Duke Energy®
Carolinas

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July 8, 2009

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

Subject: Duke Energy Carolinas, LLC (Duke)
Catawba Nuclear Station, Units 1 and 2
Docket Numbers 50-413 and 50-414
Technical Specifications (TS) and/or Bases Sections:
3.3.2, Engineered Safety Feature Actuation System (ESFAS) Instrumentation
3.3.3, Post Accident Monitoring (PAM) Instrumentation
3.5.4, Refueling Water Storage Tank (RWST)
3.6.6, Containment Spray System
License Amendment Request for Emergency Core Cooling System (ECCS) Water Management Initiative

References: Letters from Duke to NRC, same subject, dated September 2, 2008 and June 18, 2009

The September 2, 2008 reference letter requested a license amendment pursuant to 10 CFR 50.90 to revise the Unit 1 and Unit 2 TS and associated Bases to allow manual operation of the Containment Spray System and to revise the upper and lower limits on the RWST. The June 18, 2009 reference letter responded to the first set of Requests for Additional Information (RAIs) and supplemented the September 2, 2008 original submittal.

On May 11, 2009, the NRC electronically transmitted a second set of RAIs. The purpose of this letter is to formally respond to these RAIs.

The attachment to this letter contains our RAI response. The format of the response is to restate each RAI question, followed by our response.

There are no regulatory commitments contained in this letter or its attachment.

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NRR

Pursuant to 10 CFR 50.91, a copy of this letter and its attachment is being sent to the designated official of the State of South Carolina.

If you have any questions or require additional information, please contact L.J. Rudy at (803) 701-3084.

Very truly yours,

James R. Morris

LJR/s

Attachment

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, Vice President

Subscribed and sworn to me: 7-8-2009
Date

Mickey Standridge - Mickey Standridge
Notary Public

My commission expires: 7-10-2012
Date

SEAL

xc (with attachment):

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Attachment

Response to NRC Request for Additional Information

On June 3, 2009, a conference call was held between NRC and Duke representatives concerning the ECCS Water Management LAR submittal. The call focused on the second round (human factors) of RAIs and these questions are documented below, along with Duke's responses.

1. Changes to Procedures
Describe how the proposed License Amendment Request (LAR) will change the plant emergency, abnormal, and annunciator response procedures. Copies of marked-up procedures or procedure change request documents are acceptable, if available.

Duke Response:

1. **For certain small break size events, the non safety-related containment ventilation units will be secured and/or isolated to avoid sump dilution and gain sump level margin by melting ice.**
2. **For sequences leading to containment sump recirculation, a verification of adequate sump level will be added just prior to the occurrence of swapover sump level. The Residual Heat Removal (RHR) pumps will be secured if adequate sump level does not exist.**
3. **Existing steps to secure containment spray when aligned to the RWST will be removed, as containment spray will no longer be utilized with the RWST as a suction source.**
4. **Various steps checking general plant alignment will be adjusted to reflect changes to containment spray status.**
5. **RWST setpoints will be revised to reflect the new values.**
6. **The transfer to cold leg recirculation sequence will be changed as follows:**
   - **A. Overview of changes:**
     - **i) Verify successful autoswap of RHR suction (not a change).**
     - **ii) Start one train of containment spray (in normal sequence).**
     - **iii) Allow high head and intermediate head pumps to continue injection from RWST inventory until low-low RWST level.**
     - **iv) Align high head and intermediate head pumps to RHR pump discharge.**
   - **B. Comparison of sequences:**
     - **i) Original sequence:**

a) Verify automatic transfer of RHR suction to the containment sump. 195 seconds are available/~140 seconds are typically required to accomplish this task.

b) Manually transfer high head and intermediate head pump suction to the RHR pump discharge. 195 seconds are available/~140 seconds are typically required to accomplish this task.

c) Manually transfer containment spray suction to the containment sump (includes aligning heat exchanger cooling water). 240 seconds are available/~180 seconds are typically required to accomplish this task.

ii) New sequence:

a) Verify automatic transfer of RHR pump suction to the containment sump. 195 seconds are available/~140 seconds are required to accomplish this task.

b) Manually align and start containment spray from the containment sump. 310 seconds are available/~210 seconds are required to accomplish this task.

c) Scenario dependent time delay while high head and intermediate head pumps reduce RWST level.

d) Manually transfer high head and intermediate head pump suction to RHR pump discharge. 240 seconds are available/~160 seconds are required to accomplish this task.

2. Changes to Operator Actions
Describe any new operator actions, changes to actions, or deleted actions required as a result of the proposed LAR. Specifically, identify cues that operators will use to recognize when to initiate action, and describe time required for operator actions versus time available. Provide justification for the acceptability of these new actions, changes, or deletions.

Duke Response:

1. Manual start of containment spray.

A. This action is not new. The manual action to start containment spray occurs in the event

sequence roughly at the same time as the "restart" of containment spray in the original sequence. The actions are similar, except only one train is started.

B. The cue to perform is a procedure step, immediately after aligning the RHR pumps at the RWST low level alarm.

C. Time required: The new action will take approximately the same time as before. Adequate time is available, and will continue to be monitored as a time critical operator action.

D. Justification: The actions are similar to existing guidance.

E. Deleted the time critical operator action to align RHR spray during the transfer to cold leg recirculation sequence.

2. Shutdown or isolate cooling water to non safety-related containment ventilation units for small break events:

A. Cues will be procedure steps associated with the containment air return fans.

B. Action will be procedure driven, based on containment pressure.

C. Time required: The actions are control board manipulations requiring ~2 to 3 minutes. There is no set limit on the time available. This is a conservative action.

D. Justification: To eliminate any possible dilution of the containment sump inventory and gain sump level margin.

3. Changes to Control Room Controls, Displays and Alarms
Describe any changes the proposed LAR will have on the operator interfaces - controls, displays and alarms. For example, will zone markings (e.g. green, yellow, red; low, low-low) on meters change? What else will change? How will the operators know of the changes? Describe any controls, displays, alarms that will be upgraded from analog to digital. How will operators be tested to determine they can use the new/changed instruments reliably?

Duke Response:

RWST level changes (all set points are given in percent tank level)

- **The four existing level transmitter loops will be recognized as Wide Range (WR) loops and all associated**

labeling will be changed. Chart recorders and level gauges associated with the existing transmitter loops will be relabeled to reflect WR for RWST level channel inputs.

- The safety related setpoint for "FWST 2/4 LO LEVEL" (the abbreviation "FWST" is the Duke-specific nomenclature for the standard industry abbreviation "RWST") within each of the associated 7300 System protection cabinets will be adjusted from 36.60% to 19.63% for the new ECCS swapover value.
- Within the new Distributed Control System (DCS), the non-safety related setpoint associated with "FWST LO LEVEL" annunciator will be changed from 36.60% to 19.63%. This new setpoint will also apply to the "FWST LO LEVEL" status lights. During outages (Mode 5, Mode 6, and No Mode), the existing "FWST LO LEVEL" setpoint is changed from 36.60% to 11% in order to cut off the RWST heaters at a lower level. For the new setpoints, the "FWST LO LEVEL" setpoints will change from 19.63% to 11%.
- Within the DCS, the non-safety related setpoint associated with "FWST LO LO LEVEL" annunciator will be changed from 10.55% to 4.63%.
- "FWST HI LEVEL" annunciator will be reassigned to the new Narrow Range (NR) level instrumentation loops, and the setpoint will change from 97.91% to 99.26%.
- "FWST AT MAKEUP LEVEL" annunciator will be reassigned to the new NR level instrumentation loops, and the setpoint will change from 95.30% to 97.05%.
- "FWST PRE-LO LEVEL" annunciator will be added with a setpoint of 27.89%.
- Several existing Operator Aid Computer (OAC) points will have descriptions changed to add "Wide Range" wording, and new OAC points will be added for "Narrow Range" level. Limits associated with Modes 1-4, which warn of approach to tank overflow and approach to makeup level, will be deleted from the OAC and reassigned as alarms from DCS through the new NR instrument loops. OAC limit alarms will remain for

Mode 5, Mode 6, No Mode, and reduced inventory. OAC graphics display for RWST level will change.

- **RWST WR level gauges on MC9 red ranges will change to represent the minimum TS level and below. NR indications associated with DCS graphic displays will show markings for deviations from normal operating level.**

The Operations Training group will be involved in the engineering change process. Operations Training will review the engineering changes, and they will prepare lesson plans/training material to inform and test the operators.

4. Changes to the Safety Parameter Display System
Describe any changes the proposed LAR will have on the Safety Parameter Display System (SPDS). For example, does the SPDS display Reactor Water Storage Tank Level? If so, will the new RWST narrow range level instrumentation be consistent with the SPDS? How will the operators know of changes to the SPDS?

Duke Response:

The main SPDS impact is associated with the Containment SPDS tree, decision path leading to "ORANGE" for FR-Z.1.

General Discussion:

In the original design, containment spray would normally be in service for any event characterized by containment pressure greater than 3 psig. To be compatible with that design, the status tree needed only relatively simple logic that essentially said, "IF containment pressure is greater than 3 psig and containment spray is NOT in service, THEN go to procedure FR-Z.1." Following implementation of the proposed modification, containment spray will not automatically start, and it is not desired to manually start the system until the suction transfer to the containment sump has occurred. This means that a NORMAL condition in the early phases of future events could include containment pressure being above 3 psig without containment spray in service. Without a change to the SPDS status tree, this would have resulted in an "ORANGE" priority to enter FR-Z.1, which would be the inappropriate response for the ECCS Water Management design. To avoid this conflict, an additional decision block is added such that the "ORANGE" path to FR-

Z.1 is not enabled until the system has been aligned to the containment sump.

The original box representing proper containment spray operation was limited to containment spray indicating flow. The inputs to this box are being enhanced to avoid dependence on limited instruments, and to ensure cooling flow is also aligned.

Specific Discussion:

- **Added new decision box based on the status of the containment sump valves. The "ORANGE" path is only allowed if at least one sump valve is open.**
- **Expanded the criteria in the decision box for determining if containment spray is "running". The logic will now include the pumps running and cooling flow to the containment spray heat exchanger, as well as retaining the existing containment spray "flow" item. The logic may be adjusted later based on the availability of parameters. A preliminary review indicates that all of the above are at least feasible for Catawba.**

5. Changes to the Operator Training Program and the Control Room Simulator
Describe any changes the proposed LAR will have on the operator training program and the plant reference simulator, and provide the implementation schedule for completing the training and the simulator changes.

Duke Response:

The following information is a detailed outline of proposed operator training for the upcoming plant modification for Unit 2 (Unit 1 to follow).

The plant modification to the Refueling Water, Containment Spray, and ESFAS Systems and its impact on plant emergency procedure response falls under the training category "emergent issue for an existing operator training program". This category requires that a training needs analysis be completed.

The analysis will determine the scope of impact to the current information in the following training program areas:

- Refueling Water System lesson material
- Engineered Safety Features Actuation System lesson material
- Containment Spray System lesson material
- Emergency procedures lesson materials (as they relate to injection and recirculation core cooling)
- Functional restoration procedures (as they relate to containment conditions during high-energy line breaks inside containment)
- Simulator guides containing the above subject matter

For this RAI response, a general discussion is provided on the training options available.

The type of selected training will be considered Immediate Classroom and Simulator Training.

Classroom training may include:

- An explanation as to the reasons this modification is being installed
- A summary of the engineering modification packages being installed in Unit 2
- Summary descriptions on the type of accident scenarios where the Refueling Water, Containment Spray, and ESFAS System changes will impact operator responses
- A general walkthrough of the affected procedures/Explanation of any (to be determined) new or modified operator tasks

Simulator training may include:

- Additional or repeat information from classroom phase of training
- Accident scenarios to exercise the procedure changes, new system operation, and any new or modified skill/task in the form of simulator training guides

The above training will be developed and presented once for all affected licensed operators and non-licensed operators as required. Following completion, the information will be incorporated into the existing training materials and simulator guides similar to any other plant change.

During the initial training sessions there will be no impact

to the Catawba Unit 1 referenced simulator. It has been demonstrated that using the existing modeling and available instructor tools, a suitable scenario for procedure validation and training of operator crews can be created.

Based on simulator regulatory guidelines, the typical timeline for actual software modification would be after the Unit 1 outage in Spring 2011 when the normal simulator core upgrade for Cycle 19 is performed.

The Unit 2 modification will be installed during the Unit 2 End-of-Cycle 17 Refueling Outage in Fall 2010. Initial training would be presented anytime just prior to or during this outage time. Typical options include presenting this training during the normally scheduled pre-outage briefings or during agreed upon dates during the outage. In either case, the training should be scheduled for completion prior to the Unit 2 Beginning-of-Cycle 18 startup.

Future training for the Unit 1 modification would (if required) be completed in a similar manner prior to or during the Unit 1 End-of-Cycle 19 Refueling Outage in Spring 2011.

Continuing training as outlined in Catawba Operator Training procedures, beyond the next two outages, would continue as normally scheduled, with these subjects incorporated into the existing training materials.

6. On page 1 of the LAR, it is stated that Technical Specification Bases 3.3.3 will be changed to "revise the role of the containment sump level instrumentation". Please explain.

Duke Response:

During the June 3, 2009 conference call, Duke referred the NRC reviewer to the relevant TS Bases page markup included in the original submittal. The NRC reviewer had no further questions.

7. Who (what organizations) have been involved in developing this new operating strategy? Were qualified human factors specialists involved? If so, describe their involvement.

Duke Response:

The primary groups involved in the development of this

operating strategy were the General Office Safety Analysis group, the Catawba Emergency Operating Procedure group, and the McGuire Emergency Operating Procedure group. Duke does not have a program to formally qualify the procedure developers as human factors specialists. However, the procedure developers are all experienced in procedure writing, and are familiar with the proper applications and concerns related to human factors. Procedure drafts are always developed with the capabilities and vulnerabilities of potential performers in mind. The procedure drafts and any future changes for ECCS Water Management will be validated with actual operators to enhance operator timing and the probability of success, as is the normal practice for Duke emergency operating procedures.

8. What part did Operating Experience play in the development of this new operating strategy?

Duke Response:

Duke is the first ice condenser utility to develop a strategy regarding ECCS Water Management. As a result, little direct operating experience exists to support strategy development. The available operating experience contains many items related generically to procedure changes, but none specifically associated with this strategy. There are also several items providing information related to containment sump inventory and availability, but again, none discusses this newly developed procedure strategy. The ECCS Water Management project will align Catawba's strategies for mitigating more-likely-to-occur small and medium sized loss of coolant accidents and secondary line breaks with those of large dry containment design plants. This is because containment spray initiated at a low ice condenser design setpoint will no longer put Catawba in the cold leg recirculation mode within approximately 30 minutes of the occurrence of these events. This will simplify strategies employed to mitigate these events.

9. Was a Human Reliability Assessment done to support design of operator interfaces, procedures and training? If yes, will the PRA/HRA been submitted to support the LAR?

Duke Response:

No formal PRA/HRA evaluation was performed or submitted as

part of the LAR. However, aligning ECCS systems to the emergency sump is the most risk significant operator action at Catawba. Elimination of the automatic start of the Containment Spray System will preserve RWST inventory and make swapping to the sump unnecessary for many scenarios, thereby reducing overall plant risk.

10. Describe the verification and validation (V&V) of the completed design.

Duke Response:

Engineering Directives Manual (EDM) 601, "Engineering Change Manual", describes the process used to create, check, and approve engineering changes. Section 601.5.4 includes a description of the checking, inspecting, and technical approval of engineering changes. There are milestones for each person reviewing the engineering change to sign off electronically before technical approval.

11. Provide an overview of the design implementation plan and how each phase will be sequenced.

Duke Response:

For Unit 1, the DCS implementation will be performed during the End-of-Cycle 18 Refueling Outage in Fall 2009. The implementation of the ECCS Water Management project will follow in the End-of-Cycle 19 Refueling Outage in Spring 2011. All ECCS Water Management interactions with the DCS will be implemented by the ECCS Water Management project as a revision to the DCS.

For Unit 2, the DCS and ECCS Water Management project will be implemented during the End-of-Cycle 17 Refueling Outage in Fall 2010. The ECCS Water Management project will perform the external connections to the DCS; however, the internal configuration in the DCS for the ECCS Water Management project will be performed under the DCS implementation.

For both units, there will be some work performed as pre-fabrication during the innage periods prior to the refueling outages. Terminal box removal and installation and cable pulling will be performed as pre-fabrication. No tie-ins to active plant equipment will be performed prior to the refueling outages.