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nuclear power plant simulators for use in operator training and examination

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American National Standard

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Foreword

(This Foreword is not a part of American National Standard for Nuclear Power Plant Simulators for Use in Operator Training, ANSI/ANS-3.5-1998, but is included for information purposes only.)

Nuclear power plant simulators are important tools in training nuclear power plant operators. The acceptance of the value and use of simulators in operator training and examination programs has resulted in the need for a standard describing their configuration and performance. The objective of this standard is to specify the simulator configuration and performance criteria necessary to support effective training and examination programs.

The value of simulators in the training and examination of nuclear power plant operators has been recognized by the U. S. Nuclear Regulatory Commission in its regulations and regulatory guidance and by the nuclear industry through the Institute of Nuclear Power Operations and the National Academy for Nuclear Training. It is the responsibility of the individual organization which utilizes a simulator to establish a training program and to prepare personnel to operate and maintain their nuclear facility properly. The details of accomplishing this are determined by each organization.

This standard has been revised to incorporate knowledge derived from extensive application of the 1985 and 1993 revisions of the standard.

When a simulator is used for operator training or examination, it is expected to meet the requirements set forth in this standard.

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In memoriam, the Committee would like to recognize the special contribution of Mr. Benjamin Delamorton, Virginia Power, who passed away on September 8, 1996. This standard is dedicated to Ben and his lifelong contribution to the nuclear power and simulation industries. He will be missed.

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Nuclear Power Plant Simulators for Use in Operator Training and Examination

1. Scope and Background

1.1 Scope. This standard establishes the functional requirements for full-scope nuclear power plant control room simulators used for operator training and examination. Criteria are established for the degree of simulation, performance, and functional capability of the simulated control room instrumentation and controls. This standard does not address simulators for test, mobile, and research reactors, nor for reactors not subject to U.S. Nuclear Regulatory Commission licensing.

This standard does not establish criteria for application of simulators in training programs. Training criteria are established in American National Standard for Selection, Qualification, and Training of Personnel for Nuclear Power Plants, ANSI/ANS-3.1-1993 [1].[1]

1.2 Background. Operating and training practices differ among the various organizations that operate nuclear power reactors; the common goals, however, are to ensure safety, equipment availability, and efficient operations. It is intended that this standard provide flexibility in the design and use of nuclear power plant simulators in meeting these common goals. It is intended that in meeting the criteria of this standard, the simulator will possess a sufficient degree of completeness and accuracy to meet the training needs of industry and the requirements of the NRC, as described in ANS-3.1 [1] and Title 10, "Energy," Code of Federal Regulations, Part 55, "Operators' Licenses" [2]. These requirements provide guidance in determining the content and setting for training and examination purposes. This standard allows the use of a training needs assessment in several areas where the standard may require features in excess of the requirements of ANS-3.1 [1] and 10CFR55 [2].

This standard is organized so that simulator functional and physical requirements are described in Section 3, while the corresponding testing and validation requirements are described in Section 4. The subnumbering of Sections 3 and 4 is consistent so that corresponding section paragraphs address the same subject matter from a requirements and testing standpoint.[2]

2. Definitions

backtrack. The ability to reset the simulator to some prior time in its operation.

best estimate. Predicted reference unit performance data derived from engineering evaluation or operational assessment by subject matter experts for specific conditions.

computed values. Parameters representing the state of reference unit systems or components that are calculated by the simulator mathematical models.

design data base. The design documents, performance data, records, assumptions, simplifications, derivations, and other definable data on which the design of the simulator hardware and software is based.

fast time. The ability to increase the rate of simulation for some or all computed values with respect to real time.

freeze. The controlled cessation of the simulation facility.

initial condition. A set of data that represents the status of the reference unit from which real-time simulation can begin.

malfunctions. Any simulator feature or capability which provides for instructor-controlled degradation of performance or failure of simulated plant systems or equipment. Other simulator features, which affect or alter the normal operation of simulated instrumentation or components within the model, should be considered to be malfunctions.

negative training. Training on a simulator whose configuration or performance leads the

[1] Numbers in brackets refer to corresponding numbers in Section 6, References.

[2] Guidance is provided in Appendix D to adapt this standard to part-task and limited-scope simulators to ensure fidelity appropriate to the intended use for operator training and examination.