



# Criteria for Nuclear Criticality Safety Controls in Operations with Shielding and Confinement

An American National Standard

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**American National Standard  
Criteria for Nuclear Criticality Safety Controls  
in Operations with Shielding and Confinement**

Secretariat  
**American Nuclear Society**

Prepared by the  
**American Nuclear Society  
Standards Committee  
Working Group ANS-8.10**

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**Foreword** (This Foreword is not a part of American National Standard, “Criteria for Nuclear Criticality Safety Controls in Operations with Shielding and Confinement,” ANSI/ANS-8.10-2015.)

This standard amplifies the conditions necessary for the control of criticality in fissionable materials set forth in American National Standard “Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors,” ANSI/ANS-8.1-2014. Criteria for the prevention of criticality accidents are presented herein for facilities that provide adequate protection for personnel and the public against radiation and releases of radioactive materials resulting from accidental criticality. The radiation dose limits contained in the 1983 version of this standard were reexamined. The recommended radiation doses in Section 4.2.1 of this standard were adjusted to be consistent with Section 5.9 of ICRP 103 (2007). This standard recognizes the usefulness and protective features of shielding against radiation and confinement of radioactive materials and allows a relaxation of criticality safety criteria when shielding and confinement meet criteria specified in this standard. If personnel are located remotely from the fissionable materials, distance may serve in lieu of some or all of the shielding. In the context of this standard, the shielding and confinement properties may exist because of the radioactive material processed in normal operations, or they may be designed into the facility expressly to protect against the effects of criticality accidents.

This standard was initiated as the result of a survey conducted in September 1968 to establish the need for and the feasibility of such a standard. A working group was appointed by Subcommittee 8 of the Standards Committee of the American Nuclear Society in November 1968, and the first draft was submitted in June 1969. In response to comments and discussions, the working group subsequently prepared twelve succeeding drafts over a five-year period. Some of the later revisions were the consequence of recommendations from American National Standard Committee N16 during 1972. The standard was then adopted by the American National Standards Committee N16 in 1974 under the title “Criteria for Nuclear Criticality Safety Controls in Operations Where Shielding Protects Personnel.”

The prescribed five-year review of N16.8-1975/ANS-8.10 leading to ANSI/ANS-8.10-1983 was performed by a working group of Subcommittee 8 of the ANS Standards Committee, the originating body. The working group was composed of B. F. Gore and E. D. Clayton of the Battelle Pacific Northwest Laboratories. They recommended a single substantive change in the standard along with minor wording changes in the standard and in its title to reflect the broadened content. ANSI/ANS-8.10-1983 defined a criterion for determining the adequacy of a facility’s confinement of radioactive materials under accident conditions based upon a maximum radiation dose that could be received by a member of the public located outside the restricted area surrounding the facility. Definition of this criterion removed perceived ambiguity in the wording of the previous version.

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.

This revision of American National Standard ANSI/ANS-8.10-2015 was prepared by Working Group ANS-8.10 of Subcommittee 8 of the Standards Committee of the

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# Criteria for Nuclear Criticality Safety Controls in Operations with Shielding and Confinement

## 1 Introduction

Guidance for the prevention of criticality accidents in the handling, storing, processing, and transporting of fissionable materials is presented in the American National Standard for Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors, ANSI/ANS-8.1-2014 [1].<sup>1)</sup> That standard recognizes that if adequate shielding against radiation and confinement of radioactive materials are provided, the risks normally attendant with a criticality accident in a facility lacking shielding and confinement are reduced. It is stated in Sec. 4.1.1 of ANSI/ANS-8.1-2014 [1] that “Distinction may be made between shielded and unshielded facilities, and the criteria may be less stringent when adequate shielding and confinement assure the protection of personnel.” As stated in Sec. 4.2.4, distance may be used in lieu of some or all shielding.

This standard provides criteria for the prevention of criticality accidents in facilities with shielding and confinement and a definition of the adequacy of the shielding and confinement required. This standard does not apply to operations (e.g., maintenance) requiring personnel entry into the normally unoccupied shielded and confined areas. While personnel are present in normally unoccupied shielded and confined areas, activities are governed by the applicable requirements and recommendations of ANSI/ANS-8.1-2014 [1]. This standard does not include engineering specifications for shield design or for establishing its adequacy.

## 2 Scope

This standard is applicable to operations outside of nuclear reactors with  $^{235}\text{U}$ ,  $^{233}\text{U}$ ,  $^{239}\text{Pu}$ , and other fissionable materials in which shielding and confinement are provided for protection of personnel and the public. Criteria are provided that may be used for criticality safety controls under these conditions. This standard does not apply to the assembly of these materials under controlled conditions, such as in critical experiments. This standard does not include the details of administrative procedures for control, which are considered to be management prerogatives, details regarding the design of processes and equipment, or descriptions of instrumentation for process control.

## 3 Definitions

### 3.1 Limitations

The following definitions are of a restricted nature for the purposes of this standard. Other terms are defined in *Glossary of Nuclear Criticality Safety Terms* [2].

### 3.2 Shall, should, and may

The word “shall” is used to denote a requirement, the word “should” to denote a recommendation, and the word “may” to denote permission, neither a requirement nor a recommendation.

### 3.3 Glossary of terms

**criticality accident:** The release of energy as a result of the accidental production of a self-sustaining or divergent neutron chain reaction.

<sup>1)</sup>Numbers in brackets refer to corresponding numbers in Sec. 6, “References.”