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July 14, 2008

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Subject: Duke Energy Carolinas, LLC
Catawba Nuclear Station, Unit 1
Docket Number 50-413
Response to a Request for Additional Information (RAI)
Concerning the Proposed Technical Specification Amendment
Technical Specification 3.6.6, Containment Spray System; 3.7.5, Auxiliary Feedwater System

Please find the Duke Energy Carolinas (Duke) response to a Request for Additional Information (RAI) concerning the proposed license amendment request (LAR) for one-time limited duration extension of the Technical Specifications (TS) 3.6.6, Containment Spray System (CSS); and TS 3.7.5, Auxiliary Feedwater (AFW) System for Unit 1. These extensions are required to facilitate repair and replacement of the 1B NSWS pump and the activities associated with the repair.

This LAR was originally submitted by a Duke letter to the NRC dated July 14, 2008. Attachment 1 of this document contains the responses to the RAI questions received via the teleconferences on January 14, 2008.

Should you have any questions concerning this information, please call A. P. Jackson at (803) 701-3742.

Very truly yours,

James R. Morris

Attachments

A001
NRR

James R. Morris affirms that he is the person who subscribed his name to the foregoing statement, and that all the matters and facts set forth herein are true and correct to the best of his knowledge.

James R. Morris,
Site Vice President

Subscribed and sworn to me: 7/14/2008
Date

Notary Public

My commission expires: 7/2/2014
Date

ANTHONY P. JACKSON
NOTARY PUBLIC
MY COMMISSION EXPIRES
JULY 2, 2014
STATE OF SOUTH CAROLINA
SEAL

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ATTACHMENT 1

RESPONSES TO THE REQUEST FOR
ADDITIONAL INFORMATION
CATAWBA NUCLEAR STATION, UNIT 1

ATTACHMENT 1

1. The licensee states that its PRA model includes internal fire events, and that these events do not contribute significantly to the risk of the proposed configuration.

    a. Is this result expected based on how the unavailable functions (i.e., NSW backup supply to AFW, containment spray cooling, and reduced redundancy of the NSW system) are credited to mitigate internal fire events? For example, is the NSW backup to AFW is not normally challenged unless other failures of clean water are failed? Does the containment spray cooling function provide any core decay heat removal function? Some discussion regarding these unavailable functions with regards to fire mitigation would be helpful.

Response:

Yes, the insensitivity of the results to the fire initiating events in the PRA is expected. The risk significant fire initiating events in the PRA are those fires that result in failure of the component cooling system. The component cooling system provides cooling to the pumps for the majority of the mitigating systems. The component cooling system is cooled by the nuclear service water system. Consequently, when component cooling is failed by a fire, all of the significant mitigating systems are failed. The unavailability of nuclear service water does not result in any additional loss of important mitigating equipment.

The nuclear service water supply to auxiliary feedwater pump 1B is only required if the condensate grade sources are no longer available. Additionally, the nuclear service water supply to the turbine driven and 1A motor driven auxiliary feedwater pumps is still available.

The containment spray heat exchangers are only relied upon in the PRA to cool the containment sump water in the special case where the valves that open to provide cooling to the residual heat removal heat exchangers do not open. These are in general very low frequency cut sets. In the analysis supporting this LAR, the containment spray system support for this cooling function is conservatively assumed to fail and the contribution to the risk from these sequences is insignificant.

b. RG 1.200 does not endorse any industry standards for fire PRA models. How has the licensee assured the technical adequacy of its existing fire PRA to support this application?

Response:

The fire modeling that exists in the Catawba PRA is at the level of detail used to support the IPE and IPEEE submittals. The following is a list of the reviews conducted on the PRA modeling:

- A peer review sponsored by the Electric Power Research Institute (EPRI) was conducted on the original Catawba PRA
- An SER has been received on the IPE and IPEEE
- In March of 2002, a peer review of the Catawba PRA was conducted as part of the WOG PRA Certification Program

2. The licensee states that the seismic risk contribution of the NSW system is negligible, and that for the expected configuration "there is no reason to expect that that conclusion would change for the current model." The staff finds this statement to be somewhat vague, and does not understand exactly to what "current model" refers. A more robust, positive conclusion regarding seismic risk should be provided. This should specifically address the reliance upon the NSW backup supply to AFW, if it is the only seismically qualified source of water to the AFW pumps (or the licensee should identify that this is not the case).

Response:

The significance of the seismic contribution to risk when a train of NSWS is out of service was specifically evaluated for the LAR submitted by Catawba in the spring of 2005. This evaluation determined that for a 14 day completion time (CT) the contribution from seismic events was nearly a factor of 100 lower than the internal events contribution to risk. The conclusion from the previous submittal, that the seismic risk is very small relative to the internal events risk, remains a valid conclusion and that there is no need to repeat a seismic analysis.

3. The licensee states that the cutsets generated "were screened and invalid cut sets were removed and appropriate recovery events applied". Confirm that this process, including recovery events applied, is the same as is applied to the baseline PRA results. Further, the licensee needs to clarify what is meant by "invalid" - why is a technically adequate PRA model generating "invalid" cutsets? Invalid based on what criteria?

Response:

The process applied in recovering the cut sets for this analysis is identical to that utilized in the base case PRA. No changes to the post processing of cut sets are made for this analysis.

Invalid cut sets usually occur for 1 of 2 reasons. First, fault trees do not accommodate the time sequence of events. A failure event in a model may have a mission time of 24 hours utilized for calculating the failure probability. In some cases this event may result in failure of another function which for a specific sequence is demanded in the first few seconds (e.g., a dc bus failure resulting in loss of a safety injection actuation on a LOCA). The mission time is inappropriate for that specific condition and the result is negligible if an appropriate mission time is considered. These sequences are identified as invalid and removed from the solution.

Second, the fault tree models do not include the success branches of the event trees. In some sequences mutually exclusive failures can occur. When these combinations are identified in the cut sets results they are deleted.

4. The licensee's submittal does not specifically state how the PRA model was manipulated to account for the specific configuration. The licensee needs to state that the isolation of the two functions of NSW supporting AFW and CS, as well as the isolation of the non-essential header (if this is modeled in the PRA), are made unavailable in its evaluation, along with the unavailable NSW pump. The staff is further not understanding the two configurations identified as "Part 1" and "Part 2", labeled as "2 RN pumps" and "1 RN pump". The licensee needs to better explain exactly what is being assumed as unavailable for these two "parts".

Response:

Two separate and distinct configurations were identified that make up the 144 hour duration extension. The submittal calls these Part 1 and Part 2.

Part 1 represents a configuration of 72 hours duration where:

- NSWS flow to the 1B AFW pump is isolated,
- NSWS flow to the 1B CSS heat exchanger is isolated,
- NSWS flow to the Unit 1 non-essential NSWS header is isolated, and

- NSWS Train B is out of service (both 1B and 2B NSWS pumps) since NSWS pump intake pit B is drained to support repair work.

Part 2 represents a configuration of 72 hours duration where:

- NSWS flow to the 1B AFW pump is isolated,
- NSWS flow to the 1B CSS heat exchanger is isolated,
- NSWS flow to the Unit 1 non-essential NSWS header is isolated, and
- NSWS Pump 1B is out of service for repair

Since the difference between the two configurations is only the number of NSWS pumps that are assumed unavailable, the submittal characterized Part 1 as "2 RN pumps" and Part 2 as "1 RN pump". This was purely for editorial convenience.

Duke can accurately account for the two configurations, noted as Part 1 and Part 2 in the submittal, using the PRA model. Each of the functions is represented in the PRA model. The PRA model is capable of making each of the functions noted above unavailable by isolating the appropriate component or logic.

Specifically, 1) flow to the 1B AFW pump is made unavailable in the PRA model by setting isolation valve 1RN310B as failed closed, 2) the PRA model removes all credit for recovery of sump cooling by setting the appropriate recovery event to failed making this function unavailable, 3) NSWS flow through the non-essential header, which is explicitly modeled, is made unavailable by failing the appropriate non-essential header Gate logic, and 4) the PRA model places the NSWS Train B in Maintenance for Part 1 making it unavailable, and 5) the PRA places the NSWS Pump 1B in Maintenance for Part 2 making it unavailable.

The results of the risk calculation for each of the two configurations, Part 1 and Part 2, are summed to provide the overall risk values as shown in the submittal table.

5. In the submittal in section 3.0, Background, a discussion is provided on the Nuclear Service Water System (NSWS) and how it can be aligned based on plant conditions and equipment available. Provide a discussion on how this applies to your submittal including how it is applied at Catawba.

Response:

The NSWS consists of two independent trains (A and B) of essential equipment, each of which is shared between units. Each train contains two NSWS pumps, each of which is supplied from a separate emergency diesel generator. Each set of two pumps supplies two trains (1A and 2A, or 1B and 2B) of essential equipment through common discharge piping. While the pumps are unit designated, i.e., 1A, 1B, 2A, 2B, all pumps receive automatic start signals from a safety injection or blackout signal from either unit.

Therefore, a pump designated to one unit will supply post accident cooling to equipment in that loop on both units, provided its associated emergency diesel generator is available.

In the event of a pump failure, both Unit 1 and Unit 2 are required to enter into TS 3.7.8 because of the shared nature of each NSWS train. This occurred for the event on July 12, 2008. For events like this, Catawba has analyzed the NSWS to allow the NSWS train to be declared operable with an inoperable pump if the system is placed in a specific alignment. The principle behind this analysis is that given an inoperable pump, the NSWS is placed in an alignment such that the remaining operable pump on the given train is fully capable of supplying required loads and is aligned to supply loads required by one pump flow balance. The loads to be isolated are the flow path to the inoperable pump's unit specific non-essential header, AFW pump, and Containment Spray heat exchanger. This requires the affected unit to enter Required Actions for both AFW and the Containment Spray system. It does allow the non-affected unit to exit the NSWS Required Action in T.S. 3.7.8; however, the affected unit is still required to follow TS 3.6.6 and 3.7.5 for the equipment with NSWS supply isolated. This is not the normal or preferred system alignment. The preferred system alignment is for two operable pumps in each NSWS header.

On July 13, 2008 Catawba isolated NSWS supply to the 1B AFW pump, the 1B containment spray system heat exchanger, and the B NSWS non-essential header. This alignment restored operability to the B NSWS train while documenting the inoperability of the 1B AFW pump and the 1B containment spray system. At this time both Unit 1 and Unit 2 exited TS 3.7.8, while Unit 1 was in TS 3.6.6 and 3.7.5.

Recent discussions with the NRC staff have highlighted concerns on their part for this alignment and its discussion in the TS Bases. Catawba commits to hold additional discussions with the NRC staff to discuss this configuration and how it is documented in the Catawba TS and current licensing basis.

6. Why did the licensee isolate non essential loads on Unit 1 only or not Unit 2?

Response:

The Single Nuclear Service Water Pump flow balance alignment requires isolation of one unit's train related supplies to auxiliary feedwater system suction, containment spray heat exchangers, and the non-essential header. Isolating these three loads will ensure the operable Nuclear Service Water pump can supply both units train related essential loads. Isolation of the affected unit's non-essential header is selected to keep the issue contained to one unit and is procedurally controlled. References: OP/0/A/6400/006 C Enclosures 4.11, 4.12A, 4.12B and Calculation CNC-1223.24-00-0020 Analysis of RN System with one RN pump operable.

7. Provide a discussion on how cooling is provided to the reactor coolant pump motors and any support functions that the Nuclear Service Water System may provide.

Response:

The Reactor Coolant Pump Motor coolers are normally supplied with cooling water from the closed loop Containment Chilled Water System (YV). The Nuclear Service Water System supplies backup to the Containment Chilled Water System from the non-essential header. In the single nuclear service water pump flow balance alignment a backup supply is not available.

8. For the Auxiliary Feedwater System please discuss how the non-safety grade sources of water are credited in your accident analysis (non seismic events). Also discuss which accident analysis rely on nuclear service water as a suction source.

Response:

The normal suction source for the AFW System is the Condensate Storage System. The Condensate Storage System is comprised of the Upper Surge Tanks, the Auxiliary Feedwater System Condensate Storage Tank, and the Condenser Hotwell. Tech Spec 3.7.6 requires a minimum volume of water of 225,000 gallons for the Condensate Storage System.

The Condensate Storage System contains sufficient inventory to remove decay heat for 2 hours following a reactor trip and then cool down the Reactor Coolant System to RHR entry conditions within 5 hours, assuming a natural circulation cooldown.

There are certain accident scenarios that may require more water from the AFW System than is currently contained in the Condensate Storage System. One example is a post LOCA cooldown and depressurization. In this event one or more Reactor Coolant Pumps are operated to provide normal pressurizer spray capability. With the additional heat added from a Reactor Coolant Pump, more AFW System inventory will be required in order to cool the Reactor Coolant System to RHR entry conditions. To the extent possible, makeup flow will be initiated to the Condensate Storage System in an attempt to prevent swapping the AFW System suction source to the Nuclear Service Water System.

9. Provide a discussion on how the terms train and loop are used in the submittal.

Response:

In a submittal to the NRC dated May 27, 2008, in support of a TS amendment, Catawba responded to a similar RAI. Catawba has reviewed that submittal and believes it addresses the question.