**Nuclear Reference Material Program**
***U.S. Department of Energy***

# Certificate of Analysis

## Certified Reference Material 106A

## Monazite Sand – Silica Mixture Thorium Standard

**Description:** Certified Reference Material (CRM) 106A is 50 grams of a mixture of powdered monazite sand and powdered silica in a glass bottle. The certified thorium mass fraction value is reported in Table 1. Supplemental non-certified property values are provided in Table 2.

**Table 1. Certified Property Value and Uncertainty** [(a)]

| | |
|---|---|
| Thorium Mass Fraction ($g\ g^{-1}$) • 100: | 1.0291 |
| Uncertainty: | 0.0030 |

[(a)] The certified value listed above is expressed in terms of 95 % confidence limits, defined as $\bar{x} \pm \sigma \cdot t$, where $\bar{x}$ is the pooled mean of the measurement data, $\sigma$ is the pooled standard deviation of the mean, and t is the Student's t value for the indicated degrees of freedom (df = 9) and at the 5 % significance level ($\alpha = 0.05$).

**Intended use:** This CRM was prepared as a quality control reference material for chemical analysis of thorium in ore samples.

**Storage:** This material should be stored in its original packaging under normal laboratory environmental conditions.

**Period of validity:** When stored in its original, unopened container, the certification of this material is valid indefinitely. The Nuclear Reference Material Program (NRMP) will notify customers should any degradation be detected.

**Instructions for Handling:** The material in the unit bottle is radioactive. This radioactive material should be handled only by qualified individuals. To minimize personnel exposure, appropriate facilities and personal protective equipment should be used. Refer to the Safety Data Sheet for further information.

**Traceability statement:** The certified thorium mass fraction value is traceable to the SI unit kilogram.

**Additional information:** CRM 106A was prepared by milling and blending NBL CRM 7-A Monazite Sand (9.7 % mass fraction $ThO_2$) with silica (99.9 % mass fraction $SiO_2$) to obtain a uniform mixture of desired thorium concentration. Characterization and certification analyses for thorium content were performed on ten (10) units selected from the packaged final product. The analysis method used for these measurements was spectrophotometry verified with NBL Thorium Oxide ($ThO_2$).

**Table 2. Non-Certified Property Value** [(a)]

| | |
|---|---|
| Uranium Mass Fraction ($g\ g^{-1}$) • 100: | 0.0409 |

[(a)] Calculated value is based on the uranium oxide ($U_3O_8$) mass fraction value of 0.3993 % ± 0.0171 % for CRM 7-A Monazite Sand.

In 2016, the New Brunswick Laboratory facility was transitioned to a program office within the Department of Energy and is now operating within the National Nuclear Security Administration (NNSA) as the Nuclear Reference Material Program (NRMP)

(Revision of Certificate Dated December 2020)
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January 2026

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