ERRATUM ISSUED

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American Nuclear Society

nuclear criticality safety in operations with fissionable materials outside reactors

an American National Standard

REAFFIRMED

June 5, 2023
November 29, 2018
ANSI/ANS-8.1-2014 (R2023)

This standard has been reviewed and reaffirmed with the recognition that it may reference other standards and documents that may have been superseded or withdrawn. The requirements of this document will be met by using the version of the standards and documents referenced herein. It is the responsibility of the user to review each of the references and to determine whether the use of the original references or more recent versions is appropriate for the facility. Variations from the standards and documents referenced in this standard should be evaluated and documented.
This standard does not necessarily reflect recent industry initiatives for risk informed decision-making or a graded approach to quality assurance. Users should consider the use of these industry initiatives in the application of this standard.

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Erratum

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Nuclear Criticality Safety in Operations with Fissionable Material Outside Reactors

A typographical error was identified in footnote 5, on page 5. The reference to the sphere size in the last sentence should be “1/8-inch” instead of “108-inch.” The corrected footnote is below.

[5] In the homogeneous mixtures to which calculations of these subcritical limits were normalized, the average particle size of dry UO_3 was 60 µm [V. I. Neeley and H. E. Handler, “Measurement of Multiplication Constant for Slightly Enriched Homogeneous UO_3-Water Mixtures and Minimum Enrichment for Criticality,” HW-70310, Hanford Atomic Products Operations (Aug. 1961)]. It seems likely that the average particle size of the dihydrate of $UO_2(NO_3)_2$ was ~100 µm [V. I. Neeley, J. A. Berberet, and R. H. Masterson, “$k\infty$ of Three Weight Per Cent ^{235}U Enriched UO_3 and $UO_2(NO_3)_2$ Hydrogenous Systems,” HW-66882, Hanford Atomic Products Operations (Sep. 1961)]. Various H/U ratios in the nitrate mixtures were achieved with 1/8-in. spheres of polyethylene [S. R. Bierman and G. M. Hess, “Minimum Critical ^{235}U Enrichment of Homogeneous Uranyl Nitrate,” ORNLCDC-5, Oak Ridge Criticality Data Center (June 1968)].

ANSI/ANS-8.1-2014

American National Standard
Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors

Secretariat
American Nuclear Society

Prepared by the
American Nuclear Society
Standards Committee
Working Group ANS-8.1

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American National Standard

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Foreword

(This Foreword is not a part of American National Standard "Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors," ANSI/ANS-8.1-2014.)

This standard provides guidance for the prevention of criticality accidents in the handling, storing, processing, and transportation of fissionable material. It was first approved as American Standard N6.1-1964. A substantial revision that included the specification of subcritical limits applicable to process variables was approved as American National Standard N16.1-1969 and was affirmed, with minor revisions, as American National Standard N16.1-1975/ANS-8.1. It was subsequently supplemented by American National Standard for Validation of Calculational Methods for Nuclear Criticality Safety, ANSI N16.9-1975/ANS-8.11. The two standards were consolidated in 1983.

The subcritical limits given in the standard make no allowance for operating contingencies (e.g., double batching) or for inaccurate knowledge of process variables (e.g., concentrations, masses, and dimensions) and are "maximum subcritical limits" for the stated conditions. That is, under the stated conditions, the limits are close enough to critical to provide little incentive for attempting to justify slightly larger values, but concomitantly, they are confidently expected actually to be subcritical. The stated conditions (infinitely long cylinders, absence of neutron-absorbing vessel wall, plutonium solutions without free nitric acid, etc.) are unlikely to be approached in practice; hence, if a limit is reached, there will ordinarily be a larger margin of subcriticality than the minimal value used in its derivation. However, no account was taken of this unlikelihood in setting the limits. It is legitimate for the users of the standard, if they so choose, to make conservative adjustments in the limits to take advantage of the extent to which process conditions may deviate from stated conditions, e.g., to increase a cylinder diameter limit to take advantage of a finite height and of neutron absorption in steel walls.

The present revision of the standard is primarily intended to clarify the use and interpretation of the process analysis requirement, the double-contingency-principle recommendation, and their relationship in a new Appendix. In addition, the definitions for "parameter" and "process conditions" were added to assist with the understanding of the double-contingency recommendation. These and other minor changes were made that do not change the intent of the words in the previous revision. They represent clarification and amplification that should aid in uniform application of the standard.

This standard might reference documents and other standards that have been superseded or withdrawn at the time the standard is applied. A statement has been included in the references section that provides guidance on the use of references.

This standard does not incorporate the concepts of generating risk-informed insights, performance-based requirements, or a graded approach to quality assurance. The user is advised that one or more of these techniques could enhance the application of this standard.

The working group would like to gratefully acknowledge the contributions by Terry L. Hofer, who died prior to the publication of this revision.

This revision of American National Standard ANSI/ANS-8.1-2014 was prepared by Working Group ANS-8.1 of Subcommittee 8 of the Standards Committee of the American Nuclear Society. Working Group ANS-8.1 had the following membership at the time of the revision:

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