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RBG-47471

May 29, 2014

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

SUBJECT: Supplement to License Amendment Request 2013-18, Revision of Ultimate Heat Sink Design Capacity
River Bend Station – Unit 1
Docket No. 50-458
License No. NPF-47

REFERENCE: 1. Entergy letter to NRC, dated February 10, 2014, License Amendment Request 2013-18, Revision of Ultimate Heat Sink Design Capacity (Letter No. RBG-47432)

RBF1-14-0080

Dear Sir or Madam:

By way of the referenced letter, Entergy submitted a request to amend the River Bend Station operating license to revise the design basis capacity of the ultimate heat sink. During their acceptance review, the NRC staff determined that additional information is needed to complete the processing and approval of Entergy's request.

Attachment 1 to this letter contain the requested information. This letter contains no commitments. If you have any questions on this matter, please contact Joey Clark, Manager – Licensing, at 225-381-4177.

I declare under penalty of perjury that the foregoing is true and correct. Executed on May 29, 2014.

Sincerely,

Eric W. Olson

EWO/dhw

A001
NRR

Attachment 1: Response to RAI Questions

cc: Regional Administrator
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Attachment 1
RBG-47471

Response to Request for Additional Information

Question 1

The licensee states that "the UHS [ultimate heat sink] is capable of meeting the RG 1.27 guideline for 30 day inventory without makeup, considering no system leakage." In addition, the licensee states "system leakage was not part of the licensing basis" and thus the "the ability to provide makeup to the UHS in less than 30 days is only credited for non-design basis scenarios and, therefore, does not result in a failure of the UHS basin." The NRC staff's position is that the fully functioning system that does not adversely affect design requirements (last for 30 days without makeup) is part of the licensing basis by implication. System degradation or performance to a point where the system does not meet its design function means that the system is not meeting the design basis and licensing basis. The licensee has not stated in the LAR whether the system is degraded. Is the system degraded (somewhere in UHS/SSW) because of the leakage (and/or other reasons) as it cannot perform its design function without makeup.

Response

The service water system is composed of normal service water (NSW) and standby service water (SSW). Cooling to essential and non-essential components under normal conditions is provided by NSW. Under accident or loss of offsite power conditions, SSW provides cooling to essential loads.

The isolation between NSW and SSW is provided by automatic isolation valves SWP-MOV57A/B and SWP-MOV96A/B. These are 30-inch butterfly valves. The original valves were Jamesbury Model 800 valves with rubber seats. Due to leakage and obsolescence issues, these valves were replaced in 1997 with Atwood and Morrill tricentric butterfly valves, which are torque-seated valves. This change improved the seat leakage performance.

NUREG-0800, "Standard Review Plan", Section 9.2.1, "Station Service Water" does not require the SSW system or the associated UHS to be leak tight, only that provisions are available to detect leakage and to isolate, if required, so the safety function is not compromised.

RBS implements all stated leakage monitoring provisions described in the Safety Analysis Report (SAR) for both major and minor leakage. The leakage monitoring provisions as stated in the SAR are described below.

Large-scale leakage from the SSW system due to major piping or component failures can be detected by the following methods:

1. SSW flow in each redundant header is monitored and recorded. A mismatch in these readings indicates large-scale leakage.
2. Pump discharge header pressure is instrumented with transmitters that provide an alarm function.

Small-scale leakage from SSW piping or components can be detected by the following methods:

1. Routine maintenance and in-service inspection
2. Monitoring of building and tunnel sump levels
3. Monitoring the operation of components cooled by the SSW system.

The isolation valves separating NSW and SSW have no specified leakage criteria per NUREG-0800 Section 9.2.1. That document requires the valves to be designed to Quality Group C and seismic Category 1 requirements. The isolation valves at RBS are designed to Safety Class 3, seismic Category 1 requirements, which are functionally equivalent to Quality Group C and seismic Category 1.

Neither NUREG-0800 nor Regulatory Guide 1.27 provide any criteria related to the design of the UHS with respect to leakage. The losses required to be accounted for in the design and licensing basis are evaporation and drift losses. As a result, there are no design or licensing basis criteria established for leakage from SSW or the UHS.

Given the system and isolation valve design, the system currently is not, nor has it ever been, capable of meeting a 30-day UHS inventory, including realistic values for leakage. At the Technical Specification-minimum UHS water level, a leakage rate corresponding to the available system margin would be less than or equal to 1.1 GPM, which is unrealistic and unachievable with the system design. The established administrative limit for leakage is 15 GPM per division. Leakage is monitored, and the current documented leakage in Division 1 is 8.9 GPM, and 6.3 GPM in Division 2.

Neither the standby service water system nor the UHS are degraded. Standby service water and the UHS meet all design and licensing basis requirements.

Question 2

The application identifies system leakage as reducing the amount of UHS capacity after DBA from 30 days to 22 days. The application does not identify the location and quantity of system leakage and whether the system is degraded.

A) Identify whether the UHS and/or SWS is degraded and provide the basis for the operability determination.

Response

The design and licensing bases for the SSW and UHS are for 30 days of operation following a design basis accident (DBA), with a loss of offsite power and the failure of one emergency diesel generator. This is in accordance with the requirements of NUREG-0800 Sections 9.2.1 and 9.2.5. As discussed in the response to Question 1, the losses required to be accounted for in the 30-day supply are evaporation and drift. There are no specific leakage criteria or requirement to account for leakage in the 30-day design and licensing bases UHS supply. Neither the SSW system nor the UHS are degraded. SSW and the UHS meet all design and licensing bases requirements.

The basis for the 22-day UHS capacity after a DBA is different than the design basis case. The 22-day capacity is based on operation of the SSW and UHS post-DBA, with the loss of offsite power, and all electrical divisions and all essential equipment operating. This "maximum safeguards condition," with the addition of 30 GPM leakage (corresponding to the established 15 GPM per division leakage administrative limit) is the limiting scenario for basin capacity. The limiting scenario for UHS temperature is maximum safeguards condition, with a failure of one division of UHS fans.

The "maximum safeguards condition" is not part of the original design or licensing basis of the SSW system or UHS. This case was analyzed in response to a question raised by an inspector during the Engineering and Technical Support Inspection (March/April 1995). Per NRC Inspection Report 50-458/95-10: "The inspection team questioned if the ultimate heat sink would be able to maintain the standby service water temperature at 95 deg. F or lower for a case in which both safety related trains and divisions would be operable and a single active failure would be failure of one train of the forced cooling fans. The current analysis was performed for one safety-related train and division only, thus, this case was not analyzed. To address this issue, the licensee initiated Condition report 95-0282." An analysis of the "maximum safeguards condition" scenario was performed under calculation G13.18.13.2*086, Effects of Maximum Safeguards Operation on the Ultimate Heat Sink.

B) Discuss how you have quantified system leakage, identified leakage locations. If the system is degraded explain why leakage is not repaired.

Response

System leakage is primarily limited to the normal to standby service water interface valves SWP-MOV57A/B and SWP-MOV96A/B. Because SWP-MOV57A and B are in series with In-service Test Program check valves, these MOVs are not tested for leakage, as double isolation is provided. Leakage through SWP-MOV96A and B is periodically measured, either with NSW secured and depressurized and the associated SSW division operating, or with NSW operating and the downstream NSW manual valve (SWP-V1212 or SWP-V1213) isolated. If the first method is used, leakage is measured by determining the rate of water flow through a downstream drain valve. If the test is performed with NSW in operation, the leakage measured at the drain valve is adjusted for contribution from NSW by measuring the change in level at the NSW surge tank.

Due to the size and type of the isolation valves, leakage on the order of 7 GPM for 30" butterfly type valves is not unreasonable, and does not represent a condition requiring repair. Leakage at other locations in the SSW system is tracked via the corrective action process. The current total leakage rate for each division provided in the response to Question 1. The leaks identified in the corrective action process are repaired per the work management process. Also, as stated in the response to Question 1, the original isolation valves have been replaced with tricentric torque-seated butterfly valves having significantly better leakage characteristics than the original isolation valves. Other types of valves with better design characteristics for leakage cannot be used due to both physical space and pressure drop limitations.

Question 3

The UFSAR change as shown in attachment 3, which is the subject of the LAR, lists primary and alternate methods of adding water to the UHS basin after 22 days post DBA to make up for system leakage. Also, in answering the significant hazards analysis required by 10 CFR 50.92, the licensee has answered "no" to the question whether the LAR "significantly increase the consequences of an accident previously evaluated", with the justification that "adequate makeup sources are available within the approximate

22 day time frame. But the licensee has provided no justification as to why the makeup sources are adequate to compensate for a SSW/UHS system that does not leak.

A) Justify the availability of these makeup methods with respect to availability considering ability to withstand seismic and weather related events including tornadoes and tornado missiles and reliability of electric power sources. Identify time and resources to implement each method, describe flow path and SSC involved, and describe freedom of movement to implement alternate methods after a DBA.

Response

The makeup requirements and methods currently documented in the SAR are as follows:

The makeup water required after 30 days of operation is a maximum of approximately 164,000 gal/day. Additional make up is required for system leakage under licensing basis condition and when operating two divisions with system leakage. Primary makeup water is provided by the normal plant makeup wells which are described in (SAR) Section 9.2.3. Makeup to the basin is manually controlled to maintain the water level above el 111 ft. 10 in which is the minimum basin operating level. Should the primary makeup water source become unavailable, this makeup can be supplied by any of the following alternate methods:

1. Use temporary power to power the plant deep/shallow well pumps and provide makeup through the existing 4"-diameter pipeline into the SCT [standby cooling tower] basin. Also, the fire protection system can be used to provide make-up water into the SCT basin.

2. Temporary diesel driven pump, hoses, and valves can be used to pump CWS flume basin water into the SCT basin.

3. Temporary tank trucks, hoses and diesel driven pumps to transfer Mississippi River water into the SCT basin.

Details for implementation of these methods are provided in a site abnormal operating procedure. That procedure requires makeup to the UHS prior to reaching a water level of 90 ft. The station blackout diesel generator or portable diesel-driven Hale fire pump can be used to power existing pumps, or pump directly to the UHS from the water source. Both the station blackout diesel generator and the Hale fire pump are available on site. None of these methods are currently protected against seismic or weather related events. The time and resources required for implementation of each method and the freedom of movement assessments have not been specifically documented. However, as the site procedures require beginning makeup after 10 to 15 days of operation, and the minimum UHS level is not reached for 22 days, it is reasonable to conclude that one of the alternates can be implemented in a nominal 7-day period. Note that NUREG-0989 specifically evaluated using tank trucks to transport Mississippi River water to the UHS for makeup following 30 days of operation and determined this method to be acceptable. Given this method was previously determined to be acceptable, the implementation of this method prior to 30 days being reached should not negate its acceptability. A discussion on providing makeup to the UHS has also been included in the response to Operating License Order Number EA-12-049. Storage requirements, haul path requirements, and other aspects will be addressed in the station's response to FLEX Phase 3 requirements.

Question 4

According to Attachment 1, the 2002 UFSAR revision was made to account for operation with more than one division of standby service water (SSW) in operation because one emergency diesel generator (EDG) may not fail as a single failure, i.e. all EDGs may be available after a DBA.

A) Explain why this issue became pertinent circa 2002 and why this accounting was not previously considered.

Response

Per NUREG 0800 Section 9.2.1, Station Service Water System, Rev. 4 – June 1985, the system is considered to meet the requirements of General Design Criterion 44 as related to transferring heat from structures, systems and components important to safety to an ultimate heat sink based on the following:

A. The capability to transfer heat loads from safety-related structures, systems and components to a heat sink under both normal operating and accident conditions.
B. Component redundancy so that the safety function can be performed assuming a single active component failure coincident with the loss of offsite power.
C. The capability to isolate components, subsystems or piping if required so that the system safety function will not be compromised.
D. Meeting task action plant item II.K.1-C.1.22 of NUREG-0694 for boiling water reactors regarding automatic and manual actions necessary when the main feedwater system is not operable.

The regulatory acceptance criteria specifically includes a requirement to assume a single active component failure coincident with a loss of offsite power. Additionally, paragraph III.3.f of NUREG 0800 Section 9.2.1 further requires that "Essential components and subsystems necessary for safe shutdown can function as required in the event of loss of offsite power. The system design will be acceptable if the SWS meets minimum system requirements as stated in the SAR assuming a concurrent failure of a single active component, including a single failure of an auxiliary electric power source..."

Based on the above regulatory requirements, the UHS basin volume was designed per Regulatory Guide 1.27 requirements to support the SSW system function based on the limiting heat load requirements that would occur assuming a concurrent failure of a single active component, including a single failure of an auxiliary electric source.

Both the SSW and UHS meet these requirements, as documented in NUREG-0989 Section 9.2.5 and 9.2.7.

As previously stated, the "maximum safeguards condition" is not part of the original design or licensing bases of the SSW system or UHS. This condition was not required to demonstrate system acceptability per NUREG-0800. The "maximum safeguards condition" case was analyzed in response to a question raised during the Engineering and Technical Support Inspection (March/April 1995). Per NRC Inspection Report 50-458/95-10: "The inspection team questioned if the ultimate heat sink would be able to maintain the standby service water temperature at 95 deg. F or lower for a case in which both safety related trains and divisions would be operable and a single active failure would be failure of one train of the forced cooling fans. The current analysis was performed for one safety-related train and division only, thus, this case was not analyzed. To address this issue, the licensee initiated Condition report 95-0282." An analysis of the "maximum safeguards condition" scenario was performed under calculation G13.18.13.2*086, Effects of Maximum Safeguards Operation on the Ultimate Heat Sink.

Information related to "maximum safeguards condition" was added to the SAR in 2002 as part of the corrective action plan for CR-RBS-2002-01243. This analysis also included the impact of leakage.

B) Explain how this scenario affects peak UHS basin temperature and associated limits.

Response

The UHS basin temperature is equal to the SSW supply temperature. The maximum SSW supply temperature during a DBA, coincident with a loss of offsite power and the failure of the Division 2 emergency diesel generator is 92.1 deg. F, occurring at 5 hours post-accident. For the "maximum safeguards" scenario with both divisions operating and the postulated single failure of the Division 2 SCT fans, the maximum SSW supply temperature is 92.36 deg. F, occurring at 13 hours post-accident. The calculated maximum temperature for both the design basis and "maximum safeguards" cases is less than the design basis limiting temperature of 95 deg. F.

C) Explain how and why accounting for two trains of SW was not originally part of the design basis for determining UHS required capacity. Revise UFSAR UHS design basis to include use of two trains for a specified duration after a DBA if appropriate.

Response

As discussed in the response to Question 2A, NUREG-0800 does not require accounting for two divisions of SSW operating post-DBA to demonstrate system acceptability. The UHS capacity is based on the volume required for SSW to satisfy the NUREG-0800 acceptance criteria, which requires the postulation of a failure of an auxiliary power source. As a result, the UHS volume was based on providing cooling flow to a single division of SSW. The information regarding use of two divisions of SSW was added to the SAR in 2002. The revision of this information to account for the updated analysis was discussed in the original license amendment request, and in the SAR paragraph quoted in the response to Question 3A.

Question 5

Attachment 1 identifies that the licensee made non-conservative assumptions regarding pump heat which slightly increase loss from the UHS basin after a DBA. Attachment 4 addresses these assumptions vaguely by stating that these assumptions are inconsistent with the actual methodology. Attachment 4 further states that these assumptions have no adverse impact on the operation of the associated pumps and that the 30 day inventory can be met. The technical information provided is vague such that the NRC staff has no technical input to address the issues in a safety evaluation.

A) Identify and explain the non-conservative assumptions and inconsistencies in methodology and explain how the revised calculation has removed the inconsistencies in the methodology and non-conservatisms as well as other non-compliant items.

Response

The previous revision of calculation PM-194 (Revision 8) included the following non-conservative assumptions and methodology inconsistencies:

- Stated that calculated ECCS pump heat would be included in accordance with the recommendations of General Electric communication SC06-01. General Electric communication SC06-01 recommends that 100% of the ECCS pump work be assumed to be manifested as heat to the containment. However, although the calculation revision record stated that recommendations of General Electric communication SC06-01 regarding pump heat would be included and page 15 of the calculation stated, "All horsepower input to the pump motor is assumed to be converted into heat and transferred to Standby Service Water." the body of the calculation determined the pump heat based upon the energy equation, effectively neglecting the contribution of kinetic energy in turbulent flow.

- The included pump heat contribution from the Standby Service Water pumps, SWP-P2A and SWP-P2C, and the Fuel Pool Cooling pump was only the pump inefficiency rather than 100% of the pump work.

- A reference for Residual Heat Removal pump break horsepower was not provided.

- The correct reference for Low Pressure Core Spray pump horsepower was not provided.

- The calculation was not in compliance with the requirements of EN-DC-126, Engineering Calculations, with respect to the previously identified issues, calculation format, and documentation of assumptions.

By not representing 100% of the pump work as heat added to SSW, as recommended by General Electric, the resultant pump heat load contribution utilized in the calculation was non-conservative. It should be noted that a portion of this non-conservatism was accounted for in the load of the Auxiliary Building unit coolers and by the conservative assumption that the Low Pressure Core Spray pump operated for the full 30-day mission time rather than being secured following restoration of vessel level at approximately 30 minutes into the event.

The calculation was completely revised. The new revision of PM-194, Revision 9, fully complies with the requirements of EN-DC-126. The calculation format was revised to meet procedural requirements, the calculation inputs are properly referenced, assumptions are documented and provided with a basis, and the methodology is clearly documented and reflected in the body of the calculation.

All pumps operating during the 30-day mission time have 100% of the pump work during the period of operation as heat added to SSW.