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Graded Approaches to Setpoint Determination

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Foreword

In the preparation of ISA-67.04.01, Setpoints for Nuclear Safety Related Instrumentation, it was determined that additional guidance with regard to methods for implementing the requirements of the Standard would be useful. In order to address this need, Standard Subcommittee SP 67.15 was formed in 1988 and prepared a Recommended Practice, ISA-RP67.04.02-2000. It was the intent of the SP67.15 subcommittee that the Recommended Practice scope be consistent with the scope of ISA-67.04.01.

The Recommended Practice represents guidelines and examples of methods for the implementation of ISA-67.04.01, in order to facilitate the performance of instrument uncertainty calculations and setpoint determination for safety-related instrumentation in nuclear power plants.

The Recommended Practice provides guidance for the implementation of the Standard in the following areas:

a) Common assumptions and practices in instrument uncertainty determinations

b) Equations for estimating uncertainties for commonly used analog and digital modules

c) Methods to determine the impact of commonly encountered effects on instrument uncertainty

d) Sources and interpretation of data for uncertainty calculations

e) Methodologies, including sample equations to calculate total channel uncertainty

f) Application of instrument channel uncertainty in setpoint determination

g) Discussion of the interfaces between setpoint determination and plant operating and calibration procedures and accident analyses

h) Document requirements

However, there were certain topics whose development was not sufficiently mature to include in the Recommended Practice. The committee determined that the proper course was to develop these areas and then issue Technical Papers which could be incorporated into the standard or recommended practice at a later time. This Technical Report is one in a series that supplements ISA-67.04.01 and ISA-RP67.04.02.

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Abstract

This Technical Report supplements ISA-67.04.01 and ISA-RP67.04.02 in the area of graded approach for calculating and documenting channel uncertainties, uncertainty-adjusted interlock values, setpoints, test acceptance criteria, and action points for permanently installed nuclear plant instrumentation.

Key Words

Setpoint Calculation, Instrument Setpoints, Uncertainty Determination, Error Identification, Graded Approach.

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1 Scope

This Technical Report provides guidance on a graded approach for calculating and documenting channel and indication uncertainties as well as for documenting uncertainty-adjusted interlock values, setpoints, test acceptance criteria, and action points for permanently installed nuclear plant instrumentation.

2 Purpose

This Technical Report supplements the information provided in ISA-67.04.01 and ISA-RP67.04.02 for the determination of instrument channel uncertainty, instrument indication uncertainty, and instrument setpoints. Specifically, the topic addressed in this technical report is the use of a graded approach as mentioned in the Recommended Practice, where issues of higher safety significance are treated with greater rigor and issues of lower safety significance are treated with less rigor. Branch Technical Position HICB-12 allows such variations in rigor based on the safety significance of the instrument function.

Uncertainties for measurement and test equipment, laboratory instrumentation, and other non-permanently installed or non-process instrumentation such a meteorological instrumentation are outside the scope of this document.

Other guidance and requirements exist for determining instrument uncertainties for other applications. Specifically, ASME sets forth requirements for In Service Testing instrumentation. Such alternate guidance is beyond the scope of this document.

Descriptions of and requirements for a full setpoint control program are beyond the scope of this document.

3 Definitions

See ISA-RP67.04.02, “Methodologies for the Determination of Setpoints for Nuclear Safety-Related Instrumentation.”

4 Abbreviations

ESF Engineered Safety Features

LCO Limiting Condition of Operation

RTS Reactor Trip System

SR Surveillance Requirement

TS Technical Specifications

5 General Discussion

The reason for pursuing a graded approach is to focus plant resources commensurate with safety. The accuracy and uncertainty of instrumentation should always be considered in design and operation. There are instrument channels that are vital to safety and characterizing how accurately these channels work deserves the most rigorous level of uncertainty calculation and documentation. There are also instrument channels that play a lesser role in safety; although their need to function may be the same, there is less need to know exactly how accurately they will function. Applying a level of rigor and documentation commensurate with the safety significance of the instrument channel can save significant resources. Since these resources can then be applied to issues of higher safety significance, the overall effect is an increase in plant safety.