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10 CFR 50.90

December 15, 2010

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

Limerick Generating Station, Units 1 and 2
Facility Operating License Nos. NPF-39 and NPF-85
NRC Docket Nos. 50-352 and 50-353

Subject: Response to Request for Additional Information Regarding Proposed Technical Specification Changes to High Pressure Coolant Injection Equipment Room Delta Temperature Trip Setpoint and Allowable Value.

References:

1. Letter from P. B. Cowan, Exelon Generation Company, LLC, to U.S. Nuclear Regulatory Commission, "License Amendment Request Table 3.3.2-2, Item 4e, HPCI Equipment Room Delta Temperature High Isolation Trip Setpoint and Allowable Value Change," dated June 30, 2010.

2. Letter from Peter Bamford, U.S. Nuclear Regulatory Commission, to Michael J. Pacilio, President and Chief Nuclear Officer, Exelon Nuclear, "Limerick Generating Station, Units 1 and 2 - Request for Additional Information Regarding Proposed Technical Specification Changes to High Pressure Coolant Injection Equipment Room Delta Temperature Trip Setpoint and Allowable Value (TAC Nos. ME4171 and ME4172)," dated November 24, 2010.

In Reference 1, Exelon Generation Company, LLC (Exelon) submitted a request for an amendment to the Technical Specifications (TS), Appendix A of Facility Operating License Nos. 50-352 and 50-353 for Limerick Generating Station, Units 1 and 2 (LGS). The proposed amendment would revise the Technical Specification (TS) High Pressure Coolant Injection (HPCI) Equipment Room Delta Temperature High Trip Setpoint and Allowable Value listed in Table 3.3.2-2, Isolation Actuation Instrumentation Setpoints, Item 4e for LGS. The Trip Setpoint and Allowable Value are proposed to be lowered, which is in the conservative direction, to reflect a revised analysis for the HPCI equipment room temperature following a postulated 25 gallon per minute steam leak. The NRC reviewed the license amendment request and identified the need for additional information in order to complete their evaluation of the amendment request. A request for additional information (RAI) was transmitted to Exelon on November 24, 2010 (Reference 2). Attachment 1 to this letter provides a restatement of the RAI along with Exelon's response. Attachment 2 contains the Loop Uncertainty Calculation TE-055-1N028B.

Exelon has concluded that the information provided in this response does not impact the conclusions of the: 1) Technical Evaluation, 2) No Significant Hazards Consideration under the standards set forth in 10 CFR 50.92(c), or 3) Environmental Consideration as provided in the original submittal (Reference 1).

This response to the request for additional information contains no regulatory commitments.

If you have any questions or require additional information, please contact Frank Mascitelli at 610-765-5512.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 15th day of December 2010.

Respectfully,

Pamela B. Cowan

Pamela B. Cowan
Director, Licensing and Regulatory Affairs
Exelon Generation Company, LLC

Attachments: 1-Response to Request for Additional Information
2-Loop Uncertainty Calculation TE-055-1N028B, dated 11/20/09

cc:	Regional Administrator - NRC Region I	w/attachments
	NRC Senior Resident Inspector - LGS	"
	NRC Project Manager, NRR - LGS	"
	Director, Bureau of Radiation Protection - PA Department of Environmental Resources	"

ATTACHMENT 1

Limerick Generating Station
Docket Nos. 50-352 and 50-353

License Amendment Request Regarding
TS Table 3.3.2-2, Item 4e, HPCI Equipment Room Delta Temperature High
Isolation Trip Setpoint and Allowable Value Change

Response to Request for Additional Information

By letter dated June 30, 2010 (Agency wide Documents Access and Management System (ADAMS) Accession No. ML101810434), Exelon Generation Company, LLC (Exelon) submitted a license amendment request (LAR) proposing to revise the Technical Specification (TS) High Pressure Coolant Injection (HPCI) Equipment Room Delta Temperature High Trip Setpoint and Allowable Value listed in Table 3.3.2-2, Isolation Actuation Instrumentation Setpoints, Item 4e, for Limerick Generating Station (LGS), Units 1 and 2 (Reference 1). The Trip Setpoint and Allowable Values are proposed to be lowered, which is in the conservative direction, to reflect a revised analysis for the HPCI equipment room temperature following a postulated 25 gallon per minute steam leak. The Nuclear Regulatory Commission (NRC) staff has been reviewing the submittal and has determined that additional information is needed to complete its review (Reference 2).

The questions are restated below along with Exelon's response:

1.) The LAR, Attachment 1, "Evaluation of Proposed Technical Specifications Changes," pages 4 and 5, outlines the loop uncertainty calculation, but does not provide the basis for all the numbers used in the calculation. In order for the NRC staff to verify the acceptability of the setpoint analysis, please provide the complete calculation, indicated as "Reference 6 – Loop Uncertainty Calculation TE-055-1N028B." If the basis for all numbers used in the loop uncertainty calculation is not contained in TE-055-1N028B, please provide that information separately.

Response:

The complete calculation, Loop Uncertainty Calculation TE-055-1N028B, dated 11/20/09 (Reference 3), is provided as Attachment 2 to this response.

2.) The LAR, Attachment 1, pages 5 and 6, outlines instrument channel operability. For license amendment reviews, the NRC staff uses the terms As-Left and As-Found tolerances, Allowable Value, and Analytical Limit, which are all described in Regulatory Issue Summary (RIS) 2006-17, "NRC Staff Position on the Requirements of 10 CFR 50.36, 'Technical Specifications,' Regarding Limiting Safety System Settings During Periodic Testing and Calibration of Instrument Channels." From the description in the submittal, it is unclear how the "Leave Alone Zone" (LAZ) is used or treated in the instrument channel maintenance program. Therefore, please describe how application of the LAZ provides adequate assurance of channel operability. Though not required, it would be helpful to describe the LAZ as it relates to the descriptions in RIS 2006-17.

Response:

The leave alone zone (LAZ) is a range of acceptable values around a nominal value established by adding or subtracting the required accuracy during calibration from the nominal value. The required accuracy is the accuracy within which an instrument, or series of instruments, must be demonstrated to perform during calibration activities. The required accuracy is typically considered equal to the reference accuracy of the device under calibration. The required accuracy for a series of instruments calibrated or checked together is the Square Root Sum of the Squares (SRSS) combination of the individual instrument required accuracies.

When the As-Found instrument(s) reading is found within this band during surveillance testing or calibration checks, no calibration adjustment is required. If the As-Found instrument reading is found outside this band during surveillance testing or calibration checks, the instrument must be adjusted so that the As-Left instrument reading is within the LAZ. Since the required accuracy, and therefore the LAZ, is based on the reference accuracy of the device under calibration, the LAZ provides adequate assurance that this instrument is performing as expected and the instrument channel is operable. For the purpose of comparison with RIS 2006-17, the LAZ is used in the same manner as the As-Left Tolerance (ALT).

3.) As described in RIS 2006-17, values found outside the As-Found limit are typically entered in the corrective action program (CAP), recalibrated and retested. Also, as described in RIS 2006-17, it is the NRC staff position that verifying the As-Found setpoint is within limits is part of the determination that an instrument is functioning as required. Further, Title 10 of the *Code of Federal Regulations* Part 50, Appendix B, Criterion XVI, "Corrective Action," requires that significant conditions adverse to quality be promptly identified, corrected, and documented. From the process description in the LAR, it appears that the setpoint can drift up to the Allowable Value and never be entered in the CAP. Please clarify what actions would be taken for setpoints found to exceed the LAZ. If no CAP entry is made for setpoints outside of a pre-established As-Found tolerance band, please justify why this provides acceptable setpoint programmatic controls regarding evaluation, trending, and corrective actions, and explain how this ensures that these instruments are operating in accordance with the assumptions in the governing setpoint analysis.

Response:

If the As-Found setpoint is found to exceed acceptable limits (also known as LAZ) and the Allowable Value, the test performer attempts to adjust the setpoint within acceptable limits. If the setpoint can be adjusted within acceptable limits, the test is statused as Fail/Pass. If the setpoint cannot be adjusted within acceptable limits the test is statused as Fail. The test performer also initiates an Issue Report in the CAP in either case.

If the As-Found setpoint is found to exceed acceptable limits but does not exceed the Allowable Value, the test performer attempts to adjust the setpoint within acceptable limits. If the setpoint can be adjusted within acceptable limits, the test is statused as Pass. In these cases the surveillance test coordinator reviews the test for repeat occurrences. If repeat occurrences are identified, the condition is considered for inclusion in the CAP. This provides acceptable programmatic control since the setpoint can be adjusted to within acceptable limits, the instrument(s) is operating within the requirements of the instrument channel and within the allocations of margin for instrument drift. In addition, an allocation of margin for calibration accuracy is provided between the Allowable Value and Analytical Limit. The allocation of this margin assures operability of the instrument channel as long as the As-Found setpoint does not exceed the Allowable Value. If the setpoint cannot be adjusted within acceptable limits, the test is statused as Fail and the test performer initiates an Issue Report in the CAP.

4.) The LAR, Attachment 1, page 3, states that the CFLUD program is the same program as was used to support a similar LGS 1995 License Amendment. However, a review of a LGS request for additional information response from the specified 1995 amendment dated September 23, 1994 (ADAMS Legacy Library Accession No. 9409290232), and the NRC safety evaluation for the 1995 amendment dated January 20, 1995 (ADAMS Accession No. ML011560074), indicates that PCFLUD was the computer code used. The LAR provides a description of certain changes between CFLUD and PCFLUD, however it does not identify how the computer coding changes, if any, were validated. Please clarify which computer code was used for both the 1995 amendment and the current LAR. If there have been changes to the computer code used to support the current LAR as compared to the 1995 amendment, please describe the steps taken to validate the changes.

Response:

The computations of the temperature of the HPCI room following a steam leak prepared in support of the 1995 license amendment were prepared using the CFLUD computer code as was the calculation supporting the current LAR. The statement in the current LAR, Attachment 1, page 3, refers to the computations of room temperature following steam leaks. However, the post LOCA temperature curve for the HPCI pump room supplied in the response to RAI for the 1995 license amendment, included in the letter from PECO Energy to the NRC dated September 23, 1994, was prepared using PCFLUD. This curve was excerpted from Calculation LM-400, rev. 0 prepared in September 1993. The CFLUD computer code was not completed until December 1993.

Both the PCFLUD and CFLUD computer codes were prepared by Bechtel Corporation, under their QA program. The validation and verification of both computer codes was likewise performed by Bechtel in accordance with their software QA program. Validation and verification cases for both programs were supplied to PECO Energy by Bechtel to verify proper installation and operation of the computer codes. Exelon maintains both computer programs under the existing Exelon Software QA program.

REFERENCES:

1. Letter from P. B. Cowan, Exelon Generation Company, LLC, to U.S. Nuclear Regulatory Commission, "License Amendment Request Table 3.3.3-2, Item 4e, HPCI Equipment Room Delta Temperature High Isolation Trip Setpoint and Allowable Value Change," dated June 30, 2010.

2. Letter from Peter Bamford, U.S. Nuclear Regulatory Commission, to Michael J. Pacilio, President and Chief Nuclear Officer, Exelon Nuclear, "Limerick Generating Station, Units 1 and 2 - Request for Additional Information Regarding Proposed Technical Specification Changes to High Pressure Coolant Injection Equipment Room Delta Temperature Trip Setpoint and Allowable Value (TAC Nos. ME4171 and ME4172)," dated November 24, 2010.

3. Loop Uncertainty Calculation TE-055-1N028B, dated 11/20/09.

ATTACHMENT 2

Limerick Generating Station
Docket Nos. 50-352 and 50-353

License Amendment Request Regarding
TS Table 3.3.2-2, Item 4e, HPCI Equipment Room Delta Temperature High Isolation Trip Setpoint and Allowable Value Change

Loop Uncertainty Calculation TE-055-1N028B, dated 11/20/09

LOOP UNCERTAINTY CALCULATION			
Loop Number: TE-055-1N028B	01		Page 1 of 25
Originator: COLLIER KB	Date: 11/16/09		Rev: 0
Reviewer: AJMERA M.	Date: 11/17/09		
Approver: GEORGE RT	Date: 11/20/09		

TABLE OF CONTENTS

1.0 PURPOSE

This section includes the Objective, Limitations, Conclusions, and the Applicability Statement of this calculation.

1.1 Objective

The purpose of this calculation is to determine the Allowable Value (AV), Nominal Trip Setpoint (NTSP) and Actual Trip Setpoint (ATSP) for a high differential temperature steam source isolation by the Leak Detection System at the Limerick Generating Station (LGS). The increasing differential temperature signal is sensed by channel "B" of the High Pressure Coolant Injection (HPCI) Compartment Leak Detection Instrument, TE-055-1N028B & TE-055-1N029B.

This calculations is performed utilizing environmental conditions for a High Energy Line Break (HELB) accident scenario.

A summary of the calculation results may be found in Section 7.0 of this calculation.

Other redundant/mirror loops for which the results of this calculation are applicable may be found in Section 1.4, Applicability.

1.2 Limitations

The Max and Min Acceptable Limits calculated in Section 7.8 are not authorized for use in the PECo maintenance program by this revision of the calculation.

This calculation is produced utilizing the harsh environmental conditions for a HELB accident scenario. (See Section 2.2.5).

The appropriate use of this calculation to support design or station activities, other than those specified in Section 1.1 of this calculation, is the responsibility of the user.

1.3 Conclusions

The Upper Allowable Value of 108.5 DEGF was calculated by the software. The Upper Allowable Value is the result displayed in Section 7.7 of this calculation.

A Lower Allowable Value of 99.5 DEGF was determined using the calculation results and engineering judgement. The calculation produces an Upper Allowable Value of 108.5 DEGF. The Upper Allowable Value (108.5 DEGF) is subtracted from the Upper Analytical/Process Limit (113 DEGF) to obtain a value of 4.5 DEGF which represents a two (2) sigma one sided Loop Uncertainty which does not contain any instrument drift. This amount (4.5 DEGF) is then added to the Lower Analytical/Process Limit of 95 DEGF to obtain the 99.5 DEGF value (Lower Allowable Value).

An analysis of the proposed changes to the current station process setpoint values in relation to the results of this calculation has been performed and it has been concluded that the results of this calculation support the proposed changes to the current station setpoint values (Ref 4.15).

An Insulation Resistance (IR) Calculation for TE-055-1N028B Configuration 01 determined that the IR error associated with this instrument loop was insignificant (< 0.001% of loop span). It was therefore concluded that no IR effects would be included in this calculation. This IR Calculation resides in the IISCP software and is utilized as further justification for the position taken by PECo previously that IR concerns do not have any adverse effects on system operability at LGS.

The environmental conditions for the locations of the temperature elements for the redundant/mirror loops are the same/equivalent or not as harsh as those specified for the temperature element for this loop. Since the variables in this calculation are the same/equivalent or more restrictive, this calculation is valid for the redundant/mirror loops listed in Section 1.4.

1.4 Applicability

A data evaluation has been performed in order to determine which, if any, redundant/mirror instrument loops are bound by the results of this calculation (the "base" calculation). The data evaluation results validate that this "base" calculation is applicable to the following Loop Affiliation Numbers:

* TE-055-1N028D Configuration 01
  TE-055-1N029D

* TE-055-2N028B Configuration 01
  TE-055-2N029B

* TE-055-2N028D Configuration 01
  TE-055-2N029D

The results of this "base" calculation are bounding values for the instrument loops listed above based on such factors as instrument manufacturer and model number, instrument location environmental parameters, and actual installation and use of the instrument in the measurement of the process variable.

The only difference among the three redundant/mirror loops is the difference in environmental data for each loop due to the physical locations of each thermocouple, which does not introduce any additional uncertainty.

2.0 DESIGN BASIS

This section includes the Technical Background and Design Input information relevant to this calculation.

2.1 Technical Background

High temperature in the space in which the HPCI steam lines are located outside the primary containment could indicate a breach in a HPCI steam line. The automatic closure of the HPCI isolation valve prevents the excessive loss of reactor coolant and the release of significant amounts of radio-active material from the nuclear system process barrier. When high temperatures occur in the HPCI steam line space, the inboard and outboard steam supply isolation valves are isolated.

Pairs of temperature elements monitor for high ventilation air differential temperature and compartment ambient temperature. One sensor of each pair is associated with one of the logic divisions; the other is associated with the other division.

2.2 Design Input

2.2.1 Calculation -1001 specifies 113.0 DEGF as the Upper Analytical/Process Limit (AL) and 95.0 DEGF as the Lower Analytical/Process Limit (AL) (Ref 4.11).

2.2.2 This calculation includes any applicable System Rerate Design/Operating Conditions and Impacts as a result of power rerate analyses per the guidelines contained in Specification NE-177 (Ref 4.6 & 4.8).

2.2.3 Additional margin of 4.5 DEGF was added to this calculation to support the setpoint recommended by Calculation -1001. Of this 4.5 DEGF, 4.5 DEGF is assigned margin to support the IISCP Loop Leave Alone Zone (LAZ)guidelines as discussed in Section 2.2.6 and to account for the calibration practices of the instrument channels.

The calibration practices of the instrument channels are accounted for by providing additional margin for M&TE beyond that in Section 6.2.2. This is done to provide 1% to account for the setting tolerance of the TIS. This also provides additional margin beyond that portion allocated in Section 6.2.1 to cover the 1% required accuracy for the TE. Setting Tolerance is not provided specifically for the TE since it is not calibratable.

2.2.4 Based on engineering judgement, S1 has been included as a process consideration. This consideration results in a conservatively rounded Allowable Value that supports the current Tech Spec revision request.

2.2.5 The selection of HELB environmental conditions for the performance of this calculation is based on engineering judgement and system knowledge. The environmental conditions for a HELB accident scenario are the most severe conditions to which the thermocouple sensors may be exposed and still be expected to perform their safety function.

2.2.6 The delta between the Allowable Value and the Actual Trip Set Point within this calculation is 4.5 DEGF which meets or exceeds the IISCP Program Guidance of greater than one times the LAZ (Ref 4.3)

2.2.7 The Setting Tolerances for the TIS in this calculation were reallocated from the region between AL and AV to the region between NTSP and ATSP in order to obtain the target Tech Spec setpoint. This reallocation was accomplished by assigning 0.0 to the Setting Tolerance of each instrument and verifying that the assigned margin amount was greater than one LAZ. Since the LAZ is equal to the square root of the sum of the squares of the Setting Tolerances, verification that the assigned margin is greater than one LAZ insures that the effects of the Setting Tolerances are included in the determination of the ATSP. No specific setting tolerance was provided for the T/C since it is not calibratable.

2.2.8 All other design inputs to this calculation are documented on the Supporting Data Sheet Attachments.

3.0 ASSUMPTIONS

3.1 Assumptions Not Requiring Confirmation

3.1.1 None

3.2 Assumptions Requiring Confirmation

3.2.1 None

4.0 REFERENCES

4.1 Limerick Generating Station Updated Final Safety Analysis Report (UFSAR), Revision 14 (dated 9/29/08)

Section 5.2.5.2.2 - Detection of Abnormal Leakage Outside the Primary Containment;

Section 7.6.1.3 - Leak Detection System - Instrumentation and Controls;

4.2 Limerick Generating Station Technical Specifications, Unit 1, Amendment 161, (dated 8/30/02)

Table 3.3.2-2 Item 4.e.

4.3 IISCP-PP-93-001, Revision 1 - Program Plan for the Implementation of Phase I of the PECo Improved Instrument Setpoint Control Program (IISCP) (Setpoint Methodology Reference).

4.4 M-171, Revision 0016, Limerick Generating Station Units 1&2

Environmental Service Conditions Specification. (Location Data reference).

4.5 Master Calibration Sheets generated in accordance with PECo procedure IC-11-50014 for TE-055-1N028B dated 08/30/01, TE-055-1N029B dated 8/30/01, & TIS-025-101B dated 09/03/09.

4.6 Philadelphia Electric Letter from G.C. Storey to G.R. Hull General Electric Company, subject "Final OPL-3 for Limerick ARTS/MELLLA Analysis". This document contains Limerick 1 Reload 4(cycle 5) Resolved OPL-3 Forms that include ARTS/MELLLA at rerate conditions Dated 03/09/93. (Power Rerate Information Reference).

4.7 General Electric Design Specification Data Sheets (DSDS) A61-4040-L-004, Revision 0005 (Design Basis Reference).

4.8 NE-177, Revision 0001, Nuclear Safety Related Specification for Limerick Generating Station Units 1&2 Power Rerate Operating Conditions (Power Rerate Information Reference).

4.9 Calculation -1001 Revision 0004 "Compartment Temperature Transients for Steam and Water Leaks" (Analytical/Process Limit Reference)

4.10 Calculation -2208 Revision 0003 "RHR Compartment Pressurization due to Steam Line Break to RHR Hx" (Design Basis Reference).

4.11 Calculation LM-0400 Revision 0004 "HPCI and RCIC Pump Room Temperature Response Following a Small Break LOCA, Normal & Power Rerate Conditions" (Design Basis Reference).

4.12 Calculation LE-0036 Revision 0001 "Equivalency Evaluation between G.E. Numac LDM and Riley Temperature Instrumentation to demonstrate Accuracy and Support the use of existing Setpoints for the Steam Leak Detection System, LGS Units 1 and 2" (Vendor Information Reference)

4.13 Modification P-00212 Revision 0000 "HPCI/RCIC EQ Upgrade" (Design Basis Reference).

4.14 EQRR P-300 Revision "Pyco Temperature Elements" (Vendor Information Reference)

5.0 ATTACHMENTS

5.1 See Supporting Data Sheet Attachments located within this calculation.

6.0 ANALYSIS

6.1 Loop Effects

6.1.1 Loop ID No.: TE-055-1N028B Configuration: 01

6.1.2 Loop Function: STEAM LEAK DETECTION HPCI PIPEWAY

6.1.3 Configuration Description: HI DIFFERENTIAL TEMP TRIP

6.1.4 Loop Instrument List

Device	ID Number	Function	Number
1	TE-055-1N028B	IO	0
2	TE-055-1N029B	IO	0
3	TIS-025-101B	S	0

6.1.5 Device Dependency

Device	Environment	Power	Calibration	Radiation
1	A	A	A	A
2	A	A	A	A
3	B	B	B	B

6.1.6 Device Dependency References

Environmental: N/A
Power: N/A
Calibration: N/A
Radiation: N/A

6.1.7 PMA and PEA Effects

Type	Magnitude	A/N	Sign
PMA	0.00000	N	
PEA	0.00000	N	
IR	0.00000		

References
PMA:
PEA:
IR: SEE SECTION 1.3

6.1.8 Miscellaneous Random and Bias Effects

Type	Magnitude	Dependent Instrument	Dependent Uncertainty	A/N	Sign
S1	0.00992			N	R
S2	0.00000			N	
S3	0.00000			N	
R1	0.00000			N	
R2	0.00000			N	
R3	0.00000			N	

References
S1: SEE SECTION 2.2.4
S2:
S3:
R1:
R2:
R3:

6.1.9 Basis

Point of Interest: 0
Accident: HELB
Pressure Effects: Independent

6.2 Device Effects

6.2.1 Device Accuracy (CA)

CA = va/S or Setting Tolerance (whichever is greater)

Where:
va = vendor's stated accuracy
S = instrument's calibrated span
R = instrument's range

6.2.1.1 TE-055-1N028B

va = 0.75%*S*0.66
S = 300
R = 3.500e+002
Setting tolerance = 0.00000
CA = 0.00495

6.2.1.2 TE-055-1N029B

va = 0.75%*S*0.66
S = 300
R = 3.500e+002
Setting tolerance = 0.00000
CA = 0.00495

6.2.1.3 TIS-025-101B

va = 1.0%*S*0.66
S = 300
R = 3.500e+002
Setting tolerance = 0.00000
CA = 0.00660

6.2.2 Device M&TE Allowance

MTE = CA + margin

Where:
CA = device calibration accuracy
margin = additional margin supplied by calculation originator

6.2.2.1 TE-055-1N028B

CA = 0.00495
Margin = 0.00000
MTE = 0.00495

6.2.2.2 TE-055-1N029B

CA = 0.00495
Margin = 0.00000
MTE = 0.00495

6.2.2.3 TIS-025-101B

CA = 0.00660
Margin = 0.00000

MTE = 0.00660

6.2.3 Device Drift

$$D = vd * (\sqrt{(tc * 1.25 / td)}) / s$$

Where:
vd = vendor's stated drift specification
td = vendor's drift time specification
tc = instrument's calibration period
S = instrument's calibrated span
R = instrument's range

6.2.3.1 TE-055-1N028B

vd = 0.0
td = 1.0
tc = 731
S = 300
R = 3.500e+002
D = 0.00000

6.2.3.2 TE-055-1N029B

vd = 0.0
td = 1.0
tc = 732
S = 300
R = 3.500e+002
D = 0.00000

6.2.3.3 TIS-025-101B

vd = 0.233%*S*0.66
td = 31.
tc = 731
S = 300
R = 3.500e+002
D = 0.00835

6.2.4 Device Static Pressure

$$SPE = \sqrt{(SPz^2 + SPs^2)} \quad \text{(for independent pressure effects)}$$
$$SPE = SPz + SPs \quad \text{(for dependent pressure effects)}$$
$$SPz = SPz * |Po - Pc| / S$$
$$SPs = SPs * |Po - Pc| / S$$

Where:
SPz = vendor's stated zero static pressure effect
SPs = vendor's stated span static pressure effect
Po = normal operating pressure
Pc = calibrated pressure
S = instrument's calibrated span
R = instrument's range

Note: Static pressure effects are relevant to sensors only.

6.2.4.1 TE-055-1N028B

SPS = 0.0

SPZ = 0.0
Po = 0.00
Pc = 0.00000
S = 300
R = 3.500e+002
SPs = 0.00000
SPz = 0.00000
SPE = 0.00000

6.2.4.2 TE-055-1N029B

SPS = 0.0
SPZ = 0.0
Po = 0.00
Pc = 0.00000
S = 300
R = 3.500e+002
SPs = 0.00000
SPz = 0.00000
SPE = 0.00000

6.2.4.3 TIS-025-101B

Sensor is not 'Y' (see attachment 9).

6.2.5 Device Over Pressure

OPE = vope * |Pa - Pm| / S (for linear devices)
OPE = vope / S (for non-linear devices)

Where:
vope = vendor's stated over pressure effect
Pa = maximum operating pressure
Pm = instrument's design pressure
S = instrument's calibrated span
R = instrument's range
X = |Pa - Pm|

Note: Over pressure effects are relevant to sensors only, where the maximum operating pressure is greater than instrument's design pressure.

6.2.5.1 TE-055-1N028B

vope = 0.0
Pa = 0.00
Pm = 0.00
S = 300
R = 3.500e+002
OPE = 0.00000

6.2.5.2 TE-055-1N029B

vope = 0.0
Pa = 0.00
Pm = 0.00
S = 300
R = 3.500e+002
OPE = 0.00000

6.2.5.3 TIS-025-101B

Sensor is not 'Y' (see attachment 9).

6.2.6 Device Drift Temperature

DTE = vte * dT / S (for linear devices)
DTE = vte / S (for non-linear devices)

Where:
vte = vendor specified temperature effect
dT = (Normal Temp - 68° F)
S = instrument's calibrated span
R = instrument's range

6.2.6.1 TE-055-1N028B

vte = 0.0
S = 300
R = 3.500e+002
Normal temp = 115.00
DTE = 0.00000

6.2.6.2 TE-055-1N029B

vte = 0.0
S = 300
R = 3.500e+002
Normal temp = 117.00
DTE = 0.00000

6.2.6.3 TIS-025-101B

vte = 0.0
S = 300
R = 3.500e+002
Normal temp = 82.00
DTE = 0.00000

6.2.7 Device Accuracy Temperature

ATE = vte * dT / S (for linear devices)
ATE = vte / S (for non-linear devices)

Where:
vte = vendor specified temperature effect
dT = |accident temperature - normal temperature|
S = instrument's calibrated span
R = instrument's range

6.2.7.1 TE-055-1N028B

vte = 0.0
S = 300
R = 3.500e+002
Normal temp = 115.00
Accident temp = 306.83
ATE = 0.00000

6.2.7.2 TE-055-1N029B

vte = 0.0
S = 300

R = 3.500e+002
Normal temp = 117.00
Accident temp = 307.89
ATE = 0.00000

6.2.7.3 TIS-025-101B

vte = 0.0
S = 300
R = 3.500e+002
Normal temp = 82.00
Accident temp = 82.00
ATE = 0.00000

6.2.8 Device Humidity

HE = dH * vhe / S (for linear devices)
HE = vhe / S (for non-linear devices)

Where:
vhe = vendor's stated humidity specification
S = instrument's calibrated span
R = instrument's range
dH = |accident humidity - normal humidity|

6.2.8.1 TE-055-1N028B

vhe = 0.0
S = 300
R = 3.500e+002
Accident hum = 100.00
Normal hum = 90.00
HE = 0.00000

6.2.8.2 TE-055-1N029B

vhe = 0.0
S = 300
R = 3.500e+002
Accident hum = 100.00
Normal hum = 90.00
HE = 0.00000

6.2.8.3 TIS-025-101B

vhe = 0.0
S = 300
R = 3.500e+002
Accident hum = 90.00
Normal hum = 90.00
HE = 0.00000

6.2.9 Device Accuracy Radiation

ARE = vre * DeltaRad / S (for linear devices)
ARE = vre / S (for non-linear devices)

Where:
vre = vendor specified radiation effect
DeltaRad = (accident radiation - normal radiation)
S = instrument's calibrated span

R = instrument's range

6.2.9.1 TE-055-1N028B

vre = 0.0
S = 300
R = 3.500e+002
Accident rad = 4.93000
Normal rad = 0.90500
ARE = 0.00000

6.2.9.2 TE-055-1N029B

vre = 0.0
S = 300
R = 3.500e+002
Accident rad = 1.76000
Normal rad = 0.90500
ARE = 0.00000

6.2.9.3 TIS-025-101B

Environmental qualifier is not 'Y' (see attachment 5).

6.2.10 Device Seismic

VSE = SRS * vse / S (for linear devices)
VSE = vse / S (for non-linear devices)

Where:
vse = vendor's stated seismic specification
S = instrument's calibrated span
R = instrument's range
SRS = seismic response envelope

6.2.10.1 TE-055-1N028B

Seismic class is not '1' in Pims (see attachment 5).

6.2.10.2 TE-055-1N029B

Seismic class is not '1' in Pims (see attachment 5).

6.2.10.3 TIS-025-101B

Seismic class is not '1' in Pims (see attachment 5).

6.2.11 Device Power

PSE = pss * pse / S

Where:
pse = vendor's stated power supply specification
pss = device power supply stability
S = instrument's calibrated span
R = instrument's range

6.2.11.1 TE-055-1N028B

pse = 0.0
S = 300

R = 3.500e+002
pss = 0.000
PSE = 0.00000

6.2.11.2 TE-055-1N029B

pse = 0.0
S = 300
R = 3.500e+002
pss = 0.000
PSE = 0.00000

6.2.11.3 TIS-025-101B

pse = 0.0
S = 300
R = 3.500e+002
pss = 12.000
PSE = 0.00000

7.0 RESULTS

7.1 Loop Accuracy Allowance (AL)

AL_norm = A + OP + SP + PE
AL_accid = AL_norm + S (for S > TE + RE + AHE)
AL_accid = AL_norm + TE + RE + AHE (for S ≥ TE + RE + AHE)

Where:
A = $\Sigma\ CA^2$
TE = $\Sigma\ ATE^2$
OP = $\Sigma\ OPE^2$
SP = $\Sigma\ SPE^2$
RE = $\Sigma\ ARE^2$
AHE = $\Sigma\ HE^2$
S = $\Sigma\ VSE^2$
PE = $\Sigma\ PSE^2$
AL = 0.00009

7.2 Loop Drift Allowance (DL)

DL = DE + DT

Where:
DE = $\Sigma\ D^2$
DT = $\Sigma\ DTE^2$
DL = 0.00007

7.3 Loop Calibration Allowance (CL)

CL = V + M

Where:
V = Σ (setting tolerance)^2
M = $\Sigma\ MTE^2$
CL = 0.00014

7.4 TLU

(Positive)TLUp = [IR + PMAp + PEAp + PCp + PMAo + PEAo + Pco + $\sqrt{\text{(AL + CL + DL + PMAr + PEAr + PCr)}}$] * Loop span

(Negative)TLUn = [- PMAn - PEAn - PCn - PMAo - PEAo - PCo + - $\sqrt{\text{(AL + CL + DL + PMAr + PEAr + PCr)}}$] * Loop span

All other variables as previous defined.

TLUp = 6.01696 DEGF
TLUn = -6.01696 DEGF

7.5 NTSP

(Increasing) NTSP = limit + [- PMAn - PEAn - PCn - PMAo - PEAo - PCo + (1.645 / sigma) * - $\sqrt{\text{(AL + CL + DL + PMAr + PEAr + PCr)}}$] * Loop span

(Decreasing) NTSP = limit + [IR + PMAp + PEAp + PCp + PMAo + PEAo + PCo + (1.645 / sigma) * $\sqrt{\text{(AL + CL + DL + PMAr + PEAr + PCr)}}$] * Loop span

Where:
limit = loop analytical or process limit
limit = 113.00 DEGF

sigma = 2
NTSP = 108.05105 DEGF

7.6 ATSP

(Increasing) ATSP = NTSP + margin
(Decreasing) ATSP = NTSP - margin

Where:
margin = additional margin supplied by calculation originator
margin = -4.05000
ATSP = 104.00105 DEGF

7.7 Allowable Value

(Decreasing) AV = limit + [IR + PMAp + PEAp + PCp + PMAo + PEAo + Pco + (1.645 / sigma) * $\sqrt{\text{(AL + CL + PMAr + PEAr + PCr)}}$] * Loop span

(Increasing) AV = limit + [- PMAn - PEAn - PCn - PMAo - PEAo - Pco + (1.645 / sigma) * - $\sqrt{\text{(AL + CL + PMAr + PEAr + PCr)}}$] * Loop span

All other variables as previously defined.

AV = 108.50034 DEGF

ATTACHMENT 1: Session Data

Station: LG Unit: 1

Responsible Branch: LEDE

Safety Related (Y/N): Y

Description: HPCI EQUIPMENT ROOM DELTA TEMPERATURE - HIGH

System Number: 055

Structure: RX ENCL

Component: TE-55-1N28/29B TIS-2

Revision Description: LOWER AV & ATSP TO 108.5 & 104.0 PER ECR 09-00438

Vendor Calc Number: N/A Revision: NA

Other Calculations: N

Provides info TO: N/A

Receives info FROM: LE-0036 -1001
LM-0400 -2208

Supercedes: N/A

1. Accident type:	HELB
2. Pressure effects dependent or independent (I/D):	Independent
3. Process increasing, decreasing or neither (I/D/N):	Increasing
4. Input point of interest:	0
5. Include additional margin for actual setpoint calculation:	Yes
6. Additional margin to be used:	-4.05000

LOOP UNCERTAINTY CALCULATION		
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Approver: GEORGE RT	Date: 11/20/09	

Attachment 2: Calculation Results

Device	F	N	Accuracy	Temperature Normal	Temperature Accident	Humidity	Tol	Pwr Supp
TE-055-1N028B	IO	0	0.00495	0.00000	0.00000	0.00000	0.00000	0.00000
TE-055-1N029B	IO	0	0.00495	0.00000	0.00000	0.00000	0.00000	0.00000
TIS-025-101B	S	0	0.00660	0.00000	0.00000	0.00000	0.00000	0.00000

Device	F	N	SPE	Rad Acc	M&TE	Drift	Ovr Pres	Seismic
TE-055-1N028B	IO	0	0.00000	0.00000	0.00495	0.00000	0.00000	N/A
TE-055-1N029B	IO	0	0.00000	0.00000	0.00495	0.00000	0.00000	N/A
TIS-025-101B	S	0	N/A	N/A	0.00660	0.00835	N/A	N/A

Process Concerns

	Normal Positive	Normal Negative	Normal Offsetting	Accident Positive	Accident Negative	Accident Offsetting
PMA	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
PEA	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
IR				0.00000		
Other	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

Loop Results

	Normal		Accident	
TLU*	6.01696	-6.01696	6.01696	-6.01696
AL	0.00009		0.00009	

	Normal Increasing	Normal Decreasing	Accident Increasing	Accident Decreasing
NTSP*	108.05105	N/A	108.05105	N/A
AV*	108.50034	N/A	108.50034	N/A
ATSP*	104.00105	N/A	104.00105	N/A

Additional Margin: -4.05000 DL: 0.00007 CL: 0.00014

* These values are in DEGF

ATTACHMENT 3: Loop Data

Loop Number: TE-055-1N028B

Instruments	Function	Num	1	2	3	4	5	6	7	8	9	10
TE-055-1N028B	IO	0	X	X								
TE-055-1N029B	IO	0	X	X								
TIS-025-101B	S	0	X									
TIS-025-101B	2	0		X								
		0										
		0										
		0										
		0										
		0										
		0										

Configuration Descriptions	
1: HI DIFFERENTIAL TEMP TRIP	6:
2: DIFFERENTIAL TEMP IND	7:
3:	8:
4:	9:
5:	10:

Loop Description: STEAM LEAK DETECTION HPCI PIPEWAY

Originator: COLLIER KB Date: 11/12/09 Revision: 00

ATTACHMENT 4: Loop Calibration Data

Loop Number: TE-055-1N028B Configuration: 01

	Units	Min	Max	Normal	Trip
Process Temperature		0.00	0.00	0.00	0.00
Process Radiation		0.000e+000	0.000e+000	0.000e+000	0.000e+000
Process Humidity		0.00	0.00	0.00	0.00
Process Pressure		0.00	0.00	0.00	0.00
Loop Span	DEGF	-150.00	150.00	Sigma: 2	

	Value	Units		Value
Setpoint	104.00	DEGF	Loop Setting Limit	0.000
Reset	3.00	DEGF	Loop Leave Alone Zone	3.000
Allowable	108.5	DEGF	Loop Calculation Acc	0.000
Design/safety Limit	0.00		Calibration Frequency	731
Analytical/Proc Limit	113.00	DEGF		

Originator: COLLIER KB Date: 11/13/09 Revision: 00

ATTACHMENT 5: Instrument Data

Component Id: TE-055-1N028B			Facility: LG	Unit: 1	System: 055
Description: HPCI COMPARTMENT LEAK DETECTION LEAK DET -- SHOWN ONP&ID 25					Function: IO 0
Type: I E	Manufacturer Code: P427		Model #: 102-9039		
Location: 015177109	Elevation: 177		Area: 015	Serial #: 01116	
QA Class: Q	Op Time: 1	Service Life: 40		EQ: Y	Seismic Class:
Tech Spec: Y	Tech Spec Ref: T3.3.2-2.4.E		Transient: NA		Reg Guide 1.97: N
Power Supply Reg: 0.000			Tolerance: 0.000		
Loop Number: TE-055-1N028B			Loop Diagram: N/A		
Computer Address: N/A			P&ID: M-0025		
Installation Detail: N/A					
Calibration ST: ST-2-025-405-1			Calibration Proc: ST-2-025-405-1		
Functional ST: ST-2-055-611-1			Procedure #: IC-11-00001		
Response ST: N/A			Other:		
Mod Number:			Other:		
Signal From: PROCESS			Signal To: TIS-025-101B CH A4-1		Mod Rev:
Alarms & Actions: N/A					
Instruction Book:					

Input Min: 50.00		Input Max: 350.00		Input Unit: DEGF	
Output Min: 0.391		Output Max: 8.064		Output Unit: MVDC	
HC: 0.000	Setting Tolerance: 0.00000		Leave Alone Zone: 0.01000		
HC Corrected:		SP Corrected:		Add. Margin: 0.00000	
MTE device					Period: 731
MTE Accuracy					
HC Reference: N/A			SP Reference: N/A		

Originator: COLLIER KB Date: 11/12/09 Revision: 1

ATTACHMENT 5: Instrument Data

Component Id: TE-055-1N029B		Facility: LG	Unit: 1	System: 055
Description: HPCI COMPARTMENT LEAK DETECTION LEAK DET -- SHOWN ONP&ID 25				Function: IO 0
Type: I E	Manufacturer Code: P427	Model #: 102-9039		
Location: 015201288	Elevation: 201	Area: 015	Serial #: 00573	
QA Class: Q	Op Time: 1	Service Life: 40	EQ: Y	Seismic Class:
Tech Spec: Y	Tech Spec Ref: T3.3.2-2.4.E	Transient: NA	Reg Guide 1.97: N	
Power Supply Reg: 0.000		Tolerance: 0.000		
Loop Number: TE-055-1N028B		Loop Diagram: N/A		
Computer Address: N/A		P&ID: M-0025		
Installation Detail: N/A				
Calibration ST: ST-2-025-405-1		Calibration Proc: ST-2-025-405-1		
Functional ST: ST-2-055-611-1		Procedure #: IC-11-00001		
Response ST: N/A		Other:		
Mod Number:		Other:		
Signal From: PROCESS	Signal To: TIS-025-101B CH A4-1	Mod Rev:		
Alarms & Actions: N/A				
Instruction Book:				
Input Min: 50.00	Input Max: 350.00	Input Unit: DEGF		
Output Min: 0.391	Output Max: 8.064	Output Unit: MVDC		
HC: 0.000	Setting Tolerance: 0.00000	Leave Alone Zone: 0.01000		
HC Corrected:	SP Corrected:	Add. Margin: 0.00000		
MTE device				Period: 732
MTE Accuracy				
HC Reference: N/A		SP Reference: N/A		

Originator: COLLIER KB   Date: 11/12/09   Revision: 1

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Reviewer: AJMERA M.	Date: 11/17/09		
Approver: GEORGE RT	Date: 11/20/09		

ATTACHMENT 5: Instrument Data

Component Id: TIS-025-101B	Facility: LG	Unit: 1	System: 025
Description: STEAM LEAK DETECTION TEMP MONITOR DIV. 2/B1			Function: S 0
Type: I S	Manufacturer Code: G080	Model #: 304A3714G004	
Location: 008289542	Elevation: 289	Area: 008	Serial #:
QA Class: Q	Op Time: N/A	Service Life: 000	EQ: N / Seismic Class:
Tech Spec: Y	Tech Spec Ref: T3.3.2-2.4	Transient: NA	Reg Guide 1.97: N
Power Supply Req: 120.000		Tolerance: 12.000	
Loop Number: SEE REMARKS		Loop Diagram: N/A	
Computer Address: N/A		P&ID: M-0025	
Installation Detail: N/A			
Calibration ST: ST-2-025-405-1		Calibration Proc: ST-2-025-405-1	
Functional ST: SEE REMARKS		Procedure #: IC-11-00001	
Response ST: N/A		Other:	
Mod Number:		Other:	
Signal From: SEE REMARKS	Signal To: SEE REMARKS		Mod Rev:
Alarms & Actions: SEE REMARKS			
Instruction Book: N-00E-68-00024 (GEK-97146)			
Input Min: 50.00	Input Max: 350.00	Input Unit: DEGF	
Output Min: 0	Output Max: 1	Output Unit:	
HC: 0.000	Setting Tolerance: 0.00000	Leave Alone Zone: 0.01000	
HC Corrected:	SP Corrected:	Add. Margin: 0.00000	
MTE device			Period: 731
MTE Accuracy			
HC Reference: N/A		SP Reference: N/A	

Originator: COLLIER KB Date: 11/12/09 Revision: 4

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Approver: GEORGE RT	Date: 11/20/09	

ATTACHMENT 6: Vendor Data

Manufacturer Code: P427 Model #: 102-9039 Function: IO 0

Reference: REFLECTS 2 SIGMA VALUE (CALC# LE-0065)							
Min	5.000e+001	Max	3.500e+002	Units	DEGF	Pressure	0.00

Accuracy Information			
Accuracy	0.75%*S*0.66		
Seismic	0.0		
Temperature	0.0		
Radiation	0.0		
Over Pressure	0.0		
Humidity	0.0		
Drift	0.0		
Time	1.0		
Power Supply	0.0		
Pressure Zero	0.0	Pressure Span	0.0

Originator: KINCAID SC Date: 07/06/01 Revision: 00

ATTACHMENT 6: Vendor Data

Manufacturer Code: P427 Model #: 102-9039 Function: IO 0

Reference: REFLECTS 2 SIGMA VALUE (CALC# LE-0065)							
Min	5.000e+001	Max	3.500e+002	Units	DEGF	Pressure	0.00

Accuracy Information			
Accuracy	0.75%*S*0.66		
Seismic	0.0		
Temperature	0.0		
Radiation	0.0		
Over Pressure	0.0		
Humidity	0.0		
Drift	0.0		
Time	1.0		
Power Supply	0.0		
Pressure Zero	0.0	Pressure Span	0.0

Originator: KINCAID SC Date: 07/06/01 Revision: 00

LOOP UNCERTAINTY CALCULATION			
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Reviewer: AJMERA M.	Date: 11/17/09		
Approver: GEORGE RT	Date: 11/20/09		

ATTACHMENT 6: Vendor Data

Manufacturer Code: G080 Model #: 304A3714G004 Function: S 0

Reference: GEK-97146, NE-68-24; REFLECTS 2 SIGMA VALUES (CALC# LE-0036)							
Min	5.000e+001	Max	3.500e+002	Units	DEGF	Pressure	0.00

Accuracy Information			
Accuracy	1.0%*S*0.66		
Seismic	0.0		
Temperature	0.0		
Radiation	0.0		
Over Pressure	0.0		
Humidity	0.0		
Drift	0.233%*S*0.66		
Time	31.		
Power Supply	0.0		
Pressure Zero	0.0	Pressure Span	0.0

Originator: THOMAS RT Date: 04/18/94 Revision: 00

ATTACHMENT 7: Location Data

Location Code: 015177109
Description: UNIT 1 HPCI PUMP COMPT - REVISED BASED ON 94-08691

	Minimum	Normal	Trip LOCA	Trip HELB	Trip MSLB	Maximum
Temp	65.00	115.00	176.00	306.83	306.83	115.00
Radiation	2.580e+00	9.050e+05	4.930e+06	4.930e+06	4.930e+06	9.050e+05
Humidity	50.00	90.00	90.00	100.00	100.00	90.00
Pressure	14.69	14.69	14.70	17.64	17.64	14.69

Seismic Response Envelope: 0.00

Originator: GEORGE R T Date: 10/29/96 Revision: 02

ATTACHMENT 7: Location Data

Location Code: 015201288
Description: UNIT 1 HPCI PIPING AREA

	Minimum	Normal	Trip LOCA	Trip HELB	Trip MSLB	Maximum
Temp	65.00	117.00	120.00	307.89	307.89	117.00
Radiation	2.580e+00	9.050e+05	1.760e+06	1.760e+06	1.760e+06	9.050e+05
Humidity	50.00	90.00	90.00	100.00	100.00	90.00
Pressure	14.69	14.69	14.70	21.34	21.34	14.69

Seismic Response Envelope: 0.00

Originator: THOMAS RT Date: 05/02/94 Revision: 00

ATTACHMENT 7: Location Data

Location Code: 008289542
Description: ROOM 542, AUXILIARY EQUIPMENT ROOM

	Minimum	Normal	Trip LOCA	Trip HELB	Trip MSLB	Maximum
Temp	60.00	82.00	82.00	82.00	82.00	82.00
Radiation	5.000e-04	1.760e+02	1.890e+02	1.760e+02	1.760e+02	1.760e+02
Humidity	30.00	90.00	90.00	90.00	90.00	90.00
Pressure	14.70	14.70	14.70	14.70	14.70	14.70

Seismic Response Envelope: 0.00

Originator: CAROLAN JF Date: 03/31/93 Revision: 00

ATTACHMENT 8: Process Concerns

	Consideration	Contribution to Uncertainty	Sign	A/N	Dependent Device	Dependent Uncertainty	Consideration References
1	PMA	0.00000		N			
2	PEA	0.00000		N			
3	IR	0.00000					SEE SECTION 1.3
4	S1	0.00992	R	N			SEE SECTION 2.2.4
5	S2	0.00000		N			
6	S3	0.00000		N			
7	R1	0.00000		N			
8	R2	0.00000		N			
9	R3	0.00000		N			

ATTACHMENT 9: Device Dependencies

Devices	Function		Dependency Env	Pwr	Cal	Rad	Static Pressure	Calibration Humid	Sensor
TE-055-1N028B	IO	0	A	A	A	A	0.00000	90.00	Y
TE-055-1N029B	IO	0	A	A	A	A	0.00000	90.00	Y
TIS-025-101B	S	0	B	B	B	B	0.00000	90.00	N

Dependency References

Env: N/A Cal: N/A Pwr: N/A

Rad: N/A Cal Condition: N/A

Just: Maximum Normal Humidity for Location Code