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Serial: RNP-RA/15-0117

DEC 22 2015

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261 / RENEWED LICENSE NO. DPR-23

SUPPLEMENT TO REQUEST FOR TECHNICAL SPECIFICATION CHANGE TO REACTOR COOLANT SYSTEM PRESSURE AND TEMPERATURE LIMITS

REFERENCES:

1. Letter from R. Michael Glover (Duke Energy Progress) to U. S. Nuclear Regulatory Commission (USNRC) (Serial: RNP-RA/15-0083), *Request for Technical Specification Change to Reactor Coolant System Pressure and Temperature Limits,* dated November 2, 2015. ADAMS Accession No. ML15307A069.
2. Email from Robert Kuntz (USNRC) to Scott Connelly, H. B. Robinson Steam Electric Plant (Duke Energy Progress), *Robinson Amendment submitted November 2, 2015 RE: Pressure/Temperature limits,* dated December 8, 2015.

Dear Sir/Madam:

Duke Energy Progress, Inc. is submitting this Supplement to Reference 1 to provide information requested by the Nuclear Regulatory Commission (NRC) via electronic mail message (Reference 2).

By letter dated November 2, 2015 (Reference 1) Duke Energy Progress, Inc. submitted a request to amend the Technical Specifications (TS) for H. B. Robinson Steam Electric Plant, Unit No. 2 (HBRSEP2). The proposed amendment revises the reactor coolant system (RCS) pressure and temperature limits by replacing TS Section 3.4.3, "RCS Pressure and Temperature (P/T) Limits," Figures 3.4.3-1 and 3.4.3-2, with figures that are applicable up to 50 effective full power years (EFPY). On December 15, 2015, the NRC and Duke Energy Progress participated in a clarification teleconference regarding supplemental information requested by the NRC staff to enable them to perform their acceptance review of the proposed amendment. Enclosed, as agreed, please find the requested supplemental information.

Please address any comments or questions regarding this matter to Mr. Richard Hightower, Manager – Nuclear Regulatory Affairs at (843) 857-1329 or Mr. Scott Connelly at (843) 857-1569.

There are no new regulatory commitments made in this letter.

I declare under penalty of perjury that the foregoing is true and correct. Executed on December 22, 2015.

Sincerely,

John A. Krakuszeski FOR

R. Michael Glover
Site Vice President

RMG/jmw

Enclosure

cc: Administrator, NRC Region II
Ms. Martha C. Barillas, NRC Project Manager, NRR
Dennis Galvin, NRC Project Manager, NRR
NRC Resident Inspector, HBRSEP2
Ms. S. E. Jenkins, Manager, Infectious and Radioactive Waste Management Section (SC)

U. S. Nuclear Regulatory Commission
Enclosure to Serial: RNP-RA/15-0117
6 Pages (Including this cover page)

RESPONSE TO SUPPLEMENTAL INFORMATION REQUEST REGARDING REQUEST FOR TECHNICAL SPECIFICATION CHANGE TO REACTOR COOLANT SYSTEM PRESSURE AND TEMPERATURE LIMITS

NRC Issue #1

Considering the calculated-to-measured (C/M) data shows consistent under-prediction of neutron fluence calculations when compared to measurements, provide an explanation for why the neutron fluence calculations are under-predicting fluence, and if the methodology of WCAP-16083 is found to be inappropriate as implemented as was determined by the NRC staff, then (1) revise the neutron fluence calculational methodology accordingly and/or (2) consider correcting neutron fluence calculations using the guidance in RG 1.190 if correction is found to be appropriate.

Response to NRC Issue #1

Table 6-11 of WCAP-15805 (Reference 1) lists ratios of calculations to surveillance capsule measurements (C/M) for reactions of interest to fast neutron (E > 1.0 MeV) fluence evaluations. The comparisons presented in Table 6-11 of WCAP-15805 have an overall average C/M ratio 0.87 with a standard deviation of 11%. This meets the 20% criterion stipulated in Regulatory Guide 1.190 (Reference 2), and is consistent with the net calculational uncertainty of 12% at the 1-σ level assigned to surveillance capsule locations in Section 6.4 of WCAP-15805.

Note that the data presented in Table 6-11 represent a direct comparison of calculation and measurement before the least squares adjustment of the data sets, i.e. before the application of the FERRET code. The results of the least squares adjustment are summarized in Table 6-12 of WCAP-15805. The results after adjustment, based on the neutron flux (E > 1.0 MeV), indicate an average C/BE ratio of 0.89 with a standard deviation of approximately 8%.

This adjustment is fully consistent with the results indicated by the direct reaction rate C/M comparisons (0.89 vs. 0.87). The magnitude of the neutron flux adjustment (11%) is also consistent with the uncertainty assigned to the calculated neutron flux before adjustment (12% at the 1-σ level). Further, the application of the least squares adjustment algorithm has resulted in a reduction in the data scatter and, in turn, the uncertainty in the comparisons (8% vs. 11% at the 1-σ level). Therefore, the limitation on the use of the FERRET least squares adjustment procedure included in the NRC approval documented in WCAP-16083-NP-A (Reference 3) is met by the H. B. Robinson Unit 2 surveillance capsule data sets, i. e., no adjustments have been made that are inconsistent with the uncertainties associated with the unadjusted neutron flux, reaction rate measurements, or dosimetry reaction rate cross-sections.

The observation that measured reaction rates from surveillance capsule dosimetry are greater than calculated reaction rates is attributable to uncertainties in several key input parameters. Significant uncertainties include peripheral power distributions, as-built reactor internals dimensions, and other factors. There are also significant uncertainties attributable to the measurements. Considering the wider database of operating reactor benchmark comparisons performed to date and summarized in Section 4 of WCAP-16083-NP-A, Westinghouse is not aware of a systematic bias attributable to the methodology.

Regulatory Guide 1.190 does not mandate the application of a bias in instances where measured reaction rates exceed calculated reaction rates, so long as the overall calculational uncertainty is demonstrated to be within an uncertainty of 20%. The calculations performed in WCAP-15805 have met the 20% uncertainty requirement; therefore, the fluence values in WCAP-15805 are acceptable as-submitted.

NRC Issue #2

The NRC staff noted that the unadjusted C/M summary table provided in Table 6-11 of WCAP-15805 excludes all cobalt dosimeter data and the report does not explain why. Explain why it is acceptable to remove this data.

Response to NRC Issue #2

A plot of the Co-59 (n, γ) reaction cross-section from the ENDF/B-VI.8 library, obtained from Reference 4, appears in Figure 1. This reaction is predominately sensitive to neutrons in the thermal energy range. As such, it does not provide a meaningful measurement of neutrons of interest in this application, those neutrons with energies greater than 1.0 MeV. Per ASTM E262 (Reference 5), the cadmium shield selectively removes neutrons with energies below approximately 0.55 eV, but this still results in the cobalt dosimeters being predominately sensitive to neutrons with energies well below the region of interest for this application. As such, cobalt measurements are typically excluded from consideration when comparing measurements to calculations for fast fluence benchmarking.

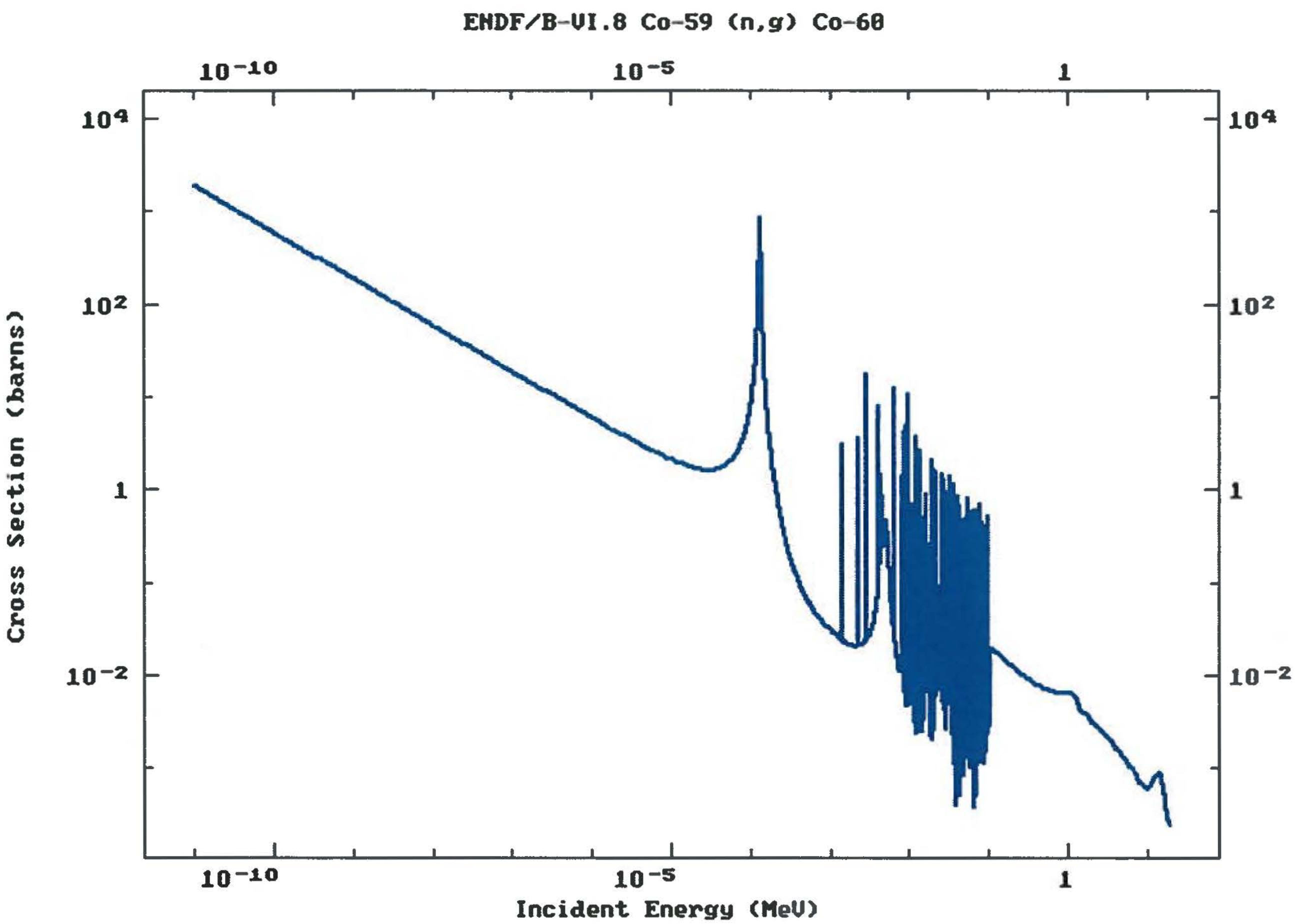

Figure 1 CO-59 (n, γ) Cross-Section

Additional Request #1 from the December 15, 2015 Clarification Phone Call

Please provide an explanation for why the results from the Cycle 9 benchmark experiment described in Section 3.3 of WCAP-16083-NP-A show better agreement with measurements than the other surveillance capsule measurements from H. B. Robinson Unit 2.

Response to NRC Additional Request #1

The Cycle 9 benchmark experiment, performed from 1982 to 1984, was part of the LWR Pressure Vessel Surveillance Dosimetry Improvement Program (Reference 6), an international research program involving Hanford Engineering Development Laboratory, Oak Ridge National Laboratory, the National Bureau of Standards (now known as the National Institute of Standards and Technology), the Electric Power Research Institute, the CEN-SCK Laboratory in Belgium, and others. The practices employed to prepare and analyze the samples from this experiment resulted in better quality measurement data than was typically available during that time period.

From WCAP-14044, "Westinghouse Surveillance Capsule Neutron Fluence Reevaluation" (Reference 7), Capsules S and V were evaluated by Southwest Research Institute (SWRI). A benchmarking exercise performed as part of the LWR Pressure Vessel Surveillance Dosimetry Improvement Program revealed significant discrepancies between results reported by SWRI and results reported by other laboratories. In addition, Capsule S was the first surveillance capsule evaluated by SWRI, and presumably coincided with the establishment of the dosimetry counting laboratory. These considerations call into question the uncertainties associated with the measurement data from Capsules S and V.

Analysis of fission monitors (U-238 and Np-237) involves dissolving oxide material of the sensor and then chemically separating the cesium for counting, a process that can easily produce erroneous results if not done carefully. Prior to the establishment of ASTM procedures in the mid-1980s, there was considerably greater uncertainty associated with these measurements than there is today. (Note that, even today, the assigned uncertainties for U-238 and Np-237 dosimeters are higher than the uncertainties attributed to other dosimeters.) For this reason, early fission monitor measurements are often rejected when they are found to be inconsistent with the calculations and other measurement data.

Dosimetry measurements from Capsules S, V, T, and X from H. B. Robinson Unit 2 were analyzed in 1973, 1975, 1982, and 2001, respectively. All of the dosimetry measurements collected from the surveillance capsules were evaluated in WCAP-15805 with the same methodology. The level of agreement between calculations and measurements for Capsule X is markedly better than level of agreement for the other capsules. This suggests that significant additional uncertainties may be attributable to the measurement practices for the earlier surveillance capsules.

Additional Request #2 from the December 15, 2015 Clarification Phone Call

Please explain how the comparisons of surveillance capsule measurements to Westinghouse calculations from H. B. Robinson Unit 2 are consistent with the wider Westinghouse database and the 12% uncertainty assigned to the calculational methodology.

Response to NRC Additional Request #2

Table 1 compares the expected and observed number BE/C ratios from Table 4-1 of WCAP-16083-NP-A, assuming that calculated values of Neutron Flux (E > 1.0 MeV) represent an unbiased estimate with a standard deviation of 12%.

H. B. Robinson Unit 2 Capsules V and T fall into the +2σ category, but the expected number of capsules in this category is 14, whereas only five (or seven, if the database is expanded to include H. B. Robinson Unit 2 capsules) have been observed. There are other capsules, from other plants, that correspondingly fall into the -2σ category. The observation that Capsules V and T fall into the +2σ category is not an indication that the methodology is inadequate or being applied incorrectly. Rather, the presence of Capsules V and T in the +2σ category is fully consistent with the wider Westinghouse database, and with the 12% uncertainty assigned to the calculational methodology.

Table 1 Comparison of Expected and Observed Best Estimate to Calculation (BE/C) Ratios

BE/C Range	Expected Fraction	Expected Number	Observed Number	Observed Fraction
1.24 – 1.36 (+3σ)	0.021	2.2	0	0.000
1.12 – 1.24 (+2σ)	0.136	14.1	5	0.038
1.00 – 1.12 (+1σ)	0.341	35.5	41	0.394
0.88 – 1.00 (-1σ)	0.341	35.5	50	0.490
0.76 – 0.88 (-2σ)	0.136	14.1	8	0.077
0.64 – 0.76 (-3σ)	0.021	2.2	0	0.000
TOTAL	**0.997**	**103.7**	**104**	**1.000**

Additional Request #3 from the December 15, 2015 Clarification Phone Call

Please state the criteria used to exclude or reject individual measurements from consideration.

Response to NRC Additional Request #3

Measurements from each surveillance capsule are compared to measurements obtained from similar plants. In the case of H. B. Robinson Unit 2, similar plants include other 3-Loop reactors with surveillance capsules mounted on thermal shields that sit between the core barrel and the reactor vessel. To account for variations in core power level and peripheral power distributions, measurements are normalized to a uniform Fe-54 (n,p) Mn-54 reaction rate to facilitate comparisons between similar plants. When a normalized reaction rate is observed to deviate more than 3σ from the average for a given location in a group of similar plants, the measurement is rejected.

Each 3-Loop thermal shield plant has four or five different surveillance capsule positions, and the total number of 3-Loop thermal shield plants is small. As such, the total quantity of data available is limited (as compared to, for example, 4-Loop neutron pad plants), and there is often insufficient justification to reject individual measurements for 3-Loop thermal shield plants.

REFERENCES

1. Westinghouse Report, WCAP-15805, Rev. 0, "Analysis of Capsule X from the Carolina Power & Light H. B. Robinson Unit 2 Reactor Vessel Radiation Surveillance Program," March 2002.

2. Regulatory Guide 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," U. S Nuclear Regulatory Commission, Office of Nuclear Regulatory Research, March 2001.

3. Westinghouse Report, WCAP-16083-NP-A, Rev. 0, "Benchmark Testing of the FERRET Code for Least Squares Evaluation of Light Water Reactor Dosimetry," May 2006, ADAMS Accession No. ML061600256.

4. Retrieved from http://www.nndc.bnl.gov/endf/ using ZVView, written by V. Zerkin, IAEA Nuclear Data Section, Vienna, Austria.

5. ASTM Designation E262, 2013, "Standard Test Method for Determining Thermal Neutron Reaction Rates and Thermal Neutron Fluence Rates by Radioactivation Techniques," A TM International, West Conshohocken, PA, 2013, DOI: 10.1520/E0262-13, www.astm.org.

6. Gold, R. and McElroy, W. N, "The Light Water Reactor Pressure Vessel Surveillance Dosimetry Improvement Program (LWR-PV-SDIP): Past Accomplishments, Recent Developments, and Future Directions," *Reactor Dosimetry: Methods, Applications, and Standardization, ASTM STP 1001*, Harry Farrar IV and E. P. Lippincott, Eds., American Society for Testing and Materials, Philadelphia, 1989, pp. 44-61.

7. Westinghouse Report, WCAP-14044, Rev. 0, "Westinghouse Surveillance Capsule Neutron Fluence Reevaluation," April 1994.