

American Nuclear Society

REAFFIRMED

May 31, 2012
ANSI/ANS-8.24-2007 (R2012)

**validation of neutron transport
methods for nuclear criticality
safety calculations**

an American National Standard

WITHDRAWN

December 12, 2017
ANSI/ANS-8.24-2007 (R2012)

No longer being maintained as an American National Standard. This standard may contain outdated material or may have been superseded by another standard. Please contact the ANS Standards Administrator for details.



published by the
American Nuclear Society
555 North Kensington Avenue
La Grange Park, Illinois 60526 USA

**American National Standard
Validation of Neutron Transport Methods
for Nuclear Criticality Safety Calculations**

Secretariat
American Nuclear Society

Prepared by the
**American Nuclear Society
Standards Committee
Working Group ANS-8.24**

Published by the
**American Nuclear Society
555 North Kensington Avenue
La Grange Park, Illinois 60526 USA**

Approved March 16, 2007
by the
American National Standards Institute, Inc.

American National Standard

Designation of this document as an American National Standard attests that the principles of openness and due process have been followed in the approval procedure and that a consensus of those directly and materially affected by the standard has been achieved.

This standard was developed under procedures of the Standards Committee of the American Nuclear Society; these procedures are accredited by the American National Standards Institute, Inc., as meeting the criteria for American National Standards. The consensus committee that approved the standard was balanced to ensure that competent, concerned, and varied interests have had an opportunity to participate.

An American National Standard is intended to aid industry, consumers, governmental agencies, and general interest groups. Its use is entirely voluntary. The existence of an American National Standard, in and of itself, does not preclude anyone from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard.

By publication of this standard, the American Nuclear Society does not insure anyone utilizing the standard against liability allegedly arising from or after its use. The content of this standard reflects acceptable practice at the time of its approval and publication. Changes, if any, occurring through developments in the state of the art, may be considered at the time that the standard is subjected to periodic review. It may be reaffirmed, revised, or withdrawn at any time in accordance with established procedures. Users of this standard are cautioned to determine the validity of copies in their possession and to establish that they are of the latest issue.

The American Nuclear Society accepts no responsibility for interpretations of this standard made by any individual or by any ad hoc group of individuals. Requests for interpretation should be sent to the Standards Department at Society Headquarters. Action will be taken to provide appropriate response in accordance with established procedures that ensure consensus on the interpretation.

Comments on this standard are encouraged and should be sent to Society Headquarters.

Published by

**American Nuclear Society
555 North Kensington Avenue
La Grange Park, Illinois 60526 USA**

Copyright © 2007 by American Nuclear Society. All rights reserved.

Any part of this standard may be quoted. Credit lines should read "Extracted from American National Standard ANSI/ANS-8.24-2007 with permission of the publisher, the American Nuclear Society." Reproduction prohibited under copyright convention unless written permission is granted by the American Nuclear Society.

Printed in the United States of America

Foreword

(This Foreword is not a part of American National Standard “Validation of Neutron Transport Methods for Nuclear Criticality Safety Calculations,” ANSI/ANS-8.24-2007.)

This standard goes beyond ANSI/ANS-8.1-1998; R2007, “Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors,” to provide additional detail about processes and techniques for the validation of computer-based neutron transport calculational methods used in nuclear criticality safety analyses. The ANS-8.24 working group has used its experience, results of conferences on area of applicability and validation, and outside experts to expand on the concepts identified in ANSI/ANS-8.1-1998; R2007. More detail and method descriptions are provided here. Section 4.3 of ANSI/ANS-8.1-1998; R2007 establishes the basic criteria for performing validation of calculational methods. This section contains material that was originally in a separate standard, ANSI/ANS-8.11-1975 (Withdrawn 1983), “Validation of Calculational Methods for Nuclear Criticality Safety,” but that was subsumed into ANSI/ANS-8.1-1983; R1988 (Withdrawn in 1998), “Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors.” As there is currently a greater reliance on computer calculations in criticality safety applications, it was felt that a separate standard describing the requirements for the validation of computer-based neutron transport methods was again needed.

Criticality safety analysts have indicated the need for additional guidance beyond that provided by ANSI/ANS-8.1-1998; R2007. For example, ANSI/ANS-8.1-1998; R2007 indicates validation shall be performed by comparison to “critical and exponential experiments” and that the area of applicability for the validation should be established from this comparison. However, criticality safety analysts would benefit from requirements and recommendations on establishment of the area of applicability as well as criteria that should be considered in the extension of the area of applicability, and the use of bias and bias uncertainty based on comparison to experiments. The existing database of critical experiments was developed largely in a period when the fissile material operations and technical criteria were different from many of the current and planned operations involving fissile material. However, as the number of experiments that focus on current and planned operations has decreased, the industry need to optimize operations and reduce unnecessary conservatism has increased. Thus, the scrutiny and importance placed on validation has increased in recent years. This standard provides requirements and recommendations on proper validation processes and techniques for computer-based neutron transport calculational methods to expand on the basic criteria established in ANSI/ANS-8.1-1998; R2007.

This version of the standard was drafted by Working Group ANS-8.24 of Subcommittee 8 of the American Nuclear Society. The membership of the working group at the time of issuance was as follows:

R. D. Busch (Chair), *University of New Mexico*

J. S. Bullington, *Washington Safety Management Solutions, LLC*

C. D. Harmon, *Los Alamos National Laboratory*

J. E. Hicks, *U.S. Department of Energy*

K. D. Kimball, *NISYS Corporation*

D. C. Morey, *U.S. Nuclear Regulatory Commission*

C. V. Parks, *Oak Ridge National Laboratory*

A. W. Prichard, *Pacific Northwest National Laboratory*

B. M. Rothleder, *U.S. Department of Energy*

N. R. Smith, *Serco Assurance, United Kingdom*

R. W. Tayloe, *Individual*

C. S. Tripp, *U.S. Nuclear Regulatory Commission*

F. E. Trumble, *Washington Safety Management Solutions, LLC*
L. L. Wetzel, *BWX Technologies, Inc.*

This standard was prepared under the guidance of ANS Subcommittee 8, Fissionable Materials Outside Reactors, which had the following membership at the time of its approval:

T. P. McLaughlin (Chair), *Individual*
J. A. Schlessor (Secretary), *Washington Safety Management Solutions, LLC*

F. M. Alcorn, *Individual*
H. D. Felsher, *U.S. Nuclear Regulatory Commission*
A. S. Garcia, *U.S. Department of Energy*
N. Harris, *British Nuclear Fuel, PLC*
C. M. Hopper, *Oak Ridge National Laboratory*
B. O. Kidd, *BWX Technologies*
R. A. Libby, *Pacific Northwest National Laboratory*
D. A. Reed, *Oak Ridge National Laboratory*
T. A. Reilly, *Individual*
H. Toffer, *Fluor Federal Services*
G. E. Whitesides, *Individual*

Consensus Committee N16, Nuclear Criticality Safety, had the following membership at the time of its approval of this standard:

C. M. Hopper (Chair), *Oak Ridge National Laboratory*
R. Knief (Vice-Chair), *XE Corporation*

G. H. Bidinger, *Individual*
R. D. Busch, *University of New Mexico*
R. S. Eby, *American Institute of Chemical Engineers*
M. A. Galloway, *U.S. Nuclear Regulatory Commission*
C. D. Manning, *AREVA NP*
B. McLeod, *Institute of Nuclear Materials Management*
S. P. Murray, *Health Physics Society*
R. E. Pevey, *University of Tennessee*
R. L. Reed, *Washington Safety Management Solutions, LLC*
B. M. Rothleder, *U.S. Department of Energy*
W. R. Shackelford, *Nuclear Fuel Services, Inc.*
R. G. Taylor, *Individual*
R. M. Westfall, *Oak Ridge National Laboratory*
L. L. Wetzel, *BWX Technologies, Inc.*
R. E. Wilson, *U.S. Department of Energy*

Contents	Section	Page
	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	Appendices	
	Appendix A	5
	Appendix B	7
	Appendix C	9
	Appendix D	12
	Tables	
	Table D.1	13
	Table D.2	14
	Table D.3	15
	Table D.4	17
	Figures	
	Figure D.1	18
	Figure D.2	18
	Figure D.3	18
	Figure D.4	20