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U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

LEVY NUCLEAR PLANT, UNITS 1 AND 2
DOCKET NOS. 52-029 AND 52-030
SUPPLEMENTAL RESPONSE TO NRC RAI LETTER 124 – SRP SECTION 6.3 AND NRC RAI LETTER 116 – SRP SECTIONS 6.3 AND 15.2.6 TO ADDRESS CONTAINMENT CONDENSATE RETURN COOLING DESIGN

Reference:

1. Letter from Donald Habib (NRC) to Christopher M. Fallon (DEF), dated March 6, 2014, "Request for Additional Information Letter No. 116 Related to SRP Sections 6.3 and 15.2.6."
2. Letter from Christopher Fallon (DEF) to Nuclear Regulatory Commission (NRC), dated May 5, 2014, "Partial Response to NRC RAI Letter 116 – SRP Sections 6.3 and 15.2.6", Serial: NPD-NRC-2014-014
3. Letter from Christopher Fallon (DEF) to Nuclear Regulatory Commission (NRC), dated May 19, 2014, "Partial Response to NRC RAI Letter 116 – SRP Sections 6.3 and 15.2.6", Serial: NPD-NRC-2014-015
4. Letter from Christopher Fallon (DEF) to Nuclear Regulatory Commission (NRC), dated July 1, 2014, "Partial Response to NRC RAI Letter 116 – SRP Sections 6.3 and 15.2.6", Serial: NPD-NRC-2014-022
5. Letter from Donald Habib (NRC) to Christopher M. Fallon (DEF), dated December 5, 2014, "Request for Additional Information Letter No. 124 Related to SRP Section 6.3."
6. Letter from Donald Habib (NRC) to Christopher M. Fallon (DEF), dated January 13, 2015, "Request for Additional Information Letter No. 125 Related to SRP Section 6.3."
7. Letter from Christopher Fallon (DEF) to Nuclear Regulatory Commission (NRC), dated January 21, 2015, "Response to NRC RAI Letter 125 – SRP Section 6.3", Serial: NPD-NRC-2015-004
8. Letter from Christopher Fallon (DEF) to Nuclear Regulatory Commission (NRC), dated May 5, 2015, "Response to NRC RAI Letter 124 – SRP Section 6.3, and Supplement 6 to Submittal of Exemption Request and Design Change Description for Departure from AP1000 DCD Revision 19 to Address Containment Condensate Return Cooling Design," Serial: NPD-NRC-2015-015

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Ladies and Gentlemen:

Duke Energy Florida, Inc. (DEF) hereby submits a supplemental response to the Nuclear Regulatory Commission's (NRC) requests for additional information (RAI) cited in References 1 and 5. The response to NRC RAI 124 (Reference 8) stated that the revised methodology described would be incorporated in a revision to other affected RAI responses previously submitted. The purpose of this submittal is to provide the revisions to the other affected RAI responses.

During the period March 6, 2014 through April 24, 2014, NRC issued RAI Letters 116, 117 and 118. DEF provided responses to the questions contained in the RAI letters during the period April 17, 2014 through July 24, 2014. Some of these responses provided detailed information on the condensate return analysis methodology. The revision to the methodology described in Reference 8 has been incorporated in a revision to the impacted RAI responses. These revised RAI responses are provided in Enclosure 1 to this letter.

The RAI responses that are directly impacted by the methodology revision described in Reference 8 are RAI numbers 06.03-6 (response submitted by Reference 2) and 06.03-9 (response submitted by Reference 3). Two other RAI responses which were potentially impacted by the methodology revision do not require revision for the reasons identified below.

RAI number 06.03-4 referenced calculation APP-PXS-M3C-020 ("PRHR HX Sizing/Performance calculation") and the response to the RAI (submitted by Reference 4) identified the calculation relationship that included this calculation. Although the revised methodology addressed in Reference 8 does not employ calculation APP-PXS-M3C-020, we do not propose a revision to this RAI response because the point of the RAI concerned very specific assumptions regarding containment and heat sink initial conditions, which are unchanged in the current revision (Revision 2) of APP-PXS-M3C-071, "Containment Response Analysis for Long-Term PRHR Operation."

DEF provided a response to NRC RAI Letter 125 (Reference 6) on January 21, 2015 (Reference 7) which discussed the resolution of the Westinghouse WGOTHIC error and the impact on the condensate return analysis. The response committed to a future update of the analysis, which was provided to the NRC in Reference 8. The response to NRC RAI Letter 125 is still applicable to the calculations identified in the revised methodology, thus no revision to that response is needed.

If you have any questions, or need additional information, please contact Bob Kitchen at (704) 382-4046, or me at (704) 382-9248.

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

Executed on June 11, 2015.

Sincerely,

Christopher M Fallon

Christopher M. Fallon
Vice President - Nuclear Development

Enclosure:

1. Revised Response to Selected Questions from NRC Request for Additional Information Letter No. 116 Related to SRP Sections 6.3 and 15.2.6 for the Combined License Application, dated March 6, 2014

cc : U.S. NRC Region II, Regional Administrator (w/o enclosures)
Mr. Donald Habib, U.S. NRC Project Manager (w/enclosures)

Levy Nuclear Power Plant Units 1 and 2
Revised Response to Selected Questions from NRC Request for Additional Information Letter No. 116 Related to SRP Sections 6.3 and 15.2.6 for the Combined License Application, dated March 6, 2014

NRC RAI #	Duke Energy RAI #	Duke Energy Response
06.03-06	L-1127	Revised response enclosed – see following pages
06.03-09	L-1134	Revised response enclosed – see following pages

NRC Letter No.: LNP-RAI-LTR-116

NRC Letter Date: March 6, 2014

NRC Review of Section 06.03 - Emergency Core Cooling System

NRC RAI #: 06.03-6

Text of NRC RAI:

The transient return rate of condensate to the IRWST used in APP-SSAR-GSC-536 ("AP1000 Safe Shutdown Temperature Evaluation"), Revision 2, seems to indicate an asymptotic long term return rate of 0.7662, while the values used in the APP-PXS-M3C-020 ("PRHR Sizing/Performance"), Revision 3, calculation indicate a long term return rate of 0.824. Justify the discrepancy between the two and explain the exact nature of the transient return rates used in the APP-PXS-M3C-020 calculation ("PRHR Sizing/Performance").

DEF RAI ID #: L-1127

DEF Response to NRC RAI:

The analysis approach described in the response to RAI 6.03-13 and APP-GW-GLR-161 Revision 2, which was communicated to the staff via a May 5, 2015 submittal (NPD-NRC-2015-015), notes that APP-PXS-M3C-020 is no longer used in the Condensate Return analysis. As a result, the discussions of the discrepancies between the calculation and APP-SSAR-GSC-536 are no longer relevant to the condensate return rate development. RAI 6.03-13 requested more detail on the same discrepancies, and the response provided to that RAI is considered to supersede the response to RAI 6.03-6.

Associated LNP COL Application Revisions:

None

Attachments/Enclosures:

None

NRC Letter No.: LNP-RAI-LTR-116

NRC Letter Date: March 6, 2014

NRC Review of Section 06.03 - Emergency Core Cooling System

NRC RAI #: 06.03-9

Text of NRC RAI:

Figure 9 of the Levy submittal dated February 7, 2014, provides an illustration of inter-relationships of four calculations.

a. Explain this figure describing how information flows from one calculation to the other for design basis and best estimate calculations.
b. Explain how information flow loops are addressed. For example, APP-PXS-M3C-071 feeds containment pressure and temperature to SSAR-GSC-536, which feeds back bounding PRHR HX heat transfer and reactor vessel downcomer temperature to APP-PXS-M3C-071, creating a loop.

DEF RAI ID #: L-1134

DEF Response to NRC RAI:

As a result of the updated analysis approach communicated in RAI 6.03-13 and APP-GW-GLR-161 Revision 2, which was communicated to the staff via a May 5, 2015 submittal (NPD-NRC-2015-015), a revision to the response previously provided to RAI 6.03-9 is shown below. To better understand the evolution of the analysis approach, the original response is set forth below with minor consistency changes (highlighted in yellow), and the updated analysis approach is described afterwards.

Original Response

Figure 1 below shows the original interrelationship between the four calculations for the design basis and conservative, non-bounding analysis cases.

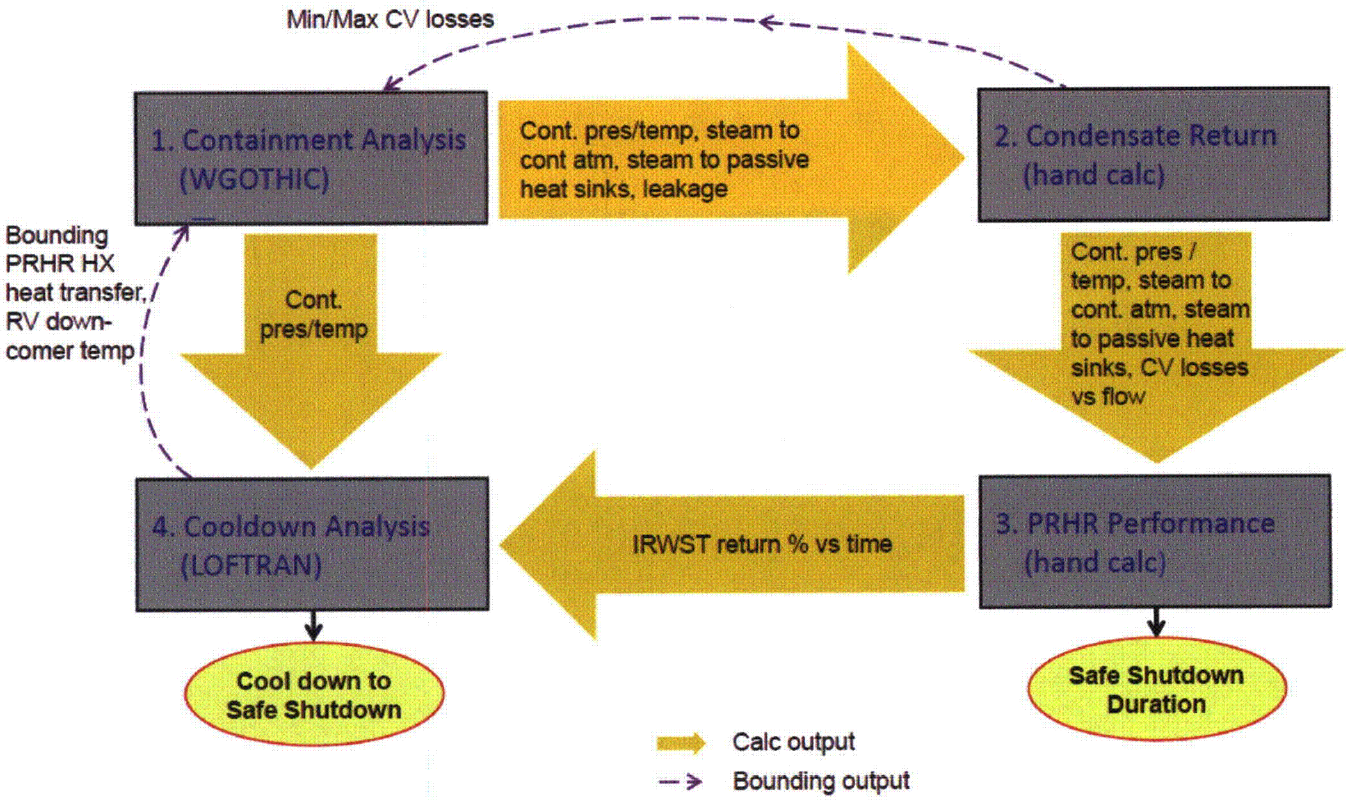

Figure 1: Original Analysis Approach

1. Containment Analysis

The purpose of "1. Containment Analysis" is to quantify the In-Containment Refueling Water Storage Tank (IRWST) water losses due to the mass of steam that is lost due to condensing on internal heat sinks, steam which pressurizes the atmosphere, and steam lost due to containment leakage.

"1. Containment Analysis" provides inputs into "2. Condensate Return". The main inputs include the containment pressure and temperature, mass of steam that condenses on heat sinks, mass of the steam that is in the containment atmosphere, and steam lost due to containment leakage. These values were solved by starting with WGOTHIC containment peak pressure model from revision 19 of the DCD and making changes to develop a conservative containment response to model condensation losses during Passive Residual Heat Removal (PRHR) Heat Exchanger (HX) operation.

"1. Containment Analysis" provides input into "4. Cooldown Analysis". The input provided to this calculation is the containment pressure and temperature response.

"1. Containment Analysis" evaluates two different fixed percentage losses from the CV, a minimum and a maximum which bound the actual loss which is determined in "2. Condensate Return".

"1. Containment Analysis" uses a bounding PRHR HX heat transfer rate and Reactor Vessel (RV) downcomer temperature input from the "4. Cooldown Analysis". The input from "4. Cooldown Analysis" provides a PRHR HX performance that is bounded on the high end to maximize the steam generated from the IRWST. The RV downcomer temperature is used to generate steam from the RV, which heats the lower portions of containment. The use of a bounding input avoids the need to iterate the calculations.

2. Condensate Return

The purpose of "2. Condensate Return" is to quantify the losses from the IRWST.

"2. Condensate Return" provides inputs into "3. PRHR Performance". The inputs provided into this calculation include the containment pressure and temperature, mass of steam to the containment atmosphere, mass of the steam to passive sinks and mass of steam lost due to containment leakage. These parameters are provided as a function of time. An additional input that is provided is a table of the losses from the CV shell (dripping, splashing) as a function of flow. The losses from the CV shell include rainout from the center of the dome and splashing losses due to CV plate weld misalignments, attachment plates, and losses at the entrance to the gutter.

"2. Condensate Return" uses the output results from "1. Containment Analysis" for the containment pressure and temperature, mass of steam to the containment atmosphere, mass of the steam to passive sinks and mass of steam lost due to containment leakage.

3. PRHR Performance

The purpose of "3. PRHR Performance" is to calculate the inputs necessary for "4. Cooldown Analysis", to demonstrate adequate safe shutdown duration and to evaluate potential Chapter 15 design basis analysis impacts.

"3. PRHR Performance" calculates the long-term transient performance including Reactor Coolant System (RCS) cooldown and re-heat (in the long term), IRWST heatup and boiloff due to PRHR HX input, PRHR HX performance based on RCS and IRWST temperature and level, and steaming from the RV. The inputs from "2. Condensate Return" are also used in this calculation. In addition to evaluating whether the Chapter 15 analyses would be affected, this calculation demonstrates that the safe shutdown duration is adequate.

"3. PRHR Performance" provides inputs into "4. Cooldown Analysis". The input provided into this calculation is the condensate return rate as a function of time. The time for the IRWST to reach saturation and the time for the top of the PRHR HX tube bundle to uncover are used for comparison purposes in "4. Cooldown Analysis."

"3. PRHR Performance" provides information to evaluate the potential impact to the Chapter 15 analyses. This information includes the time to uncover the top-most PRHR HX tubes and the impact of PRHR HX tube uncovery on RCS cooldown. Examination of the aforementioned information from "3. PRHR Performance" determined re-evaluation of the Chapter 15 analyses using the time-dependent condensate return rate would yield similar analysis results. Therefore re-evaluation of the Chapter 15 analyses was not required.

4. Cooldown Analysis

The purpose of "4. Cooldown Analysis" is to verify the PRHR HX can reduce the core average temperature to 420°F in 36 hours. The return rate as a function of time is input from "3. PRHR Performance" to account for all of the condensate losses once the IRWST begins to boil.

"4. Cooldown Analysis" also receives the containment pressure vs time from "1. Containment Analysis."

"4. Cooldown Analysis" also provides a bounding input to "1. Containment Analysis" for the PRHR HX heat transfer rate and RV downcomer temperature as discussed above. By using this bounding input the need to iterate the calculations is eliminated.

Design Basis Accidents (DBA) and conservative, non-bounding analyses are included as separate cases within these same calculations using the same approach. As a result, the flow of information between the calculations for both DBA and conservative, non-bounding cases remains the same as previously discussed.

Updated Analysis Approach

In April 2015, the Condensate Return analysis suite was revised to correct known errors and a simplified analysis approach was employed. This approach is reflected in Figure 2 below.

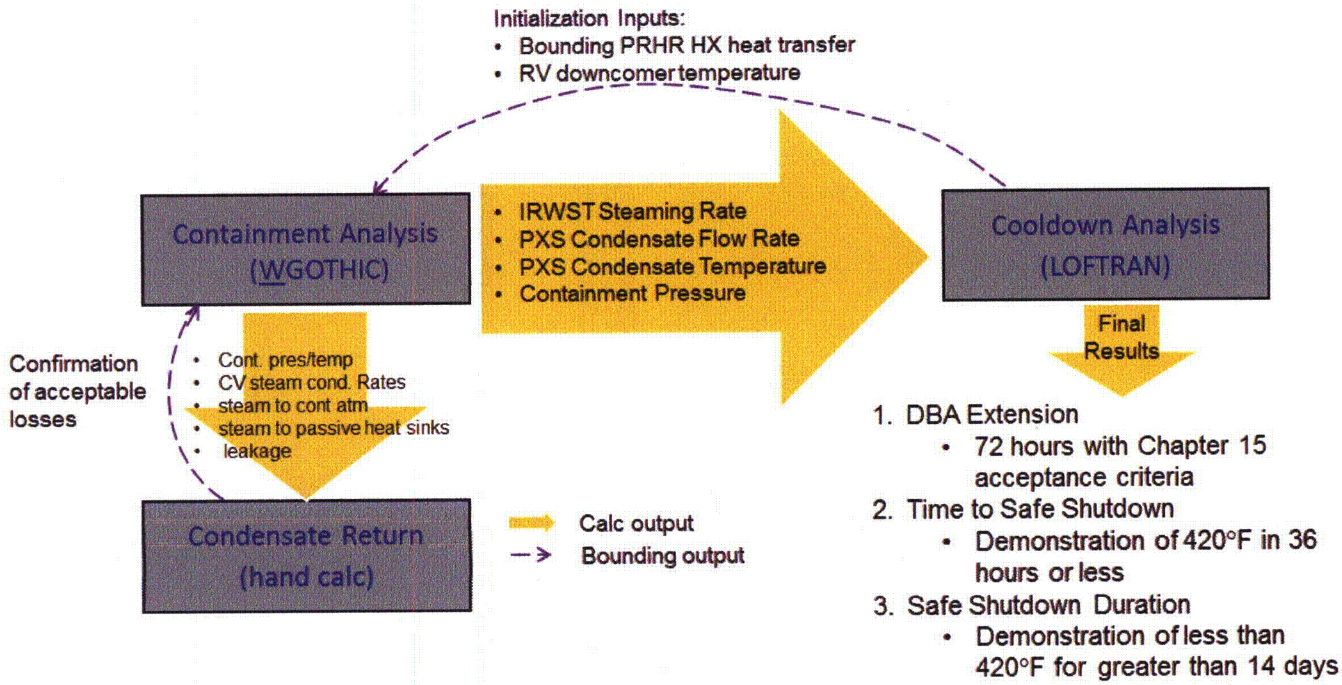

Figure 2: Simplified Analysis Approach

WGOTHIC Containment Analysis (APP-PXS-M3C-071)

The purpose of this analysis is to quantify the amount of steam from the IRWST which is not returned via the PXS downspout and gutter system. WGOTHIC tracks water losses due to the mass of steam that is lost due to condensing on internal heat sinks, steam which pressurizes the atmosphere, steam lost due to containment leakage, and the condensate which bypasses the downspout and gutter arrangement.

The condensate return hand calculation (APP-PXS-M3C-072) provides the basis for a confirmatory check regarding total losses from the containment vessel shell. A conservative constant percentage loss of condensation on the containment vessel is used by WGOTHIC which bounds the variable percentage determined by the hand calculation.

The containment analysis also provides inputs to the LOFTRAN Cooldown Analysis. The inputs provided to this calculation include the containment pressure and temperature response, IRWST steaming rate, PXS condensate temperature and PXS condensate flow rate. Cases assessing DBA as well as conservative non-bounding conditions are both assessed in this analysis.

Bounding PRHR HX heat transfer rate and RV downcomer temperature inputs from the cooldown analysis are used in the containment analysis. LOFTRAN provides a PRHR HX performance to the containment analysis that is bounded on the high end to maximize the steam generated from the IRWST. The RV downcomer temperature is used to generate steam from the RV, which heats the lower portions of containment. The use of bounding inputs avoids the need to iterate the calculations.

Condensate Return Analysis (APP-PXS-M3C-072)

The purpose of this calculation is to quantify the losses from the containment vessel shell and confirm the value used in the containment analysis calculation is appropriate.

Results from the containment analysis are used for the containment pressure and temperature, mass of steam to the containment atmosphere, mass of the steam to passive sinks and mass of steam lost due to containment leakage.

LOFTRAN Cooldown Analyses (APP-SSAR-GSC-536, APP-SSAR-GSC-009)

The purpose of the LOFTRAN Cooldown Analyses are to verify that three criteria are met regarding plant performance:

1. Design Basis Accident Extension – An analysis case using typical DBA assumptions that shows acceptability with respect to Chapter 15 acceptance criteria for 72 hours
    a. Maximum primary and secondary system pressures
    b. Maximum pressurizer water level
    c. Minimum Departure from Nucleate Boiling Ratio
2. Time to Safe Shutdown – Confirmation that PRHR HX can reduce the RCS core average temperature to 420°F in 36 hours. This licensing basis performance criterion is satisfied using a conservative, non-bounding analysis.

3. Safe Shutdown Duration – A continuation of the Time to Safe Shutdown analysis to demonstrate adequate PRHR HX performance to maintain RCS core average temperature at or below 420°F for greater than 14 days.

These analyses receive inputs from the WGOTHIC containment analysis, including the containment pressure and temperature response, IRWST steaming rate, PXS condensate temperature and PXS condensate flow rate.

This analysis also provides bounding inputs to the WGOTHIC calculation for the PRHR HX heat transfer rate and RV downcomer temperature as discussed above. The use of bounding inputs avoids the need to iterate the calculations.

Associated LNP COL Application Revisions:

None

Attachments/Enclosures:

None