U.S. NUCLEAR REGULATORY COMMISSION AUDIT FOR

WESTINGHOUSE ELECTRIC COMPANY

TOPICAL REPORT WCAP-17794-P, REVISION 0, AND

WCAP-17794-NP, REVISION 0, "10X10 SVEA FUEL CRITICAL POWER

EXPERIMENTS AND NEW CPR CORRELATIONS: D5 FOR

SVEA-96 OPTIMA3" (TAC NO. MF3368)

1.0 BACKGROUND

By letter dated November 22, 2013 (Reference 1), Westinghouse Electric company (Westinghouse) submitted to the U. S. Nuclear Regulatory Commission (NRC) Westinghouse Topical Report (TR) WCAP-17794-P, Revision 0, and WCAP-17794-NP, Revision 0, "10x10 SVEA Fuel Critical Power Experiments and New Critical Power Ratio (CPR) Correlation: D5 for SVEA-96 Optima3," (Reference 2) for review and approval. This TR describes critical power correlation for SVEA-96 Optima3 fuel. The submitted TR would allow Westinghouse to use the D5 CPR correlation on SVEA-96 Optima3 fuel.

The NRC staff has proposed to conduct an audit to discuss the **[ ]** for the CPR prediction of the SVEA-96 Optima3 fuel assembly, and to discuss Westinghouse's responses to the NRC Requests for Additional Information (RAIs).

The Nuclear Performance and Code Review Branch (SNPB) staff has performed a review of the TR, has submitted RAIs, has received responses on those RAIs, and is in the process of resolving any remaining issues. The Regulatory Audit will be held in accordance with Office of Nuclear Reactor Regulation procedure as described in LIC-111.

2.0 REGULATORY AUDIT SCOPE

The scope of this audit is to discuss the remaining open items. Chief among these items is the **[ ]** the CPR predictions for the SVEA-96 Optima3 design. A complete list of status of each RAI is provided as an appendix to this audit report.

The NRC staff would like Westinghouse to make available the engineer(s) with the best knowledge of the WCAP-17794-P, Revision 0, and WCAP-17794-NP, Revision 0, TR, **[ ]** and who can address any comprehension questions by the NRC staff as well as any appropriate references.

3.0 TEAM AND REVIEW ASSIGNMENTS

The Regulatory Audit will be held at the Westinghouse facilities in Rockville, MD.

Joshua Kaizer, SNPB, Division of Safety Systems (DSS)
Reed A. Anzalone, SNPB, DSS
Joshua J. Whitman, SNPB, DSS
John Lehning, SNPB, DSS

4.0 LOGISTICS

Audit Dates: Tuesday, March 21, 2017 – Thursday, March 23, 2017 and additional follow-up phone calls as needed.

Westinghouse should provide a conference room for discussions.

5.0 DELIVERABLES

Regulatory Audit summary will be provided within 90 days of the completion of the audit.

6.0 REFERENCES

1. Letter from James A. Gresham (W) to U.S. NRC, "Submittal of WCAP-17794-P, Revision 0, and WCAP-17794-NP, Revision 0, "10x10 SVEA Fuel Critical Power Experiments and New CPR Correlation: D5 for SVEA-96 Optima3," November 22, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13333A274).

2. Bergmann, U., Hemlin, M., Bergman, K., and LeCorre, J-M., "10x10 SVEA Fuel Critical Power Experiments and New CPR Correlation: D5 for SVEA-96 Optima3", WCAP-17794-P/NP, November 2013 (ADAMS Accession No. ML13333A275).

Appendix A – RAI Status

NEW RAI-SNPB-37

An analysis of the data **[**

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1. RAI-SNPB-01

   This RAI has been resolved.

2. RAI-SNPB-02

   This RAI has been resolved.

3. RAI-SNPB-03
   [

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4. RAI-SNPB-04

   Westinghouse discussed the differences in flow areas between the test channel and the fuel bundle. The flow area of the test channel is slightly smaller than that of the fuel bundle **[ ]** This mostly due in the corners where the water cross walls are welded to the outer channel section. They confirmed that the inner dimensions of the channel and the rod pitch are not impacted. However, why the total impact on the entire bundle flow area was only **[ ]** It seems that this localized chance would have a dramatic impact on the local flow area near the water cross corners where the weld exists. This was not addressed in the RAI response. Please address this issue.

5. RAI-SNPB-05

   This RAI has been resolved.

6. RAI-SNPB-06

   After testing, Westinghouse identified an axial shift in a number of grid spacers. Westinghouse provided some analysis of this spacer shift, but did not fully address the issue; therefore additional information was requested in RAI-SNPB-06. In their response, Westinghouse provided a more detailed description of the spacer shift. **[**

   ] Westinghouse used a separate subchannel code to calculate the impact of the spacer shift and determined it was on the order of **[ ]** in CPR. They further stated that the dryout would occur at multiple elevations at the same time, thus demonstrating that the decreased grid span had minimal impact on the CPR.

   However, Westinghouse did not provide evidence which demonstrated how often the TC in this grid span did register dryout coincident with other gird spans. Nor did Westinghouse demonstrate test repeatability during the test program which focused specifically at this elevation, which would also show that the experimental error did not increase due to the grid span shift. Please provide the evidence and demonstrate test repeatability.

7. RAI-SNPB-07

   Needs to be discussed.

8. RAI-SNPB-08

   This RAI has been resolved.

9. RAI-SNPB-09

   May be resolved, needs explanation and further discussion.

10. RAI-SNPB-10

    This RAI has been resolved.

11. RAI-SNPB-11

    This RAI has been resolved.

12. RAI-SNPB-12

    This RAI has been resolved.

13. RAI-SNPB-13

    This RAI has been resolved.

14. RAI-SNPB-14

    This RAI has been resolved.

15. RAI-SNPB-15

    This RAI has been resolved.

16. RAI-SNPB-16

    This RAI has been resolved, Westinghouse provided requested information.

17. RAI-SNPB-17

    RAI-SNPB-17 has not been resolved. In their response to RAI-SNPB-17, Westinghouse discussed how the variation in the D5 CPR prediction between similar tests was used to determine the uncertainty of the measured CPR value. However, that variation does not separate out the repeatability (i.e., uncertainty) of the experimental facility. Instead, it convolutes that repeatability with other uncertainties in the D5 model. Therefore, Westinghouse should provide an assessment of the repeatability of the experimental facility (taking into account the inability to obtain exact repeat test points) and demonstrates this test repeatability is small compared to the uncertainty in the D5 model.

18. RAI-SNPB-18

    RAI-SNPB-18 has not been resolved. In response to **Error! Reference source not found.**RAI-SNPB-18, Westinghouse discussed how the heat losses were determined, but did not discuss how the heat losses were accounted for in terms of impacting the measured critical power value. Also, Westinghouse did not discuss how heat losses are impacted by changing powers in the test assembly.

19. RAI-SNPB-19

    Thank you for the tables. Please make them available, so NRC staff could review them again for better understanding, and also for better understanding of the derivations.

20. RAI-SNPB-20

    Please explain the answer to the NRC staff.

21. RAI-SNPB-21

    This RAI has been resolved.

22. RAI-SNPB-22

    This RAI has likely been resolved. However, additional discussion is needed to confirm.

23. RAI-SNPB-23

    This RAI has been resolved.

24. RAI-SNPB-24

    This RAI has been resolved.

25. RAI-SNPB-25

    NRC staff would like to discuss it further to understand why **[**
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26. RAI-SNPB-26

    This RAI has been resolved.

27. RAI-SNPB-27

    This RAI has been resolved.

28. RAI-SNPB-28

    Needs further discussion to confirm that this RAI is resolved.

29. RAI-SNPB-29

    NRC staff would like to review a plot of the distributions. NRC staff would like to hear explanation and see data that explains what is happening at low I2's (staff's concern is that there is something happening vs. power shape).

30. RAI-SNPB-30

    This RAI has been resolved.

31. RAI-SNPB-31

    This RAI has been resolved.

32. RAI-SNPB-32

    This RAI has been resolved.

33. RAI-SNPB-33

    Needs further discussion to confirm that this RAI is resolved.

34. RAI-SNPB-34

NRC staff needs more detailed discussion.

35. RAI-SNPB-35

This RAI has been resolved.

36. KKL RAI - RAI-SNPB-36

Recently, the NRC was briefed on an event at nuclear power plant in Switzerland where **[** **]** on SVEA Optima2 fuel. Because these assemblies were **[**

] for the assemblies. Given the similarities between Optima2 and Optima3 fuel **[** **]** Westinghouse should justify the use of the **[**

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Appendix B – Talking Points

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