CALCULATION COVER SHEET

Title *Main Steam Line Steam Chase High Temperature Group 1 Isolation* CA- 97 - 241 Add. N/A

PART A – (Not Applicable to Vendor Calcs)

Assigned Personnel

Name (Print)	Signature	Title	Initials
Roger Wyatt	Roger D Wyatt	Setpoint Engineer	RDW
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Melissa Limbeck	M Limbeck	Sr. Proj. Coordinator	MAL

Record of Issues

Rev	Description	Total Sheets	Last Sheet	Preparer	Verifier	Approval	Approval Date
1	Revised to support 24-Month Fuel Cycle Extension	~~24~~ 25	Att. 2 Pg 2	RDW	RJH	MAL	12/31/03

RDW 12/31/03

Verification Method(s)

☒ Review ☐ Alternate Calculation ☐ Test ☐ Other

Approved (Signatures available in Master File)

3087 (DOCUMENT CHANGE, HOLD AND COMMENT FORM) incorporated:				
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PART B – (Applicable to Vendor Calculations Only)

Vendor Name ____________ Vendor Calc No: *N/A*

Vendor Approval Date: ____________

☐ Form 3345 or QF-0547 attached.

Reviewed by: ____________ ____________ ____________

Print Name Signature Date

Accepted by: ____________ ____________ ____________

Print Name Eng. Supv. Signature Date

Record of Issues

Revision	Description	Total No. of Sheets	Last Sheet Number

PART C – Design Basis Tracking Data (Complete for all Calculations)

10 CFR50.59 Screening or Evaluation No: *SCR-03-0758*

Associated Reference(s): *none*

Does this calculation:

Supercede another calculation?	Yes	☐	No	☒:	Calc. No(s):
Augment (credited by) another calculation?	Yes	☐	No	☒:	Calc. No(s):
Derive inputs from another calculation?	Yes	☒	No	☐:	Calc. No(s): *See Page 3 Other Comments*
Affect the Fire Protection Program (Form 3765)?	Yes (attach Form 3765)	☐	No	☒	
Affect piping or supports?	Yes (attach Form 3544)	☐	No	☒	

Approved (Signatures available in Master File)

List all documents/procedures that are based on this calculation:

Documents/Procedures (include revision): 0050

List all plant procedures used to ensure inputs/assumptions/outputs are maintained:

Procedures (include revision): 0050

What Systems or components are affected?

System Code(s): MST

Component ID's (CHAMPS Equip): TS-2-121A,B,C,D, TS-2-122A,B,C,D, TS-2-123A,B,C,D, TS-2-124A,B,C,D,

DBD Section (if any): B.05-06, B.02.04

Topic Code (eg. ASME Section XI etc): Instrument Setpoint

Other Comments: CA-03-057, CA-95-027, CA-93-077A, CA-96-042, CA-96-044, CA-96-0119, CA-96-0149, CA-96-0178, CA-96-0170, CA-96-0171, CA-98-257, CA-98-259, CA-00-072, CA-99-085, CA-99-191, CA-00-017, CA-00-036

Approved (Signatures available in Master File)

1. PURPOSE

The purpose of this calculation is to determine an acceptable instrument setpoint for the Main Steam line high temperature instruments TS-2-121A,B,C,D, TS-2-122A,B,C,D, TS-2-123A,B,C,D and 124 A, B, C, D located in the main steam chase. Instrument settings include the nominal trip setpoint and the allowable value. The results of this calculation will be used to verify the adequacy of current setpoints and calibration procedures or to establish new settings and limits as required. The setpoint will be selected high enough to avoid spurious isolation during operation at rated power yet low enough to initiate a Group 1 isolation signal upon sensing a steam line break.

Revision 1 of this calculation is being performed in support of the 24-Month Fuel Cycle Extension project. Instrument drift uncertainties and the corresponding setpoints for the temperature switches are being evaluated for the maximum 30-month extended calibration and surveillance interval (2DO 03010356).

2. METHODOLOGY

This calculation is performed in accordance with ESM-03.02-APP-I (Input 4.1). The General Electric Setpoint Methodology is a statistically based methodology. It recognizes that most of the uncertainties that affect instrument performance are subject to random behavior, and utilizes statistical (probability) estimates of the various uncertainties to achieve conservative, but reasonable, predictions of instrument channel uncertainties. The objective of the statistical approach to setpoint calculations is to achieve a workable compromise between the need to ensure instrument trips when appropriate, and the need to avoid spurious trips that may unnecessarily challenge safety systems or disrupt plant operation.

The methodology for determining instrument setpoints is not described in the USAR or its references.

3. ACCEPTANCE CRITERIA

The setpoint and instrument settings should be selected to assure that the Analytical Limit will not be exceeded when all applicable instrumentation uncertainties are considered. A setpoint value will be established with a 95%/95% tolerance interval as a criteria of uncertainties. That is, there is a 95% probability that the constructed limits contain 95% of the population of interest for a 24-month +25% calibration interval.

4. INPUTS

4.1 Engineering Standards Manual ESM-03.02-APP-I, Appendix I (GE Methodology Instrumentation & Controls), Revision 3. The ESM provides plant specific guidance on the implementation of the General Electric guidelines (Reference 10.1) and methodology (Reference 10.2).

4.2 Monticello Technical Specifications Trip Limit

Section	Setting	Function
Table 3.2.1 – 1.c	≤ 200 °F	High Temp in Main Steam Line Tunnel
Table 4.2.1	Cycle	Temperature Switch Calibration

4.3 Monticello Component Master List (CML). The CML contains instrument information relating to the installed equipment as listed in Section 6.2. The CML also provides the recent calibration records and maintenance history for the instruments included in this calculation. The current temperature switches are set to actuate on increasing temperature at a desired setting of 197.5 °F. The current As-Found range is 186.4 to 208.6 °F and the As-Left Range is 195 to 200 °F.

4.4 EQ-PART-A, Revision 12, EQ Central File Part A Equipment Master List. Data obtained from this input is listed in Section 6.2

4.5 EQ-PART-B, Revision 5, Monticello Nuclear Generation EQ Central File Part B Environmental Specification. Data obtained from this input is listed in Section 6.2

4.6 Calculation CA-95-027, Revision 1, Determination of Instrument Service Conditions for Input into Setpoint Calculations. Data obtained from this input is listed in Section 6.2

4.7 NSP Calculation CA-93-077A, Rev. 0, Steam Chase Heatup During SBO for Rerate Conditions, ISEQ # GOH02508, MO4331-0773. Under rerate conditions (1880 MWt), the maximum temperature in the steam chase during a Station Blackout after loss of HVAC is 180°F.

4.8 EDS Report No. 01-0910-1151, Revision 2, Main Steamline Tunnel Temperature Switches Technical Specification Modification ISEQ # JRR06108, MO3447-0024-DOMT.

4.9 Calculation CA-96-042, Revision 0, Main Steam HELB in the Steam Chase at 1880 MWt Rerate Conditions, Analysis Module R.1.1. Data obtained from this input is listed in Section 6.5.

4.10 Calculation CA-96-044, Revision 0, Main Steam HELB in the Steam Chase at 1880 MWt Rerate Conditions, Analysis Module R.2.1. Data obtained from this input is listed in Section 6.5.

4.11 Calculation CA-96-0119, Revision 0, Main Steam HELB in the Steam Chase, Analysis Module A.1.1. Data obtained from this input is listed in Section 6.5.

4.12 Calculation CA-96-0149, Revision 0, Main Steam HELB in the Steam Chase, Analysis Module A.2.1. Data obtained from this input is listed in Section 6.5.

4.13 Calculation CA-96-0178, Revision 0, Main Steam HELB in the Steam Chase at Hot Standby, Analysis Module B.1.1. Data obtained from this input is listed in Section 6.5.

4.14 Calculation CA-96-0170, Revision 0, Main Steam HELB in the Steam Chase at 1775 MWt Rerate Conditions, Analysis Module R.1.1-1. Data obtained from this input is listed in Section 6.5.

4.15 Calculation CA-96-0171, Revision 0, Main Steam HELB in the Steam Chase at 1775 MWt Rerate Conditions, Analysis Module R.2.1-1. Data obtained from this input is listed in Section 6.5.

4.16 Calculation CA-98-257, Revision 0, Main Steam HELB in the Steam Chase for Rerate, Steam Chase Initial Temperature of 150 °F, Analysis Module R.1.1-2. Data obtained from this input is listed in Section 6.5.

4.17 Calculation CA-98-259, Revision 0, Main Steam HELB in the Steam Chase for Rerate, Steam Chase Initial Temperature of 165 °F, Analysis Module R.1.1-3. Data obtained from this input is listed in Section 6.5.

4.18 Calculation CA-00-072, Revision 0, Main Steam HELB in the Steam Chase for Rerate, Steam Chase Initial Temperature of 150 °F, Reactor Building Railroad Door Chained, Analysis Module R.1.1-4. Data obtained from this input is listed in Section 6.5.

4.19 Calculation CA-99-085, Revision 1, Main Steam Line HELB in the Steam Chase for Rerate, Door 34 Open, Analysis Module R.1.1-5. Data obtained from this input is listed in Section 6.5.

4.20 Calculation CA-99-191, Revision 0, Main Steam Line HELB in the Steam Chase for Rerate, Door 44 Open, Analysis Module B.1.1. Data obtained from this input is listed in Section 6.5.

4.21 Calculation CA-00-017, Revision 0, Main Steam HELB in the Steam Chase for Blowout Panel Evaluation at Rerate 1880, Analysis Module B.1.1-1. Data obtained from this input is listed in Section 6.5.

4.22 Calculation CA-00-036, Revision 0, Main Steam Line HELB in the Steam Chase for Rerate, 1880Mwt, Rail Road Doors Barred, Analysis Module R2.1RRBARRED. Data obtained from this input is listed in Section 6.5.

4.23 Calculation CA-03-057, Revision 0, Instrument Drift Analysis Fenwal 01-1700200-090 Temperature Switches. The Analyzed Drift based on 95%/95% tolerance interval for a 30-month maximum calibration frequency is, AD_E = +0.5 $\pm$11.8 °F or +0.26 $\pm$ 6% of setpoint ($\leq$30 Months).

4.24 Procedure 0050, Revision 9, Steam Chase High Temperature Group 1 Isolation Instrument Test and Calibration procedure. Data obtained from this input is listed in Section 6.2.1.6.

4.25 Monticello Component Master List (CML). Instrument Calibration Worksheets contain the As Found tolerances of the devices used to calibrate the temperature switches. Data obtained from this input is listed in Section 6.2.1.6.

4.26 Mod 90M097, Replacement of Fenwal Temperature Switches With Patel Temperature Switches On HPCI, RCIC and Main Steam, ISEQ # BJW01670, MO2847-1314

4.27 PEI TR-831200-1 Revision A, Patel Engineers Technical Report, Qualification of PEI/Fenwal Temperature Switches, DI# 2.3-009-002, MO2637-008. Specified acceptance criteria used during qualification testing was $\pm$ 6 °F for model 01-170020-090 temperature switches for both normal and accident test conditions.

5. ASSUMPTIONS

5.1 None.

6. ANALYSIS

6.1 Instrument Channel Arrangement

6.1.1 Channel Diagram:

TS-2-121 A, B, C, D
TS-2-122 A, B, C, D
TS-2-123 A, B, C, D
TS-2-124 A, B, C, D
(Steam Chase)

Channel Function:

TS-2-121A,B,C,D, TS-2-122A,B,C,D, TS-2-123A,B,C,D, and TS-2-124A,B,C,D monitor Main Steam Chase ambient temperature and actuate on high temperature to initiate a Group 1 Primary Containment Isolation System (PCIS) signal. The primary function of these instruments is to detect small leaks in the main steam lines (flow rates 5 to 10 gpm), actuating on high area temperature to initiate a Group 1 isolation signal to the PCIS to close isolation valves, thus mitigating the consequences of a HELB.

The temperature switches also serve as backup to the main steam line flow monitoring instrumentation, which also initiate a Group 1 isolation signal to the PCIS for a large line break HELB with flow rates >140% rated; and as a back up to the main steam line pressure monitoring instrumentation, which also initiates a Group 1 isolation signal to the PCIS for an intermediate to large line break HELB when pressure is < 825 psig, Input 4.8, and Reference 10.10, 10.11, and 10.12.

The automatic closure of the group 1 valves prevents the excessive loss of reactor coolant so that fuel is not uncovered, fuel clad temperatures remain within acceptable limits, and release of radioactivity to the environs is well below 10 CFR 100 guidelines. Reference Sections 14.6.5 UFSAR.

Sixteen temperature detectors (channels) are grouped in four sets of four detectors. Each set is arranged in one-out-of-four-once logic. The outputs of two sets are arranged in one-out-of-two-once logic to form a trip system. These four sets of switches comprise two separate trip systems. Coincident tripping of both trip systems is required to initiate Group 1 isolation.

6.2 Instrument Definition and Determination of Device Uncertainty Terms

6.2.1 DEVICE 1 Uncertainties

6.2.1.1 Instrument Definition:

Component ID:	TS-2-121A, B, C, D TS-2-122A, B, C, D TS-2-123A, B, C, D TS-2-124A, B, C, D	Input
Function	Bi-Metallic Temperature Switch	4.26
Location:	Rx Bldg. Main Steam Chase Volume 16	4.3, 4.6
Manufacturer:	Fenwal *	4.3, 4.26
Model Number:	01-170020-090	4.3, 4.26
Range:	-100 °F to 600 °F	4.26
Channel Span:	N/A	
Input Signal:	Steam Chase Ambient Temperature	4.6
Output Range:	Contacts opens/closes	

*The temperature switches are manufactured by Fenwal to Patel/EDS specifications, Reference 4.26.

6.2.1.2 Process and Physical Interfaces:

The temperature switches are installed in the Steam Chase, Volume 16. The applicable environmental conditions for the Steam Chase, Volume 16 are as follows:

Calibration Conditions:		Input
Temperature:	65 - 90 degree F	4.6
Radiation:	Negligible (Background)	4.5, 4.6
Pressure:	Ambient	4.5, 4.6
Humidity:	20 - 90%	4.5, 4.6
Surveillance Interval:	30 months	4.2

Calibration of the temperature switches is required once every operating cycle per Input 4.2, Table 4.2.1. A surveillance interval of 30 months (24 months + 25%) is used in accordance with the guidance in Generic Letter 91-04, Reference 10.4.

Normal Plant Conditions:		Reference
Temperature:	60 - 135 degree F	4.5, 4.6
Radiation:	Negligible (Background)	4.5, 4.6
Pressure:	Ambient	4.5, 4.6
Humidity:	20 - 100%	4.5, 4.6

Trip Environmental Conditions:		Reference
Temperature:	60 - 212 degree F	4.6 , Note 1
Radiation:	Negligible (Background)	4.6
Pressure:	21.7 psia	4.6
Humidity:	20 - 100%	4.6
Seismic Conditions (ZPA):	1.78g (OBE)	4.6

Note 1: The temperature switches actuate on high steam tunnel temperature to initiate a PCIS signal. The instrument function time required for these switches is 1 minute, Input 4.6. The worse case temperature is the Analytical Limit (AL), 212 °F, Section 6.5.

6.2.1.3 Individual Device Accuracy (A_{iN}, A_{iT} & A_{iP}):

Term	Specified	Value	Sigma	Reference
VA:		± 2.5 °F	2	Note 1
ATE:		NA		Note 1
OPE:		NA		Note 2
SPE:		NA		Note 3
SE:		NA		Note 1
PE		NA		Note 1
RE:		NA		Note 1
HE:		NA		Note 1
PSE:		NA		Note 3
REE:		NA		Note 3

Note 1: The manufacturer does not specify VA, ATE, SE, PE, RE, or HE. However, an overall acceptance criteria of ± 6 °F was specified during all phases of harsh environmental qualification testing, Input 4.27. The repeatability was checked following each phase of testing. Following a short initial burn-in period, the qualification test data shows that the maximum difference between the largest value and the smallest value recorded was less then 0.2 °F; therefore, a VA of ± 2.5 °F conservatively bounds repeatability and provides allowance for burn-in if any the switches are replaced in the future. The temperature switches are mechanical

devices that are strut-and-tube type thermoswitches. The outer shell is made of a high expanding metal and the strut assembly is made of a low expanding metal. The switch contacts actuates in response to a change in net force that is produced on the low-expansion strut assembly as the high-expanding shell expands or contracts with respect to changes in ambient temperature, Input 4.26. Therefore, setpoint repeatability due to mechanical resistance is the only error contributor.
Based upon the above principals of operation the switches are not susceptible to ATE, PE, RE and HE; however, any environmental effects that affect repeatability during normal operating conditions are included in the Analyzed Drift terms and will be calibrated out during periodic calibration of the switch.

Note 2: The temperature switches are bimetallic devices and are not susceptible to Overpressure Effect (OPE). OPE is considered to be 0.

Note 3: The temperature switches are bimetallic devices and are not susceptible to Static Pressure Effects (SPE), Power Supply Effects (PSE), and RFI/EMI Effects (REE); therefore, no errors are introduced due to these effects.

Note 4 The temperature switches were seismically tested; however, the vendor has not specified an error effect due to seismic vibration. The temperature switches have been verified to be capable of withstanding a seismic event and capable of performing there prescribed functions. Since, no error effects due to the seismic forces were identified, Seismic Effects (SE) are considered negligible and are bounded by AD.

$$A_N = \sqrt{VA^2 + ATE^2 + OPE^2 + SPE^2 + SE^2 + RE^2 + HE^2 + PSE^2 + REE^2}$$

$$A_N = \sqrt{2.5^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0^2}$$

$$A_N = \pm 2.5\ °F$$

No post accident requirements have been specified for these switches; therefore A_P is N/A. There are no identified error terms that affect the instrument under trip conditions. Therefore, A_T is equal to A_N

Since the temperature switch is the only component in the loop, loop accuracy equals the accuracy of the temperature switch.

A_{LN} and $A_{LT} = A_N$

6.2.1.4 Individual Device Drift:

Vendor Drift and Vendor Drift Temperature Effect is not specified, Input 4.26. A drift analysis using instrument calibration history data was performed using 322 data points collected from 1971 to May of 2003. Using these data points, Input 4.23 determined Analyzed Drift (AD) terms for a 30-month calibration frequency.

AD_E = ±11.8 °F, +0.5 °F (bias) (30 Months) Input 4.23

AD is used in place of VD and DTE:

D_L = ±11.8 °F, +0.5 °F (bias) (30 months)

6.2.1.5 As Left Tolerance (ALT):

The existing ALT is ± 2.5 °F (Input 4.3).

6.2.1.6 Device Calibration Error:

Term	Value	Sigma	Reference
C_1:	± 2.0 °F	3	Note 1
C_{1STD}:	± 2.0 °F	3	Note 2
ALT:	± 2.5 °F	3	6.2.1.5

Input Cal. Device C_1	Range	Tolerance	Reference
XTC-9086 / XTE-2	0 to 1500 °F	± 2 °F	4.3
XTC-9087 / XTE-3	0 to 1500 °F	± 1 °F	4.3
XTC-9089 / XTE-3	0 to 1500 °F	± 1 °F	4.3
XTC-9085 / XTE-8	0 to 1500 °F	± 2 °F	4.3

Note 1: For this calculation, the Calibration Tool Error (C_1) is considered equal to ± 2.0 °F, which is the As-Found tolerance from the calibration records for XTC-9085 / XTE-8 (bounding). The tolerance reflects the total calibration uncertainty of the temperature calibrator, which is paired with a thermocouple or RTD and calibrated as a single unit. Using the As-Found tolerance accounts for calibration accuracy (including readability) of the calibration devices.

Note 2: In accordance with Input 4.1, C_{1STD} is considered to be equal to C_1.

Since, calibration term values are controlled by 100% testing, they are considered to be 3-sigma values. Individual calibration error terms are combined using the SRSS method and normalized to a 2-sigma confidence temperature.

$$C_L = \frac{2}{3}\sqrt{C_1^{\,2} + C_{1STD}^{\,2} + ALT^2}$$

$$C_L = \frac{2}{3}\sqrt{2^2 + 2^2 + 2.5^2}$$

$$C_L = \pm 2.52\ °F$$

6.3 Determination of Primary Element Accuracy (PEA) and Process Measurement Accuracy (PMA)

6.3.1 Primary Element Accuracy

The temperature switches are bimetallic switches that respond directly to changes in steam chase ambient air temperature. Uncertainties associated with the temperature switches are the only error contributors.

PEA = 0

6.3.2 Process Measurement Accuracy

The temperature switches are bimetallic switches that respond directly to changes in steam chase ambient air temperature.. Uncertainties associated with the temperature switches are the only error contributors.

PMA = 0

6.4 Determination of Other Uncertainty Terms

The switch contacts actuate in direct response to mechanical movement of bimetallic materials within the switch that expand or contract in response to temperature changes. Therefore, the error terms listed in the table below are not applicable to these electro/mechanical type of temperature switches.

Term	Value
Indicator Readability/Operator Reading Error (ORE)	0
Resistors, Multiplexers, etc.	0
Software Errors	0
Degradation of Insulation Resistance (IRE)	0

6.5 Determination of Analytical Limit

The primary function of the steam chase temperature switches is to detect small leaks in the main steam lines (flow rates 5 to 10 gpm), thus closing Group 1 isolation valves to mitigate the consequences of a HELB, Input 4.8, and Reference 10.10, 10.11, and 10.12.

Input 4.8 calculates a temperature limit of ≤ 212 °F in the steam chase based on a small break in the order of 5 to 10 gpm and recommends it as the high setpoint limit for the temperature switches.

The temperature switches also serve as backup to the main steam line flow monitoring instrumentation, which also initiate a Group 1 isolation signal to the PCIS for a large line break HELB with flow rates >140% rated; and as a back up to the main steam line pressure monitoring instrumentation, which also initiates a Group 1 isolation signal to the PCIS for an intermediate to large line break HELB when pressure is < 825 psig, Input 4.8, and Reference 10.10, 10.11, and 10.12. The assumptions used in the HELB analysis for large line breaks are as follows:

HELB Analysis Assumptions - Main Steam HELB in the Steam Chase

Analysis Module	Rated Power	Flow NTSP	Temp. NTSP	Time to NTSP	MSIV LST	Event Total Response Time	Input
A.1.1		140% Rated	200°F	< 0.21 sec	5.4 sec	10.5 sec	4.11
A.2.1		140% Rated	200°F		5.4 sec	10.5 sec	4.12
B.1.1	1880 MWt	140% Rated	200°F	< 0.22 sec	5.4 sec	10.5 sec	4.20
B.1.1	Hot Standby	140% Rated	200°F	< 0.22 sec	5.4 sec	10.5 sec	4.13
B.1.1-1	1880 MWt	140% Rated	200°F		5.4 sec	10.5 sec	4.21
R.1.1	1880 MWt	140% Rated	200°F	< 0.21 sec	5.4 sec	10.5 sec	4.9
R.1.1-1	1775 MWt	140% Rated	200°F	< 0.21 sec	5.4 sec	10.5 sec	4.14
R.1.1-2	1775 MWt	140% Rated	200°F	< 0.21 sec	5.4 sec	10.5 sec	4.16
R.1.1-3	1775 MWt	140% Rated	200°F	< 0.21 sec	5.4 sec	10.5 sec	4.17
R.1.1-4	1775 MWt	140% Rated	200°F	< 0.21 sec	9.9 sec	10.5 sec	4.18
R.1.1-5	1880 MWt	140% Rated	200°F	< 0.22 sec	5.4 sec	10.5 sec	4.19
R.2.1	1880 MWt	140% Rated	200°F	No trip	5.4 sec	10.5 sec	4.10
R.2.1-1	1775 MWt	140% Rated	200°F	No trip	5.4 sec	10.5 sec	4.15
R.2.1RRBARRED	1880 MWt	140% Rated	200°F	No trip	9.9 sec	10.5 sec	4.22

The temperature rise in the steam chase due to the large line breaks occurs rapidly. Although the HELB analyses assumes a temperature NTSP of ≤ 200 °F, that value is reached in less than 0.22 sec.; and as previously stated, the flow setpoint is credited for providing the primary trip function for the larger HELB with the temperature switches acting as backup. Therefore, the ≤ 212 °F temperature limit from Input 4.8 will be used

as the Analytical Limit since the primary function of the temperature switches is to sense a small line break and initiate a Group 1 isolation signal to the PCIS.

AL = ≤ 212 °F

6.6 Allowable Value and Operating Setpoint

6.6.1 Allowable Value:

AL = ≤ 212 °F   Section 6.5

Term	Value (°F)	Sigma	Reference
A_N	± 2.5	2	Section 6.2.1.3
C_L	± 2.52	2	Section 6.2.1.6
PEA	0	NA	Section 6.3.1
PMA	0	NA	Section 6.3.2
IRE	0	NA	Section 6.4
ORE	0	NA	Section 6.4
Other	0	NA	Section 6.4

$$AV = AL - \left(\frac{1.645}{2}\right)\left(\sqrt{A_N^2 + C_L^2 + PMA^2 + PEA^2 + ORE^2 + IRE^2}\right)$$

$$AV = 212 - \left(\frac{1.645}{2}\right)\left(\sqrt{2.5^2 + 2.52^2 + 0^2 + 0^2 + 0^2 + 0^2}\right)$$

$$AV = 209\ °F$$

Since the calculated AV value is greater than the current Technical Specification value of 200 °F, the current Technical Specification Value is conservative.

AV ≤ 209 °F (Calculated Allowable Value)

6.6.2 Nominal Trip Setpoint:

Term	Value (°F)	Sigma	Reference
A_N	± 2.5	2	Section 6.2.1.3
D_L	±11.8, +0.5 (bias)	2	Section 6.2.1.4
C_L	± 2.52	2	Section 6.2.1.6
PEA	0	NA	Section 6.3.1
PMA	0	NA	Section 6.3.2
IRE	0	NA	Section 6.4
ORE	0	NA	Section 6.4
Other	0	NA	Section 6.4

$$NTSP_1 = AL - \left(\frac{1.645}{2}\right)\left(\sqrt{A_{LT}^2 + D_L^2 + C_L^2 + PMA^2 + PEA^2 + ORE^2 + IRE^2}\right) + D_{Lbias}$$

$$NTSP_1 = 212 - \left(\frac{1.645}{2}\right)\left(\sqrt{2.5^2 + 11.8^2 + 2.52^2 + 0^2 + 0^2 + 0^2 + 0^2}\right) + 0.5$$

$$NTSP_1 \leq 201.4\ °F$$

Trip Setpoint Margin

The current Trip Setpoint is 197.5 °, Input, 4.3).

CTS = 197.5 °F

$CTS_{Margin} = NTSP_1 - CTS$ Current Trip Setpoint Margin

CTS_{Margin} = 3.9 °F

There is positive (+) margin between the Current Trip Setpoint value and the Calculated $NTSP_1$ value; therefore, the Current Trip Setpoint value is conservative. Therefore, the operating setpoint must be selected ≤ 201.4 °F.

6.6.3 LER Avoidance Evaluation:

The purpose of the LER Avoidance Evaluation is to assure that there is sufficient margin provided between the current AV and the NTSP to reasonably avoid violations of the AV. For a instrument channel, which is part of a multiple channel logic system, a Z value of greater than 0.81 provides sufficient margin between the NTSP and the AV. Therefore, $NTSP_2$ is calculated to provide a upper bound for the NTSP based on LER avoidance criteria.

$$Sigma_{LER} = \left(\frac{1}{2}\right)\left(\sqrt{A_{LN}^2 + C_L^2 + D_L^2}\right) + D_{Lbias}$$

$$Sigma_{LER} = \left(\frac{1}{2}\right)\left(\sqrt{2.5^2 + 2.52^2 + 11.8^2}\right) + 0.5$$

$$Sigma_{LER} = 6.7\ °F$$

$$NTSP_2 = AV - Z \times Sigma(LER)$$

$$NTSP_2 = 209 - (0.81 \times 6.7)$$

$$NTSP_2 \leq 203.5\ °F$$

Therefore, a NTSP $\leq$ 203.5 °F will result in a Z greater than 0.81 and provide sufficient margin between the NTSP and the Allowable Value.

The current NTSP of 197.5 °F is less than 203.5 °F; therefore, adequate LER Avoidance Margin is provided with the current setpoint.

6.6.4 Selection of Operating Setpoint

$NTSP_2$ will be used as the upper bound for the setpoint. The trip setpoint will be determined as the center of the as left tolerance.

$$TS \leq NSTP_2 - ALT$$
$$TS \leq 203.5 - 2.5$$
$$TS \leq 201\ °F$$

The current TS of 197.5 °F is less than the calculated TS; therefore, is conservative.

6.6.5 Establishing As Found Tolerance:

An as-found tolerance is calculated to provide suggested upper and lower limits for use during surveillance testing:

$$AFT_{Rand} = \sqrt{VA^2 + VD^2 + DTE^2 + C_L^2}$$

Substituting D_L (analyzed drift term) in place of VD and DTE:

$$AFT_{Rand} = \sqrt{VA^2 + D_L^2 + C_L^2}$$
$$AFT_{Rand} = \sqrt{2.5^2 + 11.8^2 + 2.52^2}$$
$$AFT_{Rand} = 12.3\ °F$$

Analyzed Drift bias term of 0.5 °F that is observed in the as-found data, Input 4.23,

$AFT_{Bias} = 0.5$ °F

$AFT_+ = AFT_{Rand} + AFT_{Bias}$ and $AFT_- = -AFT_{Rand}$

$AFT_+ = 12.3$ °F + 0.5 °F and $AFT_- = -12.3$ °F

$AFT_1 = +12.8 / -12.3$ °F

6.6.6 Required Limits Evaluation:

The purpose of a Required Limits Evaluation is to assure that the combination of errors present during calibration of each device in the channel is accounted for while allowing for the possibility that the devices may not be recalibrated. Since Leave Alone Zones are not used at MNGP, the devices are always verified or recalibrated to be within the As Left Zone. Therefore, a Required Limits Evaluation as discussed in the GE methodology is not applicable. However, since the AFT is significantly larger than the ALT, a required limits evaluation is included to assure reasonable margin is provided between the AV and the selected setpoint to account for channel instrument drift.

To assure that the combination of individual device AFTs will not cause the channel Allowable Value to be exceeded, the AFTs of the devices are combined using the SRSS method. Since the temperature switch is the only device in the loop, $AFT_L = AFT_1$.

$AFT_L = AFT_1$
$AFT_L = +12.8 / - 12.3$ °F

The available margin between the calculated AV of 209 °F and the current NTSP of 197.5 °F is 11.5 °F. Although the calculated AFT_L is greater than the available margin, the LER avoidance evaluation ensures that any setpoint ≤ 203.5 °F provides sufficient margin between the AV and the NTSP to provide for LER avoidance. Therefore, the AFT can be reduced to ± 11.5 °F to the available margin. This AFT provides reasonable assurance that the instrument will not be found outside the AFT.

$NTSP_{RL} = CTS$

$NTSP_{RL} = 197.5$ °F

$AFT_1 = \pm 11.5$ °F

6.6.7 Spurious Trip Avoidance Evaluation:

A spurious trip avoidance evaluation is performed to assure that there is a reasonable probability that during normal operation, spurious trips will not occur during normal operation. Input 4.7, determines the maximum temperature of 180°F occurs in the steam chase during a Station Blackout for rerate conditions (1880 MWt), after loss of HVAC. This is considered the highest operating limit within the steam chase.

OL = 180 °F　　　$Sigma_{LER} = 6.7$ °F　Section 6.6.3

$Sigma_{STA} = Sigma_{LER}$　　　$Sigma_{STA} = 6.7$ °F

Z is determined using CTS = 197.5 °F as the most limiting setpoint.

$$Z = \frac{CTS - OL_{SBO}}{Sigma_{STA}}$$

$$Z = \frac{197.5°F - 180°F}{6.7°F}$$

$$Z = 2.61$$

Per Input 4.1 a Z value greater than 1.65 provides adequate margin to provide reasonable assurance for spurious trip avoidance. Z is greater than 1.65; therefore, CTS = 197.5 °F provides adequate margin for spurious trip avoidance.

6.6.8 Elevation correction:

The switches are bimetallic type temperature switches and do not require elevational correction.

6.7 Instrument Scaling:

A current NTSP = 197.5 °F satisfies the required limits analysis and provides adequate margin for LER and Spurious Trip Avoidance. Therefore, the current NTSP shall remain the selected setpoint. The upper and lower as-found and as-left range limits are determined by adding and subtracting the AFT and ALT from $NTSP_{RL}$.

Value	Process Units	Signal Units
$NTSP_{RL}$	197.5 °F	Same
As-Found Range	186 to 209 °F	Same
As-Left Range	195 to 200 °F	Same

7. CONCLUSIONS

Attachment 1 graphically shows the relationships of the results of this calculation.

The results of the calculation are as follows:

Term	Value	Section
A_{LN}	±2.5 °F	6.2.1.3
A_{LT}	±2.5 °F	6.2.1.3
A_{LP}	N/A	6.2.1.3
D_L	± 11.8 °F + 0.5 °F (Bias)	6.2.1.4
C_L	± 2.52 °F	6.2.1.6
PEA	0	6.3.1
PMA	0	6.3.2
ORE	0	6.4
IRE	0	6.4
Elevation Correction	N/A	6.6.8
ALT	± 2.5 °F	6.2.1.5
AFT	± 11.5 °F	6.6.6

Term	Value	Section
AL (Analytical Limit)	≤ 212 ° F	6.5
AV (Calculated Allowable Value)	≤ 209 ° F	6.6.1
Technical Specifications Trip Limit (Current)	≤ 200 °F	4.2
$NTSP_1$	≤ 201.4 °F	6.6.2
$NTSP_2$ (LER Avoidance)	≤ 203.5 °F	6.6.3
TS (Operating Setpoint Limit)	≤ 201 °F	6.6.4
CTS (Current Trip Setpoint)	197.5 °F	4.3
$NTSP_{RL}$	197.5 °F	6.6.6
OL_{SBO}	180 °F	6.6.7

The calculation has shown that the main steam chase high temperature setpoint must be set less than or equal to the AL of 212 °F and greater than or equal to an OL_{SBO} of 180 °F.

Accounting for instrument and measurement uncertainties, the current trip setpoint CTS = 197.5 °F satisfies the required limits analysis and provides adequate margin for LER and Spurious Trip Avoidance. The analysis has determined that an Allowable Value of ≤ 209 °F provides adequate margin to protect the analytical limit of ≤ 212 °F and to account for identified instrument and measurement uncertainties.

The Monticello Technical Specifications contain information in deviation tables within the Bases section that have historically been used for determining acceptable

instrument settings. As a result of CR 02001013, the values in the deviation tables can not be used for determining As Found criteria for instrument setpoints. Administrative controls have been established to evaluate instruments whenever the As Found values exceed the Technical Specification trip setting. The Allowable Value determined in this calculation exceeds the current Technical Specification trip setting. Therefore, the Technical Specification trip setting will be changed to the calculated Allowable value as part of the 24-month fuel cycle extension License Amendment Request (LAR). The more conservative administrative controls established for these temperature switches will remain in effect until the 24-month fuel cycle extension License Amendment Request (LAR) has been approved. The AFT will be changed to ± 11.5 °F, to account for predicted drift associated with an extended 30 month calibration frequency once the LAR has been approved. The corresponding scaling values to be used during surveillance testing are listed in Section 6.7.

8. FUTURE NEEDS

8.1 Process a Setpoint Change Request (SCR) to change the As Found tolerances for the MSL High Temperature Group 1 Isolation after approval of the 24-month fuel cycle extension LAR (ACC 03013321).

9. ATTACHMENTS

1. Setpoint Relationships
2. Form 3495, Calculation/ Analysis Verification Checklist.

10. REFERENCES

10.1 GE-NE-901-021-0492, DRF A00-01932-1, Setpoint Calculation Guidelines for the Monticello Nuclear Generating Plant, October 1992.

10.2 General Electric Instrument Setpoint Methodology, NEDC-31336P-A, September 1996.

10.3 Guidelines for Instrument Calibration Extension/Reduction - Revision 1: Statistical Analysis of Instrument Calibration Data, EPRI, Palo Alto, CA: 1998. TR-103335-R1.

10.4 NRC Generic Letter 91-04, "Changes in Technical Specification Surveillance Intervals to accommodate a 24-Month Fuel Cycle."

10.5 Regulatory Guide 1.105, Revision 3, Setpoints for Safety-Related Instrumentation.

10.6 DBD T.14, Revision C, Design Bases Document for Equipment Seismic Requirements

10.7 DBD B.05.06, Revision B, Design Bases Document for Plant Protection System

10.8 DBD B.02.04, Revision C, Design Bases Document for Main Steam

10.9 DBD T.18, Revision 1, Design Bases Document for Station Blackout

10.10 GE 22A1380, Rev. 1, Nuclear Boiler Leak Detection Design Specification, ISEQ # MWS00495, MO0607-0074

10.11 NSP letter (D. Musolf) to the NRC, 9/24/82, License Amendment Request Dated September 24, 1982 - Miscellaneous Technical Specification Changes, ISEQ # SVL00291, GO18110-0102

10.12 NSP letter (D. Musolf) to the NRC, 2/7/83, Response to January 5, 1983 Request of Additional Information Related to Increased Allowable Deviation for Main Steam Line Area Temperature Switch Setpoint, ISEQ # JRR02972, GO18113-1172

10.13 UFSAR Section 14.6.5, Updated Final Safety Analysis Report

10.14 UFSAR Section 5.2.1.1, Updated Final Safety Analysis Report, Containment Systems Criteria

10.15 UFSAR Section 7.6.3.2.4 Paragraph 2, Updated Final Safety Analysis Report, Primary Containment Isolation System, Description

10.16 UFSAR Section 7.6.3.2.5 Paragraph b, Updated Final Safety Analysis Report, Primary Containment Isolation System, Instrumentation

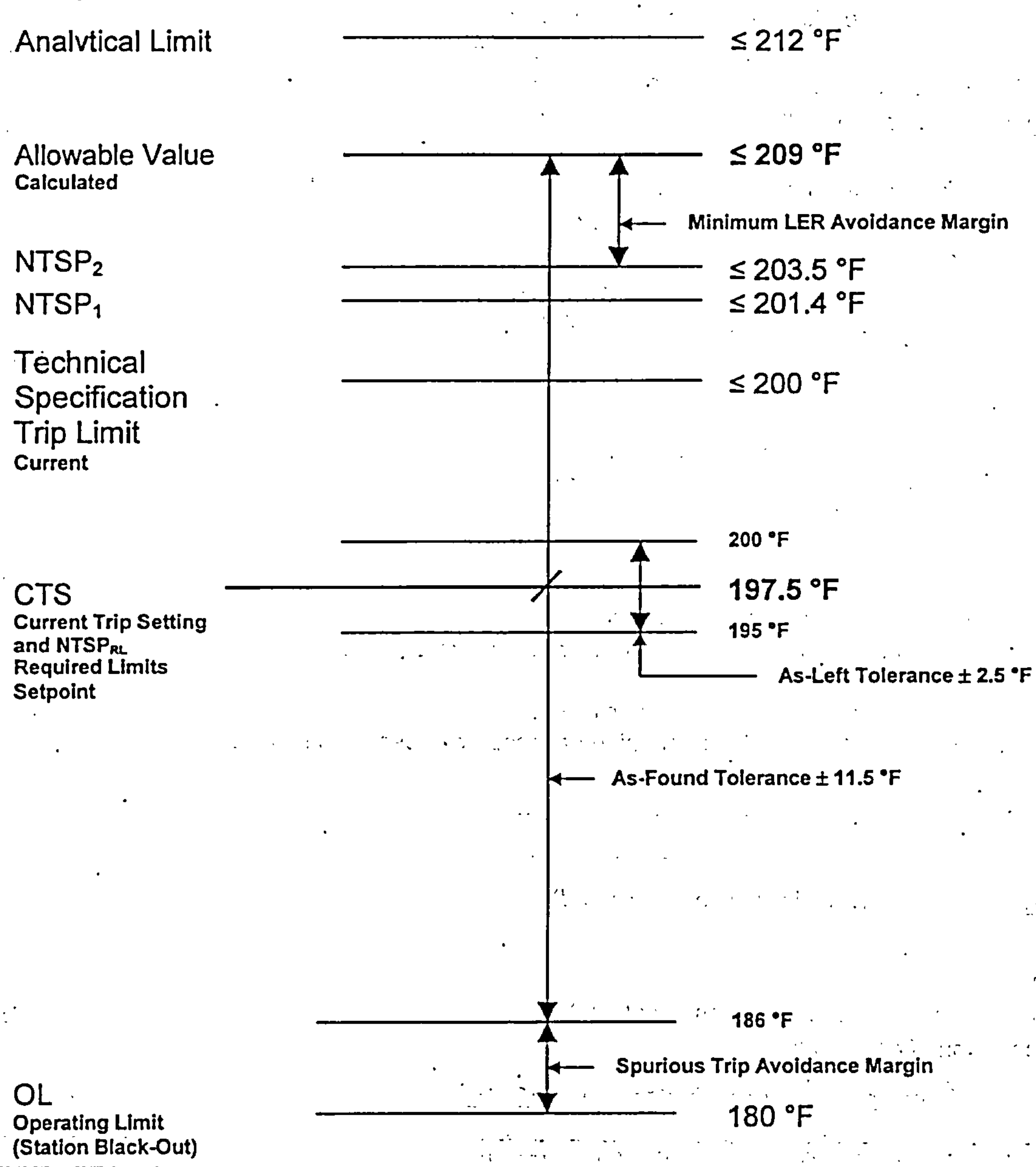
10.17 UFSAR Section 7.6.3.3.1, Updated Final Safety Analysis Report, Primary Containment Isolation System, Performance Analysis, General

10.18 Calculation CA-97-146, Revision 1, GOTHIC HELB Project Verification

MONTICELLO NUCLEAR GENERATING PLANT		CA-97-241
TITLE:	**Instrument Setpoint Calculation Main Steam Line Steam Chase High Temperature Group 1 Isolation**	Revision 1
		Attachment 1 Page 1 of 1

For Illustration Only
Not to Scale

Main Steam Chase High Temperature Group 1 Isolation Setpoint



MONTICELLO NUCLEAR GENERATING PLANT		3495
TITLE:	CALCULATION/ANALYSIS VERIFICATION CHECKLIST	Revision 5
		Page 1 of 1

Place initial by items verified.

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Attachment 2
Page 1 of 2

REVIEW	Verified
1. Inputs correctly selected.	RJH
2. Assumptions described and reasonable.	RJH
3. Applicable codes, standards and regulations identified and met.	RJH
4. Appropriate method used.	RJH
5. Applicable construction and operating experience considered.	RJH
6. Applicable structure(s), system(s), and component(s) listed.	RJH
7. Formulas and equations documented, unusual symbols defined.	RJH
8. Detailed to allow verification without recourse to preparer.	RJH
9. Neat and legible, pages all correctly numbered.	RJH
10. Signed by preparer.	RJH
11. Interface requirements identified and satisfied.	RJH
12. Acceptance criteria identified, adequate and satisfied.	RJH
13. Result reasonable compared to inputs.	RJH
14. Basis of all assumptions, acceptance criteria and inputs are identified.	RJH
15. Conclusions not in conflict with previous analysis, USAR, Technical Specifications or NRC Safety Evaluations.	RJH

ALTERNATE CALCULATION	
16. Alternate calc results consistent with original.	N/A
17. Items 1-4 above verified. (Required by ANSI N.45.2.11)	N/A

TESTING	
18. Testing requirements fully described and adequate.	N/A
19. Shows adequacy of tested feature at worst case conditions.	N/A
20. If test is for overall design adequacy, all operating modes considered in determining test conditions.	N/A
21. If model test, scaling laws and error analysis established.	N/A
22. Results meet acceptance criteria, or documentation of acceptable resolution is attached.	N/A

OTHER (Explain) ______ N/A

FINAL DOCUMENTATION (Verify applicable items included)	
23. Alternate or check calcs	N/A
24. Summary of test results.	N/A
25. Comments (errors, discrepancies, recommendations).	RJH
26. Method of resolution of comments.	RJH

Completed By: Richard J. Hannigan (signature) (Richard J. Hannigan) Date: 12/31/03

3087 (DOCUMENT CHANGE, HOLD AND COMMENT FORM) incorporated:					
FOR ADMINISTRATIVE USE ONLY	Resp Supv: GSE-NGS	Assoc Ref: AWI-05.01.25	SR: N	Freq: 0 yrs
	ARMS: 3495	Doc Type: 3042	Admin initials:	Date:

APPROVED (Signatures available in Master File)

NMC Committed to Nuclear Excellence Fleet Modification Process	**Design Review Comment Form**

Attachment 2
Sheet 2 of 2

DOCUMENT NUMBER/ TITLE: *CA-97-241; Instrument Setpoint Calculation -- Main Steam Line Steam Chase High Temperature Group 1 Isolation*

REVISION: 1 DATE: 12/31/03

ITEM #	REVIEWER'S COMMENTS	PREPARER'S RESOLUTION	REVIEWER'S DISPOSITION
1.	Input 4.7 -- Title of CA-93-077A should be "Steam Chase" not "Steam Chased".	Corrected.	Preparer's resolution found to be acceptable. No additional action needed.
2.	Input 4.21 -- In title of CA-00-017 word "Blowout" is mis-spelled.	Corrected.	Preparer's resolution found to be acceptable. No additional action needed.
3.	Section 6.2.1.6 -- In the Input Cal Device $C_{1)}$ column heading -- There is a right parenthesis after C_1.	Corrected.	Preparer's resolution found to be acceptable. No additional action needed.
4.	Section 6.5 -- In the R.2.1-1 Analysis Module where did the 9.9 sec MSIV LST time come from? Should it be 5.4 sec?	Corrected.	Preparer's resolution found to be acceptable. No additional action needed.
5.	Section 6.3.1 -- Primary Element Accuracy should be "PEA". "PMA" is listed in Section 6.3.1.	Corrected.	Preparer's resolution found to be acceptable. No additional action needed.

Reviewer: Richard J. Hanger Date: 12/31/03	Preparer: Roger D. Wyatt Date: 12/31/03