ANS

Nuclear Data Sets for Reactor Design Calculations

An American National Standard

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American National Standard Nuclear Data Sets for Reactor Design Calculations

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Foreword

(This foreword is not a part of American National Standard "Nuclear Data Sets for Reactor Design Calculations," ANSI/ANS-19.1-2019, but is included for informational purposes.)

The intent of this American National Standard is to provide guidance for the preparation of nuclear data sets for use in computer programs employed in the design of nuclear reactors. The nuclear data sets considered are evaluated data sets, processed continuous data sets, and processed averaged data sets. The nature of nuclear data sets considered in this standard is applicable to any reactor type. This standard is intended primarily for nuclear data to be used in reactor core calculations; however, the data may also be useful for other applications, such as shielding and dosimetry.

For evaluated data sets, guidance is provided concerning data sources, preparation of the evaluation, estimation of accuracy, verification, testing, and documentation. For processed (continuous or averaged) data sets, guidance is provided concerning data sources and data set preparation, checking, validation, and documentation.

The intent of this standard is not only to provide guidance on the creation of nuclear data sets, but also to require reactor analysts to (1) carefully consider the source, accuracy, and applicability of the nuclear data sets used in their simulations; (2) ensure that those data sets have been appropriately validated for the particular application; and (3) document the basis for confidence in decisions made regarding use of specific nuclear data sets. Compliance with the intent of this standard can be demonstrated through documentation that addresses all requirements of the standard.

Unlike ANS-19.1-2002 (R2011) (W2019), withdrawn with the approval of the 2019 version, no data sets are identified as standard data sets. However, several widely used data sets are listed in the appendix.

This standard might reference documents and other standards that have been superseded or withdrawn at the time the standard is applied.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 standard was prepared by the ANS-19.1 Working Group of the American Nuclear Society. The following members contributed to this standard:

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Appendix

Nuclear Data Sets for Reactor Design Calculations

1 Introduction

Nuclear data sets consist of basic microscopic nuclear physics data, which, to a large extent, include neutron-induced reactions. Since these data sets are fundamental physical constants, specified over a wide range in energies and characteristic of the materials used, they are independent of the specific application and thus can be used in the design and analysis of any reactor type, from fast to thermal and from research reactors to power reactors.

Depending on the specific needs of the user, nuclear data sets, derived from experiments or theoretical models, can be grouped into three distinct categories: evaluated data sets, processed continuous data sets, and processed averaged data sets. Each of the three categories of data sets is discussed in detail in this standard.[1)]

2 Scope

2.1 General

The purpose of this standard is to provide criteria for the use of nuclear data in reactor design calculations. Thus, this standard identifies and describes the specifications for developing, preparing, and documenting nuclear data sets. The nuclear data sets considered are evaluated data sets, processed continuous data sets, and processed averaged data sets. These data sets enable the analysts to generate cross-section data, which are used as input in neutronics codes.

2.2 Applications

Cross-section libraries as discussed in this standard, which are based on processed nuclear data sets, are primarily intended for use in reactor design calculations but, appropriately structured, can also be used in many other applications, such as shielding, dosimetry, and fusion studies.

The specific types of data sets considered to fall within the scope of this standard are defined more precisely in Sec. 3, “Definitions.” The scope of this standard does not pertain to experimental techniques for the measurement of nuclear data or to the development of nuclear model theory. It should also be noted that the scope does not apply to a few-group collapsed, application-dependent data set, which is representative of a particular application.

Because of the generic nature of nuclear data sets that fall within the scope of this standard, these data sets are applicable to a wide range of reactor compositions, geometries, and spectra; hence, they are applicable to any reactor type.

[1)] The current standard, ANSI/ANS-19.1-2019, is hereinafter referred to as “this standard.”