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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
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

Reference:

1. Letter from Christopher Fallon (DEF) to Nuclear Regulatory Commission (NRC), dated April 18, 2013, "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-2013-010

2. Letter from Christopher Fallon (DEF) to Nuclear Regulatory Commission (NRC), dated June 3, 2013, "Supplement 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-2013-023

3. Letter from Christopher Fallon (DEF) to Nuclear Regulatory Commission (NRC), dated October 21, 2013, "Supplement 2 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-2013-044

4. Letter from Christopher Fallon (DEF) to Nuclear Regulatory Commission (NRC), dated February 7, 2014, "Supplement 3 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-2014-005

5. Letter from Christopher Fallon (DEF) to Nuclear Regulatory Commission (NRC), dated June 27, 2014, "Partial Response to NRC RAI Letters 116, 117 and 118 - SRP Sections 6.3 and 15.2.6," Serial: NPD-NRC-2014-021

6. Letter from Christopher Fallon (DEF) to Nuclear Regulatory Commission (NRC), dated July 10, 2014, "Supplement 4 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-2014-023

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7. Letter from Christopher Fallon (DEF) to Nuclear Regulatory Commission (NRC), dated July 24, 2014, "Supplement to Partial Response to NRC RAI Letters 116, 117 and 118 - SRP Sections 6.3 and 15.2.6," Serial: NPD-NRC-2014-028

8. Letter from Christopher Fallon (DEF) to Nuclear Regulatory Commission (NRC), dated November 17, 2014, "Supplement 5 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-2014-038

9. 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."

10. Letter from Robert Kitchen (DEF) to Nuclear Regulatory Commission (NRC), dated March 17, 2015, "Submittal of February 26, 2015 Presentation Materials to Address Status of AP1000 IRWST Condensate Return and MCR Dose, MCR Heat Up, and Hydrogen Venting RAI Responses and Request for Withholding Information from Public Disclosure," Serial: NPD-NRC-2015-012

11. Memorandum to Lawrence J. Burkhart (NRC) from Donald Habib (NRC), "Summary of a Public Teleconference on March 26, 2015, with Members of the AP1000 Design Center to Discuss AP1000 Licensing and Technical Issues," dated April 7, 2015

Ladies and Gentlemen:

Duke Energy Florida, Inc. (DEF) hereby submits a response to the Nuclear Regulatory Commission's (NRC) request for additional information (RAI) cited in Reference 9.

Enclosure 1 to this letter contains DEF's response consisting of a response to RAI question 06.03-13. This letter also submits Supplement 6 to our request for exemption and associated design change description to address a design change to the AP1000 Design Control Document (DCD) Revision 19 (Reference 1). This design change requires Nuclear Regulatory Commission (NRC) notification and review in accordance with Interim Staff Guidance DC/COL-ISG-011, "Finalizing Licensing-basis Information." The Levy Nuclear Plant (LNP) Combined License Application (COLA) incorporates the AP1000 DCD by reference.

Enclosure 1 describes a revision to the condensate return analysis methodology described in Reference 4 in order to eliminate the impact of the error found in the Passive Residual Heat Removal Heat Exchanger (PRHR HX) Sizing/Performance calculation. The revision removes the PRHR HX Sizing/Performance calculation from the analysis methodology. As a result, previous documents submitted to the NRC which contain a description of the analyses and analysis methodology have been revised and are contained in Enclosures 2 and 3. Enclosure 2 (proprietary) consists of the report, APP-GW-GLR-161, "Changes to Passive Core Cooling System Condensate Return," Revision 2. Enclosure 3 contains a redacted, non-proprietary version of the report that is identified as APP-GW-GLR-607, Revision 2.

The subject analyses described in the enclosures have been completed and are available for NRC review and audit. Changes to the Request for Exemption regarding containment condensate return cooling are contained in Enclosure 6. Changes to the licensing basis resulting from the revised condensate return analyses, beyond those identified in References 1 through 8, are contained in Enclosures 7 and 8. The changes to the COLA identified in Enclosure 8 will be included in a future update of the COLA.

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 this response will be incorporated in a revision to the affected RAI responses and will be submitted separately to the NRC by June 8, 2015.

As Enclosure 2 contains information proprietary to Westinghouse Electric Company, LLC, it is supported by an affidavit signed by Westinghouse, the owner of the information. The affidavit sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of Section 2.390 of the Commission's regulations. Accordingly, it is respectfully requested that the information (Enclosure 2) which is proprietary to Westinghouse be withheld from public disclosure in accordance with 10 CFR Section 2.390 of the Commission's regulations. Westinghouse's Application for Withholding Proprietary Information from Public Disclosure CAW-15-4132 and accompanying Affidavit, and Proprietary Information Notice and Copyright Notice are provided as Enclosures 4 and 5 respectively.

Correspondence with respect to the copyright or proprietary aspects of the items listed above, including the supporting Westinghouse affidavit should reference CAW-15-4132 and should be addressed to J. A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company, 1000 Westinghouse Drive, Building 3 Suite 310, Cranberry Township, Pennsylvania 16066.

In public meetings held on February 26, 2015 (Reference 10) and March 26, 2015 (Reference 11), DEF provided information to the NRC staff regarding a long term analysis to confirm the duration of the PRHR HX closed loop cooling mode of operation. The closed loop cooling mode duration analysis was previously performed using the PRHR HX Sizing/Performance calculation, which is no longer part of the condensate return analysis methodology as described above. The results of this analysis are on schedule to be completed by June 15, 2015 and will be made available for NRC review and audit. DEF anticipates the analysis will confirm the duration currently contained in the licensing basis (greater than 14 days) and does not expect to submit additional changes to the licensing basis beyond those contained in this submittal.

If you have any further 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 May 5, 2015.

Sincerely,

Christopher M. Fallon

Christopher M. Fallon
Vice President - Nuclear Development

Enclosures:

1. Response to NRC Request for Additional Information Letter No. 124 Related to SRP Section 06.03 for the Combined License Application, dated December 5, 2014
2. Westinghouse APP-GW-GLR-161, Revision 2 (PROPRIETARY)
3. Westinghouse APP-GW-GLR-607, Revision 2 (NON-PROPRIETARY VERSION)
4. Westinghouse Application Letter CAW-15-4132 and Affidavit
5. Proprietary Information Notice and Copyright Notice
6. Request for Exemption Regarding Containment Condensate Return Cooling
7. Tier 1 and Tier 2 Licensing Basis Documents - Proposed Changes
8. Levy Nuclear Plant Units 1 and 2 COLA Revisions

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
Response to NRC Request for Additional Information Letter No. 124 Related to SRP Section 06.03 for the Combined License Application, dated December 5, 2014

NRC RAI #	Duke Energy RAI #	Duke Energy Response
06.03-13	L-1120	Response enclosed – see following pages

NRC Letter No.: LNP-RAI-LTR-124

NRC Letter Date: December 5, 2014

NRC Review of Section 06.03 - Emergency Core Cooling System

NRC RAI #: 06.03-13

Text of NRC RAI:

NRC staff was informed of an error in the PRHR-HX Sizing/Performance calculation during a public teleconference on 11/06/2014 (ML14297A064). This error impacts the exemption request and design change to address the containment condensate return cooling design submitted to the NRC in letter dated 2/7/2014 (ML14042A034). The resulting impact of the error on the Safe Shutdown Temperature Evaluation caused staff to question the assumptions within the PRHR-HX Sizing/Performance Calculation and the magnitude of their impact on the Safe Shutdown Temperature Evaluation. NRC staff is requesting the following additional information:

1. Identify the error in the PRHR-HX Sizing/Performance calculation.
2. Quantify the impact of the calculation error on (a) the condensate return rate and (b) the margin to the acceptance criteria for the Chapter 19E Safe Shutdown Temperature Evaluation and the 72 hour Loss of AC Power to the Plant Auxiliaries.
3. Explain how the spreadsheet calculation in the PRHR-HX Sizing/Performance calculation was assessed for its applicability. Were any comparisons against experiments performed? Provide the results of the comparisons.
4. Explain why the spreadsheet calculation in the PRHR-HX Sizing/Performance calculation provides a RCS cooldown rate different from that of the LOFTRAN calculation in the Safe Shutdown Temperature Evaluation. Discuss the differences in modeling of the PRHR-HX and the RCS. Explain the basis for the differences in modeling choices when applicable.
5. Explain how the RCS heat capacity is obtained for use in the PRHR-HX Sizing/Performance Calculation. Discuss why this is an accurate/conservative estimation of the actual RCS heat capacity.
6. Provide a description of any additional changes made to the spreadsheet calculation or any other analyses associated with condensate return.

DEF RAI ID #: L-1120

DEF Response to NRC RAI:

1. Identify the error in the PRHR-HX Sizing/Performance calculation.

The PRHR HX Sizing / Performance calculation evaluates both steady state and also transient operation of the Passive Residual Heat Removal Heat Exchanger (PRHR HX). The heat exchanger model in APP-PXS-M3C-020 (Reference 1) has the capability of evaluating the natural circulation heat transfer of the PRHR HX based on user input values for performance basis (tube plugging/resistances), Hot Leg Temperature, InContainment Refueling Water Storage Tank (IRWST) temperature, and IRWST water level. Steady state performance is evaluated over the entire operating range for the heat exchanger, which is then used to create performance tables to interpolate between reactor coolant system (RCS) and IRWST conditions to evaluate transient heat exchanger operation.

Differences between the spreadsheet and LOFTRAN results had been noticed and evaluated in the past. The spreadsheet was improved to resolve some of these differences. The remaining difference in results was attributed to the simplified nature of the spreadsheet calculation (no core makeup tanks and a lumped RCS) and was thought to be adequate for its intended purpose (determine the condensate loss vs time input to LOFTRAN and the safe shutdown duration).

A review of the PRHR HX Sizing / Performance spreadsheet and the LOFTRAN heat exchanger models revealed a series of issues in the spreadsheet calculation which were captured in the Westinghouse corrective action program (CAPAL). The CAPAL identifies three issues. Two of the issues are related to conservative treatment in the interpolation of the PRHR HX performance in the calculation which do not negatively impact the calculation results, and therefore are not discussed in this response. The third identified issue was related to an input cell for containment pressure, which does significantly impact/reduce the calculated PRHR HX heat transfer rate at IRWST temperatures greater than 212°F. The reduced PRHR HX heat transfer impacts the calculated long-term response documented in the calculation.

This error in the calculation was caused by an improperly linked input cell for the containment pressure used in the steady state heat exchanger model which determines the heat transfer rates documented in Table 5.3 of the calculation. An input of "14.7 psia" was manually typed into the calculation and used to determine local pressures along the elevation of the PRHR HX tubes. This local pressure was then used to determine the local saturation temperature and evaluate the heat exchanger performance when operating via boiling convection. Using atmospheric pressure as an input is accurate for heat exchanger operation at subcooled IRWST temperatures and also at the onset of boiling. However, when a user selected IRWST temperature of "260°F" was input for evaluation, this elevated IRWST temperature was not linked to the heat transfer model to properly adjust the containment pressure used to determine tank saturation conditions. In this case, "14.7 psia" was still being used to determine tank saturation conditions, when heat transfer was expected to be evaluated based on the 260°F input. As a result, for all performance conditions calculated at IRWST temperatures of 260°F, the heat transfer rates determined were based on an IRWST temperature of 212°F.

This error resulted in an over-estimation of the PRHR HX heat transfer for the transient RCS cooldown cases documented in Section 5.1.5 of the calculation. PRHR HX heat transfer performance at various RCS Hot Leg Temperatures and IRWST conditions are compiled into a table which is interpolated over time to track the heat exchanger performance as RCS and IRWST conditions change. Heat transfer rates are interpolated from the RCS and IRWST conditions. In this table, the heat transfer rates compiled for the IRWST temperatures of 260°F were actually determined based on an IRWST temperature of 212°F due to the disconnect between the containment pressure and the established input. As a result, significantly lower temperatures and faster cooldown rates were achieved in the spreadsheet calculation when compared with the LOFTRAN Safe Shutdown Temperature analysis documented in APP-SSAR-GSC-536 (Reference 2).

Following the identification of this error in the PRHR HX Sizing / Performance calculation, a Westinghouse review team was assembled to compare and contrast the PRHR HX models being used in each of the separate calculations. During the review of the calculation approach, it was recognized that by bounding the losses from the Containment Vessel Shell, and using the ratio of the "Mass of Steam Returned to the IRWST" to the "Mass of Steam Generated by the PRHR HX" from WGOTHIC (Reference 3), the approach could be simplified by using the WGOTHIC model to determine the condensate return rate rather than using the PRHR HX Sizing / Performance calculation. By removing the spreadsheet calculation, the condensate return rate determination is simplified and eliminates any potential distortions that may result from involving an independent PRHR HX heat transfer model.

Therefore, in an effort to simplify the condensate return analyses, the approach moving forward involves the removal of the PRHR HX Sizing / Performance calculation from the condensate return analysis methodology. Although this calculation won't be used any longer, the same overall method will be used to determine the condensate return rate. Losses from the containment response (steam which pressurizes containment, steam condensation on passive heat sinks, and containment leakage) are still determined by the WGOTHIC model. A constant bounding Containment Vessel bypass rate (provided in Reference 4) is input into WGOTHIC to accommodate losses from the shell geometry, which is sufficient since the transient doesn't result in significant differences in the percent of condensation lost from the shell as a function of flow. These losses are removed in the WGOTHIC model, and a simple return rate ratio can be developed from the code output for the condensation returned to the IRWST vs. the steam generated from the IRWST in the model. This is calculated in the same manner as it was in the PRHR HX Sizing / Performance calculation, just using the steam generated by WGOTHIC rather than the steam generated by the spreadsheet calculation as input to the condensate mass balance calculation. The steam generation rate in WGOTHIC is based on a bounding PRHR HX heat input provided by the LOFTRAN model, which provides consistency between models when the return rate is generated for input back into the LOFTRAN Safe Shutdown Temperature Evaluation.

The updated method for the condensate return basis has been evaluated and documented in revisions to the design calculations. References 6, 7, and 8 provide revisions to APP-PXS-M3C-071, APP-PXS-M3C-072, and APP-SSAR-GSC-536, respectively.

2. Quantify the impact of the calculation error on (a) the condensate return rate and (b) the margin to the acceptance criteria for the Chapter 19E Safe Shutdown Temperature Evaluation and the 72 hour Loss of AC Power to the Plant Auxiliaries.

(a) Condensate Return Rate Impact

Due to the change in the calculation approach, it is not necessary to quantify the impact of the calculation error on the condensate return rate. Formal calculation revisions are being provided and report the new condensate return rate as calculated by WGOTHIC (Reference 6).

(b) Ch. 19E and 72 Hour Cases

Due to the change in the calculation approach, the Chapter 19E Safe Shutdown Temperature evaluation documented in APP-SSAR-GSC-536 (Reference 2) and the 72 Hour Case documented in APP-SSAR-GSC-805 (Reference 5) have been revised to reflect the new approach. The APP-SSAR-GSC-805 (Reference 5) calculation has been combined with APP-SSAR-GSC-536, and documented in Reference 8. The margin to acceptance criteria is reported in this revised calculation.

3. Explain how the spreadsheet calculation in the PRHR-HX Sizing/Performance calculation was assessed for its applicability. Were any comparisons against experiments performed? Provide the results of the comparisons.

Due to the change in the calculation approach, the applicability of the PRHR HX Sizing / Performance calculation is not necessary to be assessed to support the revised calculation analysis methodology.

4. Explain why the spreadsheet calculation in the PRHR-HX Sizing/Performance calculation provides a RCS cooldown rate different from that of the LOFTRAN calculation in the Safe Shutdown Temperature Evaluation. Discuss the differences in modeling of the PRHR-HX and the RCS. Explain the basis for the differences in modeling choices when applicable.

Due to the change in the calculation approach, it is not necessary to expand on the differences in the modeling of the PRHR HX between the PRHR HX Sizing / Performance calculation and the LOFTRAN Safe Shutdown Temperature Evaluation.

5. Explain how the RCS heat capacity is obtained for use in the PRHR-HX Sizing/Performance Calculation. Discuss why this is an accurate/conservative estimation of the actual RCS heat capacity.

Due to the change in the calculation approach, it is not necessary to discuss the development of the RCS heat capacity for the PRHR HX Sizing / Performance calculation.

6. Provide a description of any additional changes made to the spreadsheet calculation.

Calculation errors associated with the PRHR HX Sizing / Performance calculation were discussed in the response to Question 1. In this RAI response, only the error in the calculation of heat transfer at IRWST saturation conditions above 212°F has been discussed in detail though the change to the approach in determining the condensate return rate makes the error in the PRHR HX Sizing / Performance calculation no longer important to the analysis basis.

Aside from these items and the new approach detailed in response to Question 1, no additional changes are required for the issues described in this subject RAI.

Changes to the Request for Exemption regarding containment condensate return cooling are contained in Enclosure 6. Changes to the AP1000 DCD Tier 2 licensing basis to reflect the results of the revised calculations for safe shutdown temperature are shown in Enclosure 7, while the associated LNP COL application revisions are shown in Enclosure 8.

References

1) APP-PXS-M3C-020 Rev. 3, "PRHR HX Sizing / Performance"
2) APP-SSAR-GSC-536 Rev. 2, "**AP1000** Safe Shutdown Temperature Evaluation"
3) APP-PXS-M3C-071 Rev. 1, "Containment Response Analysis for Long-Term PRHR Operation"
4) APP-PXS-M3C-072 Rev. 1, "Condensate Return to IRWST for Long Term PRHR Operation"
5) APP-SSAR-GSC-805 Rev. 0, "**AP1000** Safe Shutdown Temperature Evaluation – Responses to NRC RAIs"
6) APP-PXS-M3C-071 Rev. 2, "Containment Response Analysis for Long-Term PRHR Operation"
7) APP-PXS-M3C-072 Rev. 2, "Condensate Return to IRWST for Long Term PRHR Operation"
8) APP-SSAR-GSC-536 Rev. 3, "**AP1000** Safe Shutdown Temperature Evaluation"

Associated LNP COL Application Revisions:

See Enclosure 8

Attachments/Enclosures to Response to NRC:

See Enclosures 7 and 8