ATTACHMENT 6

LaSalle County Station Engineering Change (EC) 388666, Revision 0, "Revise Design Analyses for UHS Temperature of 107 °F"

Engineering Change

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EC Title: REVISE DESIGN ANALYSES FOR UHS TEMPERATURE OF 107 °F

Mod Nbr : KW1: SR KW2: KW3: KW4: KW5:

Master EC :	N	Work Group :		Temporary :	N
Outage :	N	Alert Group:	DEM	Aprd Reqd Date:	06/29/2012
WO Required :		Image Addr :		Exp Insvc Date:	
Adv Wk Appvd:		Alt Ref. :		Expires On :	
Auto-Advance:	N	Priority :		Auto-Asbuild :	N
Caveat Outst:		Department :		Discipline :	
Resp Engr :	SEAN		TANTON		
Location :					

Milestone	**Date**	**PassPort**	**Name**		**Req By**
110-PREPARE EC	06/12/2012	TANTSX	TANTON	SEAN	APPROVED
120-REVIEW EC	06/15/2012	CHONSX	CHON	STEVE	APPROVED
I have performed an independent detailed review of EC 0388666 Rev. 000 and provided my comments. All of my comments have been incorporated in the EC. Steve Chon 6/15/12					
300-APPROVE EC	06/22/2012	LSLL1	SCHMIT	DANIEL	APPROVED
400-DISTRIB EC					CLOSED
630-HOLD 1					MODIFIED
HOLD to keep Open for LAR comments					
800-ATTR CLOSED					CLOSED

Units

Fac	**Unit**	**Description**
LAS	00	COMMON UNIT
LAS	01	UNIT ONE
LAS	02	UNIT TWO

Systems

Fac	**System**	**Description**
LAS	RH	RESIDUAL HEAT REMOVAL
LAS	E12	RESIDUAL HEAT REMOVAL
LAS	HP	HIGH PRESSURE CORE SPRAY
LAS	E22	HIGH PRESSURE CORE SPRAY
LAS	LP	LOW PRESSURE CORE SPRAY
LAS	E21	LOW PRESSURE CORE SPRAY
LAS	DG	DIESEL GENERATOR
LAS	VY	ECCS EQUIPMENT COOLING

Revise Design Analyses for Post Accident UHS Temperature of 107 °F
EC 388666, Rev. 000
Design Considerations Summary

Background

The current Technical Specification Bases 3.7.3 and UFSAR Section 9.2.6 indicate UHS temperature limits (inlet cooling water temperature). The current limit is set such that the UHS inlet to the plant would not exceed 104 °F since the CSCS heat rejection equipment was analyzed based on this same inlet cooling water temperature. This EC and its supporting analyses, evaluate plant equipment for an increased inlet cooling water temperature of 107 °F. It should be noted that the current Tech Spec SR 3.7.3.1 UHS temperature limit of ≤ 101.25 °F is not being changed with this EC.

4.1.4.1 – Basic SSC Functions:

The purpose of the Ultimate Heat Sink (UHS) is to provide sufficient cooling water to permit the safe shutdown and cooldown of the station for 30 days with no makeup for both normal and accident conditions. Currently, this is to be accomplished with a maximum water temperature of 104 °F. This EC will revise the associated Design Analyses to show that this can be accomplished with a maximum UHS temperature of 107 °F.

The function of the core standby cooling system-equipment cooling water system (CSCS-ECWS) is to circulate lake water from the ultimate heat sink for cooling of the residual heat removal (RHR) heat exchangers, diesel-generator coolers, CSCS cubicle area cooling coils, RHR pump seal coolers, and low-pressure core spray (LPCS) pump motor cooling coils. This system also provides a source of emergency makeup water for fuel pool cooling and also provides containment flooding water for post-accident recovery.

4.1.4.2 – Configuration Change Safety Classification:

This configuration change involves the CSCS-ECWS and UHS which are safety related as shown in UFSAR Table 3.2-1 Articles XXVI and XLII.

4.1.4.3 – SSC Seismic Classification:

The CSCS-ECWS and UHS are classified as Seismic I as shown in UFSAR Table 3.2-1 Articles XXVI and XLII.

4.1.5 – Performance Requirements:

The heat removal requirements of the heat exchangers in the CSCS are shown below. The CCM heat removal requirement for RHR has been revised from 163.1 MBtu/hr to 165,564,000 Btu/hr.

Name	EPN	Design Heat Load	
RHR Heat Exchanger	1(2)E12-B001A/B	CCM = 165,564,000 BTU/hr	SDC* = 41.6 MBTU/hr
0 DG Jacket Water Cooler	0DG01A	8.6 MBTU/hr	
A DG Jacket Water Cooler	1(2)DG01A	8.6 MBTU/hr	
B DG Jacket Water Cooler	1(2)E22-S001	7.8 MBTU/hr	
NW Corner Room Cooler	1(2)VY01A	517,239 BTU/hr	
SW Corner Room Cooler	1(2)VY02A	646,235 BTU/hr	
SE Corner Room Cooler	1(2)VY03A	722,217 BTU/hr	
NE Corner Room Cooler	1(2)VY04A	633,288 BTU/hr	
LPCS Motor Cooler	1(2)E21-C001	NA, maintain bearing temp below 200 °F	
RHR Pump Seal Cooler	1(2)E12-C002A/B	NA, maintain seal temp below 250 °F	

*Note that the SDC function of RHR is not a safety related function. See Table 1 for associated analyses numbers and additional design inputs.

The flow rates that are inputs for the design analyses are shown below. Note that the only revision made to these flow rates from previously analyzed values was for the LPCS motor cooler. All other flow rates remain unchanged with this EC.

EPN	Process Flow	Cooling Water Flow
1(2)E12-B001A/B	7200 gpm	7400 gpm
0DG01A	1,100 gpm	800 gpm
1(2)DG01A	1,100 gpm	800 gpm
1(2)E22-S001	1,100 gpm	650 gpm **
1(2)VY01A	17,100 cfm	75 gpm
1(2)VY02A	18,000 cfm	108 gpm **
1(2)VY03A	23,760 cfm	72.5 gpm
1(2)VY04A	27,075 cfm	66.5 gpm
1(2)E21-C001	NA	3 gpm
1(2)E12-C002A/B	NA	5 gpm

**The minimum CSCS flow through the Division 3 Diesel Generator jacket water cooler was revised under ECs 370853 and 384525 for U1 and U2, respectively. The revised flow for the 1(2)E22-S001 coolers is 550 gpm. Note that the same ECs also reallocated 50 gpm to the VY02 coolers increasing their flows to 158 gpm, however, the minimum analyzed flow remains at 108 gpm. Use of 158 gpm as the minimum required cooling water flow rate would require an update to the UFSAR. The case with 550 gpm and its corresponding fouling factor have been analyzed and shown to be acceptable with a UHS temperature of 107 °F.

The methods for verifying the above information are discussed in section 4.1.6 below.

Because the increased cooling water temperature reduces the thermal margin for all of the above listed heat exchangers, Action Tracking items (ATs) have been created for System Engineering to evaluate the addition of these heat exchangers into the margin management program as necessary. These ATs are listed on the XREF panel of this EC.

The purpose of the suppression pool is to condense steam and to absorb energy from the spectrum of design basis accidents that LaSalle Station is designed for. The energy (in the form of heat) that is transferred to the suppression pool, is transferred to the UHS via the RHR heat exchangers. Sections 4.1.9 and 4.1.31 discuss the impacts of this change on the heat removal capability of the RHR heat exchangers and the corresponding impacts upon suppression pool temperature during design basis accidents.

EC 334017 previously evaluated non-safety related systems for a temperature of 104 °F. Technical Specifications currently limit service water temperature to 101.25 °F, which ensures a post-accident UHS temperature of 104 °F is not exceeded. As such, these systems will not be evaluated for a service water temperature of 107 °F. If the Technical Specifications are revised in the future for temperatures higher than 104 °F, the non-safety related systems should be evaluated at that time. These systems are not credited for accident mitigation. The systems that were evaluated under EC 334017 include the main condenser, the RBCCW heat exchangers, the TBCCW heat exchangers, the iso-phase bus duct coolers, the alternator exciter, the hydrogen coolers, the stator coolers, the turbine oil coolers, fuel pool cooling heat exchangers, and several non-safety related HVAC systems. The evaluation for multiple systems concluded that load curtailment per LOA-CW-101/201 may be necessary to maintain acceptable performance of those systems.

The FP pumps were also evaluated for the inlet temperature of 104 °F under EC 334017. The increase in inlet water temperature from 104 °F to 107 °F results in a small change in water density and saturation pressure, two key parameters affecting system pressure losses and NPSH. These small changes do not affect the ability of the FP system to perform its suppression function.

4.1.6 – Design Requirements for Surveillance Testing:

The above heat removal rates and flow rates are verified by periodic surveillance testing. Flow balances are performed for branches of the CSCS for flow verification through select heat exchangers while cooling water ΔP tests are performed on other heat exchangers. Air flow surveillance tests are conducted on the air-to-water heat exchangers to verify they pass the required air flow. The heat removal capability of the air-to-water heat exchangers is confirmed by acceptable test results from the cooling water ΔP tests and air flow rate tests. The fouling factors for the air-to-water heat exchangers are not predicted because it is not practical to set up test conditions that would allow accurate measurement of the fouling factor for these heat exchangers. For the shell and tube heat exchangers, thermal performance evaluations are completed to verify the design heat load can be removed under design conditions. At the same time, the fouling factor for that heat exchanger is predicted and compared against acceptance criteria. Finally, flow rate tests are performed for the LPCS motor coolers and RHR Pump Seal Coolers. As part of this design change, the minimum flow rate for the LPCS motor coolers will be changed from 2 gpm to 3 gpm, which increases the surveillance testing acceptance criteria to 3.6 gpm. This is discussed further in section 4.1.9. These surveillance tests will continue to be performed for the heat exchangers in the CSCS.

4.1.9 – Impact on Design Analyses:

Several design analyses will be revised with this EC. The thermal models (design analyses) for the above listed heat exchangers (where applicable) will be revised to show that the heat exchangers can remove the design heat load under design conditions. The affected thermal models are shown in Table 1 along with their associated inputs.

For the RHR heat exchangers it was necessary to revise the acceptance criteria for the heat removal rate and the fouling factor. The heat removal rate is based on the K factor, which is discussed below for analysis L-002857. The K factor is also discussed in Section 4.1.31 regarding the impact on accident analyses. The fouling factor was revised from 0.00185 $hr \cdot ft^2 \cdot {}^\circ F/BTU$ to 0.00147 $hr \cdot ft^2 \cdot {}^\circ F/BTU$. This is acceptable based on trend data from previous RHR heat exchanger thermal performance evaluations. The most recent thermal performance evaluation (EC 382267) shows a worst case fouling factor of 0.000410 $hr \cdot ft^2 \cdot {}^\circ F/BTU$, which is well below the new fouling factor of 0.00147 $hr \cdot ft^2 \cdot {}^\circ F/BTU$. The thermal performance testing prior to that shows small changes between each test. The heat exchangers are also cleaned regularly to maintain a very low actual fouling factor. The new maximum allowable fouling factor of 0.00147 $hr \cdot ft^2 \cdot {}^\circ F/BTU$ has been accepted by the GL 89-13 program manager. The new heat removal requirement of 165,564,000 BTU/hr has also been accepted by the GL 89-13 program manager.

The SDC function of RHR was analyzed for a cooling water temperature of 107 °F, but as stated above, it is a non-safety related function. The process temperature for the SDC function is 120 °F. Because the SDC function is non-safety related, the basis for the 120 °F temperature is outage productivity. This temperature is used to maintain comfortable conditions during refueling outages. For the case assuming a cooling water temperature of 107 °F, the heat transfer rate of 41.6 MBTU/hr was achieved by assuming a process water temperature of 121 °F. As stated above, the previous process temperature used for the SDC case was 120 °F. The change to 121 °F is a change of 0.83% and is considered to be essentially the same as 120 °F. The RHR pumps and seals are rated for a much higher temperature than this (250 °F).

In one case, it was necessary to raise the temperature of the process fluid in order to obtain the required heat transfer rate for the heat exchanger. This was done for the 1(2)VY02A corner room cooler (southwest corner room, division 3). The air side temperature was raised from 150 °F to 153 °F. The associated EQ calculation (EQ-01) will be revised to show that the room cooler will limit the room temperature to 153 °F during accident conditions. The EQ binders will also be revised accordingly to qualify the components in the room for the increased temperature.

Analysis L-002857, which performs a sensitivity study of the RHR heat exchanger K factors, will also be revised with this EC. The K factor is essentially an efficiency factor for removing heat through the RHR heat exchangers. This K factor is an input in the accident analyses for LaSalle. The impact on the accident analyses is discussed in section 4.1.31. The post DBA-LOCA peak suppression pool temperature is discussed in the next paragraph associated with design analysis L-003352. Design analysis L-002857 shows that with an increased cooling water temperature of 107 °F, the K factor must increase to maintain peak suppression pool temperatures at or below their currently analyzed values. Analysis L-002857 demonstrates that the combination of increased temperature (107 °F) and K factor (438) results in no increase in peak suppression pool temperature. The new K factor is 438. As discussed above, this results in a new design heat load of 165,564,000 BTU/hr.

Design analysis L-003352, which pertains to the containment response will be revised with this EC. The containment response analysis evaluates the change in drywell and wetwell parameters such as suppression pool temperature, drywell temperature, and wetwell temperature post DBA-LOCA. The heat from the containment is removed by the RHR heat exchangers via the CSCS and ultimately, the UHS. Since the post accident temperature of the UHS is changing, the containment response will also change. The containment response and heat removal capability of the RHR heat exchangers is dependent upon the heat exchanger K factor. The current containment response analysis uses a K factor of 417 for a maximum CSCS temperature of 104 °F. As discussed above, the K factor is essentially an efficiency factor for removing heat through the RHR heat exchangers. To maintain peak suppression pool temperatures at or below their currently analyzed values and offset the impact of the higher CSCS temperature, the K factor must increase. Analysis L-002857 demonstrates that the combination of increased temperature (107 °F) and K factor (438) results in no increase in peak suppression pool temperature.

Design analyses L-002874 (containment response) and L-003565 (ATWS & SBO) will be revised to show that the RHR heat exchanger K factor that is input to these calculations is evaluated in L-002857. The events that utilize the RHR heat exchangers in these analyses will respond in a similar manner as described above for the DBA LOCA scenario (i.e. the limiting suppression pool temperature in these analyses will not increase).

Design analysis L-002489, which pertains to the suppression pool temperature response will be revised with this EC. This analysis discusses the suppression pool temperature response for Station Blackout and Appendix R scenarios. After a set amount of time the RHR heat exchangers are placed in service in suppression pool cooling mode for these events. Although this analysis does not utilize the K factor discussed above, the suppression pool temperature response and RHR heat exchanger performance will be similar to those discussed above.

Design analysis BSA-L-97-02 will be revised to reflect the revised cooling water temperature and RHR heat exchanger K factor. This analysis is a simplified model of the heat input to the suppression pool during a DBA-LOCA that determines the impact of starting suppression pool cooling after a 10 minute time delay vs. a 30 minute time delay. The results show that the increased K factor offsets the increase in cooling water temperature.

Because the change in water temperature causes a change in fluid density and viscosity, the head losses associated with the CSCS will be impacted. Design analysis L-001355 will be revised with this EC to document the changes. Because the increase in temperature is only 3 °F, the change in water density and viscosity is small and the results of the analysis are the same. The available NPSH for the CSCS pumps is adequate at the current design basis diesel frequency. The analysis will be updated to document the change in temperature for future revisions.

Design analysis L-000711 will be revised to show that the RHR pump seal coolers are capable of keeping the seals cooled with a maximum cooling water temperature of 107 °F. The acceptance for this analysis is to maintain seal temperatures below 250 °F.

Design analysis L-002404 will be revised to show that the LPCS pump motor cooler can keep the motor bearings of the LPCS pump cool with a maximum cooling water temperature of 107 °F. The bearings must remain below 200 °F. To achieve this, the minimum flow will be increased from 2 gpm to 3 gpm. The surveillance minimum to be shown in L-002404 will then be 3.6 gpm (including uncertainties) vs. the current value of 2.6 gpm.

The design analyses that document the heat loads in the ECCS corner rooms (L-001077, L-001078, L-001024, and L-001221) reference 100 °F as the maximum cooling water temperature from the CSCS. This temperature is used to determine the margin in the room cooler heat removal capability. This portion of the analysis will be annotated to show that the current margin analysis for the room coolers is discussed in the Proto HX analyses (97-198, 97-199, and 97-200) for the associated corner room. Additionally, the heat load for the southwest (HPCS, Div. 3) corner room is calculated by adding the heat transfer from the pipes operating at suppression pool temperature (212 °F) to the surrounding air. The current value used in the room analysis is 148 °F. This creates a ΔT of 64 °F. Increasing the room temperature to 153 °F reduces the ΔT, which reduces the overall heat load in the room. This means that the current analysis is bounding and will only be updated for reference to the new room temperature and cooling water temperature. It should be noted that the suppression pool maximum temperature has been shown to be below 212 °F, which provides more margin for the room coolers.

Design analysis 001497(EMD) qualifies the 1E12-C300D, 0DG01P, and 2DG01P pumps for a temperature of 107 °F. This temperature is used as the design temperature for determining the allowable stress to use for seismic qualification. The analysis concludes that the aforementioned pumps remain qualified.

4.1.15 – Environmental Qualification:

As stated above, the EQ calc for the southwest corner room (HPCS pump cubicle) and EQ binders for the components in the southwest corner room will be revised. The components will be subjected to a room temperature of 153 °F. This was necessary to achieve the desired heat transfer rate for the 1(2)VY02A room cooler. The components in the southwest corner room will be qualified up to 155 °F for the entire 100 day duration of the accident. For some components, it was necessary to reduce their EQ life to qualify them for the higher temperature. For these components, Service Request (SR) 77726 was submitted to change the PM frequency.

The remaining corner rooms (NW, SE, NE) will be maintained at or below 148 °F with a maximum cooling water temperature of 107 °F. Therefore, the qualification of the components in these rooms is not impacted.

4.1.19 – System Operational Requirements:

The CSCS will not operate differently as a result of the changes associated with this configuration change. The thermal models of the safety related heat exchangers were evaluated without changing design CSCS flow rates or process fluid (air or water) flow rates, except for the LPCS pump motor cooler. Changes in either of these would normally require repositioning valves in systems or changes to pumps or fans. The operation of these components will not be impacted by this configuration change. Note that the outlet valve on the LPCS motor cooler is positioned full open. The increase in flow can be accommodated by this valve. Since trend data from surveillances shows the flows through the LPCS motor coolers above 4.5 gpm, the position of this valve will not need to be changed with this design change.

4.1.21 – Procedure Changes:

Attachment 9's have been given to Systems Engineering, Programs Engineering, and Operations to identify any affected procedures. The procedures identified by those attachments are listed on the ADL of this EC.

4.1.22 – Training Requirements:

Attachment 9's have been given to Systems Engineering, Programs Engineering, and Operations to identify training requirements that may be needed as a result of this EC. Training requests shown on those attachments are listed on the ADL of this EC.

4.1.31 – Impacts on Transient and/or Accident Analyses:

The primary containment utilizes a Mark II over/under pressure suppression configuration, with the suppression pool located at the bottom of the primary containment. The suppression pool is designed to absorb the decay heat and sensible heat released during a reactor blowdown from safety/relief valve discharges or from a loss of coolant accident (LOCA). The suppression pool must also condense steam from the Reactor Core Isolation Cooling System turbine exhaust and provides the main emergency water supply source for the reactor vessel. The suppression pool must quench all the steam released through the downcomer lines during a LOCA. This is the essential mitigating feature of a containment with pressure suppression that ensures that the peak containment pressure is maintained below the design value (45 psig). Suppression pool average temperature (along with suppression pool water level) is a key indication of the capacity of the suppression pool to fulfill these requirements.

The technical concerns that lead to the development of suppression pool average temperature limits are as follows:

A. Complete steam condensation;
B. Primary containment peak pressure and temperature;
C. Condensation oscillation (CO) loads; and
D. Chugging loads.

The postulated design basis accident (DBA) against which the primary containment performance is evaluated is the entire spectrum of postulated pipe breaks within the primary containment. Inputs to the safety analyses include initial suppression pool water volume and suppression pool temperature (UFSAR, Section 6.2 for LOCAs and UFSAR, Section 6.2 and LaSalle County Station Mark II Design Assessment Report (DAR), Section 6.2, June 1981 for the suppression pool temperature analyses required by NUREG-0783). An initial pool temperature of 105° F is assumed for the UFSAR, Section 6.2 analyses. Reactor shutdown at a pool temperature of 110° F and vessel depressurization at a pool temperature of

120° F are assumed for the UFSAR, Section 6.2 and DAR analyses. Suppression pool average temperature satisfies Criteria 2 and 3 of 10CFR50.36(c)(2)(ii).

A limitation on the suppression pool average temperature is required to assure that the primary containment conditions assumed for the safety analyses are met. This limitation subsequently ensures that peak primary containment pressures and temperatures do not exceed maximum allowable values during a postulated DBA or any transient resulting in heatup of the suppression pool. These transients include those listed in UFSAR Sections:

15.1, Increase the heat removal by the secondary system
15.2, Decrease In Heat Removal By The Secondary System
15.3, Decrease In Reactor Coolant System Flow Rate
15.6, Decrease In Reactor Coolant Inventory,
15.8, Anticipated Transients Without Scram (ATWS), and
15.9, Loss Of All Alternating Current Power (Station Blackout)

As discussed in section 4.1.9, the RHR heat exchanger K factor is impacted by the change in post accident UHS temperature. The K factor for the RHR heat exchangers is revised from 417 to 438. The K factor is essentially an efficiency factor for removing heat through the RHR heat exchangers. Because the K factor is increasing, the heat exchanger is becoming more efficient at removing heat, which shows that the current design basis accident analyses result in higher peak suppression pool temperature. The resulting suppression pool temperature does not increase even with an increased cooling water temperature of 107 °F. The peak suppression pool temperature is still below the suppression pool temperature NPSH limit for the ECCS pumps of 212°F. Therefore, no changes to the accident analyses are required or will be made. Additionally, Draft task reports for EPU show that for the current licensed thermal power, an RHR service water temperature of 107 °F, and a K factor of 421, the peak suppression pool temperature is 197 °F for the DBA-LOCA scenario. This provides additional confirmation of the accuracy of the simplified model (BSA-L-97-02) and shows that it is conservative.

Due to the expected performance of the RHR heat exchanger, other events that utilize the RHR heat exchangers for cooling would have the same results, i.e. the increased heat removal capacity of the RHR heat exchanger will offset the increase in service water temperature.

4.1.33 – Mechanical Characteristics:

Per CC-AA-309-1011, the piping systems in the CSCS are characterized as "cold" systems; their maximum operating temperatures are below 150 °F. Since the systems are still considered "cold" even with the increase in CSCS temperature from 104 °F to 107 °F, the thermal stresses remain the same and the piping stress analyses for these systems do not require revision.

Portions of the CSCS meet the criteria for MELB consideration. A review of the MELB analysis (L-001120, Rev. 2), concluded that because the lines are considered to be "cold" as stated above, the analysis is not impacted and does not require revision.

As stated in section 4.1.9, the design analyses for the safety related heat exchangers are being revised to reflect the heat removal rates for a maximum cooling water temperature of 107 °F. The room temperature of the southwest corner room (HPCS corner room) will also be revised to 153 °F. The EQ binders for the equipment in this room will be revised to qualify the equipment for the higher temperature.

Also, as stated in section 4.1.9, the design analysis for CSCS pump NPSH will be revised to evaluate the impact that the increased water temperature has on available NPSH. The 3 °F change in temperature causes a small change in water density and viscosity, which causes a small change in available NPSH for the CSCS pumps. As stated above, the available NPSH for the CSCS pumps is adequate at the current design basis diesel frequency.

4.1.36 – Instrumentation and Control:

A review of the design analyses (L-001874, Rev. 1C, L-001892, Rev. 0, L-001893, Rev. 0B, and L-001894, Rev. 0A) for the loop accuracy of the CSCS flow instruments showed that the uncertainties for these instruments were calculated with a maximum process operating temperature of 125 °F, which bounds a lake temperature of 107 °F. Due to this, and the fact that the locations of the instruments will not be subjected to temperatures that would be higher than the manufacturer's maximum operating ambient temperature range, the uncertainties associated with these instruments remain unchanged. No revisions to the aforementioned design analyses are required.

4.1.42 – Interfacing Departments:

Attachment 10's have been given to Operations Training, Operations, System Engineering, and Programs Engineering. Actions identified on those attachments are listed in the XREF Passport panel of this EC.

4.1.45 – Single Point Vulnerability:

A Single Point Vulnerability (SPV) review has been performed for the configuration change. The purpose of the review was to identify all events that can result in unplanned reactor scrams in a proactive manner, with the intent of taking action to prevent such events. The following SPVs and associated resolution were identified and addressed during the design process: NONE

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Design Considerations Summary

Table 1

EPN	Design Analysis	Process Flow	Process Temp		Cooling Water Flow	Cooling Water Temp	Overall Fouling Factor	Tube Plugging Allowance
1(2)E12-B001A/B	97-201, Rev. A02	7200 gpm	CCM = 212 °F	SDC = 120 °F	7400 gpm	107 °F	0.00147 hr·ft^2·°F/BTU	53 tubes
0DG01A	97-195, Rev. A01	1,100 gpm	190 °F		800 gpm	107 °F	0.00220 hr·ft^2·°F/BTU	9 tubes
1(2)DG01A	97-195, Rev. A01	1,100 gpm	190 °F		800 gpm	107 °F	0.00220 hr·ft^2·°F/BTU	9 tubes
1(2)E22-S001	97-197, Rev. A04	1,100 gpm	190 °F		650 gpm[1]	107 °F	0.00223 hr·ft^2·°F/BTU[2]	4 tubes
1(2)VY01A	97-200, Rev. A05	17,100 cfm	148 °F		75 gpm	107 °F	0.02832467 hr·ft^2·°F/BTU	1 tube
1(2)VY02A	97-200, Rev. A05	18,000 cfm	153 °F		108 gpm	107 °F	0.02832467 hr·ft^2·°F/BTU	1 tube
1(2)VY03A	97-199, Rev. B03	23,760 cfm	148 °F		72.5 gpm	107 °F	0.02650655 hr·ft^2·°F/BTU	1 tube
1(2)VY04A	97-198, Rev. A03	27,075 cfm	148 °F		66.5 gpm	107 °F	0.02228812 hr·ft^2·°F/BTU	1 tube
1(2)E21-C001	L-002404, Rev. 002H[3]	NA	Bearing temp maintained less than 200 °F		3 gpm	107 °F	NA	NA
1(2)E12-C002A/B	L-000711, Rev. 004D[3]	NA	Seal temp maintained less than 250 °F		5 gpm	107 °F	NA	NA

1. Revised to 550 gpm for margin recovery under ECs 370853 and 384525 for U1 and U2, respectively. This case was also analyzed for 107 °F cooling water temperature and found to be acceptable.
2. Revised to 0.00196 hr·ft^2·°F/BTU for margin recovery under ECs 370853 and 384525 for U1 and U2, respectively. This case was also analyzed for 107 °F cooling water temperature and found to be acceptable.
3. No thermal model exists for these heat exchangers.