



# REGULATORY GUIDE

## OFFICE OF NUCLEAR REGULATORY RESEARCH

### REGULATORY GUIDE 3.1 (Task CE 602-4)

## USE OF BOROSILICATE-GLASS RASCHIG RINGS AS A NEUTRON ABSORBER IN SOLUTIONS OF FISSILE MATERIAL

### A. INTRODUCTION

Section 70.22, "Contents of Applications," of 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material," requires that applications for a specific license to own, acquire, deliver, receive, possess, use, or transfer special nuclear material contain proposed procedures to avoid accidental conditions of criticality. Procedures for this purpose include incorporating neutron-absorbing material such as boron in process equipment. This regulatory guide provides guidance for complying with this portion of the Commission's regulations by describing procedures acceptable to the NRC staff for the prevention of criticality accidents by use of borosilicate-glass raschig rings as a neutron absorber in solutions of fissile material.

Any information collection activities mentioned in this regulatory guide are contained as requirements in 10 CFR Part 70, which provides the regulatory basis for this guide. The information collection requirements in 10 CFR Part 70 have been cleared under OMB Clearance No. 3150-0009.

### B. DISCUSSION

ANSI/ANS-8.5-1986, "Use of Borosilicate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Material,"<sup>1</sup> is a revision of ANSI/ANS-8.5-1979 and was prepared by Subcommittee 8, Fissionable Materials Outside Reactors, of the Standards Committee of the American Nuclear Society. ANSI/ANS-8.5-1986 was approved by the American National Standards Committee N16, Nuclear Criticality Safety, in 1985 and by the American National Standards Institute (ANSI) on January 3, 1986.

<sup>1</sup>Copies may be obtained from the American Nuclear Society, 555 North Kensington Avenue, La Grange Park, Illinois 60525.

ANSI/ANS-8.5-1986 provides guidance on the use of borosilicate-glass raschig rings as a neutron absorber in solutions of fissile material. The standard applies to the use of borosilicate-glass raschig rings for primary and for secondary criticality control in solutions containing  $^{235}\text{U}$ ,  $^{239}\text{Pu}$ , and  $^{233}\text{U}$ . The chemical and physical environment, properties of the rings and packed vessels, maintenance inspection procedures, and criticality operating limits are specified in the standard.

Maximum permissible concentrations of homogeneous solutions of plutonium or of uranium in vessels of unlimited size packed with borosilicate-glass raschig rings are specified in the standard. The concentration of these solutions is expressed as the mass of plutonium or of uranium per unit volume. The density of hydrogen in any solution cannot be less than 75 g/liter nor greater than 115 g/liter. Limitations on the relative abundance of the various isotopes of plutonium are imposed in the specifications applicable to plutonium solutions. The concentrations specified for uranium enriched in  $^{235}\text{U}$  apply regardless of the  $^{235}\text{U}$  enrichment content but with a limitation on the  $^{233}\text{U}$  content. For solutions of uranium containing up to 5.0 wt-%  $^{235}\text{U}$  and up to 0.01 wt-%  $^{233}\text{U}$  (see Table 1<sup>2</sup> on page 8 of the standard), the maximum permissible solution concentration is unrestricted. The concentrations specified for solutions of  $^{233}\text{U}$  also apply to mixtures of  $^{233}\text{U}$  and other uranium isotopes.

### C. REGULATORY POSITION

The guidance contained in ANSI/ANS-8.5-1986 for the use of borosilicate-glass raschig rings as a neutron absorber in solutions of fissile material provides a procedure

<sup>2</sup>Note that in Table 1 (3, 4) on page 8 of the standard,  $^{241}\text{Pu} > ^{241}\text{Pu}$  should read  $^{240}\text{Pu} > ^{241}\text{Pu}$ .

#### USNRC REGULATORY GUIDES

Regulatory Guides are issued to describe and make available to the public methods acceptable to the NRC staff of implementing specific parts of the Commission's regulations, to delineate techniques used by the staff in evaluating specific problems or postulated accidents, or to provide guidance to applicants. Regulatory Guides are not substitutes for regulations, and compliance with them is not required. Methods and solutions different from those set out in the guides will be acceptable if they provide a basis for the findings requisite to the issuance or continuance of a permit or license by the Commission.

This guide was issued after consideration of comments received from the public. Comments and suggestions for improvements in these guides are encouraged at all times, and guides will be revised, as appropriate, to accommodate comments and to reflect new information or experience.

Written comments may be submitted to the Rules and Procedures Branch, DRR, ADM, U.S. Nuclear Regulatory Commission, Washington, DC 20555.

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generally acceptable to the NRC staff for the prevention of accidental conditions of criticality.

Section 8.0 of ANSI/ANS-8.5-1986 lists additional documents referred to in the standard. The specific applicability or acceptability of these listed documents will be covered separately in other regulatory guides, where appropriate.

#### **D. IMPLEMENTATION**

The purpose of this section is to provide information to applicants regarding the NRC staff's plan for using this regulatory guide.

The methods described in this guide were applied in a number of specific cases during reviews and selected licensing actions. These methods reflect the latest general NRC approach to criticality safety in operations involving use of borosilicate-glass raschig rings as a neutron absorber in solutions of fissile material. Therefore, except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the methods described in this guide will be used in the evaluation of submittals in connection with license applications submitted under 10 CFR Part 70.

## VALUE/IMPACT STATEMENT

A draft value/impact statement was published with the proposed Revision 2 to Regulatory Guide 3.1 (Task CE 602-4) when the draft guide was published for public comment in March 1987. No changes were necessary, so a separate value/impact statement for the final

guide has not been prepared. A copy of the draft value/impact statement is available for inspection and copying for a fee at the Commission's Public Document Room at 1717 H Street NW., Washington, DC, under Task CE 602-4.

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