



# DRAFT REGULATORY GUIDE

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## DRAFT REGULATORY GUIDE DG-3053

(Proposed Revision 3 of Regulatory Guide 3.71, dated December 2010)

# NUCLEAR CRITICALITY SAFETY STANDARDS FOR NUCLEAR MATERIALS OUTSIDE REACTOR CORES

## A. INTRODUCTION

### Purpose

This regulatory guide (RG) describes methods that the U.S. Nuclear Regulatory Commission (NRC) considers acceptable in criticality safety standards associated with nuclear materials outside reactor cores. The standards describe procedures for preventing nuclear criticality accidents in operations that involve handling, processing, storing, or transporting special nuclear materials (or a combination of these activities).

### Applicability

This RG applies to license applicants, licensees, and certificate holders authorized under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 70, “Domestic Licensing of Special Nuclear Material” (Ref. 1); 10 CFR Part 71, “Packaging and Transportation of Radioactive Material” (Ref. 2); and 10 CFR Part 72, “Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste” (Ref. 3). This revision is not intended for use by nuclear reactor licensees, although certain technical practices may apply to operations at reactor sites outside the reactor core.

### Applicable Regulations

- 10 CFR 70.20, “General License To Own Special Nuclear Material,” requires a specific license to acquire, deliver, receive, possess, use, transfer, import, or export special nuclear material, and 10 CFR 70.22(a)(8) requires applications for such licenses to include proposed procedures to avoid nuclear criticality accidents.

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This regulatory guide is being issued in draft form to involve the public in the development of regulatory guidance in this area. It has not received final staff review or approval and does not represent an NRC final staff position. Public comments are being solicited on this draft guide and its associated regulatory analysis. Comments should be accompanied by appropriate supporting data. Comments may be submitted through the Federal-rulemaking Web site, <http://www.regulations.gov>, by searching for DG-3053. Alternatively, comments may be submitted to the Rules, Announcements, and Directives Branch, Office of Administration, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555-0001. Comments must be submitted by the date indicated in the *Federal Register* notice.

Electronic copies of this draft regulatory guide, previous versions of this guide, and other recently issued guides are available through the NRC’s public Web site under the Regulatory Guides document collection of the NRC Library at <http://www.nrc.gov/reading-rm/doc-collections/reg-guides/>. The draft regulatory guide is also available through the NRC’s Agencywide Documents Access and Management System (ADAMS) at <http://www.nrc.gov/reading-rm/adams.html>, under Accession No. ML17055B591. The regulatory analysis may be found in ADAMS under Accession No. ML17055B588.

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- 10 CFR 71.3, “Requirement for License,” requires a specific license to deliver licensed material to a carrier for transport or to transport licensed material, which must include compliance with the criticality requirements of 10 CFR 71.55, “General Requirements for Fissile Material Packages.”
- 10 CFR Part 72, “Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste,” requires a general or specific license for an independent spent fuel storage installation (ISFSI) or a certificate of compliance for a spent fuel storage cask and requires the facility or cask design to meet the regulations in 10 CFR 72.124, “Criteria for Nuclear Criticality Safety.”

### **Related Guidance**

- NUREG-1520, “Standard Review Plan for Fuel Cycle Facilities License Applications” (Ref. 4), provides guidance on the licensing of nuclear fuel cycle facilities under 10 CFR Part 70.
- NUREG-1718, “Standard Review Plan for the Review of an Application for a Mixed Oxide (MOX) Fuel Fabrication Facility” (Ref. 5), provides guidance for the licensing of a MOX fuel fabrication facility under 10 CFR Part 70.
- NUREG-1536, “Standard Review Plan for Dry Cask Storage Systems” (Ref. 6), provides guidance for the review of a certificate of compliance for a dry storage system at a general license facility under 10 CFR Part 72.
- NUREG-1567, “Standard Review Plan for Spent Dry Fuel Storage Facilities” (Ref. 7), provides guidance for the licensing of an ISFSI under 10 CFR Part 72.
- NUREG-1617, “Standard Review Plan for Transportation Packages for MOX Spent Nuclear Fuel,” Supplement 1 (Ref. 8), provides guidance for the review of a certificate of compliance for a transportation package under 10 CFR Part 71.
- NUREG-1927, “Standard Review Plan for Renewal of Specific Licenses and Certificates of Compliance for Dry Storage of Spent Nuclear Fuel” (Ref. 9), provides guidance for the licensing of an ISFSI and review of certificate of compliance for a dry storage system under 10 CFR Part 72.
- NUREG/CR-7108, “An Approach for Validating Actinide and Fission Product Burnup Credit Criticality Safety Analyses—Isotopic Composition Predictions” (Ref. 10), provides guidance for the review of the application of burnup credit for a spent fuel transport or storage system under 10 CFR Part 71 and 10 CFR Part 72.
- NUREG/CR-7109, “An Approach for Validating Actinide and Fission Product Burnup Credit Criticality Safety Analyses—Criticality ( $k_{\text{eff}}$ ) Predictions” (Ref. 11), provides guidance for the review of the application of burnup credit for a spent fuel transport or storage system under 10 CFR Part 71 and 10 CFR Part 72.

### **Purpose of Regulatory Guides**

The NRC issues RGs to describe to the public methods that the staff considers acceptable for use in implementing specific parts of the agency’s regulations, to explain techniques that the staff uses in evaluating specific problems or postulated events, and to provide guidance to applicants. Regulatory

guides are not substitutes for regulations and compliance with them is not required. Methods and solutions that differ from those set forth in regulatory guides will be deemed acceptable if they provide a basis for the findings required for the issuance or continuance of a permit or license by the Commission.

### **Paperwork Reduction Act<sup>1</sup>**

This RG contains voluntary information collections covered by 10 CFR Parts 70, 71, and Part 72 that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et. seq.). These information collections were approved by the Office of Management and Budget (OMB), under control numbers 3150-0009, 3150-0008, and 3150-0132 respectively.

### **Public Protection Notification**

The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

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<sup>1</sup> Send comments regarding this information collection to the Information Services Branch, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to [Infocollects.Resource@nrc.gov](mailto:Infocollects.Resource@nrc.gov), and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0011, 3150-0151) Office of Management and Budget, Washington, DC 20503

## **B. DISCUSSION**

### **Reason for Revision**

This revision of the guide (Revision 3) endorses the most recent revision of the American National Standards Institute/American Nuclear Society Subcommittee-8 standards (ANSI/ANS-8) listed in Regulatory Position C.1 to this guide. In addition, the scope of this revision is expanded beyond 10 CFR Part 70 fuel facilities to include transportation and storage facilities under 10 CFR Part 71 and 10 CFR Part 72, because many of the standards are based on broad principles that are not limited solely to fuel processing facilities. The staff has not evaluated the applicability to reactor facilities licensed under 10 CFR Part 50 because these facilities have cores that are designed to operate at criticality, and the facilities have existing regulatory requirements that address criticality safety. This revision also endorses International Organization for Standardization (ISO) Standard 7753:1987, “Nuclear Energy—Performance and Testing Requirements for Criticality Detection and Alarm Systems” (Ref. 12).

### **Background**

The NRC initially issued RG 3.71 in 1998; it was revised in 2005 and again in 2010. The three previous versions of RG 3.71 endorsed specific safety standards developed by ANSI/ANS to provide guidance, criteria, and best practices for use in preventing and mitigating criticality accidents during operations that involve handling, processing, storing, or transporting special nuclear material at fuel and material facilities (or a combination of these activities). The 1998 version also consolidated and replaced a number of earlier NRC RGs, thereby incorporating all of the relevant guidance at that time into a single document. ANSI/ANS Consensus Committee N16 on nuclear criticality safety developed the ANSI/ANS-8 standards that are endorsed in Regulatory Position C.1 of this RG. Each ANSI/ANS-8 standard has been developed by a working group of expert practitioners in this area and is reviewed every 5 to 10 years to ensure that the standard can be revised, reaffirmed, or withdrawn, as appropriate, to reflect up-to-date information. New standards are also added when the need arises.

Consequently, the NRC staff issued Revision 3 of this guide to provide guidance on changes that have occurred since the last revision of RG 3.71 in 2010, and to endorse several ANSI/ANS-8 nuclear criticality safety standards that have been added, reaffirmed, or revised. Because the ANSI/ANS-8 and ISO standards are constantly being issued, revised, reaffirmed, or withdrawn, the NRC staff plans to revise this guide on a regular basis.

The ANSI/ANS-8 nuclear criticality safety standards and those developed by ISO provide criteria and practices that the NRC staff considers generally acceptable for use in preventing and mitigating nuclear criticality accidents. However, use of the nuclear criticality safety standards is not a substitute for detailed nuclear criticality safety analyses for specific operations.

### **Harmonization with International Standards**

The NRC has a goal of harmonizing its guidance with international standards to the extent practical. The International Atomic Energy Agency (IAEA) and ISO have established a series of safety guides and standards that address good practices for nuclear criticality safety at nuclear fuel cycle facilities and spent fuel transportation and storage. These documents include IAEA Safety Standard No. SF-1, “Fundamental Safety Principles” (Ref. 13); IAEA Safety Requirement NS-R-5, “Safety of Nuclear Fuel Cycle Facilities” (Ref. 14); IAEA Specific Safety Guide (SSG)-27, “Criticality Safety in the Handling of Fissile Material” (Ref. 15); and IAEA SSG-15, “Storage of Spent Nuclear Fuel” (Ref. 16).

This RG incorporates similar concepts and is consistent with the basic safety principles provided in these guides and the standards listed below.

The ISO Technical Committee 85, Subcommittee 5, Working Group 8 (TC85/SC5/WG8) on nuclear criticality safety produced the following additional valuable criticality standards:

- ISO 1709:1995, “Nuclear Energy—Fissile Materials—Principles of Criticality Safety in Storing, Handling, and Processing” (Ref. 17);
- ISO 7753:1987, “Nuclear Energy—Performance and Testing Requirements for Criticality Detection and Alarm Systems” (Ref. 12);
- ISO 11311:2011, “Nuclear Criticality Safety—Critical Values for Homogeneous Plutonium-Uranium Oxide Fuel Mixtures Outside of Reactors” (Ref. 18);
- ISO 11320:2011, “Nuclear Criticality Safety—Emergency Preparedness and Response” (Ref. 19);
- ISO 14943:2004, “Nuclear Fuel Technology—Administrative Criteria Related to Nuclear Criticality Safety” (Ref. 20);
- ISO 16117:2013, “Nuclear Criticality Safety—Estimation of the Number of Fissions of a Postulated Criticality Accident” (Ref. 21);
- ISO 27467:2009, “Nuclear Criticality Safety—Analysis of a Postulated Criticality Accident” (Ref. 22); and
- ISO 27468:2011, “Nuclear Criticality Safety—Evaluation of Systems Containing PWR [pressurized water reactor] UOX [uranium oxide (e.g., uranium dioxide, uranium trioxide, triuranium octoxide)] Fuels—Bounding Burnup Credit Approach” (Ref. 23).

### **Documents Discussed in Staff Regulatory Guidance**

This RG endorses the use of one or more codes or standards developed by external organizations and other third party guidance documents. These codes, standards, and third party guidance documents may contain references to other codes, standards, or other third party guidance documents (“secondary references”). If a secondary reference has itself been incorporated by reference into an NRC regulation as a requirement, then licensees and applicants must comply with that standard as set forth in the regulation. If the secondary reference has been endorsed in an RG as an acceptable approach for meeting an NRC requirement, then the standard constitutes a method acceptable to the NRC staff for meeting that regulatory requirement as described in the specific RG. If the secondary reference has neither been incorporated by reference into NRC regulations nor endorsed in an RG, then the secondary reference is neither a legally-binding requirement nor a “generic” NRC-approved acceptable approach for meeting an NRC requirement. However, licensees and applicants may consider and use the information in the secondary reference, if appropriately justified, consistent with current regulatory practice, and consistent with applicable NRC requirements.

## C. STAFF REGULATORY POSITION

This section endorses, or endorses with clarifications or exceptions, standards that describe methods, approaches, or data that the staff considers acceptable for meeting the requirements of the regulations cited in the Introduction to this guide. As used within the body of these standards, the term “shall” in a standard denotes a requirement of the standard, the word “should” denotes a recommendation, and the word “may” denotes permission (neither a requirement nor a recommendation). When a licensee or applicant commits to a standard cited in this RG in full, the licensee or applicant commits to perform all operations in accordance with the requirements of that standard, but not necessarily with the standard’s recommendations. Applicants, licensees, or certificate holders may follow the recommendations given in the standards, unless an exception is stated in this RG, or may use other acceptable methods.

### 1. Nuclear Criticality Standards Endorsed by the NRC

The NRC endorses the following ANSI/ANS-8 and ISO nuclear criticality safety standards without exception:

- a. ANSI/ANS-8.5-1996 (Reaffirmed 2012), “Use of Borosilicate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Material” (Ref. 24);
- b. ANSI/ANS-8.6-1983 (Reaffirmed 2010), “Safety in Conducting Subcritical Neutron-Multiplication Measurements In Situ” (Ref. 25);
- c. ANSI/ANS-8.7-1998 (Reaffirmed 2012), “Nuclear Criticality Safety in the Storage of Fissile Materials” (Ref. 26);
- d. ANSI/ANS-8.12-1987 (Reaffirmed 2011), “Nuclear Criticality Control and Safety of Plutonium-Uranium Fuel Mixtures Outside Reactors” (Ref. 27);
- e. ANSI/ANS-8.14-2004 (Reaffirmed 2011), “Use of Soluble Neutron Absorbers in Nuclear Facilities Outside Reactors” (Ref. 28);
- f. ANSI/ANS-8.15-2014, “Nuclear Criticality Control of Special Actinide Elements,” (Ref. 29);
- g. ANSI/ANS-8.19-2014, “Administrative Practices for Nuclear Criticality Safety,” (Ref. 30);
- h. ANSI/ANS-8.20-1991 (Reaffirmed 2005), “Nuclear Criticality Safety Training” (Ref. 31);
- i. ANSI/ANS-8.21-1995 (Reaffirmed 2011), “Use of Fixed Neutron Absorbers in Nuclear Facilities Outside Reactors” (Ref. 32);
- j. ANSI/ANS-8.22-1997 (Reaffirmed 2011), “Nuclear Criticality Safety Based on Limiting and Controlling Moderators” (Ref. 33); and
- k. ANSI/ANS-8.26-2007 (Reaffirmed 2012), “Criticality Safety Engineer Training and Qualification Program” (Ref. 34).

## 2. Nuclear Criticality Standards Endorsed by the NRC with Clarifications or Exceptions

The NRC endorses the following ANSI/ANS-8 and ISO nuclear criticality safety standards with the following clarifications or exceptions:

**a. ANSI/ANS-8.1-2014, “Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors” (Ref. 35)**

ANSI/ANS-8.1, Table 1, “Single parameter subcritical limits for uniform aqueous solutions of fissile nuclides,” contains an error in the  $^{239}\text{Pu}(\text{NO}_3)_4$  fissile concentration limit. Licensees or applicants wishing to use a fissile concentration limit for  $^{239}\text{Pu}(\text{NO}_3)_4$  should calculate it using the methodology approved in their license applications.

**b. ANSI/ANS-8.3-1997 (Reaffirmed 2012), “Criticality Accident Alarm System” (Ref. 36)**

Section 4.2.1 of the standard requires an evaluation of the need for a criticality alarm system in each area where threshold quantities of special nuclear material are handled, used, or stored. An exception is that 10 CFR 70.24, “Criticality Accident Requirements,” takes precedence and requires a criticality alarm system in each area where threshold quantities of special nuclear material are handled, used, or stored.

Section 4.2.2 of the standard states that a criticality alarm system is not required in areas where personnel would be subject to an excessive radiation dose (defined as greater than 0.12 gray (Gy) (12 rad) in free air). A clarification is that 10 CFR 70.24 requires placement of detectors in areas where threshold quantities of special nuclear material are present, but that audible or visual alarms may be located in areas where immediate evacuation is determined to be necessary based on the potential for an excessive dose.

Section 4.4.1 of the standard permits coverage by a single reliable detector for each area monitored. An exception is that 10 CFR 70.24 takes precedence and requires that two criticality detectors cover each monitored area.

Section 5.6 of the standard states that the minimum accident of concern may be assumed to deliver an absorbed dose in free air of 0.20 Gy (20 rad) in 1 minute at 2 meters from the reacting material, or otherwise justified. An exception is that 10 CFR 70.24 requires that a monitoring system be capable of detecting a nuclear criticality that produces an absorbed dose in soft tissue of 0.20 Gy (20 rad) of combined neutron and gamma radiation in 1 minute at an unshielded distance of 2 meters from the reacting material. The detection threshold in 10 CFR 70.24 takes precedence.

Section 5.5 of the standard requires that the system be designed to produce a criticality alarm signal within 0.5 seconds of detector recognition of a criticality accident. A clarification is that the specific timing is not important if the delay between detection and alarm is effectively instantaneous relative to the time it takes a person to respond and evacuate.

**c. ANSI/ANS-8.10-2015, “Criteria for Nuclear Criticality Safety Controls in Operations With Shielding and Confinement” (Ref. 37)**

Section 4.1 of the standard states that the provisions of the standard may be applied in facilities where operations are conducted remotely by persons located outside the shielded area and where shielding and confinement are adequate to meet the radiation dose limits of the standard. A clarification is that the provisions of the standard may be applied in any areas satisfying those conditions (i.e., may be applied on a per-area rather than per-facility basis).

Section 4.2.1 of the standard states that, to apply the provisions of the standard, shielding and confinement should be such that the total effective dose to any individual outside the shielded and confined area will not exceed 100 millisievert (mSv) (10 rem), and that the total effective dose to an individual outside the restricted area will not exceed 0.5 rem. A clarification is that, whereas the radiation dose limits in Section 4.2.1 of the standard are more conservative than those in the performance requirements of 10 CFR 70.61, “Performance Requirements,” the provisions of the standard are applicable wherever the dose is less than the lower limit for an intermediate consequence event in 10 CFR 70.61(c), which the regulation defines as a dose to workers of less than 0.25 sievert (Sv) (25 rem) outside the shielded and confined area, or less than 50 mSv (5 rem) to an individual outside the controlled area.

**d. ANSI/ANS-8.17-2004 (Reaffirmed 2009), “Criticality Safety Criteria for the Handling, Storage, and Transportation of LWR Fuel Outside Reactors” (Ref. 38)**

Section 4.10 of the standard states that credit may be taken for fuel burnup in establishing fuel unit reactivity; assurance may be provided by measurement or by an analysis and verification of the exposure history of the fuel. An exception is that licensees and applicants may take credit for fuel burnup only when the amount of burnup is confirmed by physical measurements that are appropriate for each type of fuel assembly in the environment in which it is to be stored. Alternatively, licensees and applicants may perform a misload analysis, along with additional administrative loading procedures to reduce the likelihood of a misload, in lieu of a quantitative measurement.

**e. ANSI/ANS-8.23-2007 (Reaffirmed 2012), “Nuclear Criticality Accident Emergency Planning and Response” (Ref. 39)**

Section 4.1(9) of the standard requires provision for nuclear accident dosimeters meeting ANSI N13.3-1969 (Reaffirmed 1981), “Dosimetry for Criticality Accidents.” A clarification is that nuclear accident dosimeters may be used that do not necessarily comply with ANSI N13.3-1969 (R1981). This RG does not endorse that secondary reference. In addition, ANSI N13.3 was revised in 2013, so this references an obsolete version of the standard.

**f. ANSI/ANS-8.24-2007 (Reaffirmed 2012), “Validation of Neutron Transport Methods for Nuclear Criticality Safety Calculations” (Ref. 40)**

Section 4.1 of the standard requires that verification of the computer code system be completed prior to validation. A clarification is that provision should be made for routine (e.g., annual) reverification, and not merely before validation.



Section 6.1.2 of the standard requires that if a positive bias (i.e., overestimation of the effective neutron multiplication factor,  $k_{\text{eff}}$ ) is used in determining calculational margin, its use shall be justified based on an understanding of its cause. A clarification is that a positive bias should not generally be used in determining calculational margin. The NRC has not historically allowed any credit for positive bias, as the use of such a bias takes credit for errors in calculating benchmark cases that may or may not be present in actual facility calculations. The NRC may choose to evaluate the use of such a positive bias on a case-by-case basis.

Section 6.3.2 of the standard requires that rejection of outliers be based on inconsistency of the data with known physical behavior or on established statistical rejection methods. An exception is that the rejection of outliers should be based only on the inconsistency of the data with known physical behavior rather than on statistical methods. In general, if one data point in an experimental benchmark set is excluded, the entire benchmark set should be excluded. However, statistical methods may be used to identify potential outliers for further evaluation. The rejection of outliers, without a physical basis for doing so, may lead to a failure to consider all available information on possible contributions to the bias.

g. **ANSI/ANS-8.27-2015, “Burnup Credit for LWR Fuel” (Ref. 41)**

Section 5.2 of the standard allows use of a combined validation approach. An exception is that a combined validation approach should not be used without addressing several key differences between benchmark data for combined validation approaches and spent nuclear fuel storage and transportation systems. Existing benchmark data for combined validation approaches consist of data from power reactors, which have significant physical differences from spent nuclear fuel storage and transportation systems.

One significant difference is fuel temperature, which will be significantly higher for spent fuel in a reactor compared to spent fuel in a storage or transportation system. Another significant difference is that the axial neutron flux distribution in a reactor is near the center of the fuel, whereas most of the neutron flux in a storage or transportation system will be in the top of the fuel, which may affect the neutron energy spectrum. Additional physical differences between power reactors and spent fuel storage and transportation systems include fresh water in the storage or transportation system versus borated water in the reactor (for PWRs), high-worth neutron absorber plates in storage and transportation systems versus none in a reactor, and full-density water in storage and transportation systems versus low-density water in a reactor. All of these parameters significantly affect neutron energy spectrum, and their effects on code bias and bias uncertainty need to be accounted for in a combined validation approach.

Section 7.2 of the standard allows assigned fuel burnup to be obtained by measurement or records of the nuclear facility. An exception is that licensees and applicants may take credit for fuel burnup only when the amount of burnup is confirmed by physical measurements that are appropriate for each type of fuel assembly in the environment in which it is to be stored. Alternatively, licensees and applicants may perform a misload analysis, along with additional administrative loading procedures to reduce the likelihood of a misload, in lieu of a quantitative measurement.

h. **ISO 7753:1987, “Nuclear Energy – Performance and Testing Requirements for Criticality Detection and Alarm Systems First Edition” (Ref. 12)**

Section 3.2.1 of the standard requires an evaluation of the need for a criticality alarm system in each area with threshold quantities of fissile nuclides, and Section 3.1 states that alarms shall be provided in areas where they will reduce total risk. An exception is that 10 CFR 70.24 takes precedence, and requires a criticality alarm system in each area where threshold quantities of special nuclear material are handled, used, or stored.

Section 3.2.1 of the standard also requires that attention be given to moderators or reflectors that are more effective than water. A clarification is that 10 CFR 70.24 requires that the threshold quantities be halved where graphite, heavy water, or beryllium are present.

Section 3.2.2 of the standard states that a criticality alarm system is not required in areas where the maximum foreseeable dose in free air is less than 0.12 Gy (12 rad). A clarification is that 10 CFR 70.24 requires placement of detectors in areas where threshold quantities of special nuclear material are present, but that audible or visual alarms may be located in areas where immediate evacuation is determined to be necessary based on the potential for an excessive dose.

Section 3.5.1 of the standard permits coverage by a single reliable detector for each area monitored. An exception is that 10 CFR 70.24 takes precedence and requires that two criticality detectors cover each monitored area.

Section 4.2 of the standard states that the minimum accident of concern may be assumed to deliver an absorbed dose in free air of 0.20 Gy (20 rad) in 1 minute at 2 meters from the reacting material. An exception is that 10 CFR 70.24 requires that a monitoring system be capable of detecting a nuclear criticality that produces an absorbed dose in soft tissue of 0.20 Gy (20 rad) of combined neutron and gamma radiation in 1 minute at an unshielded distance of 2 meters from the reacting material. The detection threshold in 10 CFR 70.24 takes precedence.

## D. IMPLEMENTATION

The purpose of this section is to provide information on how applicants and licensees under 10 CFR Part 70, 10 CFR Part 71, and 10 CFR Part 72 may use this guide and information regarding the NRC's plans for using this regulatory guide. In addition, it describes how the NRC staff complies with the backfitting provisions in 10 CFR 70.76, "Backfitting," and 10 CFR 72.62, "Backfitting."

### Use by Applicants and Licensees

Applicants and licensees may voluntarily<sup>2</sup> use the guidance in this document to demonstrate compliance with the underlying NRC regulations. Methods or solutions that differ from those described in this regulatory guide may be deemed acceptable if they provide sufficient basis and information for the NRC staff to verify that the proposed alternative demonstrates compliance with the appropriate NRC regulations. Current licensees may continue to use guidance the NRC found acceptable for complying with the identified regulations as long as their current licensing basis remains unchanged.

Licensees may use the information in this regulatory guide for actions that do not require NRC review and approval such as changes to a facility design under 10 CFR 70.72 or 10 CFR 72.48. Licensees may use the information in this regulatory guide or applicable parts to resolve regulatory or inspection issues.

### Use by NRC Staff

The NRC staff does not intend or approve any imposition or backfitting of the guidance in this regulatory guide. The NRC staff does not expect any existing licensee to use or commit to using the guidance in this regulatory guide, unless the licensee makes a change to its licensing basis. The NRC staff does not expect or plan to request licensees to voluntarily adopt this regulatory guide to resolve a generic regulatory issue. The NRC staff does not expect or plan to initiate NRC regulatory action which would require the use of this regulatory guide. Examples of such unplanned NRC regulatory actions include issuance of an order requiring the use of the regulatory guide, generic communication, or promulgation of a rule requiring the use of this regulatory guide without further backfit consideration.

During facility-specific regulatory discussions, the staff may discuss with licensees various actions consistent with staff positions in this regulatory guide, as one acceptable means of meeting the underlying NRC regulatory requirement. Such discussions would not ordinarily be considered backfitting even if prior versions of this regulatory guide are part of the licensing basis of the facility. However, unless this regulatory guide is part of the licensing basis for a facility, the staff may not represent to the licensee that the licensee's failure to comply with the positions in this regulatory guide constitutes a violation.

If an existing licensee voluntarily seeks a license amendment or change and (1) the NRC staff's consideration of the request involves a regulatory issue directly relevant to this regulatory guide and (2) the specific subject matter of this regulatory guide is an essential consideration in the staff's determination of the acceptability of the licensee's request, then the staff may request that the licensee either follow the guidance in this regulatory guide or provide an equivalent alternative process that demonstrates compliance with the underlying NRC regulatory requirements. This is not considered backfitting as defined in 10 CFR 70.76 or 10 CFR 72.62.

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<sup>2</sup> In this section, "voluntary" and "voluntarily" means that the licensee is seeking the action of its own accord, without the force of a legally binding requirement or an NRC representation of further licensing or enforcement action.

Additionally, an existing applicant may be required to comply to new rules, orders, or guidance if 10 CFR 70.76(a)(3) or 10 CFR 72.62(c) applies.

If a licensee believes that the NRC is either using this regulatory guide or requesting or requiring the licensee to implement the methods or processes in this regulatory guide in a manner inconsistent with the discussion in this Implementation section, then the licensee may file a backfit appeal with the NRC in accordance with the guidance in NUREG-1409, "Backfitting Guidelines," (Ref. 42) and the NRC Management Directive 8.4, "Management of Facility-Specific Backfitting and Information Collection" (Ref. 43).

## REFERENCES<sup>3</sup>

1. *U.S. Code of Federal Regulations* (CFR), “Domestic Licensing of Special Nuclear Material,” Part 70, Chapter 1, Title 10, “Energy.”
2. CFR, “Packaging and Transportation of Radioactive Material,” Part 71, Chapter 1, Title 10, “Energy.”
3. CFR, “Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste,” Part 72, Chapter 1, Title 10, “Energy.”
4. U.S. Nuclear Regulatory Commission (NRC), NUREG-1520, “Standard Review Plan for Fuel Cycle Facilities License Applications,” Revision 2, Washington, DC, June 2015.
5. NRC, NUREG-1718, “Standard Review Plan for the Review of an Application for a Mixed Oxide (MOX) Fuel Fabrication Facility,” Washington, DC, August 2000.
6. NRC, NUREG-1536, “Standard Review Plan for Dry Cask Storage Systems,” Revision 1, Washington, DC, July 2010.
7. NRC, NUREG-1567, “Standard Review Plan for Spent Dry Fuel Storage Facilities,” Washington, DC, March 2000.
8. NRC, NUREG-1617, “Standard Review Plan for Transportation Packages for MOX Spent Nuclear Fuel,” Supplement 1, Washington, DC, September 2005.
9. NRC, NUREG-1927, “Standard Review Plan for Renewal of Specific Licenses and Certificates of Compliance for Dry Storage of Spent Nuclear Fuel,” Revision 1, Washington, DC, June 2016.
10. NRC, NUREG/CR-7108, “An Approach for Validating Actinide and Fission Product Burnup Credit Criticality Safety Analyses—Isotopic Composition Predictions,” Washington, DC, April 2012.
11. NRC, NUREG/CR-7109, “An Approach for Validating Actinide and Fission Product Burnup Credit Criticality Safety Analyses—Criticality ( $k_{\text{eff}}$ ) Predictions,” Washington, DC, April 2012.
12. International Organization for Standardization (ISO) 7753:1987, “Nuclear Energy—Performance and Testing Requirements for Criticality Detection and Alarm Systems First Edition,” Geneva, Switzerland, 1987.<sup>4</sup>

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<sup>3</sup> Publicly available NRC documents are available electronically through the NRC Library on the NRC’s public Web site at <http://www.nrc.gov/reading-rm/doc-collections/> and through the NRC’s Agencywide Documents Access and Management System (ADAMS) at <http://www.nrc.gov/reading-rm/adams.html>. The documents can also be viewed online for free or printed for a fee in the NRC’s Public Document Room (PDR) at 11555 Rockville Pike, Rockville, MD. For problems with ADAMS, contact the PDR staff at 301-415-4737 or (800) 397-4209; fax (301) 415-3548; or e-mail [pdresource@nrc.gov](mailto:pdresource@nrc.gov).

<sup>4</sup> Copies of International Organization for Standardization (ISO) standards may be purchased from the ISO Web site at <http://www.iso.org>; by writing to International Organization for Standardization, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland; or by telephone +41 22 749 01 11.

13. International Atomic Energy Agency (IAEA), Safety Standard No. SF-1, “Fundamental Safety Principles,” Vienna, Austria.<sup>5</sup>
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<sup>5</sup> Copies of International Atomic Energy Agency (IAEA) documents may be obtained through its Web site at <http://www.iaea.org> or by writing to the International Atomic Energy Agency, P.O. Box 100 Wagramer Strasse 5, A-1400 Vienna, Austria or by telephone (+431) 2600-0; fax (+431) 2600-7; or e-mail [Official.Mail@IAEA.org](mailto:Official.Mail@IAEA.org).

<sup>6</sup> Copies of American National Standards Institute (ANSI)/American Nuclear Society (ANS) standards may be purchased from the ANS Web site at <http://www.new.ans.org/store/>; by writing to American Nuclear Society, 555 North Kensington Avenue, La Grange Park, IL 60526; or by telephone 800-323-3044.

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