



Nebraska Public Power District

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NLS2003111

October 31, 2003

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

Subject: Response to Request for Additional Information Regarding Licensing
Amendment Request to Revise Technical Specifications (TS) Surveillance
Requirements and TS Table for Mathematical Symbols and Use of Allowable
Values in the Place of Analytical Limits
Cooper Nuclear Station, Docket 50-298, DPR-46

- References:**
1. Letter from M. Honcharik (U.S. Nuclear Regulatory Commission) to C. C. Warren (Nebraska Public Power District) dated October 2, 2003, "Cooper Nuclear Station (CNS) - Request for Additional Information Regarding Licensing Amendment Request to Revise Technical Specifications (TS) Surveillance Requirements and TS Table for Mathematical Symbols and Use of Allowable Values in the Place of Analytical Limits (TAC NO. MC0629)"
 2. Letter from C. C. Warren (Nebraska Public Power District) to U.S. Nuclear Regulatory Commission dated August 25, 2003, "License Amendment Request to Revise Technical Specification (TS) Surveillance Requirement (SR) 3.3.2.1.4 and TS Table 3.3.2.1-1 for mathematical symbols and use of Allowable Values" (NLS2003077)

The purpose of this letter is to respond to a Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) provided in Reference 1. This RAI refers to information previously provided in Reference 2. The RAI requested copies of three documents to complete the review of information provided in Reference 2. The three documents requested are: (1) the Cooper Nuclear Station (CNS) procedure used to perform the calculations, (2) the General Electric (GE) methodology, and (3) the calculations by which the revised values were computed. Attachment 1 contains a copy of the procedure used to perform the calculations. The GE methodology is proprietary and has previously been approved by the NRC as documented in a revised safety evaluation report for NEDC-31366 dated November 6, 1995. As discussed with the NRC Project Manager this document is already held by the NRC and is not being included with this RAI response. Attachment 2 contains a copy of the calculation by which the revised values were computed.

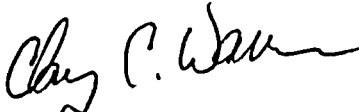
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This RAI response is limited to supplying material to assist the NRC in completing the review of the license amendment requested in Reference 2 and does not change any part of the original license amendment request and therefore does not change the original no significant hazards consideration.

This response is being submitted under oath pursuant to 10 CFR 50.30(b). By copy of this letter and its attachments, the appropriate State of Nebraska official is notified in accordance with 10 CFR 50.91(b)(1). Copies to the NRC Region IV office and the CNS Resident Inspector are also being provided in accordance with 10 CFR 50.4(b)(1).

Should you have any questions concerning this matter, please contact Mr. Paul Fleming at (402) 825-2774.

Sincerely,

A handwritten signature in dark ink, appearing to read "Clay C. Warren", is written over the typed name.

Clay C. Warren
Vice President Nuclear

/clb

Attachments

cc: Regional Administrator w/attachments
USNRC - Region IV

Senior Project Manager w/attachments
USNRC - NRR Project Directorate IV-1

Senior Resident Inspector w/attachments
USNRC

Nebraska Health and Human Services w/attachments
Department of Regulation and Licensure


NPG Distribution w/o attachments

Records w/attachments

Affidavit

STATE OF NEBRASKA)
)
NEMAHA COUNTY)

Clay C. Warren, being first duly sworn, deposes and says that he is an authorized representative of the Nebraska Public Power District, a public corporation and political subdivision of the State of Nebraska; that he is duly authorized to submit this correspondence on behalf of Nebraska Public Power District; and that the statements contained herein are true to the best of his knowledge and belief.

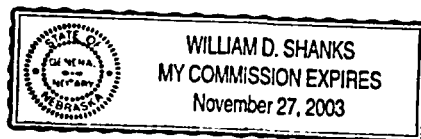


Clay C. Warren

Subscribed in my presence and sworn to before me this 31 day of October 2003.



NOTARY PUBLIC




NLS2003111
Attachment 1
Page 1 of 24

ATTACHMENT 1

Engineering Procedure 3.26.3

INSTRUMENT SETPOINT AND CHANNEL ERROR CALCULATION METHODOLOGY

COOPER NUCLEAR STATION
NRC DOCKET 50-298, DPR-46

CNS OPERATIONS MANUAL ENGINEERING PROCEDURE 3.26.3 INSTRUMENT SETPOINT AND CHANNEL ERROR CALCULATION METHODOLOGY	USE: INFORMATION  EFFECTIVE: 2/19/01 APPROVAL: SORC OWNER: W. T. FREWIN DEPARTMENT: DED
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1.	PURPOSE	1
2.	DISCUSSION	1
3.	RESPONSIBILITIES	4
4.	NPPD GENERATED CALCULATIONS	4
5.	NON-NPPD GENERATED CALCULATIONS	5
6.	RECORDS	5
7.	REFERENCES	6
	ATTACHMENT 1 SETPOINT AND CHANNEL ERROR CALCULATION	
	GUIDELINES	7

REV.	DATE	CHANGES
4	10/30/98	Removed CTS information. Made changes to Steps 2.7.2 and 2.7.3 due to implementation of ITS.
5	see above	Reformatted per latest O-PWG-01 guidance.

1. PURPOSE

This procedure describes the suggested methodology to be followed when performing instrument setpoint or channel error calculations.

2. DISCUSSION

- 2.1 When determining instrument setpoints or channel errors, it is important that all reasonably expected error sources are accounted for. Attachment 1 provides guidance on which error terms should be considered and on the combination of those error terms.
- 2.2 The methodology presented in this procedure is based on the General Electric Instrument Setpoint Methodology, NEDC-31336.
- 2.3 General Electric Document EDE-38-1090, Setpoint Calculation Guidelines for the Cooper Nuclear Station, was developed to provide specific guidance on implementing the GE setpoint methodology. This document contains certain terms that are not presently applicable at CNS. This procedure provides guidance on determining the applicability of the terms and methods used in the GE document and should be used in conjunction with it.
- 2.4 Setpoint calculations are performed when it is determined by Procedure 3.26 that one is required.

2.5 Channel error calculations are performed when there are requirements, other than a setpoint, that the error be limited or considered in the design, normally used to determine adequacy of indicator or data processing channels.

2.6 If conditions require a setpoint methodology other than the one presented here be used, the Preparer shall document and justify the method used.

2.7 DEFINITIONS

2.7.1 Preparer - The Preparer is the person responsible for generating the setpoint or channel error calculation. Only those people meeting the requirements of Procedure 3.4.7 may generate setpoint or channel error calculations.

2.7.2 Analytical Limit - The value of the sensed process variable established as part of the safety analysis prior to or at the point which a desired action is to be initiated to prevent the safety process variable from reaching the associated licensing safety limit.

2.7.3 Allowable Value - As described in the GE document, this is the limiting value (Technical Specification Limit) of the sensed process variable at which the trip setpoint may be found during instrument surveillance. (The Allowable Value provides margin between the Technical Specification limit and the analyzed limit.)

2.7.4 As-Left Tolerance - This tolerance is the precision with which the technician should be able to set the device during surveillance. This is sometime referred to as "Calibration Tolerance" in CNS calibration procedures.

2.7.5 Leave Alone Tolerance - This is the basis for determining which instruments require recalibration during surveillance testing. This tolerance is intended to allow for normal variation of accuracy and drift without requiring recalibration. This is sometime referred to as "Allowable Range" in CNS calibration procedures.

2.8 ABBREVIATIONS AND ACRONYMS

A_N - Individual Device Accuracy under normal plant operating conditions
 A_T - Individual Device Accuracy under trip conditions
 A_P - Individual Device Accuracy under long term post-accident conditions
 A_{LN} - Loop Accuracy under normal plant operating conditions
 A_{LT} - Loop Accuracy under trip conditions
 A_{LP} - Loop Accuracy under long term post-accident conditions
AL - Analytical Limit
ALT - As-Left Tolerance
ATE - Accuracy Temperature Effect
AV - Allowable Value
C - Calibration Device/Tool Error
 C_L - Loop/Channel Calibration Accuracy Error
 C_{STD} - Calibration Standard Error or Tool Calibration Error
CE - Channel Error
D - Individual Device Drift
 D_L - Loop/Channel Drift
DTE - Drift Temperature Effect
HE - Humidity Effect
IRA - Insulation Resistance Accuracy Error
LAT - Leave Alone Tolerance
LER - Licensee Event Report
M - Surveillance Interval
 N, n - The number of Standard Deviations (sigma values) used
NTSP - Nominal Trip Setpoint
OPE - Over Pressure Effect
ORE - Operator Reading Error or Indicator Readability
PEA - Primary Element Accuracy
PMA - Primary Measurement Accuracy
PSE - Power Supply Effect
RE - Radiation Effect
REE - RFI/EMI Effect
SE - Seismic Effect
SM - Setpoint Margin
SP - Span or Calibrated Span
SPE - Static Pressure Effect
STA - Spurious Trip Avoidance
UR - Upper Range or Upper Range Limit
VA - Vendor Accuracy
VD - Vendor Drift
Z - Measure of Margin in units of Standard Deviations
ZPA - Zero Period Acceleration

3. RESPONSIBILITIES

3.1 The Preparer generates a calculation per Procedure 3.4.7 following the format specified on Attachment 1.

3.2 The Reviewer reviews non-NPPD generated calculations per Procedure 3.4.7.

4. NPPD GENERATED CALCULATIONS

NOTE - Equipment technical bases, specifications and limitations must be thoroughly researched in order to ensure setpoint changes do not have the potential to result in equipment damage.

4.1 After the need for a setpoint or channel error calculation is identified, the Preparer generates a calculation per Procedure 3.4.7 following the format specified on Attachment 1.

4.2 Attachment 1 provides guidance on the specific error terms that should be included in any setpoint or channel error calculation. These guidelines are based on GE Document EDE-38-1090. The GE document should be consulted for definitions and further explanation of the terms and methods used in these guidelines.

4.3 To provide for consistent treatment of errors involved with instrument setpoints and channel errors, these guidelines are presented in the suggested format for design calculations. The fundamental objective of the calculation of setpoints or channel error is to incorporate all reasonably expected error sources, as well as any that are part of the licensing commitments applicable to the plant. As part of the calculation process, the Responsible Engineer should consider whether additional error terms other than those presented here should be considered. Accordingly, this suggested format should be followed, as applicable, but is not intended to represent the only possible method of determining setpoints. However, when other methods are used, it is up to the Responsible Engineer to document and justify the method used.

4.4 Adjusting Sigma Values - Vendor and calibration data may be given as 1, 2, or 3 sigma values. Appendix A to GE Document EDE-38-1090 provides guidance on determining the sigma levels of vendor supplied data. In Attachment 1, the sigma values are adjusted to 2 sigma values by multiplying by $2/n$, where n is the number of standard deviations for the given data. The values can be adjusted to other sigma values by multiplying by N/n , where N is the desired sigma value.

- 4.5 Working with Bias Terms - An error term may have both a random portion and a bias portion. Once a bias term is identified, it is carried through the various calculations until the setpoint margin is determined. The bias portions of the error terms are included in the calculation determining the setpoint margin and subsequent calculations by determining how the bias term physically affects the instrument signal.
- 4.5.1 If the particular bias acts in an unfavorable direction from a safety standpoint and might be present at the time of trip, it would be included in the equations in the direction that moves the setpoint away from the Analytical Limit, so the trip occurs sooner than would otherwise be expected.
- 4.5.2 If a particular bias is favorable from a safety standpoint (i.e., makes trip happen sooner), but might not be present under all conceivable trip conditions, then it would be appropriate from a safety standpoint to not include the bias in the calculations.
- 4.5.3 If a particular bias will always be present under all possible conditions of circuit use, it may be included in the calculations consistent with its affect on the setpoint (favorable or unfavorable).
- 4.6 Rounding Conventions - Normal rounding conventions do not apply to error calculations or setpoints. All rounding of results should be done in the direction which is conservative relative to plant safety (upward for all error terms, away from the Analytical Limit for Allowable Values and Nominal Trip Setpoints).
- 4.7 The calculation is checked, design verified, approved, and filed per Procedure 3.4.7.

5. NON-NPPD GENERATED CALCULATIONS

- 5.1 Review of non-NPPD generated calculations is performed per Procedure 3.4.7.
- 5.2 In addition to the requirements of Procedure 3.4.7, the Review Engineer documents and justifies the methodology used in the non-NPPD generated calculation.

6. RECORDS

- 6.1 No quality records are generated by this procedure.

7. REFERENCES

7.1 CODES AND STANDARDS

- 7.1.1 10CFR50, Domestic Licensing of Production and Utilization Facilities.
- 7.1.2 NRC Regulatory Guide 1.89, Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants.
- 7.1.3 NRC Regulatory Guide 1.97, Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident.
- 7.1.4 General Electric Document EDE-38-1090, Revision 0, Setpoint Calculation Guidelines for the Cooper Nuclear Station.
- 7.1.5 ISA Standard S67.04-1982, Setpoints for Nuclear Safety-Related Instrumentation used in Nuclear Power Plants.

7.2 PROCEDURES

- 7.2.1 Engineering Procedure 3.4.7, Design Calculations.
- 7.2.2 Engineering Procedure 3.26, Instrument Setpoint Control.

7.3 MISCELLANEOUS

- 7.3.1 NEDC-31336, October 1986, General Electric Instrument Setpoint Methodology.
- 7.3.2 SER 21-93, Hydrostatic Test Damages Reactor Coolant Pump Seal Water Heat Exchangers.

ATTACHMENT 1	SETPOINT AND CHANNEL ERROR CALCULATION GUIDELINES
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1. PURPOSE

- 1.1 This is a discussion of the purpose of the calculation. As a minimum, it should include the CIC of the instrument, a discussion of what the setpoint or instrument loop does, and why the setpoint is being changed.

2. REQUIREMENTS

- 2.1 Any setpoint or channel error calculation shall be performed per this procedure.
- 2.2 Any regulatory or functional requirements of the setpoint should be addressed in this section. Examples of regulatory requirements are: Technical Specifications, Safety Analysis Reports, NRC Safety Evaluation Reports, 10CFR50, and Regulatory Guides 1.89 and 1.97. Functional requirements include: Instrument function, Analytical and Safety Limits, Operational Limits, Function Times, Requirements imposed by plant procedures (EOPs, etc.), and allowable channel error.

3. ASSUMPTIONS

- 3.1 List all general assumptions made for the calculation. Assumptions concerning individual error terms may be listed and justified in the Methodology section.

4. METHODOLOGY

4.1 INSTRUMENT CHANNEL ARRANGEMENT

4.1.1 CHANNEL DIAGRAM

- 4.1.1.1 This is a schematic layout of the channel including both the physical layout and the electrical connections. For purposes of these guidelines, an instrument channel may consist of a single bistable switch or many devices including a transmitter, indicator, alarm unit, signal conditioner, etc.

ATTACHMENT 1	SETPOINT AND CHANNEL ERROR CALCULATION GUIDELINES
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4.1.2 DEFINITION OF CHANNELS

4.1.2.1 An instrument may provide input into more than one channel and the channel of interest should be identified. For example, a flow transmitter loop containing a indicator and an alarm unit would have two channels. One channel is the flow element - transmitter - indicator, and the other is the flow element - transmitter - alarm unit.

4.1.3 INSTRUMENT DEFINITION AND DETERMINATION OF DEVICE ERROR TERMS

4.1.3.1 This section is repeated for each instrument in the channel for which the calculation is being performed. Information should be referenced to its source (document number and revision if applicable).

a. INSTRUMENT DEFINITION

Reference

CIC:

Manufacturer:

Model:

Upper Range Limit (UR):

Calibrated Span (SP):

Input Signal: <range and units>

Output Signal: <range and units>

Vendor Performance Specifications:

List all identified manufacturers performance data.

ATTACHMENT 1	SETPOINT AND CHANNEL ERROR CALCULATION GUIDELINES
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4.1.3.2 PROCESS AND PHYSICAL INTERFACES

Reference

Calibration Temperature Range:
Calibration/Surveillance Interval:

Normal Plant Conditions:

Temperature:
Radiation:
Pressure:
Humidity:

Trip Environment Conditions - (if required):

Temperature:
Radiation:
Pressure:
Humidity:

Long Term Post-Accident Conditions - (if required):

Temperature:
Radiation:
Pressure:
Humidity:

Seismic Conditions - (if required):

Prior to Function: <ZPA at mounting location>
During Function: <ZPA at mounting location>

Process Conditions - (if required):

During Calibration:
Worst Case:
During Function:

ATTACHMENT 1	SETPOINT AND CHANNEL ERROR CALCULATION GUIDELINES
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4.1.3.3 DETERMINATION OF INDIVIDUAL DEVICE ACCURACIES

- a. All listed error terms shall be addressed in each calculation; if the error term is not applicable to a specific calculation, it shall be marked N/A and explained.
- b. All accuracy error contributions are random variables unless otherwise noted.

Normal Accuracy (A_{iN}) <*>

<u>Value</u>	<u>Sigma</u>	<u>Reference</u>
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VA: <Vendor Accuracy>
 ATE: <Accuracy Temperature Effect>
 OPE: <Overpressure Effect>
 SPE: <Static Pressure Effect>
 SE: <Seismic Effect>
 RE: <Radiation Effect>
 HE: <Humidity Effect>
 PSE: <Power Supply Effect>
 REE: <RFI/EMI Effect>

- c. These identified accuracy error contributions are combined using the SRSS method to determine total device accuracy. Device accuracy is normalized to a 2 sigma confidence level.

The following formula is to be used:

$$\begin{aligned}
 A_{i*} = & 2((VA_i/n)^2 + (ATE_i/n)^2 + (OPE_i/n)^2 + (SPE_i/n)^2 + \\
 & (SE_i/n)^2 + (RE_i/n)^2 + (HE_i/n)^2 + (PSE_i/n)^2 + \\
 & (REE_i/n)^2)^{1/2} + \text{any bias terms}
 \end{aligned}$$

Where 'n' is the sigma value associated with each individual effect.

* Up to three accuracy terms may be required for each device: accuracy under normal plant operating conditions (A_{iN}), accuracy under the trip conditions (A_{iT}), and accuracy under the long term post-accident conditions (A_{iP}). This section is repeated, as necessary, with the appropriate accuracy errors considered for each plant condition.

ATTACHMENT 1	SETPOINT AND CHANNEL ERROR CALCULATION GUIDELINES
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4.1.3.4 DETERMINATION OF INDIVIDUAL DEVICE DRIFT

<u>Value</u>	<u>Sigma</u>	<u>Reference</u>
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VD: <Vendor Drift>

DTE: <Drift Temperature Effect>

- a. Vendor Drift is usually listed for a 6 month interval and is adjusted for planned surveillance intervals (M) of longer than 6 months with the formula:

$$VD_M = (M/6)^{1/2} VD_{6mo}$$

- b. If VD is given for other than 6 month intervals, the 6 in the formula is replaced with the Vendor's interval.
- c. Trending information may be referenced to validate Vendor Drift information or be used to justify using less conservative drift values. Section 4.4.3 of NEDC-31336 provides a method for using plant performance data to confirm drift assumptions.
- d. The device drift error is determined by combining the terms using the SRSS method and normalized to a 2 sigma value.

The following formula is used:

$$D_i = 2((VD_i/n)^2 + (DTE_i/n)^2)^{1/2} + \text{any bias terms}$$

Where 'n' is the sigma value associated with each individual term.

4.1.3.5 ESTABLISHING AS-LEFT TOLERANCES

- a. This is an arbitrary term used in the calibration or surveillance procedures. If not defined in procedures, the following equation can be used as a guideline:

$$ALT = 3/2(VA)$$

Actual numbers should be based on the devices used to calibrate the instruments (usually to the nearest half of the smallest scale division). The CNS I&C Specialist may be consulted to obtain calibration device information.

ATTACHMENT 1	SETPOINT AND CHANNEL ERROR CALCULATION GUIDELINES
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4.1.3.6 DEVICE CALIBRATION ERROR

- a. Only applicable for channels consisting of one device requiring calibration.

Calibration Tool

<u>Value</u>	<u>Sigma</u>	<u>Reference</u>
C_i : Calibration Tool Error		3
C_{iSTD} : Tool Calibration Error		3

- b. C and C_{STD} are listed for each calibration tool used for calibrating the device. Meters used to monitor open or closed contacts are not considered to contribute to calibration error. Tool calibration error is the larger of either the error of the standard used in calibrating the tool or the error of the tool itself. Since standards are required to be more accurate than the tool being calibrated, C_{STD} is almost always taken to be equal to C .

ALT: As Left Tolerance 3

- c. These values are controlled by 100% testing; therefore, they are assumed to represent 3 sigma values.
- d. Individual calibration error terms are combined using the SRSS method to determine total calibration accuracy. The calibration accuracy is normalized to a 2 sigma confidence level:

$$C_L = 2(\text{the sum of } (ALT/n)^2, (C_i/n)^2, \text{ and } (C_{iSTD}/n)^2)^{1/2}$$

where 'n' is the sigma value associated with each individual effect.

ATTACHMENT 1	SETPOINT AND CHANNEL ERROR CALCULATION GUIDELINES
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4.1.4 DETERMINATION OF LOOP/CHANNEL VALUES

Only applicable when the channel consists of more than one device.

4.1.4.1 DETERMINATION OF LOOP ACCURACY

- a. The individual device accuracies determined above are combined by the SRSS method to find the Loop Accuracy:

$$A_{L*} = (A_1^2 + A_2^2 + A_3^2 + \dots)^{1/2} + \text{any bias terms}$$

* Up to three accuracy terms may be required for each channel: accuracy under normal plant operating conditions (A_{LN}), accuracy under the trip conditions (A_{LT}), and accuracy under the long term post-accident conditions (A_{LP}). This section is repeated, as necessary, with the appropriate accuracy errors considered for each plant condition.

ATTACHMENT 1	SETPOINT AND CHANNEL ERROR CALCULATION GUIDELINES
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4.1.4.2 DETERMINATION OF LOOP CALIBRATION ERROR

Loop Calibration Diagram.

- a. Provide a diagram showing the locations in the instrument channel where calibration signals are input or measured and the type of instrument used at each location.

Calibration Tool

<u>Value</u>	<u>Sigma</u>	<u>Reference</u>
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C _i : Calibration Tool Error		3
C _{iSTD} : Tool Calibration Error		3

- b. C and C_{STD} are listed for each calibration tool used for calibrating the device. Meters used to monitor open or closed contacts are not considered to contribute to calibration error. Tool calibration error is the larger of either the error of the standard used in calibrating the tool, or the error of the tool itself. Since standards are required to be more accurate than the tool being calibrated, C_{STD} is almost always taken to be equal to C.

ALT _i : As-Left Tolerance (for each calibrated device)		3
--	--	---

- c. These values are controlled by 100% testing; therefore, they are assumed to represent 3 sigma values.
- d. Individual calibration error terms are combined using the SRSS method to determine total calibration accuracy. The calibration accuracy is normalized to a 2 sigma confidence level:

$$<C_L = 2(\text{the sum of } (ALT_i/n)^2, (C_i/n)^2, \text{ and } (C_{iSTD}/n)^2)^{1/2}$$

where 'n' is the sigma value associated with each individual effect. C_i and C_{iSTD} are listed for each independent use of the calibration tool.

ATTACHMENT 1	SETPOINT AND CHANNEL ERROR CALCULATION GUIDELINES
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4.1.4.3 DETERMINATION OF LOOP DRIFT

- a. The individual device drift errors determined above are combined by the SRSS method to find the Loop Drift:

$$D_L = (D_1^2 + D_2^2 + D_3^2 + \dots)^{1/2} + \text{any bias terms}$$

4.1.5 DETERMINATION OF PEA AND PMA

Primary Element Accuracy (PEA):

Process Measurement Accuracy (PMA):

- 4.1.5.1 These two variables account for measurement errors due to sources other than the calibratable devices in the loop. Examples include flow elements and density changes in sensing lines caused by changes in ambient temperatures.
- 4.1.5.2 PEA and PMA may consist of both random and bias terms. The errors shall be classified as random or bias and the source of the error terms shall be identified. Random error terms should be normalized to a 2 sigma confidence level.

4.1.6 DETERMINATION OF OTHER ERROR TERMS

- 4.1.6.1 This section incorporates any other channel errors that may be applicable. The errors shall be classified as random or bias and the source of the error terms shall be identified. Random error terms should be normalized to a 2 sigma confidence level.

- 4.1.6.2 The following are examples of error terms that should be considered and included as applicable:

Indicator Readability/Operator Reading Error (ORE)

Resistors, Multiplexers, etc.

Software Errors

Device Transfer Functions

Degradation of Insulation Resistance (IRA) (Reference EQ Design Input 2407)

AGAF (APRM Gain Adjustment Factor)

Other Environmental Effects (e.g., post-accident pressure effect on vented SOR pressure switch)

ATTACHMENT 1	SETPPOINT AND CHANNEL ERROR CALCULATION GUIDELINES
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4.1.7 CALCULATION OF SETPOINT MARGIN AND OPERATING SETPOINT

NOTE - Only applicable for setpoint calculations.

4.1.7.1 SETPOINT MARGIN

- a. Setpoint Margin is determined using the accuracy terms applicable under trip conditions.
- b. The above determined error terms (for trip conditions) are combined using the SRSS method to determine total Setpoint Margin (SM). The SM is multiplied by 1.645/2 to adjust for a single sided 95% confidence level:

$$SM = (1.645/2)(SRSS \text{ OF RANDOM TERMS}) + \text{BIAS TERMS}$$

- c. RANDOM TERMS include the random portion of A_{LT} , C_L , D_L , PMA, PEA, IRA, and any other unique error terms known to exist.
- d. BIAS TERMS include the bias portion of A_{LT} , C_L , D_L , PMA, PEA, IRA, and any other unique error terms known to exist.

4.1.7.2 NOMINAL TRIP SETPOINT CALCULATION

Reference

Limiting Setpoint:

- a. The Limiting Setpoint is listed and applicable document is referenced. At CNS, the value listed in the Technical Specifications is usually the Analytical Limit (AL) and will be used as such in setpoint determination unless otherwise justified.

NTSP1 = Limiting Setpoint - SM
(for process variables which increase to trip.)

NTSP1 = Limiting Setpoint + SM
(for process variables which decrease to trip.)

ATTACHMENT 1	SETPOINT AND CHANNEL ERROR CALCULATION GUIDELINES
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4.1.7.3 ALLOWABLE VALUE (AV) CALCULATION

- a. Only applicable when the setpoint is contained in the Technical Specifications and is required to have an Allowable Value different from the Analytical Limit.
- b. The above determined error terms (excluding Drift) are combined using the SRSS method to determine Allowable Value. The random term is multiplied by 1.645/2 to adjust for a single sided 95% confidence level:

$AV = AL - (1.645/2)(SRSS \text{ OF RANDOM TERMS}) - \text{BIAS TERMS}$ (for process variables which increase to trip.)

$AV = AL + (1.645/2)(SRSS \text{ OF RANDOM TERMS}) + \text{BIAS TERMS}$ (for process variables which decrease to trip.)

- c. RANDOM TERMS include the random portion of A_{LT} , C_L , PMA, PEA, Insulation Resistance Error, and any other unique error terms known to exist, excluding Drift.
- d. BIAS TERMS include the bias portion of A_{LT} , C_L , PMA, PEA, Insulation Resistance Error, and any other unique error terms known to exist, excluding drift.

ATTACHMENT 1	SETPOINT AND CHANNEL ERROR CALCULATION GUIDELINES
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4.1.7.4 LER AVOIDANCE EVALUATION

NOTE - Only applicable if an Allowable Value is required.

- a. A LER avoidance evaluation is performed to ensure there is sufficient margin provided between the Allowable Value and the Nominal Trip Setpoint. Only the errors that are expected to be present during surveillance testing are considered:

1. The LER Avoidance Evaluation is performed to determine if the NTSP1 is adequately separated from the AV. The calculated values of NTSP1 and AV are used unless the calculated values were used to prove the existing values are adequate and the existing values will still be used for plant operation. In this case, the existing values for NTSP and AV are used.

$$\text{Sigma(LER)} = 1/2(\text{SRSS OF RANDOM TERMS})$$

RANDOM TERMS include the random portion of A_{LN} , C_L , D_L

$$Z = |AV - NTSP1| / \text{Sigma(LER)}$$

2. For a single instrument channel, Z should be 1.29 or greater. For an instrument channel which is part of a multiple channel logic system, Z should be 0.81 or greater.
3. If Z does not meet the above values, an adjusted value of NTSP should be calculated:

$$NTSP2 = AV - (\text{Desired Margin})(\text{Sigma(LER)}) \text{ or}$$

$$NTSP2 = AV + (\text{Desired Margin})(\text{Sigma(LER)})$$

The more conservative of NTSP1 or NTSP2 is the governing value.

ATTACHMENT 1	SETPOINT AND CHANNEL ERROR CALCULATION GUIDELINES
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4.1.7.5 SELECTION OF OPERATING SETPOINTS (input to Setpoint Data Sheet)

- a. The NTSP calculated above may not be the actual setpoint used in calibrating instrumentation. Engineering judgment and operational preferences may be used in choosing an actual setpoint. Generally, one of two methods is used:
 1. NTSP as a bound to the setpoint tolerance.
 2. NTSP as the center of the Leave Alone Zone.
- b. Using the NTSP as the center of the Leave Alone Zone is the most common method.
- c. Actual numbers should be based on the devices used to calibrate the instruments (usually to half of the smallest scale division). The CNS I&C Specialist may be consulted to obtain calibration device information.
- d. Any rounding of results should be done in the direction which is conservative to plant safety (away from the Analytical Limit).

4.1.7.6 ESTABLISHING LEAVE ALONE ZONES

- a. This is an arbitrary term used in the calibration or surveillance procedures. If not defined in procedures, the following equation can be used as a guideline:

$$LAT = 3/2(VA^2 + VD^2 + DTE^2)^{1/2}$$

- b. Actual numbers should be based on the devices used to calibrate the instruments (usually to half of the smallest scale division). The CNS I&C Specialist may be consulted to obtain calibration device information. The Leave Alone Zone is twice the LAT.

ATTACHMENT 1	SETPOINT AND CHANNEL ERROR CALCULATION GUIDELINES
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4.1.7.7 REQUIRED LIMITS EVALUATION

- a. Only required when there is an AV and the NTSP is used as the center of the Leave Alone Zone.
- b. A Required Limits Evaluation is performed to ensure the combination of errors present during calibration of each device in the channel is accounted for, while allowing for the possibility the devices may not be recalibrated.
- c. The Required Limits are considered to be adequate when the following equation is satisfied:

$$|AV - NTSP| > 1.29/2 \text{ (SRSS OF INDIVIDUAL TERMS)}$$

- d. Included in the Individual Terms are:
 - 1. The difference between the Required Limit for each device relative to the NTSP (adjusted to 2 sigma).
 - a) The Loop Calibration Error (C_L).
 - b) The Loop Drift allowance for subsequent surveillance interval (equal to D_L).
 - c) The Required Limit for each device shall bound the LAT, but shall not exceed the AV.
- e. If the equation is not satisfied, the NTSP and/or the Required Limits for each device in the channel should be adjusted until the equation is satisfied.

ATTACHMENT 1	SETPOINT AND CHANNEL ERROR CALCULATION GUIDELINES
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4.1.7.8 SPURIOUS TRIP AVOIDANCE EVALUATION

NOTE - This section may be satisfied by Engineering judgment. If there is no realistic operational condition that may remotely approach the setpoint, there is no reason to perform this evaluation.

- a. A Spurious Trip Evaluation is performed to ensure there is a reasonable probability that spurious trips will not occur using the selected setpoint. The errors that may be present during normal plant operation are determined and the margin between the worst applicable Operational Limit and the setpoint is evaluated.

$$\text{Sigma(STA)} = 1/2(\text{SRSS OF RANDOM TERMS}) + \text{BIAS TERMS}$$

RANDOM TERMS include the random portion of A_{LN} , C_L , D_L , PMA, PEA.

BIAS TERMS include any bias terms present during normal operation.

$$Z = |\text{Adjusted NTSP} - \text{Operational Limit}| / \text{Sigma(STA)}$$

Where the adjusted NTSP is the selected setpoint plus (or minus) the SRSS combination of the LAT for each device in the instrument channel (adjusted to a 1.65 sigma value). Z should be equal to or > 1.65 for the setpoint to be adequately separated from the Operational Limit to reasonably avoid spurious trip conditions. If Z is < 1.65, the selected NTSP and/or the LAT for the instruments in the channel should be optimized to achieve the best practical balance between the design constraints.

4.1.7.9 ELEVATION CORRECTION (input to Setpoint Data Sheet)

- a. Elevation correction shall be determined by a conversion factor based on the expected ambient temperature of the sensing line. Variances of the ambient temperature should be addressed as a PMA error in Section 1.5. Refer to Procedure 3.26, Attachment 3, for conversion factors.

ATTACHMENT 1	SETPOINT AND CHANNEL ERROR CALCULATION GUIDELINES
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4.1.7.10 DETERMINATION OF ACTUAL SETPOINT (input to Setpoint Data Sheet)

- a. Actual Setpoint is the Operating Setpoint plus or minus the Elevation Correction.

4.1.8 CHANNEL ERROR CALCULATION

4.1.8.1 Channel error is only determined when required. Typically it is performed to determine the worst case error under post-accident conditions. However, with the definition of suitable error terms, it can be determined for other conditions.

4.1.8.2 The above error terms that exist during post-accident conditions are combined using the SRSS method to determine total Channel Error (CE). The CE is multiplied by 1.645/2 to adjust for a single sided 95% confidence level:

$$CE = (1.645/2)(SRSS \text{ OF RANDOM TERMS}) + \text{BIAS TERMS}$$

RANDOM TERMS include the random portion of A_{LP} , C_L , D_L , PMA, PEA, IRA, indicator readout error, and any other unique error terms known to exist.

BIAS TERMS include the bias portion of A_{LP} , C_L , D_L , PMA, PEA, IRA, indicator readout error, and any other unique error terms known to exist.

4.1.8.3 Undesirable consequences are normally associated with Channel Error in a single direction. If channel error is undesirable in both directions, a two-sided normal distribution should be used and the 1.645/2 term should be eliminated from the equation.

ATTACHMENT 1	SETPOINT AND CHANNEL ERROR CALCULATION GUIDELINES
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5. CONCLUSION

- 5.1 This is a summary of the goals of the calculation and evaluation of the results.
- 5.2 If the calculation was performed to verify existing setpoints, the following should be addressed:
 - 5.2.1 Evaluate the calculated NTSP and AV (if applicable) against existing values. If the existing values are not supported by the calculations, determine whether or not it is desirable to preserve the existing values.
 - 5.2.2 If existing values are to be preserved, investigate iteration opportunities and revise the calculations. Suggested alternatives include:
 - 5.2.2.1 Modify the Analytical Limit.
 - 5.2.2.2 Re-evaluate environmental assumptions.
 - 5.2.2.3 Re-evaluate calibration errors.
 - 5.2.2.4 Modify the tolerance on the selected setpoint.
 - 5.2.2.5 Re-evaluate drift assumptions.
 - 5.2.2.6 Re-evaluate other assumptions.
 - 5.2.2.7 Examine instrument applications.
- 5.3 These iterations do not have to be documented in the final calculation; however, all assumptions made to arrive at the final calculation shall be clearly stated in the calculation.