

American Nuclear Society

probabilistic seismic hazards analysis

an American National Standard

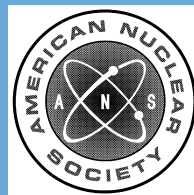
REAFFIRMED

October 11, 2016

ANSI/ANS-2.29-2008; R2016

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**American National Standard
Probabilistic Seismic Hazards Analysis**

Secretariat
American Nuclear Society

Prepared by the
**American Nuclear Society
Standards Committee
Working Group ANS-2.29**

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American National Standard

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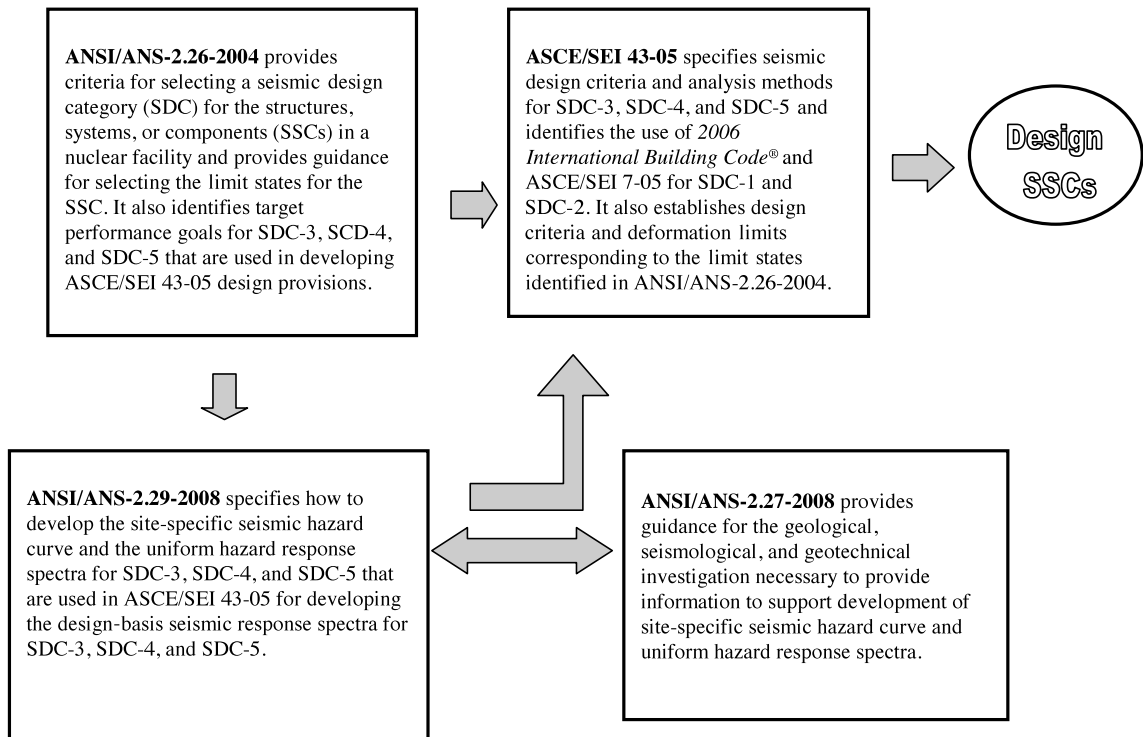
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Foreword (This Foreword is not a part of the American National Standard “Probabilistic Seismic Hazards Analysis,” ANSI/ANS-2.29-2008.)

This standard establishes requirements for performing probabilistic seismic hazard analyses (PSHAs). It is one of a group of four standards that establish requirements for the seismic design process for nuclear facilities. Figure A shows the relationship between this standard and the other three seismic standards: American National Standards Institute/American Nuclear Society ANSI/ANS-2.26-2004, “Categorization of Nuclear Facility Structures, Systems, and Components for Seismic Design”; ANSI/ANS-2.27-2008, “Criteria for Investigations of Nuclear Facility Sites for Seismic Hazard Assessments”; and American Society of Civil Engineers/Structural Engineering Institute ASCE/SEI 43-05, “Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities.” The procedural relationship among these standards is further described in ANSI/ANS-2.26-2004. The user should consult ASCE/SEI 43-05 to see how the information produced by ANSI/ANS-2.29-2008 is used in developing seismic loads specific to a structure, system, or component (SSC).

As described in ANSI/ANS-2.26-2004 and ASCE/SEI 43-05, the seismic design process for nuclear facilities is based on the consequences of seismically initiated failure of SSCs and specified limit states and design requirements. The seismic design categories identified in ANSI/ANS-2.26-2004 and the design requirements in ASCE/SEI 43-05 aim to satisfy target performance goals defined in terms of the annual probability of exceeding specified SSC performance. Achieving



Key: = Information flow when applying the standards

Figure A – Schematic showing the relationships of the seismic standards

a target performance goal is directly related to the probability of a seismic load. Therefore, the results of a PSHA are required as input to the seismic design process. ANSI/ANS-2.29-2008 establishes procedures for performing a PSHA needed to support selection of the seismic loads used in ASCE/SEI 43-05. The methods specified herein can also be used to support other applications, such as seismic probabilistic risk analyses.

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 reference section that provides guidance on the use of references.

The ANS-2.29 Working Group of the Standards Committee of the American Nuclear Society (ANS) had the following membership:

J. Savy (Chair), *Risk Management Solutions, Inc.*

J. Ake, *U.S. Nuclear Regulatory Commission*
K. Campbell, *EQECAT, Inc.*
N. Chokshi, *U.S. Nuclear Regulatory Commission*
K. Coppersmith, *Coppersmith Consulting*
C. Costantino, *Individual*
C. B. Crouse, *URS Corporation*
A. Hadjian, *Defense Nuclear Facilities Safety Board*
Q. Hossain, *Lawrence Livermore National Laboratory*
J. Kimball, *U.S. Department of Energy*
J. King, *Individual*
R. Lee, *Individual*
M. McCann, *JBA Associates*
M. Power, *Geomatrix Consultants, Inc.*
G. Toro, *Risk Engineering, Inc.*
I. Wong, *URS Corporation*
R. Youngs, *Geomatrix Consultants, Inc.*

This standard was prepared under the guidance of the Nuclear Facilities Standards Committee (NFSC) Subcommittee ANS-25 (Siting) of the ANS. At the time of the ballot, Subcommittee ANS-25 was composed of the following members:

Kevin Bryson (Chair), *Shaw Environmental, Inc.*

J. Bollinger, *Savannah River National Laboratory*
C. Costantino, *Individual*
P. Fledderman, *Westinghouse Savannah River Company*
D. Hang, *University of Illinois-Urbana*
K. L. Hanson, *Geomatrix Consultants, Inc.*
J. Litehiser, *Bechtel Corporation, Inc.*
S. Marsh, *Southern California Edison Company*
D. Pittman, *Tennessee Valley Authority*
J. Savy, *Risk Management Solutions, Inc.*
R. D. Spence, *UT-Battelle, LLC*
J. D. Stevenson, *J.D. Stevenson & Associates*

The standard was processed and approved for submittal to ANSI by the NSFC of the ANS. Committee approval of the standard does not necessarily imply that all members voted for approval. At the time it approved this standard, the NFSC had the following membership:

C. A. Mazzola (Chair), *Shaw Environmental & Infrastructure, Inc.*

R. M. Ruby (Vice Chair), *Constellation Energy*

J. K. August, *CORE, Inc.*
W. H. Bell, *South Carolina Electric & Gas Company*
J. R. Brault, *Shaw MOX Project*
C. K. Brown, *Southern Nuclear Operating Company*
R. H. Bryan, *Tennessee Valley Authority*
K. R. Bryson, *Shaw Environmental, Inc.*
T. Dennis, *Individual*

D. R. Eggett, *AES Engineering*
R. W. Englehart, *U.S. Department of Energy*
R. Hall, *Exelon Generation Company, LLC*
P. S. Hastings, *Duke Energy*
R. A. Hill, *ERIN Engineering and Research, Inc.*
N. P. Kadambi, *U.S. Nuclear Regulatory Commission*
M. P. LaBar, *General Atomics*
E. M. Lloyd, *Exitech Corporation*
E. P. Loewen, *General Electric*
S. A. Lott, *Los Alamos National Laboratory*
J. E. Love, *Bechtel Power Corporation*
R. H. McFetridge, *Westinghouse Electric Corporation*
C. H. Moseley, *ASME/NQA Liaison (BWXT Y-12)*
D. G. Newton, *AREVA NP*
W. N. Prillaman, *AREVA NP*
W. B. Reuland, *Individual*
D. M. Reynerson, *Phoenix Index*
R. E. Scott, *Individual*
D. J. Spellman, *Oak Ridge National Laboratory*
S. L. Stamm, *Shaw Stone & Webster*
J. D. Stevenson, *Individual*
C. D. Thomas, *Individual*
J. A. Wehrenberg, *Southern Nuclear Operating Company*
M. J. Wright, *Entergy Operations, Inc.*

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Probabilistic Seismic Hazards Analysis

1 Scope

This standard provides criteria and guidance for performing a probabilistic seismic hazard analysis (PSHA) for the design and construction of nuclear facilities. As defined in American National Standards Institute/American Nuclear Society ANSI/ANS-2.26-2004, “Categorization of Nuclear Facility Structures, Systems, and Components for Seismic Design” [1]¹, a nuclear facility is a facility that stores, processes, tests, or fabricates radioactive materials in such form and quantity that a nuclear risk to the workers, to the off-site public, or to the environment may exist. These include, but are not limited to, nuclear fuel manufacturing facilities; nuclear material waste processing, storage, fabrication, and reprocessing facilities; uranium enrichment facilities; tritium production and handling facilities; radioactive material laboratories; and nuclear reactors. Criteria provided in this standard address various aspects of conducting PSHAs, including

- (1) selection of the process, the methodology and the level of seismic hazard analysis appropriate for a given seismic design category (SDC) structure, system, or component (SSC) or facility (hereafter, the SDC of a facility is considered synonymous with the highest SDC SSC in the facility) and the geotechnical and seismological characteristics of the site;
- (2) seismic source characterization;
- (3) ground motion estimation;
- (4) site response assessment;
- (5) assessment of aleatory and epistemic uncertainties in a PSHA;
- (6) PSHA documentation requirements.

This standard does not specify methods for estimating the probability of fault displacement, or other seismically induced hazards such as soil liquefaction, soil settlement, landsliding, and

earthquake-induced flooding. These hazards may be applicable for certain sites and need to be evaluated and included in SSC design requirements. Methods for doing this are included in American Society of Civil Engineers/Structural Engineering Institute ASCE/SEI 43-05, “Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities” [2].

This standard does not address criteria, procedures, or methods for collecting information and data required to perform a PSHA. These are specified in ANSI/ANS-2.27-2008, “Criteria for Investigations of Nuclear Facility Sites for Seismic Hazard Assessments” [3]. In addition, this standard does not address the use of PSHA results or the selection of design-basis earthquakes for nuclear facilities. This topic is covered in ANSI/ANS-2.26-2004 [1] and ASCE/SEI 43-05 [2].

The use of this standard shall be coordinated with the other three seismic standards named above. This coordination is vital to the collection and evaluation of data required to perform the PSHA, to establish the level and scope of the analysis consistent with an application, and for consistency with the intended use of the PSHA results.

The guidelines and requirements provided in this standard are applicable for the design and evaluation of SDC-3, SDC-4, and SDC-5 facilities. These can also be applied to SDC-1 and SDC-2, or other non-U.S. Department of Energy (DOE) facilities if, for safety, economy, or other reasons, a site-specific seismic hazard determination becomes necessary.

2 Acronyms and terms

2.1 Acronyms

ANS: American Nuclear Society

ANSI: American National Standards Institute

¹Numbers in brackets refer to corresponding numbers in Sec. 6, “References.”