

**Development of a Utility Computer-Based Training
Program on Setpoint Methodology for Nuclear Power
Plants**

Dan Redden

Sr. Staff Engineer – Configuration Mgmt and Eng
Exelon Nuclear
4300 Winfield Road
Warrenville, IL 60555
daniel.redden@exeloncorp.com

Edward L. Quinn

ANS Past President
Technology Resources
23292 Pompeii Drive Dana Point, CA 92629
tedquinn@cox.net

Jerry Mauck

JLM Engineering and Technology Resources
5234 Green Bridge Road
Dayton, Maryland 21036
jerrymauck@verizon.net

Richard Bockhorst

Engineering Manger
Technology Resources
23292 Pompeii Drive
Dana Point, CA 92629
r_bockhorst@hotmail.com

INTRODUCTION

The purpose of this paper is to provide an overview of the development of the Computer-Based Training (CBT) Program for utility engineers on Setpoint Methodology for nuclear power plants. *This computer based training module was prepared by the Advanced Engineering Training initiative.*

The Advanced Engineering Training initiative is a nuclear industry effort to develop technical computer-based training modules for targeted areas of engineering expertise. The target audience is engineers at commercial nuclear power facilities in the U. S. These modules are being developed using the systematic approach to training and are being designed to maintain industry engineering expertise and to facilitate engineering knowledge transfer.

The objective of this training effort is to support the development of the next generation of site technical experts for specific topic areas. The training is one part of three key

components that would facilitate knowledge transfer to the future site Subject Matter Expert (SME).

DESCRIPTION OF THE SETPOINT METHODOLOGY TRAINING PROGRAM

The Setpoint Methodology CBT provides a detailed review to the program owner(s) on the major elements in a strong and well-maintained Setpoint Methodology program, as addressed in the INPO Engineering Program Guide, EPG-01, Setpoint Methodology (**Reference 1**) and other documents from NRC and industry. The major elements of the training include:

- The importance of setpoints in safety analysis
- Regulatory bases for the setpoint control program
- How setpoint calculations are performed
- Technical Specification issues
- Inspection Findings over the past 30 years
- Operability and 10 CFR 50.59

The key players in setpoint control for each nuclear plant are usually from engineering and are responsible to maintain all elements of the setpoint control program including program activities to establish, classify, maintain and revise instrumentation, electrical and mechanical setpoints as appropriate for the plant. This includes, in addition to device setpoints, Emergency Operating Procedure (EOP) operator actions and technical specification limiting conditions for operation (LCO) and surveillance limits. Many of the weaknesses found by NRC related to the lack of coordination between activities and updates in safety analysis affecting setpoint values and then maintenance and as-built issues affecting setpoints.

There is a strong association between this training module and the Instrument Society of America (ISA) Standard S67.04, Setpoints for Nuclear Safety-Related Setpoints, Part I and Part II, 1994 and later versions (**Reference 5&6**). This standard provides the details on how setpoint and uncertainty calculations should be performed, what elements to include, and how to combine the elements for many kinds of setpoints. It also includes the graded approach to setpoints, which supports the utility process of categorizing setpoints based on their level of importance to plant safety. This standard provides the guidance applicable to the utility specific setpoint methodology and any vendor setpoint methodology that is used to perform plant specific calculations.

There is also a strong association between this training module and the NRC laws and guidance and apply to the performance of setpoint calculations. NRC laws in 10 CFR 50 (**Reference 2 and 3**) apply to the overall requirements and will be discussed. NRC Reg Guide 1.105, Setpoints for Safety-Related Instrumentation (**Reference 4**) and NRC Branch Technical Position BTP-7-12 (**Reference 8**) are the most applicable guidance documents for the development and maintenance of setpoint and uncertainty calculations, and will also be discussed with all associated documents.

In addition, the Electric Power Research Institute (EPRI) has developed and issued strong industry guidance on the development and maintenance of a strong setpoint control

program in **References 9, 10 and 11.**

The plant owner of the Setpoint Control Program must interface with many groups within the plant and/or fleet organizations in implementing a robust and effective program including:

- Nuclear Safety Analysis
- Licensing/Compliance
- Other disciplines (other than I&C) within design engineering
- System and/or Maintenance Engineering
- Maintenance
- Operations
- Projects(capital projects, which scope includes setpoint changes)

There is a major interface between setpoint calculations and plant documents, especially Technical Specifications, in how and where setpoints are presented including relationship with LCO's and surveillance requirements. The plant Specific Setpoint Control Program interfaces with many current plant programs and projects including Improved Technical Specifications, Power Uprates, Surveillance Extensions, and Technical Specification traveler TSTF-493, "Clarify Application of Setpoint Methodology for LSSS Functions." (**Reference 7**)Interface with licensing staff is required and will be addressed in this module as both inputs and outputs to the performance of setpoint and uncertainty calculations.

Finally, the interface of setpoints with maintenance and testing documents, related to the calibration of the plant equipment and tolerances and Measurement and Test Equipment (M&TE) used. This will be addressed in both NRC and industry guidance in the module. The plant owner(s) of the Setpoint Control Program is responsible for all of these areas.

The following are the major focus areas covered in the Setpoint Methodology CBT:

Chapter 1 provides an overview of the role instrument setpoints perform in the defense-in-depth safety analysis for the plant as well introducing key definitions related to setpoints.

Chapter 2 provides the history and current regulatory requirements related to setpoint control including the laws and guidance provided by the U.S. NRC.

Chapter 3 provides describes the setpoint methodology including terms, formulae, methods of combination, graded approach and methods for drift analysis. This is a major part of the training module in covering the incremental uncertainty terms that need to be considered and how they are combined.

Chapter 4 provides and overview of the role of setpoints in Technical Specifications and associated documents.

Chapter 5 describes how the regulatory process, related to setpoint control, has been implemented in NRC inspections and how the major elements of the 10 CFR 50.59

reviews apply to the performance of a new or revised setpoint calculation.

CONCLUSION

This training provides a detailed review to the program owner(s) on the major elements in a strong and well-maintained setpoint control program, as addressed in the INPO Engineering Program Guide, EPG-01, Setpoint Control and other documents from NRC and industry.

ACCESS to the CBT

The CBT is now available to all employees of U. S. nuclear stations and their corporate offices via INPO's NANTeL learning management system. Access for suppliers of engineering services is under consideration. A brochure of all Advanced Engineering Training CBTs and their corresponding abstracts may be found online at http://www.exelonpowerlabs.com/AET/AET_Brochure.pdf

REFERENCES

1. INPO EPG-01, May, 2005, Engineering Program Guide, Setpoint Control
2. 10 CFR 50 Appendix A, GDC 13 and 20
3. 10 CFR 50.36
4. Reg Guide 1.105 Rev 0 thru Rev 4 (Draft)
5. ISA S67.04 – 1994 and 2006, Setpoints for Nuclear Safety-Related Instrumentation
6. ISA RP 67.04-1994 and 2000, Methodologies for Determination of Setpoints for Nuclear Safety-Related Instrumentation
7. TSTF-493 R4, Clarify Application of Setpoint Methodology for LSSS Functions
8. NUREG -0800 Chapter 7, BTP 7-12, Rev 6, Guidance on Establishing and Maintaining Instrument Setpoints, 2007
9. EPRI TR 103335, "Statistical Analysis of Instrument Calibration Data," Report No. 30020022556, Rev 2
10. EPRI TR-111348, Instrument Drift Study, Ontario Hydro Bruce Nuclear Station, 1998
11. EPRI Doc. 3002000864-2013, Advanced Reactor Technology-Regulatory Performance Requirements for Safety Related Instrumentation Rev 1, 2013