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the determination of thermal energy deposition rates in nuclear reactors

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American National Standard for the Determination of Thermal Energy Deposition Rates in Nuclear Reactors

Secretariat
American Nuclear Society

Prepared by the
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Working Group ANS-19.3.4

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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 Thermal Energy Deposition Rates in Nuclear Reactors N676-1976/ANS-19.3.4.)

It is the intent of this American National Standard to provide guidance for performing and validating the sequence of calculations leading to prediction of thermal energy deposition rates in 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 thermal energy deposition calculations for the entire nuclear industry; from fast to thermal reactors, 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. **Source Distribution.** Neutron reaction rate distributions and photon and beta particle emitter distributions to be obtained from calculations made in accordance with American National Standard Neutron Reaction Rate Distributions and Reactivity of Nuclear Reactors, N412-1975 (ANS-19.3), or similar applicable standard. Data to be found in accordance with American National Standard Nuclear Data Sets for Reactor Design Calculations, N411-1975 (ANS-19.1), or equivalent standard.

2. **Selection of Models and Methods.** Consideration of all phenomena listed in Table 1 and their treatment justified. Use of any approximation and application not explicitly permitted in Table 2 to be justified. Acceptable justification may be degree of rigor, conservatism or increased margin incorporated in design.

3. **Verification.** The method of analysis to be verified against experiments or more rigorous and well-established analytical methods.

4. **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 including allowance for uncertainties in the comparison data.

5. **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 is a first attempt to produce a standard for thermal energy deposition calculations in nuclear reactors 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.

This Standard was developed by Working Group ANS-19.3.4 of the American Nuclear Society which had the participation of the following members during the period it prepared and approved the Standard:

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Contents