

**Regulatory Guide Number:** 5.18, Revision 0

**Title:** Limit of Error Concepts and Principles of Calculation in Nuclear Materials Control

**Office/Division/Branch:** NMSS/FCSE/MCAB

**Technical Lead:** Glenn Tuttle

**SUBJECT:** Basis for Withdrawal

**1. What regulation(s) did the Regulatory Guide support?**

Regulatory Guide (RG) 5.18 was published in January 1974 to provide guidance on meeting the material control and accounting (MC&A) requirements that were in Title 10 of the *Code of Federal Regulations* (10 CFR) 70.51, "Material Balance, Inventory, and Records Requirements." Specifically, 10 CFR 70.51(e) required in part that a licensee calculate material unaccounted for (MUF) and its associated "limit of error," as part of the licensee's MC&A procedures. "Limit of error" was defined in 10 CFR 70.51(a)(5) as the uncertainty component used in constructing a 95% confidence interval associated with a quantity after any recognized bias had been eliminated or its effect accounted for.

The requirement to calculate a "limit of error" no longer exists in 10 CFR Part 70. In 2002, the NRC revised 10 CFR Part 74, "Material Control and Accounting of Special Nuclear Material," in part by transferring the 10 CFR 70.51 requirements to part 74. In doing so, the term "limit of error" was replaced by the term "standard error." "Standard error" is defined in NUREG-1065, "Acceptable Standard Format and Content for the Fundamental Nuclear Material Control (FNMC) Plan Required for Low-Enriched Uranium Facilities," revision 2, as the random error (at the 67% confidence level) associated with the average, or mean, value of a data set derived from repetitive determinations on the same item or sample. Mathematically, "standard error" is the standard deviation divided by the square root of the number of individual measurements used to derive the mean value.

**2. What was the purpose of the Regulatory Guide?**

RG 5.18 was developed to provide guidance on statistical controls that were required as an integral part of special nuclear materials control and accounting systems to assure that licensees of fuel processing and fuel fabrication facilities effectively account for the special nuclear material they possessed and localized losses when they occurred.

Specifically, it provided guidance on "limit of error" concepts and principles of calculation that licensees could use when calculating the limit of error of MUF, pursuant to 10 CFR 70.51(e)(4). MUF was the quantity of material unaccounted for, which is the observed difference between the amount of material that should be on hand (book inventory) and the amount of material determined as physically on hand (ending inventory).

### **3. How was the Regulatory Guide used?**

The RG was used to provide applicants and licensees a method to calculate the “limit of error.” The “limit of error” was a statistical technique licensees could use for testing to determine whether detected special nuclear material imbalances could be attributable to measurement error, biases other than those due to measurement, possible diversions, or other factors. However, it is not known if any licensee used the information in this particular RG since the “limit of error” was only one of the statistical techniques available that licensees could have used for testing MC&A data.

Also, RG 5.18 endorsed the American National Standards Institute (ANSI) Standard N15.16-1974, “Limit of Error Concepts and Principles of Calculation in Nuclear Materials Control,” providing guidance on the “limit of error” concept. This standard has been withdrawn from active status with no replacement.

### **4. Why is the Regulatory Guide no longer needed?**

No guidance is needed for calculating the “limit of error” because, as discussed above, this term is no longer used in the MC&A requirements. The MC&A requirements, now in 10 CFR part 74, use the term “standard error” in place of the term “limit of error.” The “standard error” is used in evaluating the significance of an inventory difference (ID). Further, as stated above in Response 1, 10 CFR 70.51(e) required in part that a licensee calculate its MUF and its associated “limit of error.” The ID term, defined in 10 CFR 74.4, replaces the term “MUF” that was used in 10 CFR 70.51(e).

### **5. What guidance is available once the Regulatory Guide is withdrawn?**

Guidance for calculating the “standard error” of the ID is found in guidance for licensees on acceptable format and content for their Fundamental Nuclear Material Control plans, which is provided in NUREG-1065, “Acceptable Standard Format and Content for the Fundamental Nuclear Material Control (FNMC) Plan Required for Low-Enriched Uranium Facilities,” NUREG-1280, “Standard Format and Content Acceptance Criteria for the Material Control and Accounting (MC&A) Reform Amendment,” and NUREG/CR-5734, “Recommendations to the NRC on Acceptable Standard Format and Content for the Fundamental Nuclear Material Control (FNMC) Plan Required for Low-Enriched Uranium Enrichment Facilities.”

### **6. Is the Regulatory Guide referenced in other documents and what are the “ripple effects” on these documents if it is withdrawn?**

RG 5.18 is referenced in the following RGs:

- RG 5.28, “Evaluation of Shipper-Receiver Differences in the Transfer of Special Nuclear Materials,”
- RG 5.33, “Statistical Evaluation of Material Unaccounted For,” and
- RG 5.51, “Independent Assessment of Nuclear Material Control and Accounting Systems.”

There are no ripple effects of withdrawing this RG. The guidance in RG 5.28 is being incorporated into a new RG, titled as draft regulatory guide (DG)-5051, “Shipping, Receiving, and Internal Transfer of Special Nuclear Material,” and will no longer reference RG 5.18. RG 5.28 will be withdrawn concurrently with issuance of DG-5051.

The guidance in RG 5.33 is being incorporated into a new RG, titled DG-5056, "Material Control and Accounting Physical Inventories and Material Balances at Fuel Cycle Facilities," and will no longer reference RG 5.18. RG 5.33 will be withdrawn concurrently with issuance of DG-5056.

RG 5.51 was revised and issued in October 2016 and its reference to RG 5.18 has been deleted.

In addition, the NRC staff has performed a search in the Agencywide Documents Access and Management System (ADAMS), and has confirmed that there are no other documents that reference RG 5.18.

**7. What is the basis for believing that no guidance similar to that in the Regulatory Guide will ever be needed?**

The term "limit of error" is no longer used in NRC regulations. Guidance for calculating the "standard error," which replaced the "limit of error," is now found in the guidance for licensees on acceptable format and content for their Fundamental Nuclear Material Control plans in NUREG-1065, NUREG-1280, and NUREG/CR-5734.

**8. Will generic guidance still be needed?**

No, for the reasons stated above.

**9. What is the rationale for withdrawing this Regulatory Guide instead of revising it?**

No additional guidance is needed. The term "limit of error" is no longer used and has been replaced by the term "standard error." Guidance for calculating the "standard error" is found in the updated MC&A guidance documents identified above (i.e., NUREG-1065, NUREG-1280, and NUREG/CR-5734). In addition, the ANSI standard N15.16-1974 that is endorsed in RG 5.18 has been withdrawn.

**10. Do other agencies rely upon the Regulatory Guide, e.g., the Agreement States, National Aeronautical and Space Administration, Department of Energy?**

The staff is unaware of any other agency that uses or relies on the guidance in RG 5.18.