DUKE ENERGY®

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May 15, 2013

10 CFR 50.90

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

Subject: Duke Energy Carolinas, LLC (Duke Energy)
Catawba Nuclear Station, Units 1 and 2
Docket Numbers 50-413 and 50-414
Proposed Technical Specifications (TS) and Bases Amendment
TS and Bases 3.7.8, Nuclear Service Water System (NSWS)
Response to NRC Request for Additional Information (RAI)
(TAC Nos. ME7659 and ME7660)

Reference: Letters from Duke Energy to the NRC, same subject, dated November 22, 2011, July 9, 2012, November 12, 2012, and January 28, 2013.

The reference letters constitute Duke Energy's request for amendments to the Catawba Facility Operating Licenses and TS to modify the subject TS and Bases to allow single discharge header operation of the NSWS (Duke Energy designation "RN") for a time period of 14 days. The requested change will facilitate future maintenance of the Unit 2 NSWS discharge headers in the Auxiliary Building.

On April 8, 2013, a telephone conference call was held between Duke Energy and the NRC staff to discuss the status of the peer review effort for the Probabilistic Risk Assessment (PRA) Large Early Release Frequency (LERF) model. The attachment to this letter provides our responses to the questions raised by the NRC during this conference call.

The revised proposed TS and TS Bases pages provided in the January 28, 2013 reference letter are unchanged as a result of this RAI response supplement. Also, the original regulatory evaluation contained in the November 22, 2011 reference letter is unaffected as a result of this RAI response supplement.

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

Pursuant to 10 CFR 50.91, a copy of this RAI response supplement is being sent to the appropriate State of South Carolina official.

Inquiries on this matter should be directed to L.J. Rudy at (803) 701-3084.

A001
NRR

Very truly yours,

Kelvin Henderson

LJR/s

Attachment

Kelvin Henderson 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.

Kelvin Henderson, Site Vice President

Subscribed and sworn to me: 5-15-13
Date

Notary Public

My commission expires: 6-21-2022
Date

SEAL

xc (with attachment):

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ATTACHMENT

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION (RAI)

Question 1: Provide a summary that a focused-scope peer review has been performed.

The PWR Owners Group conducted a focused peer review on the Catawba Nuclear Station Large Early Release Frequency (LERF) PRA model on December 11-14, 2012. This review was limited to the High Level and Supporting Requirements in Part 2, Requirements For Internal Events At-Power PRA, Tables 2-2.8-1 and 2-2.8-2 through 2-2.8-8, of the ASME/ANS RA-Sa-2009 PRA Standard.

The overall conclusions of the peer review team regarding the Catawba LERF PRA are as follows:

- The overall model structure is robust and well-developed for both plants.
- Documentation is generally very thorough and detailed.
- Catawba used a simplified NUREG/CR-6595 LERF model which the NRC has found acceptable for calculating the Large Early Release Frequency.

The ASME/ANS PRA Standard contains a total of 41 numbered supporting requirements for the LERF portion of the internal events standard requirements. This focused scope peer review covered these 41 supporting requirements (SRs) associated with the LERF Analyses. Only two of the LERF SRs were determined to be not applicable to the Catawba LERF PRA. Of the 39 applicable SRs, 26 SRs were rated as SR Met, Capability Category I/II, or greater. Only two SRs were not met. However, eleven of the SRs were assessed at Capability Category I. Catawba uses a LERF model based on the simplified LERF model in NUREG/CR-6595. While a NUREG/CR-6595 model is classified as Capability Category I, historically the NRC has indicated that a NUREG/CR-6595 model is of sufficient capability to support risk-informed applications.

For Catawba, the peer review found eight Facts and Observations (F&Os), including five suggestions and three findings. The three findings have been dispositioned in the following section for the Catawba LAR submittal.

Question 2: Provide a list of the findings and observations from the peer review and the responses to them.

F&Os Regarding PRA Supporting Requirements		
F&O ID:	**Other Affected SRs:**	**Peer Review CC Assessment:**
LE-E2-01		Not Met
Capability Category II Requirements:		
USE **realistic** parameter estimates to characterize accident progression phenomena **for significant accident progression sequences resulting in a large early release. USE conservative or a combination of conservative and realistic estimates for nonsignificant accident progression sequences resulting in a large early release.**		
F&O Issue and Proposed Resolution:		
Catawba basically used the conservative parameter estimates from NUREG/CR-6595 to characterize the accident progression phenomena. This approach would satisfy CC-I. However, Duke Energy is using the Conditional Containment Failure Probabilities (CCFPs) from Rev. 0 of NUREG/CR-6595 rather than the more restrictive values from Revision 1. To meet this requirement would require using the NUREG/CR-6595, Rev. 1 CCFP values or providing an engineering analysis to defend use of the older values. At the time of the peer review, Duke Energy did have an analysis, "Conditional Containment Failure Probabilities for the McGuire and Catawba Large Early Release Frequency Models", November 2012, that discusses the basis for the use of the CCFPs from Rev. 0 of NUREG/CR-6595. However, this analysis was not provided as part of the official documentation for the review and as such, was not directly reviewed. A later review of this analysis indicates that Duke Energy appears to have a reasonable basis for using the Rev. 0 CCFP values based on plant-specific analysis. Duke Energy should include this information in their LERF analysis reports.		
Disposition of the Peer Review Finding:		
The peer review finding recommends that Duke Energy include a discussion of the basis behind using CCFPs from Rev. 0 of NUREG/CR-6595 in the LERF analysis reports. This basis is instead documented in the analysis, "Conditional Containment Failure Probabilities for the McGuire and Catawba Large Early Release Frequency Models". The analysis reviewed the supporting analyses for the conditional containment failure probabilities provided in the various revisions to NUREG/CR-6595 and evaluated whether the two parameters (% clad reacted in vessel and peak pressure) related to containment failure when the deliberate ignition system (hydrogen igniters) is unavailable due to a station blackout. As part of this analysis, Duke Energy performed a set of plant-specific MAAP analyses where the igniters are turned off for the time period prior to reactor vessel failure. This allows		

hydrogen generated during core damage to accumulate in the containment. At the time of reactor vessel failure the igniters are turned on thus assuring that an ignition source is available. The CCFP provided is the contribution from the hydrogen combustion overpressure event following reactor vessel failure. The value does not include any contributions to containment failure from non-overpressure containment failure modes (e.g., debris contact with the containment steel).

Sequence (Catawba)	% Clad Reacted In Vessel	Peak Pressure (psia)	CCFP
SBO event with cycling safety relief valves with a start failure of the turbine driven auxiliary feedwater pump, RCS at DCH relevant pressure.	43.11	58.4	0.00
SBO event with cycling safety relief valves with a start failure of the turbine driven auxiliary feedwater pump, RCS at non-DCH relevant pressure due to hot leg creep rupture.	43.40	66.4	0.00
SBO event with cycling safety relief valves with a 12 hour available run time for the turbine driven auxiliary feedwater pump, RCS at DCH relevant pressure.	43.93	60.6	0.00
SBO event with cycling safety relief valves with a 12 hour available run time for the turbine driven auxiliary feedwater pump, RCS at non-DCH relevant pressure due to hot leg creep rupture.	60.26	106	0.78
SBO event with a 250 gpm/pump reactor coolant pump seal LOCA at time equals 0. Secondary side heat removal (SSHR) via the turbine driven auxiliary feedwater pump is available during the entire event, RCS at DCH relevant pressure.	29.64	47.3	0.00

The result of the MAAP runs show how wide the range of results can be for various accident sequences and how many sequences result in no challenge to containment integrity. The frequency weighting the results is more important than selecting a single scenario for a point estimate.

As noted in NUREG/CR-6427, hydrogen combustion phenomena are also a source of uncertainty in the results. The peak pressures predicted by the plant-specific MAAP analyses are lower than those predicted by the NUREG/CR-6427 analysis using CONTAIN. This is likely due to differences in the details of the hydrogen combustion event such as flame speeds, heat transfer to structures, and impact of the steam present in the containment.

Section 4.2.5 of NUREG/CR-6427 discusses the non-direct containment heating (DCH) relevant challenges. The implication is that ignition is the result of power restoration following vessel breach. Such an approach does not consider that power restoration need not lead to uncontrolled combustion. Power restoration to the igniters in a strategic manner can provide a means for a controlled reduction of the hydrogen concentration to non-threatening levels. Neglecting this capability artificially raises the probability of uncontrolled combustion and

consequently the probability of containment failure for the non-DCH case. This is one reason the CCFP for the non-DCH case is also very near 1.0. Furthermore, late restoration of power does not contribute to an "early" release as is required for a LERF evaluation even if the containment is challenged. The MAAP runs determining CCFP results demonstrate how plant-specific examination of relevant accident sequences can produce results that are different than a generic more conservative analysis. The major sources of uncertainty identified by NUREG/CR-6427 indeed do matter. The high CCFPs provided in NUREG/CR-6595 Rev. 1, while possible for certain accident sequences, are not representative of the overall class of station blackout core damage sequences. Based on the plant-specific analyses performed, the CCFPs utilized in the current Catawba LERF analyses (based on NUREG/CR-6595 original issue) are judged to be better estimates than the estimates available from NUREG/CR-6427 or NUREG/CR-6595 Rev. 1 and are appropriate for a LERF model at CC 1. The peer review noted that the analysis appeared to be a reasonable basis for using the NUREG/CR-6595 Rev. 0 results. Duke Energy also believes that the NUREG/CR-6595 Rev. 0 results are better estimates than the Rev. 1 results. Therefore, there is no impact from this finding to the results and conclusions for the Catawba LAR submittal.

F&Os Regarding PRA Supporting Requirements		
F&O ID:	**Other Affected SRs:**	**Peer Review CC Assessment:**
LE-G3-01	LE-F1	CC-I
Capability Category II/III Requirements:		
LE-G3: DOCUMENT the relative contribution of contributors (i.e., plant damage states, accident progression sequences, phenomena, containment challenges, containment failure modes) to LERF. LE-F1: **PERFORM a quantitative evaluation of the relative contribution to LERF from plant damage states and significant LERF contributors from Table 2-2.8-3.**		
F&O Issue and Proposed Resolution:		
In CNC-1535.00-00-061, Catawba documents the significant contributors to LERF in terms of contribution by initiating events. However, they did not document the relative contribution of contributors such as plant damage states, accident progression sequences, phenomena, containment challenges, and containment failure modes. To move from CC-I to CC-II/III, Catawba needs to evaluate the relative contributions to LERF by such things as plant damage states, accident progression sequences, phenomena,		

containment challenges, and containment failure modes.
Disposition of the Peer Review Finding:
The peer review indicated that SRs LE-G3 and LE-F1 are met at Capability Category I. This category only requires that significant contributors to LERF are documented instead of the more thorough treatment in CC-II/III. The Catawba LERF model is based on the simplified LERF model in NUREG/CR-6595. While a NUREG/CR-6595 model is classified as CC-I, it has been determined to be of sufficient capability to support risk-informed applications. Consistent with the definition in Section 1-2 of RA-Sa-2009, the following table provides the significant accident progression sequences for the base model used in the Catawba LAR submittal:

Accident Progression Sequence	% Contribution to LERF	Cumulative % Contribution to LERF
Interfacing Systems LOCA	37%	37%
Low Pressure Early Containment Failure	30%	67%
Steam Generator Tube Rupture	26%	93%
ATWS-Related Failure	4%	97%
High Pressure Early Containment Failure	3%	100%

Other relative contributions have not been analyzed but will not have a quantitative impact. Therefore, this finding is a documentation issue and will have no impact on the results or conclusions of the Catawba LAR submittal.

F&Os Regarding PRA Supporting Requirements

F&O ID:	Other Affected SRs:	Peer Review CC Assessment:
LE-G6-01		Not Met

Capability Category I/II/III Requirements:
DOCUMENT the quantitative definition used for significant accident progression sequence. If other than the definition used in Section 2, JUSTIFY the alternative.
F&O Issue and Proposed Resolution:
Catawba did not document the quantitative definition of significant accident progression sequence. Catawba needs to add a definition for significant accident progression sequence to CNC-1535.00-00-0143, Rev. 0 or CNC-1535.00-00-061. This can be accomplished by adding a

specific definition of referencing the appropriate definition in Section 1-2 of RA-Sa-2009.

Disposition of the Peer Review Finding:

The definition of a significant accident progression sequence from Section 1-2 of RA-Sa-2009 is as follows:

> *One of a set of accident sequences contributing to large early release frequency resulting from the analysis of a specific hazard group that, when rank-ordered by decreasing frequency, sum to a specified percentage of the large early release frequency, or that individually contribute more than a specified percentage of large early release frequency for that hazard group. For this version of the Standard, the summed percentage is 95% and the individual percentage is 1% of the applicable hazard group. (See Part 2 Requirements LE-C3, LE-C4, LE-E5, LE-C10, LE-C12, LE-D1, LE-D4, LE-D5, LE-D7, and LE-E2.) For hazard groups that are analyzed using methods and assumptions that can be demonstrated to be conservative or bounding, alternative numerical criteria may be more appropriate, and, if used, should be justified.*

Consistent with the above definition, the following table provides the significant accident progression sequences for the base model used in the Catawba LAR submittal:

Accident Progression Sequence	% Contribution to LERF	Cumulative % Contribution to LERF
Interfacing Systems LOCA	37%	37%
Low Pressure Early Containment Failure	30%	67%
Steam Generator Tube Rupture	26%	93%
ATWS-Related Failure	4%	97%
High Pressure Early Containment Failure	3%	100%

This finding is a documentation issue and will have no impact on the results or conclusions of the Catawba LAR submittal.

Question 3: Evaluate whether there are any new results for any PRA calculations impacted by changes made from the peer review.

A peer review has been performed for the Catawba PRA LERF model. Using the responses to questions 1 and 2 it is concluded that the Catawba PRA LERF model used in this LAR submittal is of sufficient technical adequacy and that no changes to the LAR submittal results and conclusions are required.