



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 15, 2017

Mr. James J. Hutto
Regulatory Affairs Director
Southern Nuclear Operating Co., Inc.
P.O. Box 1295, Bin 038
Birmingham, AL 35201-1295

SUBJECT: VOGTLE ELECTRIC GENERATING PLANT, UNITS 1 AND 2 – REQUEST FOR
ADDITIONAL INFORMATION (CAC NOS. MF9685 AND MF9686;
EPID L-2017-TOP-0038)

Dear Mr. Hutto:

By letter dated April 21, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17116A096) as supplemented by letter dated July 11, 2017 (ADAMS Accession No. ML17192A245), Southern Nuclear Operating Company, Inc. (SNC) submitted a plant-specific technical report for Vogtle Electric Generating Plant, Units 1 and 2 (VEGP), and requested U.S. Nuclear Regulatory Commission (NRC) approval of the methods and inputs described in the technical report. The plant-specific technical report describes a risk-informed methodology to evaluate debris effects with the exception of in-vessel fiber limits.

The NRC staff has reviewed the submittal and has determined that additional information is needed to complete its review. Enclosed is the NRC staff's request for additional information (RAI). The RAI was discussed with your staff on October 19, 2017, and it was agreed that your response would be provided within 45 days from the date of this letter.

Sincerely,

A handwritten signature in black ink that reads "Michael L. Marshall, Jr.".

Michael L. Marshall, Jr., Senior Project Manager
Plant Licensing Branch I
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-424 and 50-425

Enclosure:
Request for Additional Information

cc: ListServ

REQUEST FOR ADDITIONAL INFORMATION
REGARDING SYSTEMATIC RISK-INFORMED ASSESSMENT OF
DEBRIS TECHNICAL REPORT
SOUTHERN NUCLEAR OPERATING COMPANY, INC.
VOGTLE ELECTRIC GENERATING PLANT, UNITS 1 AND 2
SOUTHERN NUCLEAR OPERATING COMPANY
DOCKET NOS. 50-424 AND 50-425

By letter dated April 21, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17116A096) as supplemented by letter dated July 11, 2017 (ADAMS Accession No. ML17192A245), Southern Nuclear Operating Company, Inc. (SNC) submitted a plant-specific technical report for Vogtle Electric Generating Plant, Units 1 and 2, (VEGP) and requested U.S. Nuclear Regulatory Commission (NRC) approval of the methods and inputs described in the technical report. The plant-specific technical report describes a risk-informed methodology to evaluate debris effects with the exception of in-vessel fiber limits.

The NRC staff reviewed the submittal and determined that the enclosed additional information is needed to complete its review. The requests for additional information (RAIs) listed below are not a complete listing of the additional information needed to complete the NRC staff's review. Additional RAIs will be provided via separate correspondence. RAIs number 1 through number 3 were sent in a separate letter dated October 12, 2017 (ADAMS Accession No. ML17264A282).

RAIs

- (4) As shown on Page E5-172 of Enclosure 5 to the letter dated April 21, 2017, the strainer tests head loss stabilization criteria appeared to allow for head loss to be increasing at debris addition points and at test termination. The head loss value at the end of the test is extrapolated to account for increases that were occurring when the test was terminated. For the full load debris test of record, the head loss from calcium phosphate precipitate addition appears to be increasing when the first batch of sodium aluminum silicate precipitate is added. The VEGP chemical effects evaluation may not include head loss from aluminum based precipitates until 24 hours.

Please describe how the extrapolation of the calcium phosphate precipitate induced head loss, to the point where aluminum precipitate head loss is considered, affects the analysis.

- (5) Table 3.o.2-1 on Page E5-148 of Enclosure 5 to the letter dated April 21, 2017, shows that the confirmatory full load strainer test had a lower overall head loss after chemical precipitates were added (i.e., 11.12 ft – 3.5 ft =7.6 ft) compared to the first full load test (i.e., 15.7 ft- 5.46 ft =10.2ft). For the earlier forming calcium phosphate precipitate, the

confirmatory full load (i.e., 5.75 ft- 3.5ft =2.25 ft) head loss was about twice the value used in the VEGP chemical effects approach described on page E5-82. The NRC staff has observed significant differences in head loss tests when similar conditions were tested.

Please explain if using the results from the confirmatory full load strainer test (i.e., greater calcium phosphate head loss earlier, but less total head loss) results in greater risk (i.e., greater core damage frequency). If so, please provide the rationale for not using the confirmatory test results.

- (6) Page E5-155 of Enclosure 5 to the letter dated April 21, 2017, states that the trisodium phosphate (TSP) "clock" for phosphate inhibition of aluminum surfaces starts when the pH rises above 6.84.
- a. Please explain any differences between the projected dissolved post-loss-of-coolant accident (LOCA) pool TSP concentration at a 6.84 pH to the TSP concentration in the University of New Mexico (UNM) bench experiments.
 - b. Please clarify which Kerry J. Howe et al. paper bench test data at pH 6.84 was used to develop the aluminum release model (i.e., 6.5 mM, 10mM TSP).
- (7) The Kerry J. Howe et al. paper, *"Corrosion and solubility in a TSP-buffered chemical environment following a loss of coolant accident: Part 1 – Aluminum," Nuclear Engineering and Design, Volume 292, October 2015: 296-305,* is referenced in Enclosure 1 to the letter dated April 21, 2017. On Page E-24 it states it is only appropriate to use the phosphate passivation function within the range of experimental data. The VEGP submittal states that the phosphate passivation function is not assumed to extrapolate beyond the tested temperature range, but then seems to perform a defacto extrapolation by applying the same passivation function at the tested temperature boundaries to temperatures beyond the boundaries. The VEGP submittal justification is that the equation predicts faster passivation both above and below the temperature range. The NRC staff questions the validity of this approach since the stated conservatism is based on extrapolating the function beyond the test data. For example, the NRC staff questions if greater corrosion rates at the highest post-LOCA temperatures more than offsets the predicted faster time to passivation.

Please justify the use of the passivation function beyond the tested range.

- (8) The aluminum release from the Kerry J. Howe et al. paper prediction provides a reasonable fit to some of the Westinghouse's WCAP-17788-P, Revision 0, "Comprehensive Analysis and Test Program for GSI-191 Closure (PA-SEE-1090)" (ADAMS Accession No. ML15210A667) autoclave test data with TSP buffer and similar pH values. In other cases, when considering the referenced autoclave tests (including additional tests where aluminum release data is available only after 24 hours) it appears the aluminum release is under predicted, by about a factor of 1.5 to 2, in three of seven TSP tests.

Please explain how the under prediction of aluminum release during some of the autoclave tests is being considered in the VEGP chemical effects methodology.

(9) Page E5-163 of Enclosure 5 to the letter dated April 21, 2017, states that the Kerry J. Howe et al. equations do not credit zinc inhibition of aluminum corrosion and that bench tests with zinc coupons present indicated aluminum corrosion can be reduced by approximately two-thirds.

- a. The VEGP submittal relies on the equation for aluminium release described in Kerry J. Howe et al. paper. Please explain if the equation for aluminum release is expected to bound all the WCAP-17788-P autoclave TSP tests that included zinc coupons since it does not credit reduced aluminum corrosion due to zinc.
- b. The VEGP supplement, dated July 11, 2017, states that the aluminum release equation accurately predicts aluminum concentrations at higher pH when VEGP plant-specific or greater zinc quantities are present. Please describe how the VEGP plant-specific zinc quantity compare to that in Autoclave Test 42-01.
- c. The Autoclave Test 42-01 appeared to have a 24 hour data point significantly above the predicted aluminum value. Please describe how the VEGP post-LOCA zinc concentration varies with break size and location.

(10) As described in Enclosure 5 of the letter dated April 21, 2017 (Page E5-153), the VEGP chemical effects approach uses the aluminum solubility equation developed from work with alkaline solutions in borated water at the Argonne National Laboratory. The Kerry J. Howe et al. paper evaluated aluminum solubility in TSP buffered solutions and noted that the MINTEQ saturation line for $\text{Al}(\text{OH})_3$ line needed to be shifted by +.66 log units to fit the Chemical Head Loss Experiment tank tests data.

Please describe how the use of the Kerry J. Howe et al. paper recommended aluminum saturation (MINTEQ +.66 log units) change the VEGP chemical effects evaluation.

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ADAMS Accession No.: ML17275A026

* via memo

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