



**SAFETY DATA SHEET**  
**THORIUM-229 AMOUNT CONTENT AND ISOTOPIC REFERENCE**  
**MATERIAL**

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**SECTION 1: CHEMICAL PRODUCTS & COMPANY IDENTIFICATION**

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NBL Program Office  
U. S. Department of Energy,  
1 Science.gov Way,  
Oak Ridge, TN 37830  
1-865-576-0598

Off Hours Emergency Numbers:  
1-865-576-0598

Substance: Thorium-229 Amount Content and Isotopic Reference Material

Trade Names/Synonyms: NFRM Th-1

**Recommended Use of This Material and Restrictions of Use**

This Reference Material (RM) is intended primarily for use as an isotopic spike for Isotope Dilution Mass Spectrometry (IDMS) measurements. A unit of NFRM Th-1 consists of 3 mL of a 1.0 M (6 %) nitric acid solution in which a certified quantity of radioactive Thorium-229 is dissolved. The solution is contained in a 3 mL flame-sealed quartz glass ampoule. This RM is intended for determining the amount of substance for Thorium.

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**SECTION 2: HAZARDS IDENTIFICATION**

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**Radiological Hazard**

**Warning: THIS MATERIAL SHOULD ONLY BE USED BY PERSONS  
QUALIFIED TO HANDLE RADIOACTIVE MATERIAL!**

This product contains licensed radioactive material and is therefore subject to the requirements of 10 CFR Part 20 (e.g., public and occupational exposure limits, waste

disposal). At a minimum, the basic radiation safety principles of time, distance, and shielding, and appropriate radiation contamination control should be practiced to avoid/minimize any external and/or internal exposure. Consult with your Radiation Safety office for your facility's radiation safety requirements/precautions specific to the radionuclide(s) (including its activity and chemical/physical form) in this Radioactive RM.

**NFRM Th-1 is a radioactive material, Thorium-229, with a massic activity of 194.4 Bq•g<sup>-1</sup> in a nitric acid solution. Thorium-229 decays by alpha-particle emission. The progeny of Thorium-229 decay by alpha and beta-particle emission. None of the alpha or beta particles escapes from the RM ampoule. During the decay process X-rays and gamma rays with energies from 10 KeV to 2 MeV are emitted. THIS RM SHOULD ONLY BE USED BY PERSONS QUALIFIED TO HANDLE RADIOACTIVE MATERIAL!**

### **OSHA Hazards**

There are no known physical hazards associated with this material.

**GHS Classification** in accordance with 29 CFR 1910 (OSHA HCS)

Skin Corrosion/Irritation Category 1B

Serious Eye Damage/Irritation Category 1

GHS Label elements, including precautionary statements



Pictogram:

Signal word: Danger

Hazard statement(s)

H314 Causes severe skin burns and eye damage

Precautionary statement(s)

P260 Do not breathe fumes, mists, vapors, or spray.

P264 Wash hands thoroughly after handling.

P280 Wear protective gloves, protective clothing, and eye protection.

P301 + P330 + P331 If swallowed: Rinse mouth. Do NOT induce vomiting.

P303 + P361 + P353 If on skin (or hair): Remove immediately all contaminated clothing. Rinse skin with water.

P304 + P340 If inhaled: Remove person to fresh air and keep comfortable for breathing.  
P305 + P351 + P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.  
P310 Immediately call a doctor.  
P363 Wash contaminated clothing before reuse.  
P405 Store locked up.  
P501 Dispose of contents and container according to local regulations.

Hazards not otherwise classified (HNOC) or not covered by GHS Radioactive.

NFPA RATINGS (SCALE 0-4): HEALTH=3 FIRE=0 REACTIVITY=0

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### SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

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Substance: Thorium-229 in nitric acid, solution.

Other Designations:

Nitric Acid: Aqua fortis; hydronitrate; azotic acid; engraver's acid.

Thorium: Not applicable.

Components are listed in compliance with OSHA's 29 CFR 1910.1200; for the actual values see the NIST Certificate.

Hazardous Component(s) Concentration	CAS Number	EC Number	Nominal Mass
		(EINECS)	(%)
Nitric Acid	7697-37-2	231-714-2	6.3
Thorium-229	Not applicable	Not applicable	0.000 002 6
Non-Hazardous Component(s)			
Water	7732-18-5	231-791-2	>93

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### SECTION 4: FIRST AID MEASURES

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**INHALATION:** If adverse effects occur, remove to uncontaminated area. If not breathing, give artificial respiration or oxygen by qualified personnel. Seek immediate medical attention.

**SKIN CONTACT:** Rinse affected area with copious amounts of water followed by washing with soap Skin Contact: and water for at least 15 minutes while removing contaminated clothing. Seek medical attention, if needed.

**EYE CONTACT:** Immediately flush eyes, including under the eyelids with copious

amounts of water for at least 30 minutes. Seek immediate medical attention.

INGESTION: Contact a poison control center immediately for instructions. Wash out mouth with water, but do not induce vomiting. Seek medical aid at once, and bring the container or label.

MOST IMPORTANT SYMPTOMS/EFFECTS, ACUTE AND DELAYED: Acid burns to skin and eyes.

INDICATION OF ANY IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED, IF NECESSARY: If any of the above symptoms are present, seek immediate medical attention.

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## SECTION 5: FIREFIGHTING MEASURES

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FIRE AND EXPLOSION HAZARD: Negligible fire hazard. See Section 9, "Physical and Chemical Properties" for flammability properties.

EXTINGUISHING MEDIA:

Suitable: Use extinguishing media appropriate to the surrounding fire.

Unsuitable: None listed.

SPECIFIC HAZARDS ARISING FROM THE CHEMICAL: Oxides of nitrogen.

SPECIAL PROTECTIVE EQUIPMENT AND PRECAUTIONS FOR FIRE-FIGHTERS: Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH approved self-contained breathing apparatus (SCBA).

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## SECTION 6: ACCIDENTAL RELEASE MEASURES

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**This material is radioactive. DO NOT touch spilled material. Immediately notify safety personnel of a spill.**

**Personal Precautions, Protective Equipment, Methods and Materials for Containment and Clean up:**

RADIOLOGICAL EMERGENCY PROCEDURES:

The following is a guide for first responders. The following actions, including remediation, should be carried out by qualified individuals. In cases where a life-threatening injury occurs concurrent with personal contamination, treat the injury first.

Do not touch damaged packages or spilled material. Handle as a radioactive material spill. In addition to those actions described below, the guidelines in the 2012 Emergency

Response Guidebook (ERG) provide more specific measures that should be followed.

#### **SPILL AND LEAK CONTROL:**

Alert and clear everyone from the area affected by the spill.

Take actions to limit the spread of contamination.

Summon aid.

#### **DAMAGE TO THE RADIOACTIVE SOURCE:**

Evacuate the immediate vicinity around the source.

Place a barrier at a safe distance from the source.

Identify area as a radiation hazard.

#### **SUGGESTED EMERGENCY PROTECTIVE EQUIPMENT:**

Gloves

Footwear Covers

Outer layer or easily removed protective clothing (as situation requires)

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### **SECTION 7: HANDLING AND STORAGE**

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Safe Handling Precautions and Storage: This material is radioactive. Store and handle in accordance with all current regulations and standards. See NRC 10 CFR 20 or state regulations. See Section 8, "Exposure Controls and Personal Protection".

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### **SECTION 8: EXPOSURE CONTROL/PERSONAL PROTECTION**

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#### **EXPOSURE LIMITS:**

##### **Th-229:**

ALinh: 0.0009  $\mu\text{Ci}$  (bone surface) (See NRC 10 CFR 20 Appendix B)

ALing: 0.6  $\mu\text{Ci}$  (bone surface)

OSHA: See OSHA 29 CFR and NRC 10 CFR 20.

ACGIH: See International Commission on Radiological Protection guidelines

##### **Nitric Acid:**

NIOSH (REL): 5 mg/m<sup>3</sup> (2 ppm; TWA); 10 mg/m<sup>3</sup> (4 ppm; STEL); 65 mg/m<sup>3</sup> (25 ppm; IDLH)

ACGIH (TLV): 5 mg/m<sup>3</sup> (2 ppm; TWA); 10 mg/m<sup>3</sup> (4 ppm; STEL)

OSHA (PEL): 5 mg/m<sup>3</sup> (2 ppm; TWA)

**Engineering Controls:** Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

**Personal Protection:** In accordance with OSHA 29 CFR 1910.132, subpart I, wear appropriate Personal Protective Equipment (PPE) to minimize exposure to this material.

**Respiratory Protection:** If workplace conditions warrant a respirator, a respiratory protection program that meets OSHA 29CFR 1910.134 must be followed. Refer to NIOSH 42 CFR 84 for applicable certified respirators.

**Eye/Face Protection:** Wear splash resistant safety goggles with a face shield. An eye wash station should be readily available near areas of use.

**Skin and Body Protection:** Wear protective clothing to prevent contact with skin. Wear appropriate gloves.

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## SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

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Descriptive Properties:	Nitric Acid
Appearance (physical state, color, etc.):	colorless to yellow liquid
Molecular Formula:	HNO <sub>3</sub>
Molar Mass (g/mol):	63.01
Odor:	irritating odor
Odor threshold:	not available
pH:	1 (1 M)
Evaporation rate:	not available
Melting point/freezing point (°C):	−42 (−43 °F)
Relative Density (g/L) as specific gravity (water = 1):	1.5027 at 25 °C
Vapor Pressure (mmHg):	47.9 at 20 °C
Vapor Density (air = 1):	3.2
Viscosity (cP):	not available
Solubility(ies):	miscible with water and ether
Partition coefficient (n-octanol/water):	not available
Thermal Stability Properties:	
Autoignition Temperature (°C):	not applicable
Thermal Decomposition (°C):	not applicable
Initial boiling point and boiling range (°C):	83 (181 °F)
Explosive Limits, LEL (Volume %):	not applicable
Explosive Limits, UEL (Volume %):	not applicable
Flash Point (°C):	not applicable
Flammability (solid, gas):	not applicable

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## SECTION 10: STABILITY AND REACTIVITY

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REACTIVITY: This material is stable at normal temperatures and pressure.

STABILITY:   X   Stable        Unstable

POSSIBLE HAZARDOUS REACTIONS: None listed.

CONDITIONS TO AVOID: Avoid contact with combustible materials and incompatible materials.

INCOMPATIBLE MATERIALS: Acids, combustible materials, halo carbons, amines, bases, oxidizing materials, metals, halogens, metal salts, metal oxides, reducing agents, peroxides, metal carbide, cyanides.

FIRE/EXPLOSION INFORMATION: See Section 5, "Fire Fighting Measures".

HAZARDOUS DECOMPOSITION: Oxides of nitrogen.

HAZARDOUS POLYMERIZATION        Will Not Occur   X   Will Not Occur

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## SECTION 11: TOXICOLOGY INFORMATION

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ROUTE OF EXPOSURE:   X   Inhalation   X   Skin   X   Ingestion

SYMPTOMS RELATED TO THE PHYSICAL, CHEMICAL AND TOXICOLOGICAL CHARACTERISTICS: Burning pain and severe corrosive skin damage. Permanent eye damage including blindness could result.

### POTENTIAL HEALTH EFFECTS (ACUTE, CHRONIC AND DELAYED):

Inhalation: Nitric acid, if inhaled, can damage the mucous membranes and respiratory tract. Short term exposure may cause irritation and inflammation of the upper respiratory tract, coughing, choking, sore throat, shortness of breath, headache, dizziness, and nausea. Long term exposure to acid fumes may cause damage to teeth, bronchial irritation, chronic cough, bronchial pneumonia, and gastrointestinal disturbances.

SKIN CONTACT: Nitric acid can cause severe skin burns. Severity of the damage depends on the concentration and duration of exposure. Effects of acid burns may be delayed.

EYE CONTACT: Nitric acid can cause severe eye irritation, corneal burns, permanent eye damage, or blindness. Severity of the damage depends on the concentration and duration of exposure.

INGESTION: If ingested, nitric acid can cause severe burns and damage to the gastrointestinal tract.

### NUMERICAL MEASURES OF TOXICITY:

#### ACUTE TOXICITY:

Nitric acid, Rat, Inhalation LC50: 130 mg/m<sup>3</sup> (4 h)

SKIN CORROSION/IRRITATION: This RM contains 6 % nitric acid and it is classified as Category 1B.

Serious Eye Damage/Eye Irritation: This RM contains 6 % nitric acid and it is classified as Category 1.

RESPIRATORY SENSITIZATION: No data available.

SKIN SENSITIZATION: No data available.

GERM CELL MUTAGENICITY: No data available.

CARCINOGENICITY: No data available.

LISTED AS A CARCINOGEN/POTENTIAL CARCINOGEN \_\_\_\_Yes    XNo

Nitric acid is not listed by NTP, IARC or OSHA as a carcinogen.

RADIOLOGICAL HAZARD: Thorium-229

Ionizing radiation is a known carcinogen.

REPRODUCTIVE TOXICITY: No data available.

SPECIFIC TARGET ORGAN TOXICITY, SINGLE EXPOSURE: No data available.

SPECIFIC TARGET ORGAN TOXICITY, REPEATED EXPOSURE: No data available.

ASPIRATION HAZARD: No data available.

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## SECTION 12: ECOLOGICAL INFORMATION

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### ECOTOXICITY DATA:

Nitric acid: Fish, hooknose or pogge (*Agonus cataphractus*) LC50: 100 mg/L to 330 mg/L (48 h)

Thorium-229: No ecotoxicity data listed.

PERSISTENCE AND DEGRADABILITY: No data available.

BIOACCUMULATIVE POTENTIAL: No data available.

MOBILITY IN SOIL: No data available.

OTHER ADVERSE EFFECTS: No data available.



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## SECTION 13: DISPOSAL INFORMATION

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**Waste Disposal: This material is radioactive.** Dispose in accordance with all applicable federal, state, and local regulations for **RADIOACTIVE** materials. See NRC 10 CFR 20 subpart K.

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## SECTION 14: TRANSPORTATION INFORMATION

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**U.S. DOT and IATA:** UN2031, Corrosive liquid, n.o.s. (contains nitric acid), Hazard Class 8, Packing Group II, Excepted Quantity E2.

Subsidiary Risk: None.

Comments: Not radioactive for shipping purposes.

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## SECTION 15: REGULATORY INFORMATION

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### U.S. Regulations:

CERCLA Sections 102a/103 (40 CFR 302.4): Nitric Acid, 1000 lbs; 454 kg RQ.

SARA Title III Section 302 (40 CFR 355.30): Nitric Acid, 1000 lbs TPQ.

SARA Title III Section 304 (40 CFR 355.40): Nitric Acid, 1000 lbs EPCRA RQ.

SARA Title III Section 313 (40 CFR 372.65): Nitric Acid, 1.0 % de minimis concentrations.

OSHA Process Safety (29 CFR 1910.119): Nitric Acid at higher concentrations (>94.5 %) is regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE HEALTH: Yes.

CHRONIC HEALTH: Yes.

FIRE: No.

REACTIVE: No.

PRESSURE: No.

### State Regulations:

California Proposition 65: No components are regulated.

**U.S. TSCA Inventory:** Nitric acid is listed.

**TSCA 12(b), Export Notification:** No components are listed.

**Canadian Regulations:** WHMIS Information is not provided for this material.

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## SECTION 16: OTHER INFORMATION

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**Issue Date:** 22 December 2014

**Sources:** ChemAdvisor, Inc., MSDS Nitric Acid, 10 September 2014.

CDC; NIOSH; NIOSH Pocket Guide to Chemical Hazards; Department of Health and Human Services (DHHS), Centers for Disease Control and Prevention (CDC), National Institute for Safety and Health; Nitric Acid, 18 November 2010; available at <http://www.cdc.gov/niosh/npg/npgd0447.html> (accessed Dec 2014).

Hazardous Substances Data Bank (HSDB), National Library of Medicine's TOXNET system, Nitric Acid CAS No. 7697-37-2; available at <http://toxnet.nlm.nih.gov> (accessed Dec 2014).

OSHA 29 CFR, Subpart Z, Ionizing radiation, 1910.1096.

NRC 10 CFR 20, Standards for Protection Against Radiation.

DOT 49 CFR 173, Shippers General Requirements for Shipments and Packages.