospital, measures must be taken to prevent contamination of facilities and personnel. d) Induce vomiting or perform gastric lavage if radioactive material has been ingested. Administer activated charcoal, although its effectiveness is unknown. Certain other adsorbent materials may also be effective. e) Contact Radiation Emergency Assistance Center & Training Site (REAC/TS/: telephone (865) 576-3131 or (865) 481-1000) and the state radiologic health department for further advice. In some exposures, unusually aggressive steps may be needed (eg, lung lavage for significant inhalation of plutonium).

*[Olson, K.R. (Ed.); Poisoning & Drug Overdose. 4th ed. Lange Medical Books/McGraw-Hill. New York, N.Y. 2004, p. 330]**PEER REVIEWED***

Initial Emergency Department Considerations: Chelating agents or pharmacologic blocking drugs (potassium iodine, diethylenetriamine pentaacetic acid (DTPA), dimercaprol (British antilewisite, BAL), sodium bicarbonate, Prussian blue, calcium gluconate, ammonium chloride, barium sulfate, sodium alginate or D-penicillamine) may be useful if given before or immediately after exposure.

5. FIREFIGHTING MEASURES

Flash Point	N/A
Autoignition Temperature	N/A
Flammability	N/A
Suitable Extinguishing Media	Water spray, carbon dioxide, dry chemical powder, or appropriate foam.

Firefighting

Protective Equipment	Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.
Specific Hazard(s)	Radioactive

6. ACCIDENTAL RELEASE MEASURES

Personal Precaution(s)	Exercise appropriate precautions to minimize direct contact with skin or eyes and prevent inhalation of dust.
Methods for Cleaning Up	In most cases of contamination of equipment and buildings, a mixture of normal housecleaning methods will remove the material. Vacuum cleaners that can handle wet material and have high-efficiency filters are particularly useful. Some surfaces may require repeated scrubbing and vacuuming before they are free of contamination. *[Armed Forces Radiobiology Research Institute. Handbook. Medical Management of Radiological Casualties. 2nd ed. April 2003. p. 72-3 Available at http://www.afrri.usuhs.mil]**PEER REVIEWED***

In most cases, contamination should be controlled and removed as soon as possible. The contaminated area or equipment should be marked and posted immediately. Nonessential persons should be moved out of the area until decontamination has been completed. Usually simple cleaning techniques and procedures are adequate for most decontamination tasks. Spills and contaminated areas should be cleaned from the outer region inward to reduce the possibility of further spread of the contamination. After cleaning, the area or equipment should be surveyed to ensure that all the contamination has been removed.

*[National Council on Radiation Protection and Measurements; NCRP Report No. 127, Operational Radiation Safety Program p. 56-8, (1998)]**PEER REVIEWED***

Decontamination is most successful when the material can be recycled for use in a nuclear facility since the need to prove releasability (cleanliness) is eliminated. Nevertheless, cleaning material for unrestricted release is also possible in some cases. It may also be possible to decontaminate an item enough to change its classification from TRU - transuranic waste - to LLW - low-level waste, thereby allowing immediate disposal of the item, while a relatively small quantity of decontamination waste is stored as TRU waste. Electropolishing to remove the thinnest metal surface has been very effective and produces a relatively small waste volume, especially when one of the wetted sponge units is used rather than an emersion tank. Surface scabbling has been used in decontamination of concrete, and various abrasive blasting methods have also been effective. Strippable and self-stripping coatings may be used to decontaminate surfaces, even though the primary application of strippable coatings has been in preventing contamination of surfaces.

*[U.S. Department of Energy; Guide of Good Practices for Occupational Radiological Protection in Plutonium Facilities. p. 8-16, 17 DOE-STD-1128-98 (1998)]**PEER REVIEWED***

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7. HANDLING AND STORAGE

Handling

In any facility that handles radioactive materials, the major controls protecting workers, the public, and the environment are structures and installed equipment which shield, contain and confine the radioactive materials. However, to allow useful work to be performed in the facility and to assure that its protective features remain effective, a number of administrative controls are ordinarily required. These administrative controls are usually contained in a series of procedures related to the operations and maintenance activities to be carried out in the facility. All personnel who work in controlled areas should be familiar with the administrative controls that apply to their work. When changes or additions to administrative controls are made, these changes or additions should be effectively communicated to all persons who may be affected.

*[U.S. Department of Energy; Guide of Good Practices for Occupational Radiological Protection in Plutonium Facilities. p. 2-35 DOE-STD-1128-98 (1998)]**PEER REVIEWED***

Storage

Facilities are required to sample the air in areas where an individual is likely to receive an exposure of 40 or more DAC-hours in a year. Real-time air monitoring must be performed to detect and provide warning of airborne radioactivity concentrations that warrant immediate action to terminate inhalation of airborne radioactive material. Fixed air samplers are used in these areas (they may also be in areas with CAMs). They are sensitive to low levels of airborne radioactivity (they are capable of determining a fraction of a DAC) but do not have alarm capabilities to alert workers to airborne radioactivity.

*[U.S. Department of Energy; DOE Standard. Radiological Safety Training for Plutonium Facilities. Instructors Manual. p. 25 DOE-HDBK-1145-2001 (2001)]**PEER REVIEWED***

Administrative Controls

There are many administrative controls to reduce doses. The following are just a few that should apply to all sites: Posting. Training. Housekeeping. Maintaining Access Control. Using Radiation Work Permits. Stopping Work.

*[U.S. Department of Energy; DOE Standard. Radiological Safety Training for Plutonium Facilities. Instructors Manual. p. 21 DOE-HDBK-1145-2001 (2001)]**PEER REVIEWED***

Personnel Contamination Monitors

Personnel survey instruments are usually placed at the exits from radiologically-controlled areas. Personnel frisking shall be performed after removal of protective clothing and prior to washing and showering. The use of a personnel contamination monitor (such as a portal monitor or hand and foot counter), if available, is encouraged. Personal items such as notebooks, papers and flashlights shall be subjected to the same frisking.

*[U.S. Department of Energy; DOE Standard. Radiological Safety Training for Plutonium Facilities. Instructors Manual. p. 24 DOE-HDBK-1145-2001 (2001)]**PEER REVIEWED***

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8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Handling

Gloveboxes are almost always used when handling transuranic alpha emitters in a dispersible form. However, properly vented hoods are acceptable for handling the very small quantities used in a research laboratory. Proper hood design is critical for plutonium, and only very small quantities should be used. Gloveboxes, tanks and piping are examples of "primary containments," because there are no system openings. Gloveboxes have ports with long plastic sleeves attached to allow material to be "sealed in" or "sealed out" from the glovebox without breaching the containment. Types of equipment such as fume hoods are "primary confinements," since they are the barrier closest to the source. Primary barriers require good ventilation to maintain contamination control. Do not insert your hands into a primary barrier unless you have been trained and authorized to do so.

*[U.S. Department of Energy; DOE Standard. Radiological Safety Training for Plutonium Facilities. Instructors Manual. p. 18 DOE-HDBK-1145-2001 (2001)]**PEER REVIEWED***

Radiation Protection Procedures

A facility should have a written policy on radiation protection, including a policy on keeping exposures ALARA. All radiation protection procedures and controls should have formal, recognizable technical bases for limits, methods, and personnel protection standards. Procedures should be adequately documented, updated periodically, and maintained in a centralized historical file. A control system should be established to account for all copies and ensure that all new procedures are included in the historical files. A designated period of time for maintaining historical files should be established. In addition, radiation protection procedures should have a documented approval system and established intervals for review and/or revision. A tracking system should be developed to ensure that the required reviews and revisions occur.

*[U.S. Department of Energy; Guide of Good Practices for Occupational Radiological Protection in Plutonium Facilities. p. 2-35 DOE-STD-1128-98 (1998)]**PEER REVIEWED***

Personal Responsibility

Responsibilities should be assigned for action in response to an accidental internal contamination. The affected worker has the responsibility to inform the health physicist, Radiation Control Technician, or his immediate supervisor as soon as an intake is suspected. The health physicist or RCT should make an initial survey of the extent of the contamination and immediately contact his supervisor and, when action levels are exceeded, contact a member of the medical staff. He should continue to provide monitoring and radiation safety support to the medical staff and supervisors during the management of the contamination incident. Care should be taken to limit the spread of radioactive contamination. The health physicist should immediately begin to gather data on the time and extent of the incident. Contamination survey results should be recorded. Radionuclide identity, chemical form and solubility classification should be determined. Nasal smears should be obtained immediately if an intake by inhalation is suspected. When action levels are exceeded, all urine and feces should be collected and labeled for analysis. Decontamination should proceed with the assistance of the medical staff. Contaminated clothing and other objects should be saved for later analysis.

*[U.S. Department of Energy; Guide of Good Practices for Occupational Radiological Protection in Plutonium Facilities. p. 5-60 DOE-STD-1128-98 (1998)]**PEER REVIEWED***

Protective Equipment & Clothing

Protective clothing, commonly of Tyvex material, is used to keep contamination off personal clothing and skin. It does not stop the external radiation exposure (except alpha rays), but it helps prevent the spread of contamination both onto and into the body.

*[U.S. Department of Energy; DOE Standard. Radiological Safety Training for Plutonium Facilities. Instructors Manual. p. 17 DOE-HDBK-1145-2001 (2001)]**PEER REVIEWED***

During operations in which there is a potential to breach a containment system (such as glove changes or seal-outs) and create airborne radioactivity, respiratory protection is the primary method of preventing internal dose from inhalation. To minimize the possibility of inhalation, individuals must ensure the physical integrity of the respirator, obtain a good seal, and ensure the protection factor of the respirator is adequate. There are also methods to prevent injection wounds (such as placing leather gloves over glovebox gloves or ensuring there are no sharp objects inside containments). If personnel have any suspicion of an injection wound, they should immediately seek the assistance of the site radiological control organization.

*[U.S. Department of Energy; DOE Standard. Radiological Safety Training for Plutonium Facilities. Instructors Manual. p. 17 DOE-HDBK-1145-2001 (2001)]**PEER REVIEWED***

In most emergency situations, respiratory protection designed to protect responders against chemical or biological agents is likely to offer some degree of respiratory protection in a radiological attack. Concerns about the presence of chemical or biological contaminants will influence the selection of respiratory protection. If used properly, simple face masks provide reasonably good protection against inhaling particulates and allow sufficient air transfer for working at high breathing rates. High-efficiency particulate air filter masks provide even better protection.

*[ICRP Publication 96. Protecting People against Radiation Exposure in the Event of a Radiological Attack. Annals of the ICRP 35 (1), 2005]**PEER REVIEWED***

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Physical State	Solid
Form	Powder

Safety Data

Molecular Weight: 518.6 amu	pH: N/A
BP/BP Range: N/A	MP/MP Range: N/A
Freezing Point: N/A	Vapor Pressure: N/A
Vapor Density: N/A	Saturated Vapor Concentration: N/A
SG/Density: N/A	Bulk Density: N/A
Odor Threshold: N/A	Volatile %: N/A
VOC Content: N/A	Water Content: N/A
Solvent Content: N/A	Evaporation Rate: N/A
Viscosity: N/A	Surface Tension: N/A
Partition Coefficient: N/A	Decomposition Temperature: N/A
Flash Point: N/A	Explosion Limits: N/A
Flammability: N/A	Autoignition Temperature: N/A
Refractive Index: N/A	Optical Rotation: N/A
Miscellaneous Data: N/A	Solubility: N/A

10. STABILITY AND REACTIVITY

Stability	Stable
Hazardous Decomposition Products	N/A
Hazardous Polymerization	N/A

11. TOXICOLOGICAL INFORMATION

Evidence for Carcinogenicity

There is sufficient evidence in experimental animals for the carcinogenicity of mixed alpha particle emitters.

*[IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work), p. V78 478 (2001)]**PEER REVIEWED***

Internalized radionuclides that emit alpha-particles are carcinogenic to humans (Group 1). In making this overall evaluation, the Working Group took into consideration the following: Alpha-particles emitted by radionuclides, irrespective of their source, produce the same pattern of secondary ionizations and the same pattern of localized damage to biological molecules, including DNA. These effects, observed in vitro, include DNA doublestrand breaks, chromosomal aberrations, gene mutations and cell transformation. All radionuclides that emit alpha-particles and that have been adequately studied, including radon-222 and its decay products, have been shown to cause cancer in humans and in experimental animals. Alpha-particles emitted by radionuclides, irrespective of their source, have been shown to cause chromosomal aberrations in circulating lymphocytes and gene mutations in humans in vivo. The evidence from studies in humans and experimental animals suggests that similar doses to the same tissues - for example lung cells or bone surfaces - from alpha- particles emitted during the decay of different radionuclides produce the same types of non-neoplastic effects and cancers.

*[IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work)., p. V78 478 (2001)]**PEER REVIEWED***

Signs and Symptoms of Exposure

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

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12. ECOLOGICAL INFORMATION

Ecotoxicity

Curium-244 uptake from contaminated sea water was studied in five benthic marine species: two bivalve molluscs (*Scrobicularia plana* and *Cerastoderma edule*), two polychaete annelids (*Arenicola marina* and *Nereis diversicolor*) and one amphipod crustacean *(Corophium volutator)*. The concentrations in the whole organisms relative to the concentration in the sea water (concentration factors) were: 700 for the amphipods (after 11 d of accumulation), 140 for the cockles (after 28 d), 80 for the *scrobicularia* (after 23 d) and 30 for the two annelids (after >20 d). All species except *S. plana* accumulated americium and curium similarly; *S. plana* accumulated similar amounts of curium and plutonium. [Miramand P et al; J Environ Radioact 5 (3): 209-18 (1987)] **PEER REVIEWED**

A catalogue of biokinetic parameters for the transuranic elements plutonium, americium, curium, neptunium, and californium in marine invertebrates is presented. The parameters considered are: the seawater-animal concentration factor (CF); the sediment-animal concentration ratio (CR); transuranic assimilation efficiency; transuranic tissue distribution and transuranic elimination rates. With respect to the seawater-animal CF, authors differ considerably on how they define this parameter and a seven-point reporting system is suggested. Transuranic uptake from sediment by animals is characterized by low CRs. The assimilation efficiencies of transuranic elements in marine invertebrates are high compared to vertebrates and mammals in general and the distribution of transuranics within the body tissue of an animal is dependent on the uptake path. The elimination of transuranics from most species examined conformed to a standard biphasic exponential model though some examples with three elimination phases were identified. [Ryan TP; Environ Int 28 (1-2): 83-96 (2002)] **PEER REVIEWED**

Environmental Fate/Exposure

Curium is artificially produced. Sixteen isotopes of curium are known and all are radioactive. Curium-247 is the most stable isotope of curium with a half-life of 16 million years. Curium-242 was first produced at the University of California, Berkeley in 1944 by the bombardment of plutonium-239 with alpha particles in a cyclotron. Curium has few uses outside of research activities and is only available in small quantities. Curium-242 and 244 are available in multigram quantities; curium-248 has only been produced in milligram quantities. The release of curium compounds to the environment from research activities would likely be very limited. A small amount of curium would have been generated by atmospheric nuclear weapon testing, which ceased worldwide by 1980. A few curium compounds, including CmO2, Cm2O3, CmF3, CmF4, CmBr3, and CmI3 have been prepared. Air sampling data were used to estimate effluent release from the Savannah River Site from the plant's start-up in 1954 through 1989; it was estimated that 2.34 and 8.9474 mCi (86.6 and 0.33105 GBq) of curium-242 and curium-244 were released to the atmosphere from 1977 to 1989, respectively. If released to air, curium compounds would exist solely in the particulate phase in the ambient atmosphere, since they are ionic and would not be volatile. Particulate-phase curium compounds will be removed from the atmosphere by wet or dry deposition. If released to soil, curium is typically insoluble and binds very tightly to soils. Curium oxide is the more common form in the environment. Curium compounds are ionic and would not volatilize from moist or dry soil surfaces. If release to water, curium(III) is the primarily stable ion in aqueous solution. Curium(IV) is only stable in solution as complex fluoride ion. Curium ions would be expected to adsorb to suspended particles in water, since actinide ions with III, IV, and VI oxidation states can be adsorbed to cation-exchange resins. Since curium compounds are ionic, they will not volatilize from water surfaces. Bioconcentration is not expected to be an important fate due to the ionic nature of curium compounds. Since curium has only been produced in limited quantities and curium has few uses outside of research activities, exposure to curium compounds would be limited to individuals involved in scientific research using curium. (SRC)

TERRESTRIAL FATE: Curium oxide is the more common form in the environment. Most curium compounds are insoluble and bind very tightly to soils. Curium compounds are ionic and would not volatilize from moist or dry soil surfaces (SRC).
[Argonne National Laboratory/EVS. Human Health Fact Sheet, August 2005. Curium. Available at: http://www.ead.anl.gov/pub/doc/curium.pdf as of Nov 1, 2005.] **PEER REVIEWED**

AQUATIC FATE: Curium ions would be expected to adsorb to suspended particles in water(SRC), since actinide ions with III, IV, and VI oxidation states can be adsorbed to cation-exchange resins. Curium(III) is the primarily stable ion in aqueous solution. Curium(IV) is only stable in solution as complex fluoride ion. Since curium compounds are ionic, they will not volatilize from water surfaces (SRC). Bioconcentration is not expected to be an important fate due to the ionic nature of curium compounds(SRC).
[Seaborg GT; in Kirk-Othmer Encycl Chem Technol. Kroschwitz JI, ed. NY, NY: John Wiley & Sons 1: 412-45 (1991)] **PEER REVIEWED**

ATMOSPHERIC FATE: Curium compounds are ionic and would not be volatile and would exist solely in the particulate phase in the ambient atmosphere. Particulate-phase curium compounds will be removed from the atmosphere by wet or dry deposition. (SRC)
PEER REVIEWED

13. DISPOSAL CONSIDERATIONS

Product/Packaging

Contact a licensed professional waste disposal service to dispose of this material. Observe all federal, state and local environmental regulations.

14. TRANSPORT INFORMATION

Shipment Methods and Regulations

Regulating the safety of shipments of radioactive materials is the joint responsibility of the NRC and the Department of Transportation (DOT). The NRC establishes requirements for the design and manufacture of packages for radioactive materials. The DOT regulates the shipments while they are in transit and sets standards for labeling these packages and for smaller quantity packages.

*[U.S. Nuclear Regulatory Commission, Citizen's Guide to Nuclear Regulatory Commision Information (2003). Available from http://www.nrc.gov/reading-rm/citizen-guide.html as of November 22, 2005.]**PEER REVIEWED***

15. REGULATORY INFORMATION

US Classification and Label Text:

US Statements	Radioactive
UN Number	2915
Proper Shipping Name	Radioactive Material, Type A Packaging
Class or Subdivision	7

16. OTHER INFORMATION

Prepared By	ISOFLEX USA PO Box 472615 San Francisco CA 94147 United States
Issuing Date	December 5, 2015
Revision Date	April 23, 2024
Revision Number	3
Revision Note	Update Supplier Address

ISOFLEX USA's Commonly Used Abbreviations and Acronyms*

ACGIH	American Conference of Governmental Industrial Hygienists
ADR	European Agreement Concerning the International Carriage of Dangerous Goods by Road
ALARA	As Low As Is Reasonably Achievable
AMU	Atomic Mass Unit
ANSI	American National Standards Institute
BLS	Basic Life Support
CAM	Continuous Air Monitor
CAS	Chemical Abstracts Service (division of the American Chemical Society)
CEN	European Committee for Standardization
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CLP	Classification, Labelling and Packaging (European Union)
CPR	Controlled Products Regulations (Canada)
CWA	Clean Water Act (USA)
DAC	Derived Air Concentration (USA)
DOE	United States Department of Energy (USA)
DOT	United States Department of Transportation (USA)
DSL	Domestic Substances List (Canada)
EC50	Half Maximal Effective Concentration
EINECS	European Inventory of Existing Commercial Chemical Substances
EHS	Environmentally Hazardous Substance
ELINCS	European List of Notified Chemical Substances
EMS	Emergency Response Procedures for Ships Carrying Dangerous Goods
EPA	Environmental Protection Agency (USA)
EPCRA	Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986
GHS	Globally Harmonized System

HMIS	Hazardous Materials Identification System (USA)
IARC	International Agency for Research on Cancer
IATA	International Air Transport Association
IBC	Intermediate Bulk Containers
ICAO	International Civil Aviation Organization
IDLH	Immediately Dangerous to Life or Health
IMDG	International Maritime Code for Dangerous Goods
LC50	Lethal concentration, 50 percent
LD50	Lethal dose, 50 percent
LDLO	Lethal Dose Low
LOEC	Lowest-Observed-Effective Concentration
MARPOL	International Convention for the Prevention of Pollution from Ships
MSHA	Mine Safety and Health Administration (USA)
NCRP	National Council on Radiation Protection & Measurements (USA)
NDSL	Non-Domestic Substances List (Canada)
NFPA	National Fire Protection Association (USA)
NIOSH	National Institute for Occupational Safety and Health (USA)
NOEC	No Observed Effect Concentration
N.O.S.	Not Otherwise Specified
NRC	Nuclear Regulatory Commission (USA)
NTP	National Toxicology Program (USA)
OSHA	Occupational Safety and Health Administration (USA)
PBT	Persistent Bioaccumulative and Toxic Chemical
PEL	Permissible Exposure Limit
PIH	Poisonous by Inhalation Hazard
RCRA	Resource Conservation and Recovery Act (USA)
RCT	Radiation Control Technician
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals (Europe)
RID	Regulations Concerning the International Transport of Dangerous Goods by Rail
RTECS	Registry of Toxic Effects of Chemical Substances
SARA	Superfund Amendments and Reauthorization Act (USA)
TDG	Transportation of Dangerous Goods (Canada)
TIH	Toxic by Inhalation Hazard
TLV	Threshold Limit Value
TPQ	Threshold Planning Quantity
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average
UN	United Nations (Number)
VOC	Volatile Organic Compound
vPvB	Very Persistent Very Bioaccumulative Chemical
WGK	Wassergefährdungsklassen (Germany: Water Hazard Classes)
WHMIS	Workplace Hazardous Materials Information System

*One or more of the above-listed items may not appear in this document.

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