



# ENERGY NORTHWEST

Sudesh K. Gambhir  
Vice President, Technical Services  
P.O. Box 968, Mail Drop PE04  
Richland, WA 99352-0968  
Ph. 509-377-8313 F. 509-377-2354  
sgambhir@energy-northwest.com

September 3, 2010  
G02-10-129

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

Subject: **COLUMBIA GENERATING STATION, DOCKET NO. 50-397  
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
LICENSE RENEWAL APPLICATION**

- References:
- 1) Letter, GO2-10-11, dated January 19, 2010, WS Oxenford (Energy Northwest) to NRC, "License Renewal Application"
  - 2) Letter dated July 13, 2010, NRC to WS Oxenford (Energy Northwest), "Request for Additional Information for the Review of the Columbia Generating Station, License Renewal Application," (ADAMS Accession No. ML 101660166)

Dear Sir or Madam:

By Reference 1, Energy Northwest requested the renewal of the Columbia Generating Station (Columbia) operating license. Via Reference 2, the Nuclear Regulatory Commission (NRC) requested additional information related to the Energy Northwest submittal.

Transmitted herewith in Attachment 1 is the Energy Northwest response to a Request for Additional Information (RAI) contained in Reference 2.

No new commitments are included in this response.

If you have any questions or require additional information, please contact Abbas Mostala at (509) 377-4197.

A035  
NRR

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
LICENSE RENEWAL APPLICATION**

Page 2 of 2

I declare under penalty of perjury that the foregoing is true and correct. Executed on the date of this letter.

Respectfully,

*W. W. Coleman acting for*  
SK Gambhir  
Vice President, Technical Services

Attachment: Response to Request for Additional Information

cc: NRC Region IV Administrator  
NRC NRR Project Manager  
NRC Senior Resident Inspector/988C  
EJ Leeds - NRC NRR  
EFSEC Manager  
RN Sherman – BPA/1399  
WA Horin – Winston & Strawn  
EH Gettys - NRC NRR (w/a)  
BE Holian - NRC NRR  
RR Cowley – WDOH

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
LICENSE RENEWAL APPLICATION**

**Attachment**

Page 1 of 18

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION**

**RAI B.2.6 – BWR Feedwater Nozzle Program**

**B.2.6-1:**

**Issue:**

LRA Section B.2.6 includes a statement indicating the use of enhanced in-service inspection (ISI) for the feedwater (FW) nozzles in accordance with American Society of Mechanical Engineers (ASME) Code, Section XI requirements and the recommendations of General Electric (GE) document NE-523-A71-0594. LRA Section B.2.6 also states that the detection and sizing of FW nozzle cracks at Columbia is conducted in accordance with the ASME Boiler and Pressure Vessel Code, Section XI requirements and GE NE-523-A71-0594. The NRC staff notes that the above statements in LRA Section B.2.6 are consistent with the corresponding FW nozzle program elements described in the GALL Report, Section XI.M5.

**Request:**

The NRC staff requests that Columbia confirm whether the implementation of the GE NE-523-A71-0594 recommendation results in plant-specific FW nozzle inspection requirements that are augmented with respect to the baseline AMSE [sic] Code, Section XI requirements for FW nozzle inspections (e.g., are Columbia's plant-specific FW nozzle inspection criteria in full compliance with ASME Code, Section XI requirements, with the GE NE-523-A71-0594 FW nozzle inspection recommendations implemented at Columbia?).

Does Columbia use ultrasonic (UT) examination systems, techniques, personnel, and procedures that are qualified in accordance with the AMSE [sic] Code, Section XI, Appendix VIII Performance Demonstration Initiative (PDI) criteria when performing UT examinations of the FW nozzles?

**Energy Northwest Response:**

Columbia's FW nozzle inspections are in full compliance with ASME Section XI as modified and supplemented by 10 CFR 50.55a. The examinations are augmented by any additional requirements found in the GE NE-523-A71-0594 report. Energy Northwest uses UT examination systems, techniques, personnel, and procedures that are qualified in accordance with ASME Code, Section XI, Appendix VIII Performance Demonstration Initiative (PDI) criteria when performing UT examinations of the FW nozzles.

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
LICENSE RENEWAL APPLICATION**

**Attachment**

Page 2 of 18

**B.2.6-2:**

**Issue:**

LRA Section B.2.6 states that Columbia operating experience shows that Columbia's BWR FW nozzle program is effective in managing aging effects in that no FW nozzle cracking has been observed and that previous inspections of the FW nozzles found no unacceptable indications.

**Request:**

Please indicate whether this statement applies just to the FW nozzles or to other FW system components in the reactor, such as the FW spargers. The NRC staff recognizes that FW spargers are nonsafety-related components.

**Energy Northwest Response:**

The statement that Columbia operating experience has not experienced cracking in the FW nozzles applies only to the FW nozzles. Energy Northwest also inspects the FW sparger flow holes per the requirements of the GE NE-523-A71-0594-A revision 1 report. Small thermal cracks have been observed around some of the flow holes. This condition has been evaluated and found acceptable.

**RAI B.2.8 – BWR Stress Corrosion Cracking Program**

**B.2.8-1:**

Please describe the overall scope of the BWR stress corrosion cracking (SCC) Program at Columbia, as follows:

- a. Does this particular program address SCC of reactor coolant pressure boundary (RCPB) piping alone, or does it address SCC for any other structures, systems, or components (SSCs) other than RCPB piping?
- b. Does the BWR SCC Program at Columbia address only ASME Code, Section XI, Class 1, Examination Category B-J and B-F components; only Class 1 components (regardless of ASME Code, Section XI Examination Category); or does this AMP address SCC in components irrespective of ASME Code Class or Examination Category?

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
LICENSE RENEWAL APPLICATION**

**Attachment**

Page 3 of 18

- c. Is the overall scope of components covered by the BWR SCC Program at Columbia identical to the scope of components covered by Generic Letter (GL) 88-01, as modified by Columbia's current implementation of BWRVIP-75; does the BWR SCC Program at Columbia cover components beyond the scope of GL 88-01; or does the scope of components covered by the BWR SCC Program at Columbia not include all of the components addressed in GL 88-01?

**Energy Northwest Response:**

- a. The scope of the BWR SCC Program includes safe ends and thermal sleeves in the reactor pressure vessel and piping, pump casings, flow elements, and valve bodies in the RCPB. LRA Table 3.1.2-1 items 50, 64, 71, 92, 114, 126, and 149 and LRA Table 3.1.2-3 items 28, 99, 112, 151, and 159 list the components that are addressed by the BWR SCC Program.
- b. The BWR SCC Program addresses SCC in components irrespective of ASME Code Class or Examination Category.
- c. The scope is not identical. The overall scope of the BWR SCC Program includes all the piping addressed in GL 88-01 and the items identified in response to part "a" of this request. The BWRVIP-75 modification to the SCC Program defines the inspection schedule of those components within the scope of GL 88-01. It does not change the scope of components that is defined by GL 88-01.

**B.2.8-2:**

**Issue:**

The LRA Section B.2.8 program description for the BWR SCC Program states that Columbia mitigates aging by maintaining reactor coolant system (RCS) water chemistry in accordance with the current BWRVIP guidelines, as detailed in the BWR Water Chemistry Program and that Columbia has implemented hydrogen water chemistry (HWC) and noble metal chemical application (NMCA) to mitigate SCC.

**Request:**

Does Columbia formally credit the use of HWC and/or NMCA in establishing plant-specific piping inspection sampling, sample expansion, and frequency requirements based on the criteria of NUREG-0313, Rev. 2; GL 88-01 and its Supplement 1; and BWRVIP-75?

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
LICENSE RENEWAL APPLICATION**

**Attachment**

Page 4 of 18

**Energy Northwest Response:**

Energy Northwest does not formally credit the use of HWC and/or NMCA in establishing plant-specific piping inspection sampling, sample expansion, and frequency requirements based on the criteria of NUREG-0310, Rev. 2 and its Supplement 1 and BWRVIP-75. The current plant-specific approval to use BWRVIP-75 commits only to the normal water chemistry (NWC) inspection sampling, sample expansion, and frequency requirements.

**B.2.8-3:**

**Issue:**

While BWRVIP-75 is an NRC Staff-approved document, the implementation of BWRVIP-75 modifications to the piping inspection criteria of GL 88-01 at plants may result in the establishment of plant-specific inspection sampling and frequency criteria that are less comprehensive than those required by the ASME Code, Section XI, Examination Categories B-J and B-F for RCPB piping. Therefore, the staff position on the plant-specific implementation of BWRVIP-75 for Examination Category B-J and B-F components is that licensee's must submit to the NRC a request for alternative to the ASME Code, Section XI requirements, in order to implement the BWRVIP-75 modifications to the piping inspection criteria of GL 88-01 and obtain NRC authorization for this alternative under 10 CFR 50.55a(a)(3)(i).

**Request:**

Is Columbia currently operating with an NRC-approved alternative, granted under 10 CFR 50.55a(a)(3)(i), authorizing the implementation of the alternative inspection criteria of BWRVIP-75 for the current (third) 10-year ISI interval program at Columbia? If so, please indicate the ASME Code, Section XI, Examination Categories (e.g. Examination Category B-J, B-F, etc.) that this alternative covers. If Columbia does not currently have this alternative authorized, please indicate whether or not Columbia currently meets all ASME Code, Section XI requirements for ASME Code, Section XI, Examination Category B-F components.

(Note: The staff recognizes that the implementation of other NRC-authorized alternatives and reliefs from ASME Code, Section XI requirements for Examination Category B-J components may be applicable to Columbia and allow for a more limited inspection scope than that delineated in the ASME Code, Section XI, Table IWB-2500-1, for certain Examination Category B-J components.)

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
LICENSE RENEWAL APPLICATION**

**Attachment**

Page 5 of 18

**Energy Northwest Response:**

Energy Northwest does not have an approved alternative to ASME Section XI inspection criteria for BF welds to use BWRVIP-75 to alter inspection sample size. Columbia currently meets all ASME Section XI examination requirements for examination category B-F.

Energy Northwest has submitted a relief request to use the requirements of BWRVIP-75-A in lieu of the ASME Section XI and other augmented requirements for the examination of Category B-F, Item 5.10, nozzle-to-safe end welds, NPS 4 or larger and Category B-J, Item B9.11 dissimilar metal welds NPS 4 or larger. The submittal was dated March 11, 2010 by docket letter G02-10-039 [ML100770221].

**B.2.8-4:**

**Issue:**

LRA Section B.2.8 describes Columbia operating experience with the BWR SCC Program and inspection results for the program. It states that one relevant indication (e.g., flaw) was identified in stainless steel (SS) recirculation system piping-to-valve weld 20RRC(6)-8 in 1991. Columbia states that this indication has been monitored for 10 years and has shown no identifiable growth. The weld with the indication was examined in 2001 using EPRI PDI qualified techniques and systems, and it was determined that the indication was not caused by IGSCC. Consequently, the GL 88-01-based categorization for the weld with the indication was changed to Category B.

**Request:**

The staff requests that Columbia provide the following additional information concerning this indication:

- a. Is this indication located in the actual weld metal or is it located in the base metal heat affected zone (HAZ) adjacent to the weld?
- b. Is this a surface-breaking indication or a sub-surface indication?

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
LICENSE RENEWAL APPLICATION**

**Attachment**

Page 6 of 18

- c. LRA Section B.2.8 states that this indication was determined to be “acceptable for continued operation without repair.” How did Columbia arrive at this determination? Was this flaw screened using the ASME Code, Section XI, IWB-3500 Acceptance Standards. What were the results of this screening? If this flaw did not pass the IWB-3500 acceptance standards, did the flaw receive an analytical evaluation in accordance with IWB-3600? If so, what were the results of this analytical evaluation? Was the analytical evaluation of this flaw submitted to the NRC? If so, please provide a reference to the report documenting the analytical evaluation of this flaw. If not, please provide the actual flaw evaluation report.
- d. Is this weld with the indication still currently designated a Category B weld? Has the NRC been notified of and concurred with Columbia’s determination that this weld may be designated a Category B weld? If the NRC has not concurred with Columbia’s determination that this weld may be designated a Category B weld, please provide technical justification as to how and why Columbia determined that this weld’s categorization could be changed from Category E to Category B.
- e. If Columbia determined that this flaw was not caused by Intergranular Stress Corrosion Cracking (IGSCC), then please discuss whether this flaw is considered a fabrication flaw or a service-induced flaw. If Columbia believes that this is a service-induced flaw, please discuss the aging affect or mode of degradation that Columbia believes may have caused this flaw to form.

Does Columbia use UT examination systems, techniques, personnel, and procedures that are qualified in accordance with ASME Code, Section XI, Appendix – VIII PDI criteria when performing UT examinations of pressure boundary piping?

**Energy Northwest Response:**

- a. The defect is located in the base metal heat affected zone at the top of the pipe centered at the 0° location (twelve o'clock position).
- b. This is a surface indication.
- c. The flaw was screened using ASME Code Section XI, IWB-3500 acceptance standards and was evaluated under IWB-3600. The UT examination report stated that the flaw did not have characteristics of IGSCC; however the flaw was evaluated conservatively as IGSCC at the time. The evaluation in 1991 determined that if the flaw was due to IGSCC it would meet the acceptance criteria of IWB-3600 until the next outage. The flaw has been re-inspected numerous times with the results and evaluations submitted to the NRC. These evaluations were submitted to the NRC in letters:



**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
LICENSE RENEWAL APPLICATION**

**Attachment**

Page 7 of 18

1. Letter dated May 10, 1991, G. C. Sorensen to NRC, "Report On Flaw In Reactor Recirculation Piping (TAC No. 80358)"
  2. Letter dated May 15, 1991, G. C. Sorensen to NRC, "Report On Flaw In Reactor Recirculation Piping, Additional Information (TAC No. 80358)"
  3. Letter dated May 14, 1992, GC Sorensen to NRC, "Report on Flaw in Reactor Recirculation Piping (TAC 80358)"
  4. Letter dated May 21, 1993, JV Parrish to NRC, "Report on Flaw in Reactor Recirculation Piping"
  5. Letter dated June 9, 1994, JV Parrish to NRC, "Report on Flaw in Recirculation Piping"
  6. Letter dated May 15, 1995, JV Parrish to NRC, "Report on Flaw in Reactor Recirculation Piping"
- d. In the reactor recirculation (RRC) system, weld 20RRC(6)-8 is currently classified as a Category B weld, as it was originally classified. Upon the discovery of the unacceptable indication in 1991, the weld was conservatively classified as Category F since at the time it could not be demonstrated to be a fabrication flaw. Examinations were performed in the next 4 outages. No growth in the indication was observed so it was classified as Category E. The indication was reexamined and evaluated in 2001 with improved UT examination techniques and analysis software. The previous 6 (the 1991 examination data could not be analyzed with this software) examination results were evaluated with this new software. It was demonstrated that the indication had not changed since it was discovered 10 years previous to this 2001 examination.

The examinations performed in this 10 year period noted that the indication did not exhibit signals typical of IGSCC. The damage mechanism assessment performed on this weld for Columbia's risk-informed inservice inspection program identified only the IGSCC damage mechanism could be present. The examinations performed did not discover any other unknown damage mechanism in this weld. Based on the results of the examinations over a ten-year period and the damage mechanism assessment Energy Northwest concluded that the weld did not have a service induced crack and it was reclassified back to its original category B. The NRC has not been notified of the classification change of this weld to the original Category B.

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
LICENSE RENEWAL APPLICATION**

**Attachment**

Page 8 of 18

- e. Energy Northwest has concluded this flaw is due to fabrication. All UT examinations report that the flaw does not have any characteristics of IGSCC. The flaw has not shown any change in depth or length since discovery in 1991. This weld is part of the B-J inspection sample with the next inspection scheduled for 2011. The only damage mechanism associated with this line is IGSCC.

Energy Northwest uses UT examination systems, techniques, personnel, and procedures that are qualified in accordance with ASME Code, Section XI, Appendix VIII Performance Demonstration Initiative (PDI) criteria when performing UT examinations of pressure boundary piping.

**RAI B.2.10 – BWR Vessel Internals Program**

**B.2.10-1:**

**Background:**

The staff notes that LRA Section B.2.10 includes a statement indicating that the BWR Vessel Internals Program at Columbia incorporates all of the BWRVIP guidance documents, including those specifically called out in GALL Report, Section XI.M9. B.2.10 also states that augmented inspections (beyond the ASME Code, Section XI requirements) required by the BWRVIP program documents are performed by Columbia's BWR Vessel Internals Program, and that the program implements all BWRVIP requirements for the reactor internals components. Columbia's plant-specific commitments to specific BWRVIP programs are documented in Appendix C of the LRA through their responses to specific license renewal applicant action items for each BWRVIP document.

**Issue:**

The staff notes that Appendix C of the LRA contains no reference to several BWRVIP documents. Furthermore, the staff cannot locate any statement anywhere in the LRA indicating that Columbia's BWR Vessel Internals Program commits to and implements the programs described in these BWRVIP documents for the following components:

- i. Core Shroud – BWRVIP-76, "BWR Core Shroud Inspection and Flaw Evaluation Guidelines"
- ii. Steam Dryer – BWRVIP-139, "Steam Dryer Inspection and Flaw Evaluation Guidelines"
- iii. Access Hole Covers – BWRVIP-180, "BWR Access Hole Covers Inspection and Flaw Evaluation Guidelines"

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
LICENSE RENEWAL APPLICATION**

**Attachment**

Page 9 of 18

**Request:**

For each of the above reactor internal components, please provide a statement indicating whether Columbia commits to programs described in the BWRVIP document for the components and whether Columbia's BWR Vessel Internals Programs implements all the requirements of these BWRVIP documents.

Please provide a brief description of the reactor coolant system (RCS) water chemistry conditions that are used for mitigating cracking and other forms of aging and degradation in the reactor internal and pressure boundary components at Columbia, including whether hydrogen water chemistry is implemented and noble metal chemical additions are implemented. Also, please state the BWRVIP programs (by BWRVIP document number and/or title) that Columbia implements for managing RCS Water Chemistry.

**Energy Northwest Response:**

As stated in LRA Section B.2.10 (the BWR Vessel Internals Program), "The BWR Vessel Internals Program incorporates all of the BWRVIP guidance documents, including those specifically called out in NUREG-1801, Section XI.M9." That specifically includes the guidelines in BWRVIP-76 for the Core Shroud, the guidelines in BWRVIP-139 for the Steam Dryer, and the guidelines in BWRVIP-180 for Lower Plenum Access Hole Covers as well as any subsequent BWRVIP publications as they apply to Columbia.

As stated in the BWR Stress Corrosion Cracking Program (LRA Section B.2.8, page B-47):

"Columbia mitigates aging by maintaining water chemistry in accordance with the current BWRVIP guidelines, as detailed in the BWR Water Chemistry Program. Columbia has implemented hydrogen water chemistry (HWC) and noble metal chemical application (NMCA) to mitigate IGSCC."

As stated in the Columbia Generating Station Chemistry Strategic Plan, Columbia is committed to manage RCS water chemistry to the latest BWRVIP RCS water chemistry guidelines. The current implementation document is BWRVIP-190 "Water Chemistry Guidelines - 2008 Revision."

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
LICENSE RENEWAL APPLICATION**

**Attachment**

Page 10 of 18

**B.2.10-2:**

**Issue:**

LRA Section B.2.10 provides information on Columbia's plant-specific operating experience for the reactor internal components. With respect to nondestructive examination (NDE) inspection results, LRA Section B.2.10 describes indications in several reactor internals components, including cracking of the core shroud, cracking of the steam dryer, gaps on the jet pump set screws, and wear of the jet pump wedges.

**Request:**

The staff requests the following additional information concerning the reactor internals indications discussed in B.2.10:

- a. Please state whether there were ever any other flaws or relevant indications discovered in any reactor internal component, covered under B.2.10, other than the indications cited above.
- b. Please state whether the reactor internals indications discussed in B.2.10 were documented in Columbia's site condition reports, action requests, or a similar site condition reporting program.
- c. Please discuss how the reactor internals indications discussed in B.2.10 are being tracked and monitored, including whether Columbia is monitoring these indications in accordance with the inspection and evaluation (I&E) guidelines of applicable BWRVIP documents for the reactor internals components with indications.

Please identify the materials from which the core shroud is fabricated, including both welds and base metal (e.g., 304 stainless steel (SS), 304L SS, any nickel alloys, etc.). Identify the core shroud designation at Columbia (e.g., Category "A", "B", or "C") based on BWRVIP-76 core shroud designation criteria.

**Energy Northwest Response:**

- a. LRA Section B.2.10 includes all vessel internals flaws covered by the BWRVIP program (cracking of the core shroud, cracking of the steam dryer, cracked jet pump set screw tack welds, jet pump set screw gaps and wear of the jet pump wedges). The BWRVIP Program Plan also discusses identified vessel internals flaws outside of the BWRVIP Program scope. These flaws were found by additional inspections performed by Columbia and include a jet pump sensing line crack, thermal stress cracks around the feedwater sparger flow holes, minor dents on the steam separator, shroud head bolt pin wear and rub marks on the feedwater sparger end brackets.

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
LICENSE RENEWAL APPLICATION**

**Attachment**

Page 11 of 18

- b. Internal indications in question were reported under Columbia's corrective action process (CAP) as directed by plant programs and procedures for management of reactor vessel and internals integrity and NDE data evaluation procedures. One exception to this was the indication reported in 1998. The indication appeared to be geometric in nature and not an aging management concern.
- c. The indications in question are tracked, inspected, and monitored in accordance with (or more conservative than) the latest revisions of the applicable BWRVIP inspection and evaluation (I&E) guideline (e.g. Steam Dryer – BWRVIP-139, Jet Pumps – BWRVIP-41, Core Shroud – BWRVIP-76).

Columbia's core shroud base material is 304L SS and the weld material is Type 308 or 308L per GE Specification and FSAR 4.5.2.1. Based on the three criteria provided in BWRVIP-76-A Figure 2-1 the core shroud designation is Category "B" because 1) the core shroud material is 304L, 2) the core shroud has undergone greater than 8 hot operating years, and 3) the average coolant conductivity has remained under 0.3 $\mu$ S/cm.

**B.2.10-3:**

**Issue:**

LRA Section B.2.10 includes a brief statement indicating that Columbia has found indications of cracking of the core shroud.

**Request:**

The staff requests the following additional information concerning these indications of cracking in the core shroud:

- a. Please identify where the core shroud cracking indications were found: Were the indications of cracking found in the core shroud welds, base material, and/or heat affected zone? If cracking indications were found in or near shroud welds, identify which welds were found to have indications of cracking, based on the BWRVIP-76 nomenclature.
- b. Please provide a brief description of the nature of these indications, including the overall number of shroud cracking indications, the length of the indications (expressed as a percentage of total weld length or shroud height/circumference), and the orientation of the indications (e.g., axial or circumferential flaws).

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
LICENSE RENEWAL APPLICATION**

**Attachment**

Page 12 of 18

**Energy Northwest Response:**

The H5 Indication identified in 1998 was found in the heat affected zone of the upper plate of Columbia's H5 (horizontal) weld. The indication was conservatively estimated as 0.2% of the weld length with an axial orientation. The indication did not exhibit typical Intergranular stress corrosion cracking/irradiation assisted stress corrosion cracking (IGSCC/IASCC) characteristics. Columbia is one of the few utilities that have two beltline welds as identified in BWRVIP-76. The H5 weld reported here is the lower of the two beltline welds.

The H3 Indications identified in 2007 were found in the heat affected zone of H3 (horizontal) weld. The 6 indications total 2.66% of the weld length and are circumferentially oriented.

The H4 Indications identified in 2007 were found in the heat affected zone of the H4 (horizontal) weld. The 3 indications total 6.18% of the weld length and are circumferentially oriented.

**B.2.10-4:**

Have there been any other aging effects (other than SCC) identified for the core shroud at Columbia? Does the implementation of the BWRVIP-76 I&E guidelines provide adequate aging management for all potential forms of degradation that are applicable to the core shroud, including pitting, crevice corrosion, and cumulative fatigue damage?

**Energy Northwest Response:**

There have been no other aging effects identified on Columbia's core shroud other than SCC. The indications identified in 1997 appear to be geometric in nature and therefore not an aging management issue. The indications identified in 2007 were determined to be SCC. Implementation of BWRVIP-76-A I&E guidelines is sufficient to manage aging effects for the core shroud.

**B.2.10-5:**

Please state whether Columbia has implemented any tie rod repairs or other repairs to the core shroud. If no tie rod repairs or other repairs have been implemented, please state whether Columbia has current plans to implement tie rod repairs or other repairs to the core shroud in the future. If there are no current plans to implement tie rod repairs or other repairs to the core shroud in the future, please discuss the reasons for not implementing repairs, such as the extent of shroud cracking implementation of BWRVIP-76 I&E guidelines that would be sufficient to manage aging effects for the core shroud without implementing tie rod repairs.

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
LICENSE RENEWAL APPLICATION**

**Attachment**

Page 13 of 18

**Energy Northwest Response:**

No shroud repair has been performed to date. Energy Northwest does not plan to perform a pre-emptive repair of the shroud. Energy Northwest will repair the shroud if future inspections find indications that require shroud repair per BWRVIP-76-A. Implementation of BWRVIP-76-A I&E guidelines is sufficient to manage aging effects for the core shroud without implementing tie rod repairs.

**B.2.10-6:**

For the core shroud, please state whether Columbia follows the guidelines of BWRVIP-100-A pertaining to the updated fracture toughness assessments for neutron-irradiated SS in the core shroud.

**Energy Northwest Response:**

Columbia is committed to following all applicable BWRVIP guidelines. Columbia has implemented the guidelines of BWRVIP-100-A in site-specific core shroud analyses.

**B.2.10-7:**

Please provide the following additional information concerning the NDE inspection/examination volume for the jet pump holddown beams at Columbia:

- a. State whether the locations designated in BWRVIP-41 as "BB-1" and "BB-2" are inspected using UT with high priority, according to BWRVIP-41 guidelines.
- b. State whether the taper region of the holddown beams is inspected for cracking or other degradation. Note that the holddown beam taper region is the location of the jet pump holddown beam failure at Oyster Creek in 2002.
- c. State whether the jet pump holddown beams at Columbia are of the same, similar, or different design from the Oyster Creek jet pump holddown beams.

**Energy Northwest Response:**

- a. Jet pump (JP) Beam inspections, including locations BB-1 and BB-2, are performed via UT in accordance with techniques demonstrated in BWRVIP-03. Inspections are scheduled and performed in accordance with the latest revisions of BWRVIP-41 "BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines" and BWRVIP-138 "BWR Vessel and Internals Project, Updated Jet Pump Beam Inspection and Evaluation Guidelines."

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
LICENSE RENEWAL APPLICATION**

**Attachment**

Page 14 of 18

- b. As part of Columbia's JP beam UT inspection the taper region (BB-3) is also examined for degradation per BWRVIP-41 guidance.
- c. Oyster Creek is a BWR/2 and does not have jet pumps, therefore no jet pump holddown beams. In January 2002, Quad Cities had a jet pump beam which failed due to SCC in the taper region. It was at first thought to be a Group II but later confirmed to be a Group I design (30 years old). Columbia does not have the Group I beam design identified in the 2002 failure. There are three holddown beam designs (Group I, II, III). All domestic utilities have replaced the Group I beams with either Group II or III. Columbia replaced its holddown beams with the Group II design in 1994. There is no field experience for failures of the Group II or III designs.

**B.2.10-8:**

Please state whether neutron fluence values for the core shroud were calculated using an NRC-approved fluence methodology that is consistent with Regulatory Guide 1.190.

**Energy Northwest Response:**

The fluence values are calculated using the methodology of NEDC-32983P, "General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluation." NEDC-32983P was approved by NRC letter [S. A. Richard, USNRC, to J. F. Klapproth, GE-NE, "Safety Evaluation for NEDC-32983P, General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluation (TAC No. MA9891)," MFN 01-050, September 14, 2001] with acceptability based on the fact that the methodology followed the guidance in Regulatory Guide (RG) 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," dated March 2001.

**RAI B.2.15 – CRDRL Nozzle Program**

**B.2.15-1:**

Please list the materials for the Control Rod Drive Return Line (CRDRL) Nozzle welds and base metal.

Does Columbia use UT examination systems, techniques, personnel, and procedures that are qualified in accordance with the ASME Code, Section XI, Appendix VIII Performance Demonstration Initiative when performing UT examinations of CRDRL Nozzle?



**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
LICENSE RENEWAL APPLICATION**

**Attachment**

Page 15 of 18

**Energy Northwest Response:**

The CRDRL nozzle assembly materials are listed in the table below.

<b>Part</b>	<b>Material</b>
Nozzle forging	SA 508 CL 2
Nozzle to safe-end weld	Carbon steel
Safe-end forging	SA 508 CL 1
Cap forging	SA 508 CL 1
Cap to safe-end weld	Carbon Steel

Energy Northwest uses UT examination systems, techniques, personnel, and procedures that are qualified in accordance with ASME Code, Section XI, Appendix VIII Performance Demonstration Initiative (PDI) criteria when performing UT examinations of the CRDRL nozzle welds.

**RAI B.2.52 – Thermal Aging and Neutron Embrittlement of Cast Austenitic Stainless Steel (CASS) Program**

**B.2.52-1:**

Will the component-specific evaluations required by this aging management program (AMP) use neutron fluence values calculated using an NRC-approved fluence methodology that is consistent with Regulatory Guide 1.190?

**Energy Northwest Response:**

Yes; the component-specific evaluations required by this AMP will use neutron fluence values calculated using an NRC-approved fluence methodology that is consistent with Regulatory Guide 1.190.

**B.2.52-2:**

**Issue:**

GALL Section XI.M13, "Thermal Aging and Neutron Embrittlement of Cast Austenitic Stainless Steel (CASS)," Element 6, "Acceptance Criteria," states that flaws detected in CASS components are evaluated in accordance with the applicable procedures of IWB-3500.

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
LICENSE RENEWAL APPLICATION**

**Attachment**

Page 16 of 18

**Request:**

Although the staff states that Columbia has no pressure boundary components within the scope of this AMP, the staff requests that Columbia provide further explanation as to why the description of acceptance criteria in LRA Section B.2.52 does not directly reference the applicability of ASME Code, Section XI, IWB-3500 acceptance criteria for flaws detected in CASS components at Columbia.

**Energy Northwest Response:**

LRA Table 3.1.2-2, Aging Management Review Results – Reactor Vessel Internals, contains the following CASS components with reduction of fracture toughness managed by the Thermal Aging and Neutron Embrittlement of CASS Program:

- Control Rod Guide Tube Bases (Line 1)
- Jet pump assembly castings (Line 44)
- Orificed fuel supports (Line 56)

The Thermal Aging and Neutron Embrittlement of CASS Program, LRA Section B.2.52, does not reference the applicability of ASME Code, Section XI, IWB-3500 acceptance criteria because all of the components in the scope of this program are non-pressure boundary components and IWB-3500 does not provide acceptance standards for non pressure boundary components. The LRA discussion of acceptance criteria indicates that the criteria will be developed in accordance with ASME Section XI criteria and applicable BWRVIP guidance for the component. An example is the jet pump assembly castings that would be evaluated to BWRVIP-41 Revision 2 that provides specific guidance for determining allowable flaw size and flaw characterization. BWRVIP-41 Revision 2 does not refer to IWB-3500 for acceptance criteria.

There are other CASS components within the reactor coolant pressure boundary. Table 3.1.2-3, Aging Management Review Results – Reactor Coolant Pressure Boundary, contains the following CASS components:

- RRC pump casing (line 112)
- valve bodies  $\geq$  4 inches (line 151)

For each of these components, Cracking – stress corrosion cracking/intergranular attack (SCC/IGA) is managed by the BWR Stress Corrosion Cracking program. The BWR Stress Corrosion Cracking Program description in section B.2.8 states that Columbia has committed to evaluate flaws to ASME section XI, IWB-3500 criteria.

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
LICENSE RENEWAL APPLICATION**

**Attachment**

Page 17 of 18

**B.2.52-3:**

**Issue:**

The staff notes that certain GALL screening criteria for determining the susceptibility of CASS components to thermal aging (based on ferrite content, molybdenum content, and casting method) do not apply if the CASS components are fabricated from materials that are alloyed with Niobium.

**Request:**

Does Columbia have any CASS components fabricated from materials that are alloyed with Niobium? If so, please verify whether such Niobium-containing CASS components will be evaluated for susceptibility to loss of fracture toughness on a case-by-case basis.

**Energy Northwest Response:**

No, Columbia does not have any components within the scope of this AMP that are alloyed with niobium.

**B.2.52-4:**

**Issue:**

LRA Section B.2.52 states that Columbia has no CASS reactor coolant pressure boundary (RCPB) components that are exposed to high levels of neutron radiation; therefore, there are no pressure boundary components addressed by this program.

**Request:**

Please state whether there are any CASS RCPB components at Columbia, regardless of exposure to neutron radiation. If there are any CASS RCPB components at Columbia (regardless of exposure to neutron radiation), please provide justification as to why these components will not be screened for susceptibility to reduction in fracture toughness due to thermal aging (even if neutron embrittlement is not an issue for such CASS RCPB components). Provide an estimate of the projected neutron fluence (if negligible, state this) to which these CASS RCPB components may be exposed through the end of the period of extended operation.

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION  
LICENSE RENEWAL APPLICATION**

**Attachment**

Page 18 of 18

Please state the timeframe, relative to end of the current licensed operating period (e.g., within 5 years of the end of license (EOL), within 10 years of EOL, etc.), when Columbia plans to have completed activities associated with CASS component screening, component-specific susceptibility evaluation, augmentation of the inservice inspection (ISI) program or BWRVIP programs, and the addition of supplemental inspections to Columbia's 10-year ISI Program Plan.

**Energy Northwest Response:**

Columbia CASS RCPB components are listed in LRA Table 3.1.2-3. The CASS RCPB components are valves and pump casings that are located outside the reactor vessel sacrificial shield wall; therefore, the neutron exposure for these components is less than  $2 \times 10^{16}$  n/cm<sup>2</sup> (E > MeV) through the end of the period of extended operation. Loss of fracture toughness due to thermal aging embrittlement for these components is managed by the Inservice Inspection (ISI) Program as indicated in LRA Table 3.1.1 item number 3.1.1-55. No screening of these components will be performed; these components will continue to be inspected by the ISI program.

Columbia plans to have the activities associated with CASS component screening (component-specific susceptibility evaluation, augmentation of the Inservice Inspection (ISI) Program or BWRVIP Program, and the addition of supplemental inspections to Columbia's 10-year ISI Program Plan) completed 5 years before EOL.