June 6, 2017

Mr. James A. Gresham, Manager
Regulatory Compliance and Plant Licensing
Westinghouse Electric Company
1000 Westinghouse Drive
Cranberry Township, PA 16066

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION RE: WESTINGHOUSE ELECTRIC COMPANY LETTER "CHANGES IN WESTINGHOUSE WCAP-8354-P-A & WCAP-8355-A, "LONG TERM ICE CONDENSER CONTAINMENT CODE - LOTIC CODE" (TAC NO. MF9354)

Dear Mr. Gresham:

By letter dated February 1, 2017 (Agencywide Documents Access and Management System Accession No. ML17034A376), Westinghouse Electric Company (Westinghouse) submitted to the U.S. Nuclear Regulatory Commission (NRC) a letter for review dated February 1, 2017, "Errata for WCAP-8354-P-A (Proprietary) and WCAP-8355-A (Non-Proprietary), 'Long Term Ice Condenser Containment Code - LOTIC Code.'" Upon review of the information provided, the NRC staff has determined that additional information is needed to complete the review. Westinghouse committed to the 60-day response timeframe for RAIs once received. If you have any questions regarding the enclosed RAI questions, please contact me at 301-415-3151.

Sincerely,

/RA Leslie Perkins Acting for/

Ekaterina Lenning, Project Manager
Licensing Processes Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Project No. 700

Enclosure:
RAI Questions (Non-Proprietary)

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR CHANGES IN WESTINGHOUSE WCAP-8354-P-A & WCAP-8355-A, "LONG TERM ICE CONDENSER CONTAINMENT CODE - LOTIC CODE" LETTER DATED: JUNE 6, 2017

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REQUEST FOR ADDITIONAL INFORMATION FOR

"CHANGES IN WESTINGHOUSE WCAP-8354-P-A & WCAP-8355-A

LONG TERM ICE CONDENSER CONTAINMENT CODE - LOTIC CODE" LETTER

WESTINGHOUSE ELECTRIC COMPANY

PROJECT 700

INTRODUCTION

The NRC staff has reviewed the change proposed in Section 5.2, page 5.2-6 of WCAP-8354-P-A and WCAP-8355-A in the above referenced letter regarding the correction of discrepancy between the description of the methodology and its implementation in Westinghouse Electric Company (Westinghouse) LOTIC code for the long term ice condenser containment loss-of-coolant accident (LOCA) analysis.

A brief summary of the method used for the determination of containment pressure profile during the depressurization phase of LOCA, from the end of the blowdown to the establishment of recirculation flow between the control volumes, described in Section 5.2 of WCAP-8354-P-A and as understood by the NRC staff is as follows:

During the phase between the end of blowdown and the establishment of recirculation, nitrogen blowdown from accumulator occurs, reactor coolant system steam boil-off is initiated, and the engineered safety feature systems (recirculation fan, safety injection, and spray systems) come into operation. In this phase, the lower compartment starts to be filled with the upper compartment atmosphere at the fan flow rate. The analysis assumes an expanding volume displacing the atmosphere present in an open cylinder which does not assume mixing of the expanding volume and the atmosphere in the cylinder inferring unequal temperature for the two volumes and uniform pressure in the cylinder. The expanding volume has an atmosphere of water, steam, and air. The only flow leaving this volume is the steam which is condensing. The mass and energy balance equations for the expanding volume are combined into one equation. The resulting equation is directly integrated between two instants, while the pressure is kept constant over the integration period, equal to the value at the lower boundary of the interval. At instant 1, the pressure, temperature, and volume are known. An iterative process based on Newton's method is applied and after meeting the error criteria in an iteration, the water mass in the volume is calculated. With known masses and specific enthalpies in the expanding volume, the instantaneous total enthalpy in the volume is calculated, and continues with next time step iteration.

In Section 5.2, page 5.2-6 of WCAP-8354-P-A and WCAP-8355-A, the following logic for the calculation of the instantaneous containment pressure (pressure between two consecutive time steps) is being revised:

FROM

[1] If the expanding volume is smaller than the lower compartment volume, the system pressure calculation is based on the upper compartment and the ice-filled part of the ice compartment.

[2] If the expanding volume occupies the lower compartment, the pressure calculation then includes the lower compartment conditions.

[3] If the expanding volume fills the lower compartment and the ice-empty part of the ice compartment, this calculation period is terminated.

TO

[1] If the expanding volume is smaller than the lower compartment volume and ice-empty part of the ice compartment, the system pressure calculation is based on the upper compartment and the ice-filled part of the ice compartment.

[2] If the expanding volume fills the lower compartment and the ice-empty part of the ice compartment, this calculation period is terminated.

REQUESTS FOR ADDITIONAL INFORMATION (RAIs)

SRXB-RAI 1

The addition of “ice-empty part of the ice compartment” in [1] appears to be a significant change in the total volume (lower compartment volume + ice-empty volume) which is compared with the expanding volume, because the ice-empty volume varies from zero (or a small volume) to the full volume of the ice-compartment during the depressurization phase. Provide a quantitative impact of this change on the entire pressure response, including the peak pressure, by performing a sensitivity analysis for the most bounding ice-condenser plant in the United States.

SRXB-RAI 2

Please explain what is meant by: [2] *If the expanding volume occupies the lower compartment, the pressure calculation then includes the lower compartment conditions.*

SRXB-RAI 3

If the condition [1] is not met, i.e., expanding volume is greater than or equal to the lower compartment volume and ice-empty part of the ice compartment, what would the system pressure be based on?

SRXB-RAI-4

The above referenced states:

> *A source code inspection revealed that the lower compartment conditions are not included until the end of the depressurization period. It has been determined that the affected portion of the transient is very short, and including the lower compartment conditions in the calculation would have a negligible impact on calculated containment conditions. Code*

updates regarding this issue would provide no improved transient behavior or influence on the limiting time of the event nor increase in nuclear safety.

Please state by what method it was determined that the affected portion of the transients (containment pressure, containment temperature, and sump temperature) would have a negligible impact. Provide quantitative results by performing sensitivity study showing negligible effect on the above transients and their peak values for the most bounding ice-condenser plant in the United States.

REFERENCE

Westinghouse Letter to U. S. Nuclear regulatory Commission (NRC) dated February 1, 2017, “Errata for WCAP-8354-P-A (Proprietary) and WCAP-8355-A (Non-Proprietary), ‘Long Term Ice Condenser Containment Code - LOTIC Code’" (ADAMS Accession No. ML17034A376).