



# REGULATORY GUIDE

OFFICE OF NUCLEAR REGULATORY RESEARCH

REGULATORY GUIDE 1.149  
(Task RS 110-5)

## NUCLEAR POWER PLANT SIMULATORS FOR USE IN OPERATOR TRAINING

### A. INTRODUCTION

Appendix A, "Requalification Programs for Licensed Operators of Production and Utilization Facilities," to 10 CFR Part 55, "Operators' Licenses," permits use of simulators for operator training.

This regulatory guide describes a method acceptable to the NRC staff for specifying the functional requirements of a nuclear power plant simulator to be used for operator training.

The Advisory Committee on Reactor Safeguards has been consulted concerning this guide and has concurred in the regulatory position.

### B. DISCUSSION

The need for improvements in operator training in the areas of response to abnormal and emergency situations was highlighted as a result of the operator errors noted in NUREG-0585, "TMI-2 Lessons Learned Task Force Final Report."<sup>1</sup> Use of the actual plant for training operators to respond to accidents would result in additional challenges to the plant's protective features and is therefore undesirable. Thus, the additional training required to improve operator performance should be performed on simulators. In order to maximize the effectiveness of this training, the simulator must be kept current with changes in the reference plant and lessons learned from operating experience. Recommendations of instructors and operator trainees for improving a simulator should be encouraged. ANSI/ANS 3.5-1981, "Nuclear Power Plant Simulators for Use in Operator Training,"<sup>2</sup> in conjunction with this regulatory guide, provides guidance in these areas.

The use of simulators for operator training, including the requirements which specify the similarity that must

<sup>1</sup>Copies are available for public inspection or copying for a fee at the NRC Public Document Room, 1717 H Street NW., Washington, D.C., or copies may be purchased for \$2.50 directly from NRC by sending check or money order payable to the Superintendent of Documents to the Director, Division of Technical Information and Document Control, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555.

exist between a simulator and the facility that the operators are being trained to operate, is addressed in 10 CFR Part 55, "Operators' Licenses." This issue, the similarity that must exist between a simulator and the facility that the operators are being trained to operate, is not addressed in the guide and should not be confused with the guidance provided that specifies the similarity that should exist between a simulator and its reference plant.

### C. REGULATORY POSITION

The requirements established by ANSI/ANS 3.5-1981, "Nuclear Power Plant Simulators for Use in Operator Training," for specifying the functional capability of a simulator and for comparing a simulator to its reference plant are acceptable to the NRC staff, subject to the following:

1. The standard identifies at the point of reference (Section 1.1, "Background Data") other documents to be included as part of the standard. The applicability of these documents should be determined by referring to the latest revision of the following regulatory guides and the version of the standard the guide endorses:

ANS Standard <sup>2</sup>	Regulatory Guide
3.1	1.8
3.2	1.33

2. Section 3.1.2, "Plant Malfunctions," lists the abnormal and emergency conditions that must be performed by the simulator if applicable to the reference plant. A simulator should also be able to perform diesel generator failure.

3. Appendix A, "Procedure for Documenting Simulator Performance," to the standard should be considered an integral part of the standard.

4. The simulator performance test discussed in Section 5.4, "Simulator Performance Testing," of the standard

<sup>2</sup>Copies may be obtained from the American Nuclear Society, 555 North Kensington Avenue, LaGrange Park, Illinois 60525.

#### USNRC REGULATORY GUIDES

Regulatory Guides are issued to describe and make available to the public methods acceptable to the NRC staff of implementing specific parts of the Commission's regulations, to delineate techniques used by the staff in evaluating specific problems or postulated accidents, or to provide guidance to applicants. Regulatory Guides are not substitutes for regulations, and compliance with them is not required. Methods and solutions different from those set out in the guides will be acceptable if they provide a basis for the findings requisite to the issuance or continuance of a permit or license by the Commission.

This guide was issued after consideration of comments received from the public. Comments and suggestions for improvements in these guides are encouraged at all times, and guides will be revised, as appropriate, to accommodate comments and to reflect new information or experience.

Comments should be sent to the Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Docketing and Service Branch.

The guides are issued in the following ten broad divisions:

- |                                   |                                   |
|-----------------------------------|-----------------------------------|
| 1. Power Reactors                 | 6. Products                       |
| 2. Research and Test Reactors     | 7. Transportation                 |
| 3. Fuels and Materials Facilities | 8. Occupational Health            |
| 4. Environmental and Siting       | 9. Antitrust and Financial Review |
| 5. Materials and Plant Protection | 10. General                       |

Copies of issued guides may be purchased at the current Government Printing Office price. A subscription service for future guides in specific divisions is available through the Government Printing Office. Information on the subscription service and current GPO prices may be obtained by writing the U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Publications Sales Manager.

should include as a minimum all the provisions of Appendix A to the standard.

5. Sections 2.1, 2.2, and 2.3 of Appendix A to the standard require documentation of equipment lineup as part of the simulator data base for steady state operating conditions, transient operating conditions, and significant plant-occurring events. Equipment lineup documentation need only include equipment that may have an observable effect on the expected plant response being considered.

6. Item 2 of Section 3.2, "Abnormal Operations," of Appendix A to the standard should be taken to mean that although Section 3.1.2 of the standard requires that a minimum of 75 malfunctions be simulated, each simulator will most likely be capable of simulating more than the minimum; therefore, every malfunction that can be introduced into the simulator by the instructor should be tested.

7. The terms "transients," "abnormal conditions," "abnormal operations," and "abnormal evolutions" used in the standard should be considered equivalent to "anticipated operational occurrences."

#### D. IMPLEMENTATION

The purpose of this section is to provide information to applicants regarding the NRC staff's plans for using this regulatory guide. Except in those cases in which an applicant proposes an acceptable alternative method, the method

described in this guide will be used in the evaluation of all simulators placed in operation after August 1, 1984, that are used for training nuclear power plant operators and others whose duties require an operator's or senior operator's license. In addition, all simulators currently in use or placed in use prior to August 1, 1984, for training nuclear power plant operators and others whose duties require an operator's or senior operator's license will be evaluated in accordance with the following schedule:

1. The requirements of Section 1, "Simulator Information," of Appendix A to the standard should be complete by August 1, 1982, or by the time the simulator is placed in operation for training, whichever is later.

2. The requirements of Section 2, "Simulator Data Base," of Appendix A to the standard should be complete by August 1, 1982, or by the time the simulator is placed in operation for training, whichever is later.

3. The tests discussed in Section 3, "Simulator Tests," of Appendix A to the standard should be conducted and the initial documentation should be complete by August 1, 1983, or by the time the simulator is placed in operation for training, whichever is later.

4. Deviation from the data base should be corrected and the simulator should be in full compliance with the requirements of ANSI/ANS 3.5-1981 as modified by this guide by August 1, 1984, or by the time the simulator is placed in operation for training, whichever is later.

## VALUE/IMPACT STATEMENT

### 1. ACTION

#### 1.1 Description

Prior to issuing an operator's license to an applicant, the Commission regulations require that evidence be shown that the applicant has learned to operate the controls in a competent and safe manner. In accordance with ANSI/ANS 3.1-1978, "Qualification and Training of Personnel for Nuclear Power Plants," and Regulatory Guide 1.8, "Personnel Selection and Training,"\* reactor simulators may be used to partially fulfill this requirement. In addition, Appendix A to 10 CFR Part 55 describes the use of simulators for requalification programs, and NUREG-0094, "NRC Operator Licensing Guide,"\*\* describes the use of simulators for initial licensing. This action provides guidance on the acceptable characteristics of reactor simulators used for operator training as described in the above references.

#### 1.2 Need for Action

The need for improvements in operator training in the areas of response to abnormal and emergency situations was highlighted as a result of the operator errors noted in NUREG-0585, "TMI-2 Lessons Learned Task Force Final Report." Use of the actual plant for training operators to respond to accidents would result in additional challenges to the plant's protective features and is therefore undesirable. Thus, additional training required to improve operator performance should be performed on simulators. A recommendation to require simulator training for initial and requalification training was made to the Commission and accepted. The simulators used for current training and proposed future training should have characteristics that allow the objective of training the operator to operate the controls in a competent and safe manner to be met. The action discussed in this value/impact statement is expected to ensure that the objective stated above will be met.

#### 1.3 Value/Impact of Action

##### 1.3.1 NRC

Section 5 of ANSI/ANS 3.1-1978 (endorsed by Regulatory Guide 1.8) "Selection and Training of Nuclear Power

Plant Personnel" uses the adjectives "suitable" (Paragraph 5.2.1) or "appropriate" (Paragraphs 5.2.4 and 5.5.1.2.2) when describing reactor simulators used for training personnel. The value of this action to the NRC is the availability of guidance on what is a "suitable" or "appropriate" reactor simulator against which to review licensee training programs for adequacy. The impact of this action on the NRC will be that of the time spent in developing the guidance, reviewing the licensees' proposals to comply with the guide, and verifying implementation of the proposals.

##### 1.3.2 Other Government Agencies

This action should not impact other government agencies, unless the government agency is an applicant, such as TVA.

##### 1.3.3 Industry

The result of this action is expected to be the addition of required functions to simulators that may now be in use for specific nuclear power plants. The impact on industry will likely be that of increased cost as more complex simulators are required. An alternative to simulators is the use of the actual power plant for training. This use results in lost revenue because the power plant is not available to produce electrical power and also results in additional challenges to the plant protection systems. The value of the action to industry should be (1) more efficient operation of the power plant by better trained operators that would result in a cost savings when the power plant is put on line in an expeditious manner and (2) a reduction in operator errors that might cause plant downtime or equipment damage. The value is based on using simulators that more accurately reflect the power plant they represent and that simulate additional accidents, transients, and evolutions in a more complete manner than can safely be performed on an actual plant.

##### 1.3.4 Public

The value to the public will be that better trained operators should reduce the possibility of improper operation of nuclear power plant equipment or systems that could endanger public health and safety. The impact will be that of slightly higher electrical rates caused by higher costs as explained in Item 1.3.3.

#### 1.4 Decision on Action

This guide is being issued to provide recommendations acceptable to the NRC staff on acceptable characteristics of nuclear power plant simulators for use in operator training.

### 2. TECHNICAL APPROACH

The decision to use simulators for training of operators has been made by the Commission.

\* Second proposed Revision 2 to Regulatory Guide 1.8 entitled "Personnel Qualification and Training" was issued for comment in September 1980.

\*\* Copies are available for public inspection or copying for a fee at the NRC Public Document Room, 1717 H Street NW., Washington, D.C., or copies may be purchased for \$4.00 directly from NRC by sending check or money order payable to the Superintendent of Documents to the Director, Division of Technical Information and Document Control, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555.

### 3. PROCEDURAL APPROACH

#### 3.1 Procedural Alternatives

1. Regulation
2. Regulatory guide
3. National standard, endorsed by a regulatory guide

#### 3.2 Value/Impact of Procedural Alternatives

The value of alternative 1, a regulation, is that it would have the full force and authority of a law. The impact of alternative 1 is that it would lack flexibility in implementation. The value of alternative 2, a regulatory guide, is that it would achieve the desired result with suitable flexibility for innovation by licensees. The impact of alternative 2 is that it may not take full advantage of the work performed by industry in the area the guide addresses, which may result in a longer development period prior to issuing the guide. The value of alternative 3, a standard endorsed by a regulatory guide, is that 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 impact of alternative 3 is that effort would have to be expended by the NRC in preparing, reviewing, and issuing the regulatory guide. It is estimated, however, that the effort spent on the action would be greater if alternatives 1 or 2 were chosen.

#### 3.3 Decision on Procedural Approach

The action has been accomplished by publishing a regulatory guide endorsing ANSI/ANS 3.5-1981, "Nuclear Power Plant Simulators for Use in Operator Training."

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

### 4. STATUTORY CONSIDERATIONS

#### 4.1 NRC Authority

Authority for this guide is derived from the safety requirements of the Atomic Energy Act of 1954, as amended, and the Energy Reorganization Act of 1974 through the Commission's regulations; in particular, 10 CFR Part 55 applies.

#### 4.2 Need for NEPA Assessment

An environmental impact statement is not required since this guide is not a major action that may significantly affect the quality of the human environment.

### 5. RELATIONSHIP TO OTHER EXISTING OR PROPOSED REGULATIONS OR POLICIES

Regulatory Guide 1.8 and Appendix A to 10 CFR Part 55 make reference to simulators used in the training program for operators. In these documents, only general statements are made concerning the characteristics of acceptable simulators. This guide is consistent with existing and proposed requirements and guidelines for simulators.

### 6. SUMMARY AND CONCLUSION

Regulatory Guide 1.149, "Nuclear Power Plant Simulators for Use in Operator Training," has been prepared. It endorses, with certain exceptions, ANSI/ANS 3.5-1981.

1194060020C1 1 QP1S1R  
US NRC REGION I  
OFFICE OF INSPECTION & ENFORCE  
R J BORES  
631 PARK AVENUE  
REGION I  
KING OF PRUSSIA PA 19406