Nuclear Operating Company

South Texas Project Electric Generating Station 4000 Avenue F – Suite A Bay City, Texas 77414

August 28, 2009
U7-C-STP-NRC-090123

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
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Rockville MD 20852-2738

South Texas Project
Units 3 and 4
Docket Nos. 52-012 and 52-013
Response to Request for Additional Information

Attached are the responses to the NRC staff questions included in Request for Additional Information (RAI) letter numbers 155, 175, 176, 177, and 178 related to Combined License Application (COLA) Part 2, Tier 2, Sections 9.1, 9.2, 9.5 and 10.2. This submittal completes the response to these RAI letters.

The seventeen (17) attachments to this letter address the responses to the RAI questions listed below:

09.01.01-1	09.02.02-1	09.02.05-1	09.05.02-2	10.02-1
	09.02.02-2	09.02.05-2		10.02-2
	09.02.02-3	09.02.05-3		
	09.02.02-4	09.02.05-4		
	09.02.02-5	09.02.05-5		
		09.02.05-6		
		09.02.05-7		

When a change to the COLA is indicated, it will be incorporated in the next routine revision of the COLA following the NRC acceptance of the RAI response.

There are no new commitments in this letter. Commitment 9.2-2 was revised in the response to RAI 09.02.02-2 (Attachment 3). See Attachment 17 for the commitment summary.

STI 32526863

D091
NRO

If you have any questions, please contact me at (361) 972-7136, or Bill Mookhoek at (361) 972-7274.

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

Executed on 8/28/09

Scott Head
Manager, Regulatory Affairs
South Texas Project Units 3 & 4

jaa

Attachments:
1. RAI 09.01.01-1
2. RAI 09.02.02-1
3. RAI 09.02.02-2
4. RAI 09.02.02-3
5. RAI 09.02.02-4
6. RAI 09.02.02-5
7. RAI 09.02.05-1
8. RAI 09.02.05-2
9. RAI 09.02.05-3
10. RAI 09.02.05-4
11. RAI 09.02.05-5
12. RAI 09.02.05-6
13. RAI 09.02.05-7
14. RAI 09.05.02-2
15. RAI 10.02-1
16. RAI 10.02-2
17. Commitment Summary

cc: w/o attachment except*
(paper copy)

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RAI 09.01.01-1

QUESTION:

The ABWR DCD Sections 9.1.1 and 9.1.2 specify several criteria regarding the criticality of the spent and new fuel storage facilities. The COL License Information items in Sections 9.1.6.1 and 9.1.6.3 of the DCD state that "the COL applicant shall provide the NRC a confirmatory criticality analysis for the inadvertent placement of a fuel assembly in other than prescribed locations…". The STP FSAR does not contain a confirmatory criticality analysis as required by the ABWR DCD. Instead, the STP FSAR commits to preparing an analysis at an unspecified future date.

Provide a confirmatory criticality analysis for the inadvertent placement of a fuel assembly for the new and spent fuel storage racks as required by the ABWR DCD Sections 9.1.6.1 and 9.1.6.3, respectively.

RESPONSE:

Design activity for the new fuel and spent fuel storage facilities is currently in progress. As noted in ABWR DCD Subsections 9.1.1.1.1 and 9.1.2.3.1, the purchase specification for the new-fuel storage racks and the spent-fuel storage racks will require the vendor to provide information on criticality analysis, including the fuel misload analyses.

As noted in COLA Part 2 Tier 2 Sections 9.1.6.1 and 9.1.6.3, the confirmatory criticality analyses for the new fuel and spent fuel storage racks are required as part of ITAAC 2.5.6.2. ITAAC will be confirmed as part of the ITAAC closure process. The schedule for ITAAC closure activities is being provided to NRC separately. It is noted that the current schedule for STPNOC to complete the criticality analysis report(s) requested in COL License Information Sections 9.1.6.1 and 9.1.6.3 is by the end of the second quarter of 2011. The report(s) would be available for NRC review after completion.

No COLA change is required as a result of this RAI response.

RAI 09.02.02-1

QUESTION:

The staff reviewed the response of the applicant in Section 9.2.17.1 of the applicant's FSAR to COL License Information Item 9.11 (COM 9.2.2) item (1), that "Means shall be provided for adjusting refrigerator capacity to chilled water outlet temperature." The applicant intends to meet the item (1) design goal through technical requirements on the purchased components. As the design goal is not listed as an Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) design feature, there is no mechanism to assure that the requirement has been met prior to fuel load.

The relevant section of the Standard Review Plan, Section 9.2.2, 1.16 directs the applicant to address the requirements and restrictions included as license information items in the original Design Certification Document, DCD.

Therefore, justify why there is not an ITAAC to assure that information item (1) is satisfied prior to fuel loading.

RESPONSE:

The guidance provided in the SRP, Section 9.2.2, area of review I.16 states that the applicant must address COL information items included in the referenced DCD. As noted in the question, the COLA addresses this COL information item. Because this COL information item requires actions that are to be performed after procurement of the HECW refrigerators, this activity cannot be completed prior to COL issuance. For COL information items that cannot be completed prior to COL issuance, RG 1.206, Section C.III.4.3, provides four situations that could be used to support COL issuance before complete resolution of a COL information item, one of which is a new ITAAC proposed by the applicant.

A new ITAAC to address this COL information item is not necessary or appropriate. The DCD identified Tier 1 requirements and ITAAC for the HECW system; in addition there are more requirements in the Tier 2 DCD including the COL information item. The DCD did not include this COL information item design criteria in the ITAAC. Because the DCD was approved with the COL information item not included in the ITAAC, there is no basis for including it now. The STP 3&4 COLA does not change any of the requirements for the HECW system as described in the approved DCD.

Another option provided in RG 1.206, Section C.III.4.3, is for the COL applicant to describe in its application the proposed approach for addressing the COL information item in sufficient detail to support the NRC finding. The STP 3&4 COLA, Revision 2 includes such information. The closure of this item can be accomplished by review of the refrigerator procurement documentation, including the procurement specification and certificate of conformance, as part of the NRC's construction inspection program (CIP). The documentation would be available after refrigerator procurement, which is consistent with the COL information item as specified in the DCD. The schedule for procurement of equipment will be part of the master schedule, which NRC will have access to also through the CIP.

No COLA change is required as a result of this response.

RAI 09.02.02-2

QUESTION:

The staff reviewed the response of the applicant to COL License Information Item 9.11 (COM 9.2.2) item (3), in Section 9.2.17.1 of the FSAR that "Means shall be provided for reacting to a loss of electrical power for periods up to two (2) hours and for automatic restarting of pumps and refrigerators, under the expected environmental conditions during station blackout when electrical power is restored." The applicant intends to meet the item (3) design goal citing the alternate AC power source. As the design goal is not listed as an Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) design feature, there is no mechanism to assure that the requirement has been met prior to fuel load.

The relevant section of the Standard Review Plan, section 9.2.2, I.16 directs the applicant to address the requirements and restrictions included as license information items in the original Design Certification Document, DCD.

In addition, item (3) has taken exception to the DCD COL information Item requirements to provide a AAC design capable of reacting to loss of electrical power for "periods up to two hours for automatic restarting of pumps and refrigerators, under the expected environmental conditions during station blackout when electrical power is restored.

1. Provide justification for the proposed exception in information item (3).
2. Justify why there is not an ITAAC to assure that information item (3) is satisfied prior to fuel loading.

RESPONSE:

1. STP 3&4 FSAR Section 9.2.17.1, Item (3) will be revised to directly address the COL Information Item as delineated in the DCD, to provide means for reacting to a loss of electrical power for periods up to two (2) hours. Changes to COLA R2 are provided at the end of this RAI response.
2. The guidance provided in the SRP, Section 9.2.2, area of review I.16 states that the applicant must address COL information items included in the referenced DCD. As noted in response to (1) above, the COLA is being revised to directly addresses this COL information item. Because this COL information item requires actions that are to be performed after procurement of the HECW refrigerators, this activity cannot be completed prior to COL issuance. For COL information items that cannot be completed prior to COL issuance, RG 1.206, Section C.III.4.3, provides four situations that could be used to support COL issuance before complete resolution of a COL information item, one of which is a new ITAAC proposed by the applicant.

A new ITAAC to address this COL information item is not necessary or appropriate. The DCD identified Tier 1 requirements and ITAAC for the HECW system; in addition there are more requirements in the Tier 2 DCD including the COL information item. The DCD did not include this COL information item design criteria in the ITAAC. Because the DCD was approved with the COL information item not included in the ITAAC, there is no basis for including it now. The STP 3&4 COLA does not change any of the requirements for the HECW system as described in the approved DCD.

Another option provided in RG 1.206, Section C.III.4.3, is for the COL applicant to describe in its application the proposed approach for addressing the COL information item in sufficient detail to support the NRC finding. The STP 3&4 COLA, Revision 2 includes such information. The closure of this item can be accomplished by review of the pump and refrigerator procurement documentation, including the procurement specification and certificate of conformance, as part of the NRC's construction inspection program (CIP). The documentation would be available after refrigerator procurement, which is consistent with the COL information item as specified in the DCD. The schedule for procurement of equipment will be part of the master schedule, which NRC will also have access to through the CIP.

As noted in (1) above, the STP 3&4 COLA is being changed as a result of this response. Changes to COLA R2 are shown below, and are highlighted in gray shading. This change constitutes a revision to COM 9.2-2.

9.2.17 COL License Information

9.2.17.1 HECW System Refrigerator Requirements

The following site-specific supplement addresses COL License Information Item 9.11 (COM 9.2-2):

(3) ~~Alternate AC power is provided for reacting to a loss of electrical power for automatic restarting of pumps and refrigerators.~~ Technical requirements will be provided in the procurement documents for the pumps and refrigerators to ensure that the design of the pumps and refrigerators are capable of automatic restart, after a loss of electrical power for up to two (2) hours, under the expected environmental conditions during station blackout when electrical power is restored.

RAI 09.02.02-3

QUESTION:

The staff reviewed the response of the applicant to COL License Information Item 9.11 (COM 9.2.2) item (4), in Section 9.2.17.1 of the FSAR that "Means shall be provided to minimize the potential for coolant leakage or release into system or surrounding equipment environs." The applicant intends to meet the item (4) design goal through technical requirements on the purchased components. As the design goal is not listed as an Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) design feature, there is no mechanism to assure that the requirement has been met prior to fuel load.

The relevant section of the Standard Review Plan, section 9.2.2, I.16 directs the applicant to address the requirements and restrictions included as license information items in the original Design Certification Document, DCD.

Therefore, justify why there is not an ITAAC to assure that information item (4) is satisfied prior to fuel loading.

RESPONSE:

The guidance provided in the SRP, Section 9.2.2, area of review I.16 states that the applicant must address COL information items included in the referenced DCD. As noted in the question, the COLA addresses this COL information item. Because this COL information item requires actions that are to be performed after procurement of the HECW refrigerators, this activity cannot be completed prior to COL issuance. For COL information items that cannot be completed prior to COL issuance, RG 1.206, Section C.III.4.3, provides four situations that could be used to support COL issuance before complete resolution of a COL information item, one of which is a new ITAAC proposed by the applicant.

A new ITAAC to address this COL information item is not necessary or appropriate. The DCD identified Tier 1 requirements and ITAAC for the HECW system; in addition there are more requirements in the Tier 2 DCD including the COL information item. The DCD did not include this COL information item design criteria in the ITAAC. Because the DCD was approved with the COL information item not included in the ITAAC, there is no basis for including it now. The STP 3&4 COLA does not change any of the requirements for the HECW system as described in the approved DCD.

Another option provided in RG 1.206, Section C.III.4.3, is for the COL applicant to describe in its application the proposed approach for addressing the COL information item in sufficient detail to support the NRC finding. The STP 3&4 COLA, Revision 2 includes such information. The closure of this item can be accomplished by review of the refrigerator procurement documentation, including the procurement specification and certificate of conformance, as part of the NRC's construction inspection program (CIP). The documentation would be available after refrigerator procurement, which is consistent with the COL information item as specified in the DCD. The schedule for procurement of equipment will be part of the master schedule, which NRC will have access to also through the CIP.

No COLA change is required as a result of this response.

RAI 09.02.02-4

QUESTION:

The staff reviewed the response of the applicant to COL License Information Item 9.11 (COM 9.2.2) item (5), in Section 9.2.17.1 of the FSAR that "An evaluation of transient effects on starting and stopping or prolonged stoppage of the refrigeration/chiller units. Effects like high restart circuit draw downs on safety buses, coolant-oil interactions, degassing needs, coolant gas leakage or release in equipment areas along with flammability threats, synchronized refrigeration swapping." The applicant intends to meet the item (5) design goal through an evaluation of the purchased components. As the design goal is not listed as an Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) design feature, there is no mechanism to assure that the requirement has been met prior to fuel load.

The relevant section of the Standard Review Plan, section 9.2.2, 1.16 directs the applicant to address the requirements and restrictions included as license information items in the original Design Certification Document, DCD.

Therefore, justify why there is not an ITAAC to assure that information item (5) is satisfied prior to fuel loading.

RESPONSE:

The guidance provided in the SRP, Section 9.2.2, area of review I.16 states that the applicant must address COL information items included in the referenced DCD. As noted in the question, the COLA addresses this COL information item. Because this COL information item requires actions that are to be performed after procurement of the HECW refrigerators, this activity cannot be completed prior to COL issuance. For COL information items that cannot be completed prior to COL issuance, RG 1.206, Section C.III.4.3, provides four situations that could be used to support COL issuance before complete resolution of a COL information item, one of which is a new ITAAC proposed by the applicant.

A new ITAAC to address this COL information item is not necessary or appropriate. The DCD identified Tier 1 requirements and ITAAC for the HECW system; in addition there are more requirements in the Tier 2 DCD including the COL information item. The DCD did not include this COL information item design criteria in the ITAAC. Because the DCD was approved with the COL information item not included in the ITAAC, there is no basis for including it now. The STP 3&4 COLA does not change any of the requirements for the HECW system as described in the approved DCD.

Another option provided in RG 1.206, Section C.III.4.3, is for the COL applicant to describe in its application the proposed approach for addressing the COL information item in sufficient detail to support the NRC finding. The STP 3&4 COLA, Revision 2 includes such information. The closure of this item can be accomplished by review of the refrigerator evaluation documentation, including the evaluation result documentation, as part of the NRC's construction inspection program (CIP). The documentation would be available after refrigerator procurement, which is consistent with the COL information item as specified in the DCD. The schedule for procurement of equipment will be part of the master schedule, which NRC will have access to also through the CIP.

No COLA change is required as a result of this response.

RAI 09.02.02-5

QUESTION:

The staff reviewed STP DEP 16.3-16, LCO 3.7.1, "Reactor Building Cooling Water (RCW) System, Reactor Service Water (RSW) System, and Ultimate Heat Sink (UHS) - Operating and LCO 3.7.2, Reactor Building Cooling Water (RCW) System, Reactor Service Water (RSW) System and Ultimate Heat Sink (UHS) – Shutdown." This departure eliminates the requirement for Condition C2 requiring restoration of two inoperable RCW, RSW or UHS divisions to the operable conditions within 14 days, claiming that it is redundant with Condition A that requires restoration of a single system within 14 days.

Standard Review Plan Section 16.0, Subsection II references 10 CFR 50.34 that requires applicants to justify the selection of technical specification conditions.

The staff finds that STD DEP 16.3-16 may result in misinterpretation of the Technical Specification (TS), which may result in the TS be interpreted to allow longer down times than are specified originally specified in the approved ABWR Technical Specification. The staff finds that elimination of the requirements for condition C2 may result in the LCO being interpreted as allowing a division to be out of service for 21 days (the 7 day period to fix the first disabled unit followed by a new 14 day period to fix the second disabled unit) instead of the 14 days that is specified by condition C2 in LCO 3.7.1 of the ABWR DCD Technical Specifications. Therefore, the staff request that the applicant provide additional information or analysis to confirm the validity of this departure or remove it from the application.

RESPONSE:

Technical Specification Section 1.3 "Completion Times" establishes the Completion Time convention for use with the Technical Specifications. It states:

> "If situations are discovered that require entry into more than one Condition at a time within a single LCO (multiple Conditions), the Required Actions for each Condition must be performed within the associated Completion Time. When in multiple Conditions, separate Completion Times are tracked for each Condition starting from the time of discovery of the situation that required entry into the Condition.
>
> Once a Condition has been entered, subsequent divisions, subsystems, components, or variables expressed in the Condition, discovered to be inoperable or not within limits, will not result in separate entry into the Condition unless specifically stated. The Required Actions of the Condition continue to apply to each additional failure, with Completion Times based on initial entry into the Condition."

LCO 3.7.1 does not provide for separate condition entry as highlighted above. For the case where more than one division contains an inoperable RCW pump, RSW pump, RCW/RSW heat exchanger or cooling tower cell per LCO 3.7.1, then both Conditions A and C would apply. The initial entry into Condition A would be tracked from the time the first component became inoperable; and the Completion Time for Condition A would remain 14 days from the initial entry for both components, regardless of when the second component becomes inoperable.

When the second component becomes inoperable, Condition C would be entered, and would be tracked from the time the second component became inoperable. If the Completion Time of either Condition A or Condition C were not to be met, then Condition D would be entered, requiring shutdown.

Thus, if one component becomes inoperable at time zero, Condition A would be entered and the 14-day clock would start. If the second component became inoperable on day 3, Condition A would be entered for that component as well, with the same Completion Time as the first component (11 days from the time the second component became inoperable). Condition C would also be entered, with a 7 day Completion Time. If the first component were to be repaired and returned to Operable status on day 9, Condition C would be exited; however, Condition A would still apply for the second component. The Completion Time remaining would be 14 – 9 = 5 days, even though the second component has been inoperable for only 6 days.

The Completion Time rules provide for up to a one day extension in this case, but not the 21 day total allowed outage time the question suggests.

No COLA change is required as a result of this response.

RAI 09.02.05-1

QUESTION:

GDC 44 requires reliable operation of the ultimate heat sink (UHS) under all anticipated conditions. ITAAC 3.0-1.2a in Section 9 of the FSAR states that the RSW pump suction will be at 3.35 m above mean sea level (MSL). ITAAC 3.0-1.2a does not specify if the RSW suction elevation is a required minimum or maximum. The NRC staff cannot reconcile this number with Figure 1.2-35 presented in FSAR Section 21 of the COL application where the bottom of the pool is 4.3 m above MSL and the pump is 10 meters below the bottom of the pool (although the electronic copy of the figure is difficult to read). Nor does this elevation agree with Tier 2 Section 9.2.5.5.2(7) which states that the minimum water level is 1.83 m above the suction line's centerline. FSAR, Section 16, SR 3.7.1.2 states that the minimum level in the UHS basin is 0.91 meters with the reference level not provided. The applicant should resolve the discrepancies in the reactor service water pump suction elevation.

RESPONSE:

ITAAC 3.0-1.2a is referring to the elevation where the pump suction line interfaces with the UHS basin. This elevation is +8 ft (+2.44 m) MSL, which will be specified as a maximum. The UHS basin floor is at elevation +14 ft (+4.27 m) MSL. The RSW pump inlet centerline is nominally at elevation -14 ft 2 in (-4.31 m) MSL. The minimum UHS basin water level elevation, after 30-days of operation without make-up, is +17 ft (+5.18 m) MSL, which is 9 ft (2.74 m) above the pump suction line centerline at the interface with the UHS and 3 ft (0.91m) above the UHS basin floor.

Table 1 – Summary of Elevations of UHS Points of Interest

Reference	Elevation
Minimum UHS Basin Water Level After 30 Days without Make-up	+17 ft (+5.18 m) MSL
UHS Basin Floor	+14 ft (+4.27 m) MSL
RSW Pump Suction Line Centerline at the Interface with the UHS Basin	+8 ft (+2.44 m) MSL (maximum)
RSW Pump Inlet Centerline	-14 ft 2 in (-4.32 m) MSL

Technical Specification (TS) Surveillance Requirements (SR) 3.7.1.1, 3.7.2.1, 3.7.3.1 and 3.7.1.2, 3.7.2.2, 3.7.3.2, reference UHS basin water levels of 19.28 m and 0.91 m respectively with no apparent reference point. The Bases for Limiting Condition for Operation (LCO) 3.7.1 provides an explanation of the reference point for these two numbers using the basin level of 19.28 m as the example. The bases provides the equivalent Mean Seal Level (MSL) value for an indicated basin level of 19.28 m. The reason for providing the SR values in terms of basin indicated level instead of MSL, is so that on a basin level instrument failure, the operators could confirm basin operability by actually measuring the water level in the basin. The Bases for LCO 3.7.2 and LCO 3.7.3 reference the Bases for LCO 3.7.1 where the example is provided. No change to the TS is required.

As a result of this RAI response, the following changes will be made to the COLA:

COLA Part 9, Table 3.0-1, Acceptance Criteria 2.(a), will be revised as follows:

> The centerline elevation of the RSW pump suction lines are at a maximum Elev. ~~3.35~~2.44 m MSL at the interface with the UHS basin wall.

COLA Part 2, Tier 2, Section 9.2.5.5.2(7), will be revised as follows:

> A perforated plate will be installed above the suction line intakes to prevent large debris from entering the system and preclude vortex formation during operation. The minimum water level in the UHS basin after 30-day operation following a DBA is set at ~~1.83~~2.74 meters above the pump suction line's centerline at the interface with the UHS basin.

COLA Part 2, Tier 2, Section 9.2.5.7.3, will be revised as follows:

> Valves and other components essential to operation of the UHS system are located inside the RSW pump house. These structures prevent rainwater or snow from impinging on the components of the system, thereby protecting them from freezing or icing. The UHS basin is partially below grade, such that ground temperature maintains the water temperature above freezing and the RSW pump suction is placed ~~approximately 1.83~~2.74 meters below the minimum water level in the UHS basin at the end of 30-day operation following a DBA. The UHS is designed with a provision to bypass the cooling tower during cold weather operation (see Subsection 9.2.5.4.2). Ice formation in the UHS water storage basin is not expected to occur since the system is in service during all operating modes of the reactor (normal, hot standby, normal shutdown, startup, loss of preferred power, and emergency shutdown) and the climate in the vicinity of the site is temperate (Section 2.3).

COLA Part 2, Tier 2, Table 9.2-17, Design Data for Reactor Service Water System, will be revised as follows:

Design data		**Division A**	**Division B**	**Division C**
RSW design flow rate to RCW heat exchangers	m3/h	3240	3240	3240
RCW heat exchanger temperature increase at maximum load	°C	6.3	6.4	6.6
RCW heat exchanger pressure drop	MPa	[1]	[1]	[1]
RSW pump NPSH required	m	[1]	[1]	[1]
RSW pump NPSH available at pump's centerline based on the minimum water level of ~~1.83~~2.74 m above suction line's centerline	m	~~16.9~~15.9	~~16.9~~15.9	~~16.9~~15.9

COLA Part 2, Tier 2, Section 9.2.15.2.1(2), will be revised as follows:

> The available NPSH referenced to the pump centerline is approximately ~~17~~16 meters considering all losses, including entrance losses. The RSW pump purchase documents will specify that the NPSH required at the pump centerline shall be less than the NPSH available for all operating modes of the RSW pump. The required NPSH for the RSW pumps at pump suction locations considering anticipated low water levels will be provided following procurement, but before installation of equipment, in Table 9.2-17. (COM 9.2- 1) The design data for the RSW pumps is provided in Table 9.2-13.

COLA Part 2, Tier 2, Table 9.2-18, RSW System Performance Data for Various Modes of Operation, shall be revised as follows:

Operating Mode	RSW Flow per division (m3/h)	No. of heat exchangers in operation	Flow through each heat exchanger (m3/h)	No. of pumps in operation per division	RSW Pump total head (m)
Normal	3240	2	1620	1	~~65.5~~65.6
Reactor Shutdown 4 Hours	4860	3	1620	2	~~70.1~~55.3
Reactor Shutdown 24 Hours	4860	3	1620	2	~~70.1~~55.3
Hot Standby	4860	3	1620	2	~~70.1~~55.3
Hot Standby LOPP	4860	3	1620	2	~~70.1~~55.3
LOCA	4860	3	1620	2	~~70.1~~75.5

COLA Part 2, Tier 2, Section 19R.1(5), will be revised as follows:

The RSW pump house could also be potentially flooded by breaks in the RSW system, which is an unlimited source of water from the Ultimate Heat Sink (UHS). The RSW pump house has two floors, the pump room floor at elevation (-) ~~22~~18 ft, and the electrical and HVAC room at elevation 14 ft, and is divided into three physically separate sections, by 3 hour fire-rated concrete walls and 3 hour fire-rated watertight doors between the pump rooms and between the electrical and HVAC rooms. The watertight doors provide emergency and maintenance access to the rooms on each level. The watertight doors are capable of withstanding full flood pressure in either direction, and are alarmed at a security alarm station if open, and in the Control Room if not dogged closed.

The roof of the RSW pump house is at elevation 50 ft, which is above the site Design Basis Flood level. There are no openings into the RSW pump house below 50 ft. The entrance to the RSW pump house is from the roof.

Within each RSW pump rooms, two lines from the UHS, at approximately ~~11~~8 ft elevation, supply water to the two, horizontal RSW pumps in each division through a normally open, locked open, manual valve.

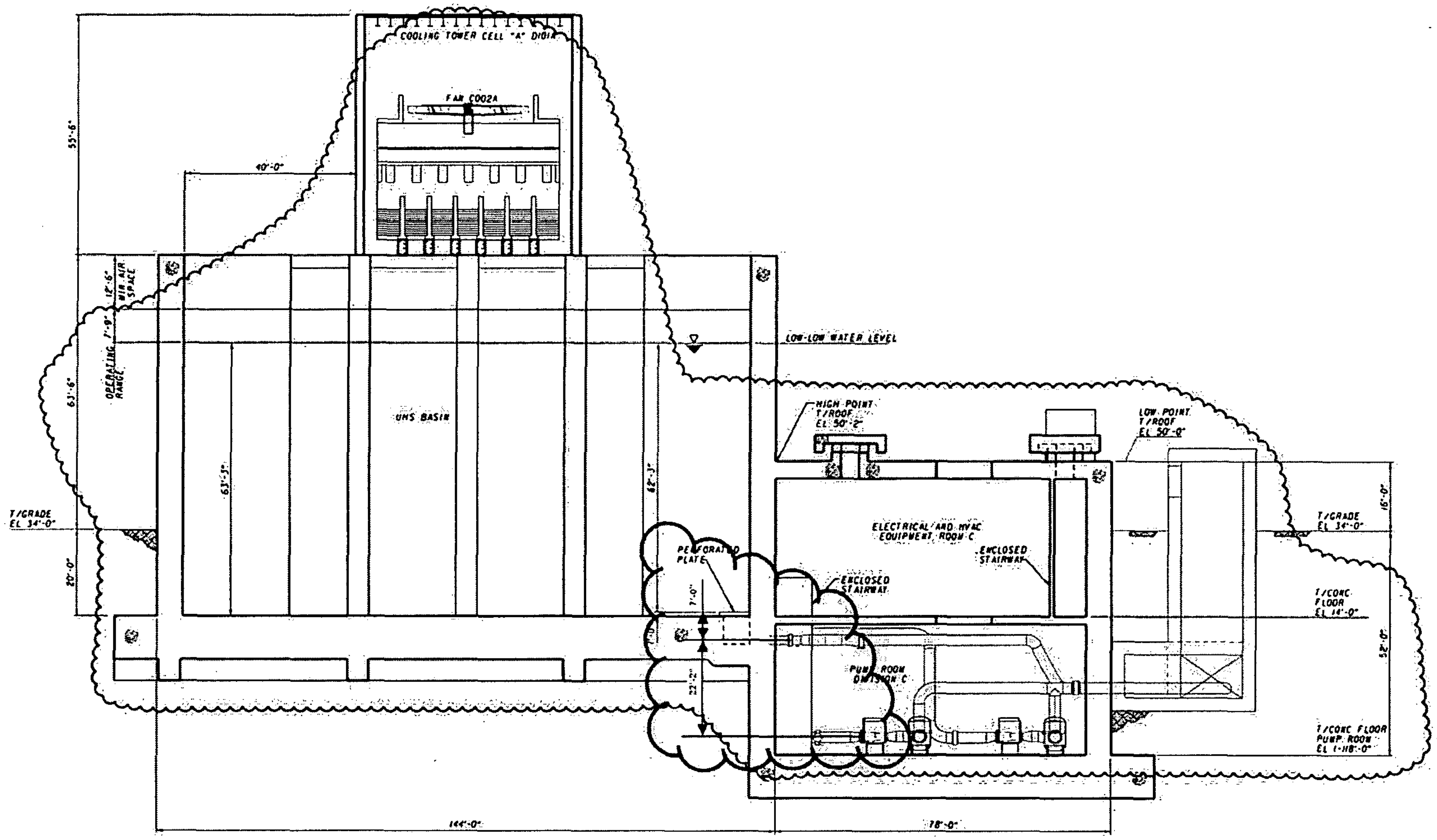
COLA Part 2, Tier 2, Section 3H.6.3.1, shall be revised as follows:

> The pump house is contiguous with the UHS basin and its walls extend from an elevation of ~~-22~~18 ft (~~-6.71~~5.49 m) MSL to an elevation of 50 ft (15.24 m) MSL.

COLA Part 2, Tier 2, Section 3H.6.3.3, shall be revised as follows:

> The pump bay for each pump house measures approximately 42 ft (12.80 m) by 72 ft (21.95 m) in plan, with the top of the bay slab being located at elevation - ~~22~~18ft (~~-6.71~~5.49 m).

COLA Part 2, Tier 2, Figure 1.2-35 will be replaced with the following, more current sectional drawings of the UHS, to be consistent with the text of the COLA.


COOLING TOWER CELL "A" DIGIA
FAN C002A
55'-6"
40'-0"
12'-6"
MIN AIR SPACE
OPERATING RANGE
7'-9"
63'-6"
LOW-LOW WATER LEVEL
UHS BASIN
63'-3"
62'-3"
T/GRADE EL 34'-0"
20'-0"
HIGH POINT T/ROOF EL 50'-2"
LOW POINT T/ROOF EL 50'-0"
ELECTRICAL AND HVAC EQUIPMENT ROOM C
ENCLOSED STAIRWAY
PERFORATED PLATE
7'-0"
PUMP ROOM DIVISION C
22'-2"
16'-0"
T/CONC FLOOR EL 14'-0"
52'-0"
T/CONC FLOOR PUMP ROOM EL 1-18'-0"
144'-0"
78'-0"

SECTION I

RAI 09.02.05-2

QUESTION:

In the COL application Tier 2, Table 9.2-26, the data for the ultimate heat sink (UHS) basin temperature is missing. However, this data is shown in Figure 9.2-17. The NRC staff requests the applicant to complete the table.

RESPONSE:

COLA Part 2, Tier2, Table 9.2-26 will be revised as follows to include the missing UHS temperature data.

Table 9.2-26 UHS Basin Water Maximum Temperature (Case D2)

Time (hr)	Time (Days)	WBT (°C)	DBT (°C)	Heat Load (MW)	Mass Evap. After DBA (kg)	Daily Mass Evap. Rate After DBA (kg/hr)	Basin Temp (°C)
0	0	24.6	26.1	4.60E+03	0.00E+00	—	32.2
1		24.3	27.8	1.32E+02	2.27E+05	2.27E+05	32.3
2		24.1	29.4	1.18E+02	4.08E+05	—	32.2
3		23.9	31.1	1.12E+02	5.90E+05	—	32.0
4		23.6	32.2	1.09E+02	7.71E+05	—	31.8
5		24.1	32.8	1.06E+02	9.53E+05	—	31.6
6		23.7	35.0	1.04E+02	1.13E+06	—	31.4
7		23.1	33.9	1.03E+02	1.32E+06	—	31.3
8		23.7	32.8	1.01E+02	1.50E+06	—	31.1
9		24.2	33.3	1.00E+02	1.68E+06	—	31.0
10		23.9	32.2	9.87E+01	1.81E+06	—	30.9
11		24.1	31.7	9.74E+01	2.00E+06	—	30.8
12		23.4	29.4	9.67E+01	2.13E+06	—	30.7
13		23.3	27.8	9.61E+01	2.31E+06	—	30.6
14		22.9	26.7	9.55E+01	2.45E+06	—	30.4
15		22.4	25.0	9.48E+01	2.59E+06	—	30.2
16		22.4	25.0	9.42E+01	2.72E+06	—	30.1
17		22.2	24.4	9.37E+01	2.86E+06	—	29.9
18		22.1	23.9	9.33E+01	2.99E+06	—	29.7
19		21.9	23.3	9.29E+01	3.08E+06	—	29.6
20		21.0	22.8	9.26E+01	3.22E+06	—	29.4
21		21.0	22.8	9.22E+01	3.36E+06	—	29.2
22		21.3	22.8	9.19E+01	3.49E+06	—	29.1
23		21.7	22.8	9.15E+01	3.63E+06	—	29.0
24	1	22.8	23.9	9.11E+01	3.72E+06	1.55E+05	29.0
25		24.2	27.2	8.87E+01	3.81E+06	—	29.0

26		23.9	28.9	8.62E+01	3.95E+06	—	29.1
27		23.6	30.0	8.37E+01	4.08E+06	—	29.1
28		23.9	32.2	8.17E+01	4.22E+06	—	29.1
29		23.7	32.8	8.15E+01	4.31E+06	—	29.1

RAI 09.02.05-3

QUESTION:

The design of the ultimate heat sink (UHS) system needs to reject the required amount of heat under all conditions to satisfy GDC 44. The applicant did not state nor justify the amount of excess margins that are included in the design to account for uncertainties, component wear and aging effects, fouling of heat transfer surfaces and spray nozzles, strainer debris collection, etc. Identify in the FSAR the margins in the design and discuss why the specified margins are considered to be adequate.

RESPONSE:

As stated in DCD Section 9.2.5.1(2), "In the event of an accident, the UHS is designed to provide sufficient cooling water to the RSW System to safely dissipate the heat for that accident." Detailed design of the UHS and associated systems has not progressed far enough to include specific numbers on margin in this response. However, a number of margins are included in the design of the UHS and its associated systems to assure conservatism for potential uncertainties. Examples of these margins include the following:

1. COLA Part 2, Tier 2, Table 9.2-4d, and COLA Part 7, Section 3.0, Standard Departure 9.2-1, specify the Reactor Building Cooling Water (RCW) heat exchanger capacities of 50.1 Gj/h and 46.1 Gj/h for Divisions A/B and Division C, respectively. This heat exchanger design capacity includes 20% margin to allow for fouling, as stated in Standard Departure 9.2-1. DCD Tier 1, Section 2.11.3, Reactor Building Cooling Water System, also discusses that the RCW heat exchanger heat removal capacities include a 20% margin above the minimum required for design basis accident conditions. The RCW heat exchangers are the interface point between the RCW system and the Reactor Service Water (RSW) system.

2. Margin in hydraulic performance analyses to account for worst case system operating conditions (i.e. fouled cooling tower spray nozzles and heat exchanger conditions, high RSW strainer differential pressure, etc.) and uncertainties for design evolution and procurement.

3. Margins will be included in the performance requirements for procured components and equipment, to account for wear and aging effects (i.e. RSW pump head and flow capacities). Additionally, margin will be included in the thermal performance requirements for the mechanical draft cooling towers.

The cumulative effect of these margins provides adequate assurance that the functional requirements of GDC 44 are satisfied, however neither GDC 44, RG 1.27 or the Standard Review plan specify any minimum margin requirements in the design of the UHS.

No COLA revision is required as a result of this RAI response.

RAI 09.02.05-4

QUESTION:

Regulatory Guide 1.27 states that the ultimate heat sink (UHS) be able to operate for 30 days without makeup, unless a very reliable water source is demonstrated. The COL application states that approximately 61 million kilograms is required to satisfy this criterion. However, the water level within the UHS basin that is equivalent to this inventory is not consistently stated within the application. FSAR Section 16.3.7.1 SR 3.7.1.1 states that the water level in the UHS basin is to be greater than 19.28 m (This value is also stated in SR 3.7.2.1 and 3.7.3.1.). It is unclear where this level is to be measured from. Also, these levels are not consistent with the minimum level presented in FSAR Section 9.2.5.7.1 where the required water level is given as 23.55 m above mean sea level (MSL). Finally, none of these levels seems consistent with Figure 1.2-35 presented in FSAR Section 21 of the COL application where the minimum water level is found to be 20.3 m (66.5 ft) from the bottom of the pool or 14.2 m (46.5 ft) above MSL (although the electronic copy of the figure is difficult to read). Clarify in the FSAR the minimum water level required for 30 days operation and correct inconsistencies in the COL application.

RESPONSE:

The normal operating minimum basin water elevation is 19.28 m (63'-3"), as specified in Surveillance Requirements (SR) 3.7.1.1, 3.7.2.1 and 3.7.3.1, with respect to the UHS basin floor. Since the UHS basin floor is at an elevation of 4.27 m (14') MSL, this water level is consistent with FSAR Section 9.2.5.7.1, which specifies a minimum water level of 23.55 m (77'-3") MSL.

FSAR Section 21, Figure 1.2-35, will be updated to correct the basin water elevation to be consistent with FSAR Section 16.3.7.1, SRs 3.7.1.1, 3.7.2.1, 3.7.3.1 and FSAR Section 9.2.5.7.1. As part of the response to RAI 09.02.05-1, the new figure shows the low-low water level at 19.28 m (63'-3") with respect to the bottom of the basin, or 23.55 m (77'-3") MSL.

As a result of this RAI response, COLA Part 2, Tier 2, Section 9.2.5.7.1 will be revised as follows:

> The analysis assumed that the UHS basin estimated water temperature at the beginning of LOCA is 32.2°C and the water inventory in the UHS water storage basin is 60,950,049 kilograms corresponding to the low-low level (elevation 23.55-meters MSL, corresponding to a basin water level of 19.28 meters above the basin floor). At the end of the 30-day operation following a LOCA, if no makeup is available, the level in the UHS water storage basin will be at elevation 5.18 meters MSL and the total water inventory will decrease to 2,897,869 kilograms.

RAI 09.02.05-5

QUESTION:

STP COL FSAR Section 9.2.5.1(3), Interface Requirement, states that the ultimate heat sink (UHS) water chemistry limits will not be exceeded after operation for 30 days without makeup. However, the application does not demonstrate that the water chemistry is acceptable after 30 days of water loss without makeup. The applicant should address this interface requirement within the COL application.

RESPONSE:

This interface requirement will be satisfied by procuring equipment and components which are suitable for the worst projected water chemistry conditions that may exist in the UHS after 30 days of operation without makeup. Additionally, the heat loads to be rejected to the UHS basin will decay significantly so that the heat load at the end of the 30 day period is small, when the concentration of scale forming constituents would be maximized. Therefore, the effects of UHS water chemistry change will not prevent associated structures, systems and components from accomplishing their safety related function.

No COLA revision is required as a result of this RAI response.

RAI 09.02.05-6

QUESTION:

GDC 44 requires that the ultimate heat sink (UHS) be operable under all anticipated conditions to assure rejection of required heat loads. However, the COL application does not discuss the specific problems of corrosion, erosion and biological fouling that is specifically addressed by Generic Letter 89-13. This letter presents information on flow and pressure monitoring, maintenance, testing, inspection, and control functions that should be considered. The COL applicant should address how the South Texas design is to deal with these problems considering the two water sources that are proposed to be used.

RESPONSE:

The following provisions in the design of the UHS, identified in COLA Part 2, Tier 2, address the concerns of Generic Letter 89-13.

FSAR Section 9.2.17.2(1) states, "The RSW/UHS water is periodically tested to ensure that the water chemistry is maintained in the acceptable limits. Periodic visual inspection of the intake structure is scheduled to detect biofouling and removal of any fouling accumulations that are detected."

FSAR Section 9.2.5.4.1 states, "Chemicals are added to control corrosion, scaling, and biological growth in the UHS. Sulfuric acid will be added for scale control as well as other chemicals such as a corrosion inhibitor, scale inhibitor, and dispersant. A hypochlorite or alternative biocides feed system is provided to inhibit biological growth in the UHS water storage basin. The chemicals are added to the UHS water storage basin as needed based on sampling and analysis."

FSAR Section 9.2.5.5.2(5) states, "The bottom of the UHS water storage basin is provided with a 0.3 meter-tall curb to prevent sediment migration to the RSW pump."

All of these provisions to maintain UHS basins water quality are utilized whether make-up is being provided from the site wells or the Main Cooling Reservoir.

As stated in FSAR Section 9.2.5.3.1, the design of the UHS system meets the requirements of GDC 46.

Per DCD Tier 2, Table 14.3-12, the UHS provides cooling water to the Reactor Service Water (RSW) system. The STP Units 3 & 4 RSW system is considered an open-cycle system as identified in Generic Letter 89-13, because it interfaces directly with an ultimate heat sink.

Flow and pressure monitoring instrumentation for the RSW system is indicated in FSAR Figure 9.2-7. Additional features of the RSW system related to Generic Letter 89-13 are described in FSAR Section 9.2.15 and 9.2.17.2.

Routine in-service inspection and surveillance testing will be performed for those components in the RSW system covered under ASME Section XI.

Two pump operation mode, of the RSW system, is the reference mode used for monitoring long term changes in system head loss characteristic of each division as a result of gradual wetted surfaces corrosion and corrosion product buildup. Such monitoring is performed periodically during initial plant startup and during the first few months of operation. It is then repeated at least once a year until the system head loss characteristic appears to have stabilized, and at least once every refueling outage thereafter.

No COLA revision is required as a result of this RAI response.

RAI 09.02.05-7

QUESTION:

GDC 44 requires that the ultimate heat sink (UHS) be operable under all anticipated conditions to assure rejection of required heat loads. STP COL FSAR Section 9.2.5.9 states that any components required for UHS operation of Divisions A and B can be operated from the remote shut down system (RSS). This implies that Division C is only operable from the main control room. However, nowhere within the FSAR is it stated that the any of three divisions can be operated from the main control room. Also, the "components required for UHS operation" are not itemized. The applicant should update the FSAR to include these details of the UHS operation and control. Operation of Division A and B of the UHS from the RSS is also required by ITAAC 3.0-1.4 presented in Part 9 of the FSAR. Here it states that Figure 3.0-1 illustrates where the controls are sent. However, Figure 3.0-1 does not specify where the displays and controls are sent. Since a single figure is provided, it is assumed that all three divisions are treated in a similar fashion, which is not consistent with FSAR Section 9.2.5. Finally, the acceptance criteria for ITAAC 3.0-1.4 states that the controls will exist in the main control room, and does not validate their existence in the RSS. The applicant should include more details in the ITAAC section, and ensure that these details are consistent with the design as presented in Tier 2.

RESPONSE:

Per DCD Tier 2, Table 14.3-12, the UHS provides cooling water to the Reactor Service Water (RSW) system. As shown in DCD Tier 2, Figure 7.3-7, Reactor Building Cooling Water/Reactor Service Water System IBD, any of the three divisions of the RSW system can be operated from the main control room. Main control room panel (MCRP) manual operation of RSW Division A components is indicated on sheets 11, 13, 18 & 19 of DCD Tier 2, Figure 7.3-7. Sheet 1 of DCD Tier 2, Figure 7.3-7 states IBD is typical for Divisions B & C of RCW/RSW.

"Components required for UHS operation" (i.e. RSW components operated from RSS) are listed in DCD Tier 2 Section 7.4.1.4.4, Remote Shutdown Capability Controls and Instrumentation-Equipment, Panels, and Displays and are indicated on STP COL FSAR Figure 7.4-2, Remote Shutdown System IED.

As a result of this RAI response, the following changes will be made to COLA Part 9, Section 3, Site-Specific ITAAC, Item 4, Acceptance Criteria, of Table 3.01-1with changes indicated by gray shading:

> Displays and controls ~~exist in the main control room and as shown on Figure 3.0.1~~ for required functions of the UHS system exist in the main control room for all three divisions of RSW as shown in DCD Tier 2, Figure 7.3-7. Displays and controls for required functions of the UHS system exist in the remote shutdown system for RSW Divisions A and B and are shown on Figure 7.4-2.

RAI 09.05.02-2

QUESTION:

In DCD Subsection 9.5.13.11(4) concerning COL License Information Item 9.28, the COL applicant is required to perform an evaluation to ensure that EMI from plant equipment startup or power transfers will not create nuisance alarms or trip security access control systems. The STP COL FSAR Subsection 9.5.13.11 does not provide sufficient information how this can be accomplished.

The NRC Staff requests that STPNOC to provide additional information on the program or procedure to address the EMI and RFI effects from other plant equipment on communications systems.

RESPONSE:

COL item 9.5.13.11(4) states:

> **9.5.13.11 Plant Security Systems Criteria**
>
> (4) Electromagnetic interference from plant equipment startups or power transfers will not create nuisance alarms or trip security access control systems.

COL License Item 9.5.13.11(4) will be addressed to the extent practical during acceptance testing of plant security systems to ensure that nuisance alarms or tripping of security access control systems does not result from equipment startups or power transfers.

In addition, COL Item 9.5.13.11(4) is currently addressed in COLA Rev. 2, Part 2, Tier 2, Subsection 9.5.13.11 as follows:

> Relevant design provisions include:
>
> - The potential for use of portable security radios to interfere with plant monitoring equipment or for electromagnetic interference to adversely impact the as-built security alarm or access systems is addressed as part of the comprehensive Electromotive Compatibility (EMC) compliance plan discussed in Tier 1 Section 3.4.B and associated ITAAC in Table 3.4, Design Commitment No. 12.

No COLA revision is required as a result of this RAI response.

RAI 10.02-1

QUESTION:

In STP FSAR Tier 2, Section 10.2.2.4, "Turbine Overspeed Protection System," the applicant stated that the normal speed control is the first line of defense against the turbine overspeed. Also, it is stated that the system includes the turbine main control valves, intermediate steam intercept valves, extraction system non-return valves, and fast acting valve-closing functions within the electro hydraulic control (EHC) system. The normal speed control unit utilizes three speed signals, loss of any of these signals initiates a turbine trip via emergency trip system (ETS). Further, it is stated that an increase in speed above setpoint closes the control and intercept valves in proportion to the speed increase. It is not clear to the staff from the FSAR description at what percentage of rated speed the normal speed control function proportionally closes and fully closes steam valves.

The regulatory basis and review criteria that the staff used for the turbine generator (TG) system is specified by General Design Criterion (GDC) 4, "Environmental and Dynamic Effects Design Bases," as it relates to the TG system for protection of structures, systems, and components (SSCs) important to the safety from the effects of turbine missiles by providing a turbine overspeed protection system (with suitable redundancy) to minimize the probability of generation of turbine missiles. Also, SRP guidance in Item 2.B, Section III, "Review Procedure," of SRP Section 10.2, "Turbine Generator," states that for normal speed control, the EHC fully cuts off steam to the turbine at approximately 103 percent of the turbine rated speed by closing the control and intercept valves. Therefore, in order to meet this GDC 4 criteria and SRP guidance, the staff requests the applicant to provide clarification and/or additional information with respect to the details on the normal overspeed protection of the STP TG system, as it relates to GDC 4 criteria and SRP guidance in this regard.

RESPONSE:

For normal speed control, the turbine control system (EHC) tends to close the control and intercept valves in proportion to the speed increase above the speed setpoint. The EHC fully shuts off steam to the high pressure turbine (HP) at approximately 105% of the turbine rated speed by closing the turbine control valves, and the EHC fully shuts off steam to the low pressure turbines (LPs) at approximately 107% of the turbine rated speed by closing the intercept valves. In addition, normal speed control is supplemented by the Power-Load Unbalance (PLU) function. The PLU uses the difference between turbine mechanical power and load indications to control overspeed in the event of a full load rejection. Redundant measurements of high pressure turbine exhaust steam pressure and generator current are used as inputs to the PLU function. Upon a prescribed power/load unbalance condition approximately greater than 40%, the fast-acting solenoid valves of the control valves and the intercept valves are energized to trip these valves to prevent rapid turbine acceleration.

As a result of this RAI response, COLA Part 2, Tier 2, Section 10.2.2.4 will be revised as follows with changes indicated by gray shading:

10.2.2.4 Turbine Overspeed Protection System

The information in this subsection of the reference ABWR DCD is replaced in its entirety with the following information.

STP DEP 10.2-3

The normal speed control system comprises a first line of defense against turbine overspeed. This system includes the main steam control valves, intermediate steam intercept valves, extraction system non-return valves, and fast-acting valve-closing functions within the EHC system. The normal speed control unit utilizes three speed signals. Loss of any two of these speed signals initiates a turbine trip via the Emergency Trip System (ETS). An increase in speed above setpoint tends to close the control and intercept valves in proportion to the speed increase. The EHC fully shuts off steam to the high pressure turbine (HP) at approximately 105% of the turbine rated speed by closing the turbine control valves, and the EHC fully shuts off steam to the low pressure turbines (LPs) at approximately 107% of the turbine rated speed by closing the intercept valves. Rapid turbine accelerations resulting from a sudden loss of load at higher power levels normally initiate the fast-acting solenoids via the speed control system's Power-Load Unbalance (PLU) function, to rapidly close the control and intercept valves irrespective of the current turbine speed. The PLU uses the difference between turbine power and load indications, high pressure turbine exhaust steam pressure and generator current, respectively, to control overspeed in the event of a full load rejection. The normal speed control system is designed to limit peak overspeed resulting from a loss of full load, to at least 1% below the overspeed trip set point. Typically, this peak speed is in a range of 106-109% of rated speed, and the overspeed trip set point is typically close to 110% of rated speed. All turbine steam control and intercept valves are fully testable during normal operation. The fast closing feature, provided by action of the fast-acting solenoids, is testable during normal operation.

If the normal speed control and the PLU function should fail, the overspeed trip devices close the steam admission valves including the main and intermediate stop valves. This turbine overspeed protection system comprises the second line of defense against turbine overspeed. It is redundant, highly reliable and diverse in design and implementation from the normal speed control system and protection system. This overspeed protection system is designed to ensure that even with failure of the normal speed control system; the resulting turbine speed does not exceed 120% of rated speed. In addition, the components and circuits comprising the turbine overspeed protection system are testable when the turbine is in operation.

RAI 10.02-2

QUESTION:

STP FSAR Section 10.2.2.4, "Turbine Overspeed Protection System," it is stated that if the normal speed control should fail, the overspeed trip devices close the main steam and intermediate stop valves. It is also stated that this overspeed trip device is the second line of defense against the turbine overspeed. It is further stated that with failure of the normal speed control system, the resulting turbine speed does not exceed 120 percent of the turbine rated speed. However, Items 2.C and 2.D of the SRP Section 10.2.III describe that the second line of defense for the turbine overspeed are: 1) a mechanical overspeed trip device that will actuate the control, stop, and intercept valves to close at approximately 111 percent of the rated turbine speed, and 2) at approximately 112 percent, an independent and redundant backup electrical overspeed trip device senses the turbine speed and closes all the above cited turbine valves, and protects turbine against the overspeed.

STP FSAR Section 10.2.2.4 is not clear in its description of the primary and secondary overspeed trip devices/systems with respect to design features and trip actuation setpoints of these devices. Therefore, the staff requests the applicant to provide the following additional information and/or clarifications with full justifications:

1) Describe the setpoints for the normal overspeed and the primary and emergency overspeed systems, with full descriptions, how they function.
2) Provide how the two electrical overspeed (primary and emergency) systems are diverse. Describe, and also provide schematics and logic diagrams to depict how the overspeed systems are diverse and independent.
3) Clarify whether, all of these (normal and two) overspeed systems share any common components or processors/inputs. If so, provide an evaluation of the impact of failures of any such features/components.
4) Is there any software used for processors or performing trip logic actuations? If so, is it common to any of the above?
5) Explain the diversity and defense-in-depth used to defend against a common cause failure (CCF) of the processors.
6) More importantly, address how the STP turbine control and overspeed control systems meet the SRP acceptance criteria described in Section II, "Acceptance Criteria," of SRP Section 10.2, and also described in Item 2.A in Section III (Review Procedure) of SRP Section 10.2.

RESPONSE:

The description of the normal overspeed control system is provided in response to RAI 10.02-1. The descriptions of the Primary and Emergency overspeed trip functions are provided herein.

The overspeed protection system consists of the Primary overspeed trip function and the Emergency overspeed trip function. The Primary overspeed trip function is redundant and utilizes three speed sensors that are separate from those used for normal speed control. Each speed signal is compared to a speed setpoint of approximately 110% of rated speed, and produces trip signals arranged in two-out-of-three logics, to de-energize the pilot solenoids of one of the two trip solenoid valves of the electro-hydraulic Emergency Trip Device (ETD). The ETD has two redundant trip solenoid valves. Tripping of either redundant trip solenoid valves will drain the emergency trip fluid, resulting in a turbine trip.

The Emergency overspeed trip function is also redundant and uses three speed sensors that are separate from those used by the Primary overspeed trip function. The speed setpoint for this trip function is approximately 111% of rated speed. The trip signals are arranged in two-out-of-three logics to de-energize the pilot solenoids of the other trip solenoid valve in the ETD to cause a turbine trip.

The overspeed trip functions are redundant and diverse. Each overspeed trip function (Primary and Emergency) itself uses two-out-of-three trip logics. Diversity is achieved between the Primary and Emergency trip functions by using different logic devices for each function. The Emergency overspeed trip function uses the same sensors used for normal speed control. However, the failure of any two of these speed sensors will result in a turbine trip.

A turbine trip will result in an orderly reactor shutdown. The scenarios and sequence of events following a turbine trip are discussed in FSAR Section 15.2.3. Periodic testing of the overspeed trip function components important to safety during operation at rated load is discussed in FSAR Sections 10.2.2.7, "Testing" and 10.2.3.6, "Inservice Inspection."

Note that the trip logic actuations are performed using logic devices, which perform specific functions and do not run any software. As such, there are no microprocessors and therefore no common cause failures of processors.

As a result of this RAI response, COLA Part 2, Tier 2, Section 10.2.2.4 will be revised as follows with changes indicated by gray shading:

10.2.2.4 Turbine Overspeed Protection System

The information in this subsection of the reference ABWR DCD is replaced in its entirety with the following information.

STP DEP 10.2-3

The overspeed trip system is electrical, redundant and diverse and consists of the Primary and Emergency overspeed trip functions. Reliability is achieved by using two sets of redundant speed sensing probes, which input to the independent and diverse Primary and Emergency Trip modules in the control system. For additional reliability, two-out-of-three logic is employed in both the Primary and Emergency overspeed trip circuitry. Either trip module can de-energize the trip solenoids of the electro-hydraulic

Emergency Trip Device (ETD). The ETD is composed of two independent trip solenoid valves, each with two normally energized solenoid operated pilot valves. The solenoid operated pilot valves de-energize in response to detection of an overspeed condition by the turbine speed control logic. De-energization of both solenoid operated pilot valves is necessary to cause the spool in their respective trip solenoid valve to reposition, which depressurizes the emergency trip fluid system, rapidly closing all steam inlet valves. Accordingly, the repositioning of only one of the two trip solenoid valves is necessary to trip the main turbine. A single component failure does not compromise trip protection, and does not result in a turbine trip. Each trip solenoid valve in the ETD is testable while the turbine is in operation.

The overspeed sensing devices are located in the turbine front bearing standard, and are therefore protected from the effects of missiles or pipe breakage. The hydraulic lines are fail-safe; if one were to be broken, loss of hydraulic pressure would result in a turbine trip. The ETD is also fail-safe. Each trip solenoid transfers to the trip state on a loss of control power, resulting in a turbine trip. These features provide inherent protection against failure of the overspeed protection system caused by low trajectory missiles or postulated piping failures.

~~The Primary and Emergency electrical overspeed trip modules each consist of three independent circuits. Each circuit monitors a separate speed signal and activates trip logic at specific speed levels.~~ The overspeed protection system consists of the Primary overspeed trip function and the Emergency overspeed trip function. The Primary overspeed trip function is redundant and utilizes three speed sensors that are separate from those used for normal speed control. Each speed signal is compared to a speed setpoint of approximately 110% of rated speed, and produces trip signals arranged in two-out-of-three logics, to de-energize the pilot solenoids of both trip solenoid valves of the electro-hydraulic Emergency Trip Device (ETD). The ETD has two redundant trip solenoid valves. Tripping of either redundant trip solenoid valves will drain the emergency trip fluid, resulting in a turbine trip.

The Emergency overspeed trip function is also redundant and uses three speed sensors that are separate from those used by the Primary overspeed trip function. The speed setpoint for this trip function is approximately 111% of rated speed. The trip signals are arranged in two-out-of-three logics to de-energize the pilot solenoids of both trip solenoid valves in the ETD to cause a turbine trip. Either the Primary or Emergency trip will de-energize the pilot solenoids in both trip solenoid valves of the ETD.

Commitment Number	Commitment Statement	Due Date
07-13868-1	(1) Technical requirements will be provided in the procurement document for the refrigerators to ensure there are provisions for adjusting the refrigerator capacity to chilled water outlet temperature. (2) Detailed design documents will be provided for starting and stopping the pump and refrigerator on proper sequence. (3) Technical requirements will be provided in the procurement documents for the pumps and refrigerators to ensure that the design of the pumps and refrigerators are capable of automatic restart, after a loss of electrical power for up to two (2) hours, under the expected environmental conditions during station blackout when electrical power is restored. (4) Technical requirements in the procurement documents will include national standards for design, fabrication, and testing to minimize the potential for coolant leakage or release into system or surrounding equipment environs. (5) After procurement of equipment, transient effects on starting and stopping or prolonged stoppage of the refrigeration/chiller units will be evaluated. The evaluation will include such effects as high restart circuit drawdowns on safety buses, coolant-oil interactions, degassing needs, coolant gas leakage, or release in equipment areas along with flammability threats, synchronized refrigeration swapping.	Prior to fuel load 6/1/2014