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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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American National Standard
Use of Soluble Neutron Absorbers in Nuclear Facilities Outside Reactors

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American Nuclear Society

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Foreword


This standard provides guidance for the use of soluble neutron absorbers for process and handling operations in which solutions of neutron absorbers are used for criticality control. This standard supplements the provisions for “Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors,” ANSI/ANS-8.1-1998, in providing more detailed guidance for the use of soluble neutron absorbers. Soluble neutron absorbers can be used as a primary means of criticality safety control or as defense in depth to provide an additional safety margin and as such make the safety of the system more robust. As with any parameter controlled for criticality safety, and particularly important with soluble neutron absorbers, one must ensure that the controlled parameter is maintained within the range that has been shown by experiment or evaluation to maintain subcriticality.

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Use of Soluble Neutron Absorbers in Nuclear Facilities Outside Reactors

1 Introduction

Guidance for criticality control in process and handling operations with fissile material is presented in American National Standard “Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors,” ANSI/ANS-8.1-1998 [1]. However, for solutions the single parameter subcritical limits on unit mass, volume, concentration, and geometric dimensions can be highly restrictive. Significantly larger limits are possible if soluble neutron absorbers are present, but are not required for nuclear criticality safety; their use is outside the scope of this standard. Separate standards have been developed to address specific applications of neutron absorbers. Examples are American National Standard “Use of Borosilicate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Material,” ANSI/ANS-8.5-1996 [2] and American National Standard “Use of Fixed Neutron Absorbers in Nuclear Facilities Outside Reactors,” ANSI/ANS-8.21-1995 [3].

2 Scope

This standard provides guidance for the use of soluble neutron absorbers for criticality control. This standard addresses neutron absorber selection, system design and modifications, safety evaluations, and quality control programs.

3 Definitions

3.1 Limitations

The definitions given below and in Sec. 3.3, “Glossary of Terms,” are of a restricted nature for the purpose of this standard. Other specialized terms are defined in Glossary of Terms in Nuclear Science and Technology [4] and “Glossary of Nuclear Criticality Terms” [5].

3.2 Shall, should, and may

The word “shall” is used to denote a requirement; the word “should” is used to denote a recommendation; and the word “may” is used to denote permission, neither a requirement nor a recommendation. To conform to this standard, all operations shall be performed in accordance with its requirements but not necessarily with its recommendations. When recommendations are not implemented, justification shall be documented.

3.3 Glossary of terms

neutron absorber: A neutron-capture material; also referred to as a neutron poison.

nuclear criticality safety: Protection against the consequences of a criticality accident, preferably by prevention of the accident.

soluble neutron absorber: Any neutron poison easily dispersed in liquid, solution, or