A Guide for Acquisition and Documentation of Reference Power Reactor Physics Measurements for Nuclear Analysis Verification

REAFFIRMED

August 24, 2022

ANSI/ANS-19.4-2017 (R2022)

ANSI/ANS-19.4-2017

An American National Standard

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American National Standard

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Foreword

(This foreword is not a part of American National Standard "A Guide for Acquisition and Documentation of Reference Power Reactor Physics Measurements for Nuclear Analysis Verification," ANSI/ANS-19.4-2017, but is included for informational purposes.)

It is the purpose of this standard to specify criteria for performing and documenting measurements on light water power reactors that are to be used as reference measurements in the validation of reactor physics computational methods. Considerably more confidence is placed in nuclear analysis methods when they have been successfully used to calculate performance characteristics that have been carefully measured in an actual operating system. The existence of well-documented measurements made in a number of operating power reactors will fill a need on the part of the nuclear designer and reactor operator and will permit the development of increased confidence in the design and performance analysis methods used to predict reactor performance. This standard is not a guide for routine measurement of reactor physics parameters in an operating reactor. The objective of routine measurements carried out on an operating reactor is to satisfy specific operational, licensing, and contractual requirements. In many cases, however, measurements made on a routine basis are of sufficient quality to merit their use as reference measurements, and reporting these measurements in accordance with this guide is encouraged.

In addition, if time, personnel, and instrumentation are available during the course of operation to perform additional measurements not normally required, reactor designers and operators are encouraged to specify, perform, document, and report such measurements for use as reference power reactor physics measurements.

This standard was developed primarily for application to measurements on reactors whose pertinent descriptions are available, or can be made available, to the technical community. This does not preclude its use on reactors for which some reactor information required to simulate the measurement is proprietary. Since performance of reference measurements is not required on any system, application of this standard is not related to the question of what reactor design information should, or should not, be publicly disseminated.

This standard provides criteria for reference reactor physics measurements. As such it specifically considers only those types of reactor physics measurements that experience has shown to be practical and reproducible when carried out in large power reactors. The intended current application of this standard is confined to light water–moderated and light water–cooled power reactors.

This standard is intended primarily for measurements that can be performed at the reactor site; destructive analysis of the spent or partially spent fuel to determine isotopic composition, for example, is not covered. In the event such destructive analysis is carried out, however, its usefulness is increased if it is preceded by a series of reference-quality measurements carried out in accordance with this standard.

As revised, this standard reflects current power reactor terminology and general practices. Guidance on periodic updates of spatial in-core power distributions and reactor core operating history is given in terms of effective full-power months rather than specific megawatt days per metric ton to provide for a common and flexible terminology. Proper axial alignment relative to the core midplane is identified as an important consideration in adjusting raw spatial in-core measurements. Control rod worth measurement using the control group exchange (rod swap) method that is now commonly used in the industry has been added. References to ANSI/ANS-19.6.1-2011 (R2016), "Reload Startup Physics Tests for Pressurized Water Reactors," and ANSI/ANS-19.11-2017, "Calculation and Measurement of the Moderator Temperature Coefficient of Reactivity for Pressurized Water Reactors," have

been identified as related standards. Documentation of fuel rod peaking factors as a desirable measurement, identification of radial variation in fuel assembly geometry, and a more detailed organization to the format of reference measurement documentation has been incorporated into the appendices.

This standard was developed by Working Group ANS-19.4 of the American Nuclear Society. The following members contributed to this standard:

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