Ameren
MISSOURI

Callaway Plant

January 16, 2014

ULNRC-06070

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

10 CFR 50.90

Ladies and Gentlemen:

DOCKET NUMBER 50-483
CALLAWAY PLANT
UNION ELECTRIC CO.
APPLICATION FOR AMENDMENT TO
FACILITY OPERATING LICENSE NPF-30
(TAC NO. MF0378, LDCN 12-0015)
REVISION TO TECHNICAL SPECIFICATION 3.7.9

References:
1. ULNRC-05867 dated December 13, 2012, Revision to Technical Specification 3.7.9 (LDCN 12-0015)
2. ULNRC-05995 dated June 11, 2013, Revision to Technical Specification 3.7.9 (LDCN 12-0015), Response to Request for Additional Information
3. NRC Request for Additional Information, Carl F. Lyon (NRC) to Thomas B. Elwood (Union Electric Company) dated December 20, 2013

In Reference 1 above, Ameren Missouri (Union Electric Company) submitted an application for amendment to Facility Operating License Number NPF-30 for the Callaway Plant. The amendment application addresses a non-conservative Technical Specification as discussed in NRC Administrative Letter 98-10, "Dispositioning of Technical Specifications That Are Insufficient To Assure Plant Safety."

The amendment application proposes changes to Technical Specification (TS) 3.7.9, "Ultimate Heat Sink (UHS)," to incorporate more restrictive UHS level and pond temperature limits which are specified in Surveillance Requirements (SRs) 3.7.9.1 and 3.7.9.2, respectively. In addition, new SR 3.7.9.4 would be added to verify that the UHS cooling tower fans respond appropriately to automatic start signals.

In Reference 2 above, Ameren Missouri responded to an NRC request for additional information.

In Reference 3 above, the NRC requested additional information to complete their review. The attachments to this letter provide the requested information. No commitments are contained in this letter.

If you have any questions on this amendment application, please contact me at (573) 676-8719 or Mr. Tom Elwood at (314) 225-1905.

I declare under penalty of perjury that the foregoing is true and correct.

Very truly yours,

Executed on: 1/16/2014

Scott M

Scott Maglio
Manager, Regulatory Affairs

GGY/

Attachments:

1 – RAI Response
2 – Setpoint Calculation J-UEF03 Revision 1

cc:

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ATTACHMENT 1

RAI RESPONSE

Question:

The NRC Staff has a question on the safety status of the setpoints for cooling tower fan speed control and cooling tower bypass valve automatic closure. The licensee has credited manual operator actions for these functions. If it is determined that these items are safety-related, the Staff requests the calculations for each setpoint; a statement of whether each is, or is not, a limiting safety system setting (LSSS), and a TSTF-493 statement.

Response:

This question has multiple parts which will be addressed in order.

There are three credited operator actions in the LDCN 12-0015 license amendment request (LAR) which have defined completion times as discussed on pages 14-15 of the LAR Enclosure:

1. **Verification of proper UHS Cooling Tower operation and securing affected ESW train within 70 minutes of the accident.**

2. **UHS Cooling Tower Inlet temperature switchover within 4 hours to ESW Pump Discharge temperature.**

3. **Securing one train of ESW within 7 days.**

Actions 2 and 3 are time-driven and do not rely on indication inputs for progression through the applicable Emergency Operating Procedures (EOPs). (See LAR Enclosure pages 14-16 and item 8 (pages 6-7) of LAR Attachment 6.)

Action 1 requires the isolation of an ESW train within 70 minutes if a failed system component is discovered, as discussed in detail on LAR Enclosure pages 15 and 16. The credited operator action requires the use of the following indications in EOP E-1 step 11:

- Step 11.a - Annunciators 30E [NG07 bus undervoltage / overvoltage annunciator] and 31E [NG08 bus undervoltage / overvoltage annunciator]: Check NG07 [480 VAC load center, train 'A' separation group 1] and NG08 [480 VAC load center, train 'B' separation group 4] bus trouble annunciators (non-safety related);

- Step 11.b - Computer points EFT0067A [UHS cooling tower inlet temperature from ESW train 'A'] or EFT0068A [UHS cooling tower inlet temperature from ESW train 'B'] : Determine ESW return temperature (UHS cooling tower inlet temperature) (non-safety related);

- Step 11.b Response Not Obtained (RNO) If computer points are unavailable, determine UHS cooling tower inlet temperature using High/Low ESW return temperature indications EFTSHL0067B, EFTSHL0068B (non-safety related);

- Step 11.c - EFHIS0065A and 66A [UHS cooling tower bypass valve hand indicating switches for ESW trains 'A' and 'B' respectively] on control room panel RL019 or locally at EFHV0065 and 66: Check UHS cooling tower bypass valve position indication is appropriate for the temperatures determined in step 11.b (These valve "HIS" hand-indicating switches are safety-related, but are similar to the devices excluded from the scope of TSTF-493-A Revision 4, i.e., devices that derive input from contacts which have no associated sensor or adjustable device.)

- Step 11.d - EFHIS0061A & 62A [UHS cooling tower fans hand indicating switches for ESW trains 'A' and 'B' respectively] on control room panel RL019 or locally at EFHIS0063A/B/C/D, EFHIS0064A/B/C/D [local UHS cooling tower fans hand indicating switches for ESW trains 'A' and 'B' respectively]: Check UHS cooling tower fan speed indication is appropriate for the temperatures determined in step 11.b (These fan "HIS" hand-indicating switches are safety-related, but are excluded from the scope of TSTF-493-A Revision 4.)

If the indications in the RNO column are unavailable, E-1 directs a transfer to EOP Addendum 17 to secure the ESW train in which a failure is suspected. Verification of successful ESW train isolation can be achieved using the ESW pump running indications found on safety-related hand indication switches EFHIS0055A and EFHIS0056A on control room panel RL019.

The ESW pump hand-indicating switches are safety-related, but are excluded from the scope of TSTF-493-A Revision 4. LAR Attachment 6 (pages 8-11) provides detailed discussions of EOP device pedigree. As such, there are no TSTF-493-A implications associated with cues for the above operator actions.

As discussed in detail on LAR Enclosure pages 15-17, step 19 of EOP E-1 directs the performance of EOP Addendum 40 to transfer the automatic control of the UHS cooling tower bypass valves and fans to the ESW pump discharge temperature channels (EFT-0061 and EFT-0062). Although not a credited operator action with a defined completion time (LAR Enclosure page 15), Step 5 of EOP Addendum 40 is a continuous action step to check UHS cooling tower fan speeds (safety-related EFHIS0061A & 62A discussed above under E-1 Step 11.d) vs. the ESW pump discharge (ESW supply) temperature (safety-related temperature indicators EFTI0061, EFTI0062) so that any equipment failures involving the temperature control handswitches (EFHS0067, EFHS0068) or ESW supply temperature loops (EFT-0061, EFT-0062) would be recognized and addressed (e.g., by securing the affected ESW train, if necessary) to support maintaining the necessary UHS pond inventory.

There is one setpoint calculation associated with the safety-related, temperature-based circuitry used to automatically position the EFHV0065/0066 UHS cooling tower return bypass valves and to automatically establish the speed of UHS cooling tower fans. That setpoint calculation is included as Attachment 2 and demonstrates that a 2.5°F Channel Uncertainty must be accounted for when establishing the Nominal Trip Setpoints that protect the Safety Analysis Limits defined in Calculation EF-123 (LAR Enclosure pages 8-12). E-1 step 11 (discussed above) verifies the proper operation of the bypass valves and cooling tower fans from the EFT-0067A and EFT-0068A channels. E-1 step 19 (manual enabling of automatic control from ESW pump

discharge temperature loops at 4 hours) directs the performance of EOP Addendum 40 which verifies proper operation of the bypass valves and cooling tower fans from the EFT-0061 and EFT-0062 channels. However, none of the setpoints in the EFT-0067A, EFT-0068A, EFT-0061, or EFT-0062 temperature channels satisfy the definition of a Safety Limit – Limiting Safety System Setting (SL-LSSS) as agreed to between the NRC Staff and the industry during the review and approval of TSTF-493-A Revision 4.

During the NRC review of TSTF-493 the Staff posted a comment on March 22, 2006 that stated:

> "TSTF-493, Revision 0 did not generically define the scope of the instrumentation affected. To cover those systems that should be covered to meet 10 CFR 50.36 the TSTF scope for identifying LSSS should apply to TSs instrumentation related to variables which protect the integrity of the reactor fuel and the integrity of the reactor coolant pressure boundary (RCPB) physical barriers. This translates to TSs instrumentation, excluding manual trip functions, that trip the reactor (i.e., reactor trip system instrumentation, reactor protection system instrumentation); TSs instrumentation that ensure the core is adequately cooled in the event of a design basis accident or transient (i.e., engineered safety feature actuation instrumentation, emergency core cooling system instrumentation); TSs instrumentation that provides additional margin to core safety limits, such as the end-of-cycle recirculation pump trip instrumentation [for BWR plants]; and TSs instrumentation that provides RCPB overpressure protection (pressurizer safety valves, safety/relief valves)."

In response to this comment the Owners Groups had the NSSS vendors identify a list of generic LSSSs that protected the reactor core and reactor coolant pressure boundary pressure Safety Limits during anticipated operational occurrences, which are the only events that are considered for determining the Safety Limit (SL) LSSSs. TSTF-493 was subsequently revised to include the identified list of LSSS functions for each NUREG. Additional supporting or exempting statements were also included to further define the components that must be considered in the LSSS scope. For Westinghouse plants, the SL-LSSS functions that are within the scope of additional, setpoint-related surveillance and operability footnotes are limited to the functions specified in TS 3.3.1, "RTS Instrumentation," and TS 3.3.2, "ESFAS Instrumentation," as discussed in TSTF-493-A, Revision 4, Attachment A, "**Identification of Functions to be Annotated with the TSTF-493 Footnotes - NUREG-1431, Westinghouse Plants.**" TSTF-493 does not apply to the LDCN 12-0015 LAR since no SL-LSSSs are involved.

ATTACHMENT 2

SETPOINT CALCULATION J-UEF03 REVISION 1

Calculation J-UEF03

Rev. 001

Instrument Loop Uncertainty Estimate: UHS Cooling Tower Fan Speed and Bypass Valve Control

Temperature loops EFT-0061/62 (ESW Supply Line) and EFT-0067A/68A (ESW Return Line) setpoint uncertainty calculation for the Ultimate Heat Sink (UHS) Cooling Tower fan speed control and ESW to UHS Cooling Tower bypass valve control.

Responsible Engineer: Scott Taylor Date: (See Elect. Sign.)

Qualified Reviewer: Ed Goss Date: (See Elect. Sign.)

Approver: Jesse Hutchison Date: (See Elect. Sign.)

Approx. Date: 08/2011

Director W.O.: CALC00001666

1.0 Purpose & Scope

This calculation determines the UHS Cooling Tower fan speed control and ESW to UHS Cooling Tower bypass valve control setpoints considering instrument uncertainties.

Post Implementation of Calculation EF-123
Temperature loops EFT-0061/62 (ESW supply line) and EFT-0067A/68A (ESW return line) actuate the UHS Cooling Tower fans (CEF01A/B/C/D); first in slow speed then into high speed as the temperature rises. The fans are normally controlled via the return line and switched to the supply line post Design Basis Accident (DBA) initiation. Fan control is used to protect two design basis parameters. In the initial hours of a DBA these loops protect the maximum UHS temperature limit (FSAR SP Chapter 9.2, Calc. EF-123). The fans are then used to ensure an adequate UHS inventory is maintained throughout the UHS's 30 day action statement (FSAR SA Chapter 9.2, Calc. EF-123).

These temperature loops also actuate the ESW to UHS Cooling Tower bypass valves (EFHV0065/66). Bypass valve control is set up to ensure freeze protection (FSAR SA Chapter 9.2, RFR 200802059). This valve also aids the above mentioned fan operation in that cooling is only achieved when the valve is closed, allowing return water over the UHS Cooling Tower fill.

Configuration A below details temperature instrumentation loops EFT-0061/62 (ESW supply line) and EFT-0067A/68A (ESW return line) for UHS Cooling Tower fan and bypass valve control. Each output isolation card feeds a selector switch (no signal impact/uncertainty) to allow selection between the supply and return lines. (EFT-0067A to EFT-0061 & EFT-0068A to EFT-0062)

Post Implementation of MP 11-0004, Pre Implementation of Calculation EF-123
MP 11-0004 is incorporating physical SSC changes to allow the plant operational changes shown above per the requirements of EF-123 once they have been approved by the NRC. Until NRC approval of the EF-123 changes, MP 11-0004 will approve the physical SSC changes against the existing UHS design basis documentation, specifically calculation EF-54. Per EF-54 and FSAR SA 9.2.5.2.3 & FSAR SA 9.2.5.5 the current design basis function of these setpoints is freeze protection only. As the EF-123 changes also review the instrumentation setpoints with respect to freeze protection, the analysis of setpoints for the "Post Implementation of Calculation EF-123" used in the remaining sections of this calculation is bounding over the interim state of operation post MP 11-0004 implementation. No further review for this is necessary or will be performed.

Configuration A: UHS fan speed and bypass valve control loop

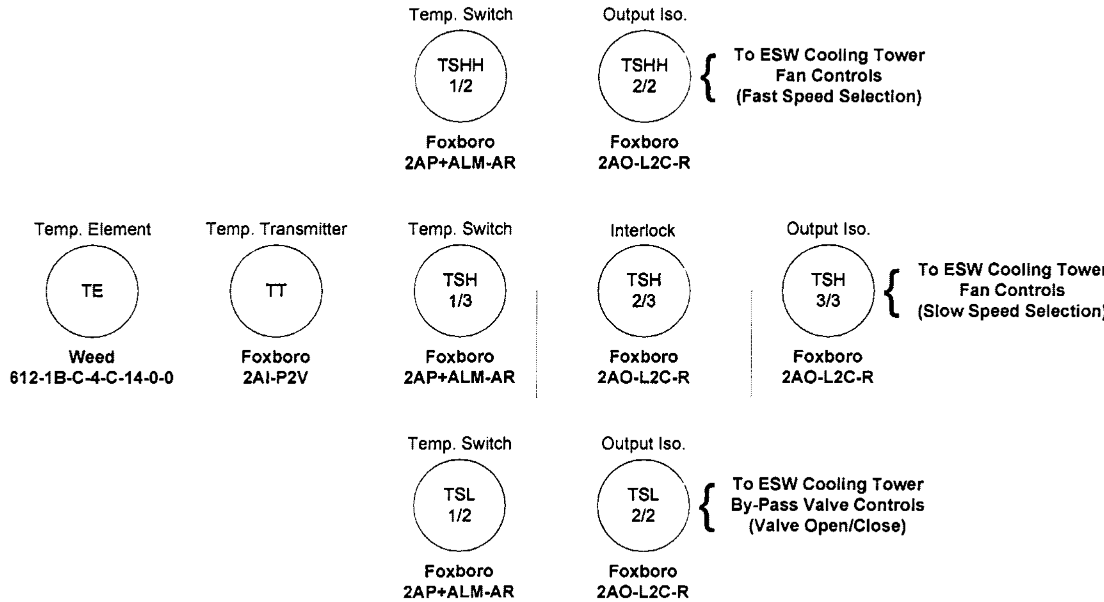


Table 1: Configuration A Director Location IDs

Train			**TSHH 1/2***	**TSHH 2/2***	
Supply					
A			EFTSHH006112	EFTSHH006122	
B			EFTSHH006212	EFTSHH006222	
Return					
A			EFTSHH0067A12	EFTSHH0067A22	
B			EFTSHH0068A12	EFTSHH0068A22	
	TE	**TT**	**TSH 1/3***	**TSH 2/3***	**TSH 3/3***
Supply					
A	EFTE0061	EFTT0061	EFTSH006113	EFTSH006123	EFTSH006133
B	EFTE0062	EFTT0062	EFTSH006213	EFTSH006223	EFTSH006233
Return					
A	EFTE0067A	EFTT0067A	EFTSH0067A13	EFTSH0067A23	EFTSH0067A33
B	EFTE0068A	EFTT0068A	EFTSH0068A13	EFTSH0068A23	EFTSH0068A33
			TSL 1/2*	**TSL 2/2***	
Supply					
A			EFTSL006112	EFTSL006122	
B			EFTSL006212	EFTSL006222	
Return					
A			EFTSL0067A12	EFTSL0067A22	
B			EFTSL0068A12	EFTSL0068A22	

Table 2: Director Switch Location IDs

Train	TSHH*	TSH*	TSL*
Supply			
A	EFTSHH0061	EFTSH0061	EFTSL0061
B	EFTSHH0062	EFTSH0062	EFTSL0062
Return			
A	EFTSHH0067A	EFTSH0067A	EFTSL0067A
B	EFTSHH0068A	EFTSH0068A	EFTSL0068A

* Callaway has given each circuit card (1/3, 2/3, 3/3, etc) a singular location ID for tracking purposes. The setpoint and tolerance data is maintained on a generic switch ID shown on Table 2 above.
** Hand switches EFHS0067 and EFHS0068 are used after each switch to select between the supply and return line for each control function (Low, High, and High-High Setpoints)

1.1 Calculation History

1.1.1 J-UEF03, Revision 000, INSTRUMENT LOOP UNCERTAINTY ESTIMATE: SYSTEM EF LOOPS 67A AND 68A. DETERMINE THE DEGREE OF UNCERTAINTY IN THE CALIBRATION AND MEASUREMENT OF THE SUBJECT INSTRUMENT LOOPS. – This Calculation determined the instrument loop uncertainty of EF Loops 67A and 68A when they exclusively controlled the UHS Cooling Tower fans/bypass valve.

1.1.2 J-1EF03, Revision 000, INSTRUMENT LOOP UNCERTAINTY ESTIMATE: SYSTEM EF LOOPS 67A & 68A DETERMINE THE DEGREE OF UNCERTAINTY IN THE SUBJECT INSTRUMENTATION LOOPS – This calculation is identical to J-UEF03, Revision 000. It shows one revision performed prior to the creation of J-UEF03, but is otherwise identical. The '1' in the title implies a link to the Wolf Creek Power Plant, but there is no UHS at Wolf Creek. J-UEF03, Revision 001 has superseded J-UEF03, Revision 000; it has also superseded J-1EF03, Revision 000.

1.1.3 J-UEF03A, Revision 000, MIN ALLOW SETPT LIMIT RACK TRIP VAL & LIMIT SYS TRIP VAL: LPS 67A & 68A. DETERMINE THE SAFETY RELATED SETPOINT RACK ALLOWABLE VALUE AND SYSTEM ALLOWABLE VALUE OF THE EF-TSL-67A & 68A, EF-TSH-67A & 68A AND EF-TSHH-67A & 68A BISTABLES. – This Calculation used the uncertainty determined via J-UEF03/J-1EF03 to determine the UHS Cooling Tower Fan and Bypass Valve setpoints. This calculation determined the setpoints when they were controlled via EF Loops EFT-0067A and EFT-0068A exclusively. This document was superseded by J-UEF03, Revision 001.

1.1.4 J-UEF03, Revision 001, Instrument Loop Uncertainty Estimate: UHS Cooling Tower Fan Speed and Bypass Valve Control – This revision incorporates the changes done by MP 11-0004 to the UHS Cooling Tower Fan Speed and Bypass Valve Control. The MP added a hand switch to allow control off of the existing ESW return line temperature instrumentation loops EFT-0067A and EFT-0068A or the new ESW supply line temperature instrumentation loops EFT-0061 and EFT-0062.

2.0 Methodology

2.1 The methodology used to determine this uncertainty will be that of ISA-S67.04, Dated September 1994, Setpoints for Nuclear Safety-Related Instrumentation, and ISA-RP67.04, Dated September 1994, Methodologies for the Determination of Setpoints for Nuclear Safety-Related Instrumentation.

2.2 The general equation for channel uncertainty (CU) is:

$$CU = [PM^2 + PE^2 + e^2_1 + e^2_2 + \ldots + e^2_N]^{1/2} + B_T + |RB_T| \qquad (2.2)$$

Where,
PM = Random component of the process measurement uncertainty
PE = Random component of the primary element uncertainty
e_n = Square Root Sum of the Squares of all random independent components of uncertainty associated with a module n
B_T = Algebraic sum of all bias estimates for all biases in a channel
RB_T = Sum of the absolute value of all random bias (and arbitrary distribution) estimates in a channel.

2.3 The general equation for a module uncertainty (e_n from equation 2.2) is:

$$e = [RA^2 + DR^2 + TE^2 + RE^2 + SE^2 + HE^2 + SP^2 + MTE^2]^{1/2} + B + |RB| \qquad (2.3)$$

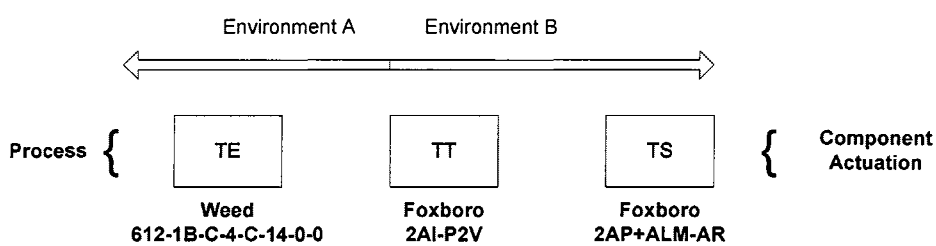
Where,
e = Module total uncertainty
RA = Module reference accuracy
DR = Module drift over a specified period
TE = Module temperature effect
RE = Module radiation effect
SE = Module seismic (vibration) effect
HE = Module humidity effect
SP = Module static pressure effect
MTE = Maintenance and test equipment used during module calibration
B = Bias uncertainty estimates associated with module
RB = Sum of absolute values of all random biases or abnormally distributed uncertainties for the module.

2.4 Bounding Uncertainty Loop

Configuration A, in section 1.0 above, shows all of the loop components necessary to actuate the UHS Cooling Tower fans and by-pass valves. This section breaks down Configuration A into a bounding set of loop modules that shows the loop uncertainty for any one component actuation.

The 2AO-L2C-R circuit cards have no impact on signal transmission. These cards are used for isolation and interlocking. For this reason they have been removed from the uncertainty. The supply/return line loop selector hand switch will also not be included as it also has no impact on signal transmission. The three Low, High, and High-High setpoint bistable (switch) circuit cards are identical and for any one component actuation only one switch will be used. Thus for any one component actuation the signal is impacted by the three modules shown below. The bounding uncertainty case is as follows:

Configuration B: Bounding Uncertainty Loop



2.5 Dependent uncertainties, shared amongst the separate modules, will be combined in such a way that independent variables will be combined using a square root sum of the square technique, (SRSS) while dependent variables will be combined by algebraic addition. Reference 8.3.2 describes how the dependence of the various effects is related. The variables described in section 2.3 are compared in Table 3, Variable Dependency, for each component in the loop.

Table 3: Variable Dependency

Effect	TE	TT	TS
PM -Process Measurement Accuracy	i	-	-
PE – Primary Element Accuracy	i	-	-
RA - Reference Accuracy	-	a	a
DR – Module Drift	i	a	a
TE – Temperature Effect	-	b	b
RE – Radiation Effect*	-*	-*	-*
SE – Seismic Effect	-	b	b
HE – Humidity Effect	-	b	b
SP – Static Pressure Effect*	-*	-*	-*
Power Supply	-	c	c
MTE**	-	a**	a**

a: The reference accuracy, or calibrated accuracy, and the module drift are both dependent with respect to M&TE and independent with respect to each other. This does not include the TE as it is not calibrated.

b: Since these components are all located in the same cabinet, they are all exposed to the same environment and seismic effect. Thus, the temperature, humidity, and seismic effects will be considered dependent between modules (circuit cards), but independent with respect to each other.

c: Since these components all use the same power supply, the power supply effects will be considered dependent.

i: This effect is considered independent of all other effects.

* Since all of the components are exposed to no more than atmospheric pressure and minimal radiation, the only environmental effects are temperature and humidity.

** Only one piece of M&TE will be considered for all of the rack mounted components.

2.6 Final Setpoint Determination

The final step in this calculation is to determine the setpoints for UHS Cooling Tower Fan and Bypass Valve control. Each setpoint is determined by combining the Safety Analysis Limits (SALs) found in the Design Inputs section, the setpoint uncertainties derived in this calculation, and margin.

The formula for a rising setpoint:

TS = SAL - CU - Margin

The formula for a falling setpoint:

TS = SAL + CU + Margin

Where,
TS = Trip Setpoint
SAL = Safety Analysis Limit
CU = Channel Uncertainty

3.0 Assumptions

3.1 Assumptions concerning the values of specific error terms for the loop components are included within the "Design Inputs" section for that component.

4.0 Design Inputs

4.1 *Environmental data for temperature loops (Configuration B, section 2.4)*

4.1.1 Environment A: Room 3101, Pipe Space & Tank Area, Elevation 1974

The following data has been taken from FSAR Table 3.11(B)-1 (Normal Environment) and FSAR Table 3.11(B)-2 (Design Basis Accident (DBA) Accident) for this room:

Table 5: Expected Environment A Values

	Pressure	Temp (°F)	Humidity (max/min)	Dose	Normal Dose	PH
Normal	Atmospheric	104/60	70/30%	<0.0005	<200	7
DBA	Atmospheric	120	95%	<2.5	X	X

4.1.2 Environment B: Room 3605, Control Room Equipment Cabinet Area

The following data has been taken from FSAR Table 3.11(B)-1 (Normal Environment) and FSAR Table 3.11(B)-2 (Design Basis Accident (DBA) Accident) for this room:

Table 6: Expected Environment B Values

	Pressure	Temp (°F)	Humidity (max/min)	Dose	Normal Dose	PH
Normal	Atmospheric	84/60	70/30%	<0.0005	<200	7
DBA	Atmospheric	84*	95%	<2.5	X	X

*Qualified to 104 °F

4.2 *Process Measurement Accuracy:*

The **Process Measurement Accuracy** is an error that is introduced due to possible fluctuations in the process medium that will impact the temperature measurement. Per calculation J-2B01, environmental effects are not considered. The temperature linearity is included in the basic accuracy. The humidity is assumed to have no effect as the RTD's are sealed devices that are also protected by a closed thermo-well and O-ring sealed connection head assembly. No Process Measurement Accuracy will be incorporated for this loop.

4.3 *Temperature Element Accuracy (TE, Primary Element Accuracy):*

Table 7: Temperature Element Accuracy Design Inputs

Effect/Value	Formula	Value	References
RA - Reference Accuracy	1/2˚F or 1/4% max temp, whichever is greater	0.5 ˚F	*
DR – Module Drift	0.15˚F/yr max * 0.5 yr	0.075 ˚F	*, 4.3.1
TE – Temperature Effect	See section 4.2.2, 4.2.2.1	None	*, 4.3.2, 4.3.2.1
RE – Radiation Effect	See Section 4.2.2	None	*
SE – Seismic Effect	See section 4.2.3	1 ˚F	*, 4.3.3, J-558B-00018
HE – Humidity Effect	See section 4.2.2, 4.2.2.2	None	*, 4.3.2, 4.3.2.2
SP – Static Pressure Effect	Not applicable for RTD	None	
Power Supply	Not applicable for RTD	None	*, J2R03
MTE – Maint. & Test Equip.	RTD can not be calibrated	None	

* Calculation J-2B01 details the uncertainties associated with Weed Instruments Platinum RTD, model number 612-1B-C-4-C-14-0-0.

4.3.1 Frequency of Element Accuracy Confirmation: Every 6 Months per MP 11-0004.

4.3.2 No uncertainty will be given to the temperature elements for temperature, radiation, and humidity. FSAR 3.11(B).5.7 describes a mild environment as being $\leq$110 ˚F, < 10^3 rads, and $\leq$ 90% humidity while FSAR Table 3.11(B) shows this room reaching 120 ˚F and 95% humidity. However, this section also describes a mild environment as an environment that will not exceed its anticipated abnormal condition. NUREG0588 implementation has further determined the temperature elements to be rated category 'D' for HELB, LOCA, and MSLB design basis accidents (Ref. Director Database). Category D is defined as being located in a mild environment post-accident. Temperature and humidity uncertainties are not necessary for equipment rated for mild environments. The expected radiation levels are within mild environment requirements.

4.3.2.1 Temperature Effect: This component will not be impacted by temperature shifts as its primary function is to measure temperature. Per Table 5, Expected Environment A Values, the element could see a temperature shift of 16˚F (120-104˚F) which is inside the temperature elements expected range. Per calculation J-2B01, the normal environmental temperature effect for this component is included in the Reference Accuracy (RA).

4.3.2.2 Humidity Effect: Per calculation J-2B01, this component will not be impacted by humidity changes as the RTD's are sealed devices that are protected by a closed Thermo-well and O-ring sealed connection head assembly.

4.3.3 Seismic Effect = 1 °F. Qualification Report J-558B-00018, pages 95 & 106 provides the pre and post seismic response for the Weed Instruments, model 612-1B-C-4-C-14-0-0 temperature element (Table 8 Below). Comparing the post seismic functional test data to the baseline functional data shows a worst case drift of 0.205 Ω. Converting to degrees $\frac{X\ ^\circ F}{100\ ^\circ F} = \frac{0.205\ \Omega}{21.54\ \Omega}$ (Ref 4.2.3.1, 4.2.3.2) determines a worst case seismic response of 0.952°F. This value will be rounded to 1 °F for conservatism.

Table 8: Seismic Response of Temperature Element

	VII (Baseline Test)	XIII (Post Seismic Test)	Difference (Ω)	Difference (°F)
P1: G1-A ($R2_a - R1_a$)	100.028	100.041	-0.013	
P1: G1-B ($R2_a - R1_a$)	100.141	99.981	0.16	
P2: G1-A ($R2_a - R1_a$)	99.997	99.964	0.033	
P2: G1-B ($R2_a - R1_a$)	100.075	99.870	0.205	0.952

This qualification report provides an RTD qualification, considering a Design Basis Accident (DBA) effect for seismic uncertainty, which is over-conservative. This test was performed after radiation testing, thermal testing, vibration aging, humidity aging, and vibration aging again. The seismic tests follow IEEE standards IEEE-323 and 344.

4.3.3.1 Temperature Element Input Span: 100 °F. (30 – 130 °F per Director Database)

4.3.3.2 Temperature Element Output Span: Dependent on RTD specifications. EFTE0061: 21.54 Ω; EFTE0062 (Fitted Serial N1169): 21.54 Ω; EFTE0067A (Fitted Serial N4155): 21.577 Ω; EFTE0068A (Fitted Serial N2051): 21.586 Ω (See Director Database). The worst case span of 21.54 Ω was used for this calculation as it bounds the other loops.

4.4 *Temperature Transmitter (TT):*

Table 9: Temperature Transmitter Accuracy Design Inputs

Effect/Value	Formula	Value	References
RA - Reference Accuracy	0.5% output span (100 °F)	0.5 °F	*, 4.4.1
DR – Module Drift	0.5% output span (100 °F)	0.5 °F	*, 4.4.1
TE – Temperature Effect	0.686 % output span (100 °F)	0.686 °F	*, 4.4.2
RE – Radiation Effect	See Section 4.3.3	None	*, 4.4.3
SE – Seismic Effect	0.5% output span (100 °F)	0.5 °F	*
HE – Humidity Effect	0.67 % output span (100 °F)	0.67 °F	*, 4.4.2
SP – Static Pressure Effect	Not applicable for Circuit Card	None	
Power Supply Effect	0.150% output span (100 °F)	0.15 °F	*, 4.4.1
MTE – Maint. & Test Equip.	See Section 4.6	0.1123 °F	4.6

* Calculation J-2A03 details the uncertainties associated with the Foxboro, Resistance to Voltage Converter, model number 2AI-P2V.

4.4.1 Transmitter output span: 100 °F. (30 – 130 °F per Director Database)

4.4.2 Temperature and Humidity Effect: DBA effects are not considered for this component. The accident and normal environment are equivalent.

4.4.3 Radiation Effect: Radiation exposure within mild environment limits. No uncertainty will be considered for this effect.

4.5 *Temperature Bistable (TS):*

Table 10: Temperature Bistable Accuracy Design Inputs

Effect/Value	Formula	Value	References
RA - Reference Accuracy	0.5% input span (100 °F)	0.5 °F	*, 4.5.1
DR – Module Drift	0.5% input span (100 °F)	0.5 °F	*, 4.5.1
TE – Temperature Effect	0.44 % input span (100 °F)	0.44 °F	*, 4.5.1, 4.5.2
RE – Radiation Effect	See Section 4.3.3	None	*, 4.5.3
SE – Seismic Effect	0.3% input span (100 °F)	0.3 °F	*
HE – Humidity Effect	0.5 % input span (100 °F)	0.5 °F	*, 4.5.1, 4.5.2
SP – Static Pressure Effect	Not applicable for Circuit Card	None	
Power Supply Effect	0.15% input span (100 °F)	0.15 °F	*, 4.5.1
MTE – Maint. & Test Equip.	See Section 4.6	0.1125 °F	4.6

* Calculation J-2A02 details the uncertainties associated with the Foxboro, bistable circuit card, model number 2AP+ALM-AR.

4.5.1 Input span: 100 °F. (30 – 130 °F per Director Database)

4.5.2 Temperature and Humidity Effect: DBA effects are not considered for this component. The accident and normal environment are equivalent.

4.5.3 Radiation Effect: Radiation exposure within mild environment limits. No uncertainty will be considered for this effect.

4.6 *Maintenance & Testing Equipment (MTE)*

Typically a 1 to 1 accuracy (MTE to Component) is used for calculating MTE uncertainties. I&C craft is then held to a 2 to 1 accuracy for calibration. This is done for conservatism in setpoint uncertainty calculations. However, calculation EF-123, which determines the safety analysis limits (SALs) for these setpoints requires all conservatisms to be removed. In order to remove conservatism, the actual MTE accuracies will be used for this calculation.

The temperature element is not calibrated. The temperature curves are determined at the factory and provided to Callaway for scaling.

The rack components (TT, TS) are calibrated using a decade box (RTD simulator) and Digital Multimeter (DMM). The DMM used to calibrate these loops must be a Keithley 197 or equivalent. Per reference 8.2.10, the uncertainty of this DMM is 0.03% span (100 °F per 4.4.1) or 0.03 °F. The decade box used to calibrate these loops must be a Transcat 7010T decade box or equivalent. Per reference 8.2.10 the uncertainty of the decade box is 0.02% of the reading. The worst case reading (the highest possible ohms reading) is 121.150 per reference 8.2.1, giving an uncertainty of 0.02423Ω. Converting to degrees $\frac{X°F}{100°F} = \frac{0.02423\Omega}{21.54\Omega}$ (Ref 4.2.3.1, 4.2.3.2) determines a decade box uncertainty of 0.1125°F.

4.7 *Safety Analysis Limits (SAL)*

4.7.1 Freeze Protection

The ESW to UHS Cooling Tower Bypass Valves open on a low temperature to prevent water going over the cooling tower fill and freezing. In addition, when the initial DBA temperature is below freezing, the water, although rising in temperature, cannot be allowed over the fill until a certain point to ensure large droplets don't freeze and impede tower performance.

Per RFR 200802059, the criteria for closing EFHV0065/66 requires either the ambient wet-bulb temperature to be greater than 32 F or the ESW return water temperature to be greater than or equal to 61 F. The fans may then be run at any temperature above this to provide cooling. The freeze protection function is necessary for both supply and return line setpoints. The Bypass valve fulfills a secondary role as being necessary for fan operation.

4.7.1.1 Freeze Protection SAL – 61 F. (RFR 200802059)

4.7.2 Return Line SALs

The UHS Cooling Tower Fan Speed and Bypass Valve Position is controlled off of the return line at the beginning of a DBA to protect the ESW system from reaching the max ESW temperature of 92.3 F (Ref. 8.2.4, 8.1.4) A discussion of the GOTHIC model anticipated max temperature and its acceptability can be found in Calculation EF-123 (Ref 8.1.4). With respect to setpoint determination the GOTHIC model requires the UHS Cooling Tower Fast Speed control (high-high setpoint) to actuate (set) between 102.5 and 107.5 F. The fast speed (high-high setpoint) reset values are of no consequence as the temperature is not anticipated to reach this limit prior to swap over to the supply line temperature loops. The slow speed (high setpoint) fan runs in this scenario are negligible as the temperature in the return line heats up quickly and doesn't reach normal levels until after swap over to the supply line. The bypass valve must be closed prior to reaching the fast speed setpoint to allow for proper cooling.

4.7.2.1 Fan Fast Speed Set – Between 102.5 and 107.5 °F (Calculation EF-123)

4.7.3 Supply Line SALs

After the ESW DBA temperature has reached a controllable state the UHS Cooling Tower Fan Speed and Bypass Valve Position will be controlled via the supply line temperature. At this point max temperature and UHS inventory is a concern for UHS operation. The GOTHIC model anticipated temperature values, as well as the inventory losses associated with using these setpoints are determined and can be found in calculation EF-123. With respect to setpoint determination the GOTHIC model fast and slow (high-high and high setpoints) set and reset values are used to ensure these two limits are maintained. The bypass valve is not expected to change state during the use of this control, but it must be closed to achieve proper cooling from the tower.

4.7.3.1 Fan Fast Speed Set – Between 87 and 92 °F (Calculation EF-123)

4.7.3.2 Fan Fast Speed Reset – Between 85 and 90 °F (Calculation EF-123)

4.7.3.1 Fan Slow Speed Set – Between 82 and 87 °F (Calculation EF-123)

4.7.3.2 Fan Slow Speed Reset – Between 80 and 85 °F (Calculation EF-123)

5.0 Calculation

Table 11 summarizes the design input values for each module in the loop.

Table 11: Complete Accuracy Design Inputs List

Effect	TE	TT	TS
PM – Process Measurement Ac.	-	-	-
PE – Primary Element Ac.	-	-	-
RA - Reference Accuracy	0.5 °F	0.5 °F	0.5 °F
DR – Module Drift	0.075 °F	0.5 °F	0.5 °F
TE – Temperature Effect	-	0.686 °F	0.44 °F
RE – Radiation Effect	-	-	-
SE – Seismic Effect	1 °F	0.5 °F	0.3 °F
HE – Humidity Effect	-	0.67 °F	0.5 °F
SP – Static Pressure Effect	-	-	-
PS - Power Supply Effect	-	0.15 °F	0.15 °F
MTE – Maint. & Test Equip.	-	0.1125 °F	0.1125 °F

5.1 The final equation for the Channel Uncertainty combines equation 2.2 and 2.3 for use with the values found in Table 11. Dependant variables between modules from table 4 are taken out of their module specific uncertainty and combined in the overall channel uncertainty. The resultant Channel Uncertainty Equation is calculated below:

Equation 5.1

$$CU = [PM^2 + PE^2 + ([DR_{TE}{}^2 + RA_{TE}{}^2 + SE_{TE}{}^2]^{1/2})^2 + ([(RA_{TT} + MTE_{TT})^2 + (DR_{TT} + MTE_{TT})^2]^{1/2})^2 + ([(RA_{TS} + MTE_{TS})^2 + (DR_{TS} + MTE_{TS})^2]^{1/2})^2 + (TE_{TT}+ TE_{TS})^2 + (SE_{TT}+ SE_{TS})^2 + (HE_{TT}+ HE_{TS})^2 + (PS_{TT}+ PS_{TS})^2]^{1/2}$$

5.2 Using equation 5.1 above with the numbers from Table 11 derives the following Channel Uncertainty:

$$CU = [0^2 + 0^2 + ([0.075^{\,2} + 0.5^{\,2} + 1.0^2]^{1/2})^2 + ([(0.5 + 0.1125)^2 + (0.5 + 0.1125)^2]^{1/2})^2 + ([(0.5 + 0.1125)^2 + (0.5 + 0.1125)^2]^{1/2})^2 + (0.686+ 0.44)^2 + (0.5+ 0.3)^2 + (0.67+ 0.5)^2 + (0.15+ 0.15)^2]^{1/2}$$

CU = 2.475 ˚F

The Setpoint Uncertainty associated with temperature instrumentation loops EFT-0067A, EFT-0068A, EFT-0061, and EFT-0062 is 2.475 ˚F. For ease of use and to add margin, the setpoint uncertainty (Channel Uncertainty CU) used in this calculation will be rounded up to **2.5 ˚F**.

5.3 Setpoint Determination

Per the methodology for deriving a Trip Setpoint (TS), found in section 2.6, TS is equal to the Safety Analysis Limit (SAL) +/- the Channel Uncertainty (CU) +/- Margin (M). The values are added or subtracted depending on whether the SAL is triggered rising or falling (directionality). The setpoints found in Tables 12 and 13 have been derived using this equation.

5.3.1 Example Calculation (Tables 12/13): Supply Line TSHH Set (Fan Fast speed actuation)

Required action point: 102.5 – 107.5.
Calculation Methodology (2.6): Rising: TS = SAL - CU - Margin
Calculation Methodology (2.6): Falling: TS = SAL + CU + Margin
If TS is known, margin is then: Rising: Margin = SAL - CU - TS
If TS is known, margin is then: Falling: Margin = SAL – (CU + TS)

Trip Setpoint Rising: TS = 107.5 ˚F – 2.5 ˚F – 0 ˚F = 105 ˚F
Trip Setpoint Falling: TS = 102.5 ˚F + 2.5 ˚F + 0 ˚F = 105 ˚F
Trip Setpoint = 105 ˚F
Margin Rising: 107.5 ˚F – 2.5 ˚F - 105 ˚F = 0 ˚F
Margin Falling: 107.5 ˚F – (2.5 ˚F + 105 ˚F) = 0 ˚F

Table 12: Return Line (EFT-0067A, EFT-0068A) Setpoint Determination

	Setpoint (°F)	Required Action Point (°F)	Margin (°F)	References
TSHH Set (fast fan start)***	105.0	102.5 - 107.5 ***	0	EF-123, 4.7.2, 4.7.2.1
TSHH Reset (fast fan stop)	102.5	(Note 1)	(Note 1)	EF-123, 4.7.2
TSH Set (slow fan start)	95.0	(Note 1)	(Note 1)	EF-123, 4.7.2
TSH Reset (slow fan stop)	92.5	(Note 1)	(Note 1)	EF-123, 4.7.2
TSL Reset (close bypass valve)***	84.0	92.5 (Note 2) ***	6.0	EF-123, 4.7.1, 4.7.2, 4.7.3
TSL Set (open bypass valve)***	78.0	61.0 ***	14.5	EF-123, 4.7.1, 200802059

***Setpoint supports a Safety Analysis Limit (SAL). Other setpoints may be changed without impacting the analysis (EF-123).

Note 1: The values chosen for non-SAL setpoints support the values used in calculation EF-123. As their function does not impact the safety analysis results, they may be revised without recourse to the safety analysis. Thus the margin associated with these setpoints is not considered. These setpoints do operate in the proper order. With raising temperature the valve closes followed by the slow start of the fans and finishing with the fast start of the fans. With falling temperature when the fast fans kick off the slow fans will be running. The slow fans will then kick off followed by the valve opening. It is important to note that there is an interlock to ensure the fast fans will run if a set signal has been provided to the slow and fan start circuitry.

Note 2: The valve must be closed prior to the fast speed start signal to ensure the safety analysis is maintained. However, the valve should be closed prior to the slow speed start for proper cooling tower operation. For this reason the slow speed start setpoint was used to determine valve reset margin.

Table 13: Supply Line (EFT-0061, EFT-0062) Setpoint Determination

	Setpoint (˚F)	Required Action Point (˚F)	Margin (˚F)	References
TSHH Set (fast fan start)***	89.5	87.0 - 92.0 ***	0	EF-123, 4.7.3, 4.7.3.1
TSHH Reset (fast fan stop)***	87.5	85.0 – 90.0 ***	0	EF-123
TSH Set (slow fan start) ***	84.5	82.0 – 87.0 ***	0	EF-123
TSH Reset (slow fan stop)***	82.5	80.0 – 85.0 ***	0	EF-123
TSL Reset (close bypass valve)***	79.0	82.5 ***	1	EF-123, 4.7.1, 4.7.3
TSL Set (open bypass valve)***	73.0	61.0 ***	9.5	EF-123, 4.7.1, 200802059

***Setpoint supports a Safety Analysis Limit (SAL). Other setpoints may be changed without impacting the analysis (EF-123).

6.0 Impact Assessment

6.1 Upstream Calculations (reviewed, not impacted): J-2B01, J-2A02, J-2A03, & EF-123.

6.2 Upstream Calculations (impacted): J-UEF03A, J-1EF03.

This calculation will supersede the two calculations discussed above. See section 1.1, Calculation History, for more information.

6.3 Downstream Calculations: None.

6.4 Downstream Design Basis Documents: Setpoint data for EFTSL0061/62/67A/68A, EFTSH0061/62/67A/68A, and EFTSHH0061/62/67A/68A. MP 11-0004. FSAR SA 9.2.5.2.3 & FSAR SA 9.2.5.5.

The setpoint data has been revised via MP 11-0004 to reflect the values chosen in this calculation. MP 11-0004 created this calculation revision and is thus not impacted by the changes. The FSAR sections have been revised via the 50.59 review found in MP 11-0004.

6.5 <u>50.59 Applicability</u>

This calculation supports the changes identified in MP 11-0004 and calculation EF-123. The 50.59 review performed via MP 11-0004 covers all changes associated with this calculation.

7.0 Conclusion

This calculation determines the UHS Cooling Tower fan speed control and ESW to UHS Cooling Tower bypass valve control setpoints considering instrument uncertainties. A Channel Uncertainty for instrumentation temperature loops EFT-0061, EFT-0062, EFT-0067A, and EFT-0068A of **2.5 °F** has been determined via this calculation. The UHS Fan slow and fast speed control setpoints, as well as the UHS bypass valve control setpoints have additionally been determined. See Table 12, Supply Line (EFT-0067A, EFT-0068A) Setpoint Determination, and Table 13, Return Line (EFT-0061, EFT-0062) Setpoint Determination, for a breakdown of the new values.

7.1 Margin Discussion

The margin associated with each setpoint is discussed in Table 12, Supply Line (EFT-0067A, EFT-0068A) Setpoint Determination, and Table 13, Return Line (EFT-0061, EFT-0062) Setpoint Determination. Per section 5.2, the Channel Uncertainty was rounded up to 2.5 °F, providing a relatively small amount of margin in the setpoint determination section. Per section 4.3.3, the seismic effect was rounded to 1 °F, providing a relatively small amount of margin to the temperature element uncertainty determination. Section 4.3.3 also discusses inherent margin associated with the testing of this equipment.

8.0 References

8.1 Calculation References

8.1.1 J-2A02, Rev 001 – Accuracy: Foxboro Bistable 2AP+ALM-AR
8.1.2 J-2A03, Rev 001 – Accuracy: Foxboro Res to Volt Conv Model 2AI-P2V
8.1.3 J-2B01, Rev 001 – Accuracy: Temperature Element (RTD) Weed Series 611 & 612
8.1.4 EF-123, Rev 000 – Callaway UHS Cooling Pond Performance using GOTHIC Model CN-CRA-10-21
8.1.5 J-1EF03, Rev 000 – Instrument Loop Uncertainty Estimate: EF Loops 67A & 68A
8.1.6 J-UEF03A, Rev 001 – Min Allow Setpt Rack Trip Val & Sys Trip Val: Lps 67A & 68A.
8.1.7 EF-54, Rev 003A – This Calculation Predicts the UHS performance for the meteorological conditions identified in FSAR SA TABLE 2.3-13 AND 2.3-15.

8.2 Design Basis Documentation References

8.2.1 Director Database (CEL, Callaway Equipment List)
8.2.2 RFR 200802059, Update OTN-EF-00001 Rev. 36 to reflect current UHS CT operating curves
8.2.3 MP 11-0004, Ultimate Heat Sink (UHS) Temperature Issue Solution
8.2.4 FSAR SP Chapter 9.2
8.2.5 FSAR SA Chapter 9.2
8.2.6 FSAR Table 3.11(B)-1, Normal Environment
8.2.7 FSAR Table 3.11(B)-2 Design Basis Accident (DBA) Accident
8.2.8 FSAR 3.11(B).5.7

8.2.9 J-558B-00018, Fast Response RTD/RTDT & Thermocouple Assemblies – Test Qual
8.2.10 AmerenUE letter NED080004, "Margin Recovery Program – Reactor Protection System Setpoint Uncertainty Calculations Information Request", 1/22/08.
8.2.11 AmerenUE letter NED080025, "Comments on Verified Draft Version of the Overtemperature and Overpower Delta T Uncertainty Calculations", 6/2/08
8.2.12 FSAR SA 9.2.5.2.3, System Operation
8.2.13 FSAR SA 9.2.5.5, Instrument Applications

8.3 Industry References
8.3.1 ISA-S67.04, Dated September 1994, Setpoints for Nuclear Safety-Related Instrumentation
8.3.2 ISA-RP67.04, Dated September 1994, Methodologies for the Determination of Setpoints for Nuclear Safety-Related Instrumentation
8.3.3 NUREG0588
8.3.4 IEEE-323
8.3.5 IEEE-344

8.4 Component References
8.4.1 EFT-0061 - ESW PMP (2PEF01A) DISCH TEMP
8.4.2 EFT-0062 - ESW PMP (2PFE01B) DISCH TEMP
8.4.3 EFT-0067A - ESW COOL TWR A (SEF01) INLET TEMP
8.4.4 EFT-0068A - ESW COOL TWR B (SEF01) INLET TEMP
8.4.5 EFTSL0061 - UHS COOLTWR Bypass VLV Temp SW Low ESW SPLY TRN A
8.4.6 EFTSL006112 - FOXBORO CIRCUIT CARD
8.4.7 EFTSL006122 - FOXBORO CIRCUIT CARD
8.4.8 EFTSL0062 - UHS COOLTWR Bypass VLV Temp SW Low ESW SPLY TRN B
8.4.9 EFTSL006212 - FOXBORO CIRCUIT CARD
8.4.10 EFTSL006222 - FOXBORO CIRCUIT CARD
8.4.11 EFTSL0067A - ESW TRN A TO UHS COOL TOWERS A & C LO TEMP SW
8.4.12 EFTSL0067A12 - FOXBORO CIRCUIT CARD
8.4.13 EFTSL0067A22 - FOXBORO CIRCUIT CARD
8.4.14 EFTSL0068A - ESW TRN B TO UHS COOL TOWERS B & D LO TEMP SW
8.4.15 EFTSL0068A12 - FOXBORO CIRCUIT CARD
8.4.16 EFTSL0068A22 - FOXBORO CIRCUIT CARD
8.4.17 EFTSH0061 - UHS COOLTWR FAN A & C TEMP SW HI ESW SPLY TRN A
8.4.18 EFTSH006113 – FOXBORO CIRCUIT CARD
8.4.19 EFTSH006123 - FOXBORO CIRCUIT CARD
8.4.20 EFTSH006133 - FOXBORO CIRCUIT CARD
8.4.21 EFTSH0062 - UHS COOLTWR FAN B & D TEMP SW HI ESW SPLY TRN B
8.4.22 EFTSH006213 - FOXBORO CIRCUIT CARD
8.4.23 EFTSH006223 - FOXBORO CIRCUIT CARD
8.4.24 EFTSH006233 - FOXBORO CIRCUIT CARD
8.4.25 EFTSH0067A - ESW TRN A TO UHS COOL TOWERS A & C HI TEMP SW
8.4.26 EFTSH0067A13 - ESW COOL TWR A (SEF01) INLET TEMP
8.4.27 EFTSH0067A23 - FOXBORO CIRCUIT CARD
8.4.27 EFTSH0067A33 - FOXBORO CIRCUIT CARD

8.4.28 EFTSH0068A - ESW PMP B TO UHS COOL TOWERS B & D HI TEMP SW
8.4.29 EFTSH0068A13 - ESW COOL TWR B (SEF01) INLET TEMP
8.4.30 EFTSH0068A23 - FOXBORO CIRCUIT CARD
8.4.31 EFTSH0068A33 - FOXBORO CIRCUIT CARD
8.4.32 EFTSHH0061 - UHS COOLTWR FAN A & C TEMP SW HIHI ESW SPLY TRN A
8.4.33 EFTSHH006112 – FOXBORO CIRCUIT CARD
8.4.34 EFTSHH006122 - FOXBORO CIRCUIT CARD
8.4.36 EFTSHH0062 - UHS COOLTWR FAN B & D TEMP SW HIHI ESW SPLY TRN B
8.4.37 EFTSHH006212 - FOXBORO CIRCUIT CARD
8.4.38 EFTSHH006222 - FOXBORO CIRCUIT CARD
8.4.39 EFTSHH0067A - ESW TRN A TO UHS COOL TOWERS A & C HI/HI TEMP SW
8.4.40 EFTSHH0067A12 - ESW COOL TWR A (SEF01) INLET TEMP
8.4.41 EFTSHH0067A22 - FOXBORO CIRCUIT CARD
8.4.42 EFTSHH0068A - ESW TRN B TO UHS COOL TOWERS B & D HI/HI TEMP SW
8.4.43 EFTSHH0068A12 - FOXBORO CIRCUIT CARD
8.4.44 EFTSHH0068A22 - FOXBORO CIRCUIT CARD
8.4.45 EFTE0061 - ESW PMP A DISCH TEMP ELEM
8.4.46 EFTE0062 - ESW PMP B DISCH TEMP ELEM
8.4.47 EFTE0067A - ESW TRN A TO UHS COOL TOWERS A & C TEMP ELEM
8.4.48 EFTE0068A - ESW TRN B TO UHS COOL TOWERS B & D TEMP ELEM
8.4.49 EFTT0061 - ESW A TEMP TO POWER BLOCK
8.4.50 EFTT0062 - ESW B TEMP TO POWER BLOCK
8.4.51 EFTT0067A - ESW COOL TWR A (SEF01) INLET TEMP
8.4.52 EFTT0068A - ESW COOL TWR B (SEF01) INLET TEMP
8.4.53 EFHS0067 - A Train ESW RTN/SPLY (Loops 67A/61) Line Temp Hand Switch
8.4.54 EFHS0068 - B Train ESW RTN/SPLY (Loops 68A/62) Line Temp Hand Switch
8.4.55 EFHV0065 - ESW UHS COOL-TWR TRN A BYP HV
8.4.56 EFHV0066 - ESW UHS COOL-TWR TRN B BYP HV
8.4.57 CEF01A - ESW ULTIMATE HEAT SINK COOLING TOWER FAN A
8.4.58 CEF01B - ESW ULTIMATE HEAT SINK COOLING TOWER FAN B
8.4.59 CEF01C - ESW ULTIMATE HEAT SINK COOLING TOWER FAN C
8.4.60 CEF01D - ESW ULTIMATE HEAT SINK COOLING TOWER FAN D