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

November 23, 2010
GO2-10-169

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 August 26, 2010, NRC to SK Gambhir (Energy Northwest), "Request for Additional Information for the Review of the Columbia Generating Station, License Renewal Application (TAC NO. 3058)," (ADAMS Accession No. ML102300229)

3) Letter dated September 21, 2010, NRC to SK Gambhir (Energy Northwest), "Request for Additional Information for the Review of the Columbia Generating Station, License Renewal Application (TAC NO. 3058,)" (ADAMS Accession No. ML102530645)

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 the Attachment is the Energy Northwest response to the Request for Additional Information (RAI) contained in Reference 2 and in the Enclosure is Amendment 12 to the License Renewal Application (LRA) that was submitted in Reference 1. Responses to five of the questions contained in Reference 2 that pertain to one time inspections will be provided under separate letter. The information related to these RAIs will be provided at that time.

In Reference 2, the NRC included an RAI (B.2.32-4) about inaccessible cables. Before Energy Northwest responded to that RAI, the NRC staff revised the RAI in Reference 3. Energy Northwest did not respond to the RAI B.2.32-4 in this letter because the response to the revised RAI is included in the response to Reference 3.

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NRR

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

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

Respectfully,

SK Gambhir
Vice President, Technical Services

Attachment: Response to Request for Additional Information

Enclosure: License Renewal Application Amendment 12

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

"Request for Additional Information for the Review of the Columbia Generating Station, License Renewal Application (TAC NO. 3058)," (ADAMS Accession No. ML102300229)

RAI B.2.32-4 Inaccessible Cables

Background:

NUREG-1801, Rev. 1, "Generic Aging Lessons Learned" (the GALL Report), addresses inaccessible medium voltage cables in Aging Management Program (AMP) XI.E3, "Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." The purpose of this program is to provide reasonable assurance that the intended functions of inaccessible medium voltage cables (2 kV to 35 kV), that are not subject to environmental qualification requirements of 10 CFR 50.49 and are exposed to adverse localized environments caused by moisture while energized, will be maintained consistent with the current licensing basis. The scope of the program applies to inaccessible (in conduits, cable trenches, cable troughs, duct banks, underground vaults or direct buried installations) medium-voltage cables within the scope of license renewal that are exposed to significant moisture simultaneously with significant voltage.

The application of AMP XI.E3 to medium voltage cables was based on the operating experience available at the time Revision 1 of the GALL Report was developed. However, recently identified industry operating experience indicates that the presence of water or moisture can be a contributing factor in inaccessible power cables failures at lower service voltages (480V to 2kV). Applicable operating experience was identified in licensee responses to Generic Letter (GL) 2007-01, "Inaccessible or Underground Power Cable Failures that Disable Accident Mitigation Systems or Cause Plant Transients," which included failures of power cable operating at service voltages of less than 2kV where water was considered a contributing factor. The staff has proposed changes to be included in the next revision of the GALL Report AMP XI.E3 to address recently identified operating experience concerning the failure of inaccessible low voltage power cables, which includes general water intrusion as a failure mechanism and increases the scope of program to include power cables greater than or equal to 480V.

Issue:

The staff has concluded, based on recently identified industry operating experience concerning the failure of inaccessible low voltage power cables (480v to 2kV) in the presence of significant moisture, that these cables should be included in an AMP. The staff notes that your AMP does not address these low voltage cables.

Request:

1. Provide a summary of the evaluation of recently identified industry operating experience and any plant specific operating experience concerning inaccessible low voltage power cable failures within the scope of license renewal (not subject to 10 CFR 50.49 environmental qualification requirements), and how this operating experience applies to the need for additional aging management activities at your plant for such cables.

2. Provide a discussion of how your AMP will address aging management of inaccessible low voltage power cables within the scope of license renewal (not subject to 10 CFR 50.49 environmental qualification requirements); with consideration of recently identified industry operating experience and any plant specific operating experience. The discussion should include an assessment of your AMP description, program elements (i.e., scope of program, parameters monitored/inspected, detection of aging effects, and corrective actions), and Final Safety Analysis Report summary description to demonstrate reasonable assurance that the intended functions of inaccessible low voltage power cable (not subject to environmental qualification requirements of 10 CFR 50.49) exposed to adverse localized environments will be maintained consistent with the current licensing basis through the period of extended operation.

Energy Northwest Response:

This RAI was revised in a letter dated September 21, 2010, NRC to SK Gambhir (Energy Northwest), "Request for Additional Information for the Review of the Columbia Generating Station, License Renewal Application (TAC NO. 3058)," (ADAMS Accession No. ML102530645). No response is provided in this letter.

RAI 3.3.1-53.1

Background:

The GALL Report Table 3, line items 53 and 54 indicate that steel or stainless steel piping, piping components, and piping elements exposed to condensation should be managed by the Compressed Air Monitoring Program. The GALL AMP XI.M24, "Compressed Air Monitoring Program" includes recommendations for the management of aging effects through visual inspection and for preventive maintenance including air quality checks and performance monitoring. Specifically, the "Monitoring and Trending" element of the GALL Report Compressed Air Monitoring Program recommends testing to verify proper operation of the compressed air system by comparing measured system performance values with specified performance limits as part of the AMP.

Issue:

License renewal application (LRA) Table 3.3.1 indicates that the GALL Report Table 3, line items 53 and 54 are not applicable to Columbia Generating Station (CGS) for compressed air system steel and stainless steel piping, piping components and piping elements exposed to internal condensation. As a result, the applicant has not developed a Compressed Air Monitoring Program consistent with the GALL guidance to manage steel or stainless steel piping, piping components, and piping elements exposed to condensation. However, it is not clear to the staff how internal condensation can be quantitatively ruled out as an environment for all compressed air system steel and stainless steel piping, piping components, and piping elements.

Request:

Identify the Compressed Air System components and their corresponding environments within the scope of license renewal and provide justification for how those environments are kept free of all moisture.

Energy Northwest Response:

There are four Columbia systems that encompass the Compressed Air Systems. These systems are Containment Instrument Air (CIA), Control Air System (CAS), Service Air (SA), and Diesel Starting Air (DSA).

The CIA system delivers clean, dry, compressed gas, nitrogen or air, to the main steam relief valve and main steam isolation valve accumulators inside primary containment. Its preferred source of gas is the Containment Nitrogen system, with a safety-related back-up supply of high-pressure nitrogen bottles. The components of the CIA system that are within the scope of license renewal and their corresponding environments are identified in LRA Table 3.3.2-5. There is no compressed air environment for the CIA system; the environment is nitrogen, which is evaluated as the NUREG-1801 "Gas" environment. There are no aging effects that require management in this environment.

The CAS provides instrument quality air, oil free, maximum particle size of 1 micron, and dried to an atmospheric dew point of -40°F, throughout the plant for pneumatic instrumentation, controls and actuators. The components of the CAS that are within the scope of license renewal and their corresponding environments are identified in LRA Table 3.3.2-10. The compressed air environment of the CAS is evaluated as the NUREG-1801 "Dried air" environment. The plant-specific Air Quality Sampling Program, as described in LRA Appendix B.2.2, ensures that the CAS remains dry and free of contaminants, thereby validating the AMR conclusion that there are no aging effects that require management.

The SA system supplies clean, oil-free compressed air to the plant for general station services, such as operating air-powered tools and equipment, and as a source of air for backwashing filters and demineralizers, and for the breathing air system. The CAS and SA systems are cross connected before the CAS filters and air dryers. This insures that

any flow into the CAS system from the SA system will be filtered and dried to meet the air quality requirements of the CAS system. The SA system is designed to be isolated from the CAS supply piping to conserve air for CAS use. The components of the SA system that are within the scope of license renewal and their corresponding environments are identified in LRA Table 3.3.2-40. The compressed air environment of the SA system is evaluated as the NUREG-1801 "Air" environment, which is a humid (moist) air environment. However, within the portion of the SA system that is within the scope of license renewal (containment isolation piping and valves), condensation is not expected to occur because it is downstream of the system air dryers. The Service Air System Inspection, as described in LRA Appendix B.2.48, will use a combination of established volumetric and visual examination techniques performed by qualified personnel to identify evidence of a loss of material, or to confirm a lack thereof. The Service Air System Inspection will be conducted within the 10-year period prior to the period of extended operation.

Also, the Diesel Engine Starting Air (DSA) System provides air to the air start motors to enable the emergency diesel generators to start, run, and load. The components of the DSA system that are within the scope of license renewal and their corresponding environments are identified in LRA Table 3.3.2-17. The air environment of the DSA system is evaluated as the NUREG-1801 "Air" environment, which is a humid (moist) air environment. In addition, based on plant-specific operating experience which shows moisture accumulation in the DSA system, an additional environment of "Raw water" is evaluated.

As described in LRA Section B.2.2, the plant-specific Air Quality Sampling Program is credited with managing the effects of aging for internal surfaces of DSA components. The scope of the plant-specific Air Quality Sampling Program includes periodic sampling of the DSA System air quality and corresponding actions, if unacceptable moisture or contaminants are detected, to mitigate loss of material for steel portions of the system. The scope of the program also includes the performance of biennial UT inspections of the DSA System air receivers to ensure that their pressure boundary integrity will be maintained. In addition, the Air Quality Sampling Program is supplemented by the separate one-time Diesel Starting Air Inspection for the DSA System dryers and downstream piping and components (excluding the DSA System air receivers) to characterize conditions and provide additional confirmation that the intended function will be maintained through the period of extended operation. Thereby, the Diesel Starting Air Inspection will verify the effectiveness of the plant-specific Air Quality Sampling Program in managing the effects of aging for steel DSA components.

As described in LRA B.2.16, the Diesel Starting Air Inspection is a one-time inspection that includes steel and stainless steel components downstream of the DSA air dryers (excluding the DSA system air receivers). As described in LRA B.2.16, and clarified in response to request for additional information 3.3.3.2.1-Y3, the Diesel Starting Air Inspection will be performed in the 10 years prior to the period of extended operation, with sufficient time to implement programmatic oversight for the period of extended operation. Implementation of the Diesel Starting Air Inspection will verify that there are no aging effects requiring management for the subject components (downstream of air

dryers) or will identify corrective actions, possibly including programmatic oversight, to be taken to ensure that the component intended functions of the DSA System will be maintained consistent with the current licensing basis during the period of extended operation. This programmatic oversight may include adjustments to the plant-specific Air Quality Sampling Program.

LRA Table 3.3.1, Item 53 is updated per the above clarification in the enclosed amendment.

RAI 3.1.1.57-01

Background:

In LRA Table 3.1.1, Item 3.1.1-57, the applicant stated that it is not applicable to the CGS LRA. The applicant stated that loss of fracture toughness due to thermal aging does not need to be identified and managed for the cast austenitic stainless steel (CASS) main steam flow restrictors because they are not part of the reactor coolant system (RCS) pressure boundary and there is no significant pressure drop across these components and thus no driving force for the propagation of cracks.

The GALL Report Item IV.C1-2 recommends GALL AMP XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)" to manage loss of fracture toughness/thermal aging in CASS boiling water reactor (BWR) piping, piping components, and piping elements (including main steam line flow elements or restrictors) that are exposed to reactor coolant/steam greater than 250°C (482°F) environment.

Issue:

The staff noted, that Item 3.1.1-57 states that there is no significant pressure drop across the flow restrictors and thus no driving force for the propagation of cracks. The applicant further stated that unpropagated cracking does not affect the throttling function of the main steam flow restrictors. In addition the applicant stated that, cracking (due to any mechanism) of the main steam flow restrictors is not an aging effect requiring management. The staff noted that loss of fracture toughness due to thermal aging embrittlement is an aging effect which may have an adverse effect on the material properties of a component and it is dependent on time and temperature.

Request:

Clarify if these CASS main steam flow restrictors have been screened for susceptibility to loss of fracture toughness due to thermal aging embrittlement consistent with GALL AMP XI.M12. If yes, please provide the results and the applicable AMP to manage this aging effect during the period of extended operation, if needed. If not, justify how loss of fracture toughness due to thermal aging embrittlement for these CASS main steam flow restrictors exposed to reactor

coolant/steam greater than 250°C (482°F) will not occur during the extended period of operation for CGS.

Energy Northwest Response:

Yes, the main steam flow restrictors have been screened for susceptibility to loss of fracture toughness per NUREG-1801, Section XI.M12. Energy Northwest has reviewed the Design Specification and certified material test reports for the flow restrictors and determined that the castings were constructed by Wisconsin Centrifugal Inc. from cast austenitic stainless steel (CASS), in conformance with material specification SA-351, Grade CF8. The certified material test reports for the CASS components of the flow elements do not indicate a molybdenum addition in the chemical composition analysis. The Grade CF8 chemical requirements do not include an addition of molybdenum. Therefore, the CASS components of the steam line flow restrictors for Columbia are considered to be constructed of low molybdenum (0.5% maximum) content steel. In accordance with the guidance provided in the GALL Section XI.M12, centrifugally-cast, low molybdenum content CASS material is not susceptible to thermal aging embrittlement.

RAI 3.3.2.1-Y1 Open Cycle

Background:

The GALL Report Table VII.C1, item VII.C1-1 states that elastomer components exposed to raw water can undergo hardening and loss of strength due to elastomer degradation, and loss of material due to erosion. The GALL Report further states that Chapter XI.M20, "Open-Cycle Cooling Water System" AMP was found acceptable to properly manage these aging effects with no further evaluation.

Issue:

The LRA Table 3.3.2-22, Row Number 15, refers to the above item and cites generic note "I," indicating that the aging effect in the GALL Report for this component, material, environment are not applicable. The LRA stated that there were no aging effects requiring managing and no AMP was credited for this component. It is not clear to the staff, why the aging effects are not applicable.

Request:

Provide technical justification substantiating the claim that the flexible connections exposed to raw water are not susceptible to the above aging effects and that no AMP is needed for these components during the period of extended operation.

Energy Northwest Response:

Loss of material due to erosion and hardening and loss of strength due to elastomer degradation are not applicable aging effects for the subject elastomer flexible connections in the Fire Protection System that are exposed to a raw water environment based on the discussion below.

The subject elastomer flexible connections exposed to a raw water (internal) environment identified in LRA Table 3.3.2-22 row number 15, are in the piping between FP-P-1 and FP-ENG-1 (FP-FLX-1 and 2) and are constructed of Viton. These flexible connections are shown on license renewal boundary drawing LR-M515-1. The piping which contains the subject flexible connections provides cooling water flow to the diesel-driven FP-P-1 gearbox.

As described in LRA Section 2.3.3.22, the primary fire protection water supply is drawn from the circulating water basin by three fire pumps: two electric (FP-P-2A and FP-P-2B) and one diesel driven (FP-P-1). A pressure maintenance jockey pump (primary water supply jockey pump (FP-P-3) or secondary water supply jockey pump (FP-P-111)) is normally running to maintain system pressure. One or multiple fire pumps will start if the other running fire pumps cannot maintain system pressure. First, the electric motor pumps will start in sequential order. Then, the diesel driven fire pumps will start to maintain system pressure. FP-P-1 is operated during surveillance testing which is performed every 30 days for a minimum of 30 minutes. Therefore, the diesel-driven FP-P-1 is not normally in continuous operation.

Loss of material due to erosion is not an applicable aging effect for the subject elastomer flexible connections exposed to a raw water environment due to the non-continuous operation of FP-P-1 as described above and good abrasion resistance exhibited by Viton.

Flexible connections exposed to raw water, in the Fire Protection System, are not susceptible to elastomer degradation due to hardening and loss of strength because the conditions do not exist for hardening and loss of strength of elastomers to occur in the raw (fire) water, as clarified below.

The elastomers in the Fire Protection System were subject to evaluation for the aging effects of change in material properties (referred to as hardening and loss of strength) and cracking due to ionizing radiation, thermal exposure, and UV radiation and ozone. However, the relevant conditions do not exist in the raw water environment of the Fire Protection System for these aging effects to occur.

- Change in Material Properties and Cracking due to Ionizing Radiation – Ionizing radiation is an applicable aging mechanism for elastomers when exposure exceeds 10^6 rads total integrated dose over the period of extended operation. The elastomers in the Fire Protection System are located in the Circulating Water Pumphouse. As such they are not subject to ionizing radiation. Therefore, change in material properties and cracking due to ionizing radiation is not an

aging effect requiring management for the elastomer components in the Fire Protection System that are exposed to the "raw water" environment.

- Change in Material Properties and Cracking due to Thermal Exposure – Thermal exposure is an applicable aging mechanism for elastomers when the temperature exceeds 95°F. The normal operating temperature of the Fire Protection System is 85°F. Therefore, change in material properties and cracking due to thermal exposure is not an aging effect requiring management for the elastomer components in the Fire Protection System that are exposed to the "raw water" environment.

- Change in Material Properties and Cracking due to UV Radiation and Ozone – UV radiation and ozone are only applicable aging mechanisms for materials made of natural rubber. The elastomers in the Fire Protection System are made of rubber/Viton which is a fluoroelastomer. Fluoroelastomers exhibit outstanding resistance to ozone and weathering. Therefore, change in material properties and cracking due to UV radiation and ozone is not an aging effect requiring management for the elastomer components in the Fire Protection System that are exposed to the "raw water" environment.

Therefore, as stated in the Table 3.3.2-22 of the License Renewal Application, there are no aging effects requiring management or aging management programs credited for managing elastomers exposed to a raw water environment in the Fire Protection System.

Also as listed in LRA Table 3.3.2-22, the Flexible Connections Inspection is credited with managing hardening and loss of strength for elastomer flexible connections in the Fire Protection System that are exposed to an air-indoor uncontrolled (external) environment (where ambient conditions could exist for thermal exposure to occur).

RAI 3.3.2.1-Y2

Background:

The GALL Report Table VII.H2, item VII.H2-22 states that steel piping, piping components, and piping elements exposed to raw water can undergo loss of material. The GALL Report further states that Chapter XI.M20, "Open-Cycle Cooling Water System" AMP was found acceptable to properly manage this aging effect with no further evaluation.

Issue:

The LRA Table 3.3.2-16, Row Number 28, refers to the above item and cites note "E," indicating that the component is consistent with the GALL Report for material, environment, and aging effect, but that a different AMP is credited. The applicant credited the Diesel Systems Inspection Program as the AMP to manage this aging

effect. However, it is not clear to the staff how the Diesel System Inspection Program, which is a one-time inspection program, will appropriately manage aging of this component, because the GALL-accepted AMP includes periodic inspections to detect the associated aging effect.

Request:

Provide technical justification for how the Diesel Systems Inspection Program will adequately manage loss of material for the steel piping exposed to raw water.

Energy Northwest Response:

Based on a teleconference with Evelyn Gettys (PM) and other NRC staff on October 26, 2010, Energy Northwest is re-evaluating the use of one-time inspections described in the License Renewal Application. A comprehensive response to this issue will be provided under a separate cover letter. The information related to this request for additional information will be provided at that time.

RAI 3.3.2.1-Y3

Background:

The GALL Report Table VII.H2, item VII.H2-22 states that steel piping, piping components, and piping elements exposed to raw water can undergo loss of material. The GALL Report Table VII.H2, item VII.H2-18 states that stainless steel piping, piping components, and piping elements exposed to raw water can undergo loss of material. The GALL Report further states that the Chapter XI.M20, "Open-Cycle Cooling Water System" AMP was found acceptable to properly manage these aging effects with no further evaluation.

Issue:

The LRA Table 3.3.2-17, Row Numbers 34, 39, and 54, indicates that steel and stainless steel components exposed to raw water can undergo loss of material, and will be managed by the Diesel Starting Air Inspection Program. The LRA further states that these items are covered by note "E," which means the component is consistent with the GALL Report for material, environment, and aging effect, but that a different AMP is credited. The applicant has credited the Diesel Starting Air Inspection Program, as the AMP to manage these aging effects for the above items. It is not clear to the staff how the Diesel Starting Air Inspection Program, which is a one-time inspection program, will appropriately manage this aging effect for these components, because the GALL-accepted AMP includes periodic inspections to detect the associated aging effects.

Request:

Provide technical justification for how the Diesel Starting Air Inspection Program will adequately manage loss of material for steel and stainless steel components exposed to raw water for the components discussed above during the period of extended operation.

Energy Northwest Response:

The Diesel Starting Air Inspection will adequately manage loss of material for steel and stainless steel components exposed to raw water, as a supplement to the plant-specific Air Quality Sampling Program. Technical justification is:

1. The diesel starting air receivers are considered bounding for the environment of the downstream piping. The air receivers are blown down once per shift (twice per day); the blow down air comes from the bottom of each receiver and will remove accumulated moisture from the air receivers. Eventually the combination of repeated air receiver blow downs and minor system leakage will cause a compressor start to refill the air receivers. During the cycle described above where the system pressure reaches the compressor start set point and is then recharged, the air in the downstream piping remains essentially static other than the air in the first short section off of the air receivers that migrates toward the air receiver as the pressure drops and is replaced by air from the receiver as the pressure is restored to the compressor shutoff set point.

   The air downstream of the air receivers is purged each time the diesel is started for the monthly surveillance, annual surveillance, or post maintenance testing starts. The air comes from the air receivers and then is static after the DG start sequence is complete. In essence a DG start blows down the downstream piping.

   As the air receivers are the first section of the system that is cold relative to the air temperature coming from the compressor (the heat of compression raises the air temperature) and it is also where the air stagnates, it forms a water trap for the system.

   Periodic internal visual inspections have been performed on some of the air receivers. The results of the internal inspection for DSA-TK-1B on February 3, 2009 are as follows:

   Mechanical craft opened the air receiver under work order 01155517-01 to follow up on the UT data that displayed a change in thickness of the bottom head. Code Programs performed a visual inspection of the lower head of the receiver and made the following observations:

   - The bottom head was not wet and spots of dry corrosion were observed with no evidence of moisture
   - The tank wall does have a light film of oil indicative of lubrication carryover from the compressor. This is helpful from a corrosion

standpoint because the compressor oil does have a corrosion inhibitor and seals the surface from oxygen.

- The carryover of oil may have adverse effects on the desiccant dryer which appears to be eliminating the water at this point. The oil can saturate the descant and lower the effectiveness of the desiccant to dry the air.

Because of the absence of any active corrosion or wet conditions it is recommended that the normal inspection UT frequency continue. Because the carryover of lubricant observed the desiccant dryer should be maintained at the normal frequency and the level of saturation of the desiccant by the compressor oil should be noted at this time.

In August 2002, DSA-TK-3B was internally inspected. The visual inspection results were:

A visual exam was performed on the tank/receiver and corrosion was observed near the bottom head drain and up the head "knuckle" or radius, the receiver was dry and the corrosion was red and black which indicates active corrosion. This confirms the UT thickness check data.

The UT thickness data referred to above was taken 5/21/02 and shows that the shell wall thickness has only lost 0.004" (maximum) from 1994 to 2002.

The outlet connection from the air receivers to the diesel generator for the downstream piping is near the top of the tank in the upper shell. From the UT data and visual inspections of the tank internals, it is evident that the shell is only experiencing minor corrosion. Since the downstream piping is supplied air from the upper tank region and is also made of steel, it is reasonable to assume that the downstream piping is also only experiencing minor surface corrosion.

The safety related check valves upstream of the air receivers are periodically removed and inspected. Recent inspections in 2007 and 2008 indicate only minor rust on the valves. These inspections results add further data to indicate that corrosion rates in the system are low.

From the evaluation of the inspection data above, there is evidence that the one time diesel starting air inspection will confirm that the condition of the piping will be the same as the air receiver shells and is not experiencing more than minor surface corrosion that does not impact the integrity of the system.

2. A review was performed for the valves and flex hoses between the air compressors and the air dryers (35 components). This review included both maintenance history and corrective action data base searches. Only one instance was found that discussed corrosion inside the valve body and gasket seal. The valve was replaced. The condition of the pipe was not specifically stated in the work package for the valve replacement; however, if it would have been severely corroded to where

minimum wall was in question, an engineering evaluation and CR would have been generated to assess the condition. The lack of adverse comments implies that the pipe was in reasonable condition. As stated above in the inspection results for DSA-TK-1B on February 3, 2009, there was a light film of compressor oil on the air receiver. The compressor oil contains a corrosion inhibitor. Since the oil is known to carry over to the air receivers, the piping between the compressor and air dryer is expected to have a heavier coating of oil with the corrosion inhibitor that will keep the corrosion rates low.

The air dryer vessels receive a periodic inspection. The inside of the vessel communicates directly with the inlet piping from the compressor. A review of a sample of the air dryer internal inspections did not reveal any excessive corrosion. For example in 2001 the inspection results were "Changed desiccant, desiccant vessel was in new condition, screen in good condition".

Based on the lack of evidence that there is significant corrosion in the piping system, the one time inspection of the diesel starting air system will either confirm that the maintenance history is indicative of the health of the system or the inspection will detect that aging effects are occurring and will initiate a periodic inspection to trend the inspection results.

RAI 3.3.2.1-Y4

Background:

The GALL Report Table VII.C1, item VII.C1-19 states that steel piping, piping components, and piping elements exposed to raw water can undergo loss of material. The GALL Report Table VII.C1, item VII.C1-5 states that steel heat exchanger components exposed to raw water can undergo loss of material. The GALL Report Table VII.C1, item VII.C1-15 indicates that stainless steel piping, piping components, and piping elements exposed to raw water can undergo loss of material. The GALL Report further states that the Chapter XI.M20, "Open-Cycle Cooling Water System" AMP was found acceptable to properly manage these aging effects for these components with no further evaluation.

Issue:

The LRA Table 3.3.2-21, Row Numbers 5, 11, 14, 17, 23, 28, 39, 42, 45, 48, and 51; Table 3.3.2-23, Row Numbers 6, 11, and 15; Table 3.3.2-24, Row Numbers 6, 9, 13, 20, 24, 28, 31, 34, 37, and 40; Table 3.3.2-25, Row Number 77; Table 3.3.2-26, Row Numbers 8, 12, and 15; Table 3.3.2-33, Row Numbers 6, 18, 22, 34, 36, 42, and 46; and Table 3.3.2-38, Row Number 15 all refer to the above items and cite generic note "E," indicating that the component is consistent with the GALL Report for material, environment, and aging effect, but that a different AMP is credited. The applicant credited the Monitoring and Collection Systems Inspection Program as the AMP to manage these aging effects. However, it is not clear to the staff how the Monitoring and

Collection Systems Inspection Program, which is a one-time inspection program, will appropriately, manage the aging effects for these components, because the GALL-accepted AMP includes period inspections to detect the associated aging effects.

Request:

Provide technical justification for how the one-time inspection of the Monitoring and Collection Systems Inspection Program will adequately manage the aging effects for the components discussed above during the period of extended operation.

Energy Northwest Response:

Based on a teleconference with Evelyn Gettys (PM) and other NRC staff on October 26, 2010, Energy Northwest is re-evaluating the use of one-time inspections described in the License Renewal Application. A comprehensive response to this issue will be provided under a separate cover letter. The information related to this request for additional information will be provided at that time.

RAI 3.3.2.1-Y5

Background:

The GALL Report Table VII.H2, item VII.H2-18 indicates that stainless steel piping, piping components, and piping elements exposed to raw water can undergo loss of material. The GALL Report Table VII.C1, item VII.C1-3 indicates that copper alloy heat exchanger components exposed to raw water can undergo loss of material. The GALL Report Table VII.C1, item VII.C1-6 indicates that copper alloy heat exchanger components exposed to raw water can undergo reduction of heat transfer due to fouling. The GALL Report Table VII.G, item VII.G-7 indicates that stainless steel heat exchanger tubes exposed to raw water can undergo reduction of heat transfer due to fouling. The GALL Report further states that the Chapter XI.M20, "Open-Cycle Cooling Water System" AMP was found acceptable to properly manage these aging effects with no further evaluation.

Issue:

The LRA Table 3.3.2-22, Row Numbers 20, 26, 27, 28, 29, 36, 40, 44, 45, 47, 51, and 54 refer to the above items and cite generic note "E," indicating that the component is consistent with the GALL Report for material, environment, and aging effect, but that a different AMP is credited. The applicant credited the Diesel Driven Fire Pumps Inspection Program as the AMP to manage these aging effects. However, it is not clear to the staff how the Diesel Driven Fire Pumps Inspection Program, which is a one-time inspection program, will appropriately manage these aging effects for these components, because the GALL-accepted AMP includes period inspections to detect the associated aging effects.

Request:

Provide technical justification for how the one-time inspection of the Diesel Driven Fire Pumps Inspection Program will adequately manage these aging effects for the stainless steel and copper components exposed to raw water, during the period of extended operation.

Energy Northwest Response:

Based on a teleconference with Evelyn Gettys (PM) and other NRC staff on October 26, 2010, Energy Northwest is re-evaluating the use of one-time inspections described in the License Renewal Application. A comprehensive response to this issue will be provided under a separate cover letter. The information related to this request for additional information will be provided at that time.

RAI 3.3.2.2.7.2 – 1

Background:

The SRP-LR Section 3.3.2.2.7, item 2, refers to Table 3.3-1, item 17 and states that steel piping in reactor water cleanup and shutdown cooling systems exposed to treated water should be managed for loss of material due to corrosion by monitoring and controlling reactor water chemistry. It continues by stating that the effectiveness of the water chemistry control program should be verified to ensure corrosion is not occurring and that a one-time inspection of select components at susceptible locations is an acceptable method to verify the effectiveness of the water chemistry program.

Issue:

The LRA Section 3.3.2.2.7 item 2 reflects the above recommendation, but notes an exception for steel piping and piping components in the equipment drains radioactive system that are exposed to treated water will be managed for loss of material by the Monitoring and Collection Systems Inspection Program, which is a new one-time inspection program. It is not clear to the staff why a water chemistry program maintaining control of the water chemistry is not implemented to manage aging of these components that are exposed to treated water.

Request:

Provide addition information on why the Monitoring and Collection Systems Inspection Program by itself will adequately manage loss of material for steel piping during the period of extended operation.

Energy Northwest Response:

Based on a teleconference with Evelyn Gettys (PM) and other NRC staff on October 26, 2010, Energy Northwest is re-evaluating the use of one-time inspections described in the License Renewal Application. A comprehensive response to this issue will be provided under a separate cover letter. The information related to this request for additional information will be provided at that time.

RAI 3.3.2.2.10.2 – 1

Background:

The SRP-LR Section 3.3.2.2.10, item 2 refers to Table 3.3-1, item 22 and states that stainless steel and aluminum components exposed to treated water should be managed for loss of material due to corrosion by monitoring and controlling reactor water chemistry. It continues by stating that high concentration of impurities at crevices and locations of stagnant flow could cause pitting and crevice corrosion, and that the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring. The SRP-LR states that a one-time inspection of select components at susceptible locations is an acceptable method to verify the effectiveness of the water chemistry program.

Issue:

The LRA Section 3.3.2.2.10 item 2 reflects the above recommendation, but states that loss of material for components in the process sampling radioactive and equipment drains radioactive systems that are not submerged with the suppression pool will only be managed by the Monitoring and Collection Systems Inspection Program, which is a new one-time inspection program. It is not clear to the staff why a water chemistry program maintaining control of the water chemistry is not implemented to manage aging of these components that are exposed to treated water.

Request:

Provide addition information on why the Monitoring and Collection Systems Inspection Program by itself will adequately manage loss of material for the associated components during the period of extended operation.

Energy Northwest Response:

Based on a teleconference with Evelyn Gettys (PM) and other NRC staff on October 26, 2010, Energy Northwest is re-evaluating the use of one-time inspections described in the License Renewal Application. A comprehensive response to this issue will be provided under a separate cover letter. The information related to this request for additional information will be provided at that time.

RAI 4.2.1-a Reactor Vessel (RV) Neutron Embrittlement

The staff has found that additional information is required from the applicant concerning the time-limited aging analyses (TLAAs) for neutron embrittlement of the reactor vessel (RV) beltline nozzles, addressed in Section 4.2 of the CGS LRA:

1. Section 4.2.1 of the CGS LRA states that RV N12 instrumentation nozzle has a thickness less than 2.5 inches and therefore requires no fracture toughness evaluation per the ASME Code, Section XI, Appendix G, Paragraph G-2223. Therefore this nozzle is not included in the analyses for the neutron fluence in LRA Section 4.2.1, the adjusted reference temperature (ART) in LRA Section 4.2.3, and the Charpy Upper Shelf Energy (USE) in LRA Section 4.2.2, despite the fact that this is a beltline nozzle that would be exposed to a projected neutron fluence greater that 1×10^{17} n/cm^2 (E > 1.0 MeV) at the end of the period of extended operation.

   Subparagraph G-2223(c) of the ASME Code, Section XI, Appendix G states that, "[f]racture toughness analysis of demonstrate protection against nonductile failure is not required for portions of nozzles and appurtenances have a thickness of 2.5 in. (63 mm) or less, provided the lowest service temperature is not lower than RT_{NDT} plus 60 °F (33 °C)." [emphasis added] Since the RV N12 instrumentation nozzle will be exposed to a projected neutron fluence greater that 1×10^{17} n/cm^2 (E > 1.0 MeV) at the end of the period of extended operation, the effects of radiation on the material properties of the nozzle must be considered. Therefore, an ART value (i.e., RT_{NDT} adjusted to account for the effects of radiation) must be determined for the N12 instrumentation nozzle to determine if the criteria stated above will continue to be met through the end of the extended operating period. If not, the N12 instrumentation nozzle must be considered when the licensee develops pressure-temperature limits for CGS in accordance with Title 10 of the Code of Federal Regulations Part 50, Appendix G (10 CFR Part 50, Appendix G) and ASME Code, Section XI, Appendix G.

   10 CFR Part 50, Appendix G, Paragraph IV.A.1.a. states that, "[r]eactor vessel beltline materials must have Charpy upper-shelf energy in the transverse direction for the base material of no less than 75 ft-lb (102 J) initially and must maintain Charpy upper-shelf energy throughout the life of the vessel of no less than 50 ft-lb (68 J)" 10 CFR Part 50, Appendix G, Paragraph II F, defines beltline materials to include those "that are predicted to experience sufficient radiation damage to be considered in the selection of the most limiting material with regard to radiation damage. Without additional evaluation of the effects of radiation on the USE of the N12 instrumentation nozzle, it cannot be determined whether this material is, or is not, limiting with respect to USE for the CGS RV.

   Therefore, please supplement Sections 4.2.1, 4.2.2, and 4.2.3; including Table 4.2-1; Table 4.2-2, 4.2-3, or 4.2-4 (as applicable); and Table 4.2-5; of the CGS LRA to include data for the analysis of the neutron fluence, ART, and USE for the CGS RV N12 instrumentation nozzle.

2. Similarly to the request in Question 1, please supplement Section 4.2.2, including Table 4.2-2, 4.2-3, or 4.2-4 (as applicable), of the CGS LRA to include data for the analysis of the USE for the RV N6 RHR/LPCI nozzles, as these are beltline nozzles, and as such, the USE for these nozzles must be projected to the end of the period of extended operation to determine whether the nozzles will remain in compliance with 10 CFR Part 50, Appendix G requirements.

Energy Northwest Response:

1. Fluence for Nozzle N12:

   The exact fluence for the N12 nozzle (four nozzles – N12A, N12B, N12C, and N12D) has not been calculated. The centerline for the N12 nozzle is only 6 inches below the centerline for the N6 nozzle. The two-inch N12 nozzle extends less than 3 inches below the centerline while the bottom of the 12-inch N6 nozzle is more than 12 inches below the centerline, thus the bottom of the N6 nozzle is below the bottom of the N12 nozzle. Therefore a bounding fluence for the N12 nozzle is the fluence for the N6 nozzle given in LRA Table 4.2-1.

   LRA Section 4.2.1, Table 4.2-1 and Section A.1.3.1.1 are amended to address nozzle N12 (See the Enclosure for LRA Amendment 12).

   ART for Nozzle N12:

   Energy Northwest does not have the data necessary to determine the Adjusted Reference Temperature (ART) for nozzle N12.

   Licensing Topical Report (LTR) NEDO-33178-A, Appendix J addresses the fracture mechanics analysis of the water level instrument (N12) nozzle. This LTR was accepted by the NRC (SER is TAC NO. MD2963, 27 April 2009). A plant-specific assessment for Columbia, based on the analysis of NEDO-33178P-A, demonstrated that nozzle N12 has no impact on the existing P-T curves. The assessment demonstrated that the water level instrument nozzle (N12) curves are bounded by the beltline and upper vessel curves previously provided. The current P-T curves remain valid until 33.1 Effective Full Power Years (EFPY) and are identified as a TLAA in LRA Section 4.2.4.

   Energy Northwest agrees that the N12 instrumentation nozzle must be considered when the licensee develops pressure-temperature limits for Columbia in accordance with Title 10 of the Code of Federal Regulations Part 50, Appendix G (10 CFR Part 50, Appendix G) and the ASME Code, Section XI, Appendix G. Energy Northwest will continue to develop future pressure-temperature limit curves considering all beltline plates, welds, and nozzles.

   LRA Section 4.2.3, 4.2.4, 4.8 and A.1.3.1.4 are revised to address ART for the N12 nozzle and the development of future P-T curves (See the Enclosure for LRA Amendment 12).

USE for Nozzle N12:

Nozzle N12 is not a thick walled forging inserted in the vessel wall and welded to the full penetration of the vessel wall. Rather, this nozzle forging is essentially a pipe with a maximum outer diameter of 3.320 inches and a constant inner diameter of 1.938 inches, resulting in a maximum wall thickness of 0.691 inches. (At the end of the nozzle outside the vessel, the wall thickness is only 0.309 inches as the inside diameter is increased to 2.406 inches to accept the 2" schedule 80 instrument piping.) This forging is inserted into a slightly larger hole in the vessel shell and welded at the vessel ID. The nozzle is in the lower intermediate shell, which has a projected USE of 86.1 ft-lb at 54 EFPY, per LRA Table 4.2-2, well above the 10 CFR 50 required USE of 50 ft-lb.

The unirradiated USE for Columbia's N12 nozzle is unknown; consequently a projection of that USE is not possible. For completeness, EN compared the N12 nozzle to the equivalent margin analysis of BWRVIP-74-A. A search of the original equipment manufacturer (OEM) records found the Certified Material Test Reports (CMTRs) for the four N12 nozzles; but only one contained the analyzed copper content. Energy Northwest projected the decrease in USE for the one N12 nozzle for which the wt% copper was known, based on that copper content and the projected fluence described in response to request 1 above. The projected USE decrease is less than the 23.5% reduction in USE that is the acceptance criterion in BWRVIP-74-A for the BWROG equivalent margin analysis, and thus is bounded by that equivalent margin analysis.

Although the acceptance criterion of 23.5% from BWRVIP-74-A is for plate material; GE records confirm that this value was derived from data that included both rolled plate and nozzle forgings, and is thus an appropriate acceptance criterion for the forged nozzle.

Energy Northwest agrees that the N12 instrumentation nozzles must be considered when the licensee develops pressure-temperature limits for Columbia in accordance with 10 CFR Part 50, Appendix G and the ASME Code, Section XI, Appendix G. Energy Northwest will continue to develop future pressure-temperature limit curves considering all beltline plates, welds, and nozzles.

LRA Section 4.2.2 and Section A.1.3.1.2 are amended to include discussion of the equivalent margin analysis for Nozzle N12 and Table 4.2-9 is added to the LRA (See the Enclosure for LRA Amendment 12).

2. The unirradiated USE for Columbia's N-6 nozzle is not known; consequently a projection of that USE is not possible. The projected decrease in USE was performed for the nozzle similar to that done in LRA Table 4.2-3 for the limiting beltline plate. Due to the relatively low copper content and the relatively low fluence, the projected decrease in USE at 54 EFPY is only 9.6%. This is not only well below the 23.5% acceptance criterion established for plates in BWRVIP-74-A, but also well below the projected 13.2% decrease for Columbia's limiting plate (LRA Table 4.2-3)

and well below the projected 21.6% decrease for Columbia's limiting weld (LRA Table 4.2-4). Although the acceptance criterion of 23.5% from BWRVIP-74-A is for plate material; GE records confirm that this value was derived from data that included both rolled plate and nozzle forgings, and is thus an appropriate acceptance criterion for the forged nozzles.

LRA Section 4.2.2 is amended to include discussion of the equivalent margin analysis for Nozzle N6 and Table 4.2-8 is added to the LRA. Section A1.3.1.3 was clarified by including the N6 nozzle when discussing the ART evaluation of record. (See the Enclosure for LRA Amendment 12).

License Renewal Application
Amendment 12

Section No.	Page No.	RAI Response No.
Table 3.3.1	3.3-91	3.3.1-53.1
Table 3.3.1	3.3-91a	3.3.1-53.1
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4.2.1	4.2-2a	4.2.1-a
4.2.1	4.2-3	4.2.1-a
Table 4.2-1 Row 4 (new)	4.2-3	4.2.1-a
	4.2-3a	4.2.1-a
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	4.2-4a	4.2.1-a
Table 4.2-2 Footnote (1)	4.2-5	4.2.1-a
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Table 4.2-8 (new table)	4.2-14	4.2.1-a
	4.2-14a	4.2.1-a
Table 4.2-9 (new table)	4.2-14	4.2.1-a
	4.2-14a	4.2.1-a
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	4.8-2a	4.2.1-a
A.1.3.1.1	A-28	4.2.1-a
	A-28a	4.2.1-a
A.1.3.1.2	A-29	4.2.1-a
	A-29a	4.2.1-a
A.1.3.1.3	A-29	4.2.1-a
A.1.3.1.4	A-30	4.2.1-a
	A-30a	4.2.1-a

Table 3.3.1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of NUREG-1801

Item Number	Component/Commodity	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-52	Steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed cycle cooling water	Reduction of heat transfer due to fouling	Closed-Cycle Cooling Water System	No	Consistent with NUREG-1801, with exceptions. The Closed Cooling Water Chemistry Program is credited to manage reduction in heat transfer for stainless steel and copper alloy heat exchanger tubes in the auxiliary systems that are exposed to closed cycle cooling water. Additionally, the Heat Exchangers Inspection is credited to verify the effectiveness of the Closed Cooling Water Chemistry Program. A Note E is applied. A heat exchanger in the reactor coolant pressure boundary is also compared to this item, crediting the same combination of programs.
3.3.1-53	Steel compressed air system piping, piping components, and piping elements exposed to condensation (internal)	Loss of material due to general and pitting corrosion	Compressed Air Monitoring	No	Not applicable. Steel compressed air system piping, piping components, and piping elements are not exposed to condensation (internal).

Insert A from Page 3.3-91a

Amendment 12

Insert A for Page 3.3-91

Table 3.3.1 Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of NUREG-1801					
Item Number	**Component/Commodity**	**Aging Effect/Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-53 (Cont.)					but to dried air (internal), as verified by the Air Quality Sampling Program per plant-specific note 0310, for which no aging management is required. Refer to Item Number 3.3.1-98. Steel DSA piping and piping components are exposed to an air (internal) or raw water (internal) environment for which the plant-specific Air Quality Sampling Program is credited and supplemented by the Diesel Starting Air Inspection. Refer to Item Number 3.3.1-76.

Fluence Projection

Fluence values at 51.6 EFPY of reactor operation (analyzed by General Electric (GE) in Reference 4.8-3) are addressed in FSAR Section 4.3.2.8 and FSAR Table 4.3-1. These fluence analyses are based on the original licensed thermal power of 3323 megawatt-thermal (MWt) through fuel cycle 10, and the currently licensed thermal power uprated to 3486 MWt from cycle 11 through the end of operation. These fluence analyses are based on the methodology of NEDC-32983P, "General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluation." NEDC-32983P was approved by NRC letter (Reference 4.8-4) 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."

Subsequently, GE incorporated the fluence analyses into a personal computer worksheet to allow production of fluence estimates at other EFPY. For purposes of license renewal, the reported fluence was linearly extrapolated from 33.1 EFPY (the original 40-year end of life estimate) through 51.6 EFPY to 54 EFPY. Those projections match the fluence values obtained from the automated worksheet for 54 EFPY.

A summary of the highest estimated values of fluence for the RPV beltline shells and welds is shown in Table 4.2-1. Fluence is calculated at the inner surface (0T) of the vessel and at ¼ thickness (1/4T) depth into the vessel.

Beltline Evaluation

NUREG-1801 indicates that ferritic materials for RPV beltline shells, welds, and assembly components are to be evaluated for neutron irradiation embrittlement if high energy neutron fluence is greater than a threshold value of 1E+17 n/cm^2 (E >1 MeV) at the end of the license renewal term. The only RPV assembly items, other than the shells and welds in Table 4.2-1, that would experience neutron fluence greater than 1E+17 n/cm^2 during the period of extended operation are instrumentation nozzle N12 and residual heat removal/low-pressure coolant injection (RHR/LPCI) nozzle N6.

~~Instrumentation nozzle N12 has a thickness less than 2.5 inches and therefore requires no fracture toughness evaluation per ASME Code Appendix G, Section G2223, and thus is not evaluated.~~

~~Nozzle N6 is evaluated for ART in Section 4.2.3 and Table 4.2-5 below. As shown in Table 4.2-5, the ART for these nozzles is only 22.2 °F, versus 53.8 °F for the highest weld and 73.6 °F for the highest plate. Consequently, nozzle N6 is not the limiting material for the vessel. However, as nozzle N6 was evaluated for ART it meets the definition of a beltline component per 10 CFR 50, Appendix G.~~

Replace with Insert A from Page 4.2-2a

Insert A for Page 4.2-2:

Instrumentation nozzle N12 has a thickness less than 2.5 inches and was not originally evaluated for fracture toughness per ASME Code Appendix G, Section G2223. A discussion of N12 USE is presented in Section 4.2.2 and a discussion of N12 ART is presented in Section 4.2.3. Nozzle N12 is not limiting for P-T curves as discussed in Section 4.2.3. However, as nozzle N12 was evaluated for impact on the P-T curves it meets the definition of a beltline component per 10 CFR 50, Appendix G.

Nozzle N6 is evaluated for USE in Section 4.2.2. Nozzle N6 is evaluated for ART in Section 4.2.3 and Table 4.2-5 below. As shown in Table 4.2-5, the ART for these nozzles is only 22.2 °F, versus 53.8 °F for the highest weld and 73.6 °F for the highest plate. Consequently, nozzle N6 is not the limiting material for the vessel. However, as nozzle N6 was evaluated for ART it meets the definition of a beltline component per 10 CFR 50, Appendix G.

As such, the beltline definition for the period of extended operation includes the lower shell, lower-intermediate shell, associated vertical (longitudinal) welds, the girth (circumferential) weld that connects the lower and lower-intermediate shells, and nozzle N6 and N12.

Disposition: Neutron fluence is not a TLAA. It is a time-limited assumption used in various neutron embrittlement TLAAs.

Table 4.2-1
RPV Beltline Fluence Values at 54 EFPY

PLATES:	Identification (I.D.) No.	0T fluence (n/cm^2)	1/4T fluence (n/cm^2)
Lower Shell	Mk 21-1-1, Mk 21-1-2, Mk 21-1-3, Mk 21-1-4	4.78E+17	2.71E+17
Lower-Intermediate Shell	Mk 22-1-1, Mk 22-1-2, Mk 22-1-3, Mk 22-1-4	1.17E+18	8.10E+17
NOZZLES:			
N6 (RHR / LPCI) (3 nozzles)	Mk 64-1	6.49E+17	4.48E+17
WELDS:			
Lower Vertical (Axial / Longitudinal)	BA, BB, BC, BD	4.78E+17	2.71E+17
Lower-Intermediate Vertical (Axial / Longitudinal)	BE, BF, BG, BH	1.17E+18	8.10E+17
Lower to Lower-Intermediate Girth (Circumferential)	AB	4.78E+17	3.3E+17

Insert row for Nozzles N12 from Insert A on Page 4.2-3a

Insert A for Page 4.2-3

N12 (Instrumentation) (4 nozzles)		6.49E+17	4.48E+17

4.2.2 Upper Shelf Energy Evaluation

10 CFR 50 Appendix G requires the USE of the RPV beltline materials to remain above 50 ft-lb at all times during plant operation, including the effects of neutron radiation. If USE cannot be shown to remain above this limit, then an equivalent margin analysis (EMA) must be performed to show that the margins of safety against fracture are equivalent to those required by Appendix G of Section XI of the ASME Code.

The USE calculation of record for the existing licensed period (33.1 EFPY) is Appendix F of GE NEDO-33144 (Reference 4.8-5). The initial (unirraditated) USE is not known for all the Columbia vessel plates and welds. For those plates and welds for which the initial USE is known, USE was projected using Regulatory Guide 1.99, Revision 2 methods. For the vessel plates and welds for which the initial USE is not known, USE EMAs were performed using the Boiling Water Reactor Owners Group EMA methodology. Results from the testing and analysis of surveillance materials were used in the EMA analyses.

The values of USE projected to 54 EFPY are listed in Table 4.2-2. All of the projected USE values from Table 4.2-2 remain above 50 ft-lbs through the end of the period of extended operation (54 EFPY).

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~~The projected EMAs are listed in Table 4.2-3 and Table 4.2-4. The projected EMAs in Table 4.2-3, and Table 4.2-4 used the projected 54 EFPY fluence listed in Table 4.2-1, and the curves provided in RG 1.99 Figure 2. The predicted values were compared to the minimum 54 EFPY USE limits in BWRVIP-74-A.~~

For the vessel beltline plates, the maximum decrease in USE was found to be 13.2 percent (see Table 4.2-3). This is less than the assumed decrease of 23.5 percent in the beltline plate equivalent margin analysis. Therefore, the maximum predicted decreases in USE for 54 EFPY for the beltline plates are bounded by the generic 54 EFPY equivalent margin analysis documented in BWRVIP-74-A. The projected USE for the vessel beltline plates is acceptable for the period of extended operation.

For the welds associated with the vessel beltline plates, the maximum decrease in USE was found to be 21.6 percent (see Table 4.2-4). This is less than the assumed decrease of 39 percent in the equivalent margin analysis. Therefore, the maximum predicted decreases in USE for the welds in the vessel beltline region are bounded by the generic 54 EFPY equivalent margin analysis documented in BWRVIP-74-A. The projected USE for the beltline welds is acceptable for the period of extended operation.

Disposition: 10 CFR 54.21(c)(1)(ii) – Reactor vessel upper shelf energy TLAAs have been projected to the end of the period of extended operation.

Insert B from Page 4.2-4a

Insert A for Page 4.2-4:

The projected EMAs are listed in Table 4.2-3, Table 4.2-4, Table 4.2-8 and Table 4.2-9. The projected EMAs in Table 4.2-3, Table 4.2-4, Table 4.2-8 and Table 4.2-9 used the projected 54 EFPY fluence listed in Table 4.2-1, and the curves provided in RG 1.99 Figure 2. The predicted values were compared to the minimum 54 EFPY USE limits in BWRVIP-74-A.

Insert B for Page 4.2-4

For the vessel beltline nozzles, the maximum decrease in USE was found to be 16.3 percent (see Tables 4.2-8 and 4.2-9). This is less than the assumed decrease of 23.5 percent in the equivalent margin analysis. Therefore, the maximum predicted decreases in USE for the nozzles in the vessel beltline region are bounded by the generic 54 EFPY equivalent margin analysis documented in BWRVIP-74-A. The projected USE for the beltline nozzles is acceptable for the period of extended operation.

EN compared only one N12 nozzle to the equivalent margin analysis of BWRVIP-74A because the Certified Material Test Reports (CMTRs) for the other three N12 nozzles did not contain the analyzed copper content. Energy Northwest agrees that the N12 instrumentation nozzle must be considered when the licensee develops pressure-temperature limits for Columbia in accordance with 10 CFR Part 50, Appendix G and the ASME Code, Section XI, Appendix G. Columbia will continue to develop future pressure-temperature limit curves considering all beltline plates, welds, and nozzles.

Table 4.2-2
USE Projections for 54 EFPY

Sub-Component[1]	I.D. No.	Heat (Single/Tandem wire)	% Cu	Initial USE	¼T Fluence n/cm^2	Drop in USE	¼T USE (ft-lb)
PLATES:							
Lower-Intermediate Shell (Course #2)	Mk 22-1-1	B5301-1	0.13	98	8.10E+17	12.1%	86.1
WELDS:							
Lower Vertical (Axial/Longitudinal)	BA-BD	3P4966 (S)	0.025	98	2.71E+17	7.0%	91.1
		3P4966 (T)	0.025	98	2.71E+17	7.0%	91.1
Lower-Intermediate Vertical (Axial/Longitudinal)	BE-BH	3P4966 (S)	0.025	98	8.10E+17	9.1%	89.1
		3P4966 (T)	0.025	98	8.10E+17	9.1%	89.1
Lower to Lower-Intermediate Girth (Circumferential)	AB	5P6756 (S)	0.080	91	3.30E+17	9.8%	82.1
		5P6756 (T)	0.080	97	3.30E+17	9.8%	87.5
	AB	3P4955 (S)	0.027	90	3.30E+17	7.4%	83.3
		3P4955 (T)	0.027	95	3.30E+17	7.4%	87.9

(1) ~~The sub-components not on this table have no projection due to the initial USE being unknown. See Table 4.2-3 and Table 4.2-4 for the equivalent margin analyses for the limiting plate and weld.~~

Replace footnote with Insert A from Page 4.2-5a

Insert A for Page 4.2-5:

(1) The sub-components not on this table have no projection due to the initial USE being unknown. See Table 4.2-3, Table 4.2-4, Table 4.2-8 and Table 4.2-9 for the equivalent margin analyses for the limiting plate, limiting weld, and beltline nozzles.

4.2.3 Adjusted Reference Temperature Analysis

In addition to USE, the other key parameter that characterizes the fracture toughness of a material is the RT_{NDT}. This reference temperature changes as a function of exposure to neutron radiation resulting in an adjusted reference temperature, ART.

The initial RT_{NDT} is the reference temperature for the unirradiated material as defined in Paragraph NB-2331 of Section III of the ASME Boiler and Pressure Vessel Code. The change due to neutron radiation is referred to as ΔRT_{NDT}.

The ART is calculated by adding the initial RT_{NDT}, the ΔRT_{NDT}, and a margin to account for uncertainties as prescribed in Regulatory Guide 1.99, Revision 2.

The ART evaluations of record for the vessel beltline plates and welds for the currently licensed period (33.1 EFPY), including power uprate conditions, are provided in NEDO-33144 (Reference 4.8-5). NEDO-33144 lists the initial RT_{NDT} and chemistry values for the Columbia reactor vessel materials obtained from the Columbia vessel Certified Material Test Reports. Some chemistry factors were adjusted when Surveillance Capsule Data and Integrated Surveillance Program (ISP) best estimates were available, as described in NEDO-33144.

~~The results and methodology in NEDO-33144, Revision 2 of Regulatory Guide 1.99 (Reference 4.8-6), and the projected fluence values listed in Table 4.2-1 were used to project the ART for 54 EFPY. The results of this projection are summarized in Table 4.2-5 for vessel beltline plates and welds. The ART values projected to 54 EFPY are used to develop P-T limit curves, as discussed in Section 4.2.4. Projected ART values are well below the 200°F end-of-life ART suggested in Section 3 of Regulatory Guide 1.99 and are, thus, acceptable for the period of extended operation.~~

Disposition: 10 CFR 54.21(c)(1)(ii) – Reactor vessel adjusted reference temperature TLAAs have been projected to the end of the period of extended operation.

Replace with Insert A from page 4.2-8a.

Insert A for Page 4.2-8:

The results and methodology in NEDO-33144, Revision 2 of Regulatory Guide 1.99 (Reference 4.8-6), and the projected fluence values listed in Table 4.2-1 were used to project the ART for 54 EFPY. The results of this projection are summarized in Table 4.2-5 for vessel beltline plates, welds and nozzles N6. The ART values projected to 54 EFPY are used to develop P-T limit curves, as discussed in Section 4.2.4. Projected ART values are well below the 200°F end of life ART suggested in Section 3 of Regulatory Guide 1.99 and are, thus, acceptable for the period of extended operation.

Reactor vessel nozzle N12 has been evaluated with respect to ART and possible impact on the pressure-temperature curves. Licensing Topical Report (LTR) NEDC-33178P-A (Reference 4.8-16) addressed the issue that nozzles less than 2 ½ inches thick did not have a calculated ART. This LTR was accepted by the NRC (Reference 4.8-17). A plant-specific assessment for Columbia based on the analysis of NEDC-33178P-A demonstrated that nozzle N12 has no impact on the existing PT curves. The assessment demonstrated that the water level instrument nozzle (N12) curves are bounded by the beltline and upper vessel curves.

4.2.4 Pressure-Temperature Limits

To ensure that adequate margins of safety are maintained for various modes of reactor operation, 10 CFR 50, Appendix G specifies pressure and temperature requirements for affected materials for the service life of the reactor vessel. The basis for these fracture toughness requirements is ASME Section XI, Appendix G. The ASME Code requires P-T limits be established for hydrostatic pressure tests and leak tests; for operation with the core not critical during heatup and cooldown; and for core critical operation.

~~The Columbia P-T limit curves were revised in 2005 to include the effects of power uprate to 3486 MWt (Reference 4.8-2). The P-T limits are valid for 33.1 EFPY through the end of the currently licensed period. P-T limits for the period of extended operation will be calculated using the most accurate fluence projections available at the time of the recalculation. The projections may be adjusted if there are changes in core design or if additional surveillance capsule results show the need for an adjustment. The projected ART for the period of extended operation, see Section 4.2.3 above, gives confidence that future P-T curves will provide adequate operating margin.~~

~~License amendment requests to revise the P-T limits will be submitted to the NRC for approval, when necessary to comply with 10 CFR 50 Appendix G, as part of the Reactor Vessel Surveillance Program.~~

Disposition: 10 CFR 54.21(c)(1)(iii) – Reactor vessel pressure-temperature limits will be adequately managed for the period of extended operation as part of the Reactor Vessel Surveillance Program.

Replace with Insert A from Page 4.2-11a.

4.2.5 Reactor Vessel Circumferential Weld Inspection Relief

BWRVIP-74-A (Reference 4.8-7) reiterated the recommendation of BWRVIP-05 (Reference 4.8-8) that RPV circumferential welds could be exempted from examination. The NRC safety evaluation report (SER) for BWRVIP-74 agreed, but required that plants apply for this relief request individually. The relief request should demonstrate that at the expiration of the current license, the circumferential welds satisfy the limiting conditional failure probability for circumferential welds in the (BWRVIP-05) evaluation. This evaluation of circumferential weld mean adjusted reference temperature is a TLAA.

Energy Northwest analysis of the conditional probability of failure for the Columbia RPV circumferential welds is consistent with the position in BWRVIP-05 and NRC Generic Letter 98-05. The NRC concluded that the conditional probability of failure for the Columbia RPV circumferential welds was sufficiently low to justify elimination of the volumetric examinations through 33.1 EFPY (Reference 4.8-9).

Insert A for Page 4.2-11:

The Columbia P-T limit curves were revised in 2005 to include the effects of power uprate to 3486 MWt (Reference 4.8-2). The P-T limits are valid for 33.1 EFPY through the end of the currently licensed period. The curves were reviewed in 2009 to assure that the instrumentation nozzles N12 did not affect the existing curves. P-T limits for the period of extended operation will be calculated using the most accurate fluence projections available at the time of the recalculation. The projections may be adjusted if there are changes in core design or if additional surveillance capsule results show the need for an adjustment. The projected ART for the period of extended operation, see Section 4.2.3 above, gives confidence that future P-T curves will provide adequate operating margin.

Columbia will continue to develop pressure-temperature limits in accordance with Title 10 of the Code of Federal Regulations Part 50, Appendix G (10 CFR Part 50, Appendix G) and ASME Code, Section XI, Appendix G, considering all vessel beltline plates, welds, and nozzles. License amendment requests to revise the P-T limits will be submitted to the NRC for approval, when necessary to comply with 10 CFR 50 Appendix G, as part of the Reactor Vessel Surveillance Program.

Replace with Insert A from page 4.2-14a.

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Table 4.2-8
Nozzle N6 USE Equivalent Margin Analysis for 54 EFPY

Surveillance Nozzle	
There is no surveillance material for the N6 nozzle, and therefore no surveillance data. Consequently Position 1.2 of RG 1.99 will be used to project USE to 54 EFPY.	
Nozzle N6 USE	
% Cu =	0.11
54 EFPY ¼T Fluence =	4.48E+17 n/cm^2
RG 1.99 Predicted Decrease =	9.6 %
Adjusted Decrease =	N/A
9.6 % ≤	23.5 % (bounding value from SER for BWRVIP-74-A)[1]
Therefore, the N6 nozzle is bounded by Equivalent Margin Analysis in BWRVIP-74-A.	

[1] The acceptance criterion of 23.5% was derived from data that included both rolled plate and nozzle forgings and is thus an appropriate acceptance criterion for the Columbia nozzles.

Table 4.2-9
Nozzle N12 USE Equivalent Margin Analysis for 54 EFPY

Surveillance Nozzle Data	
There is no surveillance material for the N12 nozzle, and therefore no surveillance data. Consequently Position 1.2 of RG 1.99 will be used to project USE to 54 EFPY.	
Nozzle N6 USE	
% Cu =	0.25
54 EFPY ¼T Fluence =	4.48E+17 n/cm^2
RG 1.99 Predicted Decrease =	16.3 %
Adjusted Decrease =	N/A
16.3 % ≤	23.5 % (bounding value from SER for BWRVIP-74-A)[1]
Therefore, nozzle N12 is bounded by Equivalent Margin Analysis in BWRVIP-74-A.	

[1] The acceptance criterion of 23.5% was derived from data that included both rolled plate and nozzle forgings and is thus an appropriate acceptance criterion for the Columbia nozzles.

4.8-14 GO2-05-153, W Oxenford (Energy Northwest) Letter to NRC Document Control Desk, "Columbia Generating Station, Docket No. 50-397 Analytical Evaluation of Inservice Inspection Examination Results," September 15, 2005.

4.8-15 NRC letter, Gus C. Lainas to Carl Terry, BWRVIP Chairman, "Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-05 Report (TAC No. M93925)," July 28, 1998.

Insert A from Page 4.8-2a.

Insert A for Page 4.8-2:

4.8-16 GE document NEDO-33178P-A, "Methodology for Development of Reactor Pressure Vessel Pressure-Temperature Curves," June 2009

4.8-17 NRC letter, Thomas B. Blount (NRC) to Doug Coleman (BWROG), "Final Safety Evaluation for Boiling Water Reactor Owners' Group Licensing Topical Report NEDO-33178P, General Electric Methodology for Development of Reactor Pressure Vessel Pressure-Temperature Curves (TAC NO. MD2693)," 27 April 2009

Beltline Evaluation

For the extended operating period, ferritic materials for vessel beltline shells, welds, and assembly components are required to be evaluated for neutron irradiation embrittlement if high energy neutron fluence is greater than a threshold value of 1E+17 n/cm^2 (E >1 MeV) at the end of the 60 years. The only vessel assembly items, other than the shells and welds of the beltline region that would experience neutron fluence greater than 1E+17 n/cm^2 during the period of extended operation are instrumentation nozzle N12 and residual heat removal/low pressure coolant injection (RHR/LPCI) nozzle N6.

~~Instrumentation nozzle N12 has a thickness less than 2.5 inches and therefore does not require a fracture toughness evaluation per ASME Code Appendix G, Section G2223.~~

~~Nozzle N6 is evaluated for ART below. The ART for this nozzle is less than that for the highest weld and plate. Consequently, nozzle N6 is not the limiting material for the vessel, and thus is not a beltline component. However, as nozzle N6 was evaluated for ART it meets the definition of a beltline component per 10 CFR 50, Appendix G.~~

The beltline definition for the period of extended operation includes the lower shell (Course #1 / Ring #21), lower-intermediate shell (Course #2 / Ring #22), associated vertical (longitudinal) welds, the girth (circumferential) weld that connects the lower and lower-intermediate shells, and nozzle N6 and N12

s

Disposition

Neutron fluence is not a TLAA, it is a time-limited assumption used in various neutron embrittlement TLAAs.

Replace with Insert A from page A-28a.

A.1.3.1.2 Upper Shelf Energy Evaluation

10 CFR 50 Appendix G requires the upper shelf energy (USE) of the vessel beltline materials to remain above 50 ft-lb at all times during plant operation, including the effects of neutron radiation. If USE cannot be shown to remain above this limit, then an equivalent margin analysis (EMA) must be performed to show that the margins of safety against fracture are equivalent to those required by Appendix G of Section XI of the ASME Code.

The initial (unirradiated) USE is not known for all the Columbia vessel plates and welds. For those plates and welds for which the initial USE is known, USE was projected using Regulatory Guide 1.99, Revision 2 methods. For the vessel plates and welds for which the initial USE is not known, USE equivalent margin analyses were performed using the Boiling Water Reactor Owners Group (BWROG) equivalent margin analysis (EMA) methodology. Results from the testing and analysis of surveillance materials were used in the EMA analyses.

Insert A for Page A-28:

Instrumentation nozzle N12 has a thickness less than 2.5 inches and was not originally evaluated for fracture toughness per ASME Code Appendix G, Section G2223. Nozzle N12 is not limiting for P-T curves as discussed in Section A.1.3.1.4; however, as nozzle N12 was evaluated for impact on the P-T curves it meets the definition of a beltline component per 10 CFR 50, Appendix G.

Nozzle N6 is included in the evaluation for USE in Section A.1.3.1.2. Nozzle N6 is evaluated for ART in Section A.1.3.1.3 below. Nozzle N6 is not the limiting material for the vessel. However, as nozzle N6 was evaluated for ART it meets the definition of a beltline component per 10 CFR 50, Appendix G.

~~All of the projected USE values for the vessel beltline plates and welds for which the initial USE is known remain above 50 ft-lbs through the end of the period of extended operation (54 EFPY). For the vessel beltline plates and welds for which the initial USE is not known, the maximum decrease in USE was found to be less than the assumed decrease in the associated equivalent margin analyses. The maximum predicted decreases in USE for 54 EFPY for these beltline plates and welds are bounded by the equivalent margin analyses. Therefore, the projected USE for the vessel beltline plates and welds is acceptable for the period of extended operation~~.

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Disposition

Reactor vessel upper shelf energy TLAAs have been projected to the end of the period of extended operation.

A.1.3.1.3 Adjusted Reference Temperature Analysis

In addition to USE, the other key parameter that characterizes the fracture toughness of a material is the RT_{NDT}. This reference temperature changes as a function of exposure to neutron radiation resulting in an adjusted reference temperature, ART.

The initial RT_{NDT} is the reference temperature for the unirradiated material. The change due to neutron radiation is referred to as ΔRT_{NDT}. The ART is calculated by adding the initial RT_{NDT}, the ΔRT_{NDT}, and a margin to account for uncertainties as prescribed in Regulatory Guide 1.99, Revision 2.

The ART evaluations of record for the vessel beltline plates ~~and~~ , welds and nozzle N6 for the currently licensed period (33.1 EFPY) include power uprate conditions. Based on projected fluence values, the methodology in Regulatory Guide 1.99 was used to project the ART for 54 EFPY. The ART values projected to 54 EFPY are used to develop P-T limit curves. Projected ART values are well below the 200°F end of life ART suggested in Section 3 of Regulatory Guide 1.99 and are, thus, acceptable for the period of extended operation.

Disposition

Reactor vessel adjusted reference temperature TLAAs have been projected to the end of the period of extended operation.

A.1.3.1.4 Pressure-Temperature Limits

To ensure that adequate margins of safety are maintained for various modes of reactor operation, 10 CFR 50, Appendix G specifies pressure and temperature requirements for affected materials for the service life of the reactor vessel. The basis for these fracture toughness requirements is ASME Section XI, Appendix G. The ASME Code requires P-T limits be established for hydrostatic pressure tests and leak tests; for operation with the core not critical during heatup and cooldown; and for core critical operation.

Insert A for Page A-29:

All of the projected USE values for the vessel beltline plates and welds for which the initial USE is known remain above 50 ft-lbs through the end of the period of extended operation (54 EFPY). For the vessel beltline plates, welds and nozzles for which the initial USE is not known, the maximum decrease in USE was found to be less than the assumed decrease in the associated equivalent margin analyses. The maximum predicted decreases in USE for 54 EFPY for these beltline plates, welds and nozzles are bounded by the equivalent margin analyses. Therefore, the projected USE for the vessel beltline plates, welds and nozzles is acceptable for the period of extended operation.

EN compared only one N12 nozzle to the equivalent margin analysis of BWRVIP-74A because the Certified Material Test Reports for the other three N12 nozzles did not contain the analyzed copper content. Energy Northwest agrees that the N12 instrumentation nozzles must be considered when the licensee develops pressure-temperature limits for Columbia in accordance with 10 CFR Part 50, Appendix G and the ASME Code, Section XI, Appendix G. Columbia will continue to develop future pressure-temperature limit curves considering all beltline plates, welds, and nozzles.

~~The Columbia P-T limit curves were revised in 2005 to include the effects of power uprate to 3486 MWt. The P-T limits are valid for 33.1 EFPY through the end of the currently licensed period. P-T limits for the period of extended operation will be calculated using the most accurate fluence projections available at the time of the recalculation. The projections may be adjusted if there are changes in core design or if additional surveillance capsule results show the need for an adjustment. The projected ART for the period of extended operation gives confidence that future P-T curves will provide adequate operating margin.~~

Replace with Insert A from Page A-30a.

License amendment requests to revise the P-T limits will be submitted to the NRC for approval, when necessary to comply with 10 CFR 50 Appendix G, as part of the Reactor Vessel Surveillance Program.

Disposition

The TLAA for P-T limits will be adequately managed for the period of extended operation as part of the Reactor Vessel Surveillance Program.

A.1.3.1.5 Reactor Vessel Circumferential Weld Inspection Relief

BWRVIP-74-A, "BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal," reiterated the recommendation of BWRVIP-05, "BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations," that vessel circumferential welds could be exempted from examination. The NRC safety evaluation report (SER) for BWRVIP-74 agreed, but required that plants apply for this relief request individually. The relief request is required to demonstrate that at the expiration of the current license, the circumferential welds will satisfy the limiting conditional failure probability in the (BWRVIP-05) evaluation. Energy Northwest requested and received permanent relief from vessel shell circumferential (girth) weld volumetric examinations through 33.1 EFPY.

The reactor pressure vessel circumferential weld parameters at 54 EFPY have been projected to remain within the bounding (64 EFPY) vessel parameters from the BWRVIP-05 SER. As such, the conditional probability of failure for circumferential welds remains below the limits contained in the SER for BWRVIP-05.

Disposition

The TLAA for reactor vessel circumferential weld examination relief has been projected to the end of the period of extended operation.

A.1.3.1.6 Reactor Vessel Axial Weld Failure Probability

The NRC SER for BWRVIP-74-A evaluated the failure frequency of axially oriented welds in BWR reactor vessels, and determined failure frequency acceptance criteria for 40 years of reactor operation. Applicants for license renewal are required to evaluate

Insert A for page A-30:

The Columbia P-T limit curves were revised in 2005 to include the effects of power uprate to 3486 MWt. The P-T limits are valid for 33.1 EFPY through the end of the currently licensed period. The curves were reviewed in 2009 to assure that the instrumentation nozzles N12 did not affect the existing curves. P-T limits for the period of extended operation will be calculated using the most accurate fluence projections available at the time of the recalculation. The projections may be adjusted if there are changes in core design or if additional surveillance capsule results show the need for an adjustment. The projected ART for the period of extended operation above, gives confidence that future P-T curves will provide adequate operating margin.

Columbia will continue to develop pressure-temperature limits in accordance with Title 10 of the Code of Federal Regulations Part 50, Appendix G (10 CFR Part 50, Appendix G) and ASME Code, Section XI, Appendix G, considering all beltline plates, welds, and nozzles.