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Standard Specification for Uranium Ore Concentrate¹

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^ε1 NOTE—Table 1 was corrected editorially ~~in~~ and the yeardate was changed on August 22, 2002.

INTRODUCTION

This specification is intended to provide the nuclear industry with a general standard for uranium ore concentrate. Material conforming to this specification will generally meet the requirements for conversion to uranium hexafluoride. However, the converter may relax or supplement this specification upon mutual agreement with the customer.

1. Scope

- 1.1 This specification covers uranium ore concentrate containing a minimum of 65 mass % uranium.
- 1.2 This specification does not include requirements for health and safety. Observance of this specification does not relieve the user of the obligation to be aware of and conform to all applicable international, national, state, and local regulations pertaining to possessing, shipping, or using source nuclear material (see 2.2).
- 1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

2. Referenced Documents

- 2.1 *ASTM Standards:*

¹ This specification is under the jurisdiction of ASTM Committee C26 on Nuclear Fuel Cycle and is the direct responsibility of Subcommittee C26.02 on Fuel and Fertile Material Specifications.

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C 859 Terminology Relating to Nuclear Materials²

C 1022 Test Methods for Chemical and Atomic Absorption Analysis of Uranium-Ore Concentrate²

C 1075 Practices for Sampling Uranium-Ore Concentrate²

C 1380 Test Method for the Determination of Uranium Content and Isotopic Composition by Isotope Dilution Mass Spectrometry²

2.2 *U.S. Government Documents:*

Nuclear Materials Licensing Code of Federal Regulations Title 10, Chapter 1, Nuclear Regulatory Commission³

Nuclear Materials Licensing Code of Federal Regulations, Title 49, *Transportation* Chapter 1, Materials Transportation Bureau⁴

Nuclear Materials Licensing Code of Federal Regulations, Energy Part 50 (10CFR 50) Licensing of Domestic Production and Utilization Facilities³

2.3 *ANSI Standard:*

ANSI/ASME NQA-1 Quality Assurance Requirements for Nuclear Facility Applications⁵

3. Terminology Definitions

3.1 Except as otherwise defined herein, definitions of terms are as given in Terminology C 859.

4. Chemical Composition

4.1 *Uranium Content*—The uranium content, as received, shall be a minimum of 65 mass %.

4.2 *Isotopic Content*—The isotopic content shall be that of naturally occurring uranium (0.7105 ± 0.0005 g ²³⁵U per 100 g. The ²³⁴U content shall not exceed the limits in Table 1.

4.3 *Insoluble Uranium*—The uranium insoluble in nitric acid shall be a maximum of 0.10 mass % on a uranium basis.

4.4 *Extractable Organic*—The extractable organic shall be a maximum of 0.10 weight % on an as-received basis of an undried sample.

4.5 *Impurity Content*—The impurity content shall be less than the maximum limits specified in Table 1. The seller should advise all parties of the presence of toxic elements such as Ag, As, Ba, Cd, Cr(VI), Hg, Pb, and Se in the uranium ore concentrate.

² *Annual Book of ASTM Standards*, Vol 12.01.

³ Available from the Nuclear Regulatory Commission, 1717 H Street, N. W., Washington, DC 20555.

⁴ Available from the Materials Transportation Bureau, 400 Seventh St., Washington, DC, 20590.

⁵ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

TABLE 1 Impurities and Maximum Concentration Limits

Impurity	Maximum Concentration Limit (Mass %, Uranium Basis) ^A	
	Limit Without Penalty ^B	Limit Without Rejection ^C
As	0.05	0.10
B	0.005	0.10
Ca	0.05	1.00
Carbonate	0.20	0.50
F	0.01	0.10
Halogens ^D	0.05	0.10
Fe	0.15	1.00
Mg	0.02	0.50
Moisture ^E	2.0	5.0
Mo	0.10	0.30
P	0.10	0.70
K	0.20	3.00
Si(calculated as SiO ₂)	0.50	2.50
Na	0.50	7.50
S	1.00	4.00
Th	1.00	2.50
Ti	0.01	0.05
V	0.06	0.30
Zr	0.01	0.10
²³⁴ U	56 ^F	62 ^F
²³⁴ U	56 ^F	†62 ^F

^AExcept as specified otherwise.

^BSurcharges may apply to concentrate having impurities exceeding these limits.

^CThese limits are based on commonly used ore compositions and processing technology and can vary when agreed upon in advance among all parties.

^DExclusive of fluorine.

^EAs determined by the sampling facility.

^Fmicrograms per gram of total uranium (µg/gU).

† Editorially corrected.

5. Physical Properties

- 5.1 *Particle Size*—All of a representative sample (Section 6) shall pass through a sieve with an aperture of ¼ in.
- 5.2 *Ability to Flow*—Concentrate shall be sufficiently free-flowing to permit sampling.
- 5.3 *Foreign Matter*—Concentrate shall be free of all materials and objects that: (a) are not produced as a constituent of concentrates in the milling of uranium ore, or, (b) would or could be detrimental to the sampling of concentrates or to the equipment used in such sampling.

6. Sampling

- 6.1 The lot size and number of tests (and retests when required) shall be as mutually agreed.
- 6.2 A representative sample, of a size sufficient to perform the tests prescribed in Sections 4 and 5, shall be taken from each lot.
- 6.3 Practices C 1075 is referenced as a guide.

7. Test Methods

- 7.1 All chemical analyses shall be performed on portions of the representative sample prepared in accordance with Section 6. Analytical chemistry methods shall be in accordance with Test Methods C 1022, C 1380 or as otherwise agreed.
- 7.1.1 The seller should advise all parties of the presence of toxic elements such as Ag, As, Ba, Cd, Cr(VI), Hg, Pb, and Se in the uranium ore concentrate.

8. Certification

- 8.1 When specified in the purchase order or contract, certification shall be furnished that the material was sampled and tested in accordance with this specification and has been found to meet the requirements. When specified in the purchase order or contract, a report of the test results shall be furnished.

9. Packaging and Package Marking

- 9.1 Uranium ore concentrate shall be packaged and shipped in drums having lids fitted with watertight sealing rings. The lids shall be attached to the drums in a manner that minimizes loss of concentrate in the event of mishandling. Shipping containers shall meet applicable regulatory requirements. CFR Title 10 and Title 49 are referenced as guides.
- 9.2 Each container shall bear, as a minimum, labels on the lid and side with the following information:
- 9.2.1 Seller's name,
 - 9.2.2 Material in containers,
 - 9.2.3 Lot number,
 - 9.2.4 Gross, tare and net weights, and
 - 9.2.5 Container () of ().

10. Quality Assurance

- 10.1 Quality assurance requirements shall be as agreed upon between the buyer and the seller when specified in the purchase order. Code of Federal Regulations Title 10, Part 50, Appendix B and ANSI/ASME NQA-1 are referenced as guides.

11. Keywords

- 11.1 concentrates; uranium ore; yellow cake

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