American National Standard

WITHDRAWN

the determination of neutron reaction rate distributions and reactivity of nuclear reactors

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American National Standard for the Determination of Neutron Reaction Rate Distributions and Reactivity of Nuclear Reactors

Secretariat
American Nuclear Society

Prepared by the
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American National Standard

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Foreword

(This Foreword is not a part of American National Standard for the Determination of Neutron Reaction Rate Distributions and Reactivity of Nuclear Reactors, N412-1975/ANS-19.3)

It is the intent of this American National Standard to provide guidance for performing and validating the sequence of calculations leading to prediction of reaction rate spatial distributions and reactivity of nuclear reactors, and to provide guidelines by which the adequacy of design calculations may be demonstrated. This Standard recognizes the diversity of the calculational procedures employed in reactor design. Consequently, the major thrust of this Standard is in the areas of verification and documentation. The Standard is intended to cover reactor physics calculations for the entire nuclear industry, from fast to thermal reactors and from research to power reactors. Since many different kinds of calculations are performed, each having its own requirement for accuracy and verification, it is necessary that this Standard be of a general nature.

Compliance with the intent of this Standard can be demonstrated for an intended area of applicability of the calculational system used by meeting the following requirements:

(1) Selection of Models and Methods

a. Consideration of all conditions of reactor composition, temperature, and configuration which significantly affect the calculated quantities and justification of the resultant model approximations

b. Preparation of multi-group constants, if employed, in conformance with ANS-19.1, American National Standard Nuclear Data Sets for Reactor Design Calculations, N411-1975, by using an application dependent energy spectrum estimate

c. Justification of geometric and neutronic transport approximations utilized in the spectrum calculation

d. Inclusion of all important space and energy effects in the calculation utilized for the generation of few group cross sections, if few group cross sections are employed

e. Demonstration of capability, as required by the application, to retrieve required neutron reaction rates in the physical reactor components from the computations, and to justify any assumptions that need to be made in order to perform this retrieval

(2) Calculational System Verification. Establishment of degree of agreement over a limited area of applicability by correlating experimental results or results of calculations using a more accurate model with results obtained by the system being verified.

(3) Evaluation of Accuracy. Evaluation of accuracy and range of applicability of data and methods by establishment of biases and uncertainties, with degree of confidence, for the calculations that include allowance for uncertainties in the comparison data.

(4) Documentation. Documentation of details of the above procedures.

It is the intent of this Standard to require the individual to: (1) give careful consideration to those physical and numerical effects that may contribute to the validity of his results, (2) document the reasons for his choice of calculational path, and (3) verify the calculational system used over the intended range of applicability by testing it against appropriate experiments or more rigorous calculations.

The requirement for documentation is a crucial part of this Standard and will provide an auditable path. In those instances where the foregoing documentation is proprietary in nature documentation edited by excluding the proprietary information shall be prepared and be publicly available or available on request. Areas omitted due

to proprietary consideration shall be noted where possible. The standard would not require all documentation to be made public, and thus by implication acknowledges the existence of proprietary documentation.

This Standard is intended to be a general framework within which additional standards for specific design applications will be written to provide the quantitative measures of accuracy. By reference to this Standard, it is hoped that subsequent standards will be more concise and uniform.

This is a first attempt to produce a standard for reactor physics calculations and it should therefore undergo review and revision within two years. Suggestions for the improvement of this Standard will be welcome. They should be sent to the American Nuclear Society, 244 East Ogden Avenue, Hinsdale, Illinois 60521

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