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DRAFT REGULATORY GUIDE DG-1080
(Proposed Revision 3 of Regulatory Guide 1.149)

NUCLEAR POWER PLANT SIMULATION FACILITIES FOR USE IN OPERATOR TRAINING AND LICENSE EXAMINATIONS

A. INTRODUCTION

In 10 CFR Part 55, "Operators' Licenses," Paragraphs 55.45(a) and 55.59(c)(3) require that an applicant for an operator or senior operator license and each licensed operator of a utilization facility demonstrate both an understanding of and the ability to perform certain essential job tasks. Paragraph 55.45(b) specifies that these operating tests will be administered, in part, either in a simulation facility consisting solely of a plant-referenced simulator that has been certified to the Commission by the facility licensee or in a simulation facility approved by the Commission after application has been made by the facility licensee.

A simulation facility is defined in 10 CFR 55.4 as one or more of the following components, alone or in combination, used for the partial conduct of operating tests for operators, senior operators, and license candidates: (1) the plant, (2) a plant-referenced simulator, (3) another simulation device.

This regulatory guide describes methods acceptable to the NRC staff for complying with those portions of the Commission's regulations regarding certification of a simulation facility consisting solely of a plant-referenced simulator. Previous revisions of this regulatory guide may still be used for certification of a simulation facility or as a basis for application for prior approval of a simulation facility for testing.

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 complete staff review and approval and does not represent an official NRC staff position.

Public comments are being solicited on the 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 and Directives Branch, Office of Administration, U.S. Nuclear Regulatory Commission, Washington, DC 20555. Copies of comments received may be examined at the NRC Public Document Room, 2120 L Street NW., Washington, DC. Comments will be most helpful if received by **October 20, 1999.**

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Regulatory guides are issued to describe to the public methods acceptable to the NRC staff for implementing specific parts of the NRC's regulations, to explain techniques used by the staff in evaluating specific problems or postulated accidents, and to provide guidance to applicants and licensees. Regulatory guides are not substitutes for regulations, and compliance with regulatory guides is not required. Regulatory guides are issued in draft form for public comment to involve the public in developing the regulatory positions. Draft regulatory guides have not received complete staff review and approval, therefore they do not represent official NRC staff positions.

The information collections contained in this draft regulatory guide are covered by the requirements of 10 CFR Part 55 and NRC Form 474, which were approved by the Office of Management and Budget, approval numbers 3150-0018 and 3150-0138. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

B. DISCUSSION

THE ROLE OF SIMULATORS IN OPERATOR LICENSING

Although ensuring that individuals who receive operator or senior operator licenses possess the knowledge, skills, and abilities necessary to operate the facility in a safe manner is the responsibility of facility licensees, the NRC performs an independent review of this process. Section 55.45, "Operating Tests," of 10 CFR Part 55 requires the applicant for a license to demonstrate (1) an understanding of and the ability to perform the actions necessary during normal, abnormal, and emergency situations; (2) the operation of systems that affect heat removal or reactivity changes; and (3) behaviors that show the individual's ability to function within the control room team in such a way that the facility licensee's procedures are adhered to and that the limitations in its license and amendments are not violated.

The use of a plant-referenced simulator for testing enables the examiner to evaluate a license applicant's performance in an environment closely correlated with conditions in the specific plant for which that applicant has applied for a license. When applicants are tested on plant-specific simulators, major facility differences are minimized between testing and operating environments, and examiners are able to make pass-fail judgments with confidence.

In accordance with the requirements in 10 CFR 55.45, the portion of the operating test given in the simulation facility will not be administered on other than an approved or a certified simulation facility after:

1. The facility licensee has submitted a certification in accordance with 10 CFR 55.45(b)(5)(i), or
2. The staff has approved an application submitted by the facility licensee in accordance with 10 CFR 55.45(b)(4), whichever occurs sooner.

The increased use of plant-referenced simulators has provided examiners with the opportunity to better discriminate between success and failure in a license applicant's knowledge and performance than could be achieved with non-plant-referenced simulators.

However, the staff recognizes the existence of several factors that could suggest the use of alternative systems or devices for conducting the nonwalkthrough portions of operating tests. These factors include the cost and lead time associated with procurement or upgrading of a plant-referenced simulator. Moreover, rapidly changing technology in the simulation industry is resulting in previously unavailable options that could lead a facility licensee to seek alternative ways to meet the simulation facility requirements of 10 CFR 55.45. ANSI/ANS 3.5-1998, "Nuclear Power Plant Simulators for Use in Operator Training and Examination" (the Standard), in conjunction with this regulatory guide, provides guidance in these areas.

REGULATORY BACKGROUND

In 1981, NRC evaluated alternative methodologies for regulatory guidance regarding simulator applications. Of the three alternatives -- rulemaking, a regulatory guide, or a national standard endorsed by a regulatory guide -- endorsement of a national standard was favored because it would achieve the desired result while taking advantage of the work performed by industry in its development of ANSI/ANS 3.5-1981, "Nuclear Power Plant Simulators for Use in Operator Training." The basis for NRC's choice of procedural alternatives for its regulatory position remains valid in terms of industry's continuing review and revision of the standard.

Industry initiatives have revised ANSI/ANS 3.5 three times, in 1985, 1993 and in 1998. Regulatory Guide 1.149 has been revised with each successive version of the standard. Throughout it's revision history, the regulatory guide has consistently endorsed the standard as an acceptable method for meeting the requirements of the regulations. Exceptions to the standard in the area of performance testing were specifed in the initial issuance through Revision 2 in 1996 of Regulatory Guide 1.149 to ensure that application of the standard would comport with the requirements of the regulations and be responsive to the NRC's concern that simulator fidelity must be ensured on a continuing basis. In the staff's view, the 1998 revision of the standard incorporates the essential aspects of the exceptions that characterized the NRC's endorsement of prior revisions.

SIMULATOR PERFORMANCE TESTING

The 1981 version of the standard specified a testing regimen that was written in the context of initial simulator procurement. Until the 1998 revision, the primary focus of the standard was initial design and construction of the simulator, a unique condition in which extensive factory acceptance testing is performed on the basis of individual simulator capabilities prior to establishing a software configuration baseline. Except for infrequent simulator replacements, facility licensees' simulators are now in an update and maintenance phase of the simulator life cycle, an area for which previous revisions of the standard were not intended and for which the standard has offered little specific guidance. In most cases, the exhaustive full-scope testing and development of initial software has been completed and is not expected to be repeated; but facility licensees' recurring performance testing programs continue to be structured to remain consistent with the structure of 10 CFR 55.45(b). In the staff's view, the type of testing described in previous revisions of the standard, while providing basic quality assurance, does not adequately consider the training

and examination environment in which the simulator will be used; this was the basis for the staff's exceptions to previous revisions of the standard.

The performance testing specified in 10 CFR 55.45(b) is suited for a capabilities and schedule-based performance testing program. This requirement is difficult to apply to the process of structured software development coupled with the scenario-based testing that is now fully adopted by the 1998 revision of the standard. The software development and performance testing requirements of ANSI/ANS 3.5-1998, while not prescriptive with respect to the details of implementation, bring the simulator application into closer conformance with current industry norms and practices for software quality assurance and training program administration than did the 1985 and 1993 revisions of the national standard. The NRC staff considers this improved software development and testing philosophy to be consistent with the NRC's intent that the simulation facility's ability to faithfully portray malfunctions and its general operability are to be verified by periodic performance testing.

In the staff's view, verification and validation testing in the software development process, coupled with scenario-based testing in the training and examination preparation processes, provides improved assurance of acceptable simulator performance over that provided by previous simulator capabilities-based, stand-alone testing programs. The staff also considers the inclusion of Appendix D, "Guidance on Part-Task and Limited-Scope Simulator Features and Fidelity," in the standard to be advantageous in improving training and examination capabilities of simulation facilities.

C. REGULATORY POSITION

1. ENDORSEMENT OF ANSI/ANS-3.5-1998

Requirements are set forth in ANSI/ANS-3.5-1998, "Nuclear Power Plant Simulators for Use in Operator Training and Examination," for specifying minimum design, testing, performance, and configuration criteria for a full scope, a part-task, or a limited-scope simulator; for integrating simulator design and performance with an accredited training program; for comparing a simulator to its reference plant; and for upgrading simulators to reflect changes to reference plant response or control room configuration or to improve simulator fidelity. The requirements in ANSI/ANS-3.5-1998 provide methods acceptable to the NRC staff for a facility licensee (1) to certify a simulation facility consisting solely of a plant-referenced simulator or (2) to obtain approval of a simulation facility for use in portions of reactor operator and senior operator license examinations, subject to the following clarifications.

1.1 Simulation facilities as defined in 10 CFR 55.4, to the extent that the facility licensee applies for approval under the requirements of 10 CFR 55.45(b), should meet the applicable requirements of ANSI/ANS-3.5-1998.

1.2 In Section 1.2, "Background," the standard identifies other documents to be included as part of the standard. The applicability of one of these documents, ANSI/ANS-3.1, is covered in Revision 2 to Regulatory Guide 1.8, "Qualification and Training of Personnel for Nuclear Power Plants."

2. USE OF A SIMULATOR FOR MULTIPLE PLANTS

If a licensee wishes to use a simulation facility to simulate more than one nuclear power plant, it must demonstrate to the NRC in its certification or in its application that the differences between the plants are not so significant that they have an impact on the ability of the simulation facility to meet the requirements and guidance of ANSI/ANS-3.5-1998 as qualified in this regulatory guide for each of the plants. This demonstration should include an analysis and summary of the differences between each plant and the simulation facility, including:

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.

3. ACCEPTABILITY OF LICENSEE'S SIMULATION FACILITY

Licensees who maintain simulation facilities that were certified under editions of ANSI/ANS 3.5 that were previously endorsed by the NRC may, but are not required to, revise existing programs such that the simulation facility will be maintained in accordance with ANSI/ANS 3.5-1998. Because ANSI/ANS 3.5-1985 has been relegated to an "Historical" status by ANS, licensees whose simulation facilities are currently certified under ANSI/ANS 3.5-1985 should, but are not required to, review their simulator programs for conformance to an active edition of the standard.

4. SCHEDULING OF PERFORMANCE TESTING

The scheduling and evaluation of simulation facility testing under ANSI/ANS 3.5-1998 is a function of the facility licensee's accredited training program. Therefore, the licensee may reference the licensed operator training schedules of the accredited training program as adequate submittal of a schedule for conduct of approximately 25 percent per year of the performance tests as required by 10 CFR 55.45(b)(4)(iii) and (vii) and 10 CFR 55.45(b)(5)(vi).

D. IMPLEMENTATION

The purpose of this section is to provide information to applicants and licensees about the NRC staff's plans for using this draft regulatory guide.

This proposed revision has been released to encourage public participation in its development. Except in those cases in which an applicant proposes an acceptable alternative method for complying with the specified portions of the NRC's regulations, the methods to be described in the final revision of this guide reflecting public comments will be used in the evaluation of the implementation of a facility licensee's simulation facility. Editions of ANSI/ANS 3.5 that were previously endorsed by the NRC remain acceptable methods of meeting the regulations, and revision of this guide will not alter any prior or existing licensing commitments based on their use.

VALUE/IMPACT ANALYSIS

A separate value/impact analysis has not been prepared for this draft regulatory guide. A value/impact analysis was included in the regulatory analysis for the amendments to 10 CFR Part 55 that were published on March 25, 1987, a copy of which was placed in the Public Document Room. This analysis is also appropriate for Revision 3 of Regulatory Guide 1.149. A copy of the regulatory analysis is available for inspection and copying for a fee at the NRC Public Document Room, 2120 L Street NW., Washington, DC. The Public Document Room's mailing address is Mail Stop LL-6, Washington, DC 20555; telephone (202)634-3273; fax (202)634-3343.

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