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

December 20, 2010

Mr. S. K. Gambhir
Vice President Technical Services
Columbia Generating Station
Energy Northwest
MD PE04
P.O. Box 968
Richland, WA 99352-0968

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE COLUMBIA GENERATING STATION, LICENSE RENEWAL APPLICATION (TAC NO. ME3058)

Dear Mr. Gambhir:

By letter dated January 19, 2010, Energy Northwest submitted an application pursuant to Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54), to renew Operating License NPF-21 for Columbia Generating Station, for review by the U.S. Nuclear Regulatory Commission (NRC or the staff). The staff is reviewing the information contained in the license renewal application and has identified, in the enclosure, areas where additional information is needed to complete the review. Further requests for additional information may be issued in the future.

Items in the enclosure were discussed with Abbas Mostala and a mutually agreeable date for the response is within 30 days from the date of this letter. If you have any questions, please contact me at 301-415-4029 or by e-mail at evelyn.gettys@nrc.gov.

Sincerely,

Evelyn Gettys

Evelyn Gettys, Project Manager
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-397

Enclosure:
As stated

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COLUMBIA GENERATING STATION
LICENSE RENEWAL APPLICATION
REQUEST FOR ADDITIONAL INFORMATION

RAI 4.2-1

Background:

The Columbia Generating Station (Columbia) reactor vessel (RV) N12 water level instrumentation nozzles (4 nozzles) are considered to be in the beltline region of the RV because they are projected to experience neutron fluence greater than 1×10^{17} n/cm^2 (E > 1.0 MeV) at the end of the period of extended operation, corresponding to 54 effective full power years (EFPY) of facility operation. The staff had requested in a previous request for additional information (RAI) that the applicant supplement license renewal application (LRA) Sections 4.2.1, 4.2.2, and 4.2.3 to include data for the neutron fluence, Charpy upper shelf energy (USE) evaluation, and adjusted nil-ductility reference temperature (ART) analysis for the four N12 instrumentation nozzles. The applicant's RAI response provided some information concerning a fluence value and a projected USE decrease for one of the four N12 nozzles; however, the RAI response did not provide sufficient data for the staff to conclude that the projected USE and ART analyses for these N12 nozzles would remain acceptable for the period of extended operation (54 EFPY), in accordance with 10 CFR 54.21(c)(1)(ii) and 10 CFR Part 50, Appendix G requirements.

The staff has also determined that the applicant has not demonstrated that the use of the BWRVIP-74-A, "BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal," equivalent margins analysis (EMA) for plate material is a valid EMA acceptance criterion for nozzle forgings. Furthermore, the staff found that the applicant has not provided analyses of either the ART or the USE for the N12 instrumentation nozzle-to-RV welds for the period of extended operation.

Issue:

The requirements of 10 CFR Part 50, Appendix G apply to "ferritic materials of pressure-retaining components of the reactor coolant pressure boundary..." The 10 CFR Part 50, Appendix G requirements do not apply to austenitic-phase materials, such as nickel-based alloys and austenitic stainless steels. Therefore, if the N12 nozzles and the associated N12 nozzle-to-RV welds are composed of an austenitic material, then the N12 nozzles and their associated welds are not subject to 10 CFR Part 50, Appendix G requirements, and they do not need to be analyzed for neutron fluence, USE, or ART in LRA Section 4.2.

However, if the N12 nozzles and the associated N12 nozzle-to-RV welds are composed of a ferritic material (such as an ASME Code, Section II, SA-508 alloy steel or carbon steel), then the 10 CFR Part 50, Appendix G requirements are applicable to these nozzles and their associated nozzle-to-RV welds, and the N12 nozzles and their associated welds must be analyzed for the USE and the ART in Sections 4.2.2 and 4.2.3 of the Columbia LRA.

ENCLOSURE

Request:

(a) Please state the general type of material (e.g., austenitic nickel-based alloy, austenitic stainless steel, or a ferritic carbon or low alloy steel) from which the N12 water level instrumentation nozzles and their associated nozzle-to-RV welds are fabricated. If all N12 nozzles and associated N12 nozzle-to-RV welds are composed of an austenitic material, then no further information is required concerning the N12 instrumentation nozzles.

The following questions apply only if the N12 instrumentation nozzles are fabricated from a ferritic-phase material such as carbon or low alloy steel.

(b) Please provide the following information, if available, for the N12 RV beltline instrumentation nozzle forgings and their associated nozzle-to-RV weld materials:

i. The ASME Code, Section II Material Specification (e.g., SA-###, Grade ## and/or Class ##) for each N12 RV beltline nozzle forging;

ii. the heat number for each N12 RV beltline nozzle forging;

iii. the heat number of wire and flux lot number used to fabricate each N12 RV beltline nozzle-to-RV weld;

iv. the chemical composition (i.e., the weight percent (wt%) of copper and nickel) for each N12 RV beltline nozzle forging;

v. the chemical composition (i.e., the wt.% of copper and nickel) for each N12 RV beltline nozzle-to-RV weld;

vi. the unirradiated nil-ductility reference temperature (RT_{NDT}) for each N12 RV beltline nozzle forging;

vii. the unirradiated RT_{NDT} for each N12 RV beltline nozzle-to-RV weld; and

viii. the method of determining the unirradiated reference temperature from the Charpy and drop weight tests for each N12 RV beltline nozzle forging and associated nozzle-to-RV weld.

(c) Based on the information provided in part (b) above for the N12 RV beltline nozzle forgings and associated nozzle-to-RV welds, please provide a calculation of the 54 EFPY ART values for the N12 RV beltline nozzle forging and associated nozzle-to-RV weld materials. If actual values for the wt.% copper and nickel are not available for any of these N12 nozzle forgings or associated nozzle-to-RV welds, then 54 EFPY ART values must be calculated for these materials based on a determination of acceptable wt.% copper and nickel values from the evaluation of a statistically significant set of representative materials or based on limiting values for the wt.% copper and nickel listed in the applicable ASME Code, Section II material specifications for these N12 nozzle forging and associated nozzle-to-RV weld materials.

(d) Appendix G to 10 CFR Part 50, "Fracture Toughness Requirements," states that RV beltline [ferritic] materials have Charpy USE in the transverse direction for base metal and along the weld for weld metal of no less than 75 ft-lb initially and must maintain USE throughout the life of the RV of no less than 50 ft-lbs unless it is demonstrated in a manner approved by the Director, Office of Nuclear Reactor Regulation, that lower values of Charpy USE will provide margins of safety against fracture equivalent to those required by Appendix G of Section XI of the ASME Code.

The applicant's RAI response concerning the USE evaluation for the N12 water level instrumentation nozzles states that that the BWRVIP-74-A EMA acceptance criterion for plate material was used to determine that N12 instrumentation nozzle forgings meet the USE requirements of 10 CFR Part 50, Appendix G. In BWRVIP-74-A, Appendix B, Section B.2, EMA for BWR/3-6 plates, the materials addressed in the analysis included: ASME Code, Section II, SA-302 Grade B and Grade B Modified low allow steel plate and SA-533 Grade B, Class 1 low alloy steel plate. Nozzle forging materials, including nozzle-to-RV welds, were not included in the BWRVIP-74-A, Appendix B analysis. Therefore, the staff does not find the application of BWRVIP-74-A acceptable for demonstrating compliance with Appendix G to 10 CFR Part 50 for the Columbia nozzle materials. The methodology contained in BWRVIP-74-A is applicable only to the materials analyzed in the report.

i. For all ferritic N12 instrumentation nozzle forgings, the staff requests that the applicant submit EMAs to demonstrate that the 54 EFPY Charpy USE will provide margins of safety against fracture equivalent to those required by Appendix G of Section XI of the ASME Code.

ii. For all ferritic N12 instrumentation nozzle-to-RV welds, the staff requests that the applicant provide an evaluation of the 54 EFPY USE values, based on either a direct calculation of the 54 EFPY USE values, or, if initial USE value are unknown, EMAs to demonstrate that the 54 EFPY Charpy USE will provide margins of safety against fracture equivalent to those required by Appendix G of Section XI of the ASME Code.

RAI 4.2-2

Background:

The Columbia RV N6 residual heat removal/low-pressure coolant injection (RHR/LPCI) nozzles (3 nozzles) are considered to be in the beltline region of the RV because they are projected to experience neutron fluence greater than 1×10^{17} n/cm^2 (E > 1.0 MeV) at the end of the period of extended operation (54 EFPY). The staff had requested in a previous RAI that the applicant supplement LRA Section 4.2.2 to include data for the USE evaluation for the three N6 RHR/LPCI nozzles. The applicant's RAI response provided information concerning a projected percent decrease in the USE value for these nozzles valid for 54 EFPY. The applicant stated in its RAI response that this value is below the 23.5% USE EMA acceptance criterion established for rolled plate material in BWRVIP-74-A.

Issue:

The staff reviewed the applicant's RAI response and determined that the applicant had provided an acceptable calculation of the projected percent decrease in the USE value for these nozzle forgings (9.6% at 54 EFPY). However, the staff found that the applicant had not demonstrated that the use of the BWRVIP-74-A EMA for plate material is a valid EMA acceptance criterion for nozzle forgings. Furthermore, the staff found that the applicant had not provided analyses of either the adjusted RT_{NDT} (ART) or the USE for the N6 RHR/LPCI nozzle-to-RV welds for the period of extended operation.

Request:

(a) Please provide the following information for the N6 RV beltline RHR/LPCI nozzle forging and the associated nozzle-to-RV weld materials, as follows:

i. The ASME Code, Section II Material Specification (e.g., SA-###, Grade ## and/or Class ##) for each N6 RV beltline nozzle forging;

ii. the heat number of wire and flux lot number used to fabricate each N6 RV beltline nozzle-to-RV weld;

iii. the chemical composition (i.e., the wt.% of copper and nickel) for each N6 RV beltline nozzle-to-RV weld;

iv. the unirradiated RT_{NDT} for each N6 RV beltline nozzle-to-RV weld; and

v. the method of determining the unirradiated reference temperature from the Charpy and drop weight tests for each N6 RV beltline nozzle-to-RV weld.

(b) Based on the information provided in part (a) above for the N6 RV beltline nozzle-to-RV welds, please provide calculations of the 54 EFPY ART values for the nozzle-to-RV weld materials. If actual values for the wt.% copper and nickel are not available for any of these N6 nozzle-to-RV welds, then 54 EFPY ART values must be calculated for these materials based on a determination of acceptable wt.% copper and nickel values from the evaluation of a statistically significant set of representative materials or based on limiting values for the wt.% copper and nickel listed in the applicable ASME Code, Section II material specifications for these N12 nozzle forging and associated nozzle-to-RV weld materials.

(c) Appendix G to 10 CFR Part 50, "Fracture Toughness Requirements," states that reactor vessel (RV) beltline [ferritic] materials have Charpy USE in the transverse direction for base metal and along the weld for weld metal of no less than 75 ft-lb initially and must maintain USE throughout the life of the RV of no less than 50 ft-lbs unless it is demonstrated in a manner approved by the Director, Office of Nuclear Reactor Regulation, that lower values of Charpy USE will provide margins of safety against fracture equivalent to those required by Appendix G of Section XI of the ASME Code." The applicant's RAI response concerning the USE evaluation for the N6 RHR/LPCI nozzles states that that the BWRVIP-74-A EMA acceptance criterion for plate material was used to determine that N6 RHR/LPCI nozzles forgings meet the USE requirements of 10 CFR Part 50, Appendix G. In BWRVIP-74-A, Appendix B, Section B.2, EMA for BWR/3-6 plates, the materials addressed in the analysis

included: ASME Code, Section II, SA-302 Grade B and Grade B Modified low allow steel plate and SA-533 Grade B, Class 1 low alloy steel plate. Nozzle forging materials, including nozzle-to-RV welds, were not included in the BWRVIP-74-A, Appendix B analysis. Therefore, the staff does not find the application of BWRVIP-74-A acceptable for demonstrating compliance with Appendix G to 10 CFR Part 50 for the Columbia nozzle materials. The methodology contained in BWRVIP-74-A is applicable only to the materials analyzed in the report.

i. For all N6 RHR/LPCI nozzle forgings, the staff requests that the applicant submit EMAs to demonstrate that the 54 EFPY Charpy USE will provide margins of safety against fracture equivalent to those required by Appendix G of Section XI of the ASME Code.

ii. For all N6 RHR/LPCI nozzle-to-RV welds, the staff requests that the applicant provide an evaluation of the 54 EFPY USE values, based on either a direct calculation of the 54 EFPY USE values, or, if initial USE values are unknown, EMAs to demonstrate that the 54 EFPY Charpy USE will provide margins of safety against fracture equivalent to those required by Appendix G of Section XI of the ASME Code.

RAI 4.7.1-1

Background:

For the time-limited aging analysis (TLAA) of the Columbia RV shell indications (i.e., flaws), discussed in LRA Section 4.7.1, the staff issued an RAI (RAI 4.7.1-10(b)) requesting that the applicant add a license renewal commitment to re-inspect the subject flaws in 2015 and, based on the results of the 2015 inspection of the subject flaws, re-evaluate the subject flaws for the period of extended operation (54 EFPY) in accordance with ASME Code, Section XI, IWB-3600 flaw evaluation requirements, or continue augmented inspections as required by the ASME Code, Section XI. The staff had determined that this license renewal commitment is necessary, given that the current flaw evaluation referenced in LRA Section 4.7.1 will only remain valid through the end of the current 40-year licensed operating period (33.1 EFPY). In its response to RAI 4.7.1-10(b), the applicant stated that all RV axial welds, including portions of RV axial welds BG and BM with the flaws, will be re-examined in 2015 as part of the NRC-approved Inservice Inspection (ISI) program for the current 10-year ISI interval. The applicant added that these examinations are required to be completed by 2015, well before the beginning of the period of extended operation. The applicant stated further that these examinations are required for the current 40-year license term, regardless of whether or not the Columbia operating license receives 20-year extension. Thus, the applicant concluded in response to RAI 4.7.1-10(b) that "it is not a license renewal commitment to repeat these inspections."

Issue:

In reviewing the applicant's response to RAI 4.7.1-10(b), the staff acknowledges that the RV axial welds, including the subject flaws, are required to be re-examined prior to the end of the third 10-year ISI interval at Columbia, in accordance with ASME Code, Section XI requirements for the current 40-year license term. However, the analysis of these RV shell indications is a license renewal TLAA that has not yet been projected to remain in compliance with ASME Code, Section XI flaw acceptance criteria through the end of the period of extended operation.

Furthermore, the Columbia ISI aging management program description in LRA Section B.2.33 does not specifically address re-evaluation of existing flaws in ASME Code Class 1 components.

Request:

In order to ensure that the effects of aging for the subject RV shell weld flaws will be adequately managed in accordance with the requirements of 10 CFR 54.21(c)(1)(iii), the staff requests that the applicant include a license renewal commitment to re-evaluate the subject flaws for the period of extended operation (54 EFPY), in accordance with the requirements of the ASME Code, Section XI, IWB-3600 based on the results of 2015 ISI.

December 20, 2010

Mr. S. K. Gambhir
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Richland, WA 99352-0968

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE COLUMBIA GENERATING STATION, LICENSE RENEWAL APPLICATION (TAC NO. ME3058)

Dear Mr. Gambhir:

By letter dated January 19, 2010, Energy Northwest submitted an application pursuant to Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54), to renew Operating License NPF-21 for Columbia Generating Station, for review by the U.S. Nuclear Regulatory Commission (NRC or the staff). The staff is reviewing the information contained in the license renewal application and has identified, in the enclosure, areas where additional information is needed to complete the review. Further requests for additional information may be issued in the future.

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Sincerely,
/RA/
Evelyn Gettys, Project Manager
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-397

Enclosure:
As stated

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Letter to S.K. Gambhir from E. Gettys dated December 20, 2010

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE COLUMBIA GENERATING STATION, LICENSE RENEWAL APPLICATION (TAC NO. 3058)

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