



DRAFT REGULATORY GUIDE

Contact: L. Vick
(301) 415-3181

DRAFT REGULATORY GUIDE DG-1248

(Proposed Revision 4 of Regulatory Guide 1.149, dated October 2001)

NUCLEAR POWER PLANT SIMULATION FACILITIES FOR USE IN OPERATOR TRAINING, LICENSE EXAMINATIONS, AND APPLICANT EXPERIENCE REQUIREMENTS

A. INTRODUCTION

This guide describes methods acceptable to the staff of the U.S. Nuclear Regulatory Commission (NRC) for complying with those portions of the Commission's regulations associated with approval or acceptance of a nuclear power plant simulation facility for use in operator and senior operator training, license examination operating tests, and meeting applicant experience requirements.

Title 10, of the *Code of Federal Regulations*, Part 55, "Operators' Licenses" (10 CFR Part 55) (Ref. 1), defines the term "simulation facility," in 10 CFR 55.4, "Definitions," as meaning one or more of the following components, alone or in combination, used for either the partial conduct of operating tests for operators, senior operators, and license applicants, or to establish on-the-job training and experience prerequisites for operator license eligibility: (1) a plant-referenced simulator, (2) a Commission-approved simulator under 10 CFR 55.46(b), or (3) another simulation device, including part-task and limited scope simulation devices, approved under 10 CFR 55.46(b). In particular, 10 CFR 55.46, "Simulation Facilities," addresses the use of a simulation facility for the administration of the operating test and plant-referenced simulators to meet experience requirements for applicants for operator and senior operator licenses. In addition, 10 CFR 55.59, "Requalification," addresses, in part, the use of a simulation facility to perform required control manipulations and plant evolutions not performed at the plant for on-the-job training of licensed operator and senior operators.

The NRC issues regulatory guides to describe to the public methods that the staff considers acceptable for use in implementing specific parts of the agency's regulations, to explain techniques that the staff uses in evaluating specific problems or postulated accidents, and to provide guidance to applicants. Regulatory guides are not substitutes for regulations and compliance with them is not required.

This regulatory guide is being issued in draft form to involve the public in the early stages of the development of a regulatory position in this area. It has not received final staff review or approval and does not represent an official NRC final staff position.

Public comments are being solicited on this draft guide (including any implementation schedule) and its associated regulatory analysis or value/impact statement. Comments should be accompanied by appropriate supporting data. Written comments may be submitted to the Rules, Announcements, and Directives Branch, Office of Administration, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; submitted through the NRC's interactive rulemaking Web page at <http://www.nrc.gov>; or faxed to (301) 492-3446. Copies of comments received may be examined at the NRC's Public Document Room, 11555 Rockville Pike, Rockville, MD. Comments will be most helpful if received by August 27, 2010.

Electronic copies of this draft regulatory guide are available through the NRC's interactive rulemaking Web page (see above); the NRC's public Web site under Draft Regulatory Guides in the Regulatory Guides document collection of the NRC's Electronic Reading Room at <http://www.nrc.gov/reading-rm/doc-collections/>; and the NRC's Agencywide Documents Access and Management System (ADAMS) at <http://www.nrc.gov/reading-rm/adams.html>, under Accession No. ML100770145.

This regulatory guide contains information collection requirements covered by 10 CFR Part 55 that the Office of Management and Budget (OMB) approved under OMB control number 3150-0018. The NRC may neither conduct nor sponsor, and a person is not required to respond to, an information collection request or requirement unless the requesting document displays a currently valid OMB control number.

B. DISCUSSION

Background

In March 1987, the Commission amended its regulations requiring all utilization facility licensees to have a simulation facility (either a “plant-referenced simulator” or an “other-than-a-plant-referenced simulator”) by May 26, 1991, for use in administering NRC operating tests and licensed operator requalification training (Volume 52, page 9460, of the *Federal Register* (52 FR 9460; March 25, 1987)) (Ref. 2).

In October 2001, the NRC amended its regulations to permit facility licensee applicants for operator’s licenses to fulfill a portion of the required experience prerequisites by manipulating a plant-referenced simulator as an alternative to manipulating the controls of the actual nuclear power plant (66 FR 52667; October 17, 2001) (Ref. 3). The final rule became effective November 16, 2001.

Also in October 2001, the staff issued Revision 3 of Regulatory Guide 1.149, “Nuclear Power Plant Simulation Facilities for Use in Operator Training and License Examinations” (Ref. 4), that endorsed the industry’s previously adopted consensus standard, American National Standards Institute/American Nuclear Society (ANSI/ANS)-3.5-1998, “Nuclear Power Plant Simulators for Use in Operator Training and Examination,” dated April 15, 1998 (Ref. 5), as well as two historical editions, ANSI/ANS-3.5-1993, dated March 29, 1993 (Ref. 6), and ANSI/ANS-3.5-1985, dated October 25, 1985 (Ref. 7), as methods acceptable to the NRC staff for implementing specific parts of the Commission’s regulations and techniques used by the staff in evaluating compliance.

As a result of the regulatory experience gained since Revision 3 of Regulatory Guide 1.149, this draft guide updates and clarifies the scope of the guideline to better serve simulation facility licensees and the regulatory community. The guide helps to ensure that simulation facilities used to meet the requirements of 10 CFR Part 55 are sufficient in both scope and fidelity for the regulatory purposes for which they are being used with respect to (1) operating tests, as described in 10 CFR 55.45(a); (2) licensed operator requalification training requirements, as described in 10 CFR 55.59; and (3) performance of control manipulations that affect reactivity to establish eligibility for an operator’s license, as described in 10 CFR 55.31(a)(5).

Role of Nuclear Power Plant Simulation Facilities in Operator Licensing

Facility licensees are responsible for ensuring that individuals who receive operator or senior operator licenses possess the knowledge, skills, and abilities necessary to operate the nuclear facility in a safe and competent manner. Since 1991, the NRC, as well as facility licensees, have been using nuclear power plant simulation facilities to determine whether or not an applicant for an operator’s license has learned to operate a facility competently and safely, and, in the case of a senior operator, whether or not an applicant has learned to direct the licensed activities of licensed operators competently and safely. Currently, 72 full-scope plant-referenced simulators are in service for use in meeting the regulatory needs of approximately 4,500 licensed operators manning 104 commercial nuclear power plants operating in the United States. When applicants are tested and evaluated on a plant-referenced simulator, major facility

differences are minimized between the testing and operating environments. As a result, NRC examiners are able to make pass-fail judgments with confidence.

Currently, no facility licensees have proposed to use a simulation facility other than a plant-referenced simulator in the administration of an operating test. Facility licensees are required to request approval from the Commission should they propose to use an other-than-a-plant-referenced simulator in the operating test. Absent the use of plant-referenced simulators, operator licensing regulatory requirements would be much more difficult to meet since Commission-approved simulation facilities and Commission approval of the use of the actual plant would require the Commission to find that the simulation facility and its proposed use, or the proposed use of the plant, are suitable for the conduct of operating tests.

The staff anticipates that additional nuclear power plant simulation facilities will be placed into service to meet future operator licensing needs with the advent of new nuclear power plants. This guide also applies to the use of new full-scope nuclear power plant simulation facilities when used to meet 10 CFR Part 55 operator licensing requirements.

Plant-Referenced Simulator Performance Testing

The NRC is updating and clarifying the guidance in this topical area to ensure a more uniform and consistent approach to performance testing a plant-referenced simulator. The Commission's regulations in 10 CFR 55.4 define the following three terms, which are very important to understanding the staff's perspective on simulator performance testing:

- “Performance testing” means testing conducted to verify a simulation facility's performance as compared to actual or predicted reference plant performance.
- “Plant-referenced simulator” means a simulator modeling the systems of the reference plant with which the operator interfaces in the control room, including operating consoles, and which permits use of the reference plant's procedures.
- “Reference plant” means the specific nuclear power plant from which a simulation facility's control room configuration, system control arrangement, and design data are derived.

For the Commission to accept a simulation facility consisting solely of a plant-referenced simulator for conducting operating tests, as described in 10 CFR 55.45(a) and 10 CFR 55.59(a)(2), for requalification training, as described in 10 CFR 55.59(c)(3), or for performing control manipulations that affect reactivity to establish eligibility for an operator's license, as described in 10 CFR 55.31(a)(5), the simulator must meet specific regulatory requirements, as described in 10 CFR 55.46(c) and 10 CFR 55.46(d). Specifically, 10 CFR 55.46(c) prescribes the minimum scope and fidelity requirements for a plant-referenced simulator, while 10 CFR 55.46(d) prescribes the performance testing requirements necessary for continued assurance of simulator fidelity.

The underlying purpose for the performance testing requirement is to ensure that plant-referenced simulators (when used to meet operator licensing requirements) demonstrate on a continuing basis: (1) expected plant response to operator input and to normal, transient, and accident conditions to which the simulator has been designed to respond, and (2) sufficiency in scope and fidelity to allow conduct of the evolutions associated with operating test content and licensed operator requalification program on-the-job training, applicable to the design of the reference plant. Additionally, the Commission's regulations in 10 CFR 55.46(c)(2) require that facility licensees that propose to use a plant-referenced simulator to meet the experience requirements in 10 CFR 55.31(a)(5) ensure that (1) the plant-referenced simulator

utilizes models relating to nuclear and thermal-hydraulic characteristics that replicate the most recent core load in the nuclear power reference plant for which a license is being sought, and (2) simulator fidelity has been demonstrated so that significant control manipulations are completed without procedural exceptions, simulator performance exceptions, or deviation from the approved training scenario sequence.

ANSI/ANS-3.5-2009, “Nuclear Power Plant Simulators for Use in Operator Training and Examination”

On September 4, 2009, ANSI approved ANSI/ANS-3.5-2009, “Nuclear Power Plant Simulators for Use in Operator Training and Examination” (Ref. 8), as an American National Standard. The ANS Standards Committee Working Group ANS-3.5 developed and approved this industry consensus standard. The 2009 version is the sixth issuance of the standard since its initial approval in 1979. The revised standard received substantial support from a diverse and dedicated group of professionals, representing many utilities and interested parties, experienced in the use of full scope nuclear power plant simulators. The ANS-3.5 Working Group comprised a wide range of utility, independent, and industry oversight organizations (including official representatives from the Institute of Nuclear Power Operations and the NRC) during the development of the revised standard.

The revised standard continues to establish the functional requirements for full-scope nuclear power plant control room simulators for use in operator training and examination, as well as criteria for the scope of simulation, performance, and functional capabilities of simulators. In addition to enhanced readability, users of the revised standard will find improvements and clarifications in simulator scenario-based performance testing, new sections addressing simulator core performance testing and post event simulator testing, and other important guidance required to ensure accurate simulation for use in operator training and examination.

NEI 09-09, “Nuclear Power Plant-Referenced Simulator Scenario Based Testing Methodology”

On December 11, 2007 (Ref. 9), the NRC and the Nuclear Energy Institute (NEI) Licensed Operator Focus Group (LOFG) agreed, in principal, on a methodology for performing, evaluating, and documenting simulator scenario-based testing (SBT) that facilitates implementation of a standardized approach to SBT mutually acceptable to both parties.

On December 8, 2009, NEI provided for NRC review and endorsement of its industry guidance document, NEI-09-09, Revision 1, “Nuclear Power Plant-Referenced Simulator Scenario Based Testing Methodology” (Ref. 10), which provides an equitable and consistent approach and methodology for the conduct and documentation of SBT, as described in Section 4.4.3.2, “Simulator Scenario-Based Testing,” of ANSI/ANS-3.5-2009. NEI-09-09, Revision 1, also supports Section 4.4.3.2, “Simulator Scenario-Based Testing,” of ANSI/ANS-3.5-1998.

Appendices to This Regulatory Guide

Appendix A to this guide contains the text of 10 CFR 55.46.

Appendix B to this guide contains the industry guidance document, NEI-09-09, Revision 1, Attachment 1, “Nuclear Power Plant-Referenced Simulator Scenario Based Testing Methodology Checklist.” The checklist ensures that simulation facility licensees (1) use the simulator performance criteria in ANSI/ANS-3.5-2009 and (2) implement the SBT methodology discussed in the evaluation

section of NEI-09-09. NEI-09-09, Revision 1, is available for public review on the NRC's public Web site.

C. REGULATORY POSITION

1. Use of Voluntary Consensus Standards

The National Technology Transfer and Advancement Act of 1995 (Pub. L. 104-113) (Ref. 11) requires that Federal agencies use technical standards developed or adopted by voluntary consensus standard bodies unless the use of such a standard is inconsistent with applicable law or otherwise impractical. NRC representatives participated in the development of ANSI/ANS-3.5-2009 in support of its mission and to encourage industry to develop a standard that the NRC can endorse and industry can voluntarily carry out (e.g., simulation facility licensees).

2. NRC Acceptance and Endorsement of ANSI/ANS-3.5-2009

In general, the NRC accepts and endorses industry consensus standards through incorporation by reference in regulations and through reference in such documents as regulatory guides, NUREG reports, standard review plans, and technical specifications. The NRC recognizes that the designation of ANSI/ANS-3.5-2009 as an American National Standard attests that the principles of openness and due process have been followed in its approval and that a consensus of those directly and materially affected by the standard has been achieved. Therefore, the agency's sponsoring office, the Office of Nuclear Reactor Regulation (NRR), through reference in this regulatory guide, accepts and endorses ANSI/ANS-3.5-2009 as described below. The clarifications outlined in the following paragraphs apply to the Commission's endorsement of ANSI/ANS-3.5-2009.

a. ANSI/ANS-3.5-2009 sets forth provisions acceptable to the NRC staff for (1) addressing minimum design, testing, performance, and configuration criteria for a full-scope plant-referenced simulator, (2) comparing a simulator to its reference plant, (3) upgrading a simulator to reflect changes to reference plant response or control room configuration, and (4) improving simulator fidelity. As such, ANSI/ANS-3.5-2009 provides methods acceptable to the NRC staff for a facility licensee to demonstrate that, through meeting the criteria of the standard, a plant-referenced simulator will possess a degree of completeness and accuracy sufficient to meet the requirements of 10 CFR Part 55.46. Although the scope statement of ANSI/ANS-3.5-2009 is limited to the use of full-scope nuclear power plant simulators in operator training and examination, the staff has concluded that simulators meeting this standard should also be satisfactory for meeting the applicant experience requirements described in 10 CFR 55.31 (a) (5).

b. In regard to Section 3.1.4, "Malfunctions," simulation facility licensees should demonstrate that they have conducted performance testing of the malfunctions listed in the standard, as applicable to the design of the reference plant, at least once in the life of the simulation facility and that the associated test documentation includes the completed test results. If performance testing of a malfunction has been completed more than once, then the licensee need only retain the latest test results. The staff recognizes that simulator malfunction test results may be retained longer than 4 years after the completion of each malfunction test. Therefore, regardless of how long it has been since the malfunction test has been performed, the NRC expects simulation facility licensees to make the results of these malfunction performance tests available for NRC review, either before, or concurrent with, the preparation for each operating test or requalification program inspection.

c. In regard to Section 3.4.1, "Simulator Verification Testing," and Section 3.4.2, "Simulator Validation Testing," the NRC neither expects nor requires the standard's quality assurance methodology (during software model development in a controlled configuration environment) to be included in the

facility licensee's quality assurance program, as described in Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." Appendix B does not apply to simulation facilities as defined in and used for meeting 10 CFR Part 55 requirements.

d. In regard to Section 3.4.3.2, "Simulator Scenario-Based Testing," simulation facility licensees should meet the requirements of the standard with respect to the following type of SBTs for inclusion as simulator performance tests: (1) NRC initial license examination (operating test) scenarios, (2) licensed operator requalification annual examination (operating test) simulator scenarios, and (3) scenarios used for performing applicant control manipulations that affect reactivity to establish eligibility for an operator's license. All other operator and senior operator training simulator scenarios (such as just-in-time training and routine plant system and equipment startup and shutdown training) are excluded from SBT for purposes of meeting the standard's SBT requirements.

e. In regard to Section 4.4.3.1, "Simulator Operability Testing," Footnote 6, as referenced to Appendix A, "Guideline for Documentation of Simulator Design and Test Performance," simulation facility licensees should note that Appendix A provides examples that are applicable to Section 4.4.3.1.

f. In regard to Section 4.4.3.2, "Simulator Scenario-Based Testing," simulation facility licensees should also adhere to the NEI standardized approach for the conduct, performance, and documentation of simulator SBT, as described in NEI 09-09, Revision 1. The NRC expects licensees to perform other simulator performance testing, such as that described in Section 4.4.3.1, "Simulator Operability Testing"; Section 4.4.3.3, "Simulator Reactor Core Performance Testing", and Section 4.4.3.4, "Post-Event Simulator Testing," separately and independently from the testing described in Section 4.4.3.2.

g. In regard to Section 4.4.3.3, "Simulator Reactor Core Performance Testing," simulation facility licensees should meet the requirements of the standard with respect to real time and the conduct of core evolutions involved. The NRC expects a facility licensee's plant-referenced simulator to utilize models relating to nuclear and thermal-hydraulic characteristics that replicate a core load in the nuclear power reference plant. If the plant-referenced simulator is used to meet NRC applicant experience requirements, as described in 10 CFR 55.31(a)(5), then the most recent core load (e.g., the current reference plant core load, or if the reference plant is in a refueling outage, the core load just previous to the outage) in the nuclear power reference plant for which a license is being sought must be utilized.

h. In regard to Section 4.4.3.4, "Post-Event Simulator Testing," simulation facility licensees should meet the requirements of the standard with respect to demonstrating that the plant-referenced simulator performance and response compares favorably to the reference plant's performance and response without significant deviation from the sequence of events for the reference plant event. As a minimum, a licensee should demonstrate on the plant-referenced simulator those reference plant events that result in (1) the automatic initiation of an engineered safety system, (2) the manual or automatic trip of the nuclear reactor, (3) a significant unplanned or unexpected reactivity change, (4) the manual or automatic trip of the main turbine-generator while online with the electrical grid, and (5) any other event deemed appropriate by the facility licensee within 60 calendar days following the event to ensure that fidelity is being met and maintained.

3. NRC Acceptance and Endorsement of NEI-09-09, Revision 1

The NRC staff has reviewed NEI-09-09, Revision 1, and finds the implementation guidance an acceptable method for simulation facility licensees to demonstrate their compliance with the requirements of Sections 3.4.3.2 and 4.4.3.2 of ANSI/ANS-3.5-2009 regarding simulator SBT. Therefore, the NRC accepts and endorses NEI-09-09 as an acceptable method for an equitable and consistent approach and

methodology for the conduct and documentation of SBT, as described in ANSI/ANS-3.5-2009 (and ANSI/ANS-3.5-1998, which NEI-09-09, Revision 0, supported). Implementation of NEI-09-09, Revision 1, ensures that simulation facility licensees will demonstrate expected plant response to operator input and to normal, transient, and accident conditions to which the simulator has been designed to respond, so that significant control manipulations are completed without procedural exceptions, simulator performance exceptions, or deviation from the approved training scenario sequence.

4. Acceptability of Licensee's Simulation Facility

Licensees who maintain simulation facilities certified under previous editions of ANSI/ANS-3.5 (-1998, -1993, and -1985) endorsed by the NRC are encouraged to, but are not required to, revise the software and testing documentation to maintain the simulation facility in accordance with ANSI/ANS-3.5-2009. The NRC staff recognizes that it will take some time for these simulation facility licensees to transition to ANSI/ANS-3.5-2009. Therefore, the NRC staff anticipates that simulation facility licensees will voluntarily move to ANSI/ANS-3.5-2009 following the date of the final regulatory guide (e.g., Regulatory Guide 1.149, Revision 4).

5. Use of Simulation Facility for Multiple Plants

If a simulation facility licensee desires to use its plant-referenced simulator to train and or examine operators for more than one nuclear power plant (other than the reference plant), it must be able to demonstrate to the NRC staff that the differences between the nuclear power plants are not so significant that they will result in negative training. This demonstration should include an analysis and summary of the differences between each nuclear power plant, including the following:

- (1) facility design and systems relevant to control room personnel,
- (2) technical specifications,
- (3) procedures, primarily abnormal and emergency operating procedures,
- (4) control room design and instrument control location, and
- (5) operational characteristics.

The NRC will only administer operating tests on a plant-referenced simulator that meets the Commission's requirements, as described in 10 CFR 55.46. In addition, a licensee must request Commission approval if it plans to administer the NRC operating test using other than a -plant-referenced simulator or the plant.

6. Use of Other Simulation Devices

If a simulation facility licensee desires to use other simulation devices, including part-task and limited scope simulation devices, approved under 10 CFR 55.46(b), to train and or examine operators and senior operators, it must be able to demonstrate to the NRC staff that use of such devices will not result in negative training. The NRC staff recognizes that other simulation devices not approved under 10 CFR 55.46(b) are being used extensively to facilitate operator and senior operator training in classroom settings or on personal computers or both. The NRC encourages the use of other simulation devices when simulation models have been derived directly from the facility licensee's plant-referenced simulator.

D. IMPLEMENTATION

The purpose of this section is to provide information to applicants and licensees regarding the NRC's plans for using this draft regulatory guide. The NRC does not intend or approve any imposition or backfit in connection with its issuance.

The NRC has issued this draft guide to encourage public participation in its development. The NRC will consider all public comments received in development of the final guidance document. In some cases, applicants or licensees may propose an alternative or use a previously established acceptable alternative method for complying with specified portions of the NRC's regulations. Otherwise, the methods described in this guide will be used in evaluating compliance with the applicable regulations regarding the acceptability of a simulation facility for use in operator training and examination, for use in licensed operator requalification training and examinations, and for use in meeting reactor experience requirements to establish applicant eligibility for an operator's license.

The NRC staff recognizes that a commitment to ANSI/ANS-3.5-2009 is voluntary on the part of simulation facility licensees. Since its last revision to Regulatory Guide 1.149, the NRC staff has worked closely with simulation facility licensees and other interested stakeholders through the NEI LOFG to facilitate voluntary movement to a single industry consensus standard. The NRC has determined that movement to a single consensus standard is in the best interest of simulation facility licensees, as well as NRC inspectors and examiners and the general public. The NRC is confident that such a movement will be seamless and transparent with minimal burden, if any. As a result, NRC review and inspection of plant-referenced simulators for compliance with the requirements of 10 CFR 55.46 will be more uniform and consistently implemented when the staff carries out the Reactor Oversight Process baseline Inspection Procedure, IP-71111.11, "Licensed Operator Requalification Program."

The NRC staff anticipates simulation facility licensees that maintain and use a plant-referenced simulator to meet 10 CFR Part 55 requirements will voluntarily transition to ANSI/ANS-3.5-2009. Subsequently, the NRC will conduct its periodic plant-referenced simulator baseline inspections for adherence to ANSI/ANS 3.5 2009 as one acceptable method for complying with those portions of the Commission's regulations associated with approval or acceptance of a nuclear power plant simulation facility for use in operator and senior operator training, license examination operating tests, and meeting applicant experience requirements.

REGULATORY ANALYSIS

Statement of the Problem

On September 4, 2009, ANSI approved ANSI/ANS-3.5-2009 as the new industry consensus American National Standard. Initially approved in 1979, the 2009 version marks the sixth issuance of the standard. The ANS-3.5 Working Group of the Standards Committee of the ANS developed and prepared the new standard.

Facility licensees that maintain a simulation facility consisting solely of a plant-referenced simulator currently adhere to and use one of three historical versions of ANSI/ANS-3.5: (1) ANSI/ANS-3.5-1985, (2) ANSI/ANS-3.5-1993, or (3) ANSI/ANS-3.5-1998. Based on recent industry feedback and work with industry representatives through the NEI LOFG, the NRC believes that the use of a single updated standard will greatly enhance facility licensees' approach to and standardization of simulator performance testing requirements, as well as the NRC's ability to uniformly inspect for and determine compliance with its plant-referenced simulator fidelity regulations. The staff

believes that simulation facility licensees can transition to ANSI/ANS-3.5-2009 with little or no impact to their simulator performance testing programs.

The NRC has revised Regulatory Guide 1.149, originally issued April 1981, three times (April 1987, April 1996, and October 2001) to endorse successive revisions of ANSI/ANS-3.5. The staff specified exceptions to previous standards in the area of performance testing in the initial issuance through Revision 3 to ensure that application of previous standards would support the requirements of the regulations and be responsive to the NRC's concern that simulator fidelity be demonstrated and met, maintained, and assured on a continuing basis.

As a result of regulatory experience gained from oversight and inspection of simulation facilities, as well as feedback from industry stakeholders, the NRC is revising Regulatory Guide 1.149 to update and clarify its position regarding methods acceptable to the staff for complying with those portions of the NRC's regulations associated with approval or acceptance of a simulation facility for use in operator and senior operator training (initial and requalification), for use in NRC license examinations (operating tests), and for use in meeting applicant experience requirements (for performing control manipulations that affect reactivity) to establish eligibility for an operator's license.

Revision of Regulatory Guide 1.149 is necessary for (1) the NRC to endorse the use of ANSI/ANS-3.5-2009 as a technical standard to ensure compliance with the Commission's simulation facility scope and fidelity requirements, (2) simulation facility licensees to voluntarily move to a single consensus standard and carry out its requirements, (3) the NRC to communicate its expectations, and (4) facilitation of a common approach and methodology for conducting and documenting simulator scenario-based performance testing.

Objective

The objective of this regulatory action is to update and clarify a number of regulatory issues important to the NRC staff and simulation facility licensees as stakeholders for which the current revision (i.e., Revision 3) of Regulatory Guide 1.149 does not provide sufficient guidance.

Alternative Approaches

The NRC staff considered the following alternative approaches:

Do not revise Regulatory Guide 1.149.

Revise and update Regulatory Guide 1.149.

Alternative 1: Do Not Revise Regulatory Guide 1.149

Under this alternative, the NRC would not revise this guidance, and the current guidance would be retained. If NRC does not take action, there would not be any changes in costs or benefit to the public, licensees, or the NRC. However, the "no-action" alternative would not address identified concerns with the current version of the guide. The NRC would continue to review each simulation facility on a case-by-case basis. This alternative provides a baseline condition from which any other alternatives will be assessed.

Alternative 2: Revise and Update Regulatory Guide 1.149

Under this alternative, the NRC would revise Regulatory Guide 1.149, taking into consideration the extensive regulatory experience gained since last revision of Regulatory Guide 1.149 in October 2001.

The benefit of updating and revising Regulatory Guide 1.149 is that it would provide guidance to ensure that nuclear power plant simulation facilities used for operator training, license examinations, and applicant experience requirements are maintained in accordance with the industry's most recent consensus standard, which will preclude negative training and inappropriate operator license evaluations. Simulation facilities that meet the minimum scope and fidelity requirements of ANSI/ANS-3.5-2009 must be able to demonstrate, on a continuing basis, compliance with the Commission's simulation facility regulations, as described in 10 CFR 55.46.

The impact to the NRC would be the costs associated with preparing and issuing the revised regulatory guide. The impact to the public would be the voluntary costs associated with reviewing and providing comments to the NRC during the public comment period. The impact to facility licensees would be the cost of implementing the new standard. The value to the NRC staff and facility licensees would be the benefits associated with enhanced efficiency and effectiveness in using a common guidance document as the technical basis for demonstrating compliance with the Commission's simulation facility scope and fidelity requirements, as described in 10 CFR 55.46, and during other interactions between the NRC and facility licensees. The staff believes that simulation facility licensees would incur little or no cost (for licensees who have not already moved to ANSI/ANS-3.5-2009, the cost is expected to be minimal, if any, since significant human resource burdens and simulator performance testing time savings are anticipated as a result of moving to one standard, which the proposed guide is advocating).

Conclusion

Based on this regulatory analysis, the staff recommends revision of Regulatory Guide 1.149. The staff concludes that the proposed action will reduce unnecessary burden on both the NRC and its licensees and will result in an improved and more uniform process for simulation facility licensees to demonstrate compliance with the Commission's plant-referenced simulator regulations. Moreover, the staff sees no adverse effects associated with issuing this regulatory guide.

GLOSSARY

controls—When used with respect to the referenced nuclear reactor, apparatus and mechanisms the manipulation of which directly affects the reactivity or power level of the referenced reactor (Ref. 1).

negative training—Training on a simulator whose configuration or performance leads the operator or senior operator to incorrect response or understanding of the reference nuclear power plant (Ref. 8).

performance testing—Testing conducted to verify a simulation facility's performance as compared to actual or predicted reference plant performance (Ref. 1).

plant-referenced simulator—A simulator modeling the systems of the reference plant with which the operator interfaces in the control room, including operating consoles, and which permits use of the reference plant's procedures (Ref. 1).

real time—Simulation of dynamic performance in the same time base relationships, sequences, durations, rates, and accelerations as the dynamic performance of the reference plant (Ref. 8).

reference plant—The specific nuclear power plant from which a simulation facility's control room configuration, system control arrangement, and design are derived (Ref. 1).

simulation facility—One or more of the following components, alone or in combination, used for either the partial conduct of operating tests for operators, senior operators, and license applicants, or to establish on-the-job training and experience prerequisites for operator license eligibility: (1) a plant-referenced simulator, (2) a Commission-approved simulator under 10 CFR 55.46(b), or (3) another simulation device, including part-task and limited scope simulation devices, approved under 10 CFR 55.46(b) (Ref. 1).

REFERENCES¹

1. 10 CFR Part 55, "Operators' Licenses," U.S. Nuclear Regulatory Commission, Washington, DC.
2. 52 FR 9460, "Operator's Licenses and Conforming Amendments," Final Rule, *Federal Register*, Volume 52, Number 57, p. 9460, Washington, DC, March 25, 1987.
3. 66 FR 52667, "Operator License Eligibility and Use of Simulation Facilities in Operator Licensing," Final Rule, *Federal Register*, Volume 66, Number 201, p. 52667, Washington, DC, October 17, 2001.
4. Regulatory Guide 1.149, "Nuclear Power Plant Simulation Facilities for Use in Operator Training and License Examinations," Revision 3, U.S. Nuclear Regulatory Commission, Washington, DC, October 2001.
5. ANSI/ANS-3.5-1998, "Nuclear Power Plant Simulators for Use in Operator Training and Examination," American Nuclear Society, La Grange Park, IL, April 15, 1998.
6. ANSI/ANS-3.5-1993, "Nuclear Power Plant Simulators for Use in Operator Training and Examination," American Nuclear Society, La Grange Park, IL, March 29, 1993.
7. ANSI/ANS-3.5-1985, "Nuclear Power Plant Simulators for Use in Operator Training," American Nuclear Society, La Grange Park, IL, October 25, 1985.
8. ANSI/ANS-3.5-2009, "Nuclear Power Plant Simulators for Use in Operator Training and Examination," American Nuclear Society, La Grange Park, IL, September 4, 2009.²
9. Memo from Nancy L. Salgado, Chief, Operator Licensing and Human Performance Branch, Division of Inspection and Regional Support (DIRS), Office of Nuclear Reactor Regulation (NRR), to Frederick D. Brown, Director, DIRS, NRR re: Summary of December 11, 2007, Meeting with Industry Focus Group on Operator Licensing Issues, January 3, 2008. ADAMS Accession No. ML073511714
10. Letter to NRC from John C. Butler, Director, Operations Support, Nuclear Generation Division, NEI, to John McHale, Chief, Operator Licensing and Human Performance Branch, DIRS, NRR re: NEI 09-09, "Nuclear Power Plant-Referenced Simulator Scenario Based Testing Methodology," Revision 1, December 8, 2009. ADAMS Accession Nos. ML093521654 (cover letter) and ML093521659 (associated attachment)
11. The National Technology Transfer and Advancement Act of 1995, Pub. L. 104-113.

¹ Publicly available NRC published documents such as Regulations, Regulatory Guides, NUREGs, and Generic Letters listed herein are available electronically through the Electronic Reading room on the NRC's public Web site at: <http://www.nrc.gov/reading-rm/doc-collections/>. Copies are also available for inspection or copying for a fee from the NRC's Public Document Room (PDR) at 11555 Rockville Pike, Rockville, MD; the mailing address is USNRC PDR, Washington, DC 20555; telephone 301-415-4737 or (800) 397-4209; fax (301) 415-3548; and e-mail PDR.Resource@nrc.gov.

² Copies of the non-NRC documents included in these references may be obtained directly from the publishing organization.

APPENDIX A

TEXT OF 10 CFR 55.46

§ 55.46 Simulation facilities.

(a) *General.* This section addresses the use of a simulation facility for the administration of the operating test and plant-referenced simulators to meet experience requirements for applicants for operator and senior operator licenses.

(b) *Commission-approved simulation facilities and Commission approval of use of the plant in the administration of the operating test.*

(1) Facility licensees that propose to use a simulation facility, other than a plant-referenced simulator, or the plant in the administration of the operating test under §§ 55.45(b)(1) or 55.45(b)(3), shall request approval from the Commission. This request must include:

(i) A description of the components of the simulation facility intended to be used, or the way the plant would be used for each part of the operating test, unless previously approved; and

(ii) A description of the performance tests for the simulation facility as part of the request, and the results of these tests; and

(iii) A description of the procedures for maintaining examination and test integrity consistent with the requirements of § 55.49.

(2) The Commission will approve a simulation facility or use of the plant for administration of operating tests if it finds that the simulation facility and its proposed use, or the proposed use of the plant, are suitable for the conduct of operating tests for the facility licensee's reference plant under § 55.45(a).

(c) *Plant-referenced simulators.*

(1) A plant-referenced simulator used for the administration of the operating test or to meet experience requirements in § 55.31(a)(5) must demonstrate expected plant response to operator input and to normal, transient, and accident conditions to which the simulator has been designed to respond. The plant-referenced simulator must be designed and implemented so that it:

(i) Is sufficient in scope and fidelity to allow conduct of the evolutions listed in §§ 55.45(a)(1) through (13), and 55.59(c)(3)(i)(A) through (AA), as applicable to the design of the reference plant.

(ii) Allows for the completion of control manipulations for operator license applicants.

(2) Facility licensees that propose to use a plant-referenced simulator to meet the control manipulation requirements in § 55.31(a)(5) must ensure that:

(i) The plant-referenced simulator utilizes models relating to nuclear and thermal-hydraulic characteristics that replicate the most recent core load in the nuclear power reference plant for which a license is being sought; and

(ii) Simulator fidelity has been demonstrated so that significant control manipulations are completed without procedural exceptions, simulator performance exceptions, or deviation from the approved training scenario sequence.

(3) A simulation facility consisting solely of a plant-referenced simulator must meet the requirements of paragraph (c)(1) of this section and the criteria in paragraphs (d)(1) and (4) of this section for the Commission to accept the plant-referenced simulator for conducting operating tests as described in § 55.45(a) of this part, requalification training as described in § 55.59(c)(3) of this part, or for performing control manipulations that affect reactivity to establish eligibility for an operator's license as described in § 55.31(a)(5).

(d) *Continued assurance of simulator fidelity.* Facility licensees that maintain a simulation facility shall:

(1) Conduct performance testing throughout the life of the simulation facility in a manner sufficient to ensure that paragraphs (c)(2)(ii), as applicable, and (d)(3) of this section are met. The results of performance tests must be retained for four years after the completion of each performance test or until superseded by updated test results;

(2) Correct modeling and hardware discrepancies and discrepancies identified from scenario validation and from performance testing;

(3) Make results of any uncorrected performance test failures that may exist at the time of the operating test or requalification program inspection available for NRC review, prior to or concurrent with preparations for each operating test or requalification program inspection; and

(4) Maintain the provisions for license application, examination, and test integrity consistent with § 55.49.

[66 FR 52667, Oct. 17, 2001]

This appendix provides the regulatory text of 10 CFR 55.46 so that the public can follow and discern the applicable references mentioned in this draft regulatory guide. The final guide may or may not include this appendix.

APPENDIX B

ATTACHMENT 1 (NEI-09-09, Revision 1) NUCLEAR POWER PLANT-REFERENCED SIMULATOR SCENARIO-BASED TESTING METHODOLOGY CHECKLIST

Scenario Number:	Revision:	IC:	Date Validated:
Item	Simulator Performance	Initials	
1	Simulator performance supported scenario objectives.		
2	Simulator initial conditions (IC) agreed with reference plant with respect to reactor status, plant configuration, and system operation.		
3	Simulator operated in real time during conduct of SBT [scenario-based testing]. <i>Note: Use of "freeze" allowed when evaluating specific performance.</i>		
4	Simulator demonstrated expected plant response to operator input and to normal, transient, and accident conditions to which the simulator has been designed to respond.		
5	Simulator permitted use of the reference plant's procedures so that the scenario was completed without procedural exceptions, simulator performance exceptions, or deviation from the scenario sequence.		
6	Simulator did not fail to cause an expected alarm or automatic action and did not cause an unexpected alarm or automatic action. <i>Note: Attach simulator alarm summary (versus time) to SBT Test Results record.</i>		
7	Observable change in simulated parameters corresponded in trend and direction to those expected from actual or best estimate response of the reference plant. <i>Note: Attach predetermined Monitored Parameter List (versus time) to SBT Test Results record.</i>		
8	Reference plant design limitations were not exceeded.		
9	Each scenario malfunction demonstrated expected plant response to its initiating cause.		
10	SBT conducted in a manner sufficient (i.e., meets requirements of ANSI/ANS-3.5-2009) to ensure that simulator fidelity has been demonstrated and met for this scenario. <i>Note: Attach relevant "as-run" marked-up plant procedures and or procedure portions/pages utilized to support assertion.</i>		
11	Modeling and hardware discrepancies identified during the conduct of SBT are documented and entered in accordance with the site simulator configuration management procedures. <i>Note: Discrepancies that directly affect operator response (or action) or expected plant response must be resolved before the SBT test results can be judged as satisfactory.</i>		
12	Simulator SBT performance test results: <div style="text-align: center;"> <input type="checkbox"/> SATISFACTORY / <input type="checkbox"/> UNSATISFACTORY </div> <i>Note: Attach list of SBT test personnel, include name, job title, and role.</i>	Date (mm/dd/yyyy) and Signature	
Technical comments attached: No/Yes (circle one: if Yes, attach comments)			

The draft regulatory guide includes this appendix so that the public can discern the staff's acceptance and endorsement of the Nuclear Energy Institute's (NEI) industry technical guidance document, NEI-09-09, Revision 1. The final guide may or may not include this appendix.