



# REGULATORY GUIDE

OFFICE OF NUCLEAR REGULATORY RESEARCH

## REGULATORY GUIDE 3.1

(Task FP 027-5)

## 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.

### B. DISCUSSION

ANSI/ANS 8.5-1979, "Use of Borosilicate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Material,"<sup>1</sup> is a revision of ANSI N16.4-1971 and was prepared by Subcommittee 8, Fissionable Materials Outside Reactors, of the Standards Committee of the American Nuclear Society. ANSI/ANS 8.5-1979 was approved by the American National Standards Committee N16, Nuclear Criticality Safety, in early 1979 and by the American National Standards Institute (ANSI) on October 9, 1979.

ANSI/ANS 8.5-1979 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 but with a limitation on the  $^{233}\text{U}$  content. For solutions of uranium containing up to 5.0 wt-%  $^{235}\text{U}$  and no  $^{233}\text{U}$ , the limitations are expressed as mass of  $^{235}\text{U}$  per unit volume. The concentrations specified for solutions of  $^{233}\text{U}$  also apply to mixtures of  $^{233}\text{U}$  and other uranium isotopes provided the  $^{233}\text{U}$  content is greater than 1 wt-% of all the uranium.

### C. REGULATORY POSITION

The guidance contained in ANSI/ANS 8.5-1979 for the use of borosilicate-glass raschig rings as a neutron absorber in solutions of fissile material provides a procedure generally acceptable to the NRC staff for the prevention of accidental conditions of criticality.

Section 8.0 of ANSI/ANS 8.5-1979 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.

\* Lines indicate substantive changes from previous issue.

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

#### 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.

Comments should be sent to the Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Docketing and Service Branch.

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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 herein will be used after the issuance of this guide in the evaluation of submittals in connection with license applications submitted under 10 CFR Part 70.

#### VALUE/IMPACT STATEMENT

The NRC staff performed a value/impact assessment to determine the proper procedural approach for updating Regulatory Guide 3.1, "Use of Borosilicate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Material," dated January 1973, which endorsed ANSI Standard N16.4-1971. The NRC staff has been involved in the development, review, and approval of a revision to ANSI N16.4-1971 (designated ANSI/ANS 8.5-1979), which was approved by the American National Standards Institute on October 9, 1979. The assessment resulted in a decision to develop a revision to Regulatory Guide 3.1 that would

endorse, with possible supplemental provisions, ANSI/ANS 8.5-1979. The results of this assessment were included in a draft regulatory guide on this subject that was issued for public comment in May 1981. Since no comments have been received from the public, there has been no need to change the regulatory position of the proposed revision to Regulatory Guide 3.1. A copy of the draft regulatory guide and the associated value/impact statement (identified by its task number, FP 027-5) is available for inspection and copying for a fee at the Commission's Public Document Room at 1717 H Street NW., Washington, D.C.

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