



# REGULATORY GUIDE

## OFFICE OF NUCLEAR REGULATORY RESEARCH

REGULATORY GUIDE 1.105  
(Task IC 010-5)

### INSTRUMENT SETPOINTS FOR SAFETY-RELATED SYSTEMS

#### A. INTRODUCTION

Criterion 13, "Instrumentation and Control," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," requires, among other things, that instrumentation be provided to monitor variables and systems and that controls be provided to maintain these variables and systems within prescribed operating ranges.

Criterion 20, "Protection System Functions," of Appendix A to 10 CFR Part 50 requires, among other things, that the protection system be designed to initiate operation of appropriate systems to ensure that specified acceptable fuel design limits are not exceeded.

Paragraph (c)(1)(ii)(A) of § 50.36, "Technical Specifications," of 10 CFR Part 50 requires that, where a limiting safety system setting is specified for a variable on which a safety limit has been placed, the setting be so chosen that automatic protective action will correct the most severe abnormal situation anticipated without exceeding a safety limit. It also requires the licensee to notify the NRC of any automatic safety system malfunctions, to review the matter, and to record the results of the review. Setpoints that exceed technical specification limits are considered a malfunction of an automatic safety system.

This guide describes a method acceptable to the NRC staff for complying with the Commission's regulations for ensuring that instrument setpoints are initially within and remain within the technical specification limits.

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

\*The substantial number of changes in this revision has made it impractical to indicate the changes with lines in the margin.

#### USNRC REGULATORY GUIDES

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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.

Any information collection activities mentioned in this regulatory guide are contained as requirements in 10 CFR Part 50, which provides the regulatory basis for this guide. The information collection requirements in 10 CFR Part 50 have been cleared under OMB Clearance No. 3150-0011.

#### B. DISCUSSION

Revision 1 to Regulatory Guide 1.105, "Instrument Setpoints," was published in November 1976 in response to the large number of reported instances in which instrument setpoints in safety-related systems drifted outside the limits specified in the technical specifications. Using the method described in Revision 1 to Regulatory Guide 1.105 and additional criteria on establishing and maintaining setpoints, Subcommittee SP67.04, Setpoints for Safety-Related Instruments in Nuclear Power Plants, under the Nuclear Power Plant Standards Committee of the Instrument Society of America (ISA) has developed a standard containing minimum requirements to be used for establishing and maintaining setpoints of individual instrument channels in safety-related systems. This standard is ISA-S67.04-1982, "Setpoints for Nuclear Safety-Related Instrumentation Used in Nuclear Power Plants."\*\*

Some key terms used throughout ISA-S67.04-1982 are not defined or have unclear applications. For convenience, the following information is provided: (1) the definition of the term "safety limit" is contained in § 50.36 of 10 CFR Part 50, (2) the term "allowable value" as used in the standard is consistent with the usage in the bases sections of the Standard Technical Specification (STS),\*\*\* (3) the term "upper setpoint

\*\*Copies are available from the Instrument Society of America, P.O. Box 12277, Research Triangle Park, North Carolina 27709.

\*\*\*NUREG-0103, Revision 4, "Standard Technical Specifications for Babcock and Wilcox Pressurized Water Reactors"; NUREG-0123, Revision 3, "Standard Technical Specifications for General Electric Boiling Water Reactors (BWR/5)"; NUREG-0212, Revision 2, "Standard Technical Specifications for Combustion Engineering Pressurized Water Reactors"; and NUREG-0452, Revision 4, "Standard Technical Specifications for Westinghouse Pressurized Water Reactors." Copies of NUREG-series documents may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Post Office Box 37082, Washington, DC 20013-7082.

Written comments may be submitted to the Rules and Procedures Branch, DRB, ADM, U.S. Nuclear Regulatory Commission, Washington, DC 20555.

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limit" as used in Figure 1 of the standard is the same as "trip setpoints" as used in the aforementioned STSs in that drift above the "upper setpoint limit" (standard) or "trip setpoint" (STSs) requires readjustment.

Paragraph 4.3 of the standard specifies the methods for combining uncertainties in determining a trip setpoint and its allowable values. Typically, the NRC staff has accepted 95% as a probability limit for errors. That is, of the observed distribution of values for a particular error component in the empirical data base, 95% of the data points will be bounded by the value selected. If the data base follows a normal distribution, this corresponds to an error distribution approximately equal to a "two sigma" value.

Section 6 requires that "software qualification" be documented. Although there is no generally accepted definition in the nuclear industry for software qualification, the industry has used ANSI/IEEE-ANS-7-4.3.2-1982, "Application Criteria for Programmable Digital Computer Systems in Safety Systems of Nuclear Power Generating Stations," for verification and validation of computer software used in safety-related systems. Regulatory Guide 1.152, "Criteria for Programmable Digital Computer System Software in Safety-Related Systems of Nuclear Power Plants," endorses this standard.

Some of the considerations in documenting setpoint drift are (1) the degree of redundancy of the channels for which the allowable limits have been exceeded, (2) the type of instrument, including the instrument's designed accuracy, function, and plant identification number, (3) the allowable value in the technical specifications, (4) the "as left" setpoint from prior surveillance, (5) the measured setpoint, (6) the amount of adjustment in the reported occurrence and the current "as left" setpoint, and (7) the history of previous testing and the amount of any drift and adjustment in previous testing.

## C. REGULATORY POSITION

ISA-S67.04-1982, "Setpoints for Nuclear Safety-Related Instrumentation Used in Nuclear Power Plants," establishes requirements acceptable to the NRC staff for ensuring that instrument setpoints in safety-related systems are initially within and remain within the technical specification limits. The last section of ISA-S67.04-1982 lists additional standards that are referenced in other sections of the standard. Those referenced standards not endorsed by a regulatory guide (or incorporated into the regulations) also contain valuable information and, if used, should be used in a manner consistent with current regulations.

## D. IMPLEMENTATION

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

Except in those cases in which the applicant or licensee proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the methods described in this guide will be used by the NRC staff in the evaluation of instrument setpoints for safety-related systems with respect to the technical specification limits for the following nuclear power plants:

1. Plants for which the construction permit is issued after February 1986.
2. Plants for which the operating license application is docketed 6 months or more after February 1986.
3. Plants for which the applicant or licensee voluntarily commits to the provisions of this guide.

## VALUE/IMPACT STATEMENT

### 1. BACKGROUND

The most common cause of a setpoint in a safety-related system being out of compliance with plant technical specifications has been the failure to allow for a sufficient margin to account for instrument inaccuracies, expected environmental drift, and minor calibration variations. For example, in some cases, the trip setpoint selected was numerically equal to the allowable value and stated as an "absolute value," thus leaving no apparent margin for drift. In other cases, the trip setpoint was so close to the upper or lower limit of the range of the instrument that instrument drift placed the setpoint beyond the range of the instrument, thus nullifying the trip function. Other general causes for a setpoint being out of conformity with the technical specifications have been instrument design inadequacies and questionable calibration procedures.

Revision 1 to Regulatory Guide 1.105, "Instrument Setpoints," was issued in November 1976 in response to the large number of instances reported in Licensee Event Reports (LERs) of setpoints drifting outside the limits specified in the technical specifications. Revision 1 provided general guidance for (1) specifying setpoints (by considering instrument drift, accuracy, and range) and (2) having a securing device for the setpoint adjustment mechanism.

The method described in Revision 1 to Regulatory Guide 1.105 has been incorporated into an Instrument Society of America Standard, ISA-S67.04-1982, "Setpoints for Nuclear Safety-Related Instrumentation Used in Nuclear Power Plants." Revision 2 to Regulatory Guide 1.105 was developed to use the guidance of ISA-S67.04-1982. This revision provides more specific

guidance on establishing and maintaining setpoints in response to the needs that were apparent from (1) a continuing large number of reportable occurrences and (2) the licensing review of methodology for specifying allowable values and trip setpoints.

### 2. VALUE/IMPACT ASSESSMENT

#### 2.1 General

ISA-S67.04-1982 is considered state-of-the-art methodology for specifying and reviewing technical specifications on allowable values and trip setpoints, and members of the industry have incorporated this standard into their internal procedures. Further, paragraphs 50.73(a) and (b) of 10 CFR Part 50 define when an LER is required and what is to be included in an LER, respectively.

#### 2.2 Value

The value to NRC operations and industry is that there would be (1) a systematic method for specifying and reviewing technical specifications on allowable values and trip setpoints, (2) more sophisticated methods for specifying technical specifications, (3) a reduction in setpoint readjustments, (4) less chance for unwarranted reactor shutdown, and (5) fewer LERs and other reportable occurrences from the allowable limits of setpoints being exceeded.

#### 2.3 Impact

The impact would be minimal as ISA-S67.04-1982 represents current industry practice that has been codified in a national consensus standard.

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