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ANS

Nuclear Power Plant Simulators for Use in Operator Training and Examination

An American National Standard

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American Nuclear Society
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American National Standard Nuclear Power Plant Simulators for Use in Operator Training and Examination

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Foreword

(This foreword is not a part of the American National Standard "Nuclear Power Plant Simulators for Use in Operator Training and Examination," ANSI/ANS-3.5-2018, but is included for informational purposes.)

The nuclear power industry is currently in a mature phase of operation with encouraging successes in operating license extensions and extended power uprates. In addition to life extension activity, new construction of nuclear power plants is in progress. This sixth revision of the 1979 original standard continues in the philosophy of further addressing issues related to maintaining simulators throughout the life of commercial nuclear power plants. This revision of the standard extends the functional requirements and criteria of this standard to new-build reactors.

The first ANS-3.5 standard, published in January 1979, provided essential requirements for the acquisition of full-scope simulators to support operator training programs. The second ANS-3.5 standard, published in April 1981, further delineated specification requirements. Improvements in testing methods and overall consistency were subsequently included in the third ANS-3.5 standard, published in October 1985. The fourth ANS-3.5 standard, published in March 1993, introduced a new testing methodology and processes that effectively integrated training processes with simulator testing and configuration management processes. The fifth ANS-3.5 standard, published in April 1998, further refined the integration of the training scenario validation process with the simulator testing process; this integration effort introduced simulator scenario-based testing. The sixth ANS-3.5 standard, published in September 2009, clarified the functional and testing requirements associated with simulator scenario-based testing; in addition, this version of the standard introduced post-event simulator testing and reactor core performance testing, the latter of which provides assurance that applicants for an operator license may meet reactivity experience requirements on a reference unit simulator.

Many nuclear power plants have realized routine steady-state operation throughout the fuel cycle as operational performance improves; while this level of maturity is excellent, it provides fewer of the operational experience opportunities previously afforded to licensed operators. Excellent plant performance demands a more vital role for the simulator in providing operators with experience previously obtained in the actual plant. The importance of a thoroughly tested simulator as a high-quality training device cannot be overemphasized.

The development of this standard, ANSI/ANS-3.5-2018, was possible through the cooperation of nuclear professionals from the domestic and international communities. Anticipating a larger user base of the ANS-3.5 standard with the construction of new-build commercial nuclear power plants, assistance from nuclear professionals associated with new-build nuclear power plant simulators was obtained. The working group acknowledges the use of this standard by international users and owners of nuclear power plant simulators that may be subject to international nuclear regulatory authorities; the degree of application of this standard to their respective nuclear power plant simulators is the responsibility of international authorities.

The Sec. 3.1.4 malfunction list and Appendix B of the ANS-3.5-2009 standard are removed from this standard. To address new-build commercial nuclear power plants and the applicability of this standard to new-build simulators, the working group considered several different design certifications already submitted and expected to be submitted for regulatory approval during the development of this standard. Priority was afforded to those designs actually under construction in the United States with near-term issuance of commercial operating licenses (5-year look ahead). It became apparent to the working group that various malfunctions listed in Sec. 3.1.4 and various transients in Appendix B of the ANS-3.5-2009 standard were not applicable to new-build commercial nuclear power plant design. The

working group considered including multiple malfunction and transient lists based on reactor design and determined such effort unwieldy to include in the standard; efforts were therefore focused to identify generic guidance that could be applied regardless of reactor type and reactor design. The working group realized the value, to existing and new nuclear power plant simulator owners, of utilizing a proven systematic approach to the training process to identify and include appropriate malfunctions to simulator design and to consider the design bases for transients unique to each plant design.

The working group diligently considered events such as the Fukushima Daiichi Nuclear Power Plant accident and uses of the simulator for both extended-duration scenarios and emergency preparedness drills/exercises for inclusion in the scope of this standard. The working group ultimately determined that these types of simulator applications are not within scope of this standard; however, the standard does not preclude the use of simulators for activities other than operator training and examination. The use of this standard in whole or in part to help define, develop, and test simulator facilities for activities beyond the current scope is encouraged.

When a simulator is used for operator training and examination, it is expected to meet the requirements set forth in this standard. The user is responsible for compliance with applicable regulatory requirements.

Acknowledgements:

This review and revision cycle was fortunate to receive substantial support from a diverse and dedicated group of nuclear simulator–experienced professionals representing many utilities and interested parties. A wide range of representation from utilities, independent contributors, industry oversight organizations, and simulator suppliers, including individuals with significant military and commercial reactor experience, contributed to the efforts of the ANS-3.5-2018 Working Group. Input to the development of the standard was received through various means, including feedback from training and simulator associations. Working group meetings were also attended and supported regularly by nonmember participants. All aspects of power reactor and simulator design, construction, and operation, in addition to extensive operator training and evaluation experience, were available throughout this review cycle. Representation at working group meetings was diverse, with approximately 675 collective years of experience in the nuclear industry, including 479 years of simulation-related experience and 249 years of operator training experience. Working group continuity was preserved by members with a range of 1 to 29 years of working group participation experience. The significant experience available and dedicated participation of each member were used effectively to prioritize and address each important issue.

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 references section that provides guidance on the use of references.

This standard does not incorporate the concepts of generating risk-informed insights, performance-based requirements, or a graded approach to quality assurance. The user is advised that one or more of these techniques could enhance the application of this standard.

In memoriam, the working group would like to recognize the special contributions of Mr. Robert “Bob” A. Felker, Western Services Corporation, who passed away on December 15, 2017. He participated in the development of the 1993, 1998, 2009, and this latest edition of the ANS-3.5 standard. This standard is dedicated to Bob and his lifelong contribution to the nuclear power and simulation industries.

This standard was prepared by the ANS-3.5 Working Group of the American Nuclear Society. The following members contributed to this standard:

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