



# REGULATORY GUIDE

OFFICE OF NUCLEAR REGULATORY RESEARCH

## REGULATORY GUIDE 3.47 (Task FP 026-5)

### NUCLEAR CRITICALITY CONTROL AND SAFETY OF HOMOGENEOUS PLUTONIUM-URANIUM FUEL MIXTURES OUTSIDE REACTORS

#### 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, among other things, proposed procedures to avoid accidental conditions of criticality. 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 in operations involving homogeneous plutonium-uranium fuel mixtures outside reactors.

#### B. DISCUSSION

ANSI/ANS 8.12-1978, "Nuclear Criticality Control and Safety of Homogeneous Plutonium-Uranium Fuel Mixtures Outside Reactors,"<sup>1</sup> was prepared by Subcommittee 8, Fissionable Materials Outside Reactors, of the Standards Committee of the American Nuclear Society. ANSI/ANS 8.12-1978 was approved by the American National Standards Committee N16, Nuclear Criticality Safety, in 1977 and subsequently by the American National Standards Institute (ANSI) on July 17, 1978.

ANSI/ANS 8.12-1978 provides guidance for the prevention of criticality accidents in operations with homogeneous plutonium-uranium fuel mixtures outside reactors. The standard applies to operations involving homogeneous plutonium-uranium fuel mixtures containing no more than 30 wt-% plutonium combined with uranium containing no more than 0.71 wt-% U-235. The standard presents tabulated subcritical limits and graphs for uniform aqueous mixtures of the oxides of plutonium and natural uranium, tabulated subcritical mass limits for single units of homogeneously mixed oxides of plutonium and natural uranium at low

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

moderation, and tabulated subcritical concentration limits for plutonium in homogeneous mixtures of plutonium and natural uranium of unlimited mass. Caution in the use of the subcritical limits in the standard is advised in establishing process specifications since the subcritical limits do not contain margins for contingencies such as double batching or inaccuracy of analytical techniques. The limits of the standard are not applicable to heterogeneous systems. Also, the standard does not include the details of administrative controls, the design of processes or equipment, the description of instrumentation for process control, or detailed criteria to be met in transporting fissionable materials.

#### C. REGULATORY POSITION

The maximum subcritical limits for operations involving homogeneous mixtures of plutonium and uranium outside reactors contained in ANSI/ANS 8.12-1978 are acceptable to the NRC staff when all conditions of ANSI/ANS 8.12-1978 are satisfied.

Section 6 of ANSI/ANS 8.12-1978 lists additional documents referred to in the standard. The specific applicability or acceptability of two of these listed documents has been addressed in the latest version of the regulatory guides identified below:

Standard <sup>1</sup>	Regulatory Guide
ANSI N16.1-1975	3.4 - Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors
ANSI N16.9-1975	3.41 - Validation of Calculational Methods for Nuclear Criticality Safety

#### 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.

The guides are issued in the following ten broad divisions:

1. Power Reactors
2. Research and Test Reactors
3. Fuels and Materials Facilities
4. Environmental and Siting
5. Materials and Plant Protection
6. Products
7. Transportation
8. Occupational Health
9. Antitrust and Financial Review
10. General

Copies of issued guides may be purchased at the current Government Printing Office price. A subscription service for future guides in specific divisions is available through the Government Printing Office. Information on the subscription service and current GPO prices may be obtained by writing the U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Publications Sales Manager.

#### D. IMPLEMENTATION

The purpose of this section is to provide information to applicants regarding the NRC staff's plans 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 homogeneous plutonium-uranium fuel mixtures outside reactors. 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 method described herein will be used after the issuance of this guide in the evaluation of submittals for license applications submitted pursuant to 10 CFR Part 70.

#### VALUE/IMPACT STATEMENT

The NRC staff performed a value/impact assessment to determine the proper procedural approach for providing guidance on the prevention of criticality accidents in operations involving homogeneous plutonium-uranium fuel mixtures outside reactors. This assessment resulted in a decision to develop a regulatory guide that would endorse ANSI/ANS 8.12-1978, "Nuclear Criticality Control and Safety of Homogeneous Plutonium-Uranium Fuel Mix-

tures Outside Reactors." The results of this assessment were included in a draft regulatory guide on this subject that was issued for public comment in December 1980. A copy of this draft guide and the associated value/impact statement (identified by its task number, FP 026-5) is available for inspection and copying for a fee at the Commission's Public Document Room at 1717 H Street NW., Washington, D.C.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1981— 341-742:1186

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

OFFICIAL BUSINESS  
PENALTY FOR PRIVATE USE, \$300

POSTAGE AND FEES PAID  
U.S. NUCLEAR REGULATORY  
COMMISSION

