

# NRC INSPECTION MANUAL

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## INSPECTION PROCEDURE 85207

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### MEASUREMENT SYSTEMS

PROGRAM APPLICABILITY: 2681

#### 85207-01 INSPECTION OBJECTIVE

Verify that the licensee has established, maintained and is following a system for measuring the quantities of SNM received, produced, transferred between MBAs/ICAs, inventoried, shipped, discarded, or otherwise removed from inventory which is sufficient to substantiate the quantities of element and isotope assigned to material in its possession.

#### 85207-02 INSPECTION REQUIREMENTS

The licensee's system for measuring SNM must comply with all applicable NRC regulations and license conditions. The FNMC Plan should provide a general description of those measurement methods contained in the system. By inspection determine whether:

02.01 Written procedures sufficient to account for all SNM possessed by the licensee are established, maintained and followed relative to performing measurements, taking samples, calibrating measurement systems, and the preparation/acquisition, maintenance, storage and use of reference standards. [70.51(c), (f)(4)(iv); 70.57(b)(5)(i), (ii)]

02.02 Procedures and performance criteria for training, qualifying, and periodically requalifying personnel who perform sampling and measurements provide adequate assurance that measurements and sampling are routinely being performed correctly. [70.51(c), 70.57(b)(7)]

02.03 Systems exist for the sampling and analysis of all forms of SNM possessed by the licensee such that the quantities of element and isotope assigned to items/materials received, produced, transferred between MBAs/ICAs, inventoried, shipped, discarded, or otherwise removed from inventory are based on valid measurements. [70.51(f)(1)(i), (2)(iii), (3)(i), (3)(ii); 70.58(e)]

02.04 Standards are used on an ongoing basis for the calibration and control of measurement systems. Calibrations are repeated

whenever a significant change occurs in the system or tests of program data indicate the need for recalibration. Calibrations are based on reference standards. [70.57(b)(8)(i)]

02.05 Process and engineering tests have been performed to establish or verify the applicability of existing procedures for the mixing and sampling of SNM and for maintaining sample integrity during transport and storage. [70.57(b)(4)]

02.06 Engineering analyses and evaluations have been made to assure the adequacy of each measurement system with respect to process flows, sampling and measurement points, and nominal material compositions. Such analyses and evaluations are repeated whenever a significant change is made in a system. [70.57(b)(6)]

02.07 Measurements of SNM performed for the licensee by contractor laboratories conform with all of the aforementioned requirements. [70.57(b)(3)]

02.08 An evaluation of data collected for testing the performance of measurement systems used for accountability purposes at Group I facilities confirms that the results of such systems are acceptable.

### 85207-03 INSPECTION GUIDANCE

03.01 Regulations. 70.51(c); 70.51(f)(1)(i), (2)(iii), (3)(i), (3)(ii), (4)(iv); 70.57(b)(3), (4), (5)(i), (5)(ii), (6), (7), (8)(i); 70.58(e).

#### 03.02 Regulatory Guides and Reports

##### a. Regulatory Guides

- 5.9 - Ge(Li) Spectroscopy Measurement Systems (5/74)
- 5.11 - NDA of SNM Scrap and Waste (4/84)
- 5.21 - U-235 Enrichment Assay Using NDA (12/83)
- 5.23 - In Situ Assay of Pu Residual Holdup (2/84)
- 5.34 - NDA for Pu in Scrap Using Spontaneous Fission (5/84)
- 5.37 - In Situ Assay of U Residual Holdup (8/74)
- 5.38 - Assay of HEU Fuel Plates Using NDA (9/74)
- 5.48 - Mass Measurement of Liquids (2/75)
- 5.53 - Qualification and Calibration of NDA (2/84)
- 5.58 - Traceability for SNM Measurements (2/80)

##### b. NUREG Reports

- 75/010 - Accountability of UO<sub>2</sub> (6/75)
- 0256 - Accountability of Mixed Oxide (5/77)
- CR-0087 - Sampling Considerations - SNM Measurements (5/78)
- CR-0139 - Working Standards Preparation: Mixed Oxide (5/78)
- CR-0289 - Measurements and Standards (9/78)
- CR-0515 - Accountability of Reprocessing Solutions (12/78)
- CR-0533 - Measurements and Standards (10/78)
- CR-0591 - Containers for SNM Measurements (2/79)
- CR-0773 - Training/Qualifying Measurement Personnel (11/80)
- CR-1446 - Preparation of Working Standards: UO<sub>2</sub> (5/80)
- CR-1847 - Containers for SNM Measurements (11/80)
- CR-0602 - Active NDA of Nuclear Materials (1/81)
- CR-2078 - Measurement Methods Handbook (9/83)

CR-3522 - Reference Materials for NDA (10/83)  
CR-3584 - Commonly Used Nuclear Material Measurements (1/84)

c. Other

TID-7029 - Measurement Methods for Pu and U (1972)  
NBS Publication 582 - Measurement Technology (6/80)

03.03 Criteria. The responsibility for preparing and updating measurement and training procedures should be assigned to personnel who are qualified to write such procedures. All initial procedures and subsequent modifications should be approved by the accountability coordinator or his designated alternate prior to being implemented. The inspector should review and analyze these procedures/modifications for ambiguity, unnecessary complexity, or inconsistency with generally accepted measurement and training techniques. If apparent deficiencies are found, they should be discussed with appropriate management and personnel until concerns are satisfactorily resolved.

Measurement standards should be stored under controlled conditions which ensure the continued validity of the standards' assigned values. The assigned values of these standards should be traceable through an unbroken chain of comparisons to a national system of measurements and standards or to a physical constant. This requires that all instruments (including volumetric glassware, thermometers, etc.) used in preparing standards be properly calibrated and that documentation of traceability be available for all such standards. Recertification of the assigned values of standards should be done in accordance with commitments contained in the FNMC Plan. When possible, standards used for calibration and control should also be representative of materials being measured. That is, each standard should have a matrix and SNM concentration resembling that of the material being processed. However, since this is not always practical, the use of nonrepresentative standards may be permissible if it is adequately justified in the FNMC Plan or other appropriate documentation.

Measurement systems should be calibrated in accordance with commitments contained in the FNMC Plan. These commitments should clearly state the criteria to be used for performing the initial calibration of a system and for determining the need for recalibration. The calibrated range must span the anticipated range of process material values. Any results outside of the range of calibration should not be allowed for material control and accounting purposes (this range includes the uncertainty associated with the standard used for calibration).

In general, process and engineering tests to verify the applicability of mixing and sampling procedures need not be performed for:

- a. UF<sub>6</sub>.
- b. Any material that utilizes a standard sampling technique as recommended by an ASTM guide, ANSI standard, Regulatory Guide, etc., provided the sampling device is a simple manual device

and historical data exists which demonstrates that the mode in which it is being used produces an unbiased sample.

- c. Any material which contributes less than 10 grams of U-235, U-233, or Pu to the material balance.

Contractor measurement programs should be checked for conformance with applicable NRC requirements by analyzing the results of the licensee's annual reviews and audits of its contractor laboratory. An occasional visit by inspectors to contractor labs (perhaps every two to three years) might also be employed as an overcheck of the effectiveness and compliance of these labs.

As part of the inspection effort for Group I fuel facilities, the adequacy of the licensee's measurement program must be independently verified. Although most of the effort in this area should focus on measurement systems that either contribute significantly to the limit of error for the plant material balance or measure in excess of 25 percent of the SNM measured during an inventory period (i.e., the key measurement systems), each measurement system used for accountability purposes, irrespective of whether or not it is considered to be a key system, must be evaluated in some manner. Key measurement systems would usually warrant a comprehensive review of system data as well as an evaluation using independent sampling and analysis. On the other hand, non-key measurement systems may only need a simple review of data generated by the system. Nevertheless, if the throughput of material measured by a non-key system were to significantly increase, its non-key status would need to be carefully reexamined.

Materials measured by key measurement systems shall be independently sampled and analyzed to determine the acceptability of these systems (Note:  $UF_6$  would normally be excluded from the requirement for independent sampling). The number of samples needed for such systems shall be determined by using a 90 percent false alarm rate coupled with the degree of variation (i.e., the magnitude of allowable deviation) deemed appropriate by the inspector. Using this approach, the inspector should be able to select a sample size that is large enough to support a meaningful comparative statistical analysis without placing an undue burden upon the licensee. The statistical methods used to evaluate the resultant data shall include, as appropriate, tests of individual and cumulative differences, tests of means, and tests of variance. The results of all such analyses shall be discussed with the licensee during a subsequent inspection and thoroughly documented in an inspection report. If the results obtained are inconclusive, the evaluation could be continued by either performing some additional sampling and analysis (e.g., split samples) or by having the licensee analyze independently certified standards brought in by the inspector. However, once an inspector verifies that a measurement problem exists, the licensee shall be required to perform any more comprehensive analyses deemed necessary by the inspector to isolate the specific source of the problem.

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