NE E 13-2T

Supersedes RDT E 13-2T

June 1971

NUCLEAR STANDARD

**CERAMIC GRADE
URANIUM DIOXIDE**

JANUARY 1984

U. S. DEPARTMENT OF ENERGY
NUCLEAR ENERGY PROGRAMS

689

NE Standards Transmittal

Hanford Engineering Development Laboratory

NE-E--13-2T

DE93 011210

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FOREWORD

This standard supersedes the June 1971 issue of RDT E 13-2T and incorporates those changes to that issue of the standard that were approved and published as Amendment 1 and those changes that were approved for publication in this revision. Because of extensive changes, the location of changes are not identified.

Significant changes that have been incorporated in this revision are summarized as follows:

1. Incorporation of uranium dioxide procurement experience.
2. Revisions of text to be more concise and more generally applicable by referencing the Ordering Data for certain technical specifications.
3. Deletion of certain quality assurance requirements that are adequately covered by reference to ANSI/ASME NQA-1 and NE F 3-15T.
4. Updating of referenced standards.
5. Addition of Systeme International (SI) metric units.
6. Format changes in accordance with the current requirements for DOE Nuclear Energy Program Standards.

Editorial changes have been made to conform to the Department of Energy nuclear energy program decision to designate the RDT standards as NE standards rather than as NE(RDT). Some of the referenced standards are in the process of being updated and issued as NE standards. To minimize editorial corrections to this standard to correct reference to RDT standards to NE standards as they are issued, the corrections are being made prior to issuance of the RDT standards as NE. These changes are not identified.

CERAMIC GRADE URANIUM DIOXIDE

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CERAMIC GRADE URANIUM DIOXIDE

1. SCOPE

This standard establishes the requirements for ceramic grade uranium dioxide for the fabrication of mixed oxide fuel pellets, insulator pellets, and blanket pellets.

2. APPLICABLE DOCUMENTS

The following documents are a part of this standard to the extent specified in Sections 3 through 5. The issue of a document in effect on the date of invitation to bid, including any amendments or other published changes also in effect, shall be as specified in the Ordering Data. Where this standard appears to conflict with the requirements of a referenced document, such conflict shall be brought to the attention of the purchaser for resolution.

2.1 NE Standards.

NE F 2-6T Qualification and Control of Analytical Chemistry Laboratories for Mixed Oxide Fuel Analysis

NE F 11-1T Analytical Chemistry Methods for Mixed Oxide Fuel

2.2 American National Standards (ANSI).

ANSI/ASME NQA-1 Quality Assurance Program Requirements for Nuclear Facilities

2.3 American Society for Testing and Materials (ASTM) Publications .

ASTM C 753 Nuclear-Grade, Sinterable Uranium Dioxide Powder

2.4 Other Publications. As specified in the Ordering Data.

3. TECHNICAL REQUIREMENTS

3.1 Particle Size. The uranium dioxide powder shall be passed through a 20-mesh U.S. Standard Sieve, or equivalent, and shall meet maximum particle size and particle size distribution requirements.

3.1.1 Maximum Particle Size. Uranium dioxide powder maximum particle size or agglomerate size shall be 75 microns (75 μm).

Table 1. Uranium Dioxide Impurity Limits

Impurity Group	Element	Maximum Impurity Limit $\mu\text{g/g}$
1	Na K	SUM = 700 (No one > 500)
2	Cl F	SUM = 30
3	C N	SUM = 350 (No one > 250)
4	Sm Eu Gd Dy	SUM = 100
5	Fe Cr Ni	SUM = 1000 (No one > 400)
6	P S	SUM = 350 (No one > 300)
7	Zn Pb Sn Cd	SUM = 220 (No one > 100) 20
8	Be Ca Mg Al Si	20 SUM = 450 (No one > 250)
9	B	20
10	Li	10
11	Co Ti V Ta W Cu Ag Mo Mn Zr	10 SUM = 900 (No one > 400)

4.3 Inspection Requirements. Uranium dioxide powder shall be inspected for conformance with Section 3 in accordance with Table 3. Reference test methods are acceptable methods. Methods used shall be equal to or better than the methods referenced. Other analytical methods may be substituted for the referenced test methods. Control of analytical methods shall meet the requirements of NE F 2-6. The initial laboratory qualification may be waived at purchaser's option based upon review of supplier's calibration standards and practices. (See NE F 2-6, 4.1.)

4.4 Inspection or Test Level. Acceptability of a lot shall be determined by lot qualification tests on representative samples taken in accordance with 3.10. Lots shall be accepted only when all specified requirements have been met.

4.5 Referee for Analytical Results. In the event of a dispute in analytical results, the purchaser and the supplier shall agree to a third party referee and to the analytical method.

5. PREPARATION FOR DELIVERY

5.1 Packaging and Shipping. Uranium dioxide powder shall be packaged in a manner to maintain conformance to this standard. Unless otherwise specified in the Ordering Data a description of the shipping container configuration shall be submitted to the purchaser.

5.2 Labeling. Uranium dioxide shall be shipped in containers and identified to show the following (See 4.2):

1. Supplier.
2. Purchase order number.
3. Identity of material in containers and ²³⁵U concentration.
4. Gross, tare, and net weight of oxide and net weight of uranium.
5. Lot number,
6. Individual package identity number.

6. NOTES AND ORDERING DATA CHECKLIST

6.1 Ordering Data Checklist. The following technical and procurement data will be furnished by the purchaser. If not furnished with the purchase documents, the supplier shall request any necessary data before submitting his bid.

<u>Item</u>	<u>Refer to Paragraph</u>
1. Applicable documents	2.
2. Other publications	2.4
3. Isotopic content	3.3
4. Moisture Content	3.7
5. Sinterability	3.8 and Table 3, Item 10
6. Sampling	3.10
7. Quality assurance requirements	4.1
8. Packaging and shipping	5.1

Table 3. Quality Conformance Inspection (continued)

Characteristic	Requirement	Sampling*	Reference Test Method
9. Moisture content	3.7	2	In accordance with NE F 11-1.
10. Sinterability	3.8	10	Conduct sinterability performance test, unless otherwise specified in the Ordering Data, in accordance with ASTM C 753.

*Minimum number of analyses per lot or sublet.

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