ASME/ANS RA-S-1.4-2013

Probabilistic Risk Assessment Standard for Advanced Non-LWR Nuclear Power Plants

TRIAL USE AND PILOT APPLICATION

Publication of this standard for trial use has been approved by The American Society of Mechanical Engineers and the American Nuclear Society. Distribution of this standard for trial use and comment shall not continue beyond 36 months from the date of publication, unless this period is extended by action of the Joint Committee on Nuclear Risk Management. It is expected that following this 36-month period, this draft standard, revised as necessary, will be submitted to the American National Standards Institute (ANSI) for approval as an American National Standard. A public review in accordance with established ANSI procedures is required at the end of the trial-use period and before a standard for trial use may be submitted to ANSI for approval as an American National Standard. This trial-use standard is not an American National Standard.

Comments and suggestions for revision should be submitted to:

Secretary, Joint Committee on Nuclear Risk Management
The American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990

The American Society of Mechanical Engineers

ANS

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The American Society of Mechanical Engineers
Two Park Avenue, New York, NY 10016-5990

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FOREWORD

The American Society of Mechanical Engineers (ASME) Board on Nuclear Codes and Standards (BNCS) and the American Nuclear Society (ANS) Standards Board mutually agreed in 2004 to form the Nuclear Risk Management Coordinating Committee (NRMCC). NRMCC was chartered to coordinate and harmonize standards activities related to probabilistic risk assessment (PRA) between ASME and ANS. A key activity resulting from NRMCC was the development of PRA standards structured around the Levels of PRA (i.e., Level 1, Level 2, Level 3) to be jointly issued by ASME and ANS. In 2011, ASME and ANS decided to combine their respective PRA standards committees to form the ASME/ANS Joint Committee on Nuclear Risk Management (JCNRM).

In 2006, ASME BNCS established the New Reactor Task Group under the Committee on Nuclear Risk Management (CNRM) to evaluate the need for codes and standards to support the design, construction, licensing, and operation of advanced non–light water reactor (non-LWR) nuclear power plants (NPPs). Following the formation of JCNRM, the New Reactor Task Group is now known as the ASME/ANS JCNRM Advanced Non-LWR PRA Standard Writing Group (Non-LWR WG). The charter of the Non-LWR WG is to develop recommendations to JCNRM on requirements for the performance of PRAs for advanced non-LWRs. The expected applications of such PRAs include input to licensing and design decisions such as selection of licensing-basis events and safety classification of equipment, satisfaction of U.S. Nuclear Regulatory Commission PRA requirements for advanced non-LWRs, and support of risk-informed applications for advanced non-LWR NPPs. With the concurrence of JCNRM, the Non-LWR WG decided early on that a new PRA standard was needed to support a broad range of applications for advanced reactor designs.

To support a diverse mixture of reactor concepts, including high-temperature gas-cooled reactors, liquid metal–cooled fast reactors, and small modular reactors, CNRM decided early on to develop this new PRA standard on a reactor-technology-neutral basis using established technology-neutral risk metrics common to existing light water reactor (LWR) Level 3 PRAs. Such risk metrics include frequency of radiological consequences, e.g., dose, health effects, and property damage impacts. In order to support a wide range of applications defined by the non-LWR stakeholders, the scope of this standard is very broad and is comparable to a full-scope Level 3 PRA for an LWR with a full range of plant operating states (POSs) and hazards. Because some of the advanced non-LWR designs supported by this standard include modular reactor concepts, this standard includes requirements that support an integrated risk of multireactor facilities including accidents on two or more reactor units concurrently.

In preparing the technical requirements in this standard, the Non-LWR WG made use of source material from the existing ASME/ANS PRA standard ASME/ANS RA-Sa-2009 as revised in 2013 in ASME/ANS RA-Sb-2013 (Addendum B) as well as draft PRA standards under development by ANS for Low-Power-and-Shutdown PRA, Level 2 PRA, and Level 3 PRA. JCNRM has approved the use of draft ANS standards with a requirement to follow up with changes to reflect changes in the supporting standards. Such changes could necessitate a need for revisions to this standard. The use of source material from not-yet-approved PRA standards and the relative lack of experience in performing PRAs on non-LWR NPPs have shaped the decision by JCNRM to issue this standard for trial use. It is expected that changes that may be required to account for changes to the supporting standards will be accomplished as part of the effort to upgrade this trial-use standard to the requirements of the American National Standards Institute.

In preparing this draft standard, the non-LWR WG has worked closely with the Advanced Light Water Reactor Writing Group (ALWR WG) to ensure consistency in approach and language to address requirements for PRAs on plants in preoperational stages of the plant life cycle. The approach to